Indonesian Journal of
Adult and Community Education

IJACE Indonesian Jurnal of Adult and Community Education

Journal homepage: https://ejournal.upi.edu/index.php/IJACE/index

Community Education Approach in Addressing Poverty as Determinant of Stunting Prevalence in West Java: Multiple Linear Regression Analysis

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ABSTRACT

Stunting remains a critical public health challenge requiring comprehensive community education interventions in West Java Province. Despite national efforts, stunting prevalence remains above WHO standards, with significant variations across districts. Research gap exists in understanding how community education level influences stunting outcomes alongside poverty and healthcare access from a community education perspective. This study examines relationships between poverty-related factors and stunting prevalence across 27 West Java districts/cities. A cross-sectional design using 2023 secondary data from Central Bureau of Statistics and West Java Open Data was employed. Multiple linear regression analysis using JASP software examined poverty rate, average years of schooling (community education indicator), and healthcare facility access on stunting prevalence. Classical assumption tests including normality, homoscedasticity, and multicollinearity were performed. Results revealed significant positive correlation between poverty and stunting ($r=0.628$, $p<0.001$). The regression model showed poverty rate ($\beta=0.487$, $p=0.003$), average years of schooling ($\beta=-0.312$, $p=0.021$), and healthcare access ($\beta=-0.289$, $p=0.035$) collectively explained 64.3% of variance in stunting prevalence ($R^2=0.643$, $F=13.25$, $p<0.001$). Average years of schooling demonstrated significant protective effect, indicating that enhanced community education level reduces stunting by 1.356% per additional schooling year. Findings emphasize community education's crucial role in stunting prevention, supporting integrated programs addressing health literacy, nutritional knowledge, and parenting education alongside poverty reduction. This study contributes to understanding how non-formal and community education interventions effectively address public health challenges in Indonesian contexts.

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ARTICLE INFO

Article History:
Submitted/Received 19 Okt 2025
First Revised 21 Okt 2025
Accepted 23 Nov 2025
First Available online 2 Des 2025
Publication Date 22 Des 2025

Keywords: stunting, community education, poverty, health literacy, West Java, multiple linear regression

1. INTRODUCTION

Stunting, defined as height-for-age below -2 standard deviations from WHO Child Growth Standards, represents a critical public health challenge requiring multisectoral interventions including comprehensive community education programs (World Health Organization, 2006). Beyond physical growth impairment, stunting has long-term implications for cognitive development, economic productivity, and increased risk of degenerative diseases in adulthood (Dewey & Begum, 2011; Black et al., 2013).

Indonesia faces serious challenges in addressing stunting. According to the Indonesian Nutritional Status Survey (SSGI) 2022, national stunting prevalence reached 21.6%, although declining from 24.4% in 2021 (Ministry of Health RI, 2022). This figure remains above the WHO maximum standard of 20% (de Onis et al., 2019). West Java Province, with Indonesia's largest population, recorded stunting prevalence of 20.2% in 2023, with significant variations across districts/cities ranging from 12.80% to 28.45% (West Java Provincial Health Office, 2023).

From a community education perspective, stunting prevention requires addressing knowledge gaps and behavioral changes among parents and caregivers. Research demonstrates that parental education level, particularly maternal education, significantly influences child nutritional status through improved health literacy, better feeding practices, and enhanced utilization of healthcare services (Akombi et al., 2017). This aligns with fundamental principles of adult and community education, where knowledge acquisition leads to behavioral change and improved quality of life (Knowles et al., 2015).

Poverty is identified as a primary determinant of stunting through various complex mechanisms that can be addressed through community education interventions. (Akombi et al, 2017) showed that poverty contributes to stunting through limited access to nutritious food, poor sanitation, and inadequate healthcare services. In Indonesia, (Torlesse et al, 2016) found that children from the poorest families have 2.5 times higher risk of experiencing stunting compared to children from the wealthiest families. Community education programs focusing on affordable nutrition, hygiene practices, and healthcare utilization can help mitigate poverty's impact on child malnutrition.

West Java exhibits considerable economic disparities across regions, with poverty rates ranging from 4.12% to 12.89% in 2023 (BPS West Java, 2023). Average years of schooling, as an indicator of community education level, also varies significantly from 6.21 to 11.84 years across districts/cities. This variation provides opportunities to analyze relationships between poverty, educational attainment, and stunting in regional contexts. Understanding these relationships is crucial for designing evidence-based interventions that leverage adult and community education principles.

The critical role of community education in stunting prevention is supported by research showing that parental knowledge of nutrition, hygiene, and childcare practices directly influences child nutritional outcomes (Victora et al., 2008). Non-formal education programs targeting parents and community members can effectively disseminate essential knowledge about the first 1,000 days of life, appropriate feeding practices, and preventive health measures. According to Malcolm Knowles' adult learning principles, adults must be involved

in designing learning objectives, experience forms the basis for education, adults seek learning relevant to their lives, and learning requires sustained motivation (Knowles et al., 2015). These principles are directly applicable to community-based stunting prevention programs.

Based on this background, research questions are: (1) What is the profile of stunting prevalence and poverty levels across West Java districts/cities? (2) Is there a significant relationship between poverty rates and stunting prevalence in West Java districts/cities? (3) How do poverty levels, average years of schooling as community education indicator, and healthcare facility access influence stunting prevalence in West Java districts/cities?

This research is expected to provide benefits by contributing empirical evidence to stunting determinants theory from a community education perspective, providing evidence for policy-making in stunting prevention programs integrated with community education initiatives, demonstrating the application of multiple regression analysis in community health education research, and identifying strategic entry points for non-formal education programs targeting adult learners in stunting prevention.

2. METHODS

This research employs an analytical cross-sectional design with quantitative approach using secondary data. This design was chosen as appropriate for analyzing relationships among variables at a specific point in time (Setia, 2016). The research population consists of all districts/cities in West Java Province, totaling 27 (18 districts and 9 cities).

3.1 Respondents and Sampling

This study uses total sampling technique, making all 27 districts/cities analysis units. Inclusion criteria were districts/cities in West Java Province with complete data on all research variables for 2023. All 27 districts/cities met the criteria.

3.2 Data Sources and Variables

Research data sources include: (1) Central Bureau of Statistics (BPS) of West Java Province for percentage of poor population 2023, average years of schooling for population aged 15+ years 2023, and Human Development Index (HDI) 2023, (2) West Java Open Data portal for stunting prevalence based on e-PPGBM 2023, and (3) West Java Provincial Health Office for healthcare facilities per 10,000 population data 2023.

The dependent variable is Stunting Prevalence, measured as percentage of children under five with short and very short nutritional status (HAZ score < -2 SD) per district/city. Independent variables are: (1) Poverty Rate (X_1): Percentage of poor population per district/city, defined based on BPS poverty line calculated from minimum food and non-food needs, (2) Average Years of Schooling (X_2): Average number of years of formal education for population aged 15 years and above, serving as indicator of community education level, and (3) Healthcare Facility Access (X_3): Ratio of healthcare facilities (Puskesmas, Puskesmas Pembantu, Clinics) per 10,000 population.

From a community education perspective, average years of schooling represents the general educational capacity of the community, reflecting potential for health literacy and

effective participation in health education programs. This variable serves as a proxy for community readiness to receive, process, and apply health information.

3.3 Data Analysis

Data analysis uses JASP software version 0.18.3 with stages: (1) Univariate Analysis for descriptive statistics including mean, standard deviation, minimum, maximum, skewness, and kurtosis, (2) Bivariate Analysis using Pearson correlation to examine relationships between independent and dependent variables, (3) Classical Assumption Tests including normality test using Shapiro-Wilk, multicollinearity test using Variance Inflation Factor (VIF), homoscedasticity test using residual scatter plot, and autocorrelation test using Durbin-Watson statistic, (4) Multiple Linear Regression Analysis with model $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$, where Y = Stunting prevalence (%), X_1 = Poverty rate (%), X_2 = Average years of schooling (years), X_3 = Healthcare facility access (per 10,000 population), ε = Error term.

Significance level was set at $\alpha = 0.05$ for all statistical tests. Model fit was evaluated using R^2, Adjusted R^2, and F-statistic. Individual predictor significance was assessed using t-tests and 95% confidence intervals. Correlation strength was interpreted using Cohen (1988) classification: 0.10-0.29 weak, 0.30-0.49 moderate, 0.50-1.00 strong.

3.4 Research Ethics

This research uses aggregate secondary data at district/city level that is public in nature, not involving human subjects directly. Data used has been published by official institutions and publicly accessible, therefore does not require special ethical clearance according to Helsinki Declaration guidelines for non-intervention research using public data (World Medical Association, 2013).

4. FINDINGS AND DISCUSSION

4.1 Descriptive Profile of Stunting and Poverty in West Java

Average stunting prevalence across 27 West Java districts/cities in 2023 is 20.35% with considerable variation (SD = 4.18%), ranging from 12.80% to 28.45% (see Table 1). This figure indicates that several districts/cities remain far above the national target of 14%. The wide variation suggests heterogeneous implementation of stunting prevention programs and differing socio-economic conditions across regions.

Average poverty rate is 8.42% with standard deviation of 2.56%, showing economic disparities across regions. Average years of schooling ranges from 6.21 to 11.84 years (mean = 8.73, SD = 1.35), reflecting significant differences in educational attainment. From a community education perspective, this variation suggests differing levels of health literacy and capacity to benefit from health education programs across districts/cities. Areas with lower average schooling years may require more intensive, tailored community education interventions with simplified messaging and enhanced facilitation support.

Healthcare facility access shows variation with an average of 4.56 units per 10,000 population (SD = 1.89), ranging from 1.85 to 9.23. This disparity in healthcare infrastructure availability affects not only direct service delivery but also opportunities for health education through facility-based programs such as Posyandu and maternal-child health clinics. Skewness and kurtosis values for all variables fall within the -1 to +1 range, indicating near-normal data distribution (Hair et al., 2014).

District city with highest stunting prevalence are generally rural areas with difficult geographic access and higher poverty rates. Conversely, major cities such as Bandung and Bekasi show lower prevalence, consistent with (Beal et al, 2018) findings about urban-rural differences in stunting incidence in Indonesia. This disparity provides opportunities for inter-regional peer learning and replication of best practices from districts/cities with low prevalence.

4.2 Normality and Classical Assumption Tests

Results of Shapiro-Wilk test (Table 2) show all variables are normally distributed ($p > 0.05$), meeting assumptions for parametric analysis. Q-Q plot for residuals shows points following the diagonal line, indicating residual normality is met.

All VIF values range from 1.523 to 2.678 (all < 10) with tolerance values from 0.373 to 0.657 (all > 0.1), indicating no serious multicollinearity (see Table 4). Residual scatter plot shows random distribution without specific patterns, confirming homoscedasticity. Durbin-Watson value of 1.876 (approaching 2) indicates no significant autocorrelation.

4.3 Bivariate Relationships Between Variables

Correlation analysis reveals three significant relationships (see Table 3). Poverty rate has a strong positive correlation with stunting prevalence ($r = 0.628$, $p < 0.001$), confirming the fundamental role of socioeconomic factors in child malnutrition. This finding is consistent with meta-analysis by (Akombi et al, 2017) showing poverty increases stunting odds ratio by 1.89 in low- and middle-income countries.

Average years of schooling has a strong negative correlation with stunting ($r = -0.542$, $p < 0.001$), indicating that increased community education levels associate with reduced stunting. This finding supports the critical role of education as a protective factor against malnutrition. From a community education perspective, this suggests that investments in adult education and literacy programs may have downstream benefits for child nutritional outcomes through enhanced parental capacity for health promotion.

Healthcare facility access has a moderate negative correlation with stunting ($r = -0.487$, $p = 0.009$), indicating that healthcare service availability plays a role in reducing stunting. Healthcare facilities serve not only as treatment centers but also as platforms for health education delivery through antenatal care, postnatal visits, and growth monitoring programs. Correlations among independent variables range from 0.456 to 0.689, indicating no severe multicollinearity ($r < 0.90$).

These correlation patterns suggest that stunting reduction requires integrated interventions addressing economic conditions while strengthening community education capacity and healthcare infrastructure. The strong correlation between education and stunting specifically highlights education's potential as a lever for health improvement.

4.4 Multiple Regression Model Results

The overall regression model is significant ($F = 13.25$, $p < 0.001$), with $R^2 = 0.643$ (see Table 5). This means 64.3% of stunting prevalence variation can be explained by the three independent variables together. Adjusted $R^2 = 0.597$ shows the model remains robust after

adjusting for the number of predictors. The regression equation is: $\hat{Y} = 36.542 + 0.795X_1 - 1.356X_2 - 0.641X_3$.

Poverty rate has significant positive influence on stunting ($\beta = 0.487$, $t = 3.272$, $p = 0.003$), representing the strongest predictor in the model. Each 1% increase in poverty rate increases stunting prevalence by 0.795%. Average years of schooling has significant negative influence ($\beta = -0.312$, $t = -2.413$, $p = 0.021$). Each 1-year increase in average schooling reduces stunting prevalence by 1.356%. Healthcare facility access shows significant negative influence ($\beta = -0.289$, $t = -2.180$, $p = 0.035$). Each unit increase in healthcare facilities per 10,000 population reduces stunting prevalence by 0.641%.

4.5 Poverty's Influence on Stunting: Community Education Implications

The finding that poverty significantly influences stunting ($\beta = 0.487$, $p = 0.003$) emphasizes the need for poverty-sensitive education programs that address resource constraints while promoting optimal child nutrition. From a community education perspective, addressing poverty's impact on stunting requires multi-pronged educational approaches.

Nutrition education programs should target parents, especially mothers, with practical knowledge about affordable nutritious foods, cost-effective meal preparation, and optimal breastfeeding and complementary feeding practices. Programs should acknowledge resource constraints while emphasizing locally available, affordable nutritious options. Poverty limits a household's ability to access nutritious food, particularly sources of animal protein, fruits, and vegetables, which are essential for child growth. Research by (Psaki et al, 2012) showed that families in the poorest quintile had a dietary diversity score 40% lower than those in the richest quintile.

Health literacy enhancement should build parents' capacity to understand growth charts, recognize nutritional deficiency signs, and navigate healthcare systems effectively. Health literacy is particularly critical in poverty contexts where limited resources make informed decision-making essential. Integration of nutrition education with income-generating skill training and financial literacy programs recognizes that addressing poverty requires both immediate knowledge application and longer-term economic empowerment.

Although Indonesia has a National Health Insurance (JKN) program, poor families still face obstacles in accessing health services, including transportation costs, opportunity costs, and limited knowledge (Mahendradhata et al., 2017). In West Java, this disparity in access can be seen from the variation in K4 coverage (the 4th ANC visit) which ranges from 78% to 95% between districts/cities.

Poverty also correlates closely with poor sanitation and hygiene conditions. Systematic review by (Cumming and Cairncross, 2016) shows that inadequate sanitation contributes to Environmental Enteric Dysfunction (EED), a chronic intestinal inflammatory condition that disrupts nutrient absorption and causes growth faltering. In Indonesia, 18% of poor households still practice open defecation (BABS) compared to only 2% of non-poor households (BPS, 2023).

4.6 Educational Attainment's Protective Effect: Mechanisms and Strategies

Average years of schooling has significant negative influence ($\beta = -0.312$, $p = 0.021$). Each 1-year increase in average schooling reduces stunting prevalence by 1.356%. This finding

demonstrates education's critical importance in stunting prevention and supports several mechanisms.

Enhanced cognitive skills through higher education develops analytical and problem-solving skills applicable to childcare challenges, nutritional planning, and health decision-making. Improved health literacy enables educated individuals to better comprehend health messages, follow medical advice, and adopt preventive health behaviors. Greater autonomy and agency, particularly for women, enhances decision-making power in households regarding resource allocation, healthcare seeking, and childcare practices. Social capital and network access expand through education, facilitating information exchange, mutual support, and resource sharing among parents.

The disparity in average length of schooling in West Java (6.21 - 11.84 years) reflects the disparity in access and quality of education between regions. Districts with average low school years are generally areas with difficult geographic access and high poverty rates, creating a poverty-low-education-stunting cycle that needs to be broken through systemic interventions.

For community education practice, these findings suggest several strategic implications. Compensatory education through intensive non-formal education programs in areas with lower average schooling years can help bridge knowledge gaps and improve health outcomes. Tailored pedagogical approaches mean community education programs must adapt content complexity, delivery methods, and facilitation styles to participants' educational backgrounds, applying adult learning principles appropriately. Multi-generational benefits underscore that investing in girls' and women's education yields long-term benefits for child health, supporting both formal education expansion and adult literacy programs.

Educational interventions for stunting prevention need to include : integrated nutrition education in the school curriculum introducing nutrition concepts from an early age, scholarship programs for children from poor families to prevent school dropouts, parenting classes especially for pregnant women and mothers of toddlers with low education, and community-based nutrition campaigns using participatory approaches and local languages.

4.7 Healthcare Access and Health Education Platforms

Healthcare facility access shows significant negative influence ($\beta = -0.289$, $p = 0.035$). Each unit increase in healthcare facilities per 10,000 population reduces stunting prevalence by 0.641%. This finding has important implications for community education.

Healthcare facilities, particularly Puskesmas and health centers, serve as strategic platforms for delivering health education during routine services such as antenatal care, immunization, and growth monitoring. Facility-based education programs can reach populations already motivated to seek health services, maximizing efficiency and impact.

Puskesmas and their networks (Pustu, Posyandu) play a crucial role in: monitoring growththrough regular weighing and height measurement for early detection of growth faltering (Ashworth et al., 2008), intervensi gizi through micronutrient supplementation (iron tablets for pregnant women, vitamin A for children under five) and supplementary feeding for malnourished children (Bhutta et al., 2013), edukasi dan konseling on infant and young child feeding (IYCF), exclusive breastfeeding, complementary feeding, and hygiene practices by

trained health workers proven to improve optimal care practices (Lassi et al., 2020), and manajemen penyakit infeksi treating diarrhea, acute respiratory infections, and other infectious diseases that can worsen children's nutritional status.

Although the ratio of health facilities per 10,000 population varies (1.85 - 9.23), physical accessibility remains a challenge, especially in the mountainous and archipelagic areas of West Java. The distance traveled >5 km to the nearest health facility increases the risk of stunting by 1.8 times (Rachmi et al., 2016). In addition to physical accessibility, the quality of service also determines the effectiveness of interventions.

Recommendations for health system strengthening include: expanding reach through adding Pustu and Posyandu in remote areas with special incentives for health workers, improving service quality through implementing minimum service standards and regular training, integrating services through one-stop service for pregnant women and children under five, utilizing technology through telemedicine for nutritional consultation and mobile apps for growth monitoring, and strengthening referral systems ensuring children with nutritional complications can be referred and treated promptly.

4.8 Model Predictive Power and Policy Implications

The resulting regression model can be used as a tool to predict the prevalence of stunting based on socio-economic and health indicators. With $R^2 = 0.643$, this model explains about 64.3% of stunting variations, indicating that the factors studied are important determinants, but there are still 35.7% variations explained by factors outside the model such as infant and child feeding practices (PMBA), maternal nutritional status (height, BMI), access to clean water and sanitation, birth distance, parenting and psychosocial stimulation, prevalence of infectious diseases, and specific stunting prevention programs at the local level.

Research results emphasize the importance of integrated and multisectoral approaches to stunting prevention, with community education serving as a cross-cutting strategy. Interventions must integrate health, social, education, economic, and infrastructure sectors with appropriate targeting to high-risk areas and families.

Effective community education strategies should: apply adult learning principles by involving parents in identifying learning needs, building on their experiences, focusing on practical problem-solving, and providing immediately applicable knowledge; address poverty constraints by recognizing resource limitations while promoting optimal practices, offering alternatives and adaptations, and integrating economic empowerment components; leverage multiple platforms utilizing diverse channels including healthcare facilities, village learning centers, religious institutions, women's groups, and digital media; ensure program quality by investing in facilitator training, developing culturally appropriate materials, implementing monitoring and evaluation systems, and continuously improving based on feedback; and promote peer learning by facilitating mother-to-mother support groups and building community support networks for sustained behavior change.

Specific recommendations for West Java context include: prioritizing districts/cities with high stunting prevalence (above 24%) and high poverty rates (above 10%) for intensive community education interventions, developing standardized training modules for Posyandu kaders and community health workers incorporating adult learning principles and participatory methods, establishing mother support groups in each village/sub-district for peer learning and

mutual encouragement, integrating nutrition and parenting education into existing programs such as PKK and religious gatherings to maximize reach, and creating partnerships between health sector, education sector, and community organizations for coordinated program implementation.

4.9 Study Limitations

This study has several limitations. Cross-sectional design limits causal inference, as relationships identified are associative rather than causal. Use of aggregate district/city-level data may mask within-district variations and individual-level relationships. Average years of schooling serves as a proxy for community education level but does not capture specific health literacy or nutritional knowledge. The study does not include data on quality and intensity of existing community education programs across districts/cities.

Despite these limitations, this study provides important evidence for the role of community education in stunting prevention and identifies strategic entry points for intervention. The findings support policy decisions to strengthen adult education and community development programs as part of comprehensive stunting reduction strategies.

5. CONCLUSION

Average stunting prevalence across 27 West Java districts/cities in 2023 is 20.35% with considerable variation (12.80% - 28.45%), indicating that West Java still faces serious challenges in achieving the national stunting target of 14% by 2024. There is a strong and significant positive relationship between poverty rates and stunting prevalence ($r = 0.628$, $p < 0.001$). Simultaneously, poverty rates, average years of schooling, and healthcare facility access significantly influence stunting prevalence with a contribution of 64.3% ($R^2 = 0.643$, $F = 13.25$, $p < 0.001$). Poverty rate is the strongest determinant ($\beta = 0.487$, $p = 0.003$), followed by average years of schooling ($\beta = -0.312$, $p = 0.021$) and healthcare facility access ($\beta = -0.289$, $p = 0.035$).

From a community education perspective, these findings highlight the critical role of adult and community education in stunting prevention. The significant influence of average years of schooling demonstrates that enhancing educational attainment, both through formal schooling and non-formal adult education programs, can effectively reduce stunting prevalence. This supports investment in comprehensive community education initiatives that address health literacy gaps through targeted nutrition and childcare education programs for parents, integrate poverty-sensitive approaches recognizing resource constraints, leverage healthcare facilities as education platforms, implement multisectoral interventions combining poverty reduction with education enhancement, and establish sustainable peer learning networks and mother support groups.

Policy recommendations include expanding access to quality non-formal education programs focusing on health literacy and parenting skills, particularly in high-poverty areas with lower educational attainment; integrating nutrition and health education into existing community development programs such as PKK and village learning centers; investing in facilitator training and program quality assurance for community health education initiatives; strengthening partnerships between health, education, and community development sectors for coordinated stunting prevention efforts; and prioritizing resource allocation to districts/cities

with highest stunting prevalence and lowest educational attainment for intensive community education interventions.

Future research should conduct longitudinal studies to establish causal relationships between community education interventions and stunting outcomes, evaluate effectiveness of different community education approaches and pedagogical methods in stunting prevention, assess health literacy levels and nutritional knowledge directly among parents in high and low stunting areas, and examine how participation in specific community education programs mediates the relationship between poverty, education, and stunting.

6. ACKNOWLEDGMENTS

The authors acknowledge the Central Bureau of Statistics (BPS) of West Java Province, West Java Open Data portal, and West Java Provincial Health Office for providing data used in this research. We also thank the reviewers for their valuable feedback in improving this manuscript.

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