Article Type: Research Paper

The role of village development on stunting prevalence reduction in Eastern Indonesia

Intan Solikhah Indriana, Romi Bhakti Hartarto*, Tiara Fadhila, and Gilang Adi Nugraha

Abstract: Stunting has become a global priority in addressing health disparities among children. The study aims to investigate the autonomy of villages in reducing the prevalence of stunting in eastern Indonesia. The research data coverage is derived from sources with high credibility in Indonesia. The prevalence of stunting is obtained from the Indonesian Nutrition Status Survey by the Ministry of Health, while the Village Development Index is sourced from the Ministry of Villages. Panel data from 13 provinces in Eastern Indonesia for 2015-2022 are estimated using the Random Effect Model through the Generalized Least Squares method. The findings indicate that the Village Development Index significantly influences the reduction of stunting rates. This highlights the importance of local empowerment strategies in combating health disparities. Furthermore, the decrease in unmet Family Planning (FP) service needs, the decline in early marriages under 18 years, and the higher years of education contribute significantly to the reduction of stunting prevalence. This underscores the interconnection between social determinants and child health outcomes.

Keywords: Stunting; Rural Development; Child Nutrition; Eastern Indonesia
JEL Classification: I15; J13; Q18

AFFILIATION:
Department of Economics, Faculty of Economics and Business, Universitas Muhammadiyah Yogyakarta, Special Region of Yogyakarta, Indonesia

***CORRESPONDENCE:**
romi.hartarto@umy.ac.id

THIS ARTICLE IS AVALILABLE IN:
http://journal.umy.ac.id/index.php/esp

DOI: 10.18196/jesp.v25i1.22099

CITATION:
Indriana, I. S., Hartarto, R. B., Fadhila, T., Nugraha, G. A. (2024). The role of village development on stunting prevalence reduction in Eastern Indonesia. *Jurnal Ekonomi & Studi Pembangunan, 25*(1), 87-96.

ARTICLE HISTORY
Received:
25 Dec 2023
Revised:
27 Feb 2024
16 Mar 2024
Accepted:
26 Apr 2024

Introduction

The failure of linear growth in children manifests as a global nutritional imbalance. Children with negative linear growth experience poor future life quality. The toddler period is the most sensitive phase for sustainable growth development (Kurniasih et al., 2010). A staggering 148.1 million children aged 5 and below suffer from stunting, with height-for-age z-scores less than -2 standard deviations. Broadly, the risk of stunting can hinder long-term human development due to limited cognitive function and economic productivity. In line with Ekholuenetale et al. (2020), stunting has the potential to reduce cognitive ability by 7%. Thus, stunting becomes a key indicator of child health disparities (Pradhan et al., 2003).

Addressing stunting, recognized as a critical impediment to achieving Sustainable Development Goal 2 (Zero Hunger) and Sustainable Development Goal 3 (Good Health and Well-being), has ascended to the forefront of the global health agenda. The World Health Organization targets a 40% reduction in stunting from 2010 to 2025, making it a primary indicator for achieving the Sustainable Development Goal of Zero Hunger.

This necessitates a 3.9% annual average global reduction in stunting prevalence. Southeast Asia has successfully decreased the stunting proportion from 38% to 31.9% from 2000 to 2020. However, this still ranks second globally after Africa at 33.1% (Aida, 2019).

A similar scenario unfolds in Indonesia, where the prevalence of stunting has relatively decreased within the last ten years from 37.2% in 2013 to 21.6% by 2022. However, this figure remains far from the 2024 National Medium-Term Development Plan threshold of 14%. The regions contributing significantly to this issue are East Nusa Tenggara (37.80%), West Sulawesi (33.80%), Aceh (33.20%), West Nusa Tenggara (31.40%), and Southeast Sulawesi (30.20%). On average, the eastern regions of Indonesia exhibit the most chronic prevalence, surpassing the national average. The developmental trends are illustrated in Figure 1.

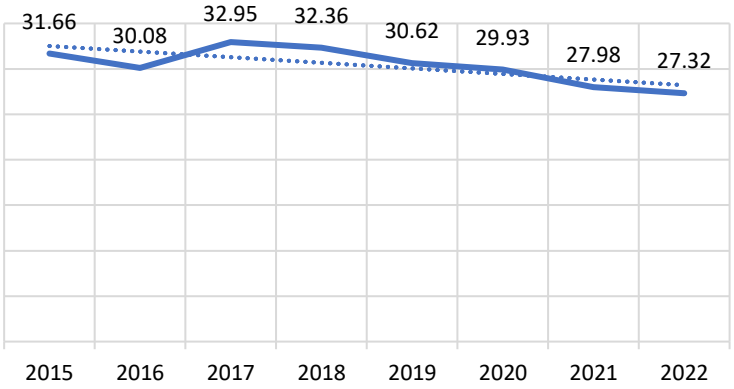

Figure 1 Stunting Trend in Eastern Indonesia
Source: Ministry of Health

The situation arises due to the high number of underdeveloped regions and the low rate of improvement in underdeveloped areas compared to western Indonesia, as shown in Table 1 (Salim & Faoziyah, 2019). This is a concern in line with Indrastuty & Pujiyanto (2019), highlighting that children in rural areas are more likely to suffer from stunting.

Table 1 Percentage of Stunting Prevalence in Underdeveloped Areas

Category	Year	Decrease in Underdeveloped Areas (%)
Western Region	2009	39
	2014	23
		41.03
Eastern Region	2009	78
	2014	74
		5.13
Total	2009	117
	2014	97
		17.09

Note: The percentage of decrease is calculated based on the figures for the years 2009 and 2014.
Source: Salim & Faoziyah (2019)

This study introduces the use of the Village Development Index to investigate its impact on stunting. The index serves as a primary benchmark to observe the success level of village development in social, economic, and ecological dimensions (Hasugian et al., 2020; Iftitah & Wibowo, 2022). This is also based on the fact that villages play a crucial role in determining the success of national development priorities outlined in The National Medium-Term Development Planning 2020-2024. So far, there has been limited research connecting the Village Development Index indicators to the prevalence of stunting in Indonesia (Wicaksono et al., 2022). Most literature still relies on micro-level data such as interviews or surveys with relevant participants (Maad & Anugrahini, 2021; Raikhani et al., 2022; Ridua & Djurubassa, 2020). Micro-focused reviews on a specific region are insufficient to conclude the overall economy (Priyono & Chandra, 2016).

This study employs panel data estimation to assess the impact of village status on the reduction of stunting. Specifically, the research utilizes data from 13 provinces over 8 years. In contrast to previous research, Widyaningsih et al (2022) only used cross-sectional data from IFLS-5 to understand the socio-economic impact of stunting in rural and urban areas through logistic regression. The use of panel data estimation can enhance the accuracy of regressor estimates due to the accumulation of cross-sectional and time series data, providing a greater degree of freedom and control over biases (Widarjono, 2013).

Therefore, this study aims to explore the role of the Village Development Index in accelerating the reduction of stunting proportions in the eastern regions of Indonesia. It is anticipated that the research findings will enrich the literature on stunting in eastern Indonesia and serve as a basis for the government to intensify interventions in rural areas.

The critical issue of stunting in children, especially in Eastern Indonesia, persists despite some reduction in prevalence. Current research relies on micro-level data, lacking a broader socioeconomic context. Introducing the Village Development Index as a primary metric, this study aims to understand the association between village development and stunting. Despite the recognized significance of villages in national development, research is scant. Previous studies using cross-sectional data have limitations. Employing panel data estimation, this research aims to deepen understanding of the Village Development Index's role in mitigating stunting and informing policy interventions. Its novelty lies in integrating socioeconomic dimensions with health outcomes, offering insights into addressing stunting in Eastern Indonesia and advancing Sustainable Development Goals 2 (Zero Hunger) and 3 (Good Health and Well-being).

Research Method

This study utilizes panel data from 13 provinces in the eastern region of Indonesia for the period 2015-2022 due to the data availability of all variables being used in this study. The complete list of provinces can be found in the Appendix. The research data coverage is derived from sources with high credibility in Indonesia. The prevalence of stunting is obtained from the Indonesian Nutrition Status Survey by the Ministry of Health, the Village Development Index is sourced from the Ministry of Villages, and food vulnerability

is collected from the Food Security Statistics by the National Food Agency. Information regarding the percentage of unmet Family Planning (FP) services, adolescents marrying under the age of 18, and educational achievements are adopted from the Central Statistics Agency.

The estimation model for the research can be specified in Equation (1) as follows:

$$stunt_{it} = \beta_0 + \beta_1 idm_{it} + \beta_2 kb_{it} + \beta_3 mrd_{it} + \beta_4 food_{it} + \beta_5 educ_{it} + \omega_{it} \quad (1)$$

The presence of *i* refers to the province, and *t* is the time. As the dependent variable, $stunt_{it}$ indicates the prevalence of stunting in infants aged 0-59 months; β_0 is the regression model intercept; idm_{it} represents the Village Development Index as a proxy; kb_{it} describes unmet family planning needs; mrd_{it} indicates adolescents married under the age of 18; $food_{it}$ represents food vulnerability; $educ_{it}$ presents the educational attainment of the community in terms of school years. ω_{it} is a combined error term consisting of μi as the error term for the province-specific individual and ε_{it} as the error term for the combination of cross-sectional and time series data.

The selection of the dependent variable is based on the statement from the World Health Organization, which categorizes a prevalence of stunting exceeding 20 percent as a chronic health problem.[1] The study selects the Village Development Index as the variable of interest because, in line with previous findings (Wicaksono et al., 2022), it establishes this indicator as a benchmark for the progress of a province in influencing the stunting rate. The investigation of stunting cases is also supported by other relevant control variables. The study controls for the unmet family planning variable to assess the quality of reproductive achievements, such as the use of contraceptives (Listyaningsih et al., 2016). The use of the percentage of children marrying under 18 years old illustrates the vulnerability of early marriages in caring for children (Windasari et al., 2020). Furthermore, the level of food vulnerability is considered concerning the adequacy of nutritional intake, which will impact a child's growth and development (Cook & Frank, 2008). Finally, the study also controls education variables regarding the duration of schooling in the relevant province. The higher the education level, the broader an individual's perspective, potentially improving child health (Damayanti & Sofyan, 2021). The variable selection has undergone experimental testing to obtain the best combination of variables.

Regression estimation of panel data in Equation (1) is obtained using three approaches: Pooled Least Squares (PLS), Fixed Effects Model (FEM), and Random Effects Model (REM) to test the stability of results. The Random Effects Model (REM) is the preferred choice based on the assumption of no correlation between the regressors and the error term. Thus, this approach can address the heterogeneity among provinces from the PLS estimates by not forcing variables to have the same effect. Furthermore, the advantage

[1] World Health Organization. (2018). Levels and Trend Child Nutrition Key Findings of the 2018 Edition of the Joint Child Malnutrition Estimates.

of using REM estimation over FEM lies in its ability to account for unobserved heterogeneity across entities, thereby yielding more efficient estimates. (Gujarati, 2003).

In the REM approach, the error term for the cross-sectional unit at two different time points is assumed to be the same, regardless of the data period range, and applies uniformly to each province. If this correlation structure is estimated through the OLS approach or not considered, it will result in inefficient estimates. Therefore, this model can be efficient if estimated using the Generalized Least Squares (GLS) method with the assumption of homoscedasticity without cross-sectional relationships, thus avoiding autocorrelation (Basuki & Yuliadi, 2015). Thus, Generalized Least Squares can explicitly capture individual differences with results that align with the criteria for the Best Linear Unbiased Estimator (BLUE).

Result and Discussion

Table 2 presents a summary of statistics describing the characteristics of each research variable. Based on the obtained statistics, the prevalence of stunting in children aged 0-59 months in the eastern region of Indonesia ranges from 8 to 44 percent, with an average of 30.36%. Table 2 also provides descriptive statistics for the average Village Development Index, which is 59.35%. This result implies that the village underdevelopment in the eastern region of Indonesia is still relatively high, which is greater than 40%. The data also indicates that there is an unmet need for family planning services in this region, accounting for 6%, early marriage among adolescents under 18 years is relatively high at around 5.16%, food vulnerability still occurs with an average of 10.9%, and most of the population completes education within 9 years or equivalent to Junior High School.

Table 2 Descriptive Statistics

Variables	Obs.	Mean	Std. dev	Min	Max
Stunting	104	30.363	6.673	8	44
Village Development Index	104	59.346	8.769	41	86
Unmet needs	104	5.786	1.941	2.16	10.21
Marriage <18 years	104	5.156	2.930	1	10.2
Food insecurity	104	10.913	5.083	1.84	33
Years of education	104	8.681	0.941	6.27	10.37

Source: Author's calculations

This research aims to investigate the influence of the Village Development Index on the acceleration of reducing stunting prevalence in the eastern region of Indonesia. Table 3 shows the estimation results using Pooled Least Squares (PLS), Fixed Effect Model (FEM), and Random Effect Model (REM) from the study data. The estimation results with Pooled Least Squares and Random Effect Model are considered to have similarities in their significance levels. However, based on tests with the Breusch-Pagan LM Test and Hausman Test, it was found that the Random Effect Model is the best model for this study.

Table 3 Coefficient Estimates of PLS, FEM, and REM

Dependent Variable: Stunting	PLS	Fixed Effect	Random Effect
Village Development Index	-0.328***	-0.389***	-0.282***
	(0.052)	(0.111)	(0.068)
Unmet needs	1.845***	0.645*	1.168***
	(0.212)	(0.331)	(0.283)
Marriage <18 years	0.039***	0.022**	0.025**
	(0.013)	(0.010)	(0.010)
Food insecurity	0.145	0.010	0.015
	(0.090)	(0.110)	(0.093)
Years of education	-2.116***	0.693	-1.847**
	(0.429)	(2.225)	(0.887)
Constant	58.87***	42.47***	54.91***
	(4.846)	(15.72)	(7.792)
Observations	104	104	104
R-squared	0.697	0.369	0.815
Number of provinces	13	13	13
Hausman Test (chi2)		2.95	
Prob>chi2		0.708	

Source: Author's calculations
Standard errors in parentheses
***p<0.01, **<0.05, *<0.1

The Hausman test indicates a chi-square value of 2.95 with a probability value of 0.708, which is greater than 0.05. Therefore, this study rejects hypothesis one, which involves estimating data using the fixed effects approach. Subsequently, the model is processed using the Generalized Least Squares method, which can account for the heterogeneity of each province. Thus, the goodness of fit produced is 0.815, meaning that the research regressors can explain 81.5% of the prevalence of stunting, with the remaining being explained by other variables not included in the research model.

As measured by the Village Development Index, the level of village development is negatively and significantly correlated with the prevalence of stunting in the relevant region. This implies that socially, economically, and ecologically independent villages can reduce stunting rates more effectively than underdeveloped villages. The development of villages in the eastern region of Indonesia has received significant recognition for addressing various issues, including stunting, from the central government through the delegation of authority and budget allocation known as the village fund (Permatasari et al., 2021). The budget is allocated for development, such as improving basic service facilities, providing business loans, and environmental infrastructure. A similar allocation has also been made in rural Africa as part of the Millennium Village Project, successfully reducing stunting cases (Mitchell et al., 2018; Pronyk et al., 2011). Consistent with the findings of Singh et al. (2021) regarding their case study in India, the issue is focused on areas experiencing underdevelopment. The stunting condition is influenced by the lack of infrastructure, such as sanitation and public health facilities for mothers and children.

Specifically, an estimated increase of 1% in the Village Development Index can lead to a 0.28% reduction in stunting. The coefficient of determination of less than 1% indicates

that the variable is inelastic. This means that the village's independence status only indirectly affects the reduction in stunting. Simultaneously, government policies in village development do not run inclusively, indicating a lack of synergy between the village government and the families involved in the sustainability of the program (Zarkasi & Dimasrizal, 2019). Often, the distribution of village funds is not equitable due to the spread of corrupt individuals. Additionally, the related families do not utilize the program assistance to address child stunting but rather spend it on other living expenses. Thus, a high level of village development has a minimal impact on reducing stunting without support from both the government and the community. In summary, village development can help decrease stunting rates, but its success depends on fair distribution and proper use of resources, requiring involvement from both the community and inclusive governance.

The positively significant coefficient of unmet Family Planning (FP) services suggests that the higher the number of family members, the greater the potential for stunting compared to families with two children. A 1% increase in unmet FP services can increase the prevalence of stunting in the eastern region by 1.17%. The difficulty in accessing family planning services, such as contraceptive facilitation, leads to inconsistencies in a mother's pregnancy, such as having pregnancies that are too close together, and the First 1000 Days of Life not progressing smoothly. As found in previous studies, a mother's health not recovering from an earlier pregnancy will affect reproductive achievement, leading to growth disorders in infants, such as short stature, small size, and low birth weight (Chungkam et al., 2020; Kozuki & Walker, 2013; Rana & Goli, 2017). The First 1000 Days are crucial periods for determining a child's growth and development. During the first phase when children are aged 0-59 months, they should receive sufficient nutrition through exclusive breastfeeding to avoid health risks such as diarrheal and respiratory infections, which have been proven to cause stunting (Horta & Victora, 2013). In short, making sure people have access to complete family planning services is vital for both mothers' health and creating the best start for children's lives, helping to prevent stunting and support their healthy growth.

The percentage of adolescents marrying under 18 years old seems to have a positive effect on the occurrence of stunting in the eastern region of Indonesia. This suggests that the majority of children born to mothers under the age of 18 are potentially more likely to experience stunting. This is because young mothers are more likely to experience pregnancy complications that impact the delayed physical growth of the born baby. This finding is consistent with Fitriahadi (2018), stating that babies born to mothers under 20 years old are potentially 1.5 times more likely to experience stunting. The educational attainment of the population in Eastern Indonesia has a significant negative implication for the prevalence of stunting. This indicates that the parent's level of education determines the degree of health in children. Educated parents will understand the appropriate nutritional intake and selection of basic health services since pregnancy (Leroy et al., 2014; Mustamin et al., 2018). People in underdeveloped areas do not consider this issue urgent and may potentially disrupt the choices of parents. This situation is in line with Mustajab & Romdiyah (2022), stating that the community does not consider stunting a serious problem, thus lacking family support for higher education.

In summary, tackling adolescent marriages and boosting education, especially among families and communities in less developed areas, are vital for reducing stunting, as they impact maternal health awareness and access to resources for children's well-being.

Conclusion

The issue of stunting remains urgent for a significant number of children in the eastern region of Indonesia, as evidenced by the prevalence percentage. Considering this reason, the Indonesian government is currently promoting the development of self-sufficient villages, manifested in the Village Development Index. However, the proportion of self-sufficient villages is still rare in the eastern region and tends to develop slowly. Based on the Generalized Least Squares method, the research shows that village development in all three aspects plays a role in accelerating the reduction of stunting prevalence in the eastern region. Although not providing a direct effect, villages can be at the forefront of eradicating stunting through the implementation of government programs, such as the village fund. Therefore, the government needs to reinforce the efforts of local authorities in allocating village funds to enhance self-sufficiency. This can be achieved if the local community also actively participates through labour, skill improvement, and social relationships.

Other factors such as early marriage and the high number of unmet family planning services will increase the stunting issue in the eastern region. Thus, the acceleration of stunting reduction can also be supported by community-based child protection efforts to intensively address early marriages and revitalize family planning services with wider coverage. Additionally, the population needs to be equipped with education to support stunting reduction. The government can expand the quantity and quality of schools in underdeveloped areas, such as the eastern region.

This research has limitations in the availability of Village Development Index data, which is only accessible for 8 years. Future research is expected to use other macro variables related to village development, such as village fund budgets or infrastructure indices, to make the research more comprehensive. Additionally, a comparison between normal conditions and conditions during the pandemic can be conducted. This way, the impact of village development can be observed from two perspectives: the pandemic and non-pandemic periods.

Author Contributions

Conceptualisation, I.S.I., T.F., and G.A.N.; Methodology, I.S.I and T.F.; Investigation, T.F. and G.A.N.; Analysis, I.S.I, T.F., and G.A.N; Original draft preparation, I.S.I and R.B.H; Review and editing, R.B.H.; Visualization, R.B.H. 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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