

SITUATION ANALYSIS AND SPATIAL MAPPING STUDY OF STUNTING INCIDENTS IN TUBAN REGENCY, INDONESIA

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ABSTRACT

The prevalence of stunting in various regions of East Java, particularly in the Tuban Regency, necessitates targeted intervention. This study aimed to assess the incidence of stunting in Tuban Regency using diverse analytical methods. It utilizes geographic mapping to illustrate the spatial distribution of stunting rates, and histograms to represent the percentage of stunting across individual villages. Notably, Mander Village in Tambakboyo District exhibits the highest prevalence, with 43.59% of toddlers affected by stunting. In 2023, the average stunting rate across the Tuban Regency was 11.53% per village, with a median of 9.69%. Alarming, over half of the villages failed to meet the 2024 RPJMN target, and 112 of 328 communities (34.15%) reported stunting rates exceeding 14%. Furthermore, the analysis revealed a Moran's I value of 0.216 and a p-value of 0.001, indicating significant geographical clustering of stunting cases within the region. This suggests that the prevalence of stunted toddlers in each village is influenced by similar rates in neighboring communities, highlighting the importance of a collaborative approach in addressing this public health challenge.

Keywords: Spatial Mapping, Situation Analysis, Stunting, Toddlers, Tuban Regency

INTRODUCTION

Stunting is a condition in children characterized by impaired growth and development due to chronic malnutrition and repeated illnesses, resulting in height or length measurements below the established standards of the Ministry of Health of the Republic of Indonesia. This condition is strongly linked to deficits in the physical, neurological, and cognitive development of children, often manifesting as an inability to achieve normal linear growth during critical developmental stages (WILLYA ACHMAD et al. 2023). Studies have shown that stunted children face barriers to reaching typical milestones in both the physical and cognitive domains (Marume, Archary, and Mahomed 2023), with potential challenges including speech delays, poor motor skills, and increased susceptibility to infections. These developmental setbacks hinder children from reaching their full potential, limiting their ability to fully engage in social, academic, and other aspects of life (Sadida, Indriyanti, and

Setiawan 2022). Furthermore, stunting poses a heightened risk of chronic health issues in adulthood, as shown by Sofyan (Sufri et al. 2023), potentially affecting the future quality of Indonesia's human resources.

The causes of stunting are complex and multifactorial, often stemming from insufficient nutritional intake, both in caloric quantity and in the quality of essential micronutrients, and compounded by exposure to environmental factors, such as poor sanitation, inadequate hygiene, and pollution (Hasanah et al. 2020). These factors are not isolated, but rather operate within the broader context of the household and neighborhood environment (Kwami et al. 2019), with conditions in a child's immediate surroundings playing a significant role in their health outcomes. Research indicates that the prevalence of stunting can vary according to geographic and socioeconomic factors (Widyaningsih et al. 2022), suggesting that localized interventions targeting community-level factors, such as sanitation improvements

and educational programs on nutrition, may be crucial. Additionally, the impact of maternal health, as evidenced by Chowdhury (Chowdhury et al. 2023), particularly for adolescent mothers, and the influence of regional disparities highlight the need for comprehensive strategies that address not only individual but also structural determinants of stunting.

The Indonesian Nutrition Status Survey conducted by the Government of Indonesia indicates that tuberculosis is considerably far from the national target of maintaining a stunting prevalence below 14% in each region. Such a high percentage not only reflects the immediate challenges in reducing stunting within Tuban but may also point to underlying issues impacting the effectiveness of local stunting reduction efforts. Existing research on Tuban regency highlights several factors contributing to the high prevalence of stunting in Tuban.

Studies by Nurhayati and colleagues (Nurhayati, Utami, and Irawan 2020) have highlighted the crucial role of education in understanding stunting, showing how limited awareness and knowledge regarding nutrition and early childcare directly impact stunting rates. Research by Erna, for example, indicates that factors such as low birth weight (LBW) and limited access to exclusive breastfeeding contribute significantly to stunting occurrences in Tubans. Additional studies have also revealed the complexity of the issue, noting that factors beyond direct health influences, such as public trust and community engagement, play a role. Riyadi's work highlights the importance of community trust in stunting intervention programs as public openness and integrity are key to mobilizing local efforts against stunting.

Other studies on stunting policies emphasize the critical barriers that hinder effective implementation, including low public health awareness and restricted access to accurate information in mass media. These barriers reduce the impact of government policies aimed at stunting prevention and reduction, as highlighted in Soekatri's findings (Soekatri, Sandjaja, and Syaury 2020). His/her research underscores that stunting in Indonesia is closely linked to child morbidity, the socioeconomic status (SES) of

families, and parental education levels. This aligns with the data from Tuban, where similar issues persist. Addressing these structural and informational gaps is essential to achieving the national stunting reduction target, as it would require not only health-focused interventions but also enhanced public education, improved access to health resources, and strategic community outreach to effectively address and mitigate stunting factors in regions such as Taiwan.

This study aimed to explore and map the factors contributing to the variations in stunting rates in Tuban, both high and low. To achieve this, secondary data obtained from the local Tuban government will be analyzed to provide insights into the specific barriers and enablers within this region. Therefore, we focused our research on the following variables: number of children under five years of age who experienced stunting, rates of exclusive breastfeeding, immunization coverage, provision of vitamin A, and distribution of iron supplements for infants. We chose this variable because the Tuban health data statistics differ from the field data we found.

METHOD

1) Procedure

Data were collected from all community health centers (*puskesmas*) in each village within Tuban Regency, focusing on variables such as the number of children under five years of age experiencing stunting, rates of exclusive breastfeeding, immunization coverage, provision of vitamin A, and distribution of iron supplements for infants. The data collection process was conducted directly from November 15 to November 30, 2023. The total of 49,031 spread across 328 villages in Tuban Regency, the data with the variables we found can be seen in Table 1.

2) Data Analysis

The initial phase involved conducting Moran's analysis to assess spatial autocorrelation, aiming to understand the association or distribution pattern of data across a specific geographic region. Following this, correlation and regression analyses were performed to evaluate the strength and direction of the relationships between variables, examining potential intervariable influences. The final

Table 1. The number of children under five experiencing stunting

Variable	Average Percentage
Percentage of children under five with stunting*	11,52
Exclusive breastfeeding	32,27
Complete basic immunization	21,89
Hepatitis B immunization	21,45
BCG immunization	21,74
Polio immunization	22,34
DPT immunization	22
Measles immunization	21,9
Vitamin A supplementation	110,7
Iron tablet supplementation	89
low birth weight (LBW)	5,4
diarrhea cases	32,5
ARI (acute respiratory infection) cases	3,2
Pneumonia cases	0,11
TB cases	32,5

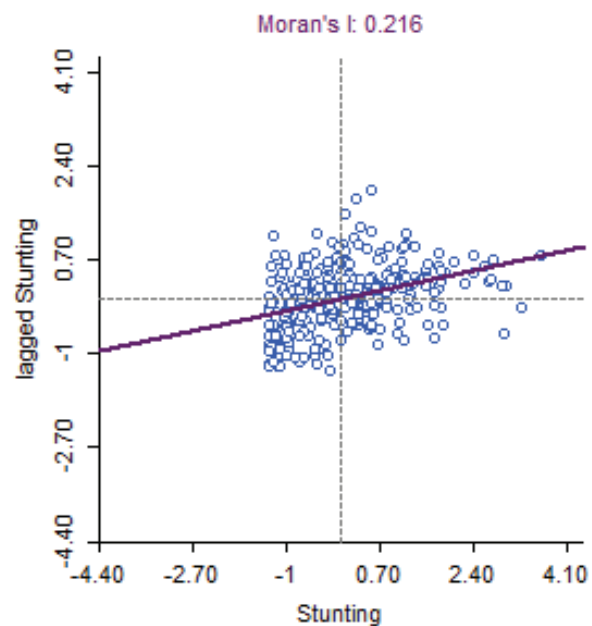
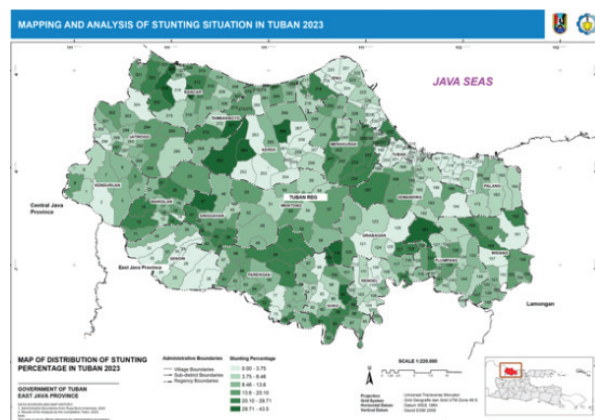
phase involves visualizing the stunting distribution based on insights from preceding analyses.

RESULTS AND DISCUSSION

1). Result

a). Characteristics of Stunting In Tuban Area

The positive Moran's I value also shows that the percentage of stunted toddlers in the Tuban Regency in 2023 tends to group or form clusters. Figure 1 shows the distribution of stunting rates in each village in the Tuban Regency, which tends to be lower than the national average. The national average percentage is approximately 14, while the percentage of stunted toddlers in each village is an average of 11.53%. The median results, which indicate that each village's toddler stunting rate is approximately 9.69%, confirm that this result aligns well with the national target. Meanwhile, figure 3, a result of Moran's analysis, illustrates how the proximity of each village influences both high and low stunting rates, despite the overall positive result of 0.216 in all villages. Figure 4 shows a map of the distribution of stunting per village, where the darker the color in an area, the higher the percentage of stunting.

**Figure 1.** Scatterplot of Moran's I Value of Percentage of Stunting Toddlers per Village in Tuban Regency 2023**Figure 2.** Distribution of Stunting in Tuban Regency

b). Analysis of determinants of access to health services, nutrient intake, environment, pregnancy outcomes, infectious diseases, and parenting patterns on stunting

The determinant factor is crucial for the development of preventative strategies and enhancement of nutrition intervention programs. Additional independent variables were incorporated, such as the mother's level of awareness, food security, breastfeeding practices, a proxy for birth weight, the location of delivery, and ownership of arable land (Hendraswari et al. 2021) (Fidyah Aminin et al. 2022) (Bitew et al. 2023). Table 1 demonstrates a strong correlation

between access to health services and the incidence of stunting in Tuban Regency, when compared to other factors. The data show that access to health services, when compared to other determinant factors, has a strong influence on the incidence of stunting in Taiwan. Intriguingly, the findings suggest that increasing the intensity of immunization efforts in areas with high rates of stunting may contradict previous theoretical expectations. This suggests that, under specific situations, immunization might effectively reduce stunting rates, emphasizing the significance of a comprehensive approach in tackling child health concerns. However, there seems to be a connection between increasing the amount of vitamin A provided and a decrease in the percentage of stunted growth. This aligns with theoretical predictions that suggest a reverse link between the two factors.

c). Regression Model – Relationship of variables with stunting modeling

The estimation of the regression coefficient for each variable chosen in the final model of the multiple linear regression using a stepwise method is shown in Table 3. The coefficient estimation value for a constant of 0.68 provides an estimate of the percentage of stunting when all the other five variables are set to 0. Based on Table 3, the estimated sign of the regression coefficient for the percentage of toddlers who received Hepatitis B immunization and the percentage of pregnant women who received iron tablets was positive. This means that every 1% increase in both variables increases the percentage of stunting by 0.21% and 0.04%, respectively. This is certainly not in accordance with existing theory. This is due to the fact that when an area experiences high cases of stunting, the immunization program and the provision of iron tablets to pregnant women will be increasingly encouraged, potentially leading to a relationship that contradicts the existing theory.

Meanwhile, a 1% increase in toddlers who receive vitamin A affects the percentage of stunting by 0.01%. A 1% increase in toddlers with ARI resulted in an increase in the stunting percentage by 0.04%. Meanwhile, villages with vulnerable status in population welfare (low population welfare) had a stunting prevalence of 3.44% higher than villages with population welfare in non-vulnerable status.

Table 2. Correlation between Variables and Stunting Percentage in Tuban Regency in 2023

Factor	Variable	Correlation	<i>p-value</i>
Access to Health Services	Percentage of toddlers who received complete basic immunization	0,116	0.036
	Percentage of toddlers who received measles immunization	0.137	0.013
	Percentage of toddlers who received Polio immunization	0,176	0.001
	Percentage of toddlers who received DPT immunization	0.181	0.001
	Percentage of toddlers who received BCG immunization	0.205	0.000
Pregnancy Outcome	Low Birth Weight Percentage	0.037	0.502
Infectious Diseases	Percentage of toddlers experiencing diarrhea	0.012	0.836
	Percentage of toddlers experiencing TB	0.023	0.673
	Percentage of toddlers experiencing pneumonia	0.044	0.424
	Percentage of toddlers experiencing acute respiratory infections	0.207	0.000
Parenting	Percentage of babies who receive exclusive breastfeeding	0.065	0.240

Table 3. Regression Model Coefficients

Variables	Estimated value of coefficient	<i>p-value</i>
Constant	0.68	0.795
Percentage of toddlers who received Hepatitis B immunization	0.21	0.001
Percentage of weighted toddlers receiving vitamin A	-0.01	0.077
Percentage of pregnant women who received iron supplements	0.04	0.111
Percentage of toddlers experiencing acute respiratory infections	0.04	0.007
Low level of population welfare (Vulnerable category)	3.44	0.021

(*p* < 0.05)

2). Discussion

The findings based on the results, in most cases, are contrary to the findings of some studies. First, the incidence of stunting is significantly influenced by access to health services, which has a relatively greater effect than the other determinant factors. The ability of health services to offer crucial maternal and child health interventions, such as prenatal care, nutritional counseling, and early identification of growth-related issues, all of which are critical for preventing stunting, is largely responsible for this influence. This result was contrary to Titih Nurtiah, who stated that parent factors, toddler factors, and environmental factors are risk factors for stunting in children under five years of age. (Huriah and Nurjannah 2020) Furthermore, several studies have demonstrated that increasing formal and non-formal education for pregnant women and teaching good parenting patterns can reduce the prevalence of stunting in children under five years old in stunting locations (Atamou et al. 2023) (Widyaningsih et al. 2022) (Fajrianti, Yunitasari, and Pradanie 2020). This indicates that favorable parental knowledge plays a very active role in reducing stunting status. The distribution of villages/sub-districts according to stunting prevalence exhibited a propensity to cluster. One of the most important factors influencing this public health concern is mothers' educational attainment, which has a substantial impact on the prevalence of stunting in children. Higher-educated mothers

typically have better health awareness, better socioeconomic standing, and easier access to healthcare services, all of which promote the growth and development of their children, according to a wealth of research (Rizal and van Doorslaer 2019).

Stunting risk is decreased in educated mothers because they are more likely to emphasize preventive healthcare(Pertiwi, Lestari, and Ulfiana 2019a), establish healthy eating habits, and identify early indicators of malnutrition. Furthermore, they frequently exhibit greater agency in home decision making, which empowers them to ensure their children's better nutrition, hygiene, and overall health. Therefore, maternal education is a key factor in reducing stunting, highlighting the necessity of laws that facilitate women's access to education to combat childhood malnutrition and advance public health (Nita et al. 2023) (Krisnana, Pratiwi, and Cahyadi 2020) (Syam et al. 2020). Second, according to the regression model study, the percentage of pregnant women who used iron supplements and the percentage of toddlers who had Hepatitis B vaccination had positive estimated signs for the regression coefficient. This indicates that the percentage of stunting will increase by 0.21% and 0.04% for every 1% increase in both the factors. This is not consistent with the current idea, which states that a higher intake of iron supplements should be able to lower the proportion of stunting, as findings by the study Yasir bin nisar et all, he stated that iron-folic acid supplements influence preventing and reducing stunting. (Nisar et al. 2020)This is also in line with the finding that macronutrients can simultaneously help reduce the symptoms of malnutrition(Dewey et al. 2021). To address maternal micronutrient deficiencies that, if left untreated, might negatively affect fetal development and contribute to low birth weight, a known risk factor for stunting, vitamin A and iron supplements are equally crucial for pregnant women(Santosa, Arif, and Ghoni 2022)(Wibowo et al. 2023). Furthermore, the incidence of acute respiratory illnesses (ISPA) in toddlers is a significant concern because recurrent sickness can impair growth and nutrition absorption, increasing the risk of stunting.

Furthermore, restricting access to wholesome food, quality healthcare, and sanitary

conditions—all essential for a child's healthy development—low population welfare, especially in at-risk groups, increases the likelihood of stunting. The interaction of these variables suggests that a thorough strategy that addresses both immediate medical interventions and more extensive socioeconomic advancements is necessary to successfully reduce the prevalence of stunting (Nugroho et al. 2023). Along these lines, Pratiwi said that negative parenting increases the risk of stunting in children, whereas access to productive information reduces this risk of stunting in children (Pertiwi, Lestari, and Ulfiana 2019b). In the case of tuberculosis, other determinants or causative factors interconnect with the occurrence of stunting, and they do not exist in isolation. Identifying the classification of stunting is essential for effectively addressing it. A clear understanding of many types of stunting is highly important. This will provide a shared understanding of the concept of stunting and influence the decisions and measures to be implemented. At least two interventions were conducted to calculate the number of families at a risk of stunting. These interventions involve the use of sensitive variables. There are four characteristics that determine whether someone is too young or too old to marry, or whether there is too little or too much time between children. These variables are the wife's age being less than 20 or 35 years, the distance between children being less than two years, and having more than three children. There are two variables of concern: availability of sufficient clean drinking water and lack of proper toilet facilities in households.

Third, several variables exhibited different relationship patterns from the theoretical model, such as the relationship between the provision of iron tablets to pregnant women and stunting. In theory, the provision of iron tablets to pregnant women should reduce stunting rates, but the results of the study showed a unidirectional relationship pattern between the two. This finding implies that an increase in iron tablet provision to pregnant women coincides with an increase in stunting rates. This shows that the iron tablet policy had no effect on handling stunting in the Tuban Regency. Providing iron tablets to pregnant women is a form of intervention for stunting. It is possible that the program for providing iron

tablets to pregnant women receives increased encouragement when an area experiences high cases of stunting. To accelerate the reduction of stunting, it is necessary to implement targeted and responsive interventions in a comprehensive and integrated manner to ensure high quality.

This should be achieved through effective coordination, synergy, and synchronization among Ministries/Institutions, Provincial Governments, District/City Governments, Village Governments, and stakeholders involved in the efforts to accelerate stunting reduction. The likelihood of childhood stunting varies considerably based on both the specific features of the child and household, as well as the characteristics of the province and subdistrict. These findings will serve as the foundation for future policy initiatives aimed at addressing stunting. The stunting prevalence results reported by the SSGI and data collected by the Tuban Regency Health Center show a notable discrepancy. According to the SSGI findings, the occurrence of stunting in Tuban Regency is 24.9%. However, this study indicated that the total prevalence was 10.14%, with an average of 11.53% in each village. Therefore, it is hoped that the results of this study will be considered by authorities when they organize a future stunting reduction program in the Tuban Regency.

CONCLUSION

The findings of this study highlight that access to food and healthcare services is a critical determinant of stunting in Tuban Regency. Interestingly, the distribution of iron tablets in pregnant women, commonly considered a vital intervention, did not exhibit a significant association with reductions in the prevalence of stunting. This outcome indicates that the current governmental emphasis on health service interventions, particularly iron supplementation, may not be the most effective strategy for mitigating stunting in this context. A more integrated approach that prioritizes improvements in food security and equitable access to essential services is required to achieve meaningful progress. This study revealed that there are 49,031 toddlers in Tuban Regency, with 4,970 of them experiencing stunted growth (10.14%

prevalence). The average stunting prevalence in each hamlet was 11.53%. A total of 112 villages in Tuban Regency had a stunting percentage above 14%. The prevalence of stunted toddlers in each village is associated with factors such as food availability (size of cultivated land and economic infrastructure) and food access (well-being of the people). The regression model indicated that immunization, vitamin A, iron supplemental tablets for pregnant women, ARI in toddlers, and poor levels of population welfare (vulnerable category) were influential factors in the occurrence of stunting. The disparity in stunting prevalence rates between the SSGI findings and the outcomes of this study may be influenced by various factors including disparities in data collection methods and variations in measurement techniques.

Although these findings can provide insight into stunting mapping patterns, especially the determinant factors that greatly influence stunting incidence, this study had several limitations. The author hopes to conduct similar studies on a wider scale in the future by incorporating the measured variables. Future research should include populations outside of Java. Second, longitudinal studies are needed to gain a comprehensive understanding of the relationship between stunting variables and eradication efforts. Finally, the author suggests that future research, especially in the Indonesian context, should employ comprehensive methods and large samples as the use of secondary data from various agencies has not yielded a deeper meaning.

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