Economics Development Analysis Journal Vol. 13 (2) (2024)

Economics Development Analysis Journal

http://journal.unnes.ac.id/sju/index.php/edaj

Stunting In Java Island: Spatial and Risk Factor Analysis

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Article Information

History of Article
Received January 2024
Accepted March 2024
Pusblished May 2024

Keywords:
Stunting
Health Economics
GeoMaps Orange
Socio-economic

Abstract

The prevalence of stunting is above 20%, indicating a significant health problem in Indonesia. This research aims to identify the predictors influencing stunting on the island of Java and to map its distribution using Geo Maps Orange data mining. Data analysis employs multiple linear regression methods with cross-sectional data. Secondary data was obtained from the Badan Pusat Statistik and the Nutrition Status Survey in 2022. The data was processed using Eviews 10 and Geo Maps Orange data mining. The results show that stunting is influenced by various variables. The Human Development Index (HDI) and proper sanitation have a significant negative influence on stunting. Based on mapping, Central Java Province has the highest incidence of stunting, while DKI Jakarta has the lowest incidence on the island of Java. Stakeholders can use this information to promote better parenting patterns, health hygiene practices, affection or compassion practices, and the implementation of clean water sanitation programs to create quality environmental conditions and mitigate the threat of infectious diseases, especially stunting.

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ISSN 2252-6560

INTRODUCTION

Stunting is a global issue affecting various countries, particularly those with low to middle incomes (Mulyaningsih et al., 2021). The proportion of malnourished children is highest in low-income countries (17%) and lower-middle-income countries (51%), compared to upper-middle-income countries (22%) and high-income countries (9%) (UNICEF, 2023). UNICEF data from 2023 also shows that approximately 83.8 million children experiencing stunting live in Asia, especially in Southeast and South Asia, 58.7 million in Africa, and 5.1 million in Latin America and the Caribbean.

Stunting is a critical concern because it relates to sustainable development, which requires attention to environmental, social, and economic factors (UNICEF, 2018). The third global goal of the Sustainable Development Goals (SDGs) commits all countries to creating good health outcomes and improving human welfare. Mulyaningsih et al. (2021) and Yuwanti et al. (2021) indicated that stunting is a significant problem that must be addressed urgently. Stunting affects children's cognitive development, potentially disrupting the quality of human resources. Below is data on the prevalence of stunting in 11 ASEAN member countries.

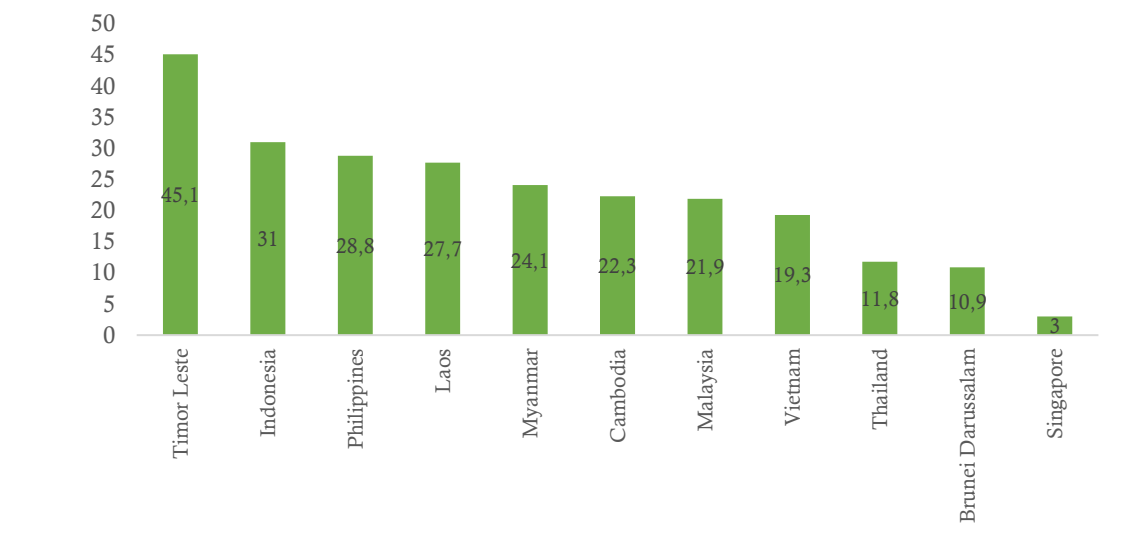

Figure 1. Prevalence of Stunting in ASEAN 2022
Source: Asian Development Bank (2022)

Indonesia is one of the countries in Southeast Asia with a very high stunting prevalence rate, as shown in the diagram, at 31% in 2022 (ADB, 2022). This figure places Indonesia second in ASEAN for the largest number of stunting cases. When compared with neighboring countries, such as the Philippines, the stunting rate in Indonesia is 2.2% higher. Meanwhile, based on data from the 2022 Indonesian Nutrition Status Survey (SSGI), the incidence of malnutrition in Indonesia is 21.6% (SSGI, 2023). The percentage of stunting prevalence is still far from the national target of 14% in 2024 and the national zero stunting movement by 2030 (SSGI, 2023). Below is data on the prevalence of stunting in Indonesia in 2022.

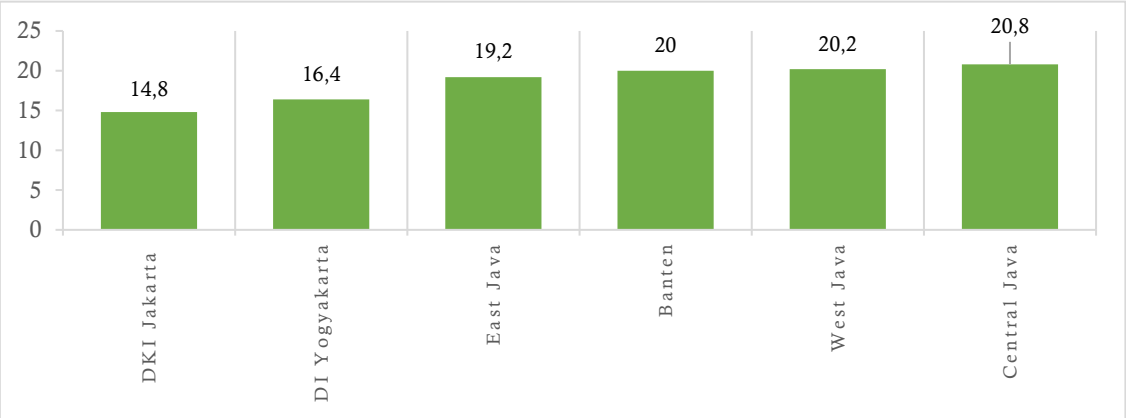

Figure 2. Prevalence of Stunting in Java Island 2022
Source: SSGI, 2023 (Processed)

The prevalence of stunting in Indonesia varies by region. Focusing on Java Island, based on data from SSGI (2023), it is recorded that six provinces on the island still have a prevalence rate of more than 14%. Central Java Province ranks first with a prevalence rate of 20.8%, West Java at 20.2%, Banten Province at 20.0%, East Java at 19.2%, DI Yogyakarta at 16.4%, and DKI Jakarta at 14.8% (Arrasyi et al., 2023; Firdanti et al., 2021; Pertiwi & Hendrati, 2023; Pramestuti et al., 2022; Setiawan & Muttaqin, 2023; Taufiqurokhman et al., 2023). The prevalence of stunting on Java Island is still above the national target set by the Indonesian Coordinating Ministry for Human Development and Cultural Affairs, which is 14% in 2024. Considering that Java Island has the largest population in Indonesia, at 56.10% (BPS-Statistics Indonesia, 2020), this has become a critical issue for all levels of society.

Malnutrition poses a health risk due to inadequate, excessive, or unbalanced intake (WHO, 2016). The prevalence of stunted children is consistently higher in communities with low socio-economic levels and often affects those living in rural areas with inadequate sanitation and access (ASEAN, 2016). Socio-economic factors play a crucial role in shaping children's health status and nutrition. Education level, employment, income, family and social support, and security are components of the socio-economic determinants of health (Senterfitt et al., 2013).

Indonesia has succeeded in reducing the early childhood mortality rate, even though the stunting rate in this country remains one of the highest in the world (Pambudi et al., 2020). This has long-term consequences for health, poverty, human resources, and equality. Furthermore, the World Bank (2020) has declared that Indonesia has performed poorly in reducing stunting rates compared to upper-middle-income countries and countries in other regions. This issue is critical because stunting significantly impacts children's cognitive levels, potentially hindering the optimal development of Indonesia's next generation (Pambudi et al., 2020).

The broader literature on stunting shows that there are predictors that influence stunting, such as HDI, poverty, proper sanitation, unemployment, and region. Anam (2021) found that HDI has a negative influence on stunting. When the Human Development Index in a country increases, the prevalence of stunting can decrease. Household wealth status is another important indicator because children from poor and unemployed households have a greater chance of being diagnosed with stunting (Skoufias, 1999). The risk of stunting is higher in children born to families with inadequate access to sanitation (Beal et al., 2018; Lestari, 2017; Mulyaningsih et al., 2021). Therefore, it is suspected that the HDI and proper sanitation variables have a negative influence on stunting, while poverty and unemployment have a positive influence on stunting.

This research aims to identify the predictors that influence stunting on the island of Java and to map the distribution of stunting. Based on previous literature, this study updates the research on the determining factors of stunting on the island of Java by incorporating spatial analysis to determine the regional distribution of areas with the highest stunting percentages.

RESEARCH METHODS

This quantitative research uses secondary data in the form of cross-sections. Data were collected in 2022, focusing on 119 cities and regencies on Java Island, namely DKI Jakarta, Banten, West Java, Central Java, East Java, and Yogyakarta. The dependent variable in this study is the percentage of stunting prevalence, while the independent variables are HDI, poverty, proper sanitation, unemployment, and a dummy variable to quantify the district or city of each province on Java Island. The poverty variable uses the natural logarithm because there is a non-linear relationship between the independent variable and the dependent variable, so the poverty variable needs to be transformed using the natural logarithm to allow for a linear model and improve the regression model (Benoit, 2011). This data was obtained from the Central Statistics Agency, as shown in Table 1.

Table 1. Operational Definition of Variables

Variable	Unit
Prevalence of Stunting	Percentage (%)
HDI	Percentage (%)
LN_Poverty	Number of Poor People
Proper Sanitation	Percentage (%)
Unemployment	Percentage (%)
Region	
Central Java	D = 1 If you are in the Central Java province
	D = 0 If you are in another province on the island of Java
DKI Jakarta	D = 1 If you are in the DKI Jakarta province area
	D = 0 If you are in another province on the island of Java
West Java	D = 1 If you are in West Java province
	D = 0 If you are in another province on the island of Java
East Java	D = 1 If you are in the province of East Java
	D = 0 If you are in another province on the island of Java
Banten	D = 1 If you are in the Banten province
	D = 0 If you are in another province on the island of Java
DI Yogyakarta	D = 1 If you are in the province of DI Yogyakarta
	D = 0 If you are in another province on the island of Java
District and city	D = 1 If it is in the district area
	D = 0 If you are in a city area

Source: BPS, 2022 (Processed)

The model used to determine the prevalence of stunting is influenced by several factors on the island of Java in 2022:

$$STUNTING_i = C_i + B1HDI_i + \beta 2LN\_POVERTY_i + \beta 3SANITATION_i + \beta 4UNEMPLOYMENT_i + \beta 5REGION_i + e_i \quad (1)$$

Where, the STUNTINGi is the prevalence of stunting in percent form; Ci is the coefficient; β1HDIi is Human Development Index in percent form; β2LN_POVERTYi is number of poor people;β3SANITATIONi is proper sanitation data in percent form; β4UNEMPLOYMENTi is open unemployment rate variable in percent form; and β5REGIONi is the regions namely

cities and districts in the form of dummy with the classification of each region. Central Java (D1), DKI Jakarta (D2), West Java (D3), East Java (D4), Banten (D5), City (D6).

This research uses descriptive analysis and econometric analysis, carried out with multiple linear regression analysis using Eviews 10. Additionally, spatial analysis is conducted to identify the distribution of stunting on the island of Java using the Orange Data Mining analysis tool, specifically with GeoMap

RESULTS AND DISCUSSION

Stunting is a serious problem that requires appropriate and prompt treatment (Beal et al., 2018; Erdi Fadhilah, 2022; Mulyaningsih et al., 2021). This research examines several predictors that are indicated to influence the incidence of stunting on the island of Java. The analysis used is multiple linear regression with cross-section data from 2022, processed using the Eviews 10 application. The following are the estimation results.

Table 2. Multiple Linear Regression Estimation Results

Variable	Coefficient	Probability
C	73.79929	0.0000***
HDI	-0.506211	0.0000***
LN_POVERTY	-0.408511	0.3653
SANITATION	-0.059672	0.0575*
UNEMPLOYMENT	0.066997	0.7364
CENTRAL JAVA	-9.396355	0.0001***
DKI JAKARTA	-10.37338	0.0003***
WEST JAVA	-11.27645	0.0000***
EAST JAVA	-7.402931	0.0005***
BANTEN	-2.483900	0.3532
CITY	-9.514498	0.0000***

Note: *** p < 0.01; **p < 0.05; *p < 0.10
Source: Data Processed, 2024

The table above shows the results of multiple linear regression estimates, which are described by the following equation:

$$\begin{aligned}STUNTING = {} & 73.79 - 0.50HDI - \\ & 0.40LNPOVERTY - 0.05SANITATION + \\ & 0.06UNEMPLOYMENT - \\ & 9.39CENTRALJAVA - 10.3DKIJAKARTA - \\ & 11.27WESTJAVA - 7.40EASTJAVA - \\ & 2.48BANTEN - 9.51CITY \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)\end{aligned}$$

These results show that HDI predictors have a significant negative effect on stunting. Every 1% increase in the HDI percentage reduces the stunting percentage by 0.5%. This finding aligns with research conducted by Fadhilah (2022), which states that as the stunting prevalence rate increases, the HDI rate decreases. One of the HDI indicators is health, and the incidence of stunting can influence this indicator. If each region can reduce the stunting rate, health indicators will improve, leading to an increase in the HDI percentage.

Proper sanitation is also a predictor that influences the incidence of stunting. Based on the research results, the sanitation variable has a significant negative effect on stunting. Every 1% increase in sanitation percentage reduces the stunting percentage by 0.05%. Torlesse et al. (2016) and Wardani et al. (2020) stated that in Indonesia, there is a significant interaction between sanitation facilities and household water treatment on stunting. The unavailability of clean water facilities in households can reduce family members' access to proper sanitation services, thereby encouraging unhygienic behavior, especially after defecating and feeding children. Cahyono (2016) stated that the chance of toddlers experiencing stunting due to poor sanitation is four times greater than with quality environmental sanitation.

Furthermore, this research also analyzes the influence of regions on the incidence of stunting in all provinces on the island of Java. The analysis predicts that a 1% increase in stunting in Central Java Province will reduce the incidence of stunting in the provinces of DKI Jakarta, West Java, East Java, Banten, and DI Yogyakarta. This result aligns with the fact that Central Java Province has the highest stunting cases on the island of Java (SSGI, 2023).

Java Island has six provinces with a stunting prevalence exceeding 14%, which is the national target Indonesia aims to achieve by 2024, as stated in the 2020-2024 RPJMN (Stunting.go.id, 2020). The book "Essential Epidemiology: An Introduction for Students and Health Professionals" by Webb explains that stunting prevalence is the number of stunting cases in an area based on collected data. Several factors affect the point prevalence figures for stunting, including disease duration, severity, number of new cases, migration of healthy people, and health services. Central Java Province is in first place with the highest stunting cases on the island of Java, at 20.8% in 2022. This figure is the accumulated percentage of stunting prevalence across Central Java's cities and districts.

Figure 3. Map of Stunting Distribution in Central Java
Source: SSGI, 2022 (Processed)

Based on this mapping, it can be seen that Brebes Regency has the highest number of stunting cases compared to other regions, reaching 29.1% and falling into the light yellow zone. Brebes Regency is also included in the 100 regencies/cities that are priority locations for stunting intervention in Indonesia (Nurva & Maharani, 2023). Meanwhile, the region in Central Java Province with the lowest stunting prevalence is Semarang City at 10.4%. The Coordinating Ministry for Human Development and Culture (2023) stated that Central Java is a province focused on accelerating stunting reduction. This program was realized by strengthening budget planning from the APBDes and receiving support from religious and community leaders as well as students to provide additional food.

West Java Province ranks second for stunting cases on the island of Java, with a prevalence of 20.2%. Nevertheless, the West Java government is optimistic about reducing the stunting rate to 14% by 2024.

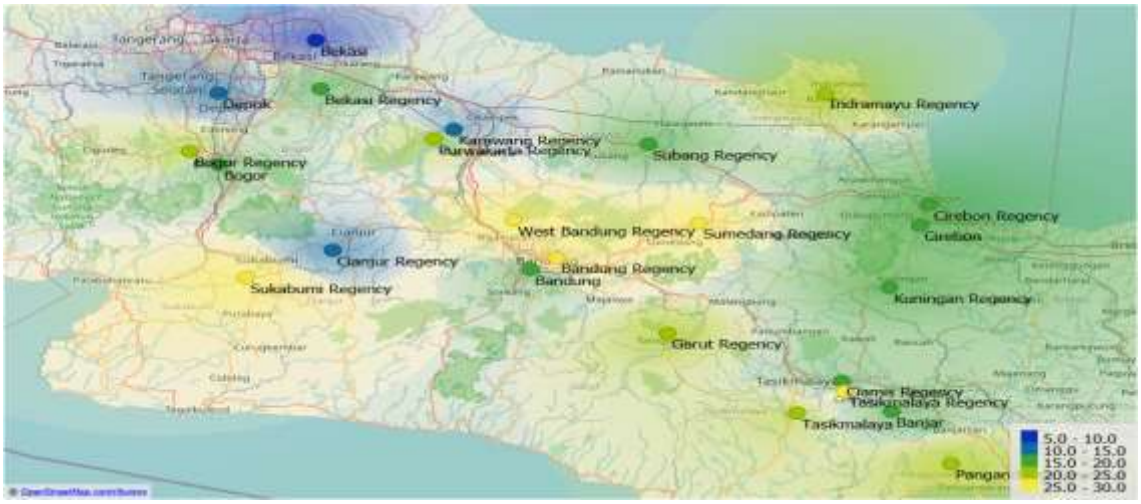

Figure 4. Map of Stunting Distribution in West Java
Source: SSGI, 2022 (Processed)

This mapping shows that Sumedang Regency has a stunting prevalence rate of 27.6% and is in the light yellow zone, while the area with the lowest prevalence is Bekasi City, at 6%. According to the West Java Province Representative from BPK RI, the local government has made several efforts, ranging from ensuring adequate nutrition during pregnancy to building sufficient infrastructure such as access to proper sanitation (Hasdiana, 2018).

Banten Province ranks third for the highest prevalence of stunting on the island of Java, with a rate of 20.0%. The following is a map depicting the distribution of stunting in cities and districts within Banten Province.

Figure 5. Map of Stunting Distribution in Banten
Source: SSGI, 2022 (Processed)

Data show that Pandeglang Regency has the highest stunting prevalence in Banten Province, at 29.4%. The Coordinating Ministry for Human Development and Culture (2023) reported that Banten Province faces several challenges in accelerating the reduction of stunting, such as areas that are not yet open defecation free (ODF), Community Health Activity or Posyandu centers lacking standard anthropometric equipment, and the fact that not all cadres are trained in measuring, weighing, and recording according to standards.

East Java Province had a stunting prevalence rate of 19.2% in 2022, a decrease from 23.5% in 2021, resulting in a reduction of 4.3%. The mapping of stunting incidents in cities and districts within East Java Province is depicted as follows.

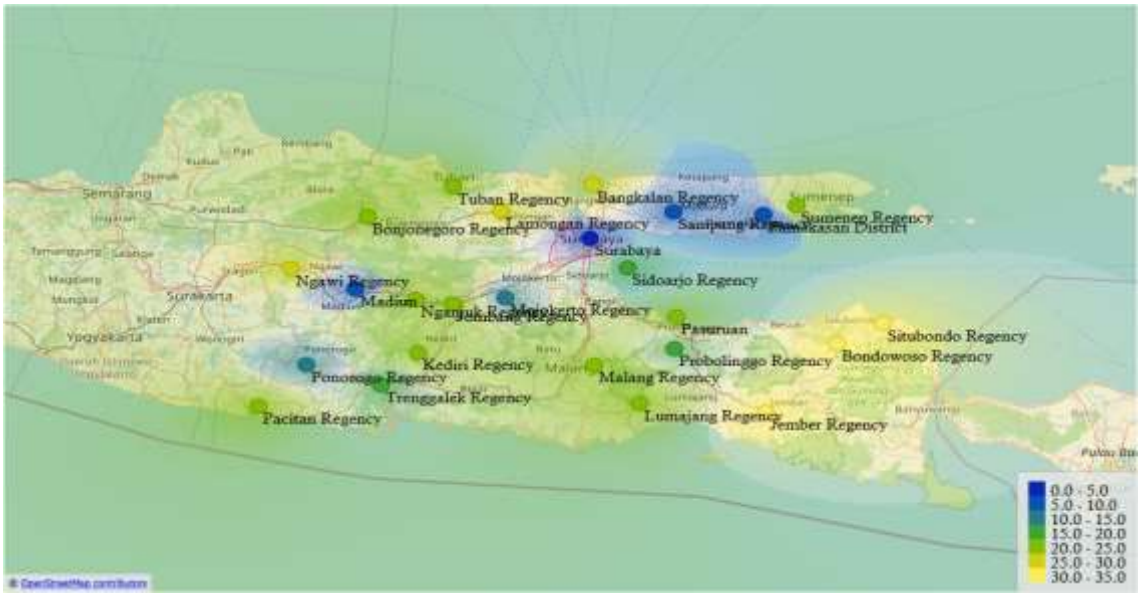

Figure 6. Map of Stunting Distribution in East Java
Source: SSGI, 2022 (Processed)

Jember Regency has the highest stunting prevalence rate, at 34.9% and is categorized in the yellow zone. Meanwhile, Surabaya ranks lowest with stunting cases of 4.8% and falls in the dark blue zone. It should be noted that East Java Province is a focus area for the Coordinating Ministry for Human Development and Culture due to its population of stunted children. East Java is highly populated, which contributes to the large number of stunted toddlers, although the prevalence has consistently decreased each year.

DI Yogyakarta Province has a stunting prevalence of 16.4%. This prevalence is relatively low compared to other provinces on the island of Java and is near the national stunting reduction target of 14%. The mapping of the distribution of stunting in DI Yogyakarta Province is shown as follows.

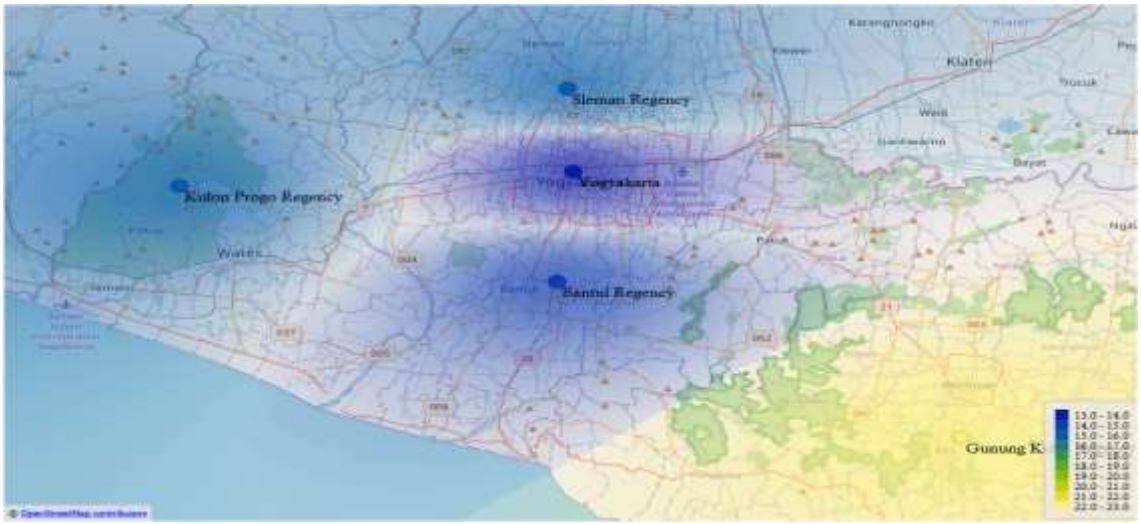

Figure 7. Map of Stunting Distribution in DI Yogyakarta
Source: SSGI (2022)

This mapping illustrates that Gunung Kidul Regency has the highest incidence of stunting in Yogyakarta Special Region Province in 2022, at 23,5%. The reported that the high stunting rate in Gunung Kidul Regency is influenced by conditions such as Chronic Energy Deficiency (CED) and anemia among pregnant women. Additionally, many toddlers are born with low birth weights due to maternal factors, including young maternal age (under 18 years). Yogyakarta City has a prevalence rate of 13.8%. This figure provides an opportunity for the City of Yogyakarta to receive an award from the National Population and Family Planning Agency (BKKBN) as the region with the lowest stunting prevalence rate, which is below the national stunting reduction target.

The province with the lowest stunting prevalence rate on the island of Java is DKI Jakarta Province, at 14.8%. This figure represents a decrease of 2% compared to 2021, when it was 16.8%. Apart from being the province with the lowest stunting cases on the island of Java, data from SSGI (2023), shows that DKI Jakarta is ranked second for the lowest stunting cases in Indonesia. DKI Jakarta's stunting prevalence rate has successfully fallen below the threshold set by the World Health Organization (WHO), which is 20%. The following provides a mapping of the distribution of stunting in DKI Jakarta Province.

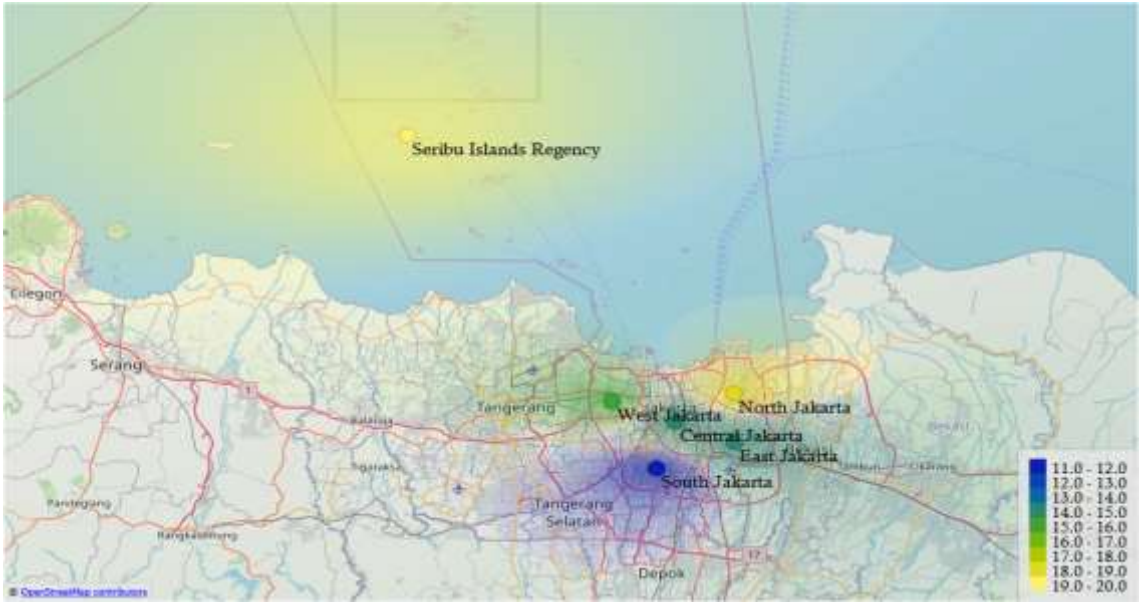

Figure 8. Map of Stunting Distribution in DKI Jakarta
Source: SSGI, 2022 (Processed)

Kepulauan Seribu Regency (Seribu Islands Regency) has the highest stunting prevalence in DKI Jakarta Province, at 20.5%. This mapping is depicted in the dark yellow zone. Although stunting cases in Seribu Islands Regency are relatively high, the local government has implemented cross-sector collaborative efforts to reduce stunting. Meanwhile, South Jakarta City has the lowest stunting prevalence rate at 11.9% and is located in the dark blue zone.

The issue of stunting in Indonesia, particularly in Java, necessitates intervention in the form of education for teenagers and parents. Research by Adhyka et al. (2023), Wahda et al. (2023), and Widjayatri et al. (2020) explains that improving understanding of stunting, parenting patterns, and health hygiene practices among teenagers and parents can be achieved through socialization.

CONCLUSION

Stunting cases are influenced by several factors. The most significant predictors of stunting are the Human Development Index (HDI) and proper sanitation. These two variables have a significant negative effect on stunting. Additionally, a 1% increase in stunting in Central

Java is associated with a reduction in stunting cases in other provinces on the island of Java. The distribution of stunting cases in cities and districts is illustrated using GeoMaps Orange Data Mining. The highest percentage of stunting on the island of Java is in Central Java Province, at 29.1%, while the lowest prevalence is in DKI Jakarta Province, at 14.8%. Addressing stunting requires appropriate intervention. Effective management of stunting can be achieved through socialization, counseling, and educational approaches for the community, including both teenagers and adults. Stakeholders should provide information on parenting patterns, health hygiene practices, affection, and clean water sanitation programs to foster quality environmental conditions and mitigate the risk of infectious diseases, particularly stunting.

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