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A Cross-Sectional Geospatial Study on Families at Risk of Stunting in West Java

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ABSTRACT

Stunting affects the physical, cognitive, and overall health development of children under five, potentially hindering long-term economic growth. In West Java, stunting prevalence reached 21.7% in 2023, exceeding the WHO standard (<20%) and falling short of Indonesia's target of 14%. This study aimed to develop a geospatial model to identify at-risk families and support targeted interventions, implemented by the Family Assistance Team (TPK). A cross-sectional research design using Quantum GIS with a scoring technique was employed. Data sources included the 2023 Indonesia Health Survey (SKI), the 2023 Ministry of Population and Family Development (BKKBN) data, and the BKKBN Family Information System. The study covered 27 districts/cities in West Java. Results showed high risk in 2 cities, with high stunting prevalence and low TPK assistance; moderate risk in 14 districts/cities with moderate stunting levels and varying TPK support; and low risk in 11 districts/cities with lower stunting prevalence and higher TPK coverage. The geospatial approach effectively mapped at-risk families and prioritized interventions, enhancing TPK effectiveness. This method supported evidence-based planning and cross-sector collaboration. The study concluded that geospatial analysis is a strategic tool for guiding targeted stunting interventions and optimizing resource allocation in West Java.

Keywords: stunting; family assistance team; geospatial analysis

INTRODUCTION

Stunting is a condition of malnutrition in children under five, associated with past nutritional deficiencies, making it a chronic nutritional issue.(1) Children suffering from stunting tend to experience delays in physical, cognitive, and overall health development. This phenomenon not only affects individual quality of life but also poses a risk to human resource potential and long-term economic development in a country.(2) According to the 2023 Indonesia Health Survey (SKI), the national stunting prevalence is 21.5%.(3) This marks a slight decrease from 21.6% in 2022. However, despite this decline, the prevalence remains relatively high, considering the 2024 national target of 14% and the WHO standard of below 20%.

The Ministry of Population and Family Development/BKKBN, as the lead executor of the stunting reduction acceleration program under Government Regulation No. 72 of 2021, has identified 12 priority provinces for stunting intervention in Indonesia, including West Java.(4) According to the 2023 Indonesia Health Survey (SKI), the stunting prevalence in West Java remains high at 21.7%, despite various reduction programs such as specific and sensitive nutritional interventions. Additionally, gradual education and training are provided to families with young children through Integrated Service Post (*Pos Pelayanan Terpadu*/*Posyandu*) programs. The combination of these approaches has been found to have a more significant impact compared to implementing them separately.(5)

One of the measures taken to accelerate stunting prevention is the establishment of the Family Assistance Team (*Tim Pendamping* Keluarga/TPK), which consists of midwives, members of the Family Welfare Empowerment Movement (*Pemberdayaan dan Kesejahteraan Keluarga*/PKK), and Family Planning cadres as a preventive effort to address stunting in Indonesia.(6) The Family Assistance Team plays a crucial role in facilitating communication between healthcare workers and the community while providing education on stunting and its prevention. This team implements comprehensive prevention efforts, primarily by assisting families at risk of

stunting, including those with children under five (0–59 months), couples of reproductive ages (PUS), or pregnant PUS who have been identified as at risk based on screening criteria.[4]

Despite these efforts, stunting reduction in West Java remains challenging due to geographic disparities and uneven resource distribution, leading to ineffective targeting of interventions. Traditional approaches may not fully capture the spatial patterns of stunting risk, making it difficult to prioritize high-risk areas. In this context, a geospatial approach offers valuable advantages by enabling the mapping of stunting risk levels and optimizing the allocation of assistance efforts. Therefore, this study aimed to develop a cross-sectional geospatial approach to assist the Family Assistance Team (TPK) in identifying priority areas for intervention, enhancing the effectiveness of stunting prevention strategies in West Java.

METHODS

This study employed a cross-sectional research design using the Geographic Information System (GIS) application, Quantum GIS, to analyze stunting vulnerability across districts in West Java Province. The objective was to identify levels of stunting risk among at-risk families and to determine priority areas for intervention by the Family Assistance Team (TPK). The study utilized secondary data sourced from the 2023 Indonesia Health Survey (SKI), the 2023 Ministry of Population and Family Development (BKKBN) data on Families at Risk of Stunting, and the BKKBN Family Information System Data collected in 2024. The unit of analysis was the district/city administrative level across 27 regions in West Java.

The study analyzed aggregate data using the following variables: (1) stunting prevalence, (2) percentage of families at risk of stunting, (3) number of TPK teams, and (4) percentage of at-risk families receiving TPK assistance. Stunting prevalence and the percentage of at-risk families were each scored on a scale from 1 (low) to 3 (high). Conversely, the percentage of at-risk families receiving assistance from TPK was scored inversely—1 indicating high assistance coverage and 3 indicating low coverage. Data analysis was conducted chronologically as follows.

First, secondary data was collected from multiple sources. Next, research variables were categorized based on risk levels. Then, Quantum GIS was used for geospatial visualization, enabling the mapping of spatial patterns and clusters of stunting risk. Afterward, a scoring and aggregation process was conducted to calculate total vulnerability scores, which were then classified into three vulnerability levels: low, moderate, and high (Table 1). The scoring method was validated by cross-referencing with existing stunting intervention data to ensure reliability and consistency in categorizing vulnerability levels. High vulnerability areas were identified as priority intervention targets for assisting at-risk families in West Java.

Table 1. Categorization and scoring of research variables

Variable	Low	Moderate	High
Stunting prevalence	< 15,0% (1)	15,0 - 24,9% (2)	≥ 25,0% (3)
Percentage of at-risk families	< 15,0% (1)	15,0 - 24,9% (2)	≥ 25,0% (3)
Percentage of at-risk families receiving TPK assistance	< 45,0% (3)	45,0 – 69,9% (2)	≥ 70,0% (1)
Stunting Vulnerability (Total Score)	3 – 5	6 – 7	8 - 9

By identifying geographic disparities, the geospatial approach supported targeted interventions and efficient resource allocation by the Family Assistance Team (TPK), thereby strengthening evidence-based decision-making.

RESULTS

The distribution of stunting cases among children under five was illustrated in Figure 1, categorized into three levels based on WHO classification: low, moderate, and high. Three different colours were used for visualization—blue represented low prevalence, green indicated moderate prevalence, and red signified high prevalence. There were seven districts/cities with a high stunting prevalence (≥25.0%): Bandung, Bandung Barat, Bogor, Ciamis, Sukabumi City, Tasikmalaya City, and Sukabumi. Meanwhile, 16 districts/cities fell into the moderate prevalence category (15.0%-24.9%), including Bandung City, Tasikmalaya, and Banjar City. The remaining four districts/cities had a low stunting prevalence (<15.0%).

Figure 2 illustrated the comparison between the percentage of families at risk of stunting and the number of Family Assistance Teams (TPK) in each district/city of West Java. The classification of at-risk families followed the WHO categorization: low, moderate, and high. A darker shade of green on the map indicated a higher percentage of at-risk families in a given district/city. Meanwhile, the bar graph in each district/city represented the number of TPKs, where taller bars indicated a higher number of TPK teams in that area.

Figure 1. Map of stunting prevalence in West Java, 2023

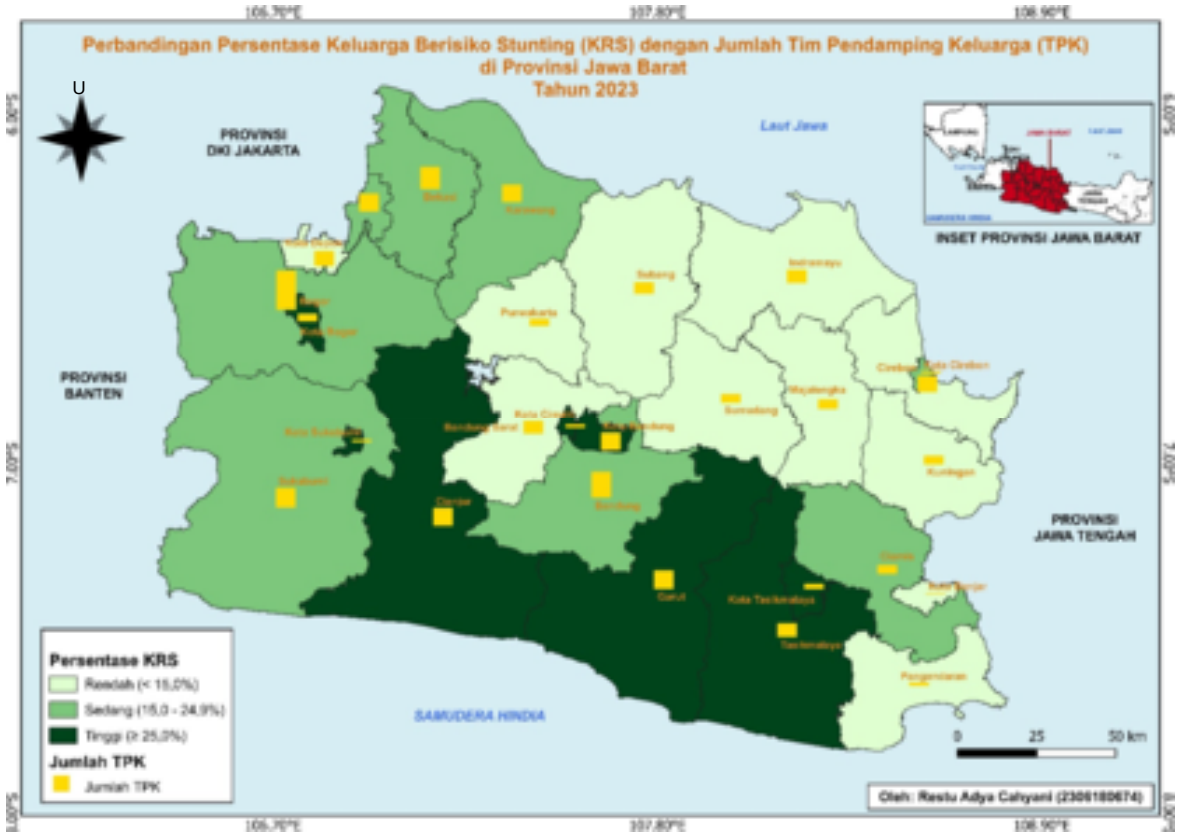

Figure 2. Map of comparison between the percentage of at-risk families (KRS) and the number of family assistance teams (TPK) in West Java, 2023

There were eight districts/cities with a high percentage of at-risk families (≥ 25.0%), including Bogor City, Cianjur, Garut, Cimahi City, Bandung City, Tasikmalaya, Tasikmalaya City, and Sukabumi City. Eight districts/cities fell into the moderate category (15.0%-24.9%), such as Bandung, Ciamis, and Sukabumi. Meanwhile, 11 other districts/cities had a low percentage of at-risk families (<15.0%).

Figure 2 also highlighted disparities in TPK distribution across regions. For instance, areas with dark green shading, such as Sukabumi City, indicated a high percentage of at-risk families but had relatively few TPKs, as shown by the shorter bar graph. Conversely, some areas with a lower percentage of at-risk families had a more sufficient number of TPKs. This imbalance underscored the need for redistribution or an increase in TPK personnel in high-risk areas to ensure optimal and equitable support throughout West Java.

The percentage of at-risk families receiving TPK assistance in Figure 3 was categorized into three levels: low, moderate, and high. A darker shade of purple on the map indicated a higher percentage of at-risk families receiving TPK support in a given district/city. There were nine districts/cities with a high percentage of assisted at-risk families (≥70.0%), including Pangandaran, Subang, and Kuningan. Meanwhile, 13 districts/cities fell into the moderate category (45.0%-69.9%), such as Cirebon, Indramayu, and Karawang. Lastly, five districts/cities had a low percentage of assisted at-risk families (<45.0%).

Figure 3. Map of at-risk families (KRS) receiving TPK assistance in West Java, 2023

Figure 4 presented the scoring results based on stunting prevalence, the percentage of at-risk families, and the percentage of at-risk families receiving assistance. The total score ranged from 3 to 9, illustrating varying levels of stunting vulnerability across districts/cities in West Java. A darker shade of orange on the map indicated a higher stunting vulnerability score for that region. Regions with the highest vulnerability scores typically had high stunting prevalence and a high percentage of at-risk families but received low levels of TPK assistance.

For example, Bandung City had a stunting prevalence of 16.3% and 32.8% at-risk families, but since less than half of these families received assistance, it fell into the high vulnerability category. On the other hand, Subang, with 18.7% stunting prevalence and 8.4% at-risk families, had over 70% of at-risk families receiving assistance, resulting in a lower vulnerability score. From the 27 districts/cities analyzed in Figure 4, the priority for stunting reduction and prevention efforts was focused on two cities with high vulnerability levels: Bandung City and Tasikmalaya City.

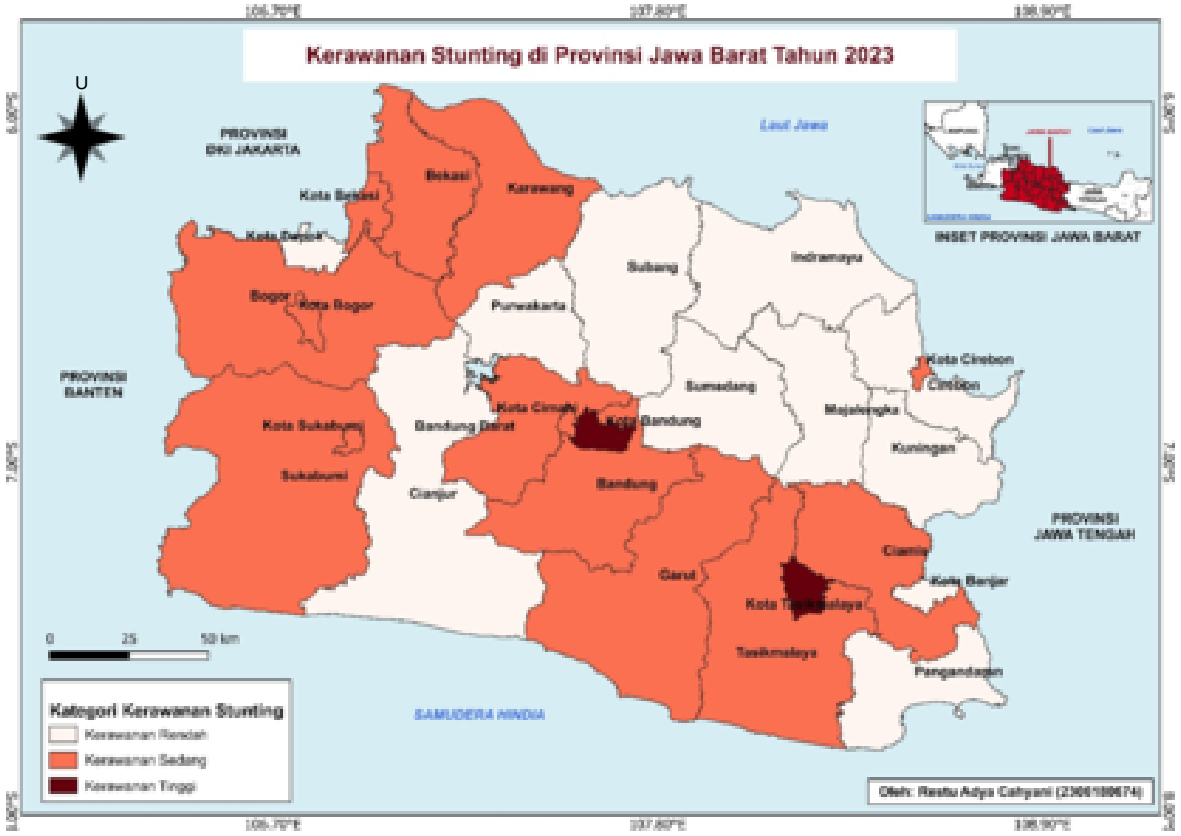

Figure 4. Map of stunting vulnerability in West Java, 2023

The results demonstrated significant geographic variations in stunting prevalence, at-risk families, and TPK assistance coverage across West Java. By integrating these variables through a geospatial approach, the study effectively identified priority areas for intervention. High-risk areas, such as Bandung City and Tasikmalaya City, exhibited high stunting prevalence and a large proportion of at-risk families, but low TPK assistance coverage, indicating an urgent need for enhanced support and resource allocation. Conversely, regions with lower stunting vulnerability generally showed higher TPK coverage, suggesting a correlation between adequate support and reduced stunting risk. The findings also revealed imbalances in TPK distribution, where some high-risk areas were under-resourced, while others with lower risk had more sufficient TPK teams. These insights emphasized the importance of redistributing TPK personnel to ensure equitable and effective stunting prevention efforts.

DISCUSSION

The analysis results indicate that stunting prevalence in West Java remains a significant challenge, with seven districts/cities classified as high-risk (≥25.0%) based on WHO categorization. Areas such as Sukabumi City and Sukabumi exhibit high stunting prevalence, while 16 districts/cities fall into the moderate category (15.0%–24.9%), including Bandung City and Tasikmalaya. This geographic variation highlights the need for region-based interventions to enhance effectiveness, as demonstrated by geospatial mapping approaches used to identify high-risk areas in other contexts, such as Ethiopia[9] and Nigeria.[10] These studies underscore the importance of geographic-targeted interventions to address regional disparities in stunting prevalence.

A comparison between the percentage of at-risk families and the number of Family Assistance Teams (TPK) reveals gaps in resource allocation. For instance, Sukabumi City has a high percentage of at-risk families but a relatively low number of TPKs. This imbalance underscores the need for a more strategic TPK allocation to ensure that high-risk areas receive adequate support. This finding aligns with studies indicating that uneven distribution of support personnel can hinder the effectiveness of local-level stunting interventions[7,11] and resource optimization is necessary to maximize impact.[12]

The Family Assistance Teams (TPK) was established to accelerate stunting reduction, as outlined in Presidential Regulation No. 72 of 2021. TPK responsibilities include education, referral service coordination, and social assistance. The team aims to increase access to information and services for at-risk families, including families with children under five (0–59 months), couples of reproductive ages (PUS), and pregnant PUS.[8] Studies

indicate that cross-sector collaboration is crucial for effective stunting intervention,[13] and TPK's role in facilitating communication and education can significantly enhance stunting prevention efforts.[14]

In terms of assistance for at-risk families, the study reveals significant variation in coverage across districts/cities. Nine districts/cities have high assistance coverage (≥70.0%), including Pangandaran and Subang. Five districts/cities have low assistance coverage (<45.0%), which tend to have higher vulnerability scores. This indicates the need to enhance assistance capacity in low-coverage areas to effectively reduce stunting risks. Similar challenges have been reported in other regions where disparities in assistance coverage impacted stunting outcomes.[15] Moreover, targeted intervention models, such as those involving specific nutrition interventions and behavioural change communication, have proven effective in reducing stunting[16] and should be considered to enhance TPK's assistance capacity.

The family assistance model integrates multiple programs and cross-sector activities. It involves field cadres from various sectors working together with their expertise to address gaps in stunting reduction efforts.[6] Effective collaboration and multi-sectoral convergence are essential to overcome implementation challenges, as highlighted in studies on sensitive-intervention stunting programs.[17] Furthermore, stakeholder commitment and community engagement play critical roles in successful stunting intervention programs.[11]

To further enhance the effectiveness of stunting interventions, it is essential to address the existing gaps in resource allocation and optimize intervention strategies. Studies have shown that integrated approaches combining nutrition-specific and nutrition-sensitive interventions are more effective in reducing stunting prevalence compared to isolated programs.[16] Additionally, community empowerment and behavioural change communication have been proven to increase awareness and engagement, leading to more sustainable stunting prevention outcomes.[19] These findings underscore the importance of a holistic intervention model, integrating nutrition, education, and community involvement to effectively reduce stunting rates. Therefore, future interventions should adopt comprehensive and context-specific strategies to maximize impact and sustainability in West Java.

Overall, the stunting vulnerability levels assessed in this study revealed significant disparities across districts and cities in West Java. Bandung City and Tasikmalaya City recorded the highest vulnerability scores, indicating an urgent need for priority intervention due to their combination of high stunting prevalence and low assistance coverage. The Family Assistance Team (TPK) plays a vital role in upstream stunting prevention, particularly through early detection and mitigation of risk factors. Strengthening TPK capacity and intervention strategies in high-vulnerability areas is therefore essential, as evidenced by the success of community-based models in reducing stunting in similar contexts.[18] The geospatial approach employed in this study offered valuable insights into spatial disparities, enabling more precise targeting of interventions and strategic allocation of resources. This finding is supported by previous research using tools like Optima Nutrition, which demonstrated how geospatial modeling can enhance the efficiency of stunting-related resource allocation.[20] The importance of spatial analysis in identifying geographic inequities and guiding interventions in areas with the greatest need.[21-26] By leveraging geospatial insights, policymakers and program implementers can optimize intervention efforts, allocate resources more effectively, and support the long-term sustainability of stunting reduction programs in West Java.

CONCLUSION

The geospatial approach effectively identifies priority areas for assisting at-risk families in West Java, guiding the Family Assistance Team (TPK) and local governments to allocate resources more efficiently. By accurately mapping at-risk families and prioritizing interventions, this method enhances assistance effectiveness and promotes cross-sector collaboration through Geographic Information System (GIS) technology. These findings provide strategic insights for stunting reduction efforts and can inform targeted interventions by provincial governments and health departments. Future research should include additional variables to further support evidence-based policymaking for stunting reduction at national and regional levels.

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