SPATIAL DISPARITY OF UNDER-FIVE NUTRITIONAL STATUS FOLLOWING THE STUNTING PREVALENCE INCREASE IN RIAU PROVINCE: A CORRELATION ANALYSIS WITH WATER AND SANITATION ACCESS, 2024

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Abstrak: *Indonesia's national stunting prevalence declined from 21.5% in 2023 to 19.8% in 2024 according to the Indonesian Nutritional Status Survey (SSGI). However, Riau Province recorded the largest increase among all provinces at 6.5 percentage points, despite previously serving as a national reference for successful stunting reduction. This study aimed to analyze the spatial disparity of under-five nutritional status across districts and cities in Riau Province in 2024, and to examine its association with access to safe drinking water and sanitation. A descriptive-analytic design with a spatial approach was employed, utilizing secondary data from the SSGI 2024 and the National Socioeconomic Survey (Susenas) published by the Central Bureau of Statistics (BPS) for nine districts and cities with complete data availability. Results showed that stunting prevalence varied substantially, ranging from 12.5% in Bengkalis to 24.5% in Rokan Hilir. Spearman correlation analysis revealed a significant strong negative correlation between stunting prevalence and access to safe drinking water (rs = -0.717; p = 0.030), while the correlation with sanitation access showed the same direction but did not reach statistical significance (rs = -0.633; p = 0.067). Rokan Hilir, Kepulauan Meranti, and Kuantan Singingi were identified as districts requiring the highest intervention priority based on combined stunting prevalence and infrastructure access indicators. Kuantan Singingi presented an anomalous pattern, with relatively adequate sanitation access yet persistently high stunting prevalence, suggesting the role of non-WASH determinants. These findings highlight the importance of area-based differential policies over uniform province-wide approaches, and demonstrate the feasibility of open secondary data for rapid spatial analysis at the provincial level.*

Key Words: *stunting, spatial disparity, drinking water access, sanitation, Riau Province, GIS.*

INTRODUCTION

Stunting is a condition of impaired growth in children under five caused by chronic malnutrition occurring from pregnancy through the first two years of life. This condition contributes to cognitive developmental delays, an increased risk of infectious disease, and reduced productivity in adulthood, making its reduction a national

development priority within Indonesia's 2045 Long-Term Development Plan (RPJP) (WHO et al., 2023).

The 2024 Indonesian Nutritional Status Survey (SSGI) reported a decline in national stunting prevalence from 21.5% in 2023 to 19.8% in 2024. This decline occurred in 24 of 38 provinces, while 11 provinces recorded an increase, with three provinces registering the largest increases: Riau (6.5 percentage points), West Nusa Tenggara (5.2), and West Sulawesi (5.1). The increase in Riau Province is particularly noteworthy, as the province had previously served as a national reference for successful stunting reduction, with prevalence once as low as 13.6% (Kementerian Kesehatan Republik Indonesia, 2025). At the district/city level, the 2024 SSGI data reveal considerable disparity, with stunting prevalence ranging from 12.5% in Bengkalis to 24.5% in Rokan Hilir. Data from the 2024 National Socioeconomic Survey (Susenas), conducted by the Central Bureau of Statistics (BPS), similarly show variation in access to safe drinking water, ranging from 77.6% (Indragiri Hulu) to 99.7% (Pekanbaru), and in access to proper sanitation, ranging from 61.3% (Kepulauan Meranti) to 98.0% (Dumai)(Badan Pusat Statistik Provinsi Riau, 2026).

Spatial research on stunting in Indonesia has been widely conducted, though generally at the sub-district or village scale within a single district or city. Gustin et al. (2023) mapped stunting risk factors in Pasaman District using GIS and found that areas with the highest case counts were associated with low posyandu (integrated health post) coverage and poor drinking water sanitation. Sonya (2025) analyzed the geographic distribution of stunting across 14 sub-districts in Tanah Datar District and found that topography, elevation, and distance to health facilities contributed to variation in prevalence, although the relationship was not always linear.

At a more micro scale, Rahma et al. (2023) employed a case-control design across nine locus villages in Ogan Ilir District and found that neither the physical nor chemical quality of drinking water was significantly correlated with stunting incidence. In contrast, Nurjazuli et al. (2025) conducting a longitudinal study in Salatiga City, found that improved bacteriological quality of drinking water was significantly correlated with a decrease in the proportion of stunted children ($p = 0.03$). Ahmad & Salim (2025), who developed a web-GIS platform in Kwandang Sub-district using spatial regression, found that distance to primary health centers (puskesmas), sanitation, and rainfall were significant predictors explaining 63.2% of the variance in stunting cases.

Based on the foregoing, three main gaps can be identified. First, prior studies have operated almost exclusively at the intra-district scale (between sub-districts or villages), while analysis of inter-district/city disparity within a single province experiencing an anomalous increase in prevalence remains largely unexplored. Second, findings regarding the relationship between water and sanitation access and stunting are inconsistent across levels of data aggregation, being non-significant at the household level (Ogan Ilir) but significant at the city level when measured in aggregate and longitudinally (Salatiga).

Third, the majority of prior studies rely on primary data obtained through direct field surveys, which require considerable time and cost, while the potential of open, national-scale secondary data (SSGI) combined with regional data (BPS Susenas) for

rapid provincial-level mapping remains largely unexplored despite this approach being more relevant to the need for rapid decision-making at the provincial health office level, particularly in the context of Riau, which has shifted from a model province to the province with the highest national increase in stunting prevalence.

This study aims to analyze the spatial disparity in under-five nutritional status across districts and cities in Riau Province in 2024, and to examine its association with access to safe drinking water and proper sanitation using Spearman correlation and QGIS thematic mapping. The findings are expected to identify priority areas for intervention and to provide a spatial information base for the Riau Provincial Health Office in formulating more targeted policies than a uniform province-wide approach.

RESEARCH METHODS

This study employed a descriptive-analytic design with a spatial approach, utilizing secondary data of a cross-sectional nature consistent with the original design of the data sources. The study was conducted from April to June 2026, covering the entire territory of Riau Province, comprising 12 districts and cities: Kuantan Singingi, Indragiri Hulu, Indragiri Hilir, Pelalawan, Siak, Kampar, Rokan Hulu, Bengkalis, Rokan Hilir, Kepulauan Meranti, Kota Pekanbaru, and Kota Dumai.

The study population consisted of all children under five in Riau Province who were respondents of the 2024 Indonesian Nutritional Status Survey (SSGI). The study sample comprised 9 of the 12 districts and cities in Riau Province that had complete under-five nutritional status prevalence data in the SSGI 2024, using total sampling applied to all districts and cities whose data met the SSGI data quality standards.

Three districts, namely Indragiri Hilir, Pelalawan, and Kampar, were excluded from the correlation analysis because they met the SSGI technical exclusion criteria (response rate below 70%, RSE exceeding 25%, or an extreme prevalence change greater than 10% compared to the previous year), resulting in their stunting data not being published in the official SSGI 2024 report. As an effort to provide complete descriptive data, the stunting prevalence of these three districts was traced through an alternative source, namely Table 48 of the 2024 Riau Provincial Health Profile, sourced from the Community-Based Nutrition Recording and Reporting System (e-PPGBM) of the Riau Provincial Health Office. Based on this e-PPGBM data, stunting prevalence in Indragiri Hilir was recorded at 2.52%, Kampar at 0.91%, and Pelalawan at 0.56%, figures that are far below the provincial average and substantially lower than SSGI estimates in comparable districts and cities, with gaps ranging from 4.6 to 20.6 percentage points.

This substantial gap between e-PPGBM and SSGI data stems from fundamental methodological differences between the two systems. The SSGI is a representative household-based survey with direct anthropometric measurement, whereas the e-PPGBM is a posyandu-based surveillance system that only captures children who actively attend health posts, with a provincial weighing coverage of only 66% in 2024. Children who do not attend posyandu, who are likely among the most socioeconomically vulnerable, are not captured by the e-PPGBM system, causing its figures to systematically underestimate the true burden of stunting. Accordingly, e-PPGBM data from these three districts were

not included in the correlation test due to methodological incompatibility with SSGI data, but are retained in the descriptive tables as contextual information.

The dependent variable was under-five nutritional status prevalence (BB/U, TB/U, and BB/TB indicators), with a primary focus on stunting prevalence (severely stunting plus stunting based on TB/U). The independent variables were access to safe drinking water and access to improved sanitation (percentage of households per district and city).

The instruments used were not primary instruments such as questionnaires or anthropometric measurement tools, but official secondary data documents, comprising: the SSGI 2024 Report (BKPK, Ministry of Health of the Republic of Indonesia) from Tables 4.10, 4.46, and 4.82; the 2024 Riau Provincial Health Profile (Riau Provincial Health Office) from Table 48 for e-PPGBM data of the three excluded districts; the publication of Riau Province in Figures 2026 (BPS) from Tables 4.3.8 and 4.3.9; administrative boundary spatial data of districts and cities from the Geospatial Information Agency (BIG); and QGIS software for spatial data processing and visualization.

Data were collected through document study of secondary data officially published by the Ministry of Health of the Republic of Indonesia, the Riau Provincial Health Office, and BPS. SSGI and Susenas data were extracted and retabulated by district and city, then merged based on matching district and city units to form a single working dataset ready for analysis. The e-PPGBM data of the three excluded districts were tabulated separately as descriptive contextual data.

Data analysis was conducted in three stages. First, descriptive tabulation was performed to map the variation in nutritional status prevalence and determinant variables across all 12 districts and cities, including the separate presentation of e-PPGBM data for the three excluded districts as contextual information alongside the nine SSGI-based districts. Second, thematic mapping was performed using QGIS to visualize the spatial distribution of stunting prevalence across districts and cities, categorizing each district and city into prevalence classes and identifying spatial clustering patterns. Third, Spearman correlation testing was conducted to assess the relationship between stunting prevalence and access to safe drinking water and improved sanitation (n=9), selected due to the small sample size and the proportional scale of the data which does not assume a normal distribution; only the nine districts and cities with SSGI 2024 data were included in this test, given that combining data from methodologically incomparable sources would risk producing biased correlation estimates.

RESULTS AND DISCUSSION

Results

Overview of Disparity in Under-Five Nutritional Status Prevalence by District/City

Table 1. Under-Five Nutritional Status Prevalence

No	District/City	BB/U Total (%)	Severely Stunting (%)	Stunting (%)	Total Stunting/TB/U (%)
1	Rokan Hilir	22.3	5.3	19.2	24.5
2	Kuantan Singingi	21.4	3.2	19.9	23.1
3	Rokan Hulu	22.9	6.7	14.7	21.4
4	Indragiri Hulu	18.4	5.0	15.0	20.0
5	Kepulauan Meranti	14.4	2.4	15.6	18.0
6	Kota Dumai	13.6	3.3	13.6	16.9
7	Siak	17.1	1.6	14.6	16.2
8	Kota Pekanbaru	18.0	3.4	11.1	14.5
9	Bengkalis	15.3	2.6	9.9	12.5
10	Indragiri Hilir	4.16	-	-	2.52
11	Kampar	2.83	-	-	0.91
12	Pelalawan	0.63	-	-	0.56

Source: 2024 SSGI, Center for Health Policy and Financing (BKPK), Ministry of Health of the Republic of Indonesia

Table 1 presents the nutritional status prevalence of children under five (TB/U) across 12 districts and cities in Riau Province based on SSGI 2024 and e-PPGBM 2024 data. The highest stunting prevalence (severely stunting plus stunting) was found in Rokan Hilir at 24.5%, while the lowest was recorded in Pelalawan at 0.56%. The nearly 40-fold difference between these two districts indicates that the provincial average figure substantially conceals the magnitude of disparity at the district level.

Of the 12 districts and cities for which data are available, four districts exceed the public health problem threshold set by the World Health Organization (20% or above), namely Rokan Hilir (24.5%), Kuantan Singingi (23.1%), Rokan Hulu (21.4%), and Indragiri Hulu (20.0%). The remaining districts and cities, comprising Kepulauan Meranti, Kota Dumai, Siak, Kota Pekanbaru, and Bengkalis, fall below this threshold, with the two cities of Pekanbaru and Dumai recording figures below 17%. It is important to note that the three districts with the lowest figures, namely Pelalawan (0.56%), Kampar (0.91%), and Indragiri Hilir (2.52%), are derived from e-PPGBM surveillance data rather than SSGI, and as previously explained, these figures likely underestimate the true stunting burden due to limited posyandu coverage. This pattern is consistent with findings from various regions in Indonesia, where urban areas tend to record lower stunting prevalence than districts, likely associated with greater ease of access to health services and more equitable basic infrastructure.

Spatial Pattern of Stunting Prevalence

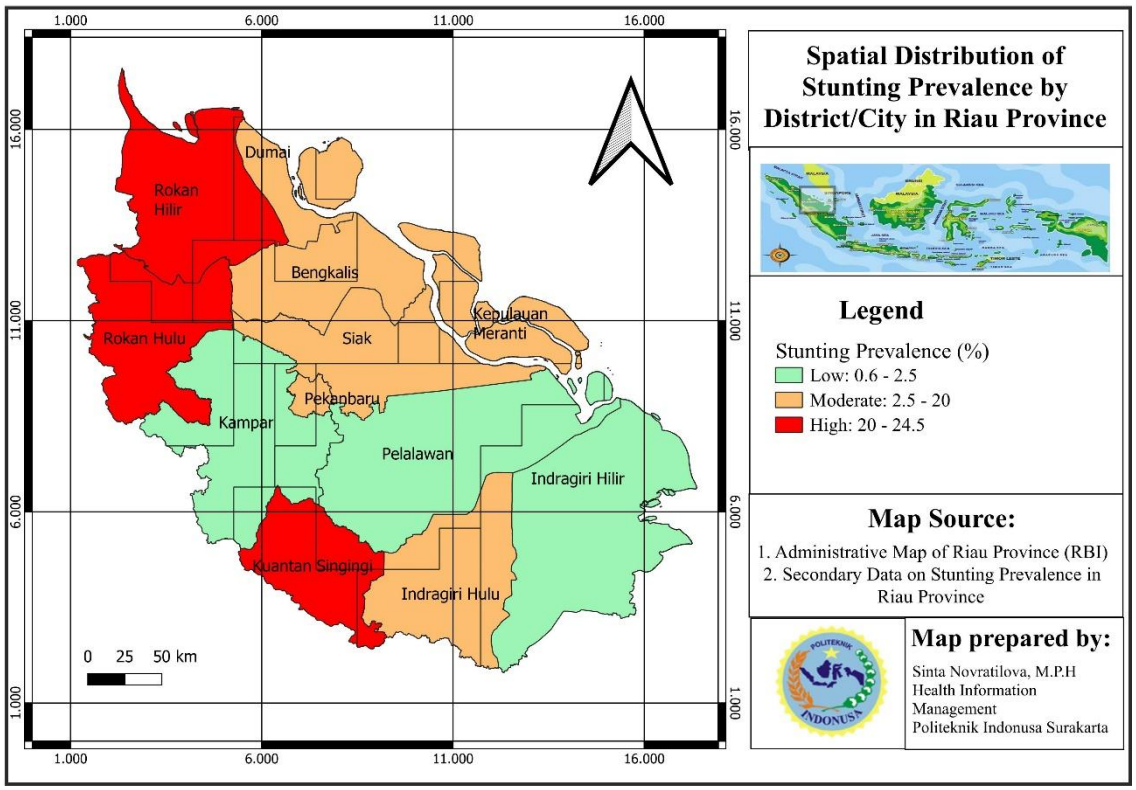

Figure 1 Choropleth Map of Stunting Prevalence by District/City

The thematic map in Figure 1 displays the spatial distribution of stunting prevalence across three categories: low (0.6–2.5%), moderate (2.5–20%), and high (20–24.5%). The visualization shows that the distribution of stunting in Riau Province is uneven and forms a fairly distinct spatial pattern.

Areas in the high category (red) are concentrated in three districts: Rokan Hilir in the northwest, Rokan Hulu in the west, and Kuantan Singingi in the south-central area. The three form an interesting pattern: two of them (Rokan Hilir and Rokan Hulu) are adjacent to one another along the province's western corridor, while Kuantan Singingi forms a separate red enclave in the south, isolated from the other two high-category districts by Kampar, which falls in the low (green) category.

Areas in the moderate category (orange) are distributed across the central and eastern parts of the province, encompassing Bengkalis, Siak, Indragiri Hilir, Indragiri Hulu, and Kepulauan Meranti. This group covers the largest share of the province's total area. Areas in the low category (green) include Kampar, Pelalawan, and the two cities (Pekanbaru and Dumai). These four are spatially dispersed: Kampar and Pelalawan lie in the central mainland, Pekanbaru sits in the middle of the province, and Dumai is located on the northern coast.

Overview of Disparity in Under-Five Nutritional Status Prevalence by District/City

Table 2: Access to Safe Drinking Water and Proper Sanitation by District/City

No	District/City	Safe Drinking Water Access (%)	Proper Sanitation Access (%)
1	Rokan Hilir	86.82	80.76
2	Kuantan Singingi	86.73	86.86
3	Rokan Hulu	93.45	90.64
4	Indragiri Hulu	77.63	86.09
5	Kepulauan Meranti	93.44	61.31
6	Kota Dumai	94.82	97.98
7	Siak	91.79	93.32
8	Kota Pekanbaru	99.65	96.63
9	Bengkalis	95.72	92.63
10	Indragiri Hilir	94.83	60.86
11	Kampar	96.00	87.82
12	Pelalawan	83.26	85.70
Rata-rata		91.12	87.34

Source: BPS, Riau Province in Figures 2026 (2024 data)

Table 2 presents access to safe drinking water and proper sanitation for all 12 districts/cities in Riau based on 2024 BPS Susenas data. Kepulauan Meranti recorded the lowest proper sanitation access, at only 61.3%, well below other districts/cities, which are generally above 80%. Indragiri Hulu recorded the lowest safe drinking water access, at 77.6%, although this remained higher than Meranti's sanitation figure.

Conversely, Pekanbaru City recorded the highest safe drinking water access (99.7%), and Dumai City recorded the highest proper sanitation access (98.0%). A general pattern emerges: cities in Riau consistently recorded better basic infrastructure access than districts, a pattern that becomes relevant when linked to stunting data in the following section.

Spearman Correlation Test Results

The Spearman correlation test was conducted only for the 9 districts/cities with stunting data from the 2024 SSGI, as correlation testing requires methodological comparability across units of analysis. Combining SSGI and e-PPGBM data within a single statistical test risks producing biased correlation estimates owing to systematic differences between the two measurement instruments (measurement incompatibility).

Table 3: Spearman Correlation Test Results

Variable	n	rs	p-value	Direction and Strength	Significance (α=0.05)
Stunting × Safe Drinking Water Access	9	-0.717	0.030	Negative, strong	Significant
Stunting × Improved Sanitation Access	9	-0.633	0.067	Negative, moderate	Not significant

The analysis revealed a strong, statistically significant negative correlation between stunting and access to safe drinking water ($r_s = -0.717$; $p = 0.030$; $p < 0.05$). This indicates that the higher a community's access to safe drinking water, the lower the stunting prevalence in that area, and that this relationship did not occur by chance.

Meanwhile, the relationship between stunting and access to proper sanitation showed the same direction, a moderate negative correlation ($r_s = -0.633$), but was not statistically significant at the $\alpha = 0.05$ level ($p = 0.067$). Nevertheless, the p-value's proximity to the significance threshold suggests a tendency toward a relationship between the two variables, which may not have been statistically confirmed owing to the limited sample size ($n = 9$). These results indicate that access to safe drinking water has a stronger and statistically more reliable relationship with reduced stunting prevalence than does access to proper sanitation in this study.

Discussion

Spatial Pattern of Stunting Prevalence

The spatial mapping results present a picture that is not entirely consistent. Rokan Hilir and Rokan Hulu indeed cluster together in the northwestern corridor of Riau and both border North Sumatra Province. Several factors may explain the high stunting prevalence in these two districts: their proximity to the neighboring province, inadequate infrastructure in border areas, and a population whose livelihoods are largely dependent on plantation agriculture and fisheries. However, the assumption that coastal areas are automatically associated with high stunting prevalence does not hold true across all of Riau. Dumai, for instance, is located on the northern coast yet falls into the low category, at 16.9% according to SSGI data. Bengkalis, an archipelagic and coastal district, falls into the moderate category instead. This pattern is noteworthy, as it challenges the assumption that coastal or border location alone can serve as a single predictor. Other factors appear to play a more significant role, although this data cannot yet confirm precisely which factors are involved.

One pattern observed from the mapping results is the position of Kuantan Singingi District as a high-stunting-prevalence area situated apart from other problem clusters in the southern part of Riau Province. This district borders directly on Kampar and Pelalawan Districts, both of which fall into the low-prevalence category. Nonetheless, stunting prevalence in Kuantan Singingi ranks second-highest among all districts/cities in Riau Province. No other high-prevalence cluster was found in geographic proximity to Kuantan Singingi, while the surrounding areas fall into the low category. This condition indicates that the high stunting prevalence in Kuantan Singingi is most likely influenced by localized factors rather than being explained by spatial influence from surrounding areas.

The spatial pattern identified in this study shows partial agreement with previous research findings, alongside some differences. Sonya & Iskarni (2025), in Tanah Datar District, West Sumatra, found that areas with hilly topography and higher elevation tended to have higher stunting prevalence, a condition attributed to limited road access and greater distance to health facilities. This finding is relevant to explaining conditions

in Rokan Hulu and Kuantan Singingi Districts. Both districts share hilly topography characteristic of the Bukit Barisan mountain range, with infrastructure access that tends to be more limited than in districts located in Riau's central plains. This pattern, however, does not fully apply to Rokan Hilir District, which is instead a lowland and river delta area. This suggests that topography alone cannot account for the variation in stunting prevalence across Riau.

Ahmad & Salim (2025), in a web-GIS-based study in Kwandang Sub-district, found that distance to the nearest primary health center (puskesmas) was the strongest predictor of village-level variation in stunting prevalence, accounting for 63.2% of the total variance in cases. This finding is relevant to understanding the pattern depicted on the Riau map. The high-prevalence districts, namely Rokan Hilir, Rokan Hulu, and Kuantan Singingi, have relatively few puskesmas relative to their land area, and much of their population resides in rural areas with greater distances to health facilities. This condition contrasts with Pekanbaru City and Dumai City, both in the low-prevalence category, which have the highest density of health facilities in Riau Province, consistent with it finding that health service density is inversely related to stunting prevalence.

The spatial approach applied in this study is consistent with previous work by the author in the context of infectious disease mapping. Novratilova & Budi (2021) employed GIS-based spatial distribution analysis to examine dengue hemorrhagic fever (DHF) cases in Central Java Province and found that case distribution was geographically uneven, forming clusters in specific areas. That finding reinforces the principle that spatial analysis reveals distribution patterns not visible through aggregate statistics alone the same principle that underpins the present study in the context of stunting disparities across districts and cities in Riau Province.

Overall, these mapping results reinforce the argument that stunting disparity in Riau Province is not a spatially random phenomenon, but instead reflects an uneven distribution of infrastructure and health service access across the region. Districts in the province's western and southern corridors, which have historically faced greater infrastructure limitations than the provincial center, bear a higher stunting burden, although the underlying mechanisms likely differ from one district to another.

Spearman Correlation Test

The Spearman correlation test results in this study show that access to safe drinking water has a strong, statistically significant negative relationship with stunting prevalence ($r_s = -0.717$; $p = 0.030$), whereas access to proper sanitation shows a moderate negative relationship that is not statistically significant ($r_s = -0.633$; $p = 0.067$). This difference in strength and significance between the two variables merits further examination, given that both are theoretically important basic-infrastructure indicators contributing to children's nutritional status.

This difference in correlation strength is consistent with the variation of findings reported in similar literature. Nurjazuli et al. (2025), in Salatiga City, found that improved bacteriological quality of drinking water was significantly correlated with a decline in the proportion of stunted children when measured in aggregate at the city level. In contrast,

Rahma et al. (2023) studying nine locus villages in Ogan Ilir District, found that neither the physical nor chemical quality of household drinking water was correlated with stunting incidence at the individual level.

This discrepancy across levels of aggregation provides relevant context for the present findings. At the district/city level, as used in this study and in the Salatiga study, the drinking water access variable appears to capture overall regional infrastructure conditions rather than the quality of water at a single well or household. This is likely why the relationship between drinking water access and stunting is more consistently observed at the aggregate scale than at the household scale, where individual-level variation may obscure patterns that genuinely exist at the population level. The small sample size (n = 9) in this study should also be noted as a factor limiting statistical power. A p-value of 0.067 for sanitation does not necessarily indicate the absence of a relationship; it may instead reflect a genuine relationship that was not detected with sufficient strength given the limited number of analytical units.

One district merits particular attention for not following the general pattern: Kuantan Singingi. This district recorded relatively good sanitation access, at 86.9%, above the average of the nine districts/cities studied, yet its stunting prevalence remained high, ranking second-highest in the province (23.1%). This pattern indicates that sanitation is not the sole determinant at play in this district. Similar findings have emerged in other studies discussed earlier. Sonya & Iskarni (2025) in Tanah Datar, documented the case of Padang Ganting Sub-district, which is far from health facilities yet has the lowest stunting prevalence, while Rahma et al. (2023) found that household lighting was correlated with stunting even though this variable is not intuitively related to nutrition.

The recurrence of such counterintuitive patterns in the Indonesian stunting literature suggests that other determinants, such as parenting practices, exclusive breastfeeding history, or household economic conditions, also play a role but are not captured in the secondary data used in this study.

When stunting prevalence is combined with drinking water and sanitation access data, Rokan Hilir stands out as the district with the most concerning combination of conditions. This district recorded the highest stunting prevalence in the province (24.5%), coupled with sanitation access also below average (80.8%). This combination makes Rokan Hilir a prime candidate for priority intervention, both in strengthening nutrition services and in improving basic infrastructure. Kepulauan Meranti also warrants attention, despite its stunting prevalence being lower than Rokan Hilir's (18.0%), given that its sanitation access lags far behind other districts/cities (61.3%). This condition suggests that uniform province-wide policy risks being poorly targeted, as the districts with the most urgent needs vary depending on which indicator is used as the reference.

The infrastructure and food access inequities that contribute to stunting have also been documented in other border region contexts. Fkun et al. (2025) examined the opportunities and challenges of Quadruple Helix collaboration for supporting food security in the Indonesia–Timor-Leste border region, finding that cross-sector coordination is key to overcoming food access disparities in remote areas. This finding is relevant to the context of Rokan Hilir and Rokan Hulu two districts in the western corridor

of Riau Province bordering North Sumatra where limited infrastructure access and cross-sector coordination gaps may have contributed to persistently high stunting prevalence.

The initial premise of this study rested on Riau's unexpected increase in stunting prevalence in 2024, given that the province had previously been recognized as a reference for successful stunting reduction yet recorded the largest increase nationally during that period. The correlation findings on drinking water access, sanitation, and stunting discussed above provide partial explanation for this phenomenon, though they remain insufficient to fully answer the research question. The strong correlation between drinking water access and stunting suggests that inter-district disparities in basic infrastructure likely contribute to part of the disparity observed at present. However, the case of Kuantan Singingi shows that adequate infrastructure does not necessarily guarantee low stunting prevalence, suggesting that the overall increase in Riau's stunting prevalence is likely driven by a broader combination of factors not captured within the limitations of the secondary data used in this study. The question of what actually changed in Riau between the period when the province was still regarded as a reference for success and the period of increased prevalence in 2024 remains open for further investigation, ideally through a longitudinal data approach capable of capturing change over time, rather than the single-point-in-time snapshot presented here.

CONCLUSION

This study shows that stunting prevalence across districts/cities in Riau Province in 2024 varied considerably, ranging from 12.5% in Bengkalis District to 24.5% in Rokan Hilir District. Of the nine districts/cities with available data, four exceeded the WHO public health problem threshold of 20% or higher. The Spearman correlation test results show that access to safe drinking water is strongly and significantly negatively correlated with stunting prevalence ($r_s = -0.717$; $p = 0.030$). Meanwhile, access to proper sanitation shows a similar direction of relationship but has not reached statistical significance ($r_s = -0.633$; $p = 0.067$), likely owing to the limited sample size.

The combination of high stunting prevalence with low drinking water and/or sanitation access identifies three districts as the highest priority for intervention: Rokan Hilir, Kepulauan Meranti, and Kuantan Singingi. These three districts each present distinct characteristics of concern, requiring policy approaches that cannot be applied uniformly. The case of Kuantan Singingi warrants particular attention, as its stunting prevalence remains high despite relatively good basic infrastructure access. This indicates that determinants beyond water, sanitation, and hygiene (non-WASH factors) also play a role and merit further investigation in future research.

These findings contribute to filling a gap in the literature, which has predominantly focused on intra-district disparity, such as between sub-districts or villages. This study demonstrates that a spatial approach based on open secondary data can be applied rapidly at the inter-district/city scale within a province. Such an approach is particularly relevant for Riau Province, given that it experienced the highest national increase in stunting prevalence in 2024, after previously being recognized as a province of reference for successful stunting reduction. Based on these findings, it is recommended

that the Riau Provincial Health Office prioritize differentiated interventions tailored to the characteristics of each area, rather than applying a uniform province-wide policy. Access to safe drinking water should also be made a primary focus, given its significant correlation strength in this study.

This study has several limitations, including the small number of analytical units (n = 9), incomplete coverage of all districts/cities in Riau owing to SSGI exclusion criteria, and the nature of secondary data, which does not allow for further explanation of non-WASH determinants such as parenting practices and exclusive breastfeeding history. Future research is recommended to employ longitudinal data to more thoroughly explain the causes of the increase in stunting prevalence in Riau Province over time.

REFERENCES

Ahmad, S. R. N., & Salim, M. (2025). Analisis Pemetaan Spasial dan Faktor Risiko Stunting Menggunakan Sistem Informasi Geografis. *Jurnal LOPI Selayar-Techno-Sociopreneur*, *1*(2), 68–74. https://ejournal.itsbmselayar.com/index.php/lopiselayar/en/

Badan Pusat Statistik Provinsi Riau. (2026). *Provinsi Riau Dalam Angka 2026* (Vol. 55). BPS Provinsi Riau.

Fkun, E., Festianto, D., & Sengkoen, M. (2025). Opportunities and Challenges in Building Quadruple Helix Collaboration to Support Food Security in The Indonesia-Timor-Leste Border Region. *Serumpun International Conference Proceedings (SICP)*, *1*(2), 76–82.

Gustin, R. K., Ramadanti, T., Ediana, D., & Putra, A. S. (2023). Analisis Pemetaan Faktor Resiko Kejadian Stunting Menggunakan Aplikasi GIS di Kabupaten Pasaman. *Human Care Journal*, *8*(1), 36–44.

Kementerian Kesehatan Republik Indonesia. (2025). *Survei Status Gizi Indonesia 2024 Dalam Angka*.

Novratilova, S., & Budi, A. P. (2021). Analisis Sebaran Demam Berdarah Dengue (DBD) Di Provinsi Jawa Tengah Tahun 2018. *(Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat)*, *6*(1). https://doi.org/10.37887/jimkesmas.v6i1.17207

Nurjazuli, N., Budiyono, B., & Arso, S. P. (2025). Kualitas Air dan Hubungannya dengan Balita Stunting di Kota Salatiga, Jawa Tengah, Indonesia. *Jurnal Kesehatan Lingkungan Indonesia*, *24*(1), 75–83. https://doi.org/10.14710/jkli.69553

Rahma, C. A. A., Razak, R., Budiastuti, A., & Septiawati, D. (2023). Spatial Analysis of Stunting Cases Based on Health Facilities and Correlation of Environmental Risk Factors in Toddlers in Ogan Ilir Regency in 2023. *Media Publikasi Promosi Kesehatan Indonesia*, *6*(12), 2588–2598. https://doi.org/10.56338/mppki.v6i12.4333

Sonya, D., & Iskarni, P. (2025). Distribusi Geografis Kasus Stunting di Kabupaten Tanah Datar. *Jurnal Keseharan Cendikia Jenius*, *3*(1), 148–158.

WHO, UNICEF, & Word Bank. (2023). *Levels and Trends in Child Malnutrition*. https://www.who.int/publications/i/item/9789240073791?