# District-Level Changes in Childhood Stunting Across Lombok, Sumbawa, and Dompu-Bima, West Nusa Tenggara, Indonesia, 2022–2024

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## ABSTRACT

Background: Childhood stunting reflects chronic constraints on growth and remains a major concern in West Nusa Tenggara (NTB), Indonesia. Provincial averages can conceal substantial district differences. Objective: To describe district and city stunting estimates in NTB across Lombok, Sumbawa, and Dompu-Bima during 2022–2024, and to place the estimates in national and global context. Methods: We conducted a descriptive ecological analysis of published SSGI 2022, SKI 2023, and SSGI 2024 estimates. We calculated percentage-point changes and unweighted cluster means. We reported 2023 weighted sample sizes and 95% confidence intervals where available. We did not perform inferential tests because compatible microdata, design weights, and covariance information across survey rounds were unavailable. We summarized routine ePPGBM surveillance separately because it covers children measured through health services and is not directly comparable with survey prevalence. Results: NTB's provincial survey estimate declined from 32.7% in 2022 to 24.6% in 2023, then increased to 29.8% in 2024. Indonesia's estimates were 21.6%, 21.5%, and 19.8%, respectively. NTB's 2022 estimate was 10.4 percentage points above the 2022 global modelled estimate of 22.3%, this comparison is contextual because the estimation methods differ. District estimates in 2023 ranged from 10.5% in West Sumbawa to 36.7% in Bima Regency. Across 2022–2024, eight of ten districts or cities ended below their 2022 point estimate; West Sumbawa increased and Sumbawa remained nearly unchanged. NTB's 2024 estimate was 15.8 percentage points above Indonesia's 14% national target. Conclusion: The estimates show a substantial and uneven burden, with a non-monotonic provincial pattern. The ecological and short observation period limit causal and individual-level interpretation. District planning should prioritize persistently high prevalence and be informed by longer follow-up and individual-level or multilevel analyses.

**Keywords:** Stunting, Child Nutrition, West Nusa Tenggara, SSGI, Ecological Study

## INTRODUCTION

Stunting is defined as height-for-age z-score below −2 standard deviations from the median of the WHO Child Growth Standards among children under five [28]. In 2022, the global modelled prevalence was 22.3%; NTB's SSGI estimate was 32.7%, a 10.4 percentage-point difference. This is a contextual comparison, not a direct statistical test, because the global figure is a modelled estimate and the NTB figure is a survey estimate [30]. Stunting indicates chronic or recurrent nutritional and health constraints that may begin before birth and continue through early childhood. Its effects extend beyond short stature and can include developmental, cognitive, educational, and later economic consequences [1, 2, 3]. Global analyses show uneven progress in child-growth targets [4]. In Indonesia, the national survey estimates were 21.6% in 2022, 21.5% in 2023, and 19.8% in 2024, while NTB recorded 32.7%, 24.6%, and 29.8%, respectively [5, 24, 29]. The difference between the provincial and national estimates, and variation between districts, make provincial averages insufficient for local programme planning.

Current evidence supports a multidimensional explanation of stunting. A global synthesis identified parental education, household socioeconomic improvement, sanitation, maternal health services, and family planning among the recurrent drivers of declining stunting prevalence [1]. A recent systematic review and meta-analysis also linked stunting inequality with maternal education, socioeconomic conditions, water treatment, sanitation, breastfeeding, and infection [6]. Indonesian reviews report a similar pattern. Household-level evidence identifies parental education, household size, socioeconomic status, exclusive breastfeeding, sanitation, and place of residence as recurrent determinants [7]. Environmental evidence specifically identifies drinking water, sanitation facilities, waste and wastewater management, and handwashing practices as relevant risk domains [8]. Other Indonesian evidence also highlights low birth weight, infectious disease, maternal height and education, family income, exclusive breastfeeding, and maternal nutritional status during pregnancy [9]. These findings support an analytical approach that connects immediate nutritional risks with household, environmental, service, and structural conditions.

Intervention evidence likewise argues against a single-sector response. The first 1,000 days of life remain a critical period for maternal nutrition, breastfeeding, complementary feeding, and early prevention of growth failure [10, 3]. Reviews of Indonesian primary health-care programmes describe antenatal care, iron supplementation, growth monitoring, exclusive breastfeeding support, complementary feeding, and supplementary feeding as core activities, while also stressing collaboration among health workers, government, and communities [11]. Policy reviews add social conditions, local potential, multisectoral integration, regulation, and coordination to the requirements for effective stunting reduction [12]. International experience from Nepal, Bangladesh, and Vietnam further indicates that sustained declines are associated with combined nutrition-specific and nutrition-sensitive interventions, stronger governance, and adaptation to local context [13, 14]. Intervention design should also consider the broader double burden of malnutrition and monitor unintended effects of food- or supplement-based programmes as nutrition transition advances [15].

NTB is a useful setting for subprovincial analysis because it contains marked social, service, economic, and geographic heterogeneity. NTB-specific studies have associated stunting with maternal education, drinking-water sources, sanitation, child illness, regional economic conditions, and health-service availability [16, 17, 18]. Evidence from Sumbawa and Bima also points to feeding, maternal nutritional status, low birth weight, household resources, and social protection as locally relevant pathways [19, 20, 21, 22]. This study therefore compares complete district and city stunting estimates across two SSGI rounds and organises them into three policy-oriented analytical clusters: Lombok, Sumbawa, and Dompu-Bima. The research question was: how did stunting prevalence and its spatial distribution change between 2022 and 2024 across these three clusters? The study aimed to identify differences in district trajectories, locate priority areas, and interpret the patterns in relation to evidence on maternal and child nutrition, household conditions, services, the environment, and governance.

## METHODS

This study used a descriptive ecological and comparative secondary-data design. The unit of analysis was the district or city. All ten administrative districts and cities in NTB were included, so no district-level sampling was conducted by the authors. For comparison, we grouped the units into three analytical clusters: Lombok, consisting of West Lombok, Central Lombok, East Lombok, North Lombok, and Mataram City, Sumbawa, consisting of Sumbawa and West Sumbawa; and Dompu-Bima, consisting of Dompu, Bima Regency, and Bima City. These clusters support comparison and do not change the formal administrative boundaries. The analysis follows recent regional studies that describe SSGI estimates alongside contextual nutrition indicators, while focusing here on district-level change in NTB [23].

The primary outcome was stunting prevalence among children under five years of age in three national survey rounds: SSGI 2022, SKI 2023, and SSGI 2024. The 2022 estimates were extracted from the official SSGI 2022 report [24]. The 2023 estimates were extracted from the SKI 2023 report, which integrated the national health survey and the under-five nutrition survey and reported district/city estimates, weighted sample sizes, and 95% confidence intervals [29]. The 2024 estimates were taken from the official SSGI

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2024 results and the subsequent completion of estimates requiring additional analysis [5, 25]. Stunting was defined as height-for-age z-score below −2 standard deviations from the median of the WHO Child Growth Standards [28]. These survey rounds provide annual point estimates, but their published district tables do not consistently provide sample sizes and confidence intervals for all years and estimation methods. The 2024 survey applied Small Area Estimation for selected district or city estimates when direct estimation did not meet specified quality criteria. We therefore report available 2023 confidence intervals and weighted sample sizes, and interpret differences across all years descriptively. A supplementary annual dataset, "Jumlah dan Persentase Balita Stunting di Nusa Tenggara Barat," was obtained from Satu Data NTB and published by the West Nusa Tenggara Provincial Health Office. The dataset is ePPGBM routine surveillance and covers 2018–2025 [26]. It reports the number of children under five whose height was measured and the percentage classified as stunted. We summarize ePPGBM only as routine monitoring and do not treat it as interchangeable with SSGI/SKI survey prevalence.

For each district or city, we calculated absolute change from 2022 to 2024 as the 2024 prevalence minus the 2022 prevalence in percentage points. Negative values indicated a lower point estimate in 2024. We also described 2022-to-2023 and 2023-to-2024 changes to show the full annual pattern. For each analytical cluster and survey year, we calculated an unweighted arithmetic mean from district and city point estimates for descriptive comparison only. These means are not population-weighted prevalence estimates. No inferential tests were performed because compatible individual-level microdata, sampling weights, and covariance information across survey rounds were unavailable. District-specific sample sizes and 95% confidence intervals were available for 2023 and are reported in Table 1; corresponding values were not consistently available in the published 2022 and 2024 tables used here. The study used only anonymised, publicly available aggregate data and involved no direct contact with human participants or identifiable records. Individual informed consent and new institutional ethics approval were therefore not applicable. For the routine monitoring series, 2024-to-2025 changes were calculated in percentage points. Cluster-level 2025 percentages were also calculated as measurement-count-weighted descriptive summaries using the number of children measured as weights.

## RESULTS

NTB's provincial survey point estimate declined from 32.7% in 2022 to 24.6% in 2023, then increased to 29.8% in 2024. Indonesia's corresponding estimates were 21.6%, 21.5%, and 19.8%; therefore, NTB remained above the national estimate in each round [5, 24, 29]. The NTB 2022 estimate was also 10.4 percentage points above the global modelled estimate of 22.3% for that year [30]. In 2024, NTB was 15.8 percentage points above Indonesia's national target of 14% [27]. These are descriptive comparisons, not tests of statistical significance. The unweighted mean across the ten districts and cities was 30.7% in 2022, 24.1% in 2023, and 26.4% in 2024. This mean is not weighted by population or survey design and does not replace the official provincial estimates. Figure 1 displays the point estimates for all ten districts/cities across the three survey rounds.

### Lombok Cluster

The unweighted Lombok cluster mean was 33.7% in 2022, 24.8% in 2023, and 28.8% in 2024. The decrease in the 2023 point estimates was followed by a higher cluster mean in 2024. Across the full interval, Central Lombok recorded the largest decline, from 37.0% to 24.9%. West Lombok declined from 34.0% to 27.3%, East Lombok from 35.6% to 33.0%, North Lombok from 35.9% to 35.3%, and Mataram City from 25.8% to 23.5%. North Lombok and East Lombok remained the two highest-prevalence districts in NTB in 2024. The three-year pattern therefore shows both changes between survey rounds and persistent district differences.

### Sumbawa Cluster

The unweighted Sumbawa cluster mean was 21.8% in 2022, 18.1% in 2023, and 24.0% in 2024. The 2023 decrease was followed by a higher 2024 point estimate. Sumbawa Regency recorded 29.7%, 25.7%, and

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29.8% across the three rounds. West Sumbawa recorded 13.9%, 10.5%, and 18.2%, respectively. Although West Sumbawa had the lowest 2024 estimate in NTB, its value rose from the 2023 estimate. This variation should be interpreted with the uncertainty and survey-method limitations described below.

**Dompu-Bima Cluster**

The unweighted Dompu-Bima cluster mean was 31.7% in 2022, 27.0% in 2023, and 24.0% in 2024. Dompu declined from 34.5% in 2022 to 12.4% in 2023, then increased to 19.8% in 2024. Bima Regency recorded 29.5%, 36.7%, and 23.8%, while Bima City recorded 31.2%, 31.8%, and 28.4%, respectively. The 2023 estimates show that change was not uniform within the cluster. The overall decline in its cluster mean is descriptive and cannot be attributed to a particular programme or intervention.

Table 1. District and city stunting prevalence in West Nusa Tenggara, 2022–2024

| **Cluster** | **District/city** | **2022 (%)** | **2023 (%)** | **2023 95% CI** | **2023 weighted n** | **2024 (%)** | **Change 2022–24 (pp)** |
|---|---|---|---|---|---|---|---|
| Lombok | West Lombok | 34.0 | 19.9 | 16.1–24.2 | 933 | 27.3 | −6.7 |
| Lombok | Central Lombok | 37.0 | 17.6 | 13.9–22.1 | 1,224 | 24.9 | −12.1 |
| Lombok | East Lombok | 35.6 | 27.6 | 22.6–33.2 | 1,886 | 33.0 | −2.6 |
| Lombok | North Lombok | 35.9 | 33.5 | 28.8–38.6 | 345 | 35.3 | −0.6 |
| Lombok | Mataram City | 25.8 | 25.6 | 21.2–30.5 | 531 | 23.5 | −2.3 |
| Sumbawa | Sumbawa | 29.7 | 25.7 | 22.2–29.6 | 603 | 29.8 | +0.1 |
| Sumbawa | West Sumbawa | 13.9 | 10.5 | 8.4–13.1 | 202 | 18.2 | +4.3 |
| Dompu-Bima | Dompu | 34.5 | 12.4 | 9.2–16.7 | 319 | 19.8 | −14.7 |
| Dompu-Bima | Bima Regency | 29.5 | 36.7 | 32.5–41.0 | 666 | 23.8 | −5.7 |
| Dompu-Bima | Bima City | 31.2 | 31.8 | 28.2–35.6 | 213 | 28.4 | −2.8 |

Note. pp = percentage points. 2023 estimates, 95% confidence intervals, and weighted sample sizes are from the SKI 2023 district/city table [29]. The 2022 and 2024 source tables did not consistently provide district-level confidence intervals and sample sizes. Negative change indicates a lower 2024 point estimate than in 2022. SSGI/SKI point estimates are presented descriptively and are not evidence of programme effects [5, 24, 25].

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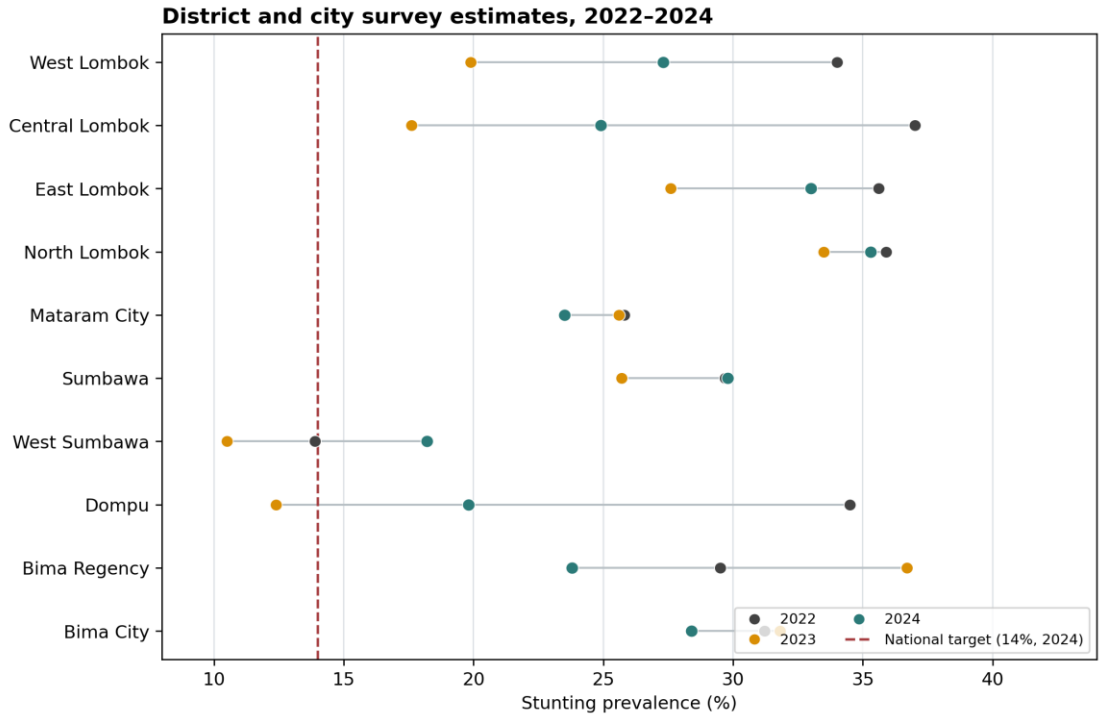



Figure 1. District and city stunting point estimates for 2022, 2023, and 2024. The dashed line denotes Indonesia's national 2024 target of 14% and is shown as a contextual reference, not a district-specific target. The global WHO/UNICEF/World Bank comparison is described in the text; it is not plotted because it is a 2022 modelled estimate.

**Routine ePPGBM monitoring, 2018-2025**

The routine monitoring series showed a different numerical scale from SSGI. At the provincial level, the reported percentage was 18.48% in 2018, increased to 20.93% in 2020, then declined to 12.22% in 2024 before increasing to 13.39% in 2025. The 2025 provincial value was based on 51,960 children whose height was measured. East Lombok had the highest 2025 district value at 22.36%, followed by North Lombok at 14.18%, while Mataram City and West Sumbawa had the lowest values at 6.59% and 7.03%, respectively.

Between 2024 and 2025, East Lombok recorded the largest increase, from 17.35% to 22.36% (+5.01 percentage points). Sumbawa increased by 1.74 percentage points, Dompu by 1.92 points, and Bima Regency by 1.34 points. Declines occurred in West Lombok, Central Lombok, West Sumbawa, North Lombok, Mataram City, and Bima City. Using the number of measured children as descriptive weights, the 2025 cluster percentages were 16.91% for Lombok, 10.06% for Sumbawa, and 12.05% for Dompu-Bima.

Table 2. Routine ePPGBM stunting monitoring in West Nusa Tenggara, 2024-2025

| Cluster | District/city | Measured 2025 (n) | 2024 (%) | 2025 (%) | Change (pp) |
|---|---|---|---|---|---|
| NTB | West Nusa Tenggara Province | 51,960 | 12.22 | 13.39 | +1.17 |
| Lombok | West Lombok | 5,436 | 10.48 | 9.58 | -0.90 |
| Lombok | Central Lombok | 8,300 | 10.39 | 10.00 | -0.39 |
| Lombok | East Lombok | 21,994 | 17.35 | 22.36 | +5.01 |

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| | | | | | |
|---|---|---|---|---|---|
| Lombok | North Lombok | 2,738 | 14.69 | 14.18 | -0.51 |
| Lombok | Mataram City | 1,476 | 8.11 | 6.59 | -1.52 |
| Sumbawa | Sumbawa | 3,464 | 8.95 | 10.69 | +1.74 |
| Sumbawa | West Sumbawa | 716 | 7.36 | 7.03 | -0.33 |
| Dompu-Bima | Dompu | 2,416 | 10.73 | 12.65 | +1.92 |
| Dompu-Bima | Bima Regency | 4,425 | 10.95 | 12.29 | +1.34 |
| Dompu-Bima | Bima City | 995 | 10.21 | 9.50 | -0.71 |

Note. Values are routine ePPGBM surveillance data from Satu Data NTB. Percentages refer to children whose height was measured and should not be directly compared with probability-based SSGI estimates. pp = percentage points.

## DISCUSSION

Stunting declined unevenly across NTB between 2022 and 2024. The provincial estimate improved, but the 2024 burden remained about ten percentage points above the national prevalence and 15.8 percentage points above the national 2024 target of 14% [5, 27]. More importantly, the direction and magnitude of change differed across the three analytical clusters. Lombok improved overall but retained the two highest district prevalences. Sumbawa did not improve as a cluster because Sumbawa Regency was stable and West Sumbawa increased from a low baseline. Dompu-Bima showed the strongest reduction, although Bima City still had a substantial burden. This pattern is consistent with broader evidence that national or provincial progress can mask subnational inequalities and that successful stunting reduction depends on different combinations of socioeconomic, maternal, service, sanitation, and governance factors across settings [1, 6, 14]. The present ecological analysis did not measure or adjust for these contextual factors, so they are possible explanations to investigate rather than causes established by this study.

The Lombok cluster requires particular attention because high burden persisted in North Lombok and East Lombok. The slow reduction in these districts differs from the sharper decline observed in Central Lombok and West Lombok. The ecological data cannot identify individual causal pathways, but NTB-specific analyses provide plausible hypotheses. Multilevel evidence has linked stunting in NTB with child illness, maternal education, drinking water, sanitation, and regional economic conditions, while SSGI-based analysis has also identified drinking-water source and maternal education as important factors [16, 18]. These findings are consistent with the Indonesian household literature, where parental education, socioeconomic status, breastfeeding, sanitation, and residence repeatedly appear as determinants [7]. The implication is that high-prevalence districts should be investigated using linked family, village, sanitation, and service indicators rather than relying on a single nutrition variable.

For Lombok, nutrition-specific actions remain essential but are unlikely to be sufficient when environmental and household constraints persist. Maternal nutrition during adolescence and pregnancy, early antenatal detection of nutritional risk, exclusive breastfeeding support, appropriate complementary feeding, growth monitoring, immunisation, and prompt management of childhood infection should be combined with reliable water, sanitation, hygiene, and social support. Indonesian environmental evidence identifies drinking water, healthy latrines, waste and wastewater management, and handwashing with soap as relevant stunting risk domains [8]. Recent synthesis also places maternal nutrition, breastfeeding, complementary feeding, infection prevention, WASH, and socioeconomic support within the same prevention framework [3]. This combined approach is especially relevant for districts where household infrastructure and service access remain uneven.

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Persistent variation inside Lombok also suggests a need to examine the distribution and effective reach of primary health care rather than only the nominal availability of services. Spatial analysis in NTB has linked community health-centre availability, human development, and regional economic output with stunting prevalence [17]. Reviews of Indonesian Puskesmas programmes show that antenatal care, iron supplementation, growth monitoring, breastfeeding, complementary feeding, and supplementary feeding require adequate personnel, infrastructure, financing, and coordination to function as an integrated package [11]. North Lombok and East Lombok should therefore be examined at subdistrict and village levels to identify whether the remaining burden reflects geographic access, staff distribution, continuity of follow-up, household constraints, or data-quality problems.

The Sumbawa cluster presents a different policy problem. Sumbawa Regency remained near thirty percent in both survey years, while West Sumbawa rose from a notably low value in 2022 but still recorded the lowest prevalence in NTB in 2024. This pattern alone does not show that programmes in West Sumbawa became less effective. Survey point estimates are subject to sampling uncertainty, and SSGI 2024 used additional estimation procedures for selected areas where direct estimates did not meet quality criteria [25]. A low baseline can also make a later absolute increase appear large. The appropriate response is to compare survey estimates with confidence intervals, routine monitoring, anthropometric data quality, and programme indicators before attributing change to programme performance.

Sumbawa Regency nevertheless deserves stronger attention because its prevalence remained high while the provincial estimate declined. Local evidence has linked feeding practice and clean-living behaviour with stunting in selected Sumbawa loci [19]. This finding fits the wider Indonesian evidence that family economic conditions, parental education, breastfeeding, sanitation, and residence interact at household level [7]. Community counselling should therefore move beyond general messages and assess dietary diversity, animal-source foods, meal frequency, breastfeeding and complementary feeding, food safety, water storage, handwashing, sanitation, and access to maternal-child services. The Puskesmas should remain the operational hub, but service delivery needs coordination with village government, sanitation programmes, and social assistance [11].

The contrast between Sumbawa and West Sumbawa is also analytically useful. Adjacent districts may share broad island ecology and cultural characteristics but differ in fiscal capacity, settlement patterns, infrastructure, service density, local governance, and implementation intensity. Policy reviews in Indonesia emphasise that effective stunting programmes should account for social problems, local potential, multisectoral integration, social capital, regulation, and coordinated acceleration teams [12]. International evidence from Nepal similarly shows that progress in child nutrition can arise from combined improvements in health services, sanitation, education, and wealth rather than from one isolated programme [13]. Future comparative research should therefore examine why West Sumbawa maintains a relatively low prevalence and determine which components are transferable to Sumbawa Regency.

Dompu-Bima showed the strongest cluster-level decline. Dompu's change was particularly large, while Bima Regency also improved and Bima City declined more modestly. Local studies in Bima have associated stunting with poor maternal nutritional status, low maternal nutrition knowledge, low birth weight, inadequate breastfeeding, household economic status, water source, toilet type, education, and maternal occupation [20, 22]. These pathways are consistent with broader Indonesian evidence identifying low birth weight, infection, maternal height and education, family income, exclusive breastfeeding, and maternal nutritional status during pregnancy as recurrent risk factors [9]. The first 1,000 days of life therefore remain central to sustaining improvement because pregnancy nutrition, birth outcomes, breastfeeding, and early complementary feeding are closely linked in the pathway to linear growth [10].

Social protection is also relevant to the Dompu-Bima context. Research in Bima City has described pathways through which conditional cash transfers to women, nutrition education, micronutrient support, health-service requirements, and field follow-up may contribute to stunting prevention [21]. This does not prove that social assistance caused the observed decline, but it illustrates how economic support can reinforce health and nutrition services. At the same time, intervention packages should be evaluated across

the broader nutrition spectrum. A systematic review of nutrition-specific and nutrition-sensitive interventions in low- and middle-income countries found that some food- or supplement-based maternal-child interventions may have unintended effects on overweight, while behavioural and social-policy interventions may provide broader benefits [15]. NTB programmes should therefore monitor both undernutrition and emerging excess-weight risks when scaling interventions.

The findings also point to a data-use issue. SSGI and ePPGBM serve different epidemiological and programmatic functions. The 2024 SSGI estimated NTB stunting prevalence at 29.8%, whereas routine ePPGBM monitoring in the Satu Data NTB series reported 12.22% among measured children in the same year, followed by 13.39% in 2025 [26, 5]. This difference should not be interpreted as a contradiction. SSGI is designed to estimate population nutritional status, while ePPGBM surveillance reflects children measured through routine services and is sensitive to coverage, measurement practice, data entry, and the composition of children reached. The 2025 increase, particularly in East Lombok, is therefore best treated as a programmatic signal requiring local verification rather than proof of a corresponding rise in population prevalence. Using both systems for their intended purposes can strengthen district action: SSGI supports population-level benchmarking, while ePPGBM can support case finding, follow-up, and service monitoring.

For nursing and public-health practice, the differences between clusters support locally tailored community care. Nurses, midwives, nutritionists, and community health workers can use family-centred assessment to identify maternal nutritional risk, low birth weight, feeding difficulties, recurrent infection, incomplete preventive care, unsafe water, inadequate sanitation, and barriers to service access. Reviews of Puskesmas programmes identify breastfeeding support, complementary feeding, antenatal examination, iron supplementation, growth monitoring, and supplementary feeding as practical components of prevention [11]. Evidence focused on the first 1,000 days also supports nutrition education for pregnant women and families as an early prevention strategy [10]. Because stunting can affect physical, cognitive, motor, and psychosocial development, early identification and continuity of follow-up should remain a core nursing responsibility [2].

District teams can apply this approach by preparing risk profiles that bring together nutrition-specific and nutrition-sensitive indicators. Programme managers could review maternal anaemia and chronic energy deficiency, low birth weight, exclusive breastfeeding, complementary feeding, childhood infection, growth-monitoring attendance, immunisation, safe drinking water, sanitation, poverty or social-assistance coverage, and health-personnel distribution. This structure reflects the evidence that stunting emerges from interacting maternal, household, environmental, service, and socioeconomic determinants [6, 3]. The profile should assess both coverage and quality. High attendance at an integrated health post is less informative when measurement is inconsistent or when children with growth faltering do not receive timely assessment and follow-up.

Governance is equally important because stunting reduction requires coordinated action across health, water and sanitation, food systems, education, family planning, village government, and social protection. Indonesia's Presidential Regulation Number 72 of 2021 formalised a holistic and integrated approach to accelerating stunting reduction [27]. Policy evidence from Indonesia similarly emphasises multisectoral integration, local adaptation, regulation, and coordinated implementation [12]. International reviews show that sustained reductions have occurred where nutrition-specific services were combined with WASH, education, food security, social protection, and strong governance [13, 14]. The spatial results in NTB provide a basis for applying these principles selectively by directing more intensive convergence reviews to persistently high-burden districts and sustainability reviews to districts with rapid improvement.

This study has several limitations. First, its ecological design and district-level aggregates cannot support conclusions about individual children and carry a risk of ecological fallacy. Second, survey estimates from SSGI 2022, SKI 2023, and SSGI 2024 may differ because of survey design, sampling, fieldwork, and estimation procedures; the selected 2024 district estimates include Small Area Estimation. Third, district-level 95% confidence intervals and sample sizes were not consistently available for 2022 and 2024.

Although the 2023 SKI tables report weighted sample sizes and confidence intervals, we lack harmonized microdata, sampling weights, and covariance estimates needed to test changes across rounds. Fourth, only three annual rounds were examined, which is too short to establish a sustained trend and leaves the analysis sensitive to round-specific variation. Fifth, the study did not model poverty, maternal nutrition or education, sanitation, feeding practices, illness, service coverage, or programme exposure. These contextual factors are plausible domains for future investigation, not causes demonstrated by this analysis. The district clusters are analytical groupings and hide within-cluster differences. Findings should therefore guide further assessment rather than be read as evidence that a programme caused a change. Future research should use longer follow-up and individual-level or multilevel analyses with harmonized data and uncertainty estimates.

## CONCLUSION

The provincial survey point estimates for stunting in NTB were 32.7% in 2022, 24.6% in 2023, and 29.8% in 2024. This non-monotonic pattern and the district differences show why a single provincial average is not enough for local planning. These ecological comparisons do not establish individual-level trends or programme effects. North Lombok and East Lombok remained the two highest-prevalence districts in 2024, while Sumbawa Regency also remained high. These locations warrant targeted review of child nutrition needs and service reach.

NTB should maintain a common package of evidence-based stunting prevention across the life course while differentiating implementation by district risk. Priority actions include maternal nutrition and antenatal care, low-birth-weight prevention, breastfeeding and complementary feeding support, infection prevention and management, safe drinking water and sanitation, strong primary health-care outreach, family-centred nutrition education, and targeted social protection. District action should combine nutrition-specific and nutrition-sensitive interventions and use integrated monitoring to distinguish household-resource constraints from service-delivery gaps. Districts with persistently high prevalence, particularly North Lombok, East Lombok, and Sumbawa, warrant focused review of local needs and programme reach. Future studies should follow districts for more years and combine SSGI or other survey microdata with district socioeconomic, sanitation, health-service, and programme data, using individual-level, multilevel, spatial, or mixed-method designs. District teams should interpret SSGI as the principal population-estimation source and use ePPGBM as a complementary surveillance tool for identifying measured children, monitoring service reach, and directing follow-up.

### Ethical Approval

This study analysed anonymised, publicly available aggregate data. Individual informed consent and new institutional ethics approval were not applicable, as described in the Methods section.

### Data Availability

### Conflict of Interest

[The authors declare that they have no competing interests.]

The SSGI 2022, SKI 2023, and SSGI 2024 reports are publicly available and cited in the References. The ePPGBM series is available through Satu Data NTB at https://data.ntbprov.go.id/dataset/9d27497f-eb7b-4513-814f-244f656bf52e/show.

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