Essential Indicators and Stunting Prevalence: An Aggregate Analysis in the Locus Villages of the Stunting Reduction Acceleration Program

Heryudarini Harahap[1], Desmil Faneni[2], Heri Yanto[2], Tuti Rahmawati[2], Mitra[3], Zulfayeni[4], Afriyanni[5]*, and Indra Agus Lukman[2]

[1] Regional Research and Innovation Agency of Riau Province, Indonesia
[2] Regional Development Planning Agency of Riau Province, Indonesia
[3] Universitas Hang Tuah Pekanbaru, Indonesia
[4] Health Office of Riau Province, Indonesia
[5] Research and Development Agency of Pekanbaru City, Indonesia
* Afriyanni, corresponding author. Email: afriyannisubhan@gmail.com
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Abstract

The analysis aimed to evaluate the attainment of essential indicators of stunting prevalence in local villages under the Stunting Reduction Acceleration Program. Data were sourced from the Emonev Stunting Ministry of Home Affairs Dashboard, comprising aggregated information from 232 locus villages across 12 districts/cities in Riau Province for 2023. Stunting prevalence was the dependent variable, whereas essential attainment indicators served as the independent variables. Spearman's correlation and linear regression analyses were performed. The findings revealed that 15 fundamental indicators, including exclusive breastfeeding (52,9%), did not meet the targets. Indicators that achieved targets included adolescent girls consuming iron pills, reduced unwanted pregnancies, adequate complementary feeding for children aged 6–23 months, and management services for malnourished children under the age of five. Exclusive breastfeeding was significantly associated with a lower prevalence of stunting ($r = -0.134$, $p < .05$). Interventions targeting exclusive breastfeeding could reduce stunting by up to 6.9% per 1% increase in coverage. The analysis emphasized the importance of improving essential indicators that remain below target indicators that directly influence stunting, such as exclusive breastfeeding, and require specific interventions. Recommendations include addressing the underlying challenges and providing lactation counselors at health centers in locus villages to promote breastfeeding practices and reduce stunting prevalence.

Keywords

Aggregate analysis; exclusive breastfeeding; program convergence; stunting prevalence; village-level indicators

Introduction

Stunting remains a pressing public health challenge in Indonesia, underscoring the need to identify and understand its underlying determinants at the regional level. This national concern is aligned with the Sustainable Development Goals (SDGs) commitment to end all forms of malnutrition by 2030, including achieving by 2025 the internationally agreed targets for reducing stunting and wasting among children under five, and addressing the nutritional needs of adolescent girls, pregnant and lactating women, and older adults (United Nations, 2025). Globally, undernutrition, including stunting, imposes significant human and economic burdens (Jumrani & Rai, 2020). Each year, it contributes to about 45% of deaths among children under five, amounting to roughly 3.1 million deaths per year (Tharumakunarajah et al., 2024) and costs billions of dollars in lost productivity and preventable health costs (Akseer et al., 2022; Jain et al., 2024; Shekar et al., 2017). Undernutrition reduces a person's lifetime income by more than 10%, while many countries experience losses of at least 2–3% of gross domestic product (Horton et al., 2010).

Stunting affects children's physical development, as well as their cognitive, motor, and emotional abilities, thereby hindering educational performance and future productivity (Dewey & Begum, 2011; McGovern et al., 2017). The World Health Organization (WHO) (2014) classifies the consequences by timing. Concurrent problems or short-term consequences include increased mortality and morbidity, reduced cognitive, motor, and language development, as well as higher health expenditures and opportunity costs associated with caring for sick children. Long-term consequences include reduced school performance, diminished work capacity and productivity, shorter adult stature, and impaired reproductive health. This problem has the potential to impede the development of high-quality human resources and to threaten a nation's competitiveness (Akseer et al., 2022; Chakravarty et al., 2019; Siregar et al., 2022). Therefore, the Indonesian Government has accelerated efforts to reduce stunting as a national strategic program. Based on the 2023 Indonesian Health Survey (SKI) (Ministry of Health of the Republic of Indonesia, 2023), the prevalence of stunting was 21.5%. This indicates a decrease in the prevalence of stunting over the past decade, from 37.6% in 2013. However, this success has not met the target of the 2020–2024 Rencana Pembangunan Jangka Menengah Nasional (RPJMN), the National Medium-Term Development Plan, which targets a 14% prevalence of stunting in 2024.

According to the UNICEF (2013) conceptual framework, stunting is directly affected by poor dietary intake and the presence of infectious diseases. These two factors influence each other: poor diet increases susceptibility to illness, whereas infections reduce appetite and nutrient absorption. At the underlying level, stunting depends on household conditions, including food security, caregiving practices, access to health services, and a healthy environment (e.g., safe water and sanitation). At the broadest level, basic or contextual factors such as poverty, education, gender norms, political stability, and resource distribution determine a household's capacity to provide adequate nutrition and care. This framework underscores that improving child nutrition requires a holistic approach that addresses not only food and health care but also broader social, economic, and policy determinants.

To address the high prevalence of stunting in Indonesia, the Indonesian government implemented the Stunting Reduction Acceleration Program, comprising five main pillars. These pillars are 1) commitment and vision of the country's highest leadership; 2) national campaigns and communication of behavior change; 3) convergence, coordination, and

consolidation of central, regional, and village programs; 4) nutrition and food security; and 5) monitoring and evaluation. The third pillar, program convergence, emphasizes the importance of intergovernmental coordination in implementing eight actions to enhance local program effectiveness.

One of the key components of the third pillar is situational analysis, which aims to identify the prevalence of stunting and assess the accessibility of existing programs. In 2021, the analysis covered 20 indicators; this will increase to 29 by 2022. These indicators include several critical aspects such as the nutritional status of adolescent girls, prospective brides/couples of childbearing age, pregnant women, toddlers, and families at risk of stunting, as well as access to drinking water, sanitation, and social protection (Ministry of Home Affairs of the Republic of Indonesia, 2022). However, the analysis of the coverage of specific and sensitive nutrition intervention services in Riau Province found that only two of the 20 indicators met the target in the village where the stunting convergence program was located (Rahmawati & Harahap, 2022).

A study on the determinants of stunting in Indonesia has identified several key factors influencing its prevalence, including the child's age, sex, low birth weight, short birth length, maternal nutritional status, infection, and feeding practices such as exclusive breastfeeding and inappropriate provision of complementary foods (Ahmad et al., 2024; Amud Sunarya et al., 2024; Jokhu et al., 2024; Siramaneerat et al., 2024; Siregar et al., 2024). Furthermore, low maternal education, limited nutrition knowledge, and low socioeconomic status, including parental occupation and income, significantly increase the risk of stunting (Ahmad et al., 2024; Mukharohmah et al., 2023; Nugroho et al., 2023). Environmental factors, including limited access to clean water, poor sanitation, and a high risk of infectious diseases, are also critical contributing factors (Anton et al., 2023; Arifuddin et al., 2023; Aulia Sandra & Sudaryanti, 2023).

A qualitative study in Indonesia identified four emergent themes: (1) toddler parenting patterns, family and environmental health, (2) eating patterns and consumption habits of toddlers, and (3) literacy and understanding of parenting and child health. The study also highlighted differences between stunted and non-stunted toddlers in parenting practices and daily activities (Azzahra et al., 2024). A study conducted in Rwanda identified three main themes: (1) awareness of a healthy diet for pregnant women, infants, and children, with subthemes covering knowledge of maternal and child nutrition and feeding practices, (2) the importance of personal and food hygiene during food handling, preparation, and consumption, with subthemes on food preparation practices and the feeding environment, and (3) factors influencing healthy eating among pregnant women, infants, and children, with subthemes addressing both barriers and facilitators to healthy eating (Albin et al., 2024).

Although the determinants of stunting have been widely studied, analyses of the relationship between key indicators and the prevalence of stunting during implementation convergence to accelerate stunting reduction, using aggregate data, remain limited. This study innovated by using aggregate data from 232 locus villages to link essential indicators to stunting within the convergence program, thereby addressing gaps in prior analyses focused on individual-level data. Therefore, this study aimed to identify which attainments and essential indicators were associated with the prevalence of stunting in the village locus during implementation of a convergence program to accelerate stunting reduction. By understanding this association, this study is expected to significantly contribute to improving the effectiveness of government programs in reducing stunting rates in Indonesia, specifically in the locus villages in Riau

Province, and to provide insights for improving policies to accelerate stunting reduction in the future.

Method

The data were aggregated from all locus villages in 12 districts/cities in Riau Province, Indonesia, in 2023. In total, 232 villages were designated for the Stunting Reduction Acceleration Program. The population comprised all villages in Riau Province, and the sample comprised all villages registered as stunting loci in 2023. Data were collected through the portal at www.aksi.bangda.kemendagri.go.id/emonev/Dashboardmonev, operated by the Ministry of Home Affairs of the Republic of Indonesia (2022).

The dependent variable was the prevalence of stunting at the stunting convergence in each village locus. The independent variable is an essential indicator of the results of the analysis of stunting convergence in the stunting locus village. The data were aggregated from individual data. The essential indicators classified as specific and sensitive comprise 6 target groups: adolescent girls, prospective brides/couples of childbearing age, pregnant women, children under five, families at risk of stunting, and households' water and sanitation. Specific indicators of stunting are measures directly related to the immediate causes of child growth faltering. They primarily capture aspects of nutritional intake and health status of mothers, infants, and young children.

These indicators are closely linked to biological and medical factors, including maternal nutrition, exclusive breastfeeding, complementary feeding practices, micronutrient supplementation, and immunization. Sensitive indicators of stunting are measures associated with the underlying and basic causes of child malnutrition and growth failure. They reflect broader determinants beyond direct nutrition and health interventions, including household food security, maternal education, socioeconomic conditions, access to health services, environmental sanitation, clean water supply, and caregiving practices. Sensitive indicators influence the enabling environment that supports or hinders the effectiveness of specific interventions.

Missing data were identified and handled using the list-wise deletion method, in which cases with missing data were excluded from analysis. All indicators analyzed are defined in the Technical Instructions for the Implementation of 8 Accelerating Stunting Reduction Actions in the Regions, 2022 Edition (Ministry of Home Affairs of the Republic of Indonesia, 2022).

Statistical analysis was conducted in two stages. Spearman's correlation test was used to determine the association between the dependent variable (prevalence of stunting) and the independent variables. Indicators with a p value $< .05$ were considered significant and included in the next stage of analysis. The next stage of the analysis was linear regression. Before conducting the regression analysis, a multicollinearity test was performed using the Variance Inflation Factor (VIF) and tolerance values. All predictors included in the regression model had VIF values below 10 and tolerance values above 0.1, indicating no evidence of multicollinearity.

Spearman's correlation was selected for the bivariate analysis because several variables did not meet normal distribution assumptions. Linear regression was applied in the multivariate stage to further examine the predictive relationship between key indicators and stunting

prevalence, aligning with the study's objective of identifying the indicators most strongly associated with stunting in locus villages. Regression results were interpreted using the regression coefficient β, the *p* value, and the adjusted R^2 to assess the model's power. The Ministry of Home Affairs conducted data-entry training to ensure data quality and consistency. Monitoring was conducted periodically by the Research and Development Planning Board of Riau Province during the data-entry period.

Results

The stunting prevalence category in this study refers to the classification by de Onis et al. (2019), which includes very low (< 2.5%), low (2.5–9.9%), moderate (10–19.9%), high (20–29.9%), and very high (≥ 30%). Table 1 shows that the prevalence of stunting at stunting loci predominantly falls into the very low (44.8%) and low (34.1%) categories. When comparing the number of convergence-locus villages across districts/cities in Riau Province, Indragiri Hilir Regency had the highest proportion (11.7%), whereas Pekanbaru City had the fewest.

Table 1: Villages Characteristics

Village Characteristic	***n***	**%**
Stunting Prevalence		
Very low (< 2.5%)	104	44.8
Low (2.5–9.9%)	79	34.1
Moderate (10–19.9%)	31	13.4
High (20–29.9%)	9	3.9
Very High ≥ 30%	9	3.9
Mean	6.6 ± 9.4%	
Number of Locus Villages in Districts/Cities		
Bengkalis	22	9.5
Dumai	10	4.3
Indragiri Hilir	40	17.2
Indragiri Hulu	15	6.5
Kampar	21	9.1
Kep. Meranti	26	11.2
Kuansing	27	11.6
Pekanbaru	9	3.9
Pelalawan	11	4.7
Rokan Hilir	11	4.7
Rokan Hulu	19	8.2
Siak	21	9.1

Table 2 presents the mean attainment and the correlation between stunting prevalence and specific essential indicators at the village level. The essential indicators that attained the target were: 1) unintended pregnancies, 2) children aged 6–23 months received complementary feeding, 3) children under five years of age with malnutrition who received malnutrition management services, and 4) undernourished children who received additional nutritional intake. The correlation analysis showed that five essential indicators were significantly negatively associated with the prevalence of stunting in the locus village: 1) unmet need for family planning services, 2) unintended pregnancies, 3) infants under six months of age receiving exclusive breastfeeding, and 4) children under five years of age with malnutrition who received malnutrition management services, The analysis revealed that higher coverage of family planning, exclusive breastfeeding, and malnutrition services was significantly

associated with lower stunting prevalence, underscoring their critical role in reducing stunting in the village.

Table 2: Specific Essential Indicators and Their Correlation With Stunting Prevalence

No.	Specific Essential Indicator/ Target group	Target (%)	*N*	Mean of Attainment (%)	R^{2}^
	Pregnant women				
1.	Additional nutritional intake for pregnant women with chronic energy deficiency (CED)	90	232	84.5 ± 35.2	-0.108
2.	Pregnant women consumed iron pills at least 90 tablets during pregnancy	80	232	78.3 ± 23.6	-0.089
3.	Unmet need for family planning services	7.4	232	18.0 ± 19.3	-0.154*
4.	Unintended pregnancy	15.5	232	3.9 ± 9.3	-0.247**
	Children under five				
5.	Exclusive breastfeeding	80	232	52.9 ± 27.5	-0.134*
6.	Children aged 6-23 months received complementary breast milk food (MP-ASI)	80	232	83.0 ± 33.1	0.087
7.	Malnutrition management services for malnourished children under five aged	90	223	95.2 ± 16.6	-0.167*
8.	Growth and development monitoring for children under five aged	90	232	69.7 ± 23.1	-0.023
9.	Additional nutritional intake for malnourished children under five aged	90	118	99.1 ± 9.0	0.079
10.	Complete basic immunization for children under five aged	90	232	74.0 ± 27.6	-0.061

*Note: * $p < .05$; ** $p < .01$; ^Spearman correlation; target (%) indicates the intended level of achievement, expressed as a percentage, for a given performance indicator.*

While Table 2 focused on specific indicators, Table 3 elaborates on sensitive essential indicators. Of the ten indicators reviewed, only the indicator on iron pill consumption among adolescent girls attained the target. The data show that 63.6% of households had access to proper sanitation facilities for managing domestic wastewater. Despite this relatively moderate level of access, the indicator demonstrated a statistically significant negative association with stunting prevalence.

Table 3: Sensitive Essential Indicators and Their Correlation With Stunting Prevalence

No.	Sensitive Essential Indicators/ Target Group	Target (%)	N	Mean of Attainment (%)	R^{2}^
	Adolescent Girls				
1.	Adolescent girls consumed iron pills	58	232	71.9 ± 35.3	0.076
2.	Adolescent girls received anemia status screening services	90	232	19.7 ± 36.0	-0.020
	Prospective Bride and Groom/Fertile Age Couples				
3.	Prospective fertile age couples received reproductive health assistance and nutrition education 3 months before marriage	90	232	64.9 ± 41.7	0.020
4.	Prospective bride and groom couples received marriage guidance with material on stunting prevention	90	232	60.7 ± 44.5	-0.013

No.	Sensitive Essential Indicators/ Target Group	Target (%)	N	Mean of Attainment (%)	R^{2}^
	Families at Risk of Stunting				
5.	Families stopped for open defecation	90	232	81.6 ± 32.9	-0.109
6.	Families implemented clean and healthy living behavior	70	232	51.2 ± 32.3	0.019
7.	Postpartum family planning services	70	232	44.6 ± 36.2	0.105
8.	Families at risk of stunting received assistance	90	232	52.5 ± 41.0	-0.061
	Household's Water andSanitation				
9.	Households that have access to clean drinking water	100	232	73.0 ± 33.7	0.018
10.	Households that have access to proper sanitation (domestic wastewater)	90	232	63.6 ± 37.1	-0.135*

*Note: * $p < .05$; ^Spearman correlation; target (%) indicates the intended level of achievement, expressed as a percentage, for a given performance indicator.*

Table 4 presents the results of the multivariate regression analysis examining the association between stunting prevalence and essential indicators. The regression analysis showed that only exclusive breastfeeding has a significant negative association with stunting prevalence. A 1% decrease in exclusive breastfeeding increased the prevalence of stunting at the village level by 6.9%.

Table 4: Multivariate Regression Analysis of The Association Between Stunting Prevalence and Essential Indicators

Essential indicators	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	10.276	1.315		7.817	.000
Exclusive breast feeding	-0.069	0.022	-0,201	-3.117	.002

Note: Adjusted $R^{2} = 0.036$

Discussion

The decline in the prevalence of stunting in Indonesia over the last decade has been quite significant but remains well below the RPJMN target of 14% by 2024. The Convergence Program for Accelerating Stunting Reduction is a key strategy implemented by the Indonesian Government to address this issue. Notably, the majority of the locus villages fell into the categories of very low or low stunting prevalence. The program comprises eight actions, with Action 1 focusing on situational analysis. One of the primary activities of this action is to determine the priority focus locations. The selection of locus villages is not based solely on a high prevalence of stunting; it also considers factors such as the number of stunted children, the number of families at risk of stunting, and the severity of problems related to essential indicators (Ministry of Home Affairs of the Republic of Indonesia, 2022). Understanding the attainment of specific and sensitive essential indicators was therefore crucial for assessing the extent to which the convergence program addresses the underlying nutritional problems in the selected locus villages.

Specific essential indicators attainment

The target group for the essential specific indicators was pregnant women and toddlers. Pregnant women, a vulnerable group with respect to nutrition, are the primary focus of the Additional Food Provision Program (Pemberian Makanan Tambahan, PMT), which addresses malnutrition by providing macro- and micronutrients to prevent low birth weight (LBW) or Berat Bayi Lahir Rendah (BBLR). The 2023 Indonesian Health Survey indicated that 32.1% of pregnant women nationwide and 26.8% in Riau Province received additional food. The PMT was integrated into Antenatal Care (ANC) services, and most pregnant women received PMT biscuits (87.1% nationwide and 93.4% in Riau Province), with smaller proportions receiving local PMT or other supplements. However, utilization of additional food was suboptimal: 25.7% of recipients nationwide and 19.9% in Riau Province did not consume all the food provided. reasons included poor taste (26.7%), lack of variety (6.1%), excessive sweetness (14.3%), unpleasant aroma (11%), side effects (6.8%), forgetting to eat (5.8%), and consumption of food by other household members (21.3%) (Ministry of Health of the Republic of Indonesia, 2023).

Iron deficiency anemia (IDA), a condition that increases the risk of miscarriage, premature birth, LBW, and postpartum hemorrhage, is another critical issue in pregnant women. Although iron pills are provided to pregnant women, their coverage remains below the target of 78.3%. Simbolon (2022) identified factors contributing to this gap, including poor-quality ANC services, lack of training among pregnancy examiners, rural residence, and low socioeconomic status. Recommendations to address these challenges include deploying nutrition officers during ANC visits to educate pregnant women about the benefits and proper use of iron tablets, reactivating pill consumption supervisors, improving access to health services in rural and low-income areas, and expanding free health programs for underprivileged families. Comprehensive interventions targeting adolescents, prospective brides, and pregnant women are essential to accelerate stunting reduction and achieve national health goals.

The unmet need for family planning services refers to the portion of the need that remains unmet. The coverage of unmet needs was high, at 18%, with a target attainment of 7.4%. The determinants of unmet needs for family planning services include age, fertility, parity, knowledge of modern family planning methods, and access to family planning services (Ismainar & Misbahuddin, 2021). Another study found that the factors were knowledge, residence, and information obtained by women of childbearing age from the media or family planning field officers (Sumiyati et al., 2024). Furthermore, Sejati (2020) analyzed the unmet need for family planning in Indonesia and found that Riau Province was included in Cluster 3, characterized by low female labor force participation, high unmet need, a high median age at first marriage, a high number of children still alive, and a high average length of schooling.

An unintended pregnancy is unwanted or mistimed at the time of conception. The rate of unintended pregnancy was high (15.5%), higher than that of the target (3.9%). In Indonesia, data analysis using the Indonesia Demographic Health Survey 2017 found that the variables associated with unintended pregnancy were female age (20–34 years and 45–49 years), education (primary and secondary), socioeconomic status (poorer), parity (multiparous), history of pregnancy termination, decision maker for women's to health center (husband only), and family planning exposure from radio and television (Wulandari & Laksono, 2021). A study in Malawi found 24% of children from unwanted pregnancies were stunted compared to 17% of those from wanted pregnancies (Baschieri et al., 2017).

The WHO recommends increasing the rate of exclusive breastfeeding in the first six months to at least 50% by 2025 (World Health Organization & UNICEF, 2014), while the Indonesian government's target is 80%. However, the proportion of exclusive breastfeeding in stunting-prone villages in 2023 was only 52.9%. These data were not significantly different from the percentages of exclusive breastfeeding among children aged 6–23 in Indonesia and Riau Province, based on the 2023 Indonesian Health Survey, which were 55.5% and 54.5%, respectively (Ministry of Health of the Republic of Indonesia, 2023). Determinants of low figures include maternal knowledge, breastfeeding self-efficacy, maternal occupation, cultural beliefs, exposure to information, family support, and support from healthcare workers (Rani et al., 2022).

Management services for children under five years can generally be provided at each Community Health Center (CHC), and trained health workers are available to provide these services. In the CHC, PMT, and additional food, such as biscuits and local foods, have also been prepared for undernourished children. The PMT is also administered to toddlers who do not gain 2 kg in a row and to children from low-income families.

Monitoring the growth and development of toddlers did not reach the target (69.7%). The 2023 SKI results showed that the proportion of children aged 1–59 in Riau Province who received growth and development monitoring in accordance with minimum service standards was low, at 7%. The operational definition of this indicator differed slightly for development monitoring: development was monitored at least twice a year using web-based data. Monev Bangda, during SKI 2023, development monitoring according to standards was conducted at least twice for children aged 1–23 months and at least 1 time for children aged 24–59 months in the last 12 months. Rehing et al. (2021) found that predisposing factors (work, education, knowledge, attitude, and mother's motivation) were associated with visiting Pos Pelayanan Terpadu (Posyandu) or integrated service posts, enabling factors (distance to Posyandu), and reinforcing factors (role of cadres, health workers, and family support).

Immunization is one of the main strategies for preventing infectious diseases and achieving Sustainable Development Goals (SDGs), particularly for reducing child mortality (Ministry of Health of the Republic of Indonesia, 2017). In 2023, the coverage of under-five children who received Imunisasi Dasar Lengkap (IDL) or complete basic immunization in Indonesia did not meet the target (74%); compared with the SKI 2023 results, the proportion was much lower (13.9%). The low IDL coverage was attributable to several factors, including mothers' lack of interest in completing immunization, primarily driven by family decision-making, such as husbands or caregivers who did not want their children to experience fever after immunization. The understanding among traditional, religious, and community leaders was that, in the past, children were not immunized but did not become ill; after immunization, children became ill or developed a fever. In Erynda et al. (2020), IDL provision was found to increase with maternal education, maternal knowledge, family income, maternal attitudes, and family support. Complete basic immunization decreased with maternal parity ≥3 and working outside the home.

Sensitive essential indicators attainment

Presidential Regulation Number 72 of 2021, concerning the Acceleration of Stunting Reduction, highlights adolescents and prospective brides as upstream targets in the stunting reduction strategy (Government of the Republic of Indonesia, 2021). The high number of adolescent girls consuming iron pills was due to the recording system that empowered the distribution of iron

pills to adolescents in schools. However, adolescent girls consuming iron pills, according to the provisions, were still low (Hasianna Silitonga et al., 2023; Hidayanti & Murwani, 2025; Hidayanty et al., 2025)

The coverage of adolescent girls receiving anemia status examination services remains alarmingly low. This issue stems from the lack of specific programs for comprehensive anemia screening at Health Centers by 2022, aside from screening for adolescents with anemia symptoms. To address this gap, the Ministry of Religion, in collaboration with the Ministry of Health and the National Population and Family Planning Board (BKKBN), introduced a marriage guidance program that incorporated stunting-prevention materials. Despite this, only 60.7% of prospective brides and grooms received marriage guidance, far below the target. Contributing factors include the busyness of prospective couples, budget limitations, and the prevalence of unregistered or sudden marriages (Setiaatmitha & Ilman, 2023; Suryani & Sayehu, 2023).

The coverage of reproductive health assistance and nutrition education for prospective fertile-age couples three months before marriage remains below target levels, largely due to limited awareness, uneven access, and weak integration of these services within health systems. Evidence shows that preconception nutrition and reproductive health education significantly improve knowledge and health-related behaviors among prospective couples; however, implementation remains inconsistent, particularly in rural and underserved areas (Atmaka et al., 2022; Nugraheni et al., 2023). Structural constraints, including inadequate institutional support and resource limitations, alongside cultural norms and stigma, further restrict service uptake despite the demonstrated effectiveness of premarital education programs delivered through both online and offline modalities (İnan Kırmızıgül & Şahin, 2024; Menezes et al., 2022).

Postpartum Family Planning (FP) services are those provided to fertile couples for up to 42 days after childbirth. The primary purpose of this service is to space pregnancies or to end fertility. Studies have shown that close birth spacing (Khan et al., 2024) and having too many children affect children's nutritional status and the incidence of stunting (Vaivada et al., 2020). However, coverage of postpartum family planning services was far from the target (44.6%). Age, education, parity, and knowledge are associated with postpartum family planning (Indrawati et al., 2022).

Open Defecation (OD) is associated with diarrhea and worm infections. The coverage of families that stopped OD was 81.6%. The Indonesian Ministry of Health has issued a regulation on Community-Based Total Sanitation (STBM), an approach to changing hygienic and sanitary behaviors by triggering community empowerment. The Public Works Department also has a sanitation program in urban areas, known as Sanitasi Berbasis Masyarakat (SANIMAS) or Community-Based Sanitation. However, these programs have not yet increased Open Defecation-Free (ODF) coverage. This was due to the status of residential land ownership, toilet ownership, conative attitudes, and employment (Yulyani et al., 2021). Another study found that the proponent factors of the implementation of ODF were attitudes and beliefs, availability of facilities, role of head family, health workers, health cadres, community leaders, and village government, while the obstacle factors were low education, knowledge, and economic status (Ruba et.al., 2021).

The Clean and Healthy Living Behavior Program, also known as Program Hidup Bersih dan Sehat (PHBS), aims to empower communities to implement healthy living behaviors in everyday life. However, the coverage of families implementing PHBS has not yet reached its

target (51.2%). The factors related to PHBS implementation included knowledge, availability of sanitation facilities, and support from health workers and local community leaders.

Families at risk of stunting are families that have risk factors for giving birth to stunted children, that is, fertile age couples (PUS), pregnant women, families with children aged 0–23 months, and families with children aged 24–59 months as well as a screening of risk factors that are easy to observe and are significant in influencing the occurrence of stunting, such as sanitation, access to clean water, 4 T conditions (too young, too old, too close, and too much), and participation in modern family planning (National Population and Family Planning Board [BKKBN], 2024). Thus far, coverage of families at risk of stunting who received mentoring was only 52.5%. Studies have shown that the low coverage of mentoring for families at risk of stunting is due to the limited number of family mentoring teams or cadres trained to provide mentoring that could reach all families in need (Indrayani et al., 2024).

In Riau Province, the coverage of households with access to clean drinking water was 73%, while the coverage of households with access to clean sanitation was 63.6%. These figures remain well below the targets of 100% and 90%, respectively. The problems of clean water and environmental sanitation in Riau Province are primarily attributable to the geographical conditions of river basins and coastal areas, which impede access to clean water. The habits of people who still dispose of waste and garbage in rivers are obstacles. In addition, high poverty rates in coastal and island areas hinder the development of adequate sanitation facilities.

Association between stunting prevalence and essential indicators

Building on the assessment of specific and sensitive essential indicators, the following section explores their association with stunting prevalence to identify potential determinants of child growth outcomes. The essential indicators associated with stunting prevalence were 1) unmet need for family planning services, 2) unwanted pregnancies, 3) infants under six months of age receiving exclusive breastfeeding, 4) children under five years of age with malnutrition who received malnutrition management services, and 5) households that have access to proper sanitation, based on bivariate analysis. These indicators play a critical role in addressing both the direct and underlying causes of stunting (UNICEF, 2013).

These findings highlight the multifaceted nature of stunting, where both health service coverage and environmental conditions must be considered simultaneously. Unmet needs for family planning and unintended pregnancies contribute to high-risk maternal and child health outcomes, which may increase the likelihood of growth faltering. Exclusive breastfeeding during the first six months and appropriate management of malnourished children are direct nutritional interventions that can prevent or reverse undernutrition. Meanwhile, access to proper sanitation reduces the risk of infection and diarrheal diseases, which often exacerbate nutrient deficiencies. Therefore, strengthening these essential indicators requires a comprehensive approach that integrates reproductive health, maternal and child nutrition, and environmental health interventions to accelerate progress in stunting reduction.

Multivariate regression analysis indicated that only breastfeeding, among the 5 essential indicators, was associated with stunting prevalence. This finding is consistent with a previous study that identified exclusive breastfeeding as a determinant of stunting in Indonesia (Beal et al., 2018). A study in Aceh Province on children aged 2–5 years also found that children who were not exclusively breastfed had a much higher risk of stunting (POR = 16.7), children

who did not receive complementary feeding (POR = 10.6), were not given vitamin A (POR = 3.5), the age at weaning from food was poor (POR = 1.5), and fathers did not work (POR = 1.5) (Bustami & Ampera, 2020). Hadi et al. (2021) also reported that children who received breast milk from poor families had a 20% lower risk of stunting compared to those who did not receive exclusive breastfeeding.

Exclusive breastfeeding is essential to a child's survival and health, as it provides nutrients vital to growth and development. Exclusive breastfeeding serves as the first immunization for a child and protects against respiratory tract infections, diarrheal diseases, and potentially life-threatening diseases. Furthermore, exclusive breastfeeding has a protective effect against obesity and certain noncommunicable diseases later in life (World Health Organization, 2013). Sankar et al. (2015) showed that children who did not receive exclusive breastfeeding had at 2 times higher risk of infectious diseases than children who received exclusive breastfeeding. In addition, exclusive breastfeeding can improve performance on intelligence tests (Horta et al., 2015) and reduce the risk of childhood obesity (Yan et al., 2014).

A qualitative study on barriers to exclusive breastfeeding in Myanmar (Thet et al., 2016) found that although respondents had high levels of knowledge about exclusive breastfeeding, adherence remained low. A key barrier was the perception among mothers, husbands, and grandmothers that breast milk alone was insufficient, leading to the early introduction of solid foods and water. Additional challenges included mothers' need to return to work and various health-related issues. While other family members offered support, most respondents indicated that the mothers themselves ultimately made decisions about breastfeeding and child feeding. These findings can be better understood through the lens of the Health Belief Model (Alyafei & Easton-Carr, 2024), which explains how individuals' perceptions of susceptibility, severity, benefits, and barriers influence their health behaviors, including exclusive breastfeeding.

Factors that drive success in providing exclusive breastfeeding include the role of health workers who provide breastfeeding counseling to mothers. Liliana et al. (2017) found that pregnant women in the third trimester who received lactation counseling were more likely to achieve exclusive breastfeeding than those who did not receive counseling. Therefore, ongoing information should be provided to pregnant women, families, and community leaders by trained health workers or breastfeeding counselors. Exclusive breastfeeding not only improves children's health but also contributes significantly to efforts to prevent stunting. Increasing the coverage of exclusive breastfeeding in the community can be a key intervention in accelerating the reduction of stunting in Indonesia, particularly in Riau Province.

The significant association found between exclusive breastfeeding and stunting prevalence might have been affected by unmeasured confounders. Variables such as maternal education, socioeconomic status, nutritional condition, and sanitation could simultaneously influence both breastfeeding practices and child growth outcomes. Because these factors were not captured in the aggregated dataset, their effects could not be adjusted for, which may explain part of the model's limited explanatory power. Furthermore, the study cannot be generalized to other areas with different social, economic, cultural, or geographical characteristics, a limitation of the study. In addition to aggregate analysis, there needs to be qualitative exploration to understand cultural factors, eating habits, and community perceptions that influence nutritional status. Despite these limitations, this study is expected not only to strengthen the effectiveness of government programs in reducing stunting rates in the Riau village locus but also to provide an important basis for formulating more targeted policies to

accelerate stunting mitigation efforts in the future.

Conclusion

The study showed that the essential indicators that met the target were specific interventions, including adolescent girls receiving iron tablets, children aged 6–23 months receiving complementary feeding, and children under 5 years with severe wasting receiving nutritional management services. These interventions were effective and targeted. This analysis also showed that the indicators associated with the stunting prevalence in the locus village were related to consumption, particularly exclusive breastfeeding. The decline in exclusive breastfeeding coverage significantly increased the risk of stunting in the locus village, underlining the importance of interventions related to child nutrition in preventing stunting. Other factors, such as an unmet need for family planning services, unwanted pregnancies, and access to proper sanitation, also need to be considered in stunting prevention strategies.

The main recommendation was to improve attainment of essential indicators that had not yet met the target through problem-based interventions. The provision of breastfeeding counselors at each Health Center within the village was a priority to increase exclusive breastfeeding coverage. Furthermore, increasing access to adequate sanitation and family planning education must be implemented through a community-based approach and cross-sectoral support to reduce stunting risk factors holistically.

This emphasizes the importance of strengthening family planning services, nutrition education, exclusive breastfeeding coverage, and access to proper sanitation to reduce stunting. Family planning ensures optimal birth intervals, while nutrition education improves knowledge of balanced diets and child-feeding practices. Promoting exclusive breastfeeding provides essential nutrition for infants, whereas improving sanitation reduces infections that hinder nutrient absorption. Together, these efforts form a comprehensive strategy to address stunting and promote children's health.

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