Health Dynamics
eISSN: 3006-5518
Publisher: Knowledge Dynamics
DOI: https://doi.org/10.33846/hd10602

*Original Research*

# Determinants and Model for Estimating the Prevalence of Stunting Toddlers in Sleman Regency

**Tri Siswati[1], Anif Muchlasin[2,3], Raden Yuli Kristyanto[4,5] and Delima Citra Dewi Gunawan[6,*]**

[1]Department of Nutrition, Poltekkes Kemenkes Yogyakarta, Yogyakarta, Indonesia
[2]DP3Ap2KB Kab Sleman, Jl. Jalan Rorojonggrang No.4, Beran Tridadi, Kabupaten Sleman, Yogyakarta, Indonesia
[3]Prodi Pembangunan Sosial, Universitas Mulawarman, Samarinda, East Kalimantan 75119, Indonesia
[4]Rumah Sakit Umum Daerah Kabupaten Sleman, Jl Bhayangkari, No 48 Triharjo Sleman, Yogyakarta, Indonesia
[5]Tim Audit Kasus Stunting Kabupaten Sleman, Sleman, Indonesia
[6]Nutrition Department, Faculty of Health Science, Universitas Respati Yogyakarta, Indonesia

**Article history**
Received: 23 April 2024
Revised: 08 June 2024
Accepted: 10 June 2024
Published Online: 29 June 2024

***Correspondence:**
Delima Citra Dewi Gunawan
Address: Nutrition Department, Faculty of Health Science, Universitas Respati Yogyakarta, Indonesia.
Email: emagunawan@respati.ac.id

**How to cite this article:** Siswati T, Muchlasin A, Kristyanto RY, Gunawan DCD. Determinants and Model for Estimating the Prevalence of Stunting Toddlers in Sleman Regency. Health Dynamics, 2024, 1(6), 191-198. https://doi.org/10.33846/hd10602



**ABSTRACT**

**Background:** The Sleman Regency Government is committed to solving the stunting problem by implementing an integrated stunting prevention program by encouraging the participation of penta-helix. Estimating stunting prevalence accomplishment targets is crucial for measuring progress, guiding strategies, and ensuring stunting reduction success. This study aims to provide information regarding the factors that contribute to the prevalence of stunted toddlers and develop a predictive model for that prevalence. **Methods:** The study investigated the prevalence of stunting, wasting, and underweight in Sleman Regency using publicly accessible reports, secondary data, and reputable websites. Data was gathered through audits of stunting cases and factors from district-level program managers, and analysed through desk reviews. This research was conducted in Sleman Regency from December 2023 to February 2024. **Results:** The investigation found that stunting is linked to family smoking, inadequate toddler nutrition, inactive JKN, chronic energy deficiency throughout pregnancy, and low-weight, preterm births. Through rules, policies, and multisectoral multistakeholder collaboration, the Sleman Regency Government aims to reduce stunting. The interventions include maternal and child health, nutritional counselling, drinking water and sanitation, early childhood education, and pre-conception family life preparation. A model to estimate long-term stunting prevalence is needed to track trends, evaluate interventions, and support evidence-based decision-making. Stunting is vital to public health and economic benefit. Based on audit data, child nutrition trends, and prediction models, Sleman Regency should reduce stunting by 0.02% per year for local data and 0.5% per year for national data. The determinants of stunting in Sleman Regency are very diverse, including problems related to nutrition and non-nutrition. **Conclusion:** Stunting prevention is focused on efforts to overcome habits, improve the nutritional status of pregnant women and optimize better pregnancy outcomes. Based on the analysis, the stunting reduction target was determined based on national and local surveys of 0.5% and 0.02% per year, respectively.

**Keywords:** Under five children; estimation model; prevalence; stunting

# 1. INTRODUCTION

Stunting is a growth and developmental disorder experienced by children with long-term malnutrition, recurrent infections, and inadequate psychosocial stimulation. Children are defined as stunting if their height for their age is less than -2 median of the WHO standard anthropometric deviation as well as the child's anthropometric standard according to Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020.[1] Stunting results in a child having a shorter height than he should have. Stunting as the impact of chronic malnutrition from an early age is parallel to the risk of morbidity and mortality, cognitive impairment, metabolic syndrome, and low productivity in adulthood.[2] Even chronic malnutrition leads to an increase in the Disability Adjusted Life Year (DALY) that reduces the potential for economic development, adult and old age independence, as well as the detriment of the country due to low productivity and high health coverage costs due to the further impact of chronic undernourishment throughout life.[2] It can be explained that undernourishment experienced at an early age/pregnancy causes vital organs not to develop perfectly, at the same time the functional capacity of the organs is also not able to perform its functions optimally.[3–8]

According to the national survey, the prevalence of stunting in Sleman regency has declined, by 2021 is 16% (SSGI 2021)[9] and by 2022 which is 15%.[10] The prevalence of stunting in 2022, in Sleman Regency is lower than in Special Region of Yogyakarta, which is 16.4%.[10] However, according to the report of the community-based electronic nutrition recording and reporting system (e-PPGBM) based on factual data from Puskesmas and Posyandu, the prevalence of stunting in Sleman regency in 2023 was 4.51%, ranging from 2.37% (Kapanewon Berbah) to 8.69% (Kapanewon Pakem). The differences in the prevalence of stunting between the surveys and the actual data may be caused by 1). selective bias of the national survey sampling methods, 2). the national survey reported that all toddlers were short in stature (stunted), including short stature not due to stunting, while the e-PPGBM factual data only reported cases of short stature due to stunting, 3). there are toddlers who do not undergo examinations at posyandu and puskesmas so they are not reported through the e-PPGBM system.

Based on a review of 89 studies in various countries regarding stunting toddler, factors that cause stunting have been identified which are then grouped into basic, intermediate and direct causes. Several studies show that the basic causes of stunting are family income and family education, especially the mother. While the intermediate causes are environmental sanitation, availability of proper toilets, clean water, maternal health care during pregnancy or antenatal care (ANC), breastfeeding practices, food safety, and direct causes are birth spacing, mother's height, birth weight, food diversity. and diarrhea incidents. In Indonesia, apart from the several causes mentioned, stunting is also caused by un-boiled drinking water, low access to health services, living in rural areas.[11–16] These studies also show that in various regions the determinants of stunting can vary, because they are influenced by geographic and demographic factors in the community. This has the implication that the focus of stunting reduction programs in various regions should specifics according to the determinants of stunting. Studies in various countries show that stunting may combated optimally through collaboration, coordination and convergence of multisectoral interventions. Therefore, strengthening collaboration, roles and contributions of penta-helix elements, which include elements of local government, academics and researchers, business actors, media and community groups, is essential to ensure the implementation of this multisectoral approach.[17] This collaboration needs to be developed in a more formal networking system with activities carried out systematically and periodically.[18]

It is crucial to predict the long-term prevalence of stunting towards a Golden Indonesia in 2045 since malnutrition, especially stunting, is an important indicator of public health that can represent a country's social and economic welfare by 2045. A sustainable estimation model can monitor stunting prevalence trends over time. over time, evaluate the effectiveness of existing interventions and policies, help plan efficient allocation of health and non-health resources, design more effective and proactive prevention efforts and support evidence-based decision making in improving children's sustainable health. This study aims to provide information about the factors that contribute to the incidence of stunting on toddler and design a prediction model for the prevalence of stunting on toddler in Sleman Regency.

# 2. METHODS

### *2.1 Study Design and Setting*

This was a survey using cross sectional. The data gathering took place from December 2023 to February 2024, ensuring that all necessary information was collected during this specific time frame to achieve comprehensive research results. The study carried out in Sleman Regency, selecting this location due to its unique characteristics and relevance to the objectives of their investigation, thus providing valuable insights for their work.

### *2.2 Instrument*

We used audit case stunting instrument (Toddler Paperwork Audit, pregnancy Paperwork Audit, post-natal Paperwork Audit, previous finding/study, Achievements of the Regional Action Plan for Food and Nutrition form and others) to observe the determinant stunting. We also apply instrument to collect the target coverage program from every local government organization in Sleman District. Based on these findings, we moved it into the matrix table that we had compiled.

We also apply matrix form to collect the target coverage program from every local government organization in Sleman District.

### *2.3 Data collection and resources*

The data collected are secondary data derived from various sources including program achievement reports, Sleman District Health Profile, official government websites, stunting audit reports, stunting policies and other policies related to efforts to support stunting, as well as relevant research publications. **P**revalence of stunting, wasting, and underweight was determined by survey data collected at the national and regional levels (e-PPGBM research) and national survey from SSGI. Stunting determinant data is processed through the audit of stunting cases (Audit Kasus Stunting or AKS) process, which is carried out in accordance with the audit of stunting cases guidelines of the National Population and Family Planning Coordinating Board.

### *2.4 Data analysis*

Data on the causes of stunting are analysed descriptively and presented in the form of narratives and graphs. The estimates stunting target and reduction was estimates through the consideration of national, provincial, and local targets, as described in the RPJPD and regional action plan on food and nutrition, together with an assessment of the capacity of regions to reach the targets for the prevalence of stunting until the year 2024.

# 3. RESULTS

### *3.1 Stunting Policy in Sleman Regency*

The commitment of the leadership in stunting reduction is a reflection of pillar 1 of the national strategy to tackle stunting. The commitment of the leadership in stunting reduction is a reflection of pillar 1 of the national strategy to tackle stunting. Collecting stunting-related regulations from the JDIH page of Sleman Regency is essential for understanding the specific policy framework that guides local efforts in stunting reduction. This helps in evaluating how well these regulations are implemented and their effectiveness in achieving desired outcomes. Additionally, analyzing these policies supports the harmonization of local and national strategies, ensuring a unified approach to tackling stunting. Furthermore, it facilitates the identification and sharing of best practices that can be adopted by other regions to enhance their own stunting reduction initiatives. The results of the desk review succeeded in collecting several policies in Sleman Regency taken from the JDIH page of Sleman Regency[19] related stunting. As detailed depicted in Table 1.

### *3.2 Determinant of Stunting in Sleman Regency*

Identification of risks and causes of potential risks, direct and indirect causes of toddler stunting, is carried out on prospective brides, pregnant women, postpartum mothers, toddlers and toddlers through Audit of Stunting Cases. Audit of Stunting Cases are one of the five priority activities of the national strategy to accelerate stunting reduction. The Sleman Regency AKS team in 2022-2023 reported that the most dominant causes of stunting in toddlers were family smoking behavior, inactive health insurance, inadequate nutritional requirements, as well as chronic energy deficiency in pregnant women and LBW. In detail in Figure 1.

**Table 1.** Policies to accelerate the reduction of stunting in Sleman Regency

| |
|---|
| **Regency Regulation*** |
| 1. Number 22 of 2012 on non-smoking area<br>2. Number 22.1 of 2021 on acceleration of integrated stunting prevention<br>3. Number 39 of 2022 amendment to regency regulation Number 28.3 of 2021 on District Authority in Integrated Stunting Prevention at the District Level<br>4. Number 40.1 of 2022 on Implementation of qualified family village |
| **Regency Decision*** |
| 1. Number 13.2/Kep.KDH/A/2021 on Stunting Prevention Coordination Implementation Team at Sleman Regency<br>2. Number 14.1 /Kep.KDH/ A/2021 on focus priority district locations for Stunting Prevention in 2021 and 2022<br>3. Number 12.3/Kep.KDH/A/2022 on Stunting Prevention Coordination Implementation Team at Sleman Regency<br>4. Number 20.6/Kep.KDH/A/2022 on focus priority district locations for Stunting Prevention in 2023<br>5. Number 21.3/Kep.KDH/A/2022 on amendment to regency decision Number 73/Kep.KDH/A/2021 on Family support team at Sleman Regency in 2022-2024<br>6. Number 49.7/Kep.KDH/A/2023 on acceleration team for stunting prevention dan stunting management secretariat at Sleman regency |

*JDIH Sleman Regency, https:/jdih.slemankab.go.id

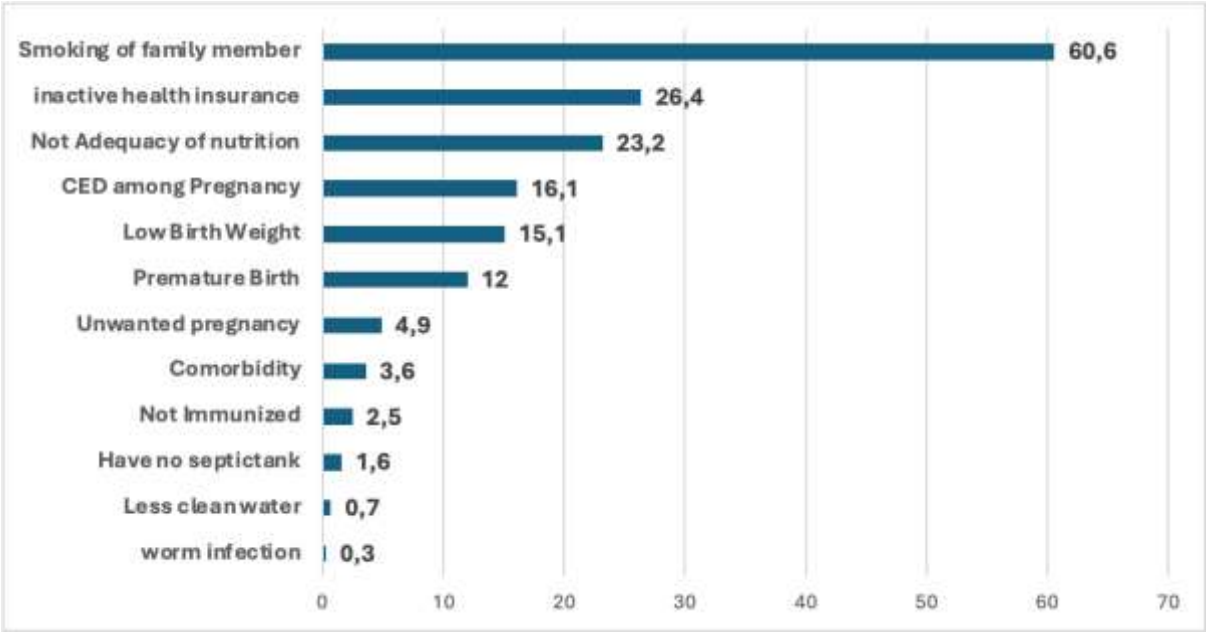


**Figure 1.** Determinants of stunting in Sleman Regency in 2023

Several data in Sleman Regency relating to trends in toddler problems on nutrition, causes of toddler stunting and analysis of stunting prevalence prediction models from various countries, it is proposed that the accelerated rate of reduction in stunting in 2024-2045 without distinguishing between the age and gender of toddlers is 0.02%. per year in Sleman Regency (Figure 2) and 0.5% per year at the National Level (Figure 3).

## 4. DISCUSSION

According to the study's findings, the Sleman Regency Government is highly committed to accelerating the reduction of stunting among children under five. There are many policies, which every policy and regulation has a unique role in efforts to overcome stunting in Sleman Regency, such as ensuring effective coordination between various related parties, encouraging accelerated reduction in stunting through effective coordination and intensive efforts, as well as

supporting families for prevention. stunting, especially in families at risk of stunting. In general, each policy has a specific aim to increase effectiveness, efficiency and focus in preventing stunting, according to the context and needs of the situation in Sleman Regency.[21]

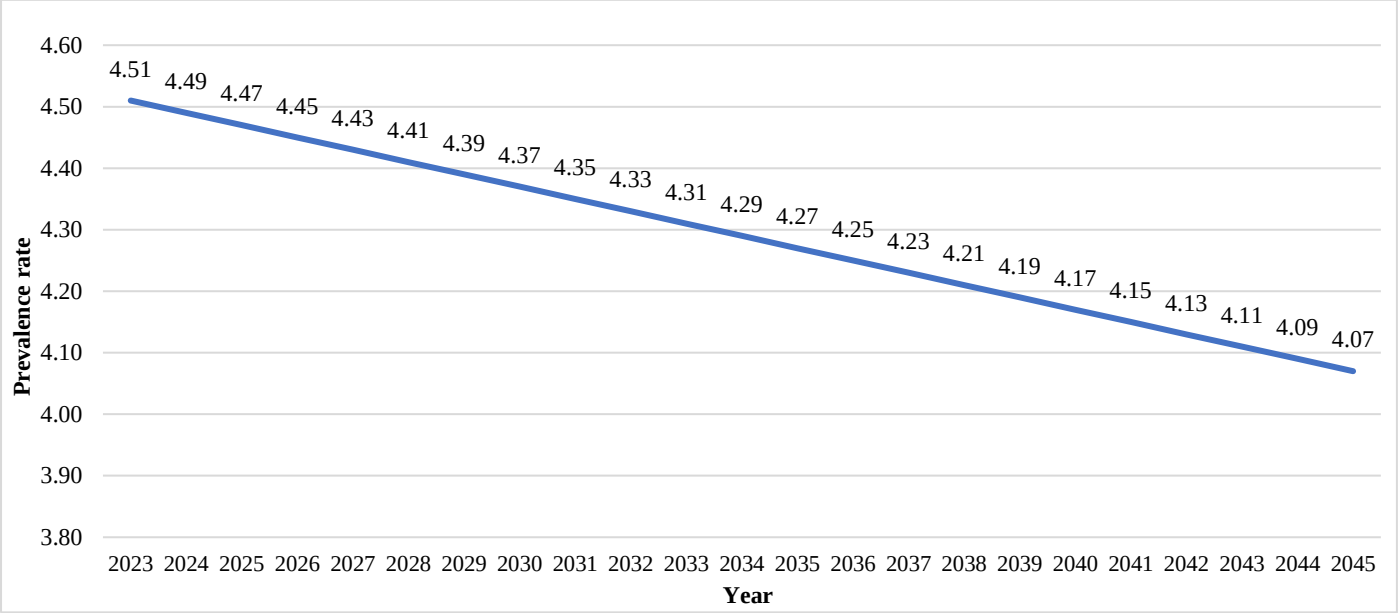


**Figure 2.** Model for estimating the prevalence of stunting under five years 2025-2045 based on e-PPGBM data

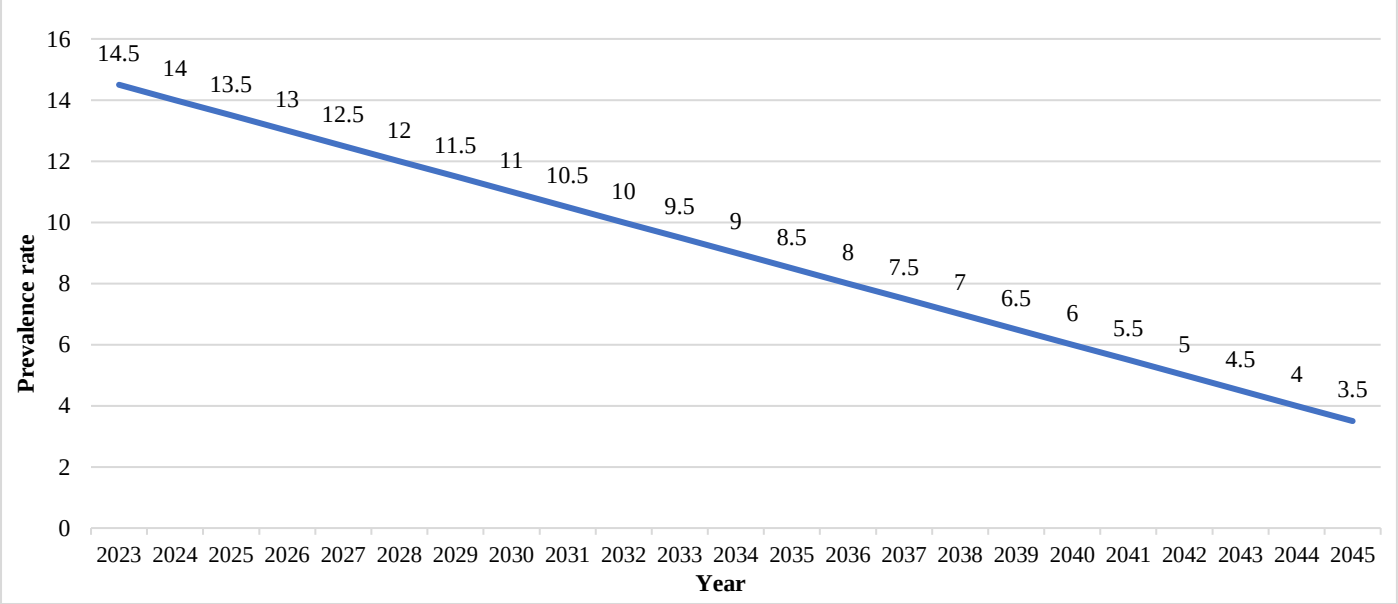


**Figure 3.** Model for estimating the prevalence of stunting under five in 2025-2045 based on a national survey

Our finding also showed that the strongest determinant of stunting found in Sleman Regency is smoking behaviour of family members. It is associated to the occurrence of stunting through exposure to parental/environmental smoke causing toddlers to become passive smokers, so that toddlers absorb various dangerous chemicals that can interfere with the performance of oxygen in the body, thereby inhibiting the transport and absorption of nutrients into the body and causes delays in growth and development, especially for young children.[22–27] Secondly, cigarette smoke has a negative effect on placental growth and function. Pregnant women who smoke or pregnant women who become passive smokers will experience

placental disorders in their fetuses, thereby hampering the supply of nutrition and oxygen to the fetus. This can cause growth disorders in the uterus or Intra Uterine Growth Retardation (IUGR) and resulting stunting.[23,25] In addition, exposure to cigarette smoke in pregnant women can affect the development of the nervous system and vital organs of toddlers, thereby disrupting their physical and cognitive growth after birth. Third, exposure to cigarette smoke affects respiratory health, increases the risk of respiratory tract infections in toddlers, interferes with nutrient absorption, increases the body's energy needs, and affects the growth and development of toddlers.[23,25] Fourth, smoking behaviour among parents, especially in families with limited income, spending on cigarettes can disrupt the food budget, so that nutritionally vulnerable groups in these families, including toddlers, are at risk of malnutrition.[27]

Lack of nutritional intake due to inadequate feeding practices for children is one of the biggest determinants of stunting cases in Sleman Regency. Inadequate feeding practices include infrequent feeding, inadequate feeding during and after illness, watery food consistency, feeding insufficient amounts, and unresponsive feeding. Research shows that low intake of food other than carbohydrate sources, especially lack of food intake high in animal protein, is an important determinant of stunting for children in Indonesia. This condition of nutritional deficiency can be experienced since the child is in the womb, but most of it starts when the child is 6 months old or when starting complementary breast milk, which is characterized by grow failure (weight faltering). Conditions of lack of nutrition and prolonged failure to grow at a later age lead to stunting and growth disorders experienced by children. Interventions in improving feeding practices and increasing animal protein intake have been proven to improve conditions of failure to thrive and stunting.[28]

Chronic Energy Deficiency (CED) experienced by mothers during pregnancy has a complex relationship with Low Birth Weight (LBW) and stunting. CED can affect the health of pregnant women, which in turn can impact the growth of the fetus and baby. Pregnant women experience CED, the risk of LBW in their babies also increases. Apart from that, CED can also affect the availability of nutrition in the early stages of a child's life, which can then contribute to delays in the child's growth and development. This can be explained by the fact that malnutrition experienced at an early age/pregnancy causes important organs not to develop optimally, along with this the organ's functional capacity is also unable to carry out its functions optimally.[3–5,8] Therefore, combating CED is very important to prevent the risk of LBW and stunting in children.[28]

The government has provided health service facilities by sharing costs through national health insurance or National Health Insurance. Not having access to national health insurance because they don't have it or are inactive because they are in arrears, for example, will potentially limit the population's access to health services at health facilities provided by the government. For stunted toddlers, there is no access to national health insurance related to health services, routine check-ups, consultations with expert doctors, referral services, nutrition services, examination of problems with growth and development disorders, as well as interventions that are needed on an ongoing basis. Hence it can be concluded that ownership of National Health Insurance plays a very important role to support nutrition and growth to avoid delays in the child's growth and development.[29,30]

## 5. CONCLUSION

The prevalence of stunting in Sleman Regency based on e-PPGBM data is in the low category (<10%), taking into account several aspects, the rate of reduction in stunting per year based on e-PPGBM data is 0.02%. Meanwhile, the prevalence of stunting is based on national survey data, the prevalence of stunting in Sleman Regency is included in the category of moderate public health problem, with the proposed rate of reduction in stunting per year being 0.5%. Some of the causes of stunting under five children include smoking behavior, inactive JKN, inadequate nutritional intake of toddlers, chronic energy malnutrition during pregnancy, low birth weight, premature, and other causes in small numbers. Based on several facts that have been explained above, the recommendations are: a) Focus on resolving the problems that cause stunting, mainly sanitation, smoking behavior, prevention of untimely pregnancy, LBW and child rearing patterns (feeding pattern) as well as ownership of national health insurance, b) It is necessary to promote nutrition. and health education for caregivers and parents of toddlers, c) Increasing collaboration and involvement between sectors, especially the business world, through

Corporate Social Responsibility (CSR) in overcoming the problem of stunting, d) Applying good practices from various countries/regions in overcoming stunting, especially Kapanewon with high prevalence of stunting, e) Utilization of yard areas to provide food, f) Monitoring and evaluation of programs, g) Development of follow-up plans. Based on this, it is necessary to establish a follow-up plan in the form of: a) Collaboration and consolidation between OPDs to reduce the stunting rate in the Sleman District, by providing data on stunting toddlers by name by address, b) Stunting prevention interventions in accordance with the findings of AKS results, including sensitive, specific, individual and environmental-based interventions at the family, sub-district, sub-district and district levels, c) Utilization of the *Elsimil* health platform broadly and comprehensively to prevent LBW and prepare mothers suitable for pregnancy, d) Intervention to overcome stunting in adolescents on a massive, continuous and sustainable basis integrated with school programs.

## Acknowledgement

We are very grateful to the Head of DP2AP3KB of Sleman Regency for giving us the opportunity to become experts, or the Stunting Reduction Acceleration Team in Sleman Regency and all informant who contributed this study.

## Funding Information

No funding available.

## Conflict of Interest

The authors declare no conflict of interest.

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