



Stunting and the Economy: Assessing Potential Economic Losses

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ABSTRACT

Stunting is an obstacle in creating a golden generation to achieve the Golden Indonesia 2045. Stunting is a failure to grow in children under five due to chronic malnutrition characterized by a body shape that is too short for their age. This occurs due to various factors, with the biggest factor being poverty where the fulfillment of food needs is low, causing potential losses in the future. This study aims to determine how much potential economic loss is caused by stunting in Semarang Regency in 2024. This research method is descriptive research, using secondary data and the results of direct interviews from related agencies which are processed using calculations according to the Konig formula and correction factors by Horton. The results showed that the potential economic losses incurred up to the time of this study were around Rp. 3,296 billion for 2% productivity to Rp. 14,832 billion for 9% productivity. The percentage of GRDP until the third quarter of 2024 is 0.006% (2%)-0.030% (9%)

INTRODUCTION

Stunting is a growth disorder in children due to poor nutrition, inadequate psychosocial stimulation (lack of encouragement or stimulation from the surrounding environment) and repeated infections. Stunting has height inappropriate for age and severe irreversible physical and cognitive damage so that growth will be inhibited. Stunting can last a lifetime and can continue to affect the next generation. Globally, around 149 million children under the age of 5 are stunted. More than half of the world's stunting comes from Asia at 55%, and Africa at more than 39%. The prevalence of stunting in Asia reached 83.6 million, with the largest number coming from South Asian states at 58.7% and the smallest prevalence coming from Central Asian countries at 0.9% (Querol et al., 2021; Wardani et al., 2020).

Stunting can have an impact on Indonesia's economic losses. This is due to a decrease in productivity due to stunting. The economic loss due to several nutritional problems and stunting is the largest economic loss, reaching 50% greater than other nutritional problems. The high birth rate of stunted children affects productivity so that it affects the human resources owned which causes economic losses (Safriadi Darmasnyah et al., 2023; Sutrisno et al., 2024). In (Mary, 2018) stated that the prevalence of stunting caused a decrease in GDP per capita by 0.4%. Based on data from Riskesdas 2018 nationally, the prevalence of stunting in Indonesia for children aged 0-60 months has decreased significantly. In 2013 the stunting rate reached 37.2% and decreased in 2018 by 6.4% to 30.8%. The prevalence of stunting in children in Central Java in 2018 reached 31.3% (11.2% very short and 20.1% short).

Stunting in children in Indonesia occurs due to several factors including not exclusively breastfeeding in the first 6 months, premature birth, short birth length, short heredity, low parental education, low family economy, living in rural areas. Parents' education and knowledge, especially related to children's nutritional needs, also have an impact on the risk of poor nutritional status in children, which leads to stunting⁷. Children who experience stunting in early life, physical and mental conditions/intelligence will be disrupted, which is feared to continue into adulthood. This is because nutritional deficiencies during the 1000 HPK period will result in growth disorders⁸. Nutrition is one of the most important factors to reduce stunting in the community.

The incidence of stunting in society represents a failure to reach genetic potential for height and other predictors of development, including cognitive and future economic potential (Achmad et al., 2020). The causes of stunting are diverse and complex, but are generally categorized into three factors: basic causes, which consist of economic, social, and political factors; underlying causes, which consist of food availability, parenting, and health services; and immediate causes, which consist of nutrient intake and infectious diseases. One type of community-based health service is the integrated service post (Posyandu). Posyandu has the benefit of monitoring the growth of children under five, providing vitamin A, immunization, growth stimulation, and education on nutrition and health.

The World Bank estimates that losses due to malnutrition are around 2.5% of a country's Gross Domestic Product (GDP) (de Onis et al. 2010). Research by (KHOTIMAH, 2022) showed a negative slope value between Gross Regional Domestic Product (GRDP) per capita and the prevalence of under-five malnutrition, which means that the higher the GRDP per capita value in a region, the lower the prevalence of malnutrition in that region. This is because a large GRDP value indicates the ability of large economic resources and vice versa (Kusharisupeni 2002). Nationally, the amount of economic potential lost due to Protein Energy Deficiency (PEM) that affects the growth of children under five is 0.27-1.21% of Indonesia's GDP or between 4.24 and 19.08 trillion rupiah per year (Kementerian Kesehatan RI, 2021; Yosephi & Jumrahwati, 2021)).

LITERATURE REVIEW

The Circle of Poverty Theory

Poverty According to (Nurwati, 2008; Nurwati Nunung, 2008) "Poverty is a social problem that continues to exist in people's lives". The problem of poverty is very old, and for a long time, just like the age of man himself, and the main element of the problem is related to various forms or characters of human life. In other words, poverty is a life problem that is global or worldwide, meaning that the problem of poverty has become a world concern, the problem exists in all countries, although the impact of poverty is very different.

(Budiadnyana & Sandisa, 2017; Waluyo, 2017) says that "poverty is associated with the ability to perform a function in society". Thus, poverty arises when people have no income, inadequate education, and poor health. Poverty is considered a multidimensional phenomenon.

Regarding poverty, the Central Bureau of Statistics (BPS, 2018) explains "poverty is the inability from an economic, material and physical perspective to meet the basic needs of food and non-food as measured by expenditure". The measure of poverty is using the poverty line. Which consists of the Food Poverty Line (GKM), and the Non-Food Poverty Line (GKNM). The food poverty line is the value of expenditure resulting from the value of the minimum food requirement calculated in 2,100 kcalories per capita per day, while the non-food poverty line is calculated from the minimum needs for clothing, education, and health and other basic needs. Poverty indicators consist of (BPS, 2018): 20 a. Head Count Index, which is the percentage of the population below the poverty line. The Head Count Index is divided into two, namely: 1) Poverty Depth Index (p1) is a measure of the expenditure of the poor against poverty. The higher the index value, the further the average expenditure of the population is from the poverty line. 2) The Poverty Severity Index (p2) is a measure of the distribution of expenditure among the poor. The higher the index value, the higher the expenditure of the poor. b. Poverty Gap Index (Index of poverty depth), is a measure of the average expenditure gap of each poor person against the poverty line. c. Poverty Severity Index (Index of poverty severity), is a description of the distribution of expenditure among the poor.

According to (Hamdani & Wulandari, 2016; Itang, 2015) poverty is caused by different causal factors and dimensions. This depends on whether the poor live in rural or urban areas, and whether they live in small family structures, nuclear families or alone. Some perspectives on the causes of poverty are: (a) if low resources and unfavorable terms of trade are seen as the main causes of poverty, then increased productivity, access to markets, fair prices for products produced by the poor are appropriate measures in eradicating poverty; (b) if the poor condition of the natural environment is seen as a crucial cause of widespread poverty, then wiser use of natural resources and ecologically oriented practices are the solution; (c) if low levels of knowledge and access to information, education, training and guidance are the causes of poverty, then human resource development is the way to overcome poverty. Here is an image of the Vicious Circle of Poverty

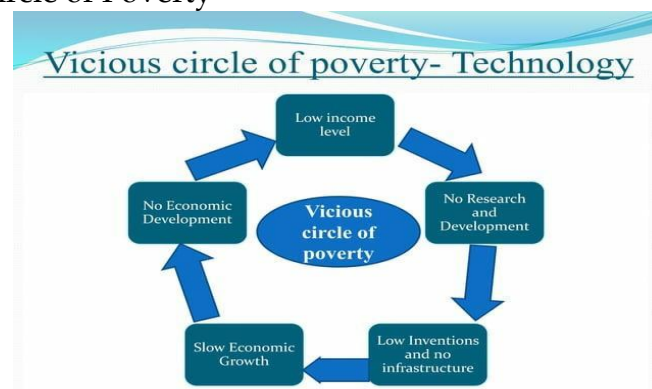


Figure 1. The Circle of Poverty (Nuscheler in Munkner, 2001)

Human Capital Investment Theory

Human Capital Investment Theory is a concept that explains how individuals and organizations invest resources such as time, money, and effort to enhance the quality of human capital through education, training, and skill development. This theory emphasizes that investment in human capital can increase individual productivity, expand career opportunities, and provide long-term economic benefits. According to recent research, investment in education and training not only enhances individual capabilities but also contributes to overall economic growth (Hanushek & Woessmann, 2020). In the context of globalization and the Fourth Industrial Revolution, this theory has become increasingly relevant due to the growing demand for highly skilled labor. A study by (Bohm et al., 2021) shows that investment in digital technology training has a significant impact on increasing productivity and innovation in the workplace. Additionally, research by (Psacharopoulos et al., 2021) found that the returns on investment in formal education remain high, especially in developing countries, as education helps individuals adapt to rapid changes in the labor market. Therefore, Human Capital Investment Theory serves as an essential foundation for public policy and organizational strategies aimed at improving the quality of human resources in addressing modern economic challenges.

METHODOLOGY

This research was conducted using a descriptive narrative qualitative method with data sources obtained from BPS secondary data sources and direct interviews with relevant parties, namely the Semarang Regency Health Office, and families with stunted children. The data obtained was processed using Microsoft excel. Estimation of potential economic losses in stunted children is calculated using the Konig formula. the following formula Calculation to assess the economic potential of children at the beginning of work.

$$FV_{[r,t]} = P_0 (1 + r)^t$$

Description:

$FV_{[r,t]}$	= Income in productive age (15-64th)
P_0	= Wage/salary 2013 (Risksdas 2013)
r	= Interest rate (5%)
t	= Years of productive life

The income value at productive age that has been obtained is continued to calculate the calculation of the amount of economic value until the child retires, with the following formula:

$$FVA_{[r,t]} = (FV_{[r,t]}) [(1 + r)^t - 1] / r$$

Description:

FVA	= Economic value until the child enters retirement
FV	= Income at productive age (15-64th)
r	= Interest rate (5%)
t	= Years of productive life

Furthermore, the amount of economic potential of children 0 years old is calculated using the following formula.

$$PV_{[0]} = FVA_{[r,t]} / (1 + r)^t$$

Description:

$PV_{[0]}$	= Economic potential of children at age 0
$FVA_{[r,t]}$	= Economic value until the child enters retirement
r	= Interest rate (5%)
t	= Years of productive life

The cost of lost productivity due to stunting is calculated by the following formula.

$$PPEM = Prev \times SBL \times PV_{[0]}$$

Description:

$PPEM$	= Economic potential lost due to stunting
$Prev$	= Prevalence of stunting (Risksdas 2013)
SBL	= Number of births (Ministry of Health, 2013)
$PV_{[0]}$	= Economic potential of children at age 0

Research by (Horton, 2017) states that in actual conditions, children who are declared stunted have the opportunity to recover so that the amount of productivity value can still be achieved less than 100%. Children with a history of malnutrition, weight-for-age (BB/U) Z-score <-3, will lose productivity by 2-9%, so the cost of losses does not come from stunted children who are 100% unproductive. This can be calculated using the following formula:

$$P = f_{(cor)} \times Prev \times SBL \times PV_{[0]}$$

Description:

- P = Amount of corrected economic loss
- f (cor) = Correction factor (2% and 9%)
- Prev = Prevalence of stunting (Risksdas 2013)
- SBL = Number of births (Ministry of Health, 2013)
- PV[0] = Economic potential of children at age 0

The assumptions used in this study are: (1) stunted children will decrease their productivity by 2-9% (Horton, 1999), so the researcher uses the 2-9% figure for the correction factor (2) equal salary / wages in all sectors (3) subject characteristics are the same (5) interest rate 5%.

RESULT

Table 1. Development of Malnutrition Cases by District/City in Central Java Province Year 2022

Perkembangan Kasus Gizi Buruk Menurut Kabupaten/Kota di Provinsi Jawa Tengah Tahun 2022									
Malnutrition Case by Regency/City in Jawa Tengah Province 2022									
Kabupaten/Kota Regency/Municipality	Sisa 2021 Rest of 2021	Baru Murni New	Kambuhan Relapse	Sub Total	Mati Dead	Sembuh Cured	Lain-lain Other	Sisa Rest	Balita Under Five YEarS
Kabupaten/Regency									
1. Cilacap	49	8	5	62	-	23	-	39	134 348
2. Banyumas	74	50	43	167	-	19	20	128	122 155
3. Purbalingga	49	10	2	61	-	9	-	52	72 016
4. Banjarnegara	35	25	-	60	-	26	-	34	84 715
5. Kebumen	25	10	10	45	-	23	-	22	94 662
6. Purworejo	36	-	-	36	-	1	-	35	44 295
7. Wonosobo	34	9	1	44	-	9	-	35	77 362
8. Magelang	36	14	9	59	1	7	-	51	86 637
9. Boyolali	13	1	-	14	-	1	-	13	74 153
10. Klaten	57	60	-	117	-	-	-	117	78 917
11. Sukoharjo	34	8	2	44	-	27	-	17	57 935
12. Wonogiri	52	-	7	59	-	12	-	47	59 355
13. Karanganyar	5	-	-	5	-	-	-	5	57 615
14. Sragen	44	16	6	66	-	30	-	36	61 541
15. Grobogan	19	-	6	25	-	9	-	16	102 355
16. Blora	64	2	12	78	1	9	1	67	55 258
17. Rembang	48	1	3	52	-	5	-	47	43 100
18. Pati	87	6	-	93	1	17	-	75	83 308
19. Kudus	192	50	5	247	-	-	-	247	68 108
20. Jepara	58	11	-	69	-	11	-	58	94 655
21. Demak	28	1	1	30	-	5	1	24	100 651
22. Semarang	46	4	-	50	-	4	-	46	66 685
23. Temanggung	26	22	8	56	-	14	-	42	51 866
24. Kendal	41	-	18	59	-	15	-	44	56 003
25. Batang	49	4	-	53	-	6	-	47	58 040
26. Pekalongan	36	-	-	36	-	3	-	33	80 062
27. Pemalang	30	3	-	33	1	2	-	30	101 943
28. Tegal	108	43	10	161	1	137	6	17	128 837
29. Brebes	422	36	7	465	-	47	-	418	147 690
Kota/Municipality									
1. Magelang	6	1	-	7	-	-	-	7	6 941
2. Surakarta	-	-	-	-	-	-	-	-	37 994
3. Salatiga	8	2	1	11	-	-	-	11	11 270
4. Semarang	43	-	-	43	-	-	-	43	89 239
5. Pekalongan	13	1	-	14	-	4	-	10	23 475
6. Tegal	35	-	-	35	-	5	-	30	14 142
Jumlah/ Total	1 902	398	156	2 456	5	480	28	1 943	1 527 328

Sumber/Source : Dinas Kesehatan Provinsi Jawa Tengah/Public Health Service of Jawa Tengah Province

In Indonesia, 30% of children under the age of five are stunted. (UNICEF et al., 2023) This is an indicator of chronic nutritional problems that require immediate attention so as not to cause major losses in the future. It is known that the nutritional status of children is influenced by direct and indirect factors. Food intake and health status are direct factors that cause stunting, if these two factors occur during the golden period of a child's brain development, there will be a decrease in intellectual ability, decreased productivity, risk of degenerative diseases, premature births and babies born with low body weight.

Table 2. Potential Economic Losses in Semarang Regency 2020-2023

Year	Minimum Wage	Pre v	SBL	$FV_{(r,t)}$	$FVA_{(r,t)}$ (Million)	$PV_{(0)}$ (Million)	P_{PEM} (Million)
2020	2.229.880,50	25,91	14.373	24.353.267,79	4.832,34	442,47	1.647.769,5
2021	2.302.798	16,4	13.237	25.149.624	4.990,35	456,94	991.948,87
2022	2.311.254	18,7	12.398	25.241.974,88	5.008,68	458,61	1.063.263,6
2023	2.480.988	18,8	12.028	27.095.696,44	5.376,51	492,29	1.113.207,1

As shown in Table 2, the potential economic loss due to stunting in 2020 in Semarang Regency reached the highest value of Rp. 1,647,769,500,000. This is because in that year there was a covid 19 pandemic and the government imposed Large-Scale Social Restrictions (PSBB) in order to prevent the spread of covid 19 cases. This includes the elimination of routine posyandu activities so that health and nutrition services for children are not achieved optimally and also results in changes in socio-cultural activities in the community (Efrizal, 2020). The covid 19 pandemic has a synergistic relationship with stunting where malnutrition and infection can increase the incidence of malnutrition ((Permatasari et al., 2020).

Table 3. Estimation of Potential Economic Losses Due to Stunting

Year	2%	9%	% GRDP	
	(Million Rupiahs)	(Million Rupiahs)	2%	9%
2020	32,95	148,30	0,067	0,30
2021	19,84	89,28	0,038	0,17
2022	21,26	95,69	0,037	0,17
2023	22,26	100,19	0,036	0,16

The value of potential economic losses due to stunting in 2020 seen in table 3 shows the highest value. This factor is influenced by the decline in GRDP in 2020, as stated by (Sánchez-Romero et al., 2021) in their research that there was a decrease in gross regional domestic product in all districts in Indonesia due to the impact of the covid 19 pandemic. In September 2020, the poverty rate in Central Java Province was 11.84%, an increase of 1.26% compared to September 2019, 10.58%. From September 2021 to September 2022, the poverty rate in Central Java Province decreased by 0.27%, from 11.25% to 10.98% ((https://www.academia.edu/113484610/Ranking_Province_Jawa_Tengah_Based_on_Indicators_of_Economic_and_Social_Sources_BPS_Indonesia_Years_2013_2023_By_Simon_Manalu_S_E_MSP)).

In the same study in 2021, the potential economic losses due to stunting in toddlers in Indonesia amounted to Rp. 15,062- Rp. 67,780 billion (Asriyana, 2023), from these data it means that Semarang district contributed to potential economic losses in the same year of Rp. 19.84 billion- Rp. 89.28 billion.

The figure of potential economic losses obtained in this study is not much different from previous research conducted by Sarah (2016) which states the amount of potential economic losses due to stunting in toddlers in Central Java Province is IDR 435 billion-IDR 1,957 billion or in other words the percentage of loss of economic potential due to decreased productivity to provincial GRDP is around 0.08% at a 2% decrease in productivity and 0.35% at a 9% decrease in productivity.

The results showed that the number of potential economic losses above decreased again in the following years. This is influenced by an increase in post-pandemic GRDP, a decrease in the prevalence of stunting, an increase in regional wages. This is in line with the research of (Harmadi et al., 2023) which states that increasing GRDP has a positive influence on the Human Development Index and stunting.

Table 4. 2024 Supplementary Food Budget for Toddlers and Pregnant Women

No	Activities	target	Freq	Source of funds	Total budget
1	PMT for pregnant women (milk)	72 pregnant women	156 days (May-Sept)	DBH Pjak Rok	148.262.400
2	PMT for toddlers (milk)	182 toddlers gibur, girang/BGM	90 days (May-July)	DBH Pjak Rok	163.800.000
3	PMT made from local food	352 stunting toddlers kelurahan,	90 days (May-Aug)	DAU	316.800.000
4	PMT made from local food	2,818 stunting toddlers village	90 days (May-Aug)	DAU SG	2.536.200.000
5	PMT made from local food	1,877 wasting toddlers and 1,025 pregnant women	120 days for women with SEZ and 56 days for children under five (April-Aug), women in sept	DAK NF Pusk.	4.378.848.000
6	PMT made from local food for toddlers and pregnant women	-180 pregnant women -218 stunting toddlers (milk/PDK) 1 package	-120 local days (July) -1 package	Bankeu Prop Jateng	4.292.400.000
7	PMT made from local food for toddlers	1719 stunting toddlers and stunting risk	90 days (Oct-Dec)	DIF	1.547.100.000
Total					13.383.410.400

The Semarang Regency Health Office as the local government responsible for handling stunting cases in Semarang Regency spent a budget of Rp. 13,383,410,400 as shown in table 3 above, with the allocation for additional food for pregnant women with Chronic Energy Conditions, malnourished toddlers, undernourished toddlers or curves below the red line, wasting toddlers, stunted toddlers and toddlers at risk of stunting.

Providing additional food helps overcome the problems of stunting toddlers and pregnant women who are in poor conditions, as stated in the research of (Dondi et al., 2020; Saha & van Wesenbeeck, 2022) Toddlers who are in the care of low-income and food-vulnerable families have a higher risk of stunting. Supplementary feeding can help increase body weight by more than 500 grams and height by up to 2.8 cm for toddlers after participating in the 3-month Supplementary Feeding program (Oka et al., 2019)

The budget sources for nutrition interventions in Semarang Regency come from the Village Fund Budget (ADD), Revenue Sharing Fund (DBH) cigarette tax, General Allocation Fund (DAU), Specific Ground General Allocation Fund (DAUSG), Non-Physical Special Allocation Fund, Central Java Province Financial Aid (Bankeu), Fiscal Incentive Fund. As regulated by the Central Java Provincial Government in the Decree of the Head of the Central Java Health Office No. 900/2829/2024 concerning instructions for the Central Java Provincial Government: 900/2829/2024 on detailed instructions for district / city financial assistance for nutritional problem management (PMG)

Based on the limited data obtained in 2024, the calculation of potential economic losses arising until this study was conducted was around Rp. 3,296 billion for a productivity of 2% to Rp. 14,832 billion for a productivity of 9%. The results of this calculation are based on the number of stunting toddlers according to data from November to December 16, 2024, with the value of GRDP until the 3rd quarter of 2024. The percentage of GRDP up to the third quarter of 2024 is 0.006% (2%)-0.030% (9%).

DISCUSSION

This study reveals that stunting remains a critical issue in Central Java, not only impacting individual health outcomes but also contributing to significant economic losses. The estimated economic burden includes reduced labor productivity, increased healthcare costs, and diminished individual income potential over the long term. Numerous studies have confirmed the link between stunting and diminished cognitive and physical development that persists into adulthood. For example, (Costa et al., 2021; Sudfeld et al., 2015) found that stunted children are less likely to complete education and tend to earn lower incomes as adults. In the context of Central Java, where the informal sector dominates the economic structure, stunting serves as a major barrier to developing a high-quality workforce.

Moreover, the findings align with (Headey et al., 2016), who estimated that stunting can lead to a loss of 2–3% of Gross Domestic Product (GDP) annually in developing countries. In Central Java, which still faces structural economic challenges, the impact of stunting on economic growth is even more pronounced due to reduced productivity across the labor force. Healthcare costs also represent a considerable burden. (Dewey & Begum, 2011) note that individuals who were stunted in early life are more likely to suffer from chronic health conditions in adulthood, which increases healthcare expenses and reduces productive work time. This adds fiscal pressure to both regional governments and households.

From a policy perspective, integrated interventions are needed – starting from improving early childhood nutrition, increasing maternal education, to enhancing sanitation and access to clean water. These recommendations are consistent with the work of (Bhutta et al., 2013), who emphasized that interventions during the first 1,000 days of life are the most effective in reducing stunting and mitigating its long-term consequences. In conclusion, addressing stunting is not merely a health initiative but a strategic economic investment. Local governments in Central Java must prioritize anti-stunting measures as part of a broader economic development plan aimed at fostering sustainable growth and human capital development..

CONCLUSIONS AND RECOMMENDATIONS

The potential economic loss due to stunting in Semarang Regency until the third quarter of 2024 is worth up to Rp. 14,832 billion at a 9% decrease in productivity, this value is greater than the budget spent as an effort to prevent and control stunting in 2024, which amounted to Rp. 13,383,410. This is in line with the understanding that preventing stunting is better than overcoming it, because the losses due to stunting are not only in material form but also non-material related to the nation's human resources in the future. For more research is encouraged to further investigate the effectiveness of various policy interventions in reducing stunting rates and minimizing long-term economic losses. Upcoming studies could focus on cost-benefit analyses of nutrition programs implemented across different regions or socio-economic groups to assess their efficiency and impact on improving community productivity. Moreover, longitudinal research is essential to understand the long-term consequences of stunting on educational attainment, workforce quality, and individual income levels. Context-specific studies that consider local conditions are also crucial in designing more targeted, effective, and sustainable strategies for stunting prevention and reduction.

FURTHER STUDY

Future research is recommended to explore the relationship between specific policy interventions and the reduction of economic losses due to stunting in greater detail. For instance, studies could focus on cost-benefit analyses of nutritional intervention programs across different regions or socio-economic groups to assess their effectiveness in reducing stunting prevalence and enhancing long-term productivity. Additionally, longitudinal studies are needed to examine the long-term impacts of stunting on educational attainment, job skills, and individual income levels. Context-specific research that considers local conditions is also essential to develop more targeted and economically efficient stunting reduction strategies.

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