



# Implementation of the AHP Method in Decision Making for Stunting Management at the Sicanang Community Health Center UPT Using a Website

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## Abstract

*Stunting remains a persistent public health challenge in Sicanang Village, where socioeconomic disparities and limited access to essential services continue to hinder effective intervention strategies. This study aims to identify and prioritize the key determinants of stunting using the Analytical Hierarchy Process (AHP) to support evidence-based decision-making for targeted interventions. Five criteria were evaluated—stunting prevalence, poor family conditions, maternal education, access to sanitation, and program support—based on expert judgment and field data. The results show that stunting prevalence (31.68%) and poor family conditions (29.43%) are the most influential factors, followed by program support (17.94%), maternal education (10.94%), and sanitation access (9.99%). The Consistency Ratio (0.0107) indicates that the weighting process is methodologically valid. At the sub-district level, Bahari Village and Pulau Bahagia obtained the highest priority scores (3.0161), while Pulau Sicanang ranked lowest (2.6776), highlighting the need for differentiated intervention strategies across locations. These findings underscore the importance of data-driven prioritization to optimize resource allocation, strengthen local health programs, and address the multidimensional determinants of stunting. The study provides a practical framework for policymakers to design targeted, context-specific interventions that can enhance the effectiveness of stunting reduction efforts in vulnerable communities.*

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## 1. Introduction

Stunting (dwarfism) is a condition in which a toddler has a significantly shorter height or length compared to the average child of the same age. This condition is measured based on height-for-age indicators that fall below minus two standard deviations ( $-2$  SD) from the median of the World Health Organization (WHO) Child Growth Standards. Stunting is categorized as a chronic nutritional disorder because it reflects long-term deficiencies in nutrient intake, frequent infections, and inadequate caregiving practices that occur during crucial periods of growth, particularly the first 1,000 days of life. Research shows that stunted children face increased risks of impaired cognitive and

physical development, weakened immune systems, and decreased school performance, which ultimately reduces productivity during adulthood (Victora et al., 2021). At the macro level, high stunting prevalence is associated with broader socioeconomic challenges, such as slower economic growth, higher health expenditures, and persistent cycles of poverty and inequality (UNICEF, 2020). Therefore, stunting is not merely a health issue but a multidimensional development problem that threatens communities with high poverty levels. Belawan Sicanang Village is identified as one of the priority slum areas in Medan City, characterized by dense settlements, inadequate sanitation, and limited access to quality health services—conditions that increase vulnerability to stunting. Despite numerous government interventions, the community continues to struggle with nutritional problems, indicating the need for more effective and data-driven approaches to stunting prevention and management.

Sicanang Village continues to face a high incidence of stunting despite ongoing efforts by the Community Health Center (Puskesmas) and various stakeholders. The health center has implemented numerous programs, such as nutrition counseling, routine growth monitoring, immunization, and supplementation, yet stunting cases remain persistent. One of the underlying causes is the lack of accurate, data-driven decision-making in the prioritization of stunting interventions. Decisions are often based on general observations or limited knowledge among caregivers regarding proper nutrition, exclusive breastfeeding, complementary feeding, sanitation practices, and early detection of infections. Similar findings in national studies indicate that the slow decline in stunting rates in Indonesia is influenced by inadequate household knowledge, inconsistent program implementation, limited cross-sector coordination, and socioeconomic constraints (Kemenkes RI, 2021). Moreover, the absence of structured criteria to identify high-risk children contributes to ineffective targeting of interventions. As a result, Puskesmas often faces difficulties in determining which children require urgent handling or which households need prioritized health education and monitoring. To address this gap, it is essential to adopt a systematic method that supports decision-making based on measurable and well-documented criteria. Data-driven decision support can significantly improve the accuracy and effectiveness of stunting management by ensuring resources are directed to the most vulnerable children and households. Thus, the need for a formal, structured decision support method becomes increasingly urgent to assist Sicanang Village Puskesmas in optimizing stunting prevention and control.

The application of computer science has significantly transformed problem-solving approaches across various sectors, including healthcare, where technology is increasingly used to improve service efficiency, accuracy, and reach. In the context of stunting management, computerized systems offer great potential to support decision-making by processing complex datasets, identifying patterns, and generating recommendations that assist health workers. One of the key approaches in computer science is the development of Decision Support Systems (DSS), which have been widely applied in health-related decision-making, such as disease diagnosis, risk assessment, and program planning (Turban et al., 2018). A DSS can integrate multiple criteria—such as nutritional status, socioeconomic background, maternal health, and environmental conditions—to produce more objective and systematic evaluations. For Puskesmas in Sicanang Village, which deals with a high number of stunting cases, a DSS can be an essential tool for prioritizing cases, optimizing resource allocation, and ensuring timely interventions. However, to operate effectively, a DSS requires a structured method for evaluating and weighting each criterion used in decision-making. Without a proper methodological framework, the system may produce inaccurate or biased outputs. Therefore, selecting an appropriate decision-making method is crucial to ensure reliability and validity. Researchers aim to leverage computer science not only to digitize data but also to transform it into actionable insights that enhance stunting management strategies at the community level.

This study adopts the Analytic Hierarchy Process (AHP) as the decision-making method for developing a decision support system to assist the Sicanang Village Community Health Center. AHP, introduced by Saaty (1980), is widely recognized for its ability to structure complex problems hierarchically and produce accurate weight values for each criterion using pairwise comparisons. This method is particularly effective in health-related decision-making, where multiple interrelated factors

must be considered. AHP has been applied successfully in various healthcare cases, such as assessing nutritional risks, determining priorities in health intervention programs, and allocating limited resources to high-risk groups (Ishizaka & Labib, 2011). Its primary strength lies in its systematic approach to evaluating subjective judgments, converting them into numerical values, and checking the consistency of decision-makers' inputs. This ensures the decisions generated are logical and justifiable. In the context of stunting management, AHP can help determine the relative importance of factors such as nutritional intake, maternal health, sanitation, growth monitoring, and socioeconomic indicators. Through this method, Puskesmas can make more objective and transparent decisions regarding which children should receive urgent interventions or specialized monitoring. Implementing AHP-based decision-making is expected to enhance the quality of stunting management in Sicanang Village by providing a scientifically grounded, efficient, and user-friendly tool. Ultimately, this study aims to develop a system that supports health workers in making informed decisions, improving program effectiveness, and contributing to long-term stunting reduction efforts.

## 2. Research Methodology

The following are several stages of the research method used in writing this thesis.

### A. Data Collection

Data collection was conducted at the research site, Sicanang Village, with the following stages and steps:

#### 1. Field Research

##### a. Search

In this section, the researcher conducted a search at the Community Health Center (Puskesmas) in Sicanang Village to obtain data on stunting management and its criteria at the Secanang Community Health Center.

##### b. Interviews

In this section, the researcher interviewed Dr. Rahman Nasution, Sp.A, M. Kes. Anak, a stunting treatment doctor at the Secanang Community Health Center, to obtain any unclear data regarding stunting management and its criteria.

##### c. Samples

In this section, the researcher collected several data samples from previous research and data from the research site.

#### 2. Literature Review

In this stage, the researcher used several references from journals related to the research.

### B. Research Methodology

The research methodology is the research stages undertaken during the study. Several stages are presented in the research diagram in Figure 1.

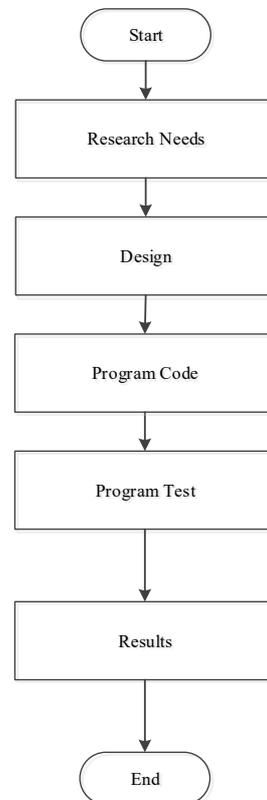


Figure 1. Diagram of Research Methodology

Description:

1. Needs Analysis  
The needs analysis for this research involved data on stunting management obtained through medical records and criteria obtained through interviews.
2. Design  
The theoretical design used by the researcher was UML modeling, including use case diagrams, class diagrams, activity diagrams, and sequence diagrams.
3. Program Code  
The program code used web programming languages HTML, PHP, JavaScript, and MySQL.
4. Trial  
The trial was conducted using two methods: blackbox testing and practical testing. If errors persist, the research stages required review.
5. Results  
The final result of this research stage was the Application of the AHP Method in Decision-Making for Stunting Management in Sicanang Village Using a Website.

### 3. Results and Discussion

Stunting in Sicanang Village is a health problem influenced by various interrelated factors. The main causes include inadequate nutritional intake in toddlers, poor environmental sanitation conditions such as lack of access to clean water, low parental understanding of parenting and child health, and limited access to basic health services such as integrated health posts (Posyandu) and community health centers (Puskesmas). To date, stunting management efforts have tended to be sporadic and unfocused because they are not based on objective priority analysis. Consequently, programs are often poorly targeted and ineffective in reducing stunting prevalence. The method used in this study, AHP, is used for decision-making regarding stunting management in Sicanang Village:

Table 1. Village Data

No	Sub-district Name	Location
1	Pulau Sicanang	Sicanang Blok B LK IX
2	Bahari	Belawan Bahari Lorong
3	Pulau Bahagia	Kp.Kolam Lk 9

### 1. Criteria Data

Criteria data were obtained from the Sicanang sub-district and are presented in Table 2.

Tabel 2. Criteria

No	Criteria	Information
1	Prevalence	Percentage of toddlers with below-standard height.
2	Poor Families	Toddlers from families experiencing multidimensional poverty.
3	Poor Access to Sanitation	Homes without access to clean water/sanitary latrines and poor handwashing with soap (CTPS) practices.
4	Lowly Educated Mothers	Mothers with low education (elementary/junior high school) who lack nutritional knowledge.
5	Strong Program Support	Integrated health service posts (Posyandu) or involvement of cadres, community health centers, NGOs, or CSR companies

### 2. Data Sub Criteria

Sub-criteria data were obtained from Sicanang sub-district and are presented in Table 3.

Tabel 3. Sub Criteria

No	Kriteria	Sub Criteria
1	Prevalence	a. Percentage of stunted toddlers >20% (WHO threshold). b. Increase in stunting cases in the past year. c. Regional concentration (e.g., 50% of cases come from two specific neighborhood associations).
2	Poor Families	a. Included in the Integrated Social Welfare Data (DTKS) or recipients of the Family Hope Program (PKH/BPNT). b. Family income below the Regency/City Minimum Wage (UMK). c. Limited asset ownership (e.g., not having their own home/clean water source).
3	Poor Access to Sanitation	a. Lack of a healthy toilet (still defecating in the open). b. Drinking water source does not meet requirements (dug well/without a filter). c. Handwashing with Soap (CTPS) is rarely practiced.
4	Lowly Educated Mothers	a. Mother only graduated from elementary school/did not attend school. b. Minimal knowledge about nutrition and parenting. c. Never attended health counseling/integrated health posts (posyandu).
5	Strong Program Support	a. Active cadres regularly provide support. b. A dedicated budget from the Village Fund/Regional Budget (APBD) for stunting. c. Collaboration with NGOs/Community Health Centers (e.g., PMT programs, immunizations).

### 3. Pairwise Comparison Matrix

The pairwise comparison matrix begins by entering the values above the vector 1, which is structured as follows:

$$\begin{bmatrix} 1 & a & b & c & d \\ & 1 & e & f & g \\ & & 1 & h & j \\ & & & 1 & k \\ & & & & 1 \end{bmatrix}$$

From the matrix above, the values a, b, c, d, e, f, g, h, i, j, and k must be entered randomly until the Consistency Value is reached. Table 4 shows the values that have met the consistency value.

Table 4. Pairwise Comparison Matrix

Criteria	Identifikasi	Intervensi	Edukasi	Kolaborasi	Evaluasi
Prevalence	1	1	3	3	2
Poor Families	1	1	3	2	2
Poor Access to Sanitation	1/3	1/3	1	1	1/2
Lowly Educated Mothers	1/3	1/2	1	1	1/2
Strong Program Support	1/2	1/2	2	2	1

4. Matrix Normalization

The first step is to sum each column:

$$\begin{bmatrix} 1 & 1 & 3 & 3 & 2 \\ 1 & 1 & 3 & 2 & 2 \\ 1/3 & 1/3 & 1 & 1 & 1/2 \\ 1/3 & 1/2 & 1 & 1 & 1/2 \\ 1/2 & 1/2 & 2 & 2 & 1 \end{bmatrix}$$

Result

$$[3.1667 \quad 3.3333 \quad 10 \quad 9 \quad 6]$$

Then, divide each element in the matrix by the number of its respective columns:

$$\left[ \begin{array}{l} \frac{1}{3.1667} = 0.3158 \quad \frac{1}{3.3333} = 0.3 \quad \frac{3}{10} = 0.3 \quad \frac{3}{9} = 0.3333 \quad \frac{2}{6} = 0.3333 \\ \frac{1}{3.1667} = 0.3158 \quad \frac{1}{3.3333} = 0.3 \quad \frac{3}{10} = 0.3 \quad \frac{2}{9} = 0.2222 \quad \frac{2}{6} = 0.3333 \\ \frac{1/3}{3.1667} = 0.1053 \quad \frac{1/3}{3.3333} = 0.1 \quad \frac{1}{10} = 0.1 \quad \frac{1}{9} = 0.1111 \quad \frac{1/2}{6} = 0.0833 \\ \frac{1/3}{3.1667} = 0.1053 \quad \frac{1/2}{3.3333} = 0.15 \quad \frac{1}{10} = 0.1 \quad \frac{1}{9} = 0.1111 \quad \frac{1/2}{6} = 0.8333 \\ \frac{1/3}{3.1667} = 0.1579 \quad \frac{1/2}{3.3333} = 0.15 \quad \frac{2}{10} = 0.2 \quad \frac{2}{9} = 0.2222 \quad \frac{1}{6} = 0.1667 \end{array} \right]$$

6. Calculate the Priority Vector (Weight)

The priority vector is calculated by finding the average of each row:

$$\begin{bmatrix} 0.3165 & 0.3 & 0.3 & 0.3333 & 0.3333 \\ 0.3165 & 0.3 & 0.3 & 0.2222 & 0.3333 \\ 0.1053 & 0.1 & 0.1 & 0.1111 & 0.0833 \\ 0.1053 & 0.15 & 0.1 & 0.1111 & 0.8333 \\ 0.1579 & 0.15 & 0.2 & 0.2222 & 0.1667 \end{bmatrix}$$

Result :

$$\begin{bmatrix} 0.3165 \\ 0.2942 \\ 0.0999 \\ 0.1099 \\ 0.1794 \end{bmatrix}$$

## 7. Calculating Consistency

First step: Multiply the comparison matrix by the priority vector:

$$\begin{bmatrix} (1 * 0.3165 + 1 * 0.2943 + 3 * 0.0999 + 3 * 0.1099 + 2 * 0.1794) \\ (1 * 0.3165 + 1 * 0.2943 + 3 * 0.0999 + 2 * 0.1099 + 2 * 0.1794) \\ (1/3 * 0.3165 + 1/3 * 0.2943 + 1 * 0.0999 + 1 * 0.1099 + 1/2 * 0.1794) \\ (1/3 * 0.3165 + 1/2 * 0.2943 + 1 * 0.0999 + 1 * 0.1099 + 1/2 * 0.1794) \\ (1/2 * 0.3165 + 1/2 * 0.2943 + 2 * 0.0999 + 2 * 0.1094 + 1 * 0.1794) \end{bmatrix}$$

Result

$$\begin{bmatrix} 1.5825 \\ 1.4713 \\ 0.4997 \\ 0.5497 \\ 0.8968 \end{bmatrix}$$

Second step: Calculate  $\lambda_{\max}$  by dividing the resulting element by the priority vector:

$$\lambda_{\max} = \frac{1.5825}{0.3165} + \frac{1.4713}{0.2943} + \frac{0.4997}{0.0999} + \frac{0.5497}{0.1099} + \frac{0.8968}{0.1794} = 5.0481$$

Step three: Calculate the Consistency Index (CI):

$$CI = \frac{\lambda_{\max} - n}{n - 1} + \frac{5.0481 - 5}{5 - 1} = 0.012037$$

Fourth step: Calculate the Consistency Ratio (CR) using the RI value = 1.12 (for  $n=5$ ):

Tabel 5. RI (Random Index)

n (Ordo Matriks)	Random Index (RI)
1	0
2	0
3	0.58
4	0.9
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

$$CR = \frac{CI}{RI} = \frac{0.0107}{1.12} = 0.01075$$

## 8. Conclusion

From all the processes, the following conclusions were drawn:

a. Final Weights:

- 1) Prevalence: 31.68%
- 2) Poor Families: 29.51%
- 3) Poor sanitation access: 9.97%
- 4) Mothers with low education: 10.94%
- 5) Strong program support: 17.91%

b. Consistency Values:

- 1)  $\lambda_{\max}$ : 5.0481
- 2) CI: 0.01204
- 3) CR: 0.0107 (Consistent)

Because  $CR < 0.1$ , this comparison is valid and consistent, so the weights obtained can be used for decision-making.

The following is the calculation based on the AHP method, including the weights for each criterion:

Table 6. Weights of Vector Calculation Results

Inisial	Criteria	Bobot
C1	Prevalence	0.3168
C2	Poor Families	0.2943
C3	Poor Access to Sanitation	0.0999
C4	Lowly Educated Mothers	0.1099
C5	Strong Program Support	0.1794

Count all sub-districts with:

Table 7. Sub-Criteria Data for Sub-districts

No	Sub-district Name	C1	C2	C3	C4	C5
1	Pulau Sicanang	1	1	1	3	3
2	Bahari	3	1	1	2	3
3	Pulau Bahagia	3	3	1	2	1

Multiply by the vector result:

Tabel 8. Data Sub Kriteria Sub-district Name

No	Sub-district Name	C1	C2	C3	C4	C5
1	Pulau Sicanang	1*0,3168	1*0,2943	1*0,0999	3*0,1099	3*0,1794
		=0,3168	=0,2943	=0,2951	=0,8853	=0,8853
2	Bahari	3*0,3168	1*0,2943	1*0,0999	2*0,1099	3*0,1794
		=0,9504	=0,2943	=0,2951	=0,5902	=0,8853
3	Pulau Bahagia	3*0,3168	3*0,2943	1*0,0999	2*0,1099	1*0,1794
		=0,9504	=0,8853	=0,2951	=0,5902	=0,2951

Add up the total:

Tabel 9. Addition Result

No	Sub-district Name	C1	C2	C3	C4	C5	HASIL
1	Pulau Sicanang	0,3168	0,2951	0,2951	0,8853	0,8853	2,6776
2	Bahari	0,9504	0,2951	0,2951	0,5902	0,8853	3,0161
3	Pulau Bahagia	0,9504	0,8853	0,2951	0,5902	0,2951	3,0161

Ranking Results:

Tabel 10. Ranking Results:

No	Sub-district Name	Result	RANK
1	Bahari	3,0161	1
2	Pulau Bahagia	3,0161	2
3	Pulau Sicanang	2,6776	3

Based on the calculation results in Table III.10, the stunting management that must be carried out most importantly in Bahari Village is obtained.

Discussion

The results of the Analytical Hierarchy Process (AHP) analysis show that stunting prevalence (31.68%) and poor family conditions (29.43%) are the most dominant criteria influencing stunting intervention priorities in Sicanang Village. The prominence of these two factors indicates that stunting in this area is strongly shaped by structural and socioeconomic vulnerabilities within households. Additionally, limited access to sanitation (9.99%) and low maternal education (10.94%) also contribute

to stunting risk, although with lower priority weights. Meanwhile, strong program support (17.94%) demonstrates that the presence of active cadres, Posyandu, Puskesmas, and multisectoral collaborations remains critical in enhancing intervention effectiveness. The Consistency Ratio (CR = 0.0107) confirms that all pairwise comparisons are methodologically consistent, ensuring that the calculated priority weights are reliable for informing policy decisions.

Based on the sub-district analysis, Bahari Village obtained the highest score (3.0161), indicating its position as the top priority for stunting intervention. This is attributed to high scores in prevalence, economic vulnerability, and program support, which collectively amplify the urgency of targeted actions in the area. Pulau Bahagia ranks second with an identical score (3.0161), but its comparatively weaker program support suggests the need for stronger institutional coordination and community engagement. Meanwhile, Pulau Sicanang ranks last (2.6776) despite having relatively strong program support, primarily due to lower prevalence and poverty-related indicators. Overall, these findings emphasize that stunting mitigation cannot be uniformly applied across all areas; instead, it requires a tailored, evidence-based approach that considers the unique challenges and contextual needs of each sub-district. The use of AHP proves beneficial in ensuring that resource allocation and intervention strategies are both targeted and impactful.

#### 4. Conclusion

This study demonstrates that stunting intervention priorities in Sicanang Village are largely influenced by structural and socioeconomic factors, particularly stunting prevalence and poor family conditions, which received the highest weights in the Analytical Hierarchy Process (AHP) analysis. Additional factors, such as access to sanitation, maternal education, and program support, also play important roles, highlighting the multidimensional nature of stunting. The high level of consistency in the AHP results confirms the methodological reliability of the prioritization process. At the sub-district level, Bahari Village emerged as the top priority for intervention, followed by Pulau Bahagia and Pulau Sicanang, indicating the need for differentiated and context-specific strategies. These findings emphasize that effective stunting reduction efforts require targeted, data-driven planning rather than uniform intervention across all areas. Strengthening local program support, improving socioeconomic conditions, and addressing key determinants must be central components of future policymaking to ensure sustainable and impactful outcomes in stunting mitigation.

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