Journal of Creativity Student
http://journal.unnes.ac.id/journals/jcs

Causal Loop Diagram Analysis of Stunting Specific Intervention for Policy Recommendation: A Case from Pekalongan Regency Indonesia

Yuniarti[1]*, Siti Harnina Bintari[2], Intan Zainafree[2]

[1]Universitas Negeri Semarang, https://orcid.org/0000-0002-2088-6924
[2]Universitas Negeri Semarang

*Corresponding Author: yuniartiunikal@students.unnes.ac.id

Abstract
Stunting is still a global health issue, especially in lower-middle class countries, the problem of stunting reflects a multidimensional problem that has not been addressed effectively. In Indonesia, the prevalence of stunting has decreased significantly by 18.9% in 2023, but has not reached the target set at 14%. This study is a qualitative study with a causal loop diagram analysis approach, the causal loop diagram method was chosen because it is able to describe problems that interact dynamically as causality. Data collection by interviewing 23 informants and analyzing documents on the achievement of specific interventions in 2023 from the Pekalongan District Health Office. There are five key variables identified, namely the ability of officers, specific interventions, budget, community roles and access to health services. The results of the CLD analysis formed 26 causal links, strengthening one loop and balancing two loops. The findings highlight the disparity in access to health services and the role of the community that is not yet optimal. Policy recommendations, improve cross-sector coordination to improve the provision of health services and increase the role of the community, especially mothers of toddlers and cadres in specific nutrition interventions. The use of CLD analysis in holistic and strategic specific nutritional interventions in identifying stunting problems to determine the most appropriate interventions.

Keywords: causal loop diagram, specific interventions, stunting

INTRODUCTION

Globally, 155 million children under the age of five suffer from stunting based on WHO data and around 79 million cases of stunting occur in the Asian region [1]. The problem of stunting generally occurs in countries with lower middle income which is identical to the problem of poverty, infectious diseases in children and lack of adequate nutritional intake. Stunting is defined as a condition of abnormal height based on age z score (HAZ) which begins in the prenatal period. This condition will continue until the child reaches the age of the first two years of impaired growth and has an impact on child development [2]. Almeida et al (2020) stated that poverty increases the prevalence of stunting, this is reinforced by the results of research by Dirghayu et al (2021) that limited access to food sources due to poverty factors further increases the prevalence of stunting. There are four indicators of the food security index that affect the incidence of stunting, namely food availability, access to food sources, utilization of food sources related to food diversity and vulnerability [3]. The main factors of stunting are lack of food intake and infectious diseases in children. Malnutrition makes children more vulnerable to infectious diseases due to low immune function. And conversely, infectious diseases cause impaired food absorption (malabsorption) and impact the risk of stunting [4].

The prevalence of stunting in Indonesia has shown a significant decrease from 25.5% in 2019 to 21.6% in 2023. The achievement of stunting reduction is still far from the target set by the Government of 14% by 2024. Based on the 2022 Nutrition Status Survey Report, Central Java Province's stunting prevalence of 20.8% is ranked 21st out of 35 provinces in Indonesia. Based on the Central Java Province Stunting Reduction Acceleration Team Report 2024, Pekalongan Regency's stunting

prevalence is ranked second at 28.6% [5]. In detail, Pekalongan Regency's stunting prevalence is as follows: 25.3% in 2019, increased to 24.1% in 2020 due to the impact of Covid-19, in 2021 decreased to 22.8% since the implementation of the accelerated stunting reduction strategy [6].

The program was implemented in 156 villages in Pekalongan district and succeeded in reducing the prevalence of stunting between 2-5% in 70% of the villages. A total of 85% of posyandu monitored the nutritional status of children under five and the coverage of vitamin A administration amounted to 80% by 2023. On the other hand, there are still disparities in stunting prevalence between sub-districts, including the stunting prevalence of Kedungwuni Sub-district at 15% while Paninggaran Sub-district at 28%. This condition occurs due to unequal access to basic health services in mountainous areas due to geographical factors.

Looking at the achievements of the stunting reduction program and specific nutrition interventions, not all targets and indicators have been successfully achieved by the Pekalongan District Government. More effective policies are needed to reduce stunting prevalence effectively and significantly to achieve the 14% target [7]. The program evaluation carried out so far is more oriented towards quantitative achievements, lacking in-depth qualitative aspects regarding the causes and consequences of problems in the implementation of stunting reduction interventions. Therefore, this research tries to answer the need for a more comprehensive study using the *Causal Loop Diagram* (CLD) method approach as a response to the weaknesses of the evaluation methods carried out so far. This method is a causal analysis of problems using system dynamics in specific nutrition interventions. The results of the Causal Loop Diagram analysis serve as the basis for comprehensive stunting reduction policy recommendations. This study aims to analyze the causal relationship between specific nutrition intervention factors in Pekalongan District using CLD analysis to formulate appropriate policy recommendations.

METHOD

Study Design

This study is a qualitative, explanatory approach to the implementation of nutrition-specific interventions. This study integrates the Causal Loop Diagram (CLD) model as a causal analysis tool for program outcomes. The choice of CLD is based on the need for a system dynamic perspective of the analysis in accordance with the context of the problem under study so as to produce comprehensive information [8].

Data Collection

Data collection began with document analysis of the Pekalongan District Health Office's 2023 stunting reduction program-specific nutrition intervention achievement report. Interviews were conducted using interview guidelines to collect data and information seven health, the Health Office, the Social Affairs Office and seven villages located in seven health centers in Pekalongan District. Data included the prevalence of stunting in 2019-2024, the 2023 specific nutrition intervention achievement report and the results of in-depth interviews covering causal relationships, success factors and barriers to program implementation [9,10].

Research Informants

The informants were selected based on their relevance to the stunting reduction program, namely seven people in charge of the stunting reduction program at seven puskesmas, the head of the public health nutrition section at the Health Office, the head of the public health sector at the Social Affairs Office, seven village heads and seven village midwives in the puskesmas working areas. All informants. A total of 23 people, the selection of health centers was based on sub-district areas with a high prevalence of stunting in Pekalongan Regency [11].

Causal Loop Diagram Analysis

Causal Loop Diagram analysis technique to map the causal relationship through stages: 1). Define the problem based on the results of interviews with informants and support data on the achievements of specific nutrition interventions, 2). Identifying key variables, 3). Mapping the causal relationships that influence the success and constraints of the program represented in the form of reinforcing and balancing relationships, 4). Visualization diagram, 5). Impact analysis and policy/program recommendations [12,13].

RESULT & DISCUSSION

Data and information obtained from informant interviews and document analysis of the 2023 nutrition intervention achievement report were used as the basis for defining problems and causal relationships. The results of the causal analysis are visualized in the causal loop diagram in Figure 1.

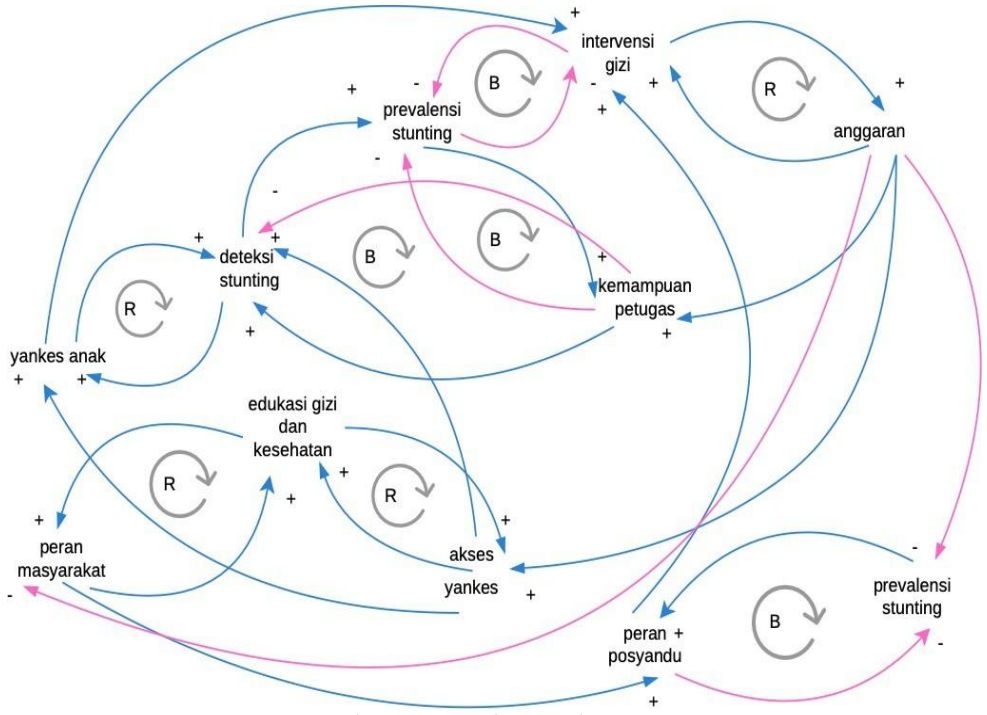

Figure 1. Causal Loop Diagram

As a result of the analysis of informants' responses and document analysis, five key variables were formulated: the ability of specific and sensitive nutrition interventions, the role of the community, the budget, access to health services, and nutrition and health education. These key variables are described as causes and effect factors so that there is an additional variable, namely the prevalence of stunting, stunting detection, child health services and the role of posyandu. Four additional variables were included in the causal analysis and interacted dynamically with the key variables. In this study, the triangulation technique was a combination of literature review and empirical data on the links formed as a result of the extraction of the literature review [13]. Mix-method triangulation to strengthen the causal relationship between variables is reinforcing and balancing. Causal loop diagrams have successfully identified 26 links that show causal relationships between variables with positive and negative polarity and have one reinforcing loop and two balancing loops [14]. A visualization of the loop is depicted in Figure 2.

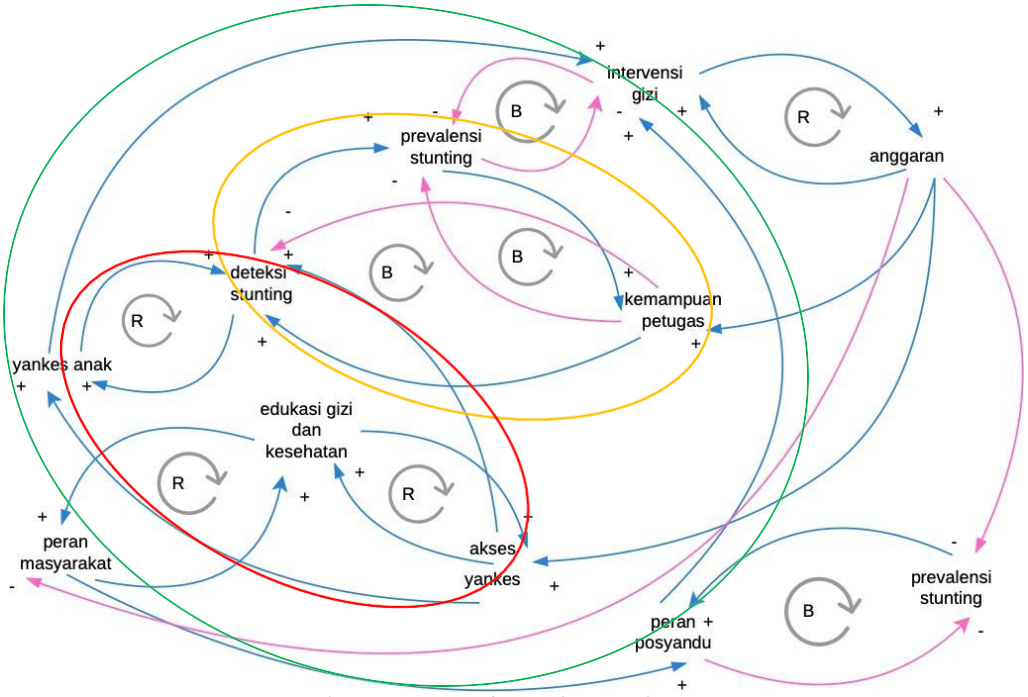

Figure 2. Loops of Causal Loop Diagram

There are three loops formed in Figure 2, loop 1; the availability of health services for stunting treatment and intervention, loop 2; the capacity of program implementers to implement stunting reduction programs through detection and screening, loop 3; community participation in stunting detection and screening activities and nutritional interventions.

Loop 1 describes the interaction between variables, namely the availability of health services and efforts to deal with stunting. Health services at puskesmas and services at the village level (village midwives and posyandu) detect stunting through anthropometric measurements and weighing of infants and toddlers. Increased access to health services correlates with the speed of stunting detection and the speed and accuracy of handling. On the other hand, health services are closely related to the success of the first 1000 days of life, which starts from the baby in the womb until the child reaches the age of two. Puskesmas has long involved posyandu in handling child nutrition including stunting through services that are held regularly every month to monitor the nutritional status of toddlers and intervene in malnutrition cases [15,16]. Research conducted by Kedir Y. Ahmed (2023) states that Ante Natal Care visits <3 times during pregnancy at health services are proven to correlate with the risk of stunting [17].

Loop 2 describes the capacity of stunting program implementers in implementing the stunting program as the main focus. Program implementers include puskesmas nutrition officers and village midwives as well as the village head as the person in charge of the stunting program in their respective village areas. The capacity and ability of nutrition officers includes the ability to conduct early detection of stunting with anthropometric measurements and the ability to conduct specific and sensitive nutrition interventions. Nutrition officers are required to have communication and coordination skills with various parties including cadres, communities, village officials, village midwives, community leaders and health offices in the convergence of stunting programs [18,19]. One of the specific nutrition interventions is the provision of blood supplement tablets for pregnant women to prevent and overcome anemia in pregnant women [4]. Blood supplements are also given to adolescent girls for early prevention of anemia. Another specific intervention is the provision of supplementary food for pregnant women to address chronic malnutrition suffered during pregnancy [20].

Loop 3 illustrates the importance of community participation in stunting detection and screening activities and nutrition interventions. The community involved in the stunting reduction program are cadres, mothers of toddlers and community leaders as key factors in the success of stunting reduction [21]. The form of community participation is the role of posyandu cadres in monitoring the growth and development of infants and toddlers and providing additional food for toddlers and pregnant women [1]. Communities that are actively involved in health programs will better understand the importance of good nutrition and early detection of stunting. This involvement can

increase community awareness and knowledge about child health and encourage them to participate in existing programs. However, the challenge is the lack of understanding and awareness about stunting and its impact. Therefore, effective health education and campaigns need to be conducted to increase community participation [18,19]. By increasing community participation, it is expected that stunting reduction programs can be more successful and sustainable.

CONCLUSION

Stunting is caused by factors that interact dynamically, so the use of causal loop diagrams is very suitable for analyzing dynamic problems. The loop that is formed is dominated by a balancing loop, meaning that the system is relatively stable because there is a mechanism that can prevent a significant decline. On the other hand, if there is no complex intervention, the dominance of this balancing loop cannot achieve effective results because the system will return to its initial condition again. This is evidenced by the fact that the prevalence rate in Pekalongan District has not been significantly reduced and the nutrition intervention program has not reached the target of one hundred percent. The use of causal loop diagrams is effective in unraveling the causal relationship to the root of the problem.

ACKNOWLEDGMENTS

None

DECLARATION OF CONFLICTING INTERESTS

I declared there is no conflict of interest of this research or publication.

FUNDING

None

REFERENCES

1. Kamaruzaman, N. A., Musa, N., Pasi, H. & Osman, I. F. Stunting and its association with feeding problem among under five children: a case-control study in Kuantan district, Malaysia. J Med 79, 436–442 (2024).
2. Roediger, R., Taylor Hendrixson, D. & Manary, M. J. A roadmap to reduce stunting. American Journal of Clinical Nutrition 112, 773S-776S (2020).
3. Hamzah, M. Z., Sofilda, E. & Kusairi, S. How do socioeconomic indicators and fiscal decentralization affect stunting? Evidence from Indonesia. International Journal of Development Issues (2024) doi:10.1108/IJDI-05-2024-0150.
4. Karlsson, O., Kim, R., Moloney, G. M., Hasman, A. & Subramanian, S. V. Patterns in child stunting by age: A cross-sectional study of 94 low- and middle-income countries. Matern Child Nutr 19, (2023).
5. TPPS Jawa Tengah. Laporan TPPS Semester 1 2024 Jawa Tengah. (2024).
6. Kementerian Kesehatan RI. Buku Saku Hasil Survei Status Gizi Indonesia (SSGI) 2022.
7. Sekretariat Daerah Kabupaten Pekalongan. Peraturan Bupati Kabupaten Pekalongan Nomor 9 Tahun 2020 Tentang Penurunan Stunting Di Kabupaten Pekalongan.
8. Baugh Littlejohns, L., Hill, C. & Neudorf, C. Diverse Approaches to Creating and Using Causal Loop Diagrams in Public Health Research: Recommendations From a Scoping Review. Public Health Reviews vol. 42 Preprint at https://doi.org/10.3389/phrs.2021.1604352 (2021).
9. Tenny Steven, Brannan, G. D., Brannan, J. M. & Sharts-Hopko C., N. Qualitative Study. (StatPearls Publishing, Treasure Island, 2020).
10. Alam, M. K. A systematic qualitative case study: questions, data collection, NVivo analysis and saturation. Qualitative Research in Organizations and Management: An International Journal 16, 1–31 (2021).
11. Tutar, H., Şahin, M. & Sarkhanov, T. Problem areas of determining the sample size in qualitative research: a model proposal. Qualitative Research Journal 24, 315–336 (2024).
12. Daniel, D. et al. Interactions of Factors Related to the Stunting Reduction Program in Indonesia: A Case Study in Ende District. International Journal of Social Determinants of Health and Health Services 53, 354–362 (2023).

13. Uleman, J. F. et al. Triangulation for causal loop diagrams: constructing biopsychosocial models using group model building, literature review, and causal discovery. npj Complexity 1, 19 (2024).
14. Osman, M. et al. Health system determinants of tuberculosis mortality in South Africa: a causal loop model. BMC Health Serv Res 21, (2021).
15. Sufri, S. et al. Child Stunting Reduction in Aceh Province: Challenges and a Way Ahead. Matern Child Health J 27, 888–901 (2023).
16. Cahyati, W. H., Putriningtyas, N. D., Rengga, W. D. P. & Suharyo. Nutrition Intake, Physical Activity, and Sleep Quality in the Month of Fast During Covid-19 Pandemic. Kemas 18, 507–515 (2023).
17. Ahmed, K. Y. et al. Population-Modifiable Risk Factors Associated with Childhood Stunting in Sub-Saharan Africa. JAMA Netw Open 6, (2023).
18. Prasetyo, A. et al. Stunting Convergence Management Framework through System Integration Based on Regional Service Governance. Sustainability (Switzerland) 15, (2023).
19. Gani, A. A. et al. The effect of convergent action on reducing stunting prevalence in under-five children in Banggai District, Central Sulawesi, Indonesia. Gac Sanit 35, S421–S424 (2021).
20. Rengga, W. D. P. et al. Human Adsorption and Release of Ibuprofen from Silica-Carbon Composites Based on Rice Husks (Oryza sativa) and Banana Peels (Musa acuminata). Engineered Science 23, (2023).
21. Siswati, T. et al. Drivers of Stunting Reduction in Yogyakarta, Indonesia: A Case Study. Int J Environ Res Public Health 19, (2022).

AUTHOR(S) BIOGRAPHY

The researcher is a doctoral student in Public Health Program at The Medical Faculty of Semarang State University. The author comes from Pekalongan City and works at Pekalongan University with a home base of Public Health Study Program. The researcher's publications include on stunting in international journals indexed by scopus, publications on risk assessment in journals accredited by sinta 2 and many other publications in several national journals accredited by sinta.