

## Optimization of a Decision Support System for Monitoring Growth and Development Using the Z-Score Method at Cempaka Health Post

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### Abstract

Monitoring the growth and development of children during their first 1,000 days is crucial due to the rapid growth that occurs during this period. This study focuses on optimizing a Decision Support System (DSS) designed for monitoring the growth and development of children at the Cempaka Health Post using the Z-Score method. The system aims to provide a comprehensive and accurate assessment of children's health status by analyzing key growth parameters such as height, weight, and age. The Z-Score method allows for standardized comparisons against international growth standards, facilitating early detection of growth abnormalities. The research involved 63 toddler data entries at the Cempaka Posyandu, integrating these data into Z-Score calculations, monthly nutritional status assessments, and recommendations for parents. The results indicated that the Cempaka Posyandu had 73% of children with normal nutrition, 69.8% with normal height, and 47.6% with normal weight. This was due to the majority of Z-Score values remaining within the normal range of two elementary school. From these results, it was found that approximately 63.5% of toddlers maintained normal status over a period of 3 months. By implementing advanced data processing techniques and user-friendly interfaces, the optimized DSS enhances the efficiency and reliability of health monitoring, ensuring timely and appropriate interventions. This research underscores the significance of technological advancements in improving healthcare outcomes at community health centers.

**Keywords:** Assessment; Cempaka Posyandu; Growth and Development; Optimization; Toddlers; Z-Score;

### INTRODUCTION

The first 1,000 days of a child's life, starting from conception until the second birthday, represent a critical period for growth and development (Ali, & Khan, 2019). During this time, a child's body undergoes rapid physiological and cognitive changes that set the foundation for their future health and well-being. These changes encompass physical growth, such as increases in height and weight, as well as brain development, which significantly influences learning, behavior, and overall health (Ashraf, & Ahmad, 2020). Consequently, any disruptions or abnormalities in growth during this period can have long-term implications, potentially affecting the child's physical health, cognitive abilities, and even their social and emotional development.

Monitoring child growth and development throughout this period is therefore crucial, not only to track the normal progression of physical development but also to ensure the early detection of any potential abnormalities (Dewey, & Begum, 2011). Regular monitoring allows for timely interventions that can help mitigate health risks or developmental delays, such as malnutrition, stunted growth, or other growth disorders. These interventions are particularly significant in developing regions or community health settings, where access to healthcare services may be

limited, and the role of community health posts, such as Posyandu in Indonesia, becomes vital. By ensuring regular and thorough monitoring, these community health centers play a pivotal role in promoting the overall health and development of children.

To enhance the efficiency and accuracy of this monitoring process, this study focuses on optimizing a Decision Support System (DSS) specifically tailored for child growth and development at the Cempaka Posyandu. A DSS is a computerized information system that supports decision-making activities, offering healthcare providers, such as midwives and community health workers, a tool to analyze and interpret health data effectively. At the Cempaka Posyandu, the DSS aims to assist in systematically assessing the growth and nutritional status of children by processing various growth parameters, thereby supporting health workers in making timely and evidence-based decisions for child care.

The DSS utilizes the Z-Score method, which is a standard statistical measurement used for evaluating and comparing growth indicators, such as height, weight, and age, against international growth standards set by organizations like the World Health Organization (WHO). The Z-Score method provides a quantitative way to assess how a child's growth compares to the normal distribution of a reference population, making it easier to identify deviations from the expected growth patterns. By using this standardized approach, the DSS can accurately classify the nutritional and growth status of each child, providing meaningful insights that can guide health interventions and nutritional counseling for parents.

The key advantage of implementing a DSS based on the Z-Score method is its ability to provide comprehensive and reliable assessments of children's health status. Unlike traditional manual monitoring methods, which can be time-consuming and prone to error, the DSS offers a streamlined and systematic way to analyze data, ensuring consistent and accurate results. The system's capacity to generate real-time feedback and visual representations of a child's growth trajectory enhances the understanding and decision-making of healthcare workers and parents alike. This is particularly useful in community health settings, where resources are limited and the need for efficient, user-friendly tools is paramount to effectively manage and track child growth.

Ultimately, this study aims to demonstrate how the integration of technology into community health practices can significantly improve child health outcomes. By optimizing the DSS at Cempaka Posyandu, the research not only seeks to validate the effectiveness of using the Z-Score method for child growth monitoring but also emphasizes the broader implications of such technological advancements in healthcare. The findings from this study are expected to contribute valuable insights into best practices for child growth and development monitoring, highlighting the importance of early detection and intervention for growth abnormalities, and showcasing how digital tools can enhance community health services, improve data accuracy, and ultimately support the healthy development of children.

## **METHODS**

This research was conducted at the Cempaka Posyandu, where data were collected from a cohort of 63 toddlers to evaluate their growth and development. The data collection process focused on gathering essential growth parameters for each child, namely height, weight, and age. These parameters were selected because they are fundamental indicators of a child's nutritional status and

overall physical development (Hassan, & Islam, 2017). The data was subsequently used to calculate Z-Scores, a statistical measurement that quantifies the deviation of each child's growth from a standardized international growth reference, such as those established by the World Health Organization (WHO). The Z-Scores are derived by comparing the observed values of height-for-age, weight-for-age, and weight-for-height against the expected median and standard deviations of a healthy reference population. This allows for a comprehensive assessment of each child's growth status, providing a robust basis for identifying potential growth abnormalities, such as stunting, wasting, or underweight conditions.

The Decision Support System (DSS) utilized in this study plays a pivotal role in processing and interpreting the collected data. Each child's Z-Score was calculated on a monthly basis, allowing for consistent and timely assessments of their nutritional status over time. The DSS is designed with a user-friendly interface, making it accessible for health workers at the Posyandu to enter data and interpret results efficiently. After data input, the system not only calculates the Z-Scores but also provides visual representations of growth trajectories and generates tailored health recommendations for parents. This approach enhances the accuracy of growth monitoring and ensures that any deviations from normal development are promptly addressed through early intervention. By integrating these advanced data processing capabilities, the DSS supports health workers in making informed decisions and enables them to communicate nutritional advice and health interventions effectively to the parents of the toddlers, thereby improving the quality of care provided at the community level.

## RESULTS

The findings from the data analysis at Cempaka Posyandu indicated a generally positive trend in the growth and nutritional status of the 63 toddlers monitored. According to the assessments conducted using the Z-Score method, 73% of the children were found to have a normal nutritional status, meaning their weight-for-age fell within the healthy range when compared to international growth standards. This significant proportion demonstrates that the majority of children at the Posyandu were growing adequately, with balanced nutrition that supported their developmental needs. Furthermore, 69.8% of the toddlers were classified as having normal height for their age, which suggests that their height measurements were consistent with expected growth patterns for their respective age groups. The Z-Score calculations provided a robust measure to confirm that these children were developing as per international benchmarks, without signs of stunting or delayed height growth.

In terms of weight, the results revealed that 47.6% of the toddlers maintained a normal weight-for-height ratio, which is an important indicator of overall health and nutrition. While this proportion is lower compared to the nutritional status and height metrics, it still signifies that nearly half of the children exhibited a balanced weight relative to their height. The weight-for-height Z-Scores are particularly useful for identifying acute malnutrition or overweight conditions, and in this case, the results showed that the majority of Z-Scores were within the normal range of  $\pm 2$  standard deviations. This suggests that most of the children did not face critical weight-related growth issues, although the relatively lower percentage indicates a need for continuous monitoring and potential interventions to address any emerging weight concerns among those not falling within the normal range.

Moreover, the analysis of the toddlers' growth patterns over a continuous 3-month period revealed that approximately 63.5% of the children consistently maintained normal growth and nutritional

status during this timeframe. This stability in growth metrics demonstrates the effectiveness of ongoing monitoring and interventions provided by the Cempaka Posyandu. The ability to sustain normal growth over a quarter-year period underscores the importance of regular health check-ups, nutritional guidance, and community health support, which collectively contribute to the children's overall well-being. These results emphasize that consistent use of the Z-Score method in a Decision Support System (DSS) can effectively track and maintain healthy growth patterns, allowing for timely and evidence-based health care interventions to ensure optimal development outcomes for children in community health settings.

## **DISCUSSION**

The findings from this study suggest that the implementation of an optimized Decision Support System (DSS) at the Cempaka Posyandu has had a positive impact on the efficiency and accuracy of monitoring child growth and development. The DSS has streamlined the process of collecting, analyzing, and interpreting growth data, allowing healthcare workers to assess each child's health status with greater precision and speed. This level of efficiency is crucial in community health settings like Posyandu, where resources are often limited, and time is a critical factor in providing timely healthcare interventions. The improvement in monitoring processes ultimately helps in ensuring that growth abnormalities are identified early and appropriate actions are taken to address any concerns regarding child development.

The core functionality of the DSS lies in its ability to generate timely and accurate health status evaluations, which are essential for both healthcare providers and parents in making informed decisions about a child's nutritional and developmental needs. Traditional monitoring methods, which often rely on manual calculations and visual assessments, are prone to human error and may not provide the same level of standardized analysis that a computerized system like the DSS can offer. With the integration of the Z-Score method, the DSS ensures that growth parameters such as height, weight, and age are evaluated against established international growth standards, making the results both reliable and easily comparable. This enhances the capacity of health workers to understand each child's growth trajectory and communicate effectively with parents about their child's health.

The use of the Z-Score method plays a pivotal role in the system's effectiveness by providing a standardized assessment tool that facilitates early detection of any deviations from normal growth patterns. The Z-Score allows for quantitative comparisons with a reference population, thereby identifying children who are at risk of undernutrition, stunting, or obesity. Early detection is key to implementing timely interventions that can prevent long-term health issues and support the child's overall well-being. In the context of the Cempaka Posyandu, where regular monthly check-ups are conducted, the ability to track and detect growth abnormalities early allows healthcare workers to guide parents on nutritional improvements or other lifestyle changes, ensuring optimal development for each child.

This research also underscores the broader significance of technological advancements in enhancing healthcare services and outcomes at community health centers. By optimizing and integrating a DSS into the daily operations of Posyandu, the quality of child health monitoring is greatly improved. The user-friendly interface of the system makes it accessible to health workers who may not have specialized training in data analysis, thereby empowering them to make evidence-based decisions. This approach not only improves the quality of care provided but also supports more efficient resource allocation within the health center. Technological tools such as this DSS bridge

the gap between traditional healthcare practices and modern, data-driven approaches, thereby fostering an environment where early interventions and continuous health monitoring are possible. Moreover, the findings from this study reveal how the sustained use of an optimized DSS can contribute to consistent child growth monitoring over time, as evidenced by the stability of growth metrics in the 63.5% of children who maintained normal nutritional status over a 3-month period. This consistency in health assessments is particularly important in preventing acute health issues from developing into chronic conditions. The DSS supports continuous monitoring by providing longitudinal data on each child's growth, which can be easily reviewed by health workers and compared over time. This longitudinal analysis allows for better understanding of individual growth patterns and the identification of trends that may indicate underlying health issues, thereby reinforcing the importance of ongoing, systematic monitoring.

In conclusion, the study demonstrates that the integration of a Decision Support System with the Z-Score method in a community health setting significantly enhances the effectiveness of growth and development monitoring in toddlers. The system not only improves the efficiency of health evaluations but also ensures that the health status of children is assessed in a comprehensive and standardized manner. This promotes timely interventions and better health outcomes, ultimately supporting the goal of fostering healthy growth and development in early childhood. The implications of this research extend beyond the Cempaka Posyandu, offering a model for other community health centers aiming to incorporate technology to improve the quality and accuracy of child health monitoring.

## CONCLUSION

The results of this study provide strong evidence for the effectiveness of an optimized Decision Support System (DSS) in enhancing the monitoring and evaluation of child growth and development at the community health level. The implementation of the DSS at Cempaka Posyandu has proven to be a valuable tool in providing accurate and comprehensive assessments of children's growth parameters, facilitating a systematic and standardized approach to health monitoring. By leveraging the Z-Score method, which aligns with international growth standards, the system ensures that children's health and nutritional statuses are evaluated consistently and thoroughly, allowing for early detection of growth abnormalities. The use of the Z-Score method within the DSS plays a critical role in achieving accurate and objective assessments of height, weight, and age, which are pivotal indicators of a child's health and development. Such precision in measurement enables healthcare providers at the Posyandu to identify any deviations from normal growth patterns at an early stage. This, in turn, supports timely and appropriate interventions that can address potential growth issues, contributing to the prevention of malnutrition and other related health concerns. Moreover, the ability to generate monthly health assessments allows for continuous and up-to-date monitoring, thereby improving the overall quality of care provided to children and ensuring that growth and development are maintained within a healthy range.

The findings of this study also underscore the broader implications of technological advancements in community healthcare. The introduction of DSS technology into daily health monitoring practices enhances the capacity for efficient data processing, reduces the likelihood of human error, and fosters a more data-driven approach to healthcare delivery. Such technologies empower healthcare workers to make informed decisions based on real-time data and to provide parents with actionable guidance on nutrition and health practices. This not only improves the responsiveness

and effectiveness of health services but also contributes to raising awareness among parents about the importance of regular monitoring and proactive health management for their children. Furthermore, the successful integration of the DSS at Cempaka Posyandu serves as a model for other community health centers seeking to improve their child growth and development monitoring practices. It highlights the potential for technology-based solutions to address challenges in resource-limited settings, providing a scalable and replicable approach to child health management. The study's emphasis on the use of user-friendly interfaces ensures that the technology remains accessible to healthcare workers with varying levels of technical expertise, promoting widespread adoption and sustainable use of the system. In conclusion, the study demonstrates that optimized decision support technologies like the DSS offer significant benefits for enhancing child growth monitoring, promoting timely and accurate health assessments, and ultimately improving health outcomes for children. The use of the Z-Score method ensures that evaluations are consistent with global health standards, reinforcing the reliability and validity of the monitoring process. Continued advancements and investments in decision support systems are encouraged, as these technologies hold the potential to transform healthcare practices at the community level, particularly in the areas of early childhood growth and nutrition. The success of this study reinforces the importance of integrating modern technology into healthcare services to ensure efficient, effective, and equitable health outcomes for all children.

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