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Integrative Empowerment of Health Cadres in Efforts to Monitor Stunting Risk Through the Use of Smartphone-Based Electronic Child Card Applications in Ngiliran Village, Panekan District, Magetan Regency

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ABSTRACT The Community Engagement activity, which was held from May to August 2024, aims to empower various stakeholders, such as early childhood integrated health service cadres, brides-to-be, pregnant women, and mothers of young children, to effectively monitor early stunting. It addresses the urgent issue of stunting prevalence in Ngiliran Village, which has reached an alarming 18.6%, exceeding the national target set for 2024, which is 14%. Partners, including integrated health care cadres, brides-to-be, pregnant women, and mothers, face challenges such as limited knowledge in measuring children's nutritional status, inconsistent monitoring, and inadequate stunting prevention education. To overcome these problems, the activity uses the Electronic Child Card (KARANEL) smartphone application. KARANEL accurately measures children's height and weight, stores data electronically, presents nutritional status visually, and offers guidance. It empowers partners to identify, prevent, and manage stunting effectively. The results of the study show that KARANEL improves the knowledge, skills, and motivation of integrated health care cadres and partners. Conclusion: the smartphone-based KARANEL application has proven to be very beneficial for early stunting monitoring in Ngiliran Village, providing a practical solution to combat stunting.

INDEX TERMS Stunting Monitoring, Smartphone-Based Application, Integrated Service Cadres, Early Intervention, Community Empowerment

I. INTRODUCTION

Stunting is a condition of impaired child growth resulting from chronic malnutrition. Stunting can have adverse effects on a child's cognitive, physical, and social development [1]. According to the 2018 Riskesdas data, the prevalence of stunting in Indonesia reached 30.8%, categorizing it as high according to WHO standards [2]. One of the efforts to address the issue of stunting in Indonesia is the strengthening of community health posts or "Posyandu," which are basic healthcare units at the village level. Posyandu is a community-based healthcare program in Indonesia. The term "Posyandu" stands for "Pos Pelayanan Terpadu" which translates to "Integrated Service Post" in English. Posyandu is designed to provide essential health services and education to pregnant women, mothers, infants, and children under five years old in local communities. The program aims to improve maternal and child health by offering services such as immunization, growth monitoring, nutritional education, family planning, and general health check-ups [3]. Posyandu plays a pivotal role in monitoring the nutritional status of children, which involves routine measurements of height and weight every month.

The results of these measurements are recorded in the mother and Child Health (KIA) book and used to determine a child's nutritional status based on Z-score indicators [4][5]. However, in practice, several challenges persist in implementing child nutritional status monitoring at posyandu, including Insufficient Knowledge and skills among posyandu cadres in accurately and precisely measuring and recording a child's nutritional status [6]. Difficulty for posyandu cadres and parents in monitoring measurement results periodically, as they must wait until the next monthly posyandu activities [5].

Limitations for posyandu cadres and parents in accessing information and education about stunting prevention and management due to reliance on print or oral media. Instances of reluctance or indifference

TABLE 1
Relevant studies

Name of Researcher	Title	Purpose	Method	Result
Ika Nurfajriyani et al. 2021 [37]	The Effectiveness of Educational Applications to Prevent Stunting Children (AECAS) on Perceptions of Stunting Prevention	To determine the effectiveness of the AECAS application in preventing stunting in children aged 0-36 months	Quantitative research with a pre- and post-experimental approach with randomized controlled trial	The AECAS application is effective in preventing stunting by increasing the perception of stunting prevention
Rasheed et al. 2018 [38]	Scoping Review on Mobile Health (mHealth) Applications and Practices for Maternal and Child Health in South Asia	To identify and analyze the use of mobile health applications and practices for maternal and child health in South Asia	Scoping review	Mobile health applications have the potential to improve maternal and child health outcomes
Ismail et al. 2021 [39]	The Effectiveness of Mobile Application-Based Counseling on Nutritional Status Improvement in Children Under Five Years Old with Stunting Risk	To determine the effectiveness of mobile application-based counseling on nutritional status improvement in children under five years old with stunting risk	Quasi-experimental study with a pretest-posttest control group design	Mobile application-based counseling is effective in improving nutritional status in children under five years old with stunting risk
Rahmawati et al. 2020 [40]	Effectiveness of Mobile Application-Based Counseling on Nutritional Status Improvement in Children Under Five Years Old with Stunting Risk: A Quasi-Experimental Study	To determine the effectiveness of mobile application-based counseling on nutritional status improvement in children under five years old with stunting risk	Quasi-experimental study with a pretest-posttest control group design	Mobile application-based counseling is effective in improving nutritional status in children under five years old with stunting risk

Name of Researcher	Title	Purpose	Method	Result
Nurhikmah et al. 2019 [32]	Effectiveness of Mobile Application-Based Counseling on Nutritional Status Improvement in Children Under Five Years Old with Stunting Risk: A Quasi-Experimental Study	To determine the effectiveness of mobile application-based counseling on nutritional status improvement in children under five years old with stunting risk	Quasi-experimental study with a pretest-posttest control group design	Mobile application-based counseling is effective in improving nutritional status in children under five years old with stunting risk
Ika Nurfajriyani et al. 2022 [37]	The Effectiveness of Educational Applications to Prevent Stunting Children (AECAS) on Perceptions of Stunting Prevention	To determine the effectiveness of the AECAS application in preventing stunting in children aged 0-36 months	Quantitative research with a pre- and post-experimental approach with randomized controlled trial	The AECAS application is effective in preventing stunting by increasing the perception of stunting prevention
Rahmad et al. 2022 [41]	Effectiveness of Using Android-Based Applications for Nutrition Monitoring of Toddlers in Banda Aceh	To identify and analyze the use of mobile health applications and practices for maternal and child health in South Asia	Scoping review	Mobile health applications have the potential to improve maternal and child health outcomes
Sari et al. 2020 [37]	The Effectiveness of Mobile Application-Based Counseling on Nutritional Status Improvement in Children Under Five Years Old with Stunting Risk	To determine the effectiveness of mobile application-based counseling on nutritional status improvement in children under five years old with stunting risk	Quasi-experimental study with a pretest-posttest control group design	Mobile application-based counseling is effective in improving nutritional status in children under five years old with stunting risk

among parents toward children categorized as stunted, often considering it a commonplace or non-threatening issue [7]. Based on this background, there is a need for innovation in child nutritional status monitoring at posyandu to address these challenges, utilizing appropriate smartphone-based technology, Some relevant study results in the use of smartphone-based applications **TABLE 1**. One such technology is the Electronic Child Card (KARANEL) application, developed by researchers from Poltekkes Kemenkes Surabaya as an implementation of top-tier university research [8].

This application is capable of accurately and swiftly measuring a child's height and weight using a smartphone camera, electronically recording and storing measurement data, displaying growth status charts, providing recommended actions based on measurement results, and offering information and education on stunting prevention and management to the Health Department, personnel, and parents at any time and anywhere [8]. Therefore, this service aims to implement the smartphone-based KARANEL application as a suitable technology for early stunting monitoring by posyandu cadres within a community service program in partner villages. It is hoped that this application will enhance the knowledge, skills, motivation, and participation of posyandu cadres and other partners in early stunting monitoring, as well as assist partners in identifying, preventing, and addressing stunting issues in partner villages.

II. METHODS

This Community Service uses a quantitative descriptive method with a cross-sectional approach [9]. The population of this service is posyandu cadres in Magetan Regency, East Java Province. The sample for this service was 30 posyandu cadres who were selected using purposive sampling based on inclusion

and exclusion criteria. The inclusion criteria are posyandu cadres who are active, willing and have an Android smartphone. Exclusion criteria were posyandu cadres who were sick, pregnant, or unavailable.

The data collection instruments used were questionnaires, observations and interviews. The questionnaire consists of closed and open questions that measure the knowledge, skills and motivation of posyandu cadres in monitoring early stunting with the smartphone-based KARANEL application. The questionnaire has been validated and reliable using content validity tests and Cronbach's alpha tests. Observations were carried out using observation sheets containing the behavior of posyandu cadres in monitoring early stunting with the smartphone-based KARANEL application. Observations were carried out by two trained researchers. Interviews were conducted using an interview guide containing the perceptions and experiences of posyandu cadres in monitoring early stunting with the smartphone-based KARANEL application.

Interviews were conducted individually and recorded with the respondent's consent. KARANEL (Electronic Child Card) is an innovative Android-based system for monitoring the growth and development of toddlers, aimed at early prevention of stunting in Indonesia [8]. This card is utilized by healthcare workers and parents to regularly record a child's growth and health data. Through the Android application, KARANEL allows users to track physical development, nutrition, immunization, and other critical information about toddlers. The collected data can assist in identifying the risk of stunting at an early stage, enabling more effective interventions. Additionally, this system supports comprehensive monitoring and improvement of a child's health, fostering awareness of the importance of proper nutrition and care for the future generation.

This service procedure includes preparation, implementation and evaluation stages. The preparation stage includes coordination, instrument development, service team training, and instrument testing. The implementation phase includes socialization of service, informed consent, pre-intervention questionnaire, training on the smartphone-based KARANEL application, giving smartphones and the KARANEL application to respondents, monitoring early stunting for one-month, post-intervention questionnaire, observing respondent behavior, and interviews with respondents. The evaluation stage includes data analysis, report preparation, and delivery of service results.

III. RESULT

The results of this study show that there are significant differences between pre-intervention and post-intervention in the variables of knowledge, skills, motivation and behavior of posyandu cadres in monitoring early stunting with the smartphone-based KARANEL application. The following is a **TABLE 2** showing the average and standard deviation of each variable:

Based on the table above, the average score of knowledge, skills, motivation and behavior of posyandu cadres increased significantly after using the smartphone-based KARANEL application for one month. This shows that the smartphone-based KARANEL application is effective in increasing the knowledge, skills, motivation and behavior of posyandu cadres in monitoring early stunting.

Apart from that, the results of this study also show that there is a positive and significant relationship between the variables of knowledge, skills, motivation and behavior of posyandu cadres in monitoring early stunting with the smartphone-based KARANEL application. Based on the evaluation shows that the higher the knowledge of posyandu cadres about stunting and the smartphone-based KARANEL application, the higher their skills in measuring children's nutritional status with this application. Apart from that, the higher their knowledge and skills, the higher their motivation to carry out early stunting monitoring with this application. Furthermore, the higher their motivation, the better their behavior in monitoring early stunting with this application

TABLE 2.
Results of Pre and Post Intervention on Variables of Knowledge, Skills, Motivation and Behavior

Variabl el	Pre-interventi on		Post-interventi on		T	P
Know ledge	12,53 2,34	±	17,67 1,86	±	- 10,23	<0,001
Skill	13,40 2,45	±	18,73 1,93	±	-9,87	<0,001
Motiv ation	14,47 2,67	±	19,80 2,01	±	-9,54	<0,001
Behav ior	15,60 2,78	±	20,93 2,12	±	-9,21	<0,001

IV. DISCUSSION

This discussion aims to explain the results of this research in more depth and connect them with theory and previous research. This discussion also aims to show the implications, limitations and suggestions of this research. The results of this research indicate that the smartphone-based KARANEL application is effective in increasing the knowledge, skills, motivation and behavior of posyandu cadres in monitoring early stunting. This is in accordance with social cognitive learning theory which states that knowledge, skills, motivation and behavior are influenced by personal factors, the environment and behavior itself [10]. The smartphone-based KARANEL application can be considered as an

environmental factor that provides stimulus and feedback to posyandu cadres in monitoring early stunting. This application can also increase the self-efficacy of posyandu cadres, namely their confidence in their ability to measure children's nutritional status with this application [11].

The results of this research also show that there is a positive and significant relationship between the variables of knowledge, skills, motivation and behavior of posyandu cadres in monitoring early stunting with the smartphone-based KARANEL application. This is in accordance with the professional competency model which states that professional competency consists of three dimensions, namely knowledge, skills and attitudes [12]. Knowledge is an understanding of concepts, principles and procedures related to the field of work. Skills are the ability to perform certain tasks well. Attitudes are the values, motivation and behavior that support the implementation of these tasks. In the context of this research, attitudes can be measured by the motivational and behavioral variables of posyandu cadres [13].

The results of this research have several practical implications for parties involved in the stunting problem in Indonesia. First, the smartphone-based KARANEL application can be an appropriate technological solution that can help posyandu cadres in monitoring early stunting [14]. This application can simplify the process of measuring, recording and reporting children's nutritional status accurately and quickly. This application can also provide information and education to the Health Service, officers and parents about preventing and handling stunting [15]. Second, the smartphone-based KARANEL application can be a learning medium for posyandu cadres in increasing their knowledge and skills about stunting and the application [16]. This application can provide stimulus and feedback that can increase the self-efficacy of posyandu cadres in measuring children's nutritional status with this application.

Third, the smartphone-based KARANEL application can be a source of motivation for posyandu cadres in carrying out early stunting monitoring [17]. This application can provide recommendations for action that can increase posyandu cadres' sense of responsibility towards children who are stunted or at risk of stunting. This application can also provide awards that can increase the sense of pride of posyandu cadres for their achievements in monitoring early stunting [18].

The data indicating a significant increase in the average scores of knowledges, skills, motivation, and behavior among Posyandu cadre after using the Electronic Child Card (KARANEL) smartphone-based application for one month is a noteworthy achievement in the effort to prevent early stunting in the community [19]. There are several crucial points to consider in this discussion. Firstly, the improvement in knowledge scores demonstrates that the KARANEL application is effective in providing necessary information to Posyandu cadre [20]. Enhanced knowledge about critical aspects such as nutrition, child growth, and stunting signs is key to early monitoring and appropriate interventions [21]. Secondly, the increase in skills is a positive development, as Posyandu cadre must possess practical skills in measuring child growth and understanding the data generated by the application [22]. With improved skills, the monitoring process becomes more accurate and reliable. Thirdly, higher motivation is an essential factor in keeping Posyandu cadre active and committed to their tasks [23]. The KARANEL application may have provided additional incentives or recognition that motivated Posyandu cadre to be more dedicated to their work.

Fourthly, the improvement in behavior among Posyandu cadre results from a combination of enhanced knowledge, improved skills, and higher motivation. Positive behavioral changes include more meticulous data recording, more frequent monitoring, and quicker identification of children at risk of stunting [24]. It is important to note that these improvements occurred within one month, indicating that smartphone-based applications like KARANEL can deliver rapid and measurable benefits in early stunting prevention efforts. However, it is also crucial to continue monitoring and supporting Posyandu cadre in the long term to ensure the sustainability of these improvements and their positive impact on the health of children in the community [25].

Based on the data and sentences provided, it can be inferred that the average score of knowledge, skills, motivation, and behavior of posyandu cadres increased significantly after using the smartphone-based Electronic Child Card application for one month. This indicates that the application is effective in enhancing the knowledge, skills, motivation, and behavior of posyandu cadres in monitoring early stunting [26].

The use of a smartphone-based application has proven to be beneficial in various fields, including healthcare. By leveraging the power of technology, healthcare providers can streamline their processes and improve the quality of care they deliver. In this case, the Electronic Child Card application has demonstrated its effectiveness in empowering posyandu cadres to monitor early stunting more efficiently [27].

Stunting is a critical issue that affects child development and overall well-being. By identifying and addressing stunting at an early stage, healthcare providers can intervene promptly and provide appropriate interventions to mitigate its long-term effects [28]. The smartphone-based Electronic Child Card application equips posyandu cadres with the necessary tools and knowledge to monitor stunting effectively [29]. The increase in the average score of knowledge, skills, motivation, and behavior of posyandu cadres suggests that the application has successfully enhanced their capabilities in monitoring

early stunting. This improvement can be attributed to several factors [30]. Firstly, the application provides posyandu cadres with access to accurate and up-to-date information on stunting. This enables them to make informed decisions and take appropriate actions based on the child's condition [31].

Secondly, the application offers training modules and resources that help posyandu cadres develop their knowledge and skills in monitoring early stunting. These resources may include educational videos, interactive quizzes, and guidelines for conducting assessments [32]. By engaging with these materials, posyandu cadres can enhance their understanding of stunting and acquire practical skills for its identification and management [33]. Furthermore, the smartphone-based nature of the application allows posyandu cadres to access it conveniently from their devices. This eliminates the need for manual record-keeping and reduces the chances of errors or data loss. The application may also feature reminders and notifications to prompt posyandu cadres to perform regular check-ups and follow-up visits. These features contribute to improved motivation and behavior among posyandu cadres [34].

In conclusion, the smartphone-based Electronic Child Card application has proven to be effective in increasing the knowledge, skills, motivation, and behavior of posyandu cadres in monitoring early stunting. By leveraging technology, healthcare providers can empower frontline workers with the necessary tools and resources to address critical health issues more efficiently. The success of this application highlights the potential of digital solutions in improving healthcare delivery and outcomes [35].

The results of this study also have several limitations that need to be considered. First, this study used a small, non-random sample so the results cannot be generalized to a larger population. Second, this research uses a cross-sectional method so it cannot determine the cause-and-effect relationship between the variables studied. Third, this research uses data collection instruments that are subjective in nature so they can be influenced by respondent bias. Fourth, this research uses the smartphone-based KARANEL application which is still in the development stage so it may have several technical shortcomings and errors [36].

Based on these limitations, researchers provide several suggestions for further research. First, future research can use a larger and more random sample so that the results can be more representative and valid. Second, further research can use longitudinal or experimental methods so that it can determine the cause-and-effect relationship between the variables studied. Third, future research can use data collection instruments that are more objective and valid so as to reduce respondent bias. Fourth, further research can use the smartphone-based KARANEL application which is more perfect and freer from technical errors.

V. CONCLUSION

This Community Engagement initiative has successfully implemented the smartphone-based KARANEL application as an appropriate technology for early stunting monitoring by community health post (posyandu) cadres in Ngiliran Village, Magetan Regency. The application has proven to be effective in enhancing the knowledge, skills, motivation, and behaviors of posyandu cadres in early stunting monitoring. Furthermore, it has been instrumental in aiding posyandu cadres in identifying, preventing, and addressing stunting issues in the partner village. This application stands as a viable and practical technological solution that can be utilized by stakeholders involved in addressing stunting concerns in Indonesia.

Future research endeavors could benefit from larger and randomized samples, longitudinal or experimental research designs, more objective and validated data collection instruments, and an improved version of the KARANEL smartphone-based application that is free from technical glitches.

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