

The e-Posyandu Health Application (ePoK) as a medium to enhance parental independence in stimulating growth and development of children under five

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Abstract

The early childhood period, specifically from birth to five years of age, represents a crucial phase for growth and development. However, stunting prevalence worldwide remains high. Parental independence in stimulating children under five's growth and development is pivotal in addressing this issue. The study aims to explore the impact of the e-Posyandu Health Application (ePoK) in promoting parental independence in the growth and development of their children. The research employed a quasi-experimental method with a pre-posttest control group design. The sample consisted of 140 parents with children under five years old in Tanjungpinang City, divided into intervention (70 parents) and

control (70 parents) groups. The intervention group used the ePoK application for 3 months, while the control group received routine *puskesmas* (community health center) services. Data collection used a parental independence questionnaire. The intervention group showed a significant 23% increase in mean independence scores ($p=0.001$), compared to no significant changes in the control group. After the intervention, a meaningful difference between groups was observed ($p=0.001$). Multiple regression analysis revealed education, knowledge, skills, and motivation as significant predictors, explaining 58.4% of the variation in independence (adjusted $R^2=0.584$). Based on our findings, the ePoK application effectively enhances parental independence by stimulating the growth and development of children under five. The application can be a supportive tool for parents to monitor and optimize child development independently.

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Introduction

The children under five phase is a critical period encompassing two important dimensions: physical growth and ability development. Growth refers to changes in body size and structure, while development includes improvements in motor skills, communication, social interaction, and independence. Optimal growth and development stimulation can enhance a child's cognitive, social, and emotional development, ultimately leading to better health status.¹⁻⁵ The first five years of life are critical as children lay the groundwork for their learning and socio-emotional abilities.⁶⁻⁸ According to WHO, in 2022, 148.1 million children under five were diagnosed with stunting, equivalent to 22.3% of the global children under five population, and approximately 45 million children suffered from wasting.

Based on UNICEF reports, around 101 million children under five worldwide experience underweight conditions.⁹ In Indonesia, the government aims to reduce stunting prevalence to 14% by 2024, in line with the global target set by WHO. However, based on the latest data, stunting prevalence in Indonesia remains at 21.6%, indicating that reduction efforts need to be intensified to achieve the established target.^{10,11}

In developing countries, over 200 million children under five fail to reach their cognitive and social development potential due to poverty, poor health, inadequate nutrition, and insufficient caregiving.^{7,8,12} The involvement of parents and family members is essential in promoting the growth and development of children under the age of five; parental participation and independence in providing stimulation will help children improve in the future, not only physically but also intellectually, socially, emotionally, and in terms of independence.^{2,6,7,13-16} Active parents who support and stimulate their children can promote child development and maintain the child's nutritional status. Parents play a central role as they are closest to the child: they can recognize the child's specific needs,

provide appropriate stimulation, and perform early interventions if issues arise.^{2,7,17-20}

An integrated, evidence-based approach to optimizing early childhood health is globally recommended. Effective interventions focusing on the first 1000 days of life include specific micronutrient provision (vitamin A, zinc, iron), early cognitive development stimulation, systematic nutrition management through Integrated Management of Childhood Illness (IMCI), and digital health technology use for continuous growth and development monitoring. Digital technology and data-based interventions are increasingly becoming key strategies in nutritional status monitoring, with primary targets of reducing stunting rates, improving exclusive breastfeeding quality, and comprehensively optimizing children under five's physical-cognitive growth.^{15,20-24} The Indonesian government has developed a series of comprehensive interventions to improve children under five's growth and development through the First 1000 Days of Life Program, National Stunting Prevention, Posyandu, Supplementary Feeding Program (PMT), and specific nutrition interventions. These programs are designed as systematic efforts to address child nutrition and health issues. These efforts not only focus on health aspects but also integrate technological approaches through children's nutrition e-monitoring systems, enabling real-time recording and reporting of child nutrition conditions, with the expectation of reducing stunting rates and improving the quality of Indonesian human resources.^{10,25-27}

Parents must be independent, especially in stimulating the growth and development of their toddlers. They are not merely caregivers but active partners in the child's development process, responsible for understanding, monitoring, and optimizing each growth stage holistically and continuously. Independent parents have a better understanding of child development milestones, such as motor, language, and social skills. They are more quickly responsive in recognizing growth and development disturbance signs, such as speech delays or age-inappropriate physical development, thus enabling earlier intervention decisions.²⁸⁻³⁰ Increasing parental independence in stimulation can be achieved through digital applications for monitoring child growth. Digital growth charts are particularly helpful for parents in understanding child development efficiently and independently. Application information and features significantly contribute positively to parental independence in stimulating child growth and development.^{7,31-36} There are several other applications similar to ePoK, but ePoK stands out with several advantages. These include providing tutorial videos and growth monitoring features based on WHO growth charts, as well as developmental stimulation features complete with the necessary tools and media tailored to the child's age. Additionally, it offers reminders for immunization schedules, vitamin A supplementation, and deworming schedules. The app also includes a chatroom feature, enabling parents to exchange ideas with their community. These features greatly assist parents in independently monitoring and stimulating their child's growth and development.

Given this context, it is critical to investigate the effect of the e-Posyandu Health Application on parental independence in stimulating the growth and development of children under the age of five. This study aims to provide a clearer picture of ePoK application's effectiveness in enhancing parental independence.

Materials and Methods

Research design

The study employs a quantitative method based on a quasi-experimental design with a pre-posttest control group approach. The research was conducted from July to September 2024. The intervention group used the ePoK application for three months. Meanwhile, the control group received primary healthcare programs provided by the Community Health Center, which included toddler health services at the Posyandu. During the study, communication with all respondents was conducted through a WhatsApp group. Every month, the research team conducted direct monitoring of the application usage and the growth and development stimulation activities performed by the parents.

Study participants

The population in this study comprised all parents with children under five in the working area of Batu 10 Community Health Center, Tanjungpinang City. The research sample was a subset of the population meeting specific inclusion and exclusion criteria. The inclusion criteria were: parents of children under five who have previously participated in posyandu activities, own an Android device with a minimum version of 5, and are capable of using it. Exclusion criteria included parents who are health cadres or healthcare professionals. A total of 70 samples were taken for each group at the same location. The samples were selected using the proportional stratified random sampling technique.

Variable, instrument, and data collection

The independent variable in this study is the intervention provided to both groups, while the dependent variable is parental independence in stimulating the growth and development of children under five. The research instrument used a questionnaire to assess parental independence, which has been tested for validity and reliability. Parental independence in providing stimulation can be assessed through health check-ups performed on children under five, consistency in following immunization schedules and vitamin supplementation, provision of proper nutrition, the amount of time spent on stimulation, the use of stimulation aids, as well as the types and variety of activities provided.

Data analysis

Data was processed and analyzed using SPSS Software. The data was analyzed through univariate and bivariate methods. Univariate analysis was used to examine characteristic variables, while bivariate analysis employed nonparametric tests, specifically the Wilcoxon Signed Rank test and Mann-Whitney test. Multivariate analysis was conducted using multiple linear regression.

Ethical clearance

This study received ethical approval from the Research Ethics Commission of Stikes Bani Saleh Bekasi, as evidenced by the ethical certificate number EC.188/KEPK/STKBS/VI/2024. Throughout the research, the researchers adhered to ethical principles of informed consent, respecting human rights, beneficence, and non-maleficence.

Results

Respondent characteristics observed in this study consisted of maternal age, education, occupation, and number of children, with results as shown in Table 1.

In the intervention group, the majority of respondents were aged 20-40 years (82.9%), had an education level above high school, accounting for 78.6%, and the majority were housewives (72.9%). Additionally, most respondents had more than one child (65.7%). Similarly, in the control group, most respondents were also aged 20-40 years (71.4%). The majority of respondents had an education level above high school, representing 67.1%, and most were housewives (67.1%). A significant portion of respondents had more than one child (51.4%). Statistical analysis yielded p-values greater than 0.05, indicating that both groups were homogeneous and shared similar characteristics, thus making them suitable for comparison.

As shown in Table 2, the independence variable analysis revealed significant findings. In the intervention group, the mean pretest value was 11.13, which increased to 13.6 after the intervention. The average percentage increase was 23%, indicating a substantial improvement. The Wilcoxon Signed Rank test produced a

p-value of 0.000 (≤ 0.05), demonstrating a statistically significant difference in independence between pretest and posttest values for the intervention group. In contrast, the control group showed minimal changes. The mean pretest value was 11.41, with a slight increase to 11.56 after the intervention. The average percentage increase was only 1%, which was not statistically significant, as confirmed by the Wilcoxon Signed Rank test with a p-value of 0.105 (> 0.05). This result indicated no significant difference in independence between pretest and posttest values for the control group. Further analysis using the Mann-Whitney U test for pretest comparison between groups yielded a p-value of 0.195 (> 0.05), suggesting no statistically significant differences in independence between the intervention and control groups before the intervention. However, after the intervention, the Mann-Whitney U test for posttest comparison showed a p-value of 0.000 (≤ 0.05), indicating a statistically significant difference in independence between the two groups. Specifically, the posttest mean differences revealed that the intervention group experienced a substantially greater increase in independence compared to the control group. This improvement is evident from the average change (Δ), with the intervention group showing a 23% increase *versus* only 1% in the control group. The Mann-Whitney U test result, with a p-value of

Table 1. Respondent characteristics.

Respondent characteristics		Group (N=140)				p ^(a)
		Intervention (n=70)		Control (n=70)		
		n	%	n	%	
Age	<20 years	7	10.0	9	12.9	0.213
	20-40 years	58	82.9	50	71.4	
	>40 years	5	7.1	11	15.7	
	Total	70	100	70	100	
Education	<Senior high school	15	21.4	21	30.0	0.334
	>Senior high school	55	78.6	49	70.0	
	Total	70	100	70	100	
Occupation	Not working	51	72.9	47	67.1	0.580
	Work	19	27.1	23	32.9	
	Total	70	100	70	100	
Children	1	24	34.3	36	51.4	0,060
	>1	46	65.7	34	48.6	
	Total	70	100	70	100	

^(a)Chi-square test.

Table 2. Impact of the intervention on parental independence.

Independence	Group (N=140)		p ^(b)
	Intervention (n=70)	Control (n=70)	
Pretest			0.195
Mean (SD)	11.13 (1.37)	11.41 (1.08)	
Median	11	11	
Range	9-14	9-14	
Posttest			0.000*
Mean (SD)	13.6 (1.04)	11.56 (1.15)	
Median	14	12	
Range	11-15	9-14	
p ^(a) Differences in <i>pretest-posttest</i>	0.000*	0.105	
Improvement score			0.000*
Mean (SD)	0.23 (0.11)	0.01 (0.07)	
Median	0.21	0	
Range	0.07-0.56	-0.1-0.3	

^(a)Wilcoxon test; ^(b)Mann Whitney test; *Sig<0.05.

0.000 (≤ 0.05), further confirmed the significant differences between groups in terms of independence improvement.

The study conclusively demonstrates that the intervention had a marked positive effect on independence, with the intervention group showing a significantly larger increase than the control group. These findings highlight the potential effectiveness of the intervention in enhancing participants' independence.

Therefore, it can be concluded that the intervention using the ePoK application significantly improves respondents' independence, as evidenced by the higher mean and median differences in the intervention group compared to the control group. The statistical significance of these differences was confirmed through Wilcoxon and Mann-Whitney test results, which demonstrated $p \leq 0.05$.

Based on Table 3, the multiple linear regression analysis of the intervention group yielded an F-value of 14.817 and a p-value of 0.000 (≤ 0.05), indicating that all variables in the intervention group can effectively explain the variations in independence. The adjusted R² value of 0.584 demonstrates that 58.4% of the variation in independence can be explained by independent variables, while the remaining 41.6% is attributed to factors outside the research scope. The percentage of skill improvement emerged as the most dominant factor influencing independence, with the highest standardized beta coefficient of 0.341. This was followed by education (0.31), knowledge increase (0.228), and motivation increase (0.203). Age, occupation, and number of children variables showed no statistically significant influence on independence, with $p > 0.05$.

In contrast, the control group's multiple linear regression analysis produced an F-value of 5.957 and a p-value of 0.000 (≤ 0.05), suggesting that all variables can explain the variations in independence. The adjusted R² value of 0.335 indicates that 33.5% of the independence increase variation can be explained by independent variables in the model, with the remaining 66.5% attributed to factors outside the research model. Education emerged as the dominant factor with the most significant impact on independence increase, displaying the highest standardized beta coefficient of 0.397. This was followed by the number of children, with a standardized beta coefficient of 0.367. Conversely, variables such as age, occupation, percentage of knowledge increase, skill improvement percentage, and motivation increase demonstrated no statisti-

cally significant influence on independence increase, with $p > 0.05$. These findings highlight the complex nature of factors affecting independence and underscore the potential importance of targeted interventions in promoting personal autonomy

Discussion

Based on the research findings, there is a significant difference in independence between the pretest and posttest values in the intervention group, which showed a much larger improvement in independence compared to the control group, indicating that the use of the ePoK application has a significant positive impact on enhancing the respondents' independence. Parental independence is a critical component in optimizing the growth and development of children under five, which is formed through knowledge, awareness, and active involvement in each stage of child development. Parental independence is a practical concept that requires a thorough understanding of child growth and development, the ability to provide proper stimulation, and the skills to monitor a child's progress effectively.^{7,29,30,37} Parental self-efficacy has a significant correlation with the quality of growth monitoring;^{29,37,38} parents with knowledge, confidence, and independence can better identify potential developmental problems in their children.

In this study, parental independence is not influenced by age, number of children, or occupation. In contrast, a parent's ability to independently stimulate their child's development is more affected by their awareness and knowledge; younger and older parents can have comparable levels of awareness and access to information. Similarly, the number of children does not impact parental independence. Having more children does not automatically reduce a parent's ability to provide stimulation, as they can allocate time and attention equitably with proper management. This also applies to working parents, who actively contribute to their child's growth and development stimulation by managing their time effectively. In fact, working parents often utilize technology, such as parenting applications, to support their role. The variables of educational characteristics, increased knowledge, improved skills, and increased motivation were found to influence parental independence in

Table 3. Regression analysis results for independence variable in each group.

Coefficients ^a Group	Model		Standardized coefficients		Unstandardized coefficients Beta	ANOVA				Adjusted R-Square
			B	Std. error		t	Sig.	F	Sig.	
Intervention	1	(Constant)	-0.148	0.059		-2.503	0.015	14.817	0.000*	0.584
		Age	-0.012	0.022	-0.046	-0.549	0.585			
		Education	0.079	0.023	0.301	3.447	0.001*			
		Occupation	-0.012	0.020	-0.050	-0.601	0.550			
		Children	0.039	0.024	0.173	1.631	0.108			
		% Knowledge improvement	0.187	0.074	0.228	2.548	0.013*			
		% Skill improvement	0.293	0.083	0.341	3.522	0.001*			
		% Motivation improvement	0.553	0.233	0.203	2.372	0.021*			
Control	1	(Constant)	-0.230	0.077		-2.990	0.004	5.957	0.000*	0.335
		Age	0.005	0.014	0.038	0.352	0.726			
		Education	0.058	0.026	0.397	2.216	0.030*			
		Occupation	0.041	0.024	0.291	1.723	0.090			
		Children	0.049	0.015	0.367	3.180	0.002*			
		% Knowledge improvement	0.041	0.032	0.137	1.284	0.204			
		% Skill improvement	-0.040	0.129	-0.031	-0.308	0.759			
		% Motivation improvement	0.661	0.384	0.187	1.721	0.090			

^aDependent variable; % independence improvement.

stimulating children under five's growth and development. The level of education affects an individual's knowledge: higher education allows for easier acceptance of a wider and more diverse range of information, thus making it easier to develop oneself, especially in seeking health information and improving health status. The use of the ePoK application has been proven to enhance parents' knowledge and skills in child growth and development.³⁵ This application can encourage positive attitudes and motivate parents to monitor and stimulate their children's growth and development.^{7,39,40} The features available in the ePoK application can facilitate parents to independently assist their child, reducing their reliance on health cadres and professionals.³⁵

The strategy for parental independence includes cognitive stimulation through educational interactions with the child, periodic physical growth monitoring, continuous documentation of development, and the ability to provide stimulation and interventions based on the individual needs of the child.^{7,13,19,41-44} Independence is not merely a routine activity but a dynamic process that requires continuous education, professional support, and access to up-to-date information sources.⁴⁴ Parents play a strategic role in optimizing children's developmental potential through various positive interventions. Home-based educational stimulation, quality communication, and providing diverse learning experiences are key factors in supporting optimal growth and development.^{5,19,43,45-47} Consistent and high-quality stimulation provided by both parents can enhance a child's cognitive abilities, language skills, and social competencies.^{13,18,48-51}

The active role of parents in fostering their child's potential has undergone a significant transformation, with a primary focus on direct and quality involvement in the child's developmental process. Meaningful interactions between parents and children are not just routine activities but a strategy to support the child's comprehensive development. Through a series of interactive activities such as reading stories, playing together, and providing age-appropriate educational media, parents effectively construct a conducive learning environment. Recent research in child developmental psychology shows that intensive and planned parental involvement can optimize the development of social-emotional skills, enhance cognitive capacities, and build a strong psychological foundation during the child's golden years. Parents' role is not only to stimulate intellectual development but also to build a lasting emotional bond between them and their children.^{2,4,5,16,45,47,51-53}

Currently, there are many available applications to improve health outcomes, including tools for parents to monitor their children's development through real-time tracking. Advances in digital technology have transformed health information access, enabling the public to use innovative platforms for enhanced understanding and health independence. These technologies not only provide information but also empower individuals through interactive education and encourage active participation in managing personal and family health.^{7,31-36,54}

Health applications are designed with user-friendly architectures, accessible to various age groups, and allow users to easily understand and act on health information independently and comprehensively. Utilizing these applications can enhance knowledge and foster independence, enabling individuals to monitor their health and that of their families.⁵⁵⁻⁶¹ It is essential for parents to strengthen their independence in stimulating their toddler's growth and development by utilizing technological advancements, such as the ePoK application.

Conclusions

Based on the research findings, it can be concluded that the ePoK application can enhance parental independence in stimulating the growth and development of children under five. The results of the multiple linear regression analysis show that the variables of education, knowledge improvement, skills, and motivation significantly influence parental independence. In contrast, the variables of parental age, occupation, and number of children do not impact parental independence.

There are still many other health-related variables that have not been addressed. Therefore, there is a need to include additional predictor variables that could influence stunting in children under five, with the hope that the R^2 value will increase. Healthcare professionals at health facilities are expected to use this application as a tool to enhance parents' independence and encourage their active role in stimulating their children's growth and development. This approach aims to empower parents to prevent delays in their child's growth and development independently.

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