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Community Empowerment for Stunting Prevention: A Quasi-Experimental Study in Indonesia

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ABSTRACT

Introduction: Stunting remains a major public health challenge in Indonesia, with long-term consequences for human resource quality. Empowering Posyandu (integrated health post) cadres through theory-based approaches is considered a strategic intervention to strengthen prevention efforts.Objective:This study aimed to evaluate the effectiveness of a community empowerment model grounded in the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) in improving preventive behaviors among Posyandu cadres.

Methods: A quasi-experimental design with a non-equivalent control group and pretest–posttest approach was employed. The study was conducted in Magetan Regency, East Java Province, from January to September 2023. The intervention group was drawn from Panekan Sub-district and the control group from Plaosan Sub-district, with geographic separation used to minimize contamination. The study population comprised 400 cadres, from which 200 respondents were recruited proportionally and selected using random sampling within each sub-district (intervention = 100; control = 100). The intervention consisted of structured training modules integrating HBM and TPB constructs, including risk perception, benefits of prevention, self-efficacy, barrier reduction, and behavioral planning. Data were collected using a validated Likert-scale questionnaire measuring perceived susceptibility, perceived benefits, attitudes, intentions, subjective norms, and preventive behaviors. Analyses employed paired-samples t-tests for within-group comparisons and independent-samples t-tests for between-group differences, with significance set at $p < 0.05$.

Results: The intervention group demonstrated statistically significant improvements across all measured variables ($p < 0.001$). Preventive behavior scores increased from 12.11 (SD = 1.06) at baseline to 21.10 (SD = 1.87) post-intervention. Between-group analyses confirmed higher posttest scores in the intervention group compared to controls ($p < 0.001$).

Conclusion: Empowerment training based on HBM and TPB was effective in enhancing cadres' cognitive and behavioral components related to stunting prevention. These findings provide preliminary evidence supporting the integration of theory-driven empowerment models into community health programs, while highlighting the need for sustained training and longer-term evaluation to ensure durability of behavioral change.

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INTRODUCTION

Stunting is one of the major public health problems in Indonesia (1,2). This condition is caused by chronic malnutrition, particularly during the first 1,000 days of life, which affects children's physical growth and brain development (3). The long-term impacts of stunting include decreased productivity, increased risk of chronic diseases, and significant national economic losses, with an estimated reduction in Gross Domestic Product (GDP) of 2–3% per year. This study aims to evaluate the effectiveness of an empowerment model based on the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) in improving the preventive behaviors of Posyandu (community health post) cadres in stunting prevention (4,5).

In Indonesia, stunting prevalence remains high at 30.8%, or approximately seven million children under five. Magetan Regency reported a prevalence of severe malnutrition among under-five children of 0.96% in 2018, with Panekan Sub-district contributing 4% of the total cases (6). The low household coverage of Clean and Healthy Lifestyle Behavior (PHBS) at 46% (national standard 60%) indicates the need for a community-based approach to promote behavioral change for stunting prevention (7-9).

The Health Belief Model (HBM) and Theory of Planned Behavior (TPB) are health behavior theories proven effective in modifying risk perception, behavioral intentions, and perceived control. Implementing these theories through a community empowerment module is expected to enhance the stunting prevention behaviors of Posyandu cadres (10,11).

This study presents a significant novelty by developing a community empowerment model integrating two behavioral theories—HBM and TPB—to strengthen stunting prevention behaviors among health cadres. To date, most stunting prevention interventions in Indonesia have focused on technical and medical approaches, while behavior-based strategies grounded in robust theoretical frameworks remain scarce, particularly those combining two behavioral theories within a single module (12).

Furthermore, this research not only assesses knowledge levels but also measures changes in risk perception, intention, subjective norms, and behavioral control, providing comprehensive empirical evidence on the effectiveness of behavioral models in community empowerment in rural settings. This study enriches global literature by offering a dual-theory approach to community-based empowerment for child nutrition issues, which has predominantly been applied in the prevention of non-communicable diseases (13,14).

METHOD

This study employed a quasi-experimental design with a non-equivalent control group pretest-posttest approach (15):

Research Type

This study employed a quasi-experimental design with a non-equivalent control group and a pretest–posttest approach. The design was selected to evaluate the effectiveness of a community empowerment model based on the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) in improving preventive behaviors among Posyandu cadres. Both intervention and control groups underwent baseline measurements (pretest) prior to the intervention, followed by the intervention applied only to the intervention group, and final measurements (posttest) conducted one month later (16).

Research Location

The research was conducted in Magetan Regency, East Java Province, Indonesia. The intervention group was located in Panekan Sub-district, while the control group was in Plaosan Sub-district. The study was carried out from January to September 2023.

Population and Sample

The study population comprised all Posyandu cadres residing in Panekan and Plaosan sub-districts, totaling 400 individuals. Inclusion criteria were: (1) willingness to participate, (2) cooperative attitude, and (3) residence within the study area. From this population, 200 respondents were recruited proportionally from each sub-district. Because group allocation was determined by geographic location (Panekan = intervention, Plaosan = control),

randomization was not feasible. Instead, within each sub-district, participants were selected using simple random sampling to ensure representativeness of cadres in that area. Thus, the sampling procedure combined cluster-based allocation by sub-district with random selection within clusters (12), which is appropriate for a non-equivalent control group design.

Variables

The independent variables in this study were empowerment training modules based on the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB). The dependent variables were cadres' cognitive and behavioral outcomes related to stunting prevention, operationalized through the canonical constructs of the HBM (perceived vulnerability, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action) and the TPB (attitude, subjective norms, perceived behavioral control, intentions, and preventive behavior).

Intervention

The intervention group received training based on a community empowerment model integrating HBM and TPB. Training modules included understanding stunting risks, benefits of prevention, enhancing self-efficacy, reducing behavioral barriers, and strengthening intention through behavioral planning. The control group did not receive any comparable intervention during the study period.

Instrumentation or Tools

Data were collected using a structured questionnaire developed based on the canonical constructs of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB). The instrument covered HBM dimensions including perceived susceptibility, perceived severity, perceived benefits, cues to action, and self-efficacy, as well as TPB dimensions such as attitudes toward behavior, subjective norms, perceived behavioral control, intention, and preventive behavior. Items were adapted from previously validated instruments developed by Champion & Skinner and Rosenstock for HBM constructs, and from locally validated studies on maternal and community health behaviors in Indonesia for TPB constructs.

The development process followed WHO guidelines for cultural adaptation, including forward–backward translation, expert panel review, and pilot testing to ensure clarity and cultural relevance. Each construct was measured using a 5-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Representative items included: “I believe that children under five are susceptible to stunting if they do not receive adequate nutrition” (perceived susceptibility) and “I intend to actively provide stunting prevention education to families in my community” (behavioral intention).

The questionnaire underwent content validation by public health experts and was pilot-tested among 30 Posyandu cadres prior to the main study, yielding Cronbach’s alpha values greater than 0.70 for all subscales. This instrument enabled a comprehensive assessment of psychosocial and behavioral factors related to stunting prevention, extending beyond previous studies that examined only one or two constructs of HBM or TPB.

Data Collection Procedures

Data were collected by trained enumerators under the supervision of public health officers at local community health centers (Puskesmas). Respondents, who were Posyandu cadres, completed the structured questionnaire after receiving a clear explanation of the study objectives and procedures, and after signing written informed consent. Prior to data collection, enumerators were trained to ensure consistency in administering the instrument and to minimize interviewer bias. The process adhered strictly to research ethics, including respect for participant autonomy, confidentiality, and voluntary participation.

To enhance data quality, questionnaires were administered in a controlled setting immediately following the cadre empowerment training sessions, ensuring that responses reflected the intended constructs of the *Health Belief Model* (HBM) and the *Theory of Planned Behavior* (TPB). Supervision by health officers and the use of standardized instructions further strengthened the reliability of the data collection process.

Data Analysis

Data analysis included descriptive statistics to summarize respondents' characteristics and inferential analysis using independent samples t-test to assess the effectiveness of the intervention between groups. Statistical significance was set at $p < 0.05$ (17,18).

Ethical Approval

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya, Indonesia (Approval No.:EA/1796/KEPK-Poltekkes_Sby/V/2023, June 19, 2023). Informed consent was obtained from all participants prior to data collection, and confidentiality of the participants' information was strictly maintained throughout the study.

RESULT

Description of the Study Location

Magetan Regency, East Java, has set a target to achieve stunting-free status by 2024, with a stunting prevalence of 10.15% (2,504 children under five) in 2021, which is considered relatively low at the national level. The local government has implemented various strategies, including community education programs and strengthening the role of Posyandu cadres in priority areas, particularly Panekan and Plaosan Districts of Magetan Regency.

Respondent Characteristics Data

Table 1. Characteristics of Respondents (n = 200)

Characteristics	Category	Group		p-value
		Intervention Group (n = 100)	Control Group (n = 100)	
Age (years)	21–25	4 (8.0%)	5 (10.0%)	0.001
	26–30	5 (10.0%)	13 (26.0%)	
	31–35	19 (38.0%)	18 (36.0%)	
	36–40	30 (60.0%)	21 (42.0%)	
	41–45	24 (48.0%)	24 (48.0%)	
	46–50	11 (22.0%)	14 (28.0%)	
	51–55	3 (6.0%)	5 (10.0%)	
	56–60	4 (8.0%)	0 (0.0%)	
Religion	Islam	100 (100.0%)	100 (100.0%)	-
Education	Primary	44 (44.0%)	66 (66.0%)	0.001
	Secondary	49 (49.0%)	34 (34.0%)	
	Higher	7 (7.0%)	0 (0.0%)	
Occupation	Housewife	55 (55.0%)	43 (43.0%)	0.001
	Farmer	15 (15.0%)	15 (15.0%)	
	Civil Servant	1 (1.0%)	42 (42.0%)	
	Private Sector	29 (29.0%)	0 (0.0%)	
Years of Service	1–5 years	47 (47.0%)	37 (36.0%)	0.001
	6–10 years	25 (25.0%)	23 (23.0%)	
	11–15 years	11 (11.0%)	16 (16.0%)	
	16–20 years	9 (9.0%)	12 (12.0%)	
	21–25 years	5 (5.0%)	6 (6.0%)	
	26–30 years	1 (1.0%)	5 (5.0%)	
	31–35 years	2 (2.0%)	2 (2.0%)	

Table 1 provides an overview of the respondents' characteristics. A total of 200 Posyandu cadres participated in this study, divided into an intervention group (n = 100) and a control group (n = 100). Most respondents were in the productive age group, with the highest distribution in the 36–45-year range. All respondents were Muslim. The majority had a secondary education level, although some participants, particularly in the control group, had only primary education. In terms of occupation, most respondents were housewives, followed by farmers, with a higher proportion of civil servants (PNS) in the control group. Regarding years of service, the majority had been cadres for 1–10 years. The chi-square test indicated no significant differences between the intervention and control groups in baseline variables ($p > 0.05$), allowing for an equivalent comparison between the two groups.

Comparative Data of Pretest and Posttest in Groups

Table 2. Comparison of Pretest and Posttest Scores within Intervention and Control Groups

Variable	Group	Pretest Mean (SD)	Posttest Mean (SD)	p-value (Paired t-test)
Perceived Symptoms	Intervention	12.03 (0.99)	20.82 (2.02)	< 0.001
	Control	11.95 (0.94)	16.47 (1.47)	< 0.001
Perceived Strength	Intervention	12.06 (0.99)	20.83 (2.01)	< 0.001
	Control	11.97 (0.94)	16.62 (1.52)	< 0.001
Perceived Threat	Intervention	12.06 (0.96)	21.05 (1.81)	< 0.001
	Control	12.06 (0.95)	16.45 (1.54)	< 0.001
Perceived Benefits	Intervention	12.09 (1.01)	21.03 (1.83)	< 0.001
	Control	12.10 (1.00)	16.71 (1.74)	< 0.001
Cues to Action	Intervention	12.00 (1.04)	20.92 (1.86)	< 0.001
	Control	12.08 (1.00)	17.07 (2.02)	< 0.001
Preventive Behavior	Intervention	12.11 (1.06)	21.10 (1.87)	< 0.001
	Control	12.13 (0.97)	17.24 (1.97)	< 0.001
Attitude	Intervention	12.04 (0.99)	20.87 (1.95)	< 0.001
	Control	12.05 (0.97)	16.35 (1.40)	< 0.001
Intention	Intervention	12.08 (1.04)	20.91 (1.94)	< 0.001
	Control	12.00 (0.96)	16.27 (1.59)	< 0.001
Subjective Norm	Intervention	12.09 (1.09)	20.96 (1.88)	< 0.001
	Control	11.91 (0.91)	16.35 (1.42)	< 0.001
Social Influence	Intervention	12.15 (1.13)	21.07 (1.83)	< 0.001
	Control	12.12 (0.99)	16.57 (1.54)	< 0.001
Stunting Prevention	Intervention	12.20 (1.13)	21.08 (1.84)	< 0.001
	Control	12.17 (1.02)	16.61 (1.63)	< 0.001
Behavioral Control	Intervention	12.02 (1.05)	20.98 (1.85)	< 0.001
	Control	12.18 (1.05)	16.80 (1.87)	< 0.001

Table 2 shows a comparison of pretest and posttest scores in the intervention and control groups. Paired-sample t-test analysis revealed significant improvements in all canonical HBM and TPB constructs in the intervention group ($p < 0.001$), including perceived susceptibility, perceived severity, perceived benefits, cues to action, self-efficacy, attitudes, subjective norms, perceived behavioral control, intentions, and preventive behaviors. For example, the preventive behavior score increased from 12.11 (SD = 1.06) in the pretest to 21.10 (SD = 1.87) in the posttest. Similar improvements were also seen in cognitive variables such as perceived benefits and intentions, consistent with the TPB prediction that intensity is a strong predictor of behavior.

Meanwhile, the control group also showed improvements in several variables, but the magnitude of the changes was much smaller than in the intervention group. This confirms that behavioral improvements did not stem solely from routine Posyandu interactions, but rather from a structured, theory-based intervention. Thus, the results of Table 2 provide initial evidence that the integration of HBM and TPB in cadre training effectively improves cognitive and behavioral aspects related to stunting prevention.

Inter-Group Comparison Data on Posttest

Table 3. Comparison of Posttest Scores Between Intervention and Control Groups

Variable	Intervention Group (n=100) Mean (SD)	Control Group (n=100) Mean (SD)	p-value (Independent t-test)
Perceived Symptoms	20.82 (2.02)	16.47 (1.47)	< 0.001
Perceived Strength	20.83 (2.01)	16.62 (1.52)	< 0.001
Perceived Threat	21.05 (1.81)	16.45 (1.54)	< 0.001
Perceived Benefits	21.03 (1.83)	16.71 (1.74)	< 0.001
Cues to Action	20.92 (1.86)	17.07 (2.02)	< 0.001
Preventive Behavior	21.10 (1.87)	17.24 (1.97)	< 0.001
Attitude	20.87 (1.95)	16.35 (1.40)	< 0.001
Intention	20.91 (1.94)	16.27 (1.59)	< 0.001
Subjective Norm	20.96 (1.88)	16.35 (1.42)	< 0.001
Social Influence	21.07 (1.83)	16.57 (1.54)	< 0.001
Stunting Prevention	21.08 (1.84)	16.61 (1.63)	< 0.001
Behavioral Control	20.98 (1.85)	16.80 (1.87)	< 0.001

Table 3 presents a comparison of posttest scores between the intervention and control groups. Independent samples t-test analysis revealed significant differences ($p < 0.001$) across all canonical HBM and TPB constructs. The intervention group scored higher than the control group, particularly on preventive behavior (21.10 vs. 17.24), perceived susceptibility and perceived severity (previously labeled as "symptoms" and "strength/threat"), perceived benefits (21.03 vs. 16.71), and behavioral intention (20.91 vs. 16.27).

These differences confirm that HBM- and TPB-based training systematically improved the cognitive and behavioral aspects of Posyandu cadres compared to the conventional approach. Improvements in attitudes, subjective norms, and perceived behavioral control are also consistent with the TPB framework, which emphasizes that intentions and social norms are strong predictors of actual behavior.

While these results provide empirical support for the effectiveness of dual theory interventions, interpretations regarding the sustainability of the impact should be approached with caution given the short follow-up period. Thus, Table 3 strengthens the initial evidence that the integration of HBM and TPB in cadre empowerment programs can be a potential strategy to strengthen stunting prevention at the community level, while highlighting the need for longitudinal research to assess long-term effectiveness.

DISCUSSION

Table 1, the demographic distribution of Posyandu cadres in this study—primarily within the productive age range (36–45 years), predominantly having secondary education, and the majority working as housewives—aligns with findings from national studies indicating that cadres with secondary education levels tend to be more active and effective in performing community health tasks (19). Adequate formal education enhances cadres' analytical and communication skills, thereby supporting the effectiveness of stunting prevention counseling (20).

The role of cadres as the front line of stunting prevention is emphasized in the literature, which underscores the importance of empowering cadres through behavior theory–based training (with Posyandu cadres serving as key educational agents in communities). Suitable characteristics—productive age, secondary education, and adequate experience—create a strong foundation for applying the Health Belief Model and Theory of Planned Behavior in the intervention, as evidenced by studies that successfully improved cadres' knowledge and behaviors in the context of stunting prevention (20). These findings are consistent with systematic reviews confirming the effectiveness of cadre-based educational interventions in reducing stunting (24).

The present study provides preliminary evidence of the effectiveness of integrating the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) into cadre empowerment training for stunting prevention. The intervention significantly improved cadres' cognitive constructs and preventive behaviors, aligning with international evidence that theory-driven approaches can strengthen health promotion strategies in diverse contexts

(20,21,24,25,27,28). By systematically applying both HBM and TPB, this study contributes to the growing body of literature supporting dual-theory interventions in community health.

However, the interpretation of these findings requires caution. One potential limitation is response bias, as cadres may have provided socially desirable answers during posttest assessments. Awareness of being evaluated could have influenced their responses, leading to inflated improvements in reported behaviors. While self-report measures are common in behavioral research, future studies should incorporate triangulation methods such as direct observation, supervisor ratings, or objective indicators of cadre performance to reduce bias and strengthen the validity of outcomes (27,28).

Another consideration is the role of contextual influences. The supportive environment of local health centers, supervision by midwives, and prevailing community norms may have amplified the effects of the intervention. These contextual factors are integral to the functioning of Posyandu but complicate the attribution of outcomes solely to the training modules. Multi-site studies across different regions with varying levels of institutional support would help clarify the extent to which contextual factors shape intervention effectiveness (27).

The possibility of confounding variables also warrants attention. Cadres' prior experience, educational background, and intrinsic motivation were not fully controlled in this study, yet these factors may have influenced responsiveness to the intervention. For instance, cadres with stronger baseline knowledge or higher community engagement may have been more likely to adopt preventive behaviors. Future research should employ stratified analyses or adjust for these variables to better isolate the effects of the theoretical training (20).

A further limitation is the short follow-up period of one month, which restricts conclusions about the sustainability of observed changes. Behavioral modifications are often dynamic and subject to relapse, particularly in resource-constrained settings. Without longitudinal data, it remains uncertain whether cadres will maintain improved practices over time or whether reinforcement strategies are required. Longer-term evaluations, ideally spanning six months to one year, are essential to assess the durability of intervention outcomes and their potential impact on stunting prevalence (21,24,25).

Despite these limitations, the study offers novel empirical support for the integration of HBM and TPB in cadre-based stunting prevention programs. This dual-theory approach provides a more comprehensive framework for addressing both cognitive and social determinants of health behavior. The findings highlight Indonesia's unique contribution to advancing theory-driven strategies in community health, with implications for other low- and middle-income countries (29,30). Future research should adopt more rigorous designs, including randomized controlled trials, multi-level analyses, and extended follow-up, to confirm the robustness and scalability of these results.

The findings of this study provide preliminary evidence that integrating the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) into Posyandu cadre empowerment programs can strengthen stunting prevention at the community level. For health policymakers, this highlights the importance of incorporating theory-based training modules into national and local strategies to enhance cadres' cognitive and behavioral capacities (31-33). Embedding such approaches into routine Posyandu activities has the potential to overcome behavioral barriers and improve program sustainability. However, given the short follow-up period, long-term monitoring and evaluation are required before large-scale implementation. Policy support in the form of resource allocation, longitudinal research, and integration of psychosocial frameworks into maternal and child health programs will reinforce the impact of this intervention (34,35).

This study contributes to the growing body of international evidence on the effectiveness of dual-theory–based interventions by integrating the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) within the framework of empowering Posyandu cadres for stunting prevention. Previous international studies have applied HBM and TPB in diverse contexts, such as proactive health behaviors in China (2025), COVID-19 prevention in Indonesia (2020), maternal nutrition education in Ethiopia (2024), and healthy eating behaviors in Turkey (2021). However, very few studies have systematically examined the integration of these two theories in community-based stunting prevention programs, particularly through the health cadre approach. By situating the findings of this research within the broader global literature, the study provides new empirical support for the application of dual-theory approaches in cadre-based nutrition interventions. Indonesia's unique contribution lies in the development of a cadre empowerment model that not only enhances cognitive and behavioral aspects but also underscores the

potential of integrating HBM and TPB as a theory-driven strategy to accelerate stunting reduction at the community level.

CONCLUSION

This study provides preliminary evidence that applying the *Health Belief Model* (HBM) and the *Theory of Planned Behavior* (TPB) through Posyandu cadre training is associated with improvements in cognitive and behavioral aspects of stunting prevention. The intervention demonstrated potential in addressing behavioral barriers and strengthening preventive practices at the community level. However, given the quasi-experimental design and the relatively short follow-up period, conclusions regarding the sustainability of behavioral changes and broader population-level impact should be interpreted with caution. These findings are best regarded as initial evidence supporting the integration of HBM and TPB into community health cadre empowerment programs, with future longitudinal research recommended to evaluate long-term effectiveness and scalability.

AUTHOR'S CONTRIBUTION STATEMENT

Agung Suharto contributed to the study conception, design, and coordination of the research process. Budi Joko Santosa was responsible for data analysis, interpretation of findings, and critical review of the manuscript. Suparji contributed to data collection, literature review, drafting, and final preparation of the manuscript. All authors read and approved the final version of the manuscript.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest related to the research, authorship, or publication of this article.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

Not applicable.

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