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Associations Between Community Health Worker Capacity and Stunting Reduction Efforts in South Central Timor, Indonesia

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ARTICLE INFO	ABSTRACT
	Introduction: Malnutrition, particularly childhood stunting, remains a critical issue in Indonesia, including the South-Central Timor (SCT) District, East Nusa Tenggara Province. Stunting affects 149.2 million children under five years globally. In the SCT District (2025), stunting prevalence reached 41%. Climatic conditions, food insecurity, and cultural factors contribute to this problem. Prevention efforts involve national strategies, including behavioral change communication campaigns, with Community Health Workers (CHWs) playing crucial roles due to their community credibility and responsiveness. CHW participation is voluntary without continuous commitment obligations. CHW activity and roles in stunting reduction acceleration are paramount, necessitating the investigation of influencing factors. This study aims to identify the factors associated with the roles of Community Health Workers (CHWs) in accelerating stunting reduction in the SCT District in 2025.
	Methods: This quantitative cross-sectional study included 124 CHWs from 10 community health centers in the SCT District. The study was conducted from January to May 2025. Separate questionnaires measured each variable (CHW role, knowledge, and skills). Ethical approval was obtained from the Kupang Health Polytechnic Research Ethics Committee. **Results:** Bivariate analysis revealed that knowledge level, education, training history, work duration (all p<0.001), and CHW skills (p=0.002) were significantly associated with CHW roles. The final model showed training history increased CHW role effectiveness by 45.3 times (OR=45.354; 95% CI=1.634-1258.56), CHW skills by 44.3 times (OR=44.393; 95% CI=2.721-724.36), and work duration by 16.9 times (OR=16.934; 95% CI=1.280-224.02). **Conclusion:** Training, skill level, and work duration were associated with higher CHW role performance, supporting improved stunting prevention efforts. This study provides a new understanding of the importance of enhancing CHW knowledge and skills through structured/routine training programs. Further research comparing CHW capacity in low versus high stunting areas is important for understanding CHW capacity management program improvements.

INTRODUCTION

According to WHO (1986), a Community Health Worker (CHW) is a man or woman chosen by the community and trained to handle individual and community health problems while working closely with primary healthcare facilities (1). CHWs are appropriate volunteers for community efforts as they originate from the community, know local conditions, are respected and trusted by the community, ensuring their advice and guidance will be heard and followed (2).

CHWs have an important influence in communities as they are closer to the environment and people in their work areas. CHW roles are crucial as they are responsible for implementing community health center programs. CHWs can help communities reduce malnutrition and stunting rates while also helping reduce maternal and under-five mortality rates (3).

The role of CHWs can be better understood by situating them within global health policy guidance and theoretical perspectives on community health systems. The *WHO Guideline on Health Policy and System Support to Optimize Community Health Worker Programmes* emphasizes that addressing health workforce shortages and performance challenges is essential for achieving universal health coverage. Within this context, CHWs are recognized as an important component of a diverse and sustainable skills mix, particularly when they operate as part of interprofessional primary care teams. However, the guideline underscores that support for CHWs and their integration into health systems and communities remain uneven across settings. Effective CHW programmes therefore require evidence-based models for education, deployment, and management, grounded in a systematic assessment of population needs, health system requirements, and resource implications. The role of CHWs must also be defined in relation to other health workers to ensure appropriate integration into both the formal health system and existing community structures (4).

Complementing this policy perspective, the Community Health System (CHS) framework conceptualizes community health not as a set of isolated activities but as a dynamic system involving diverse actors, relationships, and contextual influences. CHS theory highlights that actors include not only formal health providers and volunteers but also informal caregivers, community intermediaries, other government sectors, and representative structures. CHWs occupy a unique position in this system because they simultaneously belong to the community and the health sector, and thus must navigate the expectations of both (5).

Having discussed CHW roles using the above framework, it is important to emphasize that the core of this study was to know if the quality of CHWs contribute to the acceleration of stunting reduction. Various research results prove that CHW empowerment effectively improves maternal knowledge, attitudes, and practices while enhancing child and family nutritional status (6). CHW empowerment is conducted through various models, from counseling and direct practice in using weight and height measurement tools for under-fives to preparing complementary feeding from local ingredients. As a result, CHWs are better equipped with the skills and capacity needed for early detection and timely intervention in stunting cases (7). More systematic and regular empowerment programs are needed for CHWs to control stunting incidence rates among Indonesian under-fives (8). Therefore, CHWs should possess correct knowledge, skills, and understanding related to community health. These crucial CHW roles need to be balanced with good knowledge about balanced nutrition, particularly for pregnant women. Correct information received by pregnant women from CHWs can help improve maternal and child health through anemia prevention, chronic energy deficiency, and other malnutrition problems. Their participation and activity are expected to mobilize community participation.

However, CHW presence and roles are relatively unstable as their participation is voluntary without regular payment, providing no guarantee they will continue functioning as expected. When family or other interests arise, community health centers are abandoned. Community health center work is service-oriented without official obligations. As a sector influencing stunting management, we consider it necessary to investigate whether CHW roles contribute significantly to stunting reduction acceleration. Existing CHWs vary in education, age, marital status, employment status, work duration, training frequency, participation, and skills. Identifying the most influential factors will provide future information for preparing programs to enhance CHW capacity. This study aims to identify dominant factors influencing CHW roles in the South-Central Timor District, East Nusa Tenggara Province, Indonesia.

METHOD
Research Design

This study employed a quantitative cross-sectional research design to identify and analyze the factors associated with the roles of Community Health Workers (CHWs) in accelerating stunting reduction in the SCT District in 2025. TTS Regency has 30 community health centers. The 10 selected with inclusion criteria were those with the highest stunting cases, easily accessible locations, and a minimum of 10 integrated health post (Posyandu) cadres. Exclusion criteria were areas that were difficult to reach and had fewer than 10 cadres.

Population and Sample

The accessible population and sample comprised 124 CHWs working in the SCT District from 10 community health centers. Inclusion criteria included: willingness to participate, cooperation, registration as CHWs in health center data, and residence in the SCT District. The study was conducted from January to May 2025.

Research Location

This study was conducted in the SCT District, a district with the highest poverty rates in East Nusa Tenggara and high population numbers. Participating CHWs came from 10 health centers: Binaus, Fatumnasi, Tetaf, Nulle, Siso, Kapan, Batu Putih, Niki-Niki, Kota Soe, and Oenino.

Instrumentation

Separate questionnaires measured each variable (CHW role, knowledge, and skills). Each questionnaire consisted of 20 questions. Definition of the role of a cadre is Concrete actions of cadres according to standards (five Posyandu tables, PWS, advocacy, collaboration) and a focus on the frequency and consistency of routine task implementation, reporting, coordination with midwives/Community Health Centers, and community mobilization efforts. Knowledge means Cognitive understanding of stunting, specific nutrition (1000 HPK), signs of malnutrition, and specific/sensitive interventions, with a focus on accurate information regarding causes, long-term impacts, referral procedures, and immunization/vitamin schedules. Cadre skills means Practical technical and interpersonal skills in carrying out Posyandu duties, with a focus on accurate anthropometric measurements (weight, height, and LiLA), communication skills (education/counseling), and form completion/data recording.

Cadre Knowledge Measurement (20 Items). Format: Multiple Choice or True/False (Dichotomous). Scoring: Correct Answer = 1 Point; Incorrect Answer = 0 Points. Scoring Range: Minimum Score 0, Maximum Score 20. Determination of Final Thresholds: Good; score >16 (>80%), and Poor; score <16 (<80%). Psychometric Criteria: Content Validity: Must be assessed by at least 5 experts (Nutrition/Public Health) to ensure all aspects of stunting knowledge are represented. Construct Validity (Item-Total Correlation): Each item must have an item-total correlation of at least 0.30 (tested through a Pilot Test).

Cadre Skills Measurement (20 Items). Format: 4-Point Likert Scale (measures frequency or quality of implementation). Response Options: (4) Always/Very Appropriate, (3) Often/Appropriate, (2) Sometimes/Less Appropriate, (1) Never/Not Appropriate. Scoring: Minimum Score 20, Maximum Score 80 (20 x 4) Psychometric Criteria; Content Validity: Must be assessed by an expert who focuses on Posyandu Standard Operating Procedures (SOP). Internal Reliability: Cronbach's Alpha Coefficient (α) for this dimension must be > 0.70%. Threshold Determination (Skilled / Unskilled); Skilled; Score > 60, Unskilled; Score 0.60.

Measurement of the Role of Cadres (20 Items). Format: 4-Point Likert Scale (measures frequency of involvement or implementation). Response Options: (4) Always, (3) Often, (2) Sometimes, (1) Never. Scoring: Minimum Score 20, Maximum Score 80 (20 x 4). Psychometric Criteria; Content Validity: Must be assessed by policy makers (e.g., Community Health Center Coordinators) to ensure items reflect official role expectations. Construct Validity (Factor Analysis): EFA/CFA must demonstrate that these items cluster distinctly from Skills. Threshold Determination (Active/Inactive). Active >64%; Inactive <64%.

Before use, validity and reliability tests were conducted with 20 respondents. CHW role validity results showed r-count values (0.503-0.904) greater than r-table values (0.497), with reliability testing yielding alpha values of 0.960, exceeding the acceptable threshold of 0.60. For knowledge, validity test r-count values (0.873-0.968) also exceeded

r-table values, with reliability test alpha values of 0.988, exceeding the threshold. CHW skill validity testing showed r-count values (0.512-0.941) greater than r-table values, with reliability alpha values of 0.970.

Data Collection

Data collection was conducted directly with respondents using questionnaires. Structured interviews with closed questions were directed to CHWs. Secondary data on stunting incidence percentages were obtained from monthly weighing data from the SCT District Health Office. Data collection followed ethical principles, including confidentiality, privacy, and autonomy. Respondents provided informed consent by signing consent forms before study initiation.

Data Analysis

Respondent characteristics were analyzed using descriptive statistics. Research variables were analyzed univariately to examine frequency distributions of age, gender, marital status, employment status, CHW role, work duration, CHW training, CHW education, knowledge, and skills. Bivariate analysis used chi-square tests, while multivariate analysis used logistic regression to identify dominant factors in CHW roles for stunting management and reduction acceleration. Data were analyzed using IBM SPSS version 27.

Ethical Approval

This research obtained permits from Kupang City Government with research permit number 070/2339/DPMPTSP.4.3/06/2024 and ethical approval from Kupang Health Polytechnic Research Ethics Committee number LB.02.03/1/0232/2024. Willing respondents signed consent forms, with names and identities kept confidential by researchers.

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RESULTS

Stunting incidence continued increasing in the SCT District from 2023-2025, reaching 38.83% in 2024 (September) and rising to 42% in 2025 (March) (Table 1).

Table 1. Stunting Incidence in SCT District 2024-2025

Year/Month	Total Under-fives	Wasting	Under Weight	Stunting	Stunting Percentage
Sept 2024	34,333	3,935	10,976	13,333	38.83%
Feb 2025	32,092	4,176	11,309	13,223	41.21%
Mar 2025	32,093	4,005	11,316	13,572	42%

Source: SCT District Health Office Data

The 42% rate represents the average from 13 health centers in the SCT District. Notably, 5 health centers still reported stunting incidence above 50%. The highest incidence was at Sei Health Center (61.49%), followed by Fatukopa Health Center (59.95%) (Table 2).

Table 2. Five Health Centers with the Highest Stunting Rates

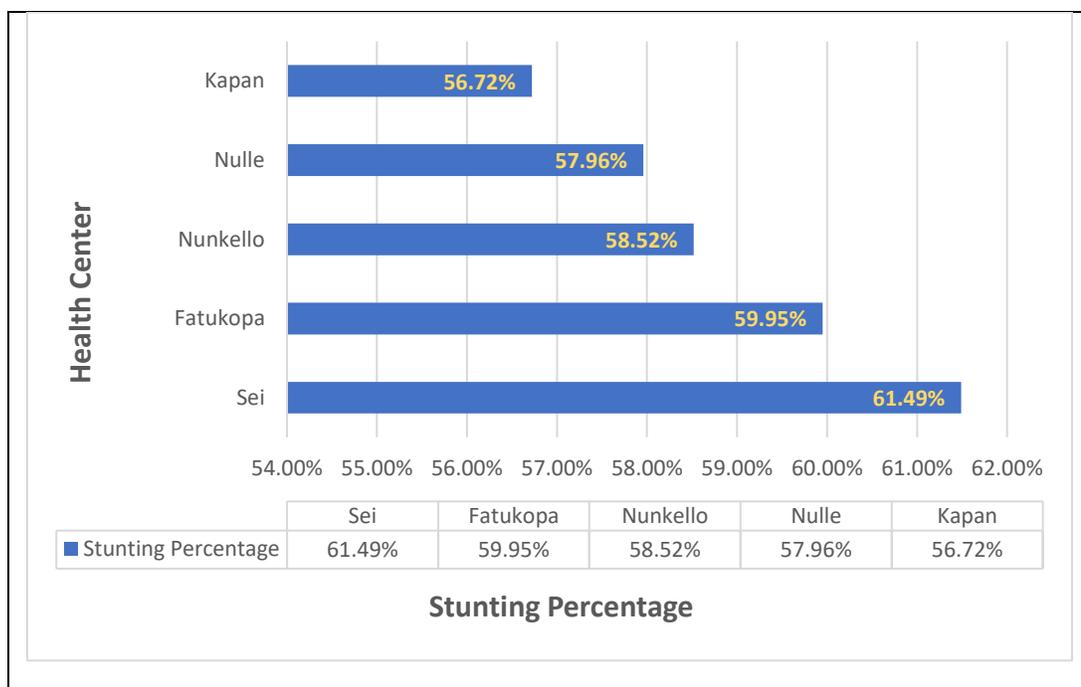| No	Health Center	Stunting Percentage
1	Sei	61.49%
2	Fatukopa	59.95%
3	Nunkello	58.52%
4	Nulle	57.96%
5	Kapan	56.72%

Figure 1. Five health centers with the highest stunting rates.
Source: SCT District Health Office Data

To measure CHW roles in stunting management and reduction, and influencing factors, we interviewed 124 respondents. Respondent characteristics were as follows: age 51-60 years (30.65%), followed by 30-40 years (20.16%), with notable participants >70 years (10.48%), predominantly female respondents (66.94%), with interesting male participation (33.06%) willing to serve as CHWs. Most were married (63.71%) with housewife status (63.71%) (Table 3).

Univariate analysis of CHW roles showed active CHWs (50.8%) and less active (49.2%), good CHW knowledge (51.6%) and poor (48.4%). Notably, most CHWs had low education (73.4%) versus high education (26.6%), most had attended training (71%) versus never (29%). Work duration was predominantly >5 years (70.2%) versus <5 years (29.8%). CHW skill measurements showed most were skilled (71%) versus less skilled (29%) (Table 3).

Table 3. CHW Demographic Characteristics

Characteristics	Frequency (n)	Percentage (%)
Age		
- 30 - 40 years	25	20.16
- 41 - 50 years	35	18.23
- 51 - 60 years	38	30.65
- 61 - 70 years	13	10.48
- >70 years	13	10.48
Gender		
- Female	83	66.94
- Male	41	33.06
Marital Status		
- Married	79	63.71
- Unmarried	45	36.29
Employment Status		
- Housewife	79	63.71
- Employed	45	36.29

Characteristics	Frequency (n)	Percentage (%)
CHW Role		
- Active	63	50.8%
- Less Active	61	49.2%
CHW Knowledge		
- Good	64	51.6%
- Poor	60	48.4%
CHW Education		
- High	33	26.6
- Low	91	73.4
CHW Training		
- Ever	89	71%
- Never	36	29%
CHW Work Experience		
- <5 years	37	29.8%
- >5 years	87	70.2%
CHW Skills		
- Skilled	88	71%
- Less Skilled	36	29%

Source: Primary research data

Subsequently, relationship analysis between CHW roles and independent variables showed all variables had correlations (Table 4). Knowledge level ($p<0.001$), education ($p<0.001$), training history ($p<0.001$), work duration ($p<0.001$), and CHW skills ($p=0.002$) showed significance (Table 4).

Table 4. Bivariate Test Results: Relationship Between CHW Roles and Other Variables

Variable		CHW Role Active	Less Active	p-value
Knowledge	Good	60 (48.4%)	4 (3,2%)	<0.001*
	Poor	3 (30.5%)	57 (29.5%)	
Education	High	2 (16.8%)	31 (16.2%)	<0.001*
	Low	61 (46.2%)	30 (44.8%)	
Training	Ever	60 (44.7%)	28 (43.3%)	<0.001*
	Never	3 (18.3%)	33 (17.7%)	
Work Duration	>5 years	46 (44.2%)	41 (42.8%)	<0.001*
	<5 years	17 (18.8%)	20 (18.2%)	
Skills	Skilled	51 (44.7%)	37 (43.3%)	0.002*
	Less Skilled	12 (18.3%)	24 (17.7%)	

*$p<0.05$ (significant). n = 124 respondent Source: Primary research data

To identify the most influential variables, multivariate analysis was conducted (Table 5). The final model showed training history influenced CHW roles by 45.3 times (OR=45.354; 95% CI=1.634-1258.56), CHW skills by 44.3 times (OR=44.393; 95% CI=2.721-724.36), and work duration by 16.9 times (OR=16.934; 95% CI=1.280-224.02) in improving CHW roles.

Table 5. Final Multivariate Model

Model	Unstandardised Coefficients		Standardised Coefficients		Exp (B)	95% CI (lower-upper)	Sig (p value)
	B	Std Error	Df	Wald			
Training	3.814	1.696	1	5.061	45.354	(1,634-1258,56)	0.024*
Work Duration	2.829	1.318	1	4.611	16.934	(1,280-224,02)	0.032*
CHW Skills	3.793	1.425	1	7.089	44.393	(2,721-724,36	0.008*

$p<0.05$ (significant). Dependent Variable: CHW Role. *n = 124 respondent*

DISCUSSION

Our study results show that training history influenced CHW roles by 45.3 times (OR=45.354; 95% CI=1.634-1258.56), CHW skills by 44.3 times (OR=44.393; 95% CI=2.721-724.36), and work duration by 16.9 times (OR=16.934; 95% CI=1.280-224.02) in supporting stunting reduction efforts in the SCT District. Our findings prove that training, work duration, and CHW skills play important roles. Efforts to improve CHW knowledge and skills through training have become primary recommendations in stunting management acceleration. Previously in the SCT District, CHWs functioned only to weigh children, measure height, and record data in registers. Subsequently, CHWs were involved in supplementary feeding programs for stunted children. Our research proves that efforts such as routine training, workshops, courses, and regular learning classes are needed to enhance CHW capacity.

Our study aligns with several previous studies revealing similar findings, including statements that stunting reduction acceleration is influenced by improved CHW roles (9), knowledge (10), and attitudes (11)(12), and it is also inseparable from parental roles, family welfare movement team roles, and nurse/midwife roles(10)(13). Relationships were found between knowledge factors, work duration, skills, and training with the roles of CHW in stunting prevention efforts(14)(15).

CHW participation affects under-five nutritional status, meaning higher CHW roles correlate with higher malnutrition reduction rates in under-fives(16)(17). Studies also show CHW communication influences stunting prevention efforts (OR=18.40), meaning communicating CHWs are 18 times better at behavioral change efforts for stunting prevention, and mobilization variables (OR=41.23), meaning mobilizing CHWs are 41 times better at behavioral change efforts for stunting prevention (18). Other studies provide different results showing that knowledge and performance of long-serving CHWs are not significantly meaningful for stunting reduction. CHW motivation is known to dominantly influence CHW performance (19).

CHWs are frontline workers directly interacting with communities at the most basic level of community health centers (20). Without adequate knowledge and skills, they cannot effectively perform their duties, ultimately hampering stunting prevention programs. CHWs with good knowledge and skills can conduct early stunting detection through accurate anthropometric measurements (weight, length/height) (11)(21). Accurate measurement is crucial for detecting early stunting signs in under-fives. Measurement errors can cause unidentified stunting cases, delaying intervention (22).

CHWs serve as trusted informants for communities. With high knowledge, they can provide correct education and counseling to pregnant women and parents regarding balanced nutrition, the importance of exclusive breastfeeding, appropriate complementary feeding, and environmental hygiene (23). They can also become motivators, encouraging positive behavioral changes in communities. Trained CHWs can regularly monitor child growth and development. When under-fives with growth problems are found, they can immediately be referred to health facilities like health centers for further medical personnel intervention. They can also provide continuous support to families with stunted children (24) .

Competent CHWs can effectively collaborate with midwives, health center staff, and other related teams. They can convey accurate field data and information, making stunting intervention program planning and implementation more targeted (25). This collaboration is crucial for ensuring all stunting reduction efforts work synergistically. In summary, CHW knowledge and skills directly correlate with community stunting prevention program effectiveness. Better CHW capacity increases program success opportunities (24)(26).

Theoretically, this study is grounded in the Socio-Ecological Model, which recognizes that health outcomes (such as stunting) are influenced by interactions between the individual, interpersonal, community, and structural environments. CHWs are uniquely positioned at the intersection of the interpersonal and community levels, enabling them to facilitate behavior change at the household level while simultaneously mobilizing support at the village/community level (4,5).

Although our study gives information on the importance of training, work duration, and CHW skills in supporting the acceleration of stunting reduction, these findings may have limitations. First, in applications outside the SCT District, this research is contextual/local. Although this study has potential implications for enhancing CHW capacity in childhood stunting prevention, applying these results as policies in other areas may be difficult, as local variations in resources, infrastructure, and community needs are not considered (15). Second, stunting management requires complex and multifactorial approaches. Stunting requires coordinated efforts from various sectors, including

government and private institutions (10)(27). The absence of comprehensive multi-sectoral approaches and structured education and health promotion strategies can hinder widespread stunting management application and effectiveness (28).

Another limitation we encountered in this study relates to the statistical instability of the Odds Ratio (OR) estimates for the variable [Name the Variable in Question, e.g., History of Rare Disease]. The logistic regression analysis revealed a very high odds ratio (OR=45.35), but accompanied by a very wide 95% confidence interval (95% CI=1.63–1258.56). This wide confidence interval strongly indicates model instability or high standard errors in the regression coefficient estimates. We acknowledge that more sophisticated statistical approaches, such as Logistic Regression with Firth Correction, could be used to produce more stable estimates and narrower confidence intervals. However, because the focus of this study is on the interpretation of the standard MLE model commonly used in healthcare, we chose to present these results while explicitly acknowledging and discussing its statistical limitations.

A further limitation of our study is self-report bias, particularly in measuring CHW knowledge and practices. External validity is also important: our study results may limit the generalizability of our findings to other regions with different socio-cultural contexts and program implementation. Unmeasured confounding factors, such as household water and sanitation quality, father involvement in caregiving, family income, and extreme poverty, all independently influence stunting outcomes, potentially affecting our estimated intervention effect (29).

Comparing CHW roles and capacity in low stunting areas versus high stunting areas is important (26). CHW knowledge about stunting, causes, and impacts is crucial. Stunting is not just about short children, but chronic growth failure due to chronic malnutrition. Other important points CHWs must understand include: 1) Stunting causes are malnutrition in the First 1000 Days of Life from fetus to 2-year-old children, unbalanced eating patterns in children and adolescents(30), wrong parenting patterns, and poor sanitation and clean water(31). 2) Stunting impacts are not only physical but also on cognitive, motor development, and future child health. 3) CHWs should educate about balanced nutrition(32): animal protein importance (fish, eggs, chicken, meat), exclusive breastfeeding importance, and appropriate complementary feeding(33). 4) CHWs should educate about clean and healthy living behaviors(34), healthy latrine use, and clean water provision for drinking and hygiene (8).

In-depth studies are needed about CHW skill improvement through routine/programmed training, including skills for: 1) Measuring weight/height correctly and accurately (35). 2) Recording data: maternal and child health books or growth monitoring cards, using WHO growth curves (36). 3) Analyzing results: interpreting point positions on WHO growth charts (green (normal), yellow (risk), or red (stunting/malnutrition)). 4) Documentation: manual record books or simple digital applications (37). 5) Reporting: preparing simple reports (number of attending children and found cases) for health center submission. Accurate data is crucial for higher-level program planning(35).

CONCLUSION

This study investigated CHW roles in stunting reduction acceleration efforts, aiming to assess influencing factors. Our findings show that training history, work duration, and CHW skills are critical factors. Specifically, the importance of enhancing CHW knowledge and skills through programmed/routine training was found. Our results highlight that CHW capacity management deserves serious government attention. Although CHW roles are not primary factors in stunting reduction, multisectoral collaboration is needed for stunting reduction cooperation. Further research on CHW capacity differences in low stunting versus high stunting case areas could potentially enhance our understanding of the importance of CHW capacity management and provide government input for providing special programs for CHWs.

AUTHOR'S CONTRIBUTION STATEMENT

RP, I, PEW, and FH contributed to the study's concept, design, literature search, experimental work, data acquisition, and analysis. NTK assisted with experimental studies and data acquisition. MH contributed to study design and data acquisition. OME managed the data analysis, statistical analysis, involved in the study's design, and experimental work. All authors participated in manuscript preparation, with NTK and OME responsible for editing and review

CONFLICTS OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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

We declare that in preparing our manuscript, we did not use artificial intelligence (AI) tools or technologies such as ChatGPT, Grammarly, or DeepL.

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