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Tiered Training Model to Improve the Skills of Posyandu Cadres in Measuring Child Anthropometry in Demak Regency, Indonesia

Model Pelatihan Berjenjang untuk Meningkatkan Kemampuan Kader Posyandu dalam Mengukur Antropometri Anak di Kabupaten Demak, Indonesia

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ABSTRACT

Background: Posyandu cadres still lack the skills to measure anthropometry. Not all cadres received regular training.
Objectives: This study aims to develop a training model to improve the skills of Posyandu cadres in conducting anthropometric measurements.
Methods: This study used a research and development approach with two main stages. The first stage was the development of the training model. The second stage was field testing of the new training model, using a pretest-posttest control group design. The training model in the form of Training of trainers (ToT) was tested to 49 cadres in the treatment and control groups with expert resource persons, followed by grassroots training with 142 cadres in the treatment group and 146 cadres in the control group with resource persons from the ToT participants. The intervention lasted three months. The effect of applying the training model on changes in the ability of cadres in anthropometric measurements was analyzed using the General Linear Model with a significant p-value <0.05.
Results: The developed anthropometry training model is tiered training, including ToT followed by grassroots training. Through the implementation of this training model, the number of trained cadre participants increased threefold. The results of the tiered anthropometry training model trial proved to improve knowledge, attitude, practice, self-efficacy, as well as the precision and accuracy of measuring the length, height, and weight of children by Posyandu cadres (p<0.05).
Conclusions: The implementation of a tiered anthropometry training model can increase cadre participants and improve the capacity of cadres in measuring child anthropometry.

INTRODUCTION

The development of public health is currently faced with the triple burden of malnutrition, namely the problem of malnutrition in children under five, excess nutrition (overweight and obesity), and deficiency of micronutrients which are quite high in Indonesia[1]. If the issue of undernutrition in children is not promptly addressed, it can have a detrimental impact on their physical growth, increasing the risk of stunted growth or a deficit in body size[2]. Furthermore, it can lead to an increased prevalence of child morbidity and mortality. In the long term, this can have a significant impact on the nutritional status of adolescents, adults, and the elderly. It can cause reduced cognitive abilities and reduced work capacity, which can increase poverty and economic losses. Furthermore, it can affect the quality of human resources, which is the basic capital of nation-building[3].

Considering the impact of malnutrition on the future of the nation, the government has carried out a program to accelerate the reduction of malnutrition in children under five through Growth Monitoring and Promotion (GMP), which is a specific intervention intensively promoted to improve nutrition and health[4,5]. Growth onitoring and promotion (GMP) at integrated health posts (Posyandu) requires good anthropometric measurement accuracy because inaccurate measurement results will lead to misclassification of nutritional status, resulting in inaccurate early detection and interventions. In addition, the government policy requires that all anthropometric measurement results for toddlers at Posyandu must be uploaded to the Electronic application-Community Based Nutrition Recording and Reporting (e-PPGBM) application so that individual target data for children can be displayed. Individual nutritional status can be known quickly and accurately, and malnourished toddlers can be quickly identified for appropriate referral or intervention[6].

Efforts to improve the accuracy of anthropometric measurements at Posyandu can be

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carried out by providing measuring tools (anthropometric kits) and increasing the capacity of cadres by improving the training, supervision/mentoring, and motivation activities[7]. Many cadres are still lacking in terms of knowledge, performance, and expertise[8]. To enhance the cadres' capacity to measure, the community health centers/Puskesmas have conducted regular training/refreshing of cadres. However, with the large number of cadres and frequent changes, not all cadres have been exposed to training, because in general, the participants are usually representatives of cadres. Furthermore, some cadre trainings are designated as trainers through Training of Trainers (ToT), and after the training, structured follow-up activities are required to ensure that cadres who have been trained can transfer their skills to other cadres who did not attend the training. The achievement of these objectives can be facilitated by the mobilization of community participation[8,9].

The government has limited resources in dealing with increasingly complex health problems in society. On the other hand, the community has considerable potential to help solve problems in their area[9]. Most Posyandus have cadres with potential. With intensive and systematic training, these cadres can enhance their skills to become vital trainers, supporting others at the village or Posyandu level.

Based on this background, the researcher developed a cadre training model by utilizing the existing potential of the community to increase the precision and accuracy of toddler anthropometric measurements at Posyandu. The research was conducted at Demak Regency, a district in Central Java which is one of the districts/cities designated as the locus of stunting management. In this district, Posyandu service quality remains low due to poor human resource quality, high cadre dropout rates, inadequate facilities, lack of incentives for cadres, and suboptimal community health activities at the village level[10]. Around 15% of children under five in this district are facing growth issues that require constant monitoring. Cadre skills are still lacking, leading to significant disparities between stunting data collected by cadres and validated measurements by trained teams.

The model development activities are expected to increase the ability of cadres to measure anthropometry and produce cadres who can train other cadres (training cadres) so that all Posyandu cadres in the village have better accuracy and precision in anthropometric measurements. The general objective of this research is to develop and examine the anthropometric training model to increase the precision and accuracy of anthropometric measurements of children by cadres at Posyandu in Demak Regency. The specific objectives of the research are to develop a tiered anthropometric training model that could increase the precision and accuracy of the results of anthropometric measurements of children at the Posyandu, and examine the effect of applying a new training model to changes in the precision (intra-observer variability) and accuracy (inter-observer variability) of toddler length, height, and weight measurements by cadres at Posyandu which were analyzed jointly with other variables (confounding).

METHODS

This research comprised two related stages: developing the initial model (stage 1) and field trials of the model (stage 2). Various approaches were used for developing training models, including Research and Development (R&D).[11]. Borg and Gall outline ten stages for development research: preliminary study, planning, hypothetical model development, hypothetical model review, revision, limited trials, revised trial results, wider trials, final model revisions, and dissemination. Sugiyono summarizes these into two main stages: product development and field trial[11].

The product development phase began with a Training Needs Assessment (TNA) comprising quantitative and qualitative studies. Quantitative research examined the behavior and measurement skills of Posyandu cadres through interviews and observations of their anthropometric measurements. A comparison was made between measurements by cadres and supervisors to assess accuracy and precision.

The quantitative study involved 452 purposefully chosen Posyandu cadres from 20 villages in Demak District. Ten villages with high stunting prevalence and ten with low prevalence were selected. Research sites included Kembangan and Betahwalang in Bonang, Donorojo in Demak, Kedongori in Dempet, Sidomulyo in Wonosalam, Boyolali, Gedangalas, and Sambiroto in Gajah, Guntur in Guntur, and Bumirejo in Karangawen sub-district for high prevalence. Low prevalence sites were Sumberejo and Jatirogo in Bonang, Kalikondang in Demak, Jerukgulung in Dempet, Pilangrejo in Wonosalam, Banjarsasi, Kedongdong, and Surodadi in Gajah, Bakalrejo in Guntur, and Pundenarum in Karangawen sub-district. The qualitative study included a literature review and Focus Group Discussions (FGD) involving 12 health workers from the district health office and community health centers experienced in training cadres. FGD sessions aimed to address Posyandu management issues, training implementation, and cadre mentorship comprehensively.

Based on the results of the Training Needs Assessment (TNA), the researchers carried out product planning and design, preliminary product development, and early-stage trials. The preliminary product design was a model and a tiered anthropometric training module was developed. Then, an internal product trial was conducted. Required elements for the internal product trial include (1) expert validation (expert review) involving 3 people with different types of expertise purposively selected as subjects, namely public health nutrition experts, health promotion experts, and empowerment experts. The experts held Indonesian National Competency Qualification Level 9 or a Ph.D.; (2) user validation involved three selected subjects, including cadres, village health workers, and public health nutritionists at Puskesmas Mranggen, Demak Regency; and (3) Limited subject testing featured 30 selected Posyandu cadres in Mranggen sub-district, Demak Regency. Adjustments were made to

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the model based on the limited subject trial results before continuing to the field trial.

In the second stage of the study, field trials were conducted to assess the efficacy of the model in comparison to the conventional training model. Conventional training is defined as the training model that is routinely or commonly conducted by officers at the district health office, community health centers, and auxiliary health centers. The second stage involved the field testing of the training model design, employing a pretest-posttest control group design. Field trials of the model were conducted at two levels: level 1 was a ToT training to train cadres of trainers at the district level with expert resource persons and grassroots training at the village level with ToT trainee resource persons.

The subjects or participants in the level 1 training were 47 key cadres representing Posyandu from 10 stunting locus villages as the intervention group, and 47 key cadres representing Posyandu from 10 non-stunting locus villages as the control group. However, the cadres who fully participated until the end of the level 1 training (after taking the pre and post-test) were 39 cadres in the treatment group and 39 cadres in the control group. Level 2 trainees were new cadres or regular cadres who had never attended anthropometry training. Subjects or participants of level 2 training consisted of 184 cadres from 10 stunting villages as the treatment group and 174 cadres from 10 non-stunting villages as the control group. However, cadres who fully participated until the end of the level 2 training (following the pre and post-test) were 142 cadres in the intervention group and 146 cadres in the control group.

The model intervention was conducted over three months. In the initial month, preparation activities and level 1 training (ToT) were organized at the district level. Then, in the second month, level 2 training was conducted at the village or Posyandu level, and field mentoring was conducted for two months. The trainers and facilitators of the level 2 training are cadres who have attended the level 1 training (ToT) at the district level. In the third month, in addition to mentoring activities, monitoring and evaluation of intervention results were also conducted. The evaluation of the results of the model implementation was carried out by comparing changes in the ability of the cadre group that participated in the level 2 training and the control group (who received conventional training).

The research variables observed and quantified in the subjects or cadres were as follows: the independent variable was the implementation of a novel model of Posyandu cadre training. Intermediate variables include attitudes, knowledge, self-efficacy, and cadre measurement practices. Confounding variables include cadre-specific factors such as gender, employment status, age, cadre experience, the number of incentives, and education of cadres. The dependent variable was the change in cadres' ability to measure the anthropometry of children under five, as measured by changes in intra-observer variability (precision), and changes in inter-observer variability (accuracy). The effectiveness of the new training model was evaluated by comparing the change in measuring ability between the intervention group (cadres who received level 2 training) and the control group (cadres who received conventional training). To ascertain the impact of the intervention, a different test was conducted on the changes observed in both groups, and the results were also analyzed using a multivariate General Linear Model (GLM).

This multi-year study has obtained an ethical approval from the Health Research Ethics Committee, Faculty of Public Health, University of Diponegoro, Number: 558/EA/KEPK-FKM/2019. All participants gave their consent before taking part in the study. The children were involved in the study with their mothers' consent.

RESULTS AND DISCUSSIONS

The model development phase began with a Training Needs Assessment (TNA) through a quantitative study that highlighted differences in the accuracy of anthropometric measurements made by cadres at Posyandu. The results of the observation revealed that the anthropometric measurement practices carried out by cadres did not follow the established standards. The findings of this assessment are presented in Table 1. The consequences of not adhering to measurement procedures can be seen in the results of anthropometric measurements that were imprecise and inaccurate. The observations of the 452 cadres in the study sites revealed that only 35.8%, 29.6%, and 92% of cadres measured child height, body length, and child weight, respectively, with good precision. Furthermore, the proportion of cadres who performed measurements of children's height, length, and weight with an acceptable level of accuracy was low, at 17.3%, 13.1%, and 20.1% respectively. The accuracy and precision of cadres in measuring child length was the lowest compared to measuring child height and weight.

Table 1. Inventory of anthropometric measurement errors of toddlers at Posyandu

No	Type of Measurement	Description Non-conformance with standard operating procedures (SOPs)
1	Body weight (Dacin or Steelyard)	- Balancing pendulum is not always checked before weighing to ensure the needle is in a straight position. - Bulky clothing is not removed or minimized (jackets, diapers, hats, baby shoes, etc). - Weighing results are rounded, not written to 0.1 kg scale. - Parallax reading position. - One-off measurement without repetition.

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No	Type of Measurement	Description Non-conformance with standard operating procedures (SOPs)
2	Body length (infantometer)	- Socks, pendants, pigtails, headgear, or hats are sometimes not removed. - Measurement is done alone without the help of other cadres/assistant measurers. - The position of the head is not ensured to look up straight, and the top of the head is attached to the measuring board. - At the time of reading the position of both feet is not tight, straight, and against the measuring board. - Measurement is only done once without repetition.
3	Height (microtoise)	- Socks, pendants, pigtails, headgear or hats are sometimes not removed. - The child's head position is sometimes still lowered when reading the results. - The position of the measuring eye when reading the results is sometimes not straight reading window. - Measurement is only done once without repetition.

Referring to the general guidelines for Posyandu revitalization issued by the Ministry of Home Affairs to increase the precision and accuracy of the anthropometric measurements of children, there are at least six models that can be developed and implemented, namely the policy and regulatory model; the model of increasing community participation and partnerships; the cadre training model; the model of coaching and technical assistance; the model for providing standard measurement infrastructure at Posyandu; and the model for improving service governance[12].

Given the limited resources and time, to increase the precision and accuracy of anthropometric measurements at Posyandu, the development of a cadre training model was chosen. The model was chosen because it can have a direct effect on increasing the knowledge and skills of measuring cadres, and many studies have proven this[13–15]. Referring to the Posyandu training guidelines developed by the Ministry of Health, the tiered training or training of trainer (ToT) model has often been used as a training model for cadre facilitators. Training for Human Development Workers (HDWs) in villages also uses the ToT model[16]. It should be noted that the aforementioned study incorporated a specific curriculum pertaining to anthropometric assessments of children at Posyandu.

There were four sub-themes obtained related to the Posyandu cadre training method, namely (1) special anthropometric training for cadres, (2) there were simulation sessions and measuring practices, (3) training media as needed, in addition to PowerPoint (PPT), equipped with multimedia (videos and modules), (4) ToT training model for posyandu key cadres with structured post-training activities. Overall, the results of the Focus Group Discussion (FGD) produced themes and sub-themes that became feedback for the development of anthropometric training models for Posyandu cadres (Table 2).

Table 2. Topics and sub-topics in Posyandu implementation based on the results of the FGD

Topic	Sub-topics
Monitoring the growth of children	- The concept of growth and the importance of monitoring child growth, - How to determine the exact age, - How to determine the direction of N/T growth (plotting to KMS)
Anthropometric measurement tools at Posyandu	- The importance of standard measuring instruments - How to maintain the tools - Provision of standard measuring instruments - Knowledge of standard measuring instruments
Anthropometric measurement practice at Posyandu	- Factors affecting the quality of measurement - Correct measuring procedure - Examples of right and wrong measurement practices
Posyandu cadres	- Roles and duties of cadres - Mastery of effective communication - Motivating staff performance
Desk activity at Posyandu	- A good description of 5 table service activities - Setting up cadres at the counseling table
Cadres training	- There are simulation sessions and practice measurements - Anthropometric special training for cadres - Training media as needed, apart from PPT, equipped with multimedia (videos and modules), - ToT training model with structured post-training activities

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The training needs assessment (TNA) revealed the need to develop a model for enhancing the accuracy and precision of anthropometric measurements of toddlers in Posyandu. The aforementioned model, which is a tiered anthropometric training model for Posyandu cadres, is supported by components presented in Figure 1. The formulation of the tiered anthropometric training model for Posyandu (Figure 1) represented the initial stage of the product development process. The design of the modules or training media was planned according to the new training model once it had been defined. The results of the training needs assessment (TNA) indicated that multimedia products, specifically videos, were the most suitable training media for subjects. The training videos were created based on the results of a review of the Ministry of Health's toddler growth assessment videos (see https://youtu.be/id68KWUPRHM). The new training videos contained more comprehensive topics and subtopics based on the findings of the observations and focus group discussions (see https://youtu.be/rV_AUgvV_eU).

Following the initial development of the cadre training model, the model was subjected to validation and approval by experts and users. A limited trial was conducted. The pilot test results demonstrated that the training model was effective in enhancing knowledge, attitude, and practice measurement scores. Furthermore, validity and reliability tests resulted in 25 valid and reliable knowledge instrument items and 20 valid and reliable attitude instrument items. After the module was revised, it was tested in the field.

In phase 2, field testing of the new model was conducted with the intervention group, which employed a multilevel training approach. The first level comprised Training of Trainers (ToT) for prospective cadre trainers. Level 2 training involved all cadres, including new appointees, in a village or grassroot setting, effectively training three times more cadres than the conventional model.

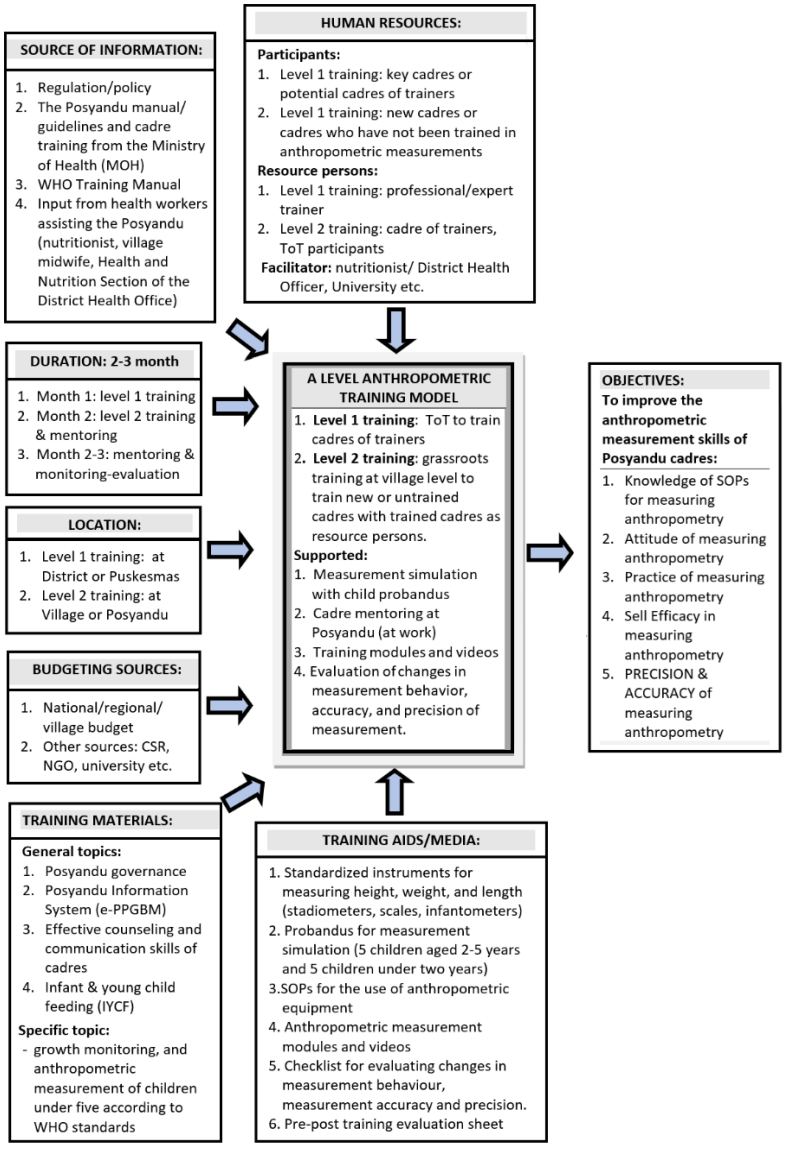

Figure 1. The formulation of a level anthropometric training model for Posyandu cadres to increase the precision and accuracy of measurements

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The results of the analysis indicated a notable enhancement in knowledge, attitudes, practices, and self-efficacy following the implementation of the training model. This was particularly evident among training participants at the village level (Table 3). The lack of previous training experience among those participating in the village training was a significant factor in the more pronounced increase in knowledge, attitudes, and practices compared to those who received Training of Trainers (ToT) at the district level. The cadres who participated in the ToT training at the district level were predominantly those who had consistently represented their respective Posyandu at every training and meeting at the district level. As a result, they had accumulated a wealth of knowledge from various sources.

Table 3. The effect of multilevel training on changes in self-efficacy, knowledge, attitudes, and practice of measuring anthropometry of Posyandu Cadres in Demak Regency, Indonesia

Training Level	Control			Intervention			p-value
	n	Mean	SD	n	Mean	SD	
Training Level 1 (Training of Trainers /District)							
Change in self-efficacy score	39	7.1	9.00	39	9.7	9.48	0.2252[a]
Change in knowledge score	39	-1.9	11.28	39	7.6	26.63	0.326[b]
Change in attitude score	39	7.7	30.16	39	18.6	21.82	0.057[b]
Change in practice score of measuring Body Length	39	14.7	27.80	39	26.1	20.98	0.048[b]*
Change in practice score of measuring Weight	39	25.6	14.32	39	29.3	15.80	0.285[a]
Change in practice score of measuring High	39	29.8	16.08	39	27.8	11.82	0.429[b]
Training Level 2 (Grassroot/Village)							
Change in self-efficacy score	146	6.88	11.91	142	11.63	14.22	0.002[a]*
Change in knowledge score	146	-0.09	1.08	142	10.13	19.91	0.000[b]*
Change in attitude score	146	2.83	30.75	142	11.71	28.88	0.019[b]
Change in practice score of measuring Body Length	146	14.32	25.89	142	17.16	22.22	0.419[b]
Change in practice score of measuring Weight	146	23.33	17.97	142	29.19	18.54	0.007[a]*
Change in practice score of measuring High	146	25.08	17.43	142	27.84	17.02	0.058[b]

[a]Independent t-test; [b]Mann Whitney U Test; *sig (p-value<0.05)

The change in knowledge, as indicated by the training participants in the village, was relatively more significant than the changes in attitudes, self-efficacy, and practice. Through anthropometric training, the cadres were trained in measuring children's body length, height measurement, baby scales, and stepping scales to measure children's weight according to SOPs. Several other studies that examined the impact of anthropometric training on increasing knowledge also showed a significant increase after the training[17,18]. The results of this study are in line with the findings of research conducted in Palopo City, indicating that anthropometric training is related to the improved ability of cadres to detect stunting[19]. As demonstrated in Table 3, multi-level training had a positive impact on the improvement of cadres' measurement skills. The observed decline in measurement practice scores following training indicates that the proficiency in measuring body length exhibited a lesser reduction than that observed in the practice scores for height and weight measurements. Measuring body length uses more complex tools and more parts of the procedure to control than measuring a child's height and weight. The results of the analysis demonstrated that the difficulty of anthropometric measurements of infants decreased to a greater extent than that of toddlers[15]. Measuring the body length of younger children is more difficult. Carsley et al. found that length measurements in children under 2 years old had the highest measurement error[20].

This study revealed improvements in cadres' knowledge, attitudes, and practices alongside enhanced accuracy in anthropometric measurements for toddlers. The implementation of the cadre measuring skill score model led to increased skills, impacting measurement precision. Similarly, Eti et al.'s study in Semarang demonstrated improved measuring skills among cadres, achieving mastery in required competencies[21]. Alignment with SOPs and training in correct measurement methods were crucial for precise results. In-service training and regular supervision have been identified in other studies as vital for performance enhancement[5].

The effect of multilevel training on changes in intra-observer variability (precision) and inter-observer variability (accuracy) in child anthropometric measurements made by village cadres is presented in Table 4. The results in Table 4 indicate confounding variables analyzed using the multivariate general linear model. There was a decrease in intra and inter-observer variability of measurements (especially length and height of children) in the control group which was lower than the intervention group (shown by the beta coefficient). This means that the cadre group that received the tiered training model intervention experienced a greater reduction in intra and inter-variability of measurements or increased precision and accuracy of anthropometric measurements, higher than the group that received conventional training. The findings of this study are similar to those of Gupta et al. which showed that the quality of manual anthropometric data in children under five years old improved after training. The reliability of measurement after training increased as evidenced by a decrease in

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the technical error of measurement (TEM)[22]. The training and standardization of surveyors for Ethiopia's Large Household Nutrition Survey showed that most anthropometricians (>75%) could achieve satisfactory precision in anthropometric measurements. This protocol allows the researchers to assess trainees, identify individuals who have not achieved the desired level of precision, and retrain or adjust their roles before survey implementation[23].

Table 4. The effect of multilevel training on changes in precision and accuracy anthropometry measurement in village cadres in Demak Regency Indonesia

Parameter	Intra-observer Variability (Precision)					Inter-observer Variability (Accuracy)				
	B	SE	sig	LB for B	UB for B	B	SE	sig	LB for B	UB for B
Length Measurement		R-square=0.068[b]					R-square=0.056[c]			
Intercept	0.446	0.517	0.389	-0.571	10.463	0.581	0.312	0.063	-0.032	10.195
Control group	-0.339	0.118	0.004*	-0.571	-0.106	-0.138	0.071	0.054*	-0.278	0.002
Intervention group	reff					reff				
Female	-0.550	0.381	0.150	-10.299	0.200	-0.611	0.230	0.008*	-10.063	-0.159
Male	reff					reff				
Non-working	0.106	0.084	0.208	-0.059	0.272	0.091	0.051	0.075	-0.009	0.191
Working	reff					reff				
Age, year	0.003	0.006	0.561	-0.008	0.015	0.001	0.003	0.900	-0.006	0.007
Experience as cadre, year	-0.005	0.006	0.408	-0.016	0.007	0.001	0.003	0.947	-0.007	0.007
Change of knowledge, score	-0.003	0.003	0.271	-0.009	0.002	0.001	0.002	0.897	-0.004	0.003
Change of attitude, score	0.001	0.001	0.779	-0.003	0.002	0.001	0.001	0.761	-0.002	0.001
Change of self eficacy, score	-0.002	0.003	0.522	-0.008	0.004	-0.003	0.002	0.076	-0.007	0.000
Change of practice, score	-0.002	0.002	0.318	-0.005	0.002	0.001	0.001	0.891	-0.002	0.002
Cadre incentive, sum	0.033	0.069	0.635	-0.104	0.170	0.039	0.042	0.355	-0.044	0.121
Cadre education, year	-0.002	0.015	0.887	-0.031	0.026	0.007	0.009	0.395	-0.010	0.025
Height Measurement		R-square=0.114[a]					R-square=0.024[b]			
Intercept	0.497	0.470	0.291	-0.429	10.423	0.248	0.339	0.465	-0.419	0.916
Control group	-0.382	0.104	0.001*	-0.586	-0.179	-0.067	0.075	0.372	-0.214	0.080
Intervention group	reff					reff				
Female	0.005	0.346	0.988	-0.677	0.687	-0.232	0.250	0.353	-0.724	0.259
Male	reff					reff				
Non-working	-0.040	0.077	0.600	-0.192	0.111	-0.026	0.056	0.647	-0.135	0.084
Working	reff					reff				
Age, year	-0.003	0.005	0.623	-0.013	0.008	0.004	0.004	0.262	-0.003	0.012
Experience as cadre, year	0.003	0.005	0.600	-0.008	0.013	-0.002	0.004	0.613	-0.009	0.006
Change of knowledge, score	0.002	0.003	0.442	-0.003	0.007	-0.002	0.002	0.341	-0.005	0.002
Change of attitude, score	-0.00003	0.001	0.980	-0.002	0.002	0.001	0.001	0.783	-0.001	0.002
Change of self eficacy, score	0.003	0.003	0.305	-0.002	0.008	0.00005	0.002	0.981	-0.004	0.004
Change of practice, score	-0.005	0.002	0.013*	-0.009	-0.001	-0.001	0.001	0.348	-0.004	0.002
Cadre incentive, sum	0.035	0.059	0.559	-0.082	0.151	-0.014	0.043	0.743	-0.098	0.070
Cadre education, year	-0.003	0.013	0.815	-0.029	0.023	0.004	0.010	0.642	-0.014	0.023
Weight Measurement		R-square=0.045[a]					R-square=0.098[b]			
Intercept	-0.040	0.543	0.941	-1.108	1.028	1.018	0.487	0.037	0.060	1.976
Control group	-0.016	0.121	0.896	-0.254	0.222	0.149	0.108	0.170	-0.064	0.362
Intervention group	reff					reff				
Female	0.393	0.394	0.320	-0.383	1.170	-0.403	0.354	0.256	-1.099	0.294
Male	reff					reff				
Non-working	-0.024	0.088	0.788	-0.196	0.149	0.061	0.078	0.438	-0.094	0.215
Working	reff					reff				
Age, year	-0.005	0.006	0.431	-0.017	0.007	0.004	0.005	0.483	-0.007	0.014
Experience as cadre, year	0.007	0.006	0.244	-0.005	0.019	0.003	0.005	0.579	-0.008	0.014

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Parameter	Intra-observer Variability (Precision)					Inter-observer Variability (Accuracy)				
	B	SE	sig	LB for B	UB for B	B	SE	sig	LB for B	UB for B
Change of knowledge, score	-0.003	0.003	0.321	-0.009	0.003	0.004	0.003	0.091	-0.001	0.010
Change of attitude, score	-0.001	0.001	0.330	-0.004	0.001	0.0005	0.001	0.687	-0.002	0.003
Change of self eficacy, score	0.008	0.005	0.075	-0.001	0.017	0.001	0.004	0.826	-0.007	0.009
Change of practice, score	0.004	0.002	0.068	0.000	0.008	-0.002	0.002	0.381	-0.006	0.002
Cadre incentive, sum	-0.070	0.068	0.305	-0.203	0.064	-0.238	0.061	0.001*	-0.358	-0.118
Cadre education, year	0.002	0.015	0.905	-0.028	0.032	0.017	0.014	0.212	-0.010	0.044

B (Beta Coefficient); SE (Standar Error); Sig (Significancy or p-value); LB (Lower Bound); UB (Upper Bound); [a]General Linear Medel; *sig (p-value<0.05); [b]Dependent Variable: Intra-observer variability change; [c]Dependent Variable: Inter-observer variability change

The anthropometry training intervention was implemented over three months, including two months of mentoring. The results were measurable, with improved measuring skills of the cadres. Improvements in cadre practices and performance cannot be achieved in a short period, and do not require training or mentoring. As the cadre empowerment study conducted in Semarang found, change from mentoring requires at least two months of mentoring[7].

Based on the results of this research, it is recommended that cadre training at the community health center/district level be strengthened and reformatted with a special focus on anthropometric measurements carried out in stages. For expert resources, local governments can collaborate with universities as was done in this study. To ensure program sustainability, coordination and synchronization of activities and funding between regional and village governments is needed. For example, the training budget (ToT) at the district/community health center level must be obtained from the Health Operational Assistance Fund (BOK) for each community health center, while the training budget at the grassroots or village can be sourced from village funds. The use of village funds for cadre empowerment is possible based on government regulation[24].

The limitation of this study was the potential for interaction and communication between cadres in the intervention group and those in the control group. This was because they were in the same sub-district and there was a communication forum between cadres in one sub-district. However, during the trial of the model, it was established that in the control group, no training activities were conducted at the village level, or such on-the-job assistance was provided, whether carried out independently by cadres or by the community health center/health office. The involvement of cadres during the pre-evaluation activities and the progress of the digitalization may result in the acceptance of additional information by cadres during the implementation of the intervention, thereby allowing for changes in the ability of cadres due to non-intervention factors. The application of the pretest-posttest control group design was expected to eliminate the effect of the non-intervention. The measurement process requires children to be calm while being measured by trained cadres and enumerators (gold standard). On occasion, it was found that the children could not be measured properly because the children were fussy, crying, or bored. This situation could affect the measurement results. If the child could calm down, then the measurement would continue. In the event of an uncooperative child, a replacement child would be used as a backup object to be measured.

CONCLUSIONS

The tiered anthropometry training model has the potential to expand the coverage of trainees with greater involvement (three times) compared to conventional training. In addition, the application of the tiered anthropometric training model has increase the cadres' knowledge, attitudes, self-efficacy, and ability to take anthropometric measurements of children, better than the conventional training model The tiered anthropometry training model can significantly reduce the variability of measurement results or increase the precision and accuracy of anthropometric measurements, especially measurements of child height and length conducted by Posyandu cadres at the village level.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare that they have no competing interests. The research was funded by the Faculty of Public Health, Universitas Diponegoro.

AUTHOR CONTRIBUTIONS

S: conceptualization, investigation, methodology, supervision, writing–review and editing; MIK: methodology, writing–original draft; HSS: methodology; formal analysis; SF: writing–review and editing; SAN: formal analysis, resources.

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