GAPS IN COMPETENCE OF INTEGRATED SERVICE POST CADRES AND HEALTH WORKERS IN MEASURING BODY LENGTH AND STUNTING STATUS OF CHILDREN UNDER TWO YEARS OLD IN CENTRAL JAVA, INDONESIA

Suyatno[1,2], Martha Irene Kartasurya[2], Henry Setyawan[3], Agus Suwandono[3]

[1]Public Health Doctoral Program, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia, [2]Department of Public Health Nutrition, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia
[3]Department of Epidemiology, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia

Abstract. Integrated service post cadres in Indonesia carry out early detection of stunting in the community. They are volunteers and not all of them are specially trained in anthropometric measurements. Hence, the results of stunting measurement by cadres may be inaccurate. This study analyzed differences in accuracy of body length and stunting status measured by integrated service post cadres and health workers. This study was an observational study using a cross-sectional design. The study was conducted in Demak Regency with 452 cadres from 94 integrated service posts in 20 villages that were selected purposively. Each cadre measured the body length of 10 children under two years old, compared to that of the health workers as a reference group. Measured children were randomly selected. Stunting status was calculated from the percentage of children with a length-for-age Z-score (LAZ) smaller than –2 standard deviation (SD). Data were analyzed by Wilcoxon signed rank test and Chi-square test. The cadres performed body length measurements less accurately than health workers. Stunting status in children under two years old was measured less accurately by cadres (3.5% difference) than by health workers (16.1% *versus* 19.6%). There was a significant difference in the accuracy of child body length and stunting status of children under two years old measured by the cadres and health workers (p<0.001). In summary, the ability of cadres to measure children's body length was weaker than that of health workers, and the poor competence in measuring may potentially cause misclassification of stunting status.

Keywords: integrated service post cadres, stunting, accuracy, measurement, misclassification

Correspondence: Suyatno, Faculty of Public Health, Universitas Diponegoro, Jl. Prof Soedarto, SH, Tembalang, Semarang, Indonesia
Tel: +62 8122815730 E-mail: suyatnofkmundip@gmail.com

INTRODUCTION

Policies to overcome stunting to improve the welfare of every citizen to achieve an increase in the quality of life of the Indonesian people (Adji *et al*, 2019). The government's target is to reduce the stunting prevalence to 14% in 2024 (State Secretariat of the Republic of Indonesia, 2021). To achieve the target, the government has done various efforts such as converging the related existing programs and integrating one program into another in a policy framework.

One of the ways in reducing stunting prevalence in Indonesia is actualized through the Nutrition Improvement Movement in the first 1,000 days of life (Putri *et al*, 2016). This period is often referred to as the "golden period", "critical period" or "window of opportunity" as called by the World Bank (World Bank, 2006). Based on an analysis of child growth patterns in African and Asian countries, there was a rapid decline in height z-scores during the first two years of life, and it was never recovered until the children were less than five years of age (Prentice *et al*, 2013).

One of the specific interventions for improving nutrition in the first 1,000 days of life is monitoring child growth and development (Ross and English, 2005). Such monitoring is routinely carried out through anthropometric measurements and health counseling (Mangasaryan *et al*, 2011). The main pillar of nutrition monitoring for children under five years old in Indonesia has been carried out in a community-based action for health services at an integrated service post or Posyandu.

Although the integrated service post was established in the 1980s, its management is faced with a lack of facilities and technical skills of cadres (Indonesian Ministry of Health, 2011). Hence, some of their nutrition counseling functions are not well-organized to prevent malnutrition (Kalsum and Jahari, 2015), which, in turn, can affect the effectiveness of monitoring

the nutritional status of children under five (Anwar *et al*, 2010). Whereas monitoring the nutritional status of children under five is the main reason mothers come to the integrated service post (Nazri *et al*, 2016).

Cadres are volunteers and not all of them receive special training in anthropometric measurements, but the results of cadre measurements are used to detect malnutrition in toddlers (Fuada *et al*, 2014). Even now, the integrated service posts uploaded their data to the national integrated nutrition information system (*e-PPGBM*) to display data on individual targets for toddlers in Indonesia, find out the nutritional status of individuals quickly and accurately, and quickly identify malnourished toddlers who must be referred or intervened (Indonesian Ministry of Health, 2017). Accuracy in measuring body length and stunting status is very important to provide trustworthy data on the nutritional status of children under two years old. Otherwise, there will be misclassification of nutritional status which has implications for the mistargeting of food and nutrition programs (D'Souza and Tandon, 2015). In addition, errors in measuring length/height affect the results of determining nutritional status and management for further treatment (Rusdiarti, 2019).

Many cadre training activities have been carried out by relevant stakeholders and various studies have examined whether the low ability of cadres to measure child body length and nutritional status affects the data accuracy of the measurements. However, little research analyzes the gap in the ability of cadres compared to that of health workers in measuring child nutritional status and body length. Besides, previous research has not investigated the impacts of measurement errors caused by cadres on the misclassification of stunting status in children under two years old. With the research gaps, this study aimed to analyze differences in the accuracy of body length and stunting status of children under two years old measured by integrated service post cadres and health workers.

This research was conducted in one of the districts where stunting was prevalent. The results of this study are expected to present common errors in measurements to generate a more accurate nutritional status of children under two years old.

MATERIALS AND METHODS

Study design and location

This observational study used a cross-sectional design, and it was conducted on October 2019 in Demak Regency which was one of the first-batch priority districts for stunting reduction programs in Central Java Province, Indonesia. The research location selected 20 villages from 249 villages in Demak Regency purposively, consisting of 10 priority criteria villages and 10 non-priority villages for the stunting reduction program. The number of integrated service posts in the selected villages was 94 units.

Study population, sampling, and ethical considerations

The study population was all cadres (456 people) from 94 integrated service posts in 20 selected villages. The number of research subjects was all integrated service post cadres who were willing and present on the observation schedule. The number of cadres selected as research subjects amounted to 452 people, and other cadres were absent due to other activities. Together with cadres, this study also involved 20 health workers from 20 selected villages as the gold standard reference. Health workers were village midwives who supervised measurements at the integrated service posts; had work experience of more than five years; had a midwifery education background; had attended anthropometric training, and experienced in measuring child anthropometry. This study involved 945 children under two years old as objects whose body length would be measured by cadres and health workers (at least 10 children from each integrated service post were randomly selected).

This study was conducted based on ethical approval from the Health Research Ethics Committee, Faculty of Public Health, Universitas Diponegoro, Number: 558/EA/KEPK-FKM/2019. Before the research began, all participant cadres, health workers, and mothers of children under five years old filled out informed consent forms stating their voluntary participation in this study. The research also was granted a permit from the local health office.

Data collection

This study uses primary data based on interviews and observations. Cadre characteristics were carried out through interviews as scheduled by subject and researcher. The child's body length data was obtained from the resu lts of measurements by cadres and health workers. Children's body length was measured with the same instrument using a portable infantometer (Seca 417, Seca Corporation, Hanover, MD). Cadre characteristics were carried out through interviews as scheduled by the research participants and researchers. Cadres and then health workers measured the body length of the same 10 children, and they repeated the measurements twice for each child. Measurement results were blinded to each other (cadres and midwives)

Variable analyzed

Before data processing and analysis, the data from the measurements of body length were used to calculate the length-for-age z-score (LAZ), determine stunting status, and calculate the precision and accuracy of measurements. The LAZ calculation was done using the WHO Anthro software (WHO, 2011). Stunting status was determined according to the child's body length and age and compared to the WHO Multicentre Growth Reference Study (MGRS) standard, if the z-score was less than -2 standard deviation (SD) then it was categorized as stunting (WHO, 2006).

Accuracy and precision in measurement were matched with the WHO's guidelines (WHO, 1983). In this study, the accuracy (inter-variability) was the absolute mean of the difference ("|Dc|") in the measurement results from all measured children (10 children per one cadre and health worker). Meanwhile, the precision (intra-variability) was the absolute mean of the difference between the first and second measurements by cadre ("dc") or health worker ("ds") on the same children. The classification of precision and accuracy was determined based on $\sum dc^2$ (cadre), $\sum ds^2$ (health worker), and $\sum Dc^2$ (cadre). If the $\sum dc^2$ was not more than twice $\sum ds^2$, it meant the measurement precision was satisfactory (good precision), and if $\sum Dc^2$ (cadre) was not more than three-time $\sum ds^2$ (health worker), the measurement accuracy was satisfactory (good accuracy) (WHO, 1983).

Statistical analysis

Descriptive and inferential statistical analyses were conducted. From the results of the Kolmogorov-Smirnov 1 sample test, all the variables were not normally distributed. Therefore, the Chi-square test was used to compare the categorical data, and the Wilcoxon signed-rank test was utilized to find the differences between two-paired variables. The level used for statistical significance was p-value<0.05.

RESULTS

Cadre characteristics

Almost all cadres involved were female (98.5%), almost all (99.8%) were married, more than half (65%) were housewives, and the average cadre age was 38.58 years old. The youngest age was 29 years, and the oldest age was 65 years. The lowest cadre education was below the elementary school, and the highest education was a bachelor's degree with average schooling of 10 years. Cadre's work period was quite adequate (mean: 9.4 years), the longest work period of the cadres was 40 years, and some had worked for a year. In many integrated service posts, the regeneration process is difficult because no one wants to become a new cadre. There were 37.2% concurrently other cadres (multi cadres). On average, cadres had a small family with two children, and some had children under five years old. The average family income was lower than the regional minimum wage rate. In several villages, the cadres received incentives in terms of transportation costs although the amount was not that much.

Competency gap in measuring child body length

Based on observations of 452 cadres involved as research subjects, it was found that there was a gap in the ability of cadres and health workers to measure child body length as presented in Table 1.

Table 1 represents that the absolute mean of intra-observer cadres was higher than that of health workers, and the difference in the measurement results between the groups was significant. The absolute mean of inter-observers between the groups was 5.05 cm. According to WHO criteria (WHO, 1983), only 11.95% of the cadres accurately measured the child's body length with good criteria, and 43.14% of the cadre's precision measured the child's body length with good criteria.

Competency gap in measuring stunting status

One of the goals of anthropometric measurements is to determine a child's nutritional status. The results of LAZ calculations and stunting status are presented in Table 2. It could be concluded that there was a difference

Table 1
Comparison of body length measurements conducted by cadres and health workers

Measurement criteria	Measurement conducted by		*p*-value
	Cadres	Health Workers	
Absolute mean intra-observers (cm), mean ± SD	0.96 ± 0.54	0.62 ± 0.38	<0.001[b]
Absolute mean inter-observers (cm), mean ± SD	5.05 ± 5.07		
Accuracy[a], percent			
Good	11.95		
Not good	88.05		
Precision[a], percent			
Good	43.14		
Not good	56.86		

[a]Health worker as the reference group; [b]Wilcoxon signed-rank test (significance when $p<0.05$)

Table 2
Differences in length-for-age z-scores (LAZ) and stunting status findings according to observers

Measurement criteria	Measurement conducted by		*p*-value
	Cadres	Health Workers	
Length-for-age z-score (LAZ), mean ± SD	-0.85 ± 0.53	-1.05 ± 0.50	<0.001[b]
Number of stunting statuses from body length measurementsa, percent			
Stunting	16.06	19.56	<0.001[c]
Not Stunting	83.94	80.44	

[a]Stunting if the length-for-age z-score (LAZ) is lesser than -2 standard deviation (SD) (WHO, 2006); [b]Wilcoxon Signed Rank Test; [c]Chi-square test (significance when $p<0.05$)

in the mean LAZ scores obtained by the cadres and health workers. The average LAZ obtained by the cadres was 0.2 SD higher than that obtained by the health workers with a significant difference.

According to Table 2, this study showed that the percentage of stunting status based on the body length of children under two years old, which was found by the cadres was lower than by health workers. In addition, there was a significant difference in stunting cases from the child's body length obtained by the cadres and health workers ($p< 0.05$).

DISCUSSION

This study found that there was a significant difference between the measurement results between cadres and health workers and between the first and second measurements by cadres. This means that the cadre made two measuring errors, including (1) measurements resulting in the true value (inaccuracy) and (2) repeated actions that do not result in the same value

(unreliability, imprecision, undependability) due to the performance of the examiner or observer (Ulijaszek and Kerr, 1999). Accuracy and precision in anthropometric measurements can be influenced by the instrument used, observer, and person of measurement (Gibson and Rosalind, 2005).

The study found that the intra-observer variability of cadres to measure child body length was higher than that of health workers. Measuring body length is more difficult than body height and weight because it uses a complex tool with detailed procedures. Several previous studies mention measuring the body length of younger children is more difficult. Children under two years old had the highest error in length measurement. There were some significant differences in intra-observer reliability of child length obtained by observers (Carsley *et al*, 2019). Previous research found that body length measurements were less reliable, and thus it is important to increase the reliability and validity of observers (Jamaiyah *et al*, 2010). Likewise, measurements of height and weight were more reproducible, and measurements in older children were more reliable than in younger children (Ayele *et al*, 2012).

This study found that most integrated service post cadres had poor accuracy and precision in measuring child body length according to the WHO category. Very few cadres (11.95%) were able to measure the child's body length accurately, and less than half of the cadres (43.14%) were able to measure it with precision. The small number of competent cadres is possibly due to the low performance of standard operating procedures, poor understanding, and false use of instruments. Not all cadres received training on the WHO's measurement method standards. This condition is similar to the results of studies in other locations (Fuada, *et al*, 2014).

This study proved that the inaccuracy in measuring body length causes misclassification of stunting status in children under two years of age. The percentage of stunted children found by the cadres was 3.5 % lower than by health workers. Thus, some children under two years old who were stunted according to the measurement of health workers, but by cadres were classified as not stunting. If the measurements are less accurate and precise, it can lead to data misinterpretation and misclassification. The implication is that more children will be mistreated and given late treatment (Gibson and Rosalind,

2005) or mistargeting of food and nutrition programs (D'Souza and Tandon, 2015). Invalid growth and development data may cause mothers to ignore the errors in the child's growth monitoring. For example, mothers do not realize that their child's having nutritional problems such as malnutrition (Jahari, 2008).

To improve accuracy in measurements by the integrated service post cadres, there are two ways possibly applied, namely providing adequate standard measuring instruments (Indonesian Ministry of Health, 2011) and capacity building on nutritional and technical skills of cadres (Kalsum and Jahari, 2015; Hariyanti and Putri, 2022). Various strategies can improve the measurement accuracy of nutritional assessment systems, including performing non-intrusive measurements, blinding, and instrument calibration (Gibson and Rosalind, 2005). Increased measurement precision can be done by: compiling an operation manual, training all examiners to use standard techniques consistently, selecting and standardizing data collection instruments, refinement, and standardization of questionnaires and interview protocols, and reducing the effect of random error from any source (de Onis *et al*, 2004).

The limitation of this study is that this study requires children as objects, who are calm and conducive while they are measured by cadres and health workers. Sometimes it is found that the child cannot be measured properly because the child is fussy, crying, or bored. This situation can affect the measurement results. If the child can be calmed then the measurement is continued. In a forced condition, it will be replaced with another child as a backup object to be measured.

In summary, the ability of the cadres to measure child anthropometry greatly determines the success of early detection and monitoring of under-two-year-old children stunting in Indonesia. This study found that cadres measured stunting status less accurately and precisely than health workers. Inaccuracy in these measurements causes misclassification of stunting status in children under two years of age. With the low ability of cadres to measure body length, early stunting detection in children under five years old gets difficult to accomplish. Therefore, continuous training and mentoring on the carder's measuring skills are needed to align the measurement procedures

with the predetermined guidelines.

ACKNOWLEDGMENTS

The author would like to thank the promotor and co-promotor for providing many ideas and insights; the enumerators, midwives, mothers of toddlers, and the Demak District Health Office for supporting data collection; and Universitas Diponegoro for funding this research. This study was supported by Universitas Diponegoro, through the Research for Development and Application (RPP) scheme in 2020.

CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflicts of interest.

REFERENCES

Adji A, Asmanto P, Tuhiman H. Priority regions for prevention of stunting, 2019 [cited 2022 Oct 16]. Available from: URL: https://www.tnp2k.go.id/download/8831947WPstuntingENGF.pdf

Anwar F, Khomsan A, Sukandar D, Riyadi H, Mudjajanto ES. High participation in the Posyandu nutrition program improved children nutritional status. *Nutr Res Pract* 2010; 4: 208-14.

Ayele B, Aemere A, Gebre T, *et al*. Reliability of measurements performed by community-drawn anthropometrists from rural Ethiopia. *PLoS One* 2012; 7: 30345.

Carsley S, Parkin PC, Tu K, *et al*. Reliability of routinely collected anthropometric measurements in primary care. *BMC Med Res Methodol* 2019; 19: 84.

D'Souza A, Tandon S. How well do household-level data characterize

undernourishment? Evidence from Bangladesh, 2015 [cited 2022 Oct 07]. Available from: URL: https://paa2015.populationassociation.org/papers/150243

de Onis M, Wijnhoven TM, Onyango AW. Worldwide practices in child growth monitoring. *J Pediatr* 2004; 144: 461-5.

Fuada N, Salimar, Irawati A. The ability of integrated health center cadre on height/length measurement of underfive children, 2014 [cited 2022 Oct 07]. Available from: URL: https://media.neliti.com/media/publications/82587-ID-kemampuan-kader-posyandu-dalam-melakukan.pdf

Gibson RS. Principles of nutritional assessment. 2nd ed. New York, NY: Oxford University Press; 2005.

Hariyanti HF, Putri EBP. Correlation of the length of being a cadre, knowledge, education, training, skills with the precision and accuracy of children under five's weighing results by integrated healthcare post (Posyandu) cadres in the working area of Bangkalan Public Health Cen. *J Public Health Res Commun Health Dev* 2022; 5: 117-25.

Indonesian Ministry of Health. General guidelines for Posyandu management, 2011 [cited 2022 Sep 11]. Available from: URL: https://promkes.kemkes.go.id/download/jsf/files72087Pedoman_Umum_Pengelolaan_Posyandu.pdf [in Indonesian]

Indonesian Ministry of Health. Technical instructions for integrated nutrition information system, 2017 [cited 2022 Oct 07]. Available from: URL: https://sigiziterpadu.kemkes.go.id/login_sisfo/assets/PANDUAN_SIGIZI_TERPADU.pdf [in Indonesian]

Jahari AB. What's wrong with nutrition program policy? Why growth faltering among under-five children remains high?, 2008 [cited 2022 Sep 11]. Available from: URL: https://www.researchgate.net/publication/336858117_asalah_gagal-tumbuh_pada_anak_balita_masih_tinggi_adakah_yang_kurang_dalam_kebijakan_program_gizi_di_indonesia/fulltext/5db79862299bf1a47bf9d65c/asalah-gagal-tumbuh-pada-anak-balita-masih-tinggi-adakah-

yang-kurang-dalam-kebijakan-program-gizi-di-indonesia.pdf [in Indonesian]

Jamaiyah H, Geeta A, Safiza MN, *et al*. Reliability, technical error of measurements and validity of length and weight measurements for children under two years old in Malaysia. *Med J Malaysia* 2010; 65 (Suppl A): 131-7.

Kalsum U, Jahari AB. The strategy to reduce the prevalence of malnutrition among children under five in Jambi Province, 2015 [cited 2022 Sep 11]. Available from: URL: https://online-journal.unja.ac.id/kedokteran/article/view/2719/7999

Mangasaryan N, Arabi M, Schultink W. Revisiting the concept of growth monitoring and its possible role in community-based nutrition programs. *Food Nutr Bull* 2011; 32: 42-53.

Nazri C, Yamazaki C, Kameo S, *et al*. Factors influencing mother's participation in Posyandu for improving nutritional status of children under-five in Aceh Utara District, Aceh Province, Indonesia. *BMC Public Health* 2016; 16: 69.

Prentice AM, Ward KA, Goldberg GR, *et al*. Critical windows for nutritional interventions against stunting. *Am J Clin Nutr* 2013; 97: 911-8.

Putri OQ, Arimbi DQ, Fauzi HD. Study on Stunting Prevention Program in Indonesia: a literature review, 2016 [cited 2022 Sep 11]. Available from: URL: https://core.ac.uk/download/pdf/230264913.pdf

Ross A, English M. Early infant growth monitoring--time well spent? *Trop Med Int Health* 2005; 10: 404-11.

Rusdiarti. Analysis of the accuracy of anthropometric measurements of toddlers' height in training for Posyandu cadres in Panduman, Jelbuk Subdistrict, 2019 [cited 2022 Oct 07]. Available from: URL: https://myjurnal.poltekkes-kdi.ac.id/index.php/hijp/article/view/141/97 [in Indonesian]

State Secretariat of the Republic of Indonesia. Presidential Regulation Number 72 of 2021 concerning the acceleration of stunting reduction,

2021 [cited 2022 Feb 20]. Available from: URL: https://peraturan.bpk.go.id/Home/Details/174964/perpres-no-72-tahun-2021 [in Indonesian]

Ulijaszek SJ, Kerr DA. Anthropometric measurement error and the assessment of nutritional status. *Br J Nutr* 1999; 82: 165-77.

World Bank. Repositioning nutrition as central to development. A strategy for large-scale action, 2006 [cited 2022 Sep 11]. Available from: URL: https://openknowledge.worldbank.org/bitstream/handle/10986/7409/347750PAPER0Re101OFFICIAL0USE0ONLY1.pdf?sequence=1&isAllowed=y

World Health Organization (WHO). Measuring changes in the nutritional status of children. Guidelines for assessing the nutritional impact of supplementary feeding programmes for vulnerable groups, 1983 [cited 2022 Sep 11]. Available from: URL: http://apps.who.int/iris/bitstream/handle/10665/38768/9241541660.pdf;jsessionid=7639A423FD3A779E53D69D06CB30A6C8?sequence=1

World Health Organization (WHO). WHO Anthro for personal computers manual, software for assessing growth and development of the world's children, 2011 [cited 2022 Sep 11]. Available from: URL: https://www.nutritioncluster.net/sites/nutritioncluster.com/files/2020-01/anthro_pc_manual_v322.pdf

World Health Organization (WHO). WHO child growth standards. Length/height-for-age, weight-for-age, weight-for-length, weight-for-height, and body mass index-for-age. Methods and development, 2006 [cited 2022 Sep 11]. Available from: URL: https://apps.who.int/iris/rest/bitstreams/51510/retrieve