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# EFFECT OF TRAINING ON HEALTH PROFESSIONALS' ACCURACY IN CALCULATING BMI AND WAIST-HIP RATIO

**Ragil Putri Permatasari, Dr.Demsa Simbolon ✉, Yunita**
Jurusan Gizi Poltekkes Kemenkes Bengkulu, Indonesia

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**ABSTRACT**

The results of body mass index (BMI) and pelvic waist circumference ratio (PWCR) measurements can indicate the risk of non-communicable diseases. However, the precision and accuracy of the results of the measurement of health cadres at the integrated coaching post (posbindu) is still low. This study used the Pre-Experimental method (One group pre-test and post-test) to evaluate the effect of training on the precision and accuracy of BMI and PWCR measurements. The independent variable was a 6-day training, and the dependent variable was the knowledge, precision, and accuracy of BMI and WCR measurements. The sample consisted of 24 active cadres at the Nusa Indah Health Center, Bengkulu City, selected with a total sampling technique. Data analysis was carried out by the Chi-Square and McNemar Test. The results showed an increase in the proportion of good knowledge after training. The McNemar test with p=0.0001 revealed that the training significantly improved the precision of BMI and PWCR measurements. Before the training, 23 of the 24 cadres were not precise in measuring BMI, which was reduced to 21 after the training; in the accuracy of the BMI, 24 cadres were inaccurate before the training, reduced to 22 after the training. For PWCR measurements, 22 cadres were not precise before the training, to 18 afterward; in the accuracy of the PWCR, 24 cadres were inaccurate before, increasing to 28 after training. Thus, the training has proven to be effective in improving the precision and accuracy of measurements. It is recommended that continuous training be implemented regularly to maintain and improve the quality of BMI and WCR measurements by health cadres in Posbindu.

***Kata Kunci:***

*Presisi; Akurasi; IMT; RLPP; Usia dewasa; kader Posbindu.*

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**ABSTRAK**

Hasil pengukuran Indeks massa tubuh (IMT) dan Rasio Lingkar Pinggang Panggul (RLPP dapat mengindikasikan risiko penyakit tidak menular. Namun, presisi dan akurasi hasil pengukuran kader kesehatan di Pos pembinaan terpadu (posbindu) masih rendah. Penelitian ini menggunakan metode Pre-Eksperimental (*One group pre-test and post-test*) untuk mengevaluasi pengaruh pelatihan terhadap presisi dan akurasi pengukuran IMT dan RLPP. Variabel independen adalah pelatihan selama 6 hari, dan variabel depeden adalah pengetahuan, presisi dan akurasi pengukuran IMT dan RLPP. Sampel terdiri dari 24 kader aktif di Puskesmas Nusa Indah Kota Bengkulu dipilih dengan tehik total sampling. Analisis data dilakukan dengan Uji Chi Square dan McNemar. Hasil penelitian menunjukkan peningkatan proporsi pengetahuan yang baik setelah pelatihan. Uji McNemar dengan p=0,0001 mengungkapkan bahwa pelatihan secara signifikan meningkatkan presisi pengukuran IMT dan RLPP. Sebelum pelatihan, 23 dari 24 kader tidak presisi dalam pengukuran IMT, yang berkurang menjadi 21 setelah pelatihan; dalam akurasi IMT, 24 kader tidak akurat sebelum pelatihan, berkurang menjadi 22 setelah pelatihan. Untuk pengukuran RLPP, 22 kader tidak presisi sebelum pelatihan, menjadi 18 setelahnya; dalam akurasi RLPP, 24 kader tidak akurat sebelumnya, meningkat menjadi 28 setelah pelatihan. Dengan demikian, pelatihan terbukti efektif dalam meningkatkan presisi dan akurasi pengukuran. Disarankan agar pelatihan berkelanjutan diterapkan secara rutin untuk menjaga dan meningkatkan kualitas pengukuran IMT dan RLPP oleh kader kesehatan di Posbindu.

***Corresponding Author:***

Demsa Simbolon
Telp. 081398908917
Email: demsa@poltekkesbengkulu.ac.id

## INTRODUCTION

Non-communicable diseases (NCDs) such as diabetes mellitus and hypertension are a global health concern due to their widespread impact on morbidity and mortality. Death data according to the World Health Organization (WHO) shows that 73% of deaths are currently caused by non-communicable diseases (WHO, 2019). According to the International Diabetes Federation (IDF) in 2021, Indonesia is ranked 5th with the highest number of people with diabetes in the world, with 19.47 million people and a prevalence of 10.6%. Currently, the prevalence of diabetes in Indonesia is estimated to reach 11%, which means above the global prevalence percentage (Agustiningrum and Kusbaryanto, 2019). Hypertension is one of the most common health problems worldwide. According to data from the WHO, about 1.13 billion people worldwide have hypertension, with two-thirds of that number in developing countries (WHO, 2021). The prevalence of hypertension in Indonesia in adults reaches 34.1% (Kemenkes RI, 2018).

Body Mass Index (BMI) and Pelvic Waist Circumference Ratio (WCR) are important anthropometric indicators used to assess the risk of NCDs, as the results of BMI and WCR measurements can be used to diagnose obesity in adulthood (Mocini *et al.*, 2023). BMI measures weight relative to height and is often used to assess obesity (Shafiee *et al.*, 2024; Wong *et al.*, 2020). WCR, which measures the distribution of body fat around the waist and pelvis, is also relevant in assessing the risk of metabolic syndrome and cardiovascular disease (Khan *et al.*, 2023). BMI and WCR are indicators of metabolic and cardiovascular risk (Zhu *et al.*, 2020). Accurate anthropometric measurements are essential for effective risk assessment and management of NCDs (Destra *et al.*, 2023). Health Cadres at the Integrated Development Post (Posbindu) have an important responsibility in detecting Non-Communicable Diseases including BMI and WCR measurements to monitor public health (Kaptiningsih *et al.*, 2023). Measurement inaccuracies lead to miss-assessment of risks and suboptimal health interventions (Asri *et al.*, 2020; Fajrin *et al.*, 2016). This is proof that intensive training for cadres is a solution to improve their knowledge and skills (Asri *et al.*, 2020). Through training, it is hoped that measurement errors can be minimized so that accurate data is produced (Purnami *et al.*, 2020). To improve the quality of measurement, training for health cadres is expected to improve their technical skills (Munir, 2024). Policies related to improving the competence of cadres, especially related to anthropometric measurement skills, are still not enough (Herlina, 2021).

The low precision and accuracy of BMI and PWCR measurements carried out by health cadres at the Integrated Development Post (Posbindu) can result in errors in risk identification, which in turn affects the effectiveness of public health interventions. Therefore, it is necessary to conduct training for cadres and evaluate whether training can improve the quality of measurements carried out by health cadres to ensure more accurate and reliable results in disease prevention efforts. It is hoped that the training can improve precision and accuracy, this research has the potential to improve the quality of health data collected by health cadres, thereby increasing the ability of the health system to prevent and manage NCDs more effectively. This study aims to evaluate the effect of training on the precision and accuracy of BMI and WCR measurements by health cadres in Posbindu.

## METHOD

### Research Design

This study uses a Pre-Experimental design with a group pre-test and post-test approach. This design aims to evaluate the effect of training on the precision and accuracy of Body Mass Index (BMI) and Pelvic Waist Circumference Ratio (PWCR) measurements by health cadres. In this design, measurements are made before and after training to assess changes in the variables studied.

### Location and Time of Research

This research was carried out at the Nusa Indah Health Center, Bengkulu City. Data collection was carried out during a training period lasting 6 days, and measurements were made before the training started and after the training was completed. The research was carried out on March 1-6, 2023 at the Nusa Indah Health Center, Bengkulu City.

## Population and Sample

The population in this study is all active health cadres at the Nusa Indah Health Center, Bengkulu City. The sample consisted of 24 health cadres who were selected using a total sampling technique from 12 posbindu in the Nusa Indah Health Center work area, where all active cadres were taken as research subjects.

## Data Collection

The independent variable in this study was the training provided for 6 days. This training includes materials and practices related to BMI and PWCR measurement to improve the skills of health cadres. Dependent variables include knowledge, precision, and accuracy of BMI and PWCR measurements. Knowledge was measured through tests before and after training, while precision and accuracy were measured based on BMI and PWCR measurements carried out by health cadres before and after training. Data collection is done by filling out pretest and posttest questionnaires and then practicing measuring height, weight, and waist circumference. The instruments used in this study are questionnaires to measure knowledge, as well as BMI and PWCR measuring tools to assess the precision and accuracy of measurements. The knowledge questionnaire has been tested for validity and reality. The results of the validity test were obtained with a > of 0.444, then the 10 questionnaire questions were declared valid.

The results of the Reality Test obtained a Cronbach Alpha value of 0.9 > 0.6, then the questionnaire was declared reliable. Knowledge is categorized as good if the score is ≥ 7 and poor if the score is < 7. Precision is the comparison of the results of the first measurement and the re-measurement of BMI or PWCR by the same cadre with the results of BMI or PWCR measurements carried out by supervisors/gold Standard. The measurement results are categorized as precise if the results of the first measurement and re-measurement of BMI or PWCR by cadres are the same as the results of BMI or PWCR measurements made by supervisors/gold Standard and are not precise if the results of the first measurement and re-measurement of BMI or PWCR by cadres are not the same as the results of BMI or PWCR measurements made by supervisors/gold Standard. Measurement accuracy is a comparison of the results of BMI measurement by cadres with Supervisors/Gold Standard. The measurement results are categorized as accurate if the cadre measurement results are the same as the Supervisor/Gold standard measurement value and inaccurate if the cadre measurement results are not the same as the Supervisor/Gold standard measurement value.

## Data Processing and Analysis

The data obtained from the measurements and questionnaires were analyzed using the Chi-Square Test to assess the difference in the proportion of knowledge before and after training. The McNemar test was used to analyze changes in the precision and accuracy of BMI and PWCR measurements before and after training. This analysis aims to determine the extent to which training affects the improvement of measurement precision and accuracy as well as the knowledge of health cadres.

## RESEARCH RESULTS

### Characteristic

Table 1 shows the results of the study that most respondents are between 50 and 70 years old, which makes up 75% of the total respondents. This shows that the majority of health cadres in Posbindu are in older age groups. In addition, the distribution of old cadres is evenly divided: 50% of new respondents have been cadres for 5 years or less, while the other 50% have been cadres for more than 5 years. This shows that there is a balance between relatively new cadres and more experienced cadres. The education of the majority of respondents is high school graduates, accounting for 58.3% of the total.

Table 1. Characteristics of Posbindu Cadres in the Work Area Nusa Indah Health Center, Bengkulu City

| Characteristic | Frequency | Percentage |
|---|---|---|
| **Age** | | |
| < 50 years | 6 | 25.0 |
| ≥50 years | 18 | 75.0 |
| **Long time as a cadre** | | |
| New (≤ 5 years) | 12 | 50.0 |
| Long (> 5 years) | 12 | 50.0 |
| **Education level** | | |
| Primary school | 2 | 8.3 |
| Junior High School | 2 | 8.3 |
| High School | 14 | 58.4 |
| College | 6 | 25.0 |

**The Effect of Training on Knowledge, Precision, and Accuracy of BMI Measurement**

Table 2. Differences in Knowledge of Posbindu Cadres before and after Training

| Knowledge BMI Measurement | | After Training | | | |
|---|---|---|---|---|---|
| | | Not Good | Good | Total (%) | p-value[a] |
| **Before Training** | Not Good | 1 | 8 | 9 (37.5) | 0,001 |
| | Good | 0 | 15 | 15 (62.5) | |
| **Total** | | 1 (8.3) | 23 (91.7) | 24 (100) | |
| Knowledge PWCR Measurement | | After Training | | | |
| | | Not Good | Good | Total | p-value[a] |
| **Before Training** | Not Good | 2 | 22 | 20 (83.3) | 0,001 |
| | Good | 0 | 0 | 4 (16.7) | |
| **Total** | | 2 (8.3) | 22 (91.7) | 24 (100) | |

[α] Chi-Square Test

Table 2 shows a significant improvement in knowledge of BMI and PWCR measurements after training. BMI measurement, before the training, 37.5% of health cadres were declared to be less precise in measuring BMI, while 62.5% were declared good. After the training, the proportion of cadres who were less precise decreased drastically to 8.3%, while those who were declared good increased to 91.7%. This shows that the training has succeeded in substantially improving the accuracy of BMI measurements, with the majority of cadres now taking higher precision BMI measurements. PWCR measurement, before the training, 83.3% of health cadres showed less precise PWCR measurement results, and only 16.7% were good. After the training, the proportion of cadres who are less precise decreased to 8.3%, while the good ones increased significantly to 91.7%. This shows that the training is also very effective in improving the accuracy of PWCR measurements, with almost all cadres now able to make measurements with better accuracy. The training has proven to be very effective in increasing knowledge about BMI and PWCR measurements. The results of the statistical test showed that there was an effect of training on cadres' knowledge about IMT and PWCR measurements (p-value 0.001<0.05).

Table 3. The Effect of Training on the Precision and Accuracy of Body Mass Index Measurements before and after Training

| | | After Training | | | |
|---|---|---|---|---|---|
| | | Not Precision | Precision | Total | p-value[a] |
| **Before Training** | Not Precision | 2 | 21 | 23 (95.8) | 0,0001 |
| | Precision | 0 | 1 | 1(4.2) | |
| **Total** | | 2(8.3) | 22(91.7) | 24(100.0) | |
| | | **After Training** | | | |
| | | Inaccurate | Accurate | Total | p-value[a] |
| **Before Training** | Inaccurate | 2 | 22 | 24(100.0) | 0,0001 |
| | Accurate | 0 | 0 | 0 | |
| **Total** | | 2(8.3) | 22(91.7) | 24(100.0) | |

[a]*McNemar test*

Table 3 shows that before the training, only 4,2% of health cadres carried out BMI measurements with good precision, while after the training, the proportion increased to 91.7%. For accuracy measurements, the proportion of cadres who made precise measurements increased from nothing accurate before training to 100% after training. The McNemar test results obtained a p-value of 0.0001<0.05, which means that BMI measurement training effectively improves the precision of BMI measurement. Before the training, 23 cadres were not precise in measuring BMI, after the training 21 people became precise. The McNemar test results obtained a p-value of 0.0001<0.05, meaning that BMI measurement training effectively improves the accuracy of BMI measurement.

**Effect of Training on the Precision and Accuracy of PWCR Measurements**

Table 4. Effect of Training on the Precision and Accuracy of Circumference Ratio Measurements Waist and Hips Before and After Training

| | | After Training | | | |
|---|---|---|---|---|---|
| | | Not Precision | Precision | Total | p-value[a] |
| **Before Training** | Not Precision | 4 | 18 | 22 (91.7) | 0,0001 |
| | Precision | 0 | 2 | 2 (8.3) | |
| **Total** | | 4 (16.7) | 20 (83.3) | 24 (100.0) | |
| | | **After Training** | | | |
| | | Inaccurate | Accurate | Total | p-value[a] |
| **Before Training** | Inaccurate | 4 | 18 | 22 (91.7) | 0,0001 |
| | Accurate | 0 | 2 | 2 (8.3) | |
| **Total** | | 4 (16.7) | 20 (83.3) | 24 (100.0) | |

[a]*McNemar test*

Table 4 shows that the McNemar test results obtained a p-value of 0.0001<0.05, meaning that PWCR measurement training effectively improves the precision and accuracy of PWCR measurements. Before the training, 22 cadres were not precise and inaccurate in measuring PWCR, after the training 18 people became precise and accurate in measuring PWCR. The results showed that before the training, only 8.3% of health cadres carried out PWCR measurements with good precision and accuracy, while after the training, the proportion increased to 83.3%.

## DISCUSSION

**Characteristic Health Cadre**

The results of the study show that most (75%) of cadres are in the age group over 50 years old. This was also found in a study at the Central Kedungpoh Posyandu in Yogyakarta showing that most of the cadres were > 40 years old (70%) (Lusiyana, 2020), Likewise, the results of other studies found that 84.2% of cadres were over 30 years old (Himmawan, 2019). Age is related to thinking maturity,

individuals with adult age have better knowledge compared to much younger ages. Mature age also makes people have a mature perspective, the socio-cultural environment will shape a new experience in a person A cadre will remain a cadre until the person decides to no longer be a cadre because there are no regulations that mention the limit on the working period and age of a person can become a cadre, so many cadres are elderly but still become a cadre. In theory, age affects the development of a person's grasp and mindset, the older a person's age, the lower the grasp (Nurayu, 2013). The dominance of cadres over the age of 50 years will be reflected in declining skills and abilities in conducting anthropometric measurements, although older health cadres tend to have better experience in carrying out their duties, but are likely to face challenges in the use of anthropometric tools.

The education level of cadres is almost entirely high school (58.3%) and university (25%). In line with the results of other studies that most of the cadres with higher education (Zalela *et al.*, 2023), However, the results of other studies found that most of the cadres with low education had an impact on the low knowledge of cadres (Himmawan, 2019). These results show the need for coaching and training for cadres to have qualified knowledge and skills and high motivation in carrying out their duties and providing health services (Agarwal *et al.*, 2019; Ngabonziza, 2019). Higher levels of education are positively correlated with the ability to understand and apply new knowledge gained from training. Individuals with higher education tend to have better cognitive skills, which makes it easier for them to follow and absorb the information conveyed during training, understand the training material, and implement it in practice. Higher education can increase confidence and problem-solving skills, which are very important in carrying out tasks as cadres (Bragg *et al.*, 2017).

The distribution of old cadres shows a balance between relatively new cadres and experienced cadres. 50% of respondents have only been cadres for 5 years or less, while the other 50% have been cadres for more than 5 years. In contrast to the results of research in Bangkalan Regency, it was found that 78% had been cadres for a long time (Hariyanti and Permana Putri, 2022) Likewise, in Pandeglang Regency, Banten, it was found that 63.2% of posyandu cadres had a long service period (> 5 years) (Himmawan, 2019). Long time as a cadre is important in the process of transferring knowledge and experience between generations of cadres. These long experiences are often associated with increased skills and in-depth knowledge of their duties, as well as stronger relationships with the communities they serve (Zalela *et al.*, 2023). The length of time to be a cadre is related to the many experiences and learnings gained during being a cadre. A long working period will form an effective work pattern because it is related to experience. Cadres with longer experience will have a lot of knowledge (Profita, 2018).

**The Effect of Training on Knowledge of BMI and PWCR Measurement**

The results of the study found an increase in cadre knowledge in measuring BMI and PWCR after participating in the training. Some research results also show the influence of training on improving the knowledge of health cadres (Asri *et al.*, 2020). The results of previous research showed that there was an influence of knowledge on the precision of weighing toddlers by posyandu cadres in the working area of the Coconut Thorn Health Center (Hardiyanti *et al.*, 2018). Knowledge is the result of learning and experience, awareness so that the person can become knowledgeable. The training intervention was related to the improvement of the knowledge of posbindu cadre mothers about the measurement of body mass index and the waist-hip circumference ratio of adult age with its precision and accuracy (Fadjri, 2016). Increasing knowledge will be able to improve the ability of cadres to take measurements. Good cadre knowledge is related to the ability of cadres to make anthropometric measurements so that the measurement results are precise and accurate (Hariyanti and Permana Putri, 2022). The training provides the theoretical knowledge base necessary to better understand the concepts of BMI and PWCR. The structured training helps participants understand the basic theory and practical applications of health measurement techniques, which in turn improves measurement accuracy. Training typically includes hands-on sessions that allow health cadres to directly apply the theory in real-life situations and can reduce measurement errors (Puji Lestari *et al.*, 2023). Training that focuses on health measurement techniques such as BMI and PWCR improves the knowledge and skills of cadres. The training not only improves technical skills but also increases participants' confidence in making accurate measurements. The results of this study recommend the need for regular and continuous training for health cadres to ensure that cadre skills remain up-to-date. An effective training program can reduce measurement errors

and improve the quality of health data, which is important for the planning and evaluation of public health programs.

**Effect of Training on the Precision and Accuracy of BMI and PWCR Measurements**

The results of this study prove that the training is effective in improving the precision and accuracy of BMI and PWCR measurements. The results of this study are in line with other studies that found that training affects cadre skills in conducting anthropometric and blood pressure checks. The information obtained during the training increases the knowledge and understanding of cadres in conducting anthropometric measurements and blood pressure checks (Lusiyana, 2020). In this study, before the training, almost all respondents were not precise and accurate in measuring BMI and PWCR, after participating in the training, almost all cadres became precise and accurate in measuring BMI and PWCR. This dramatic change shows that training also has a positive impact on the precision of PWCR measurements. The results of the McNemar test showed a very significant p-value (<0.05) for the precision of BMI and PWCR measurements, indicating that the change in measurement precision was the result of training, not a coincidence. The results of this study are in line with the findings in Bangkalan Regency that in the initial condition, most of the cadres were not precise and accurate in anthropometric measurements (Hariyanti and Permana Putri, 2022). The results of these measurements that are not precise and accurate can lead to less precise conclusions about the nutritional status of individuals. Inaccurate conclusions will result in inaccurate decision-making, on the contrary, the right measurement will produce accurate data so that actions and handling can be taken by the existing problem (Suyatno *et al.*, 2019).

Precision and accuracy are two fundamental concepts in measurement related to data quality, but they refer to different aspects. Precision is the degree of consistency or uniformity of measurement results when repeated under the same conditions. This means how similar the results obtained from multiple measurements made on the same object with the same tool. Precision measures the variability or dispersion of measurement results. A precision measuring instrument produces similar results each time it is used, although the results may not be close to the actual value. (Mocini *et al.*, 2023). Training is a process or activity in which a person or group of people acquires new knowledge, skills, or competencies through education, training, or experience. The purpose of training is to improve a person's ability to perform certain tasks or develop knowledge in a certain field (Geniets *et al.*, 2021). The interactive lecture method applied in the training is very effective in increasing the knowledge of Posyandu cadres (Vinci *et al.*, 2022). The interactive approach allows participants to be more involved and actively participate in the learning process so that the material is better absorbed and easier to remember. The involvement of cadres in the discussion and question-and-answer process encourages them to share their experiences, opinions, and knowledge (Kurniasari *et al.*, 2023). In addition, utilizing technology and interactive media such as PowerPoint presentations, videos, images, or props to support the delivery of material can enrich the presentation and help visualize the concepts taught (Rahmadi *et al.*, 2023). The practical method applied in this training is one of the most effective approaches to improving the skills of Posyandu cadres (Noordiati, 2020). Live practicum exercises provide opportunities for cadres to practice directly on certain skills under the supervision of instructors. This allows them to learn and improve their skills in real life. Training sessions involving cadres from several Posyandu allow for the exchange of experiences, ideas, and best practices between cadres (Rahmadi *et al.*, 2023).

Accuracy is how close the measurement results are to the actual value or the correct reference value. Accuracy measures the accuracy of a measurement in terms of how well the measurement results reflect the correct value. An accurate measuring tool provides results that are close to the actual value, although the results may be inconsistent if measured repeatedly (Mocini *et al.*, 2023). The results of this study prove that training can improve the accuracy of BMI and PWCR measurements. The training provides a better understanding of the correct way to measure BMI and PWCR, including appropriate techniques and procedures. Training can provide an in-depth understanding of correct measurement techniques and proper procedures. By understanding the correct way to measure BMI and PWCR, health cadres can minimize systematic errors and variability in measurement results. Effective training teaches cadres about standard methodologies and the use of appropriate tools, which are essential to achieve accurate results. Training can significantly improve the precision and accuracy of measurements

(Wahyuningsih *et al.*, 2024). Systematic and evidence-based training improves the knowledge and skills of health cadres in making accurate measurements (Azizan *et al.*, 2023). Measurement accuracy will increase as the training process is carried out on an ongoing basis (Tikasni *et al.*, 2024). The results of this study imply that systematic and continuous training needs to be carried out to improve the knowledge and skills of cadres in conducting anthropometric measurements, thereby increasing the precision and accuracy of measurement results.

## CONCLUSIONS AND SUGGESTIONS

The results showed that the training significantly improved the knowledge and skills of cadres in the measurement of Body Mass Index (BMI) and Upper Arm Circumference (PWCR), with measurable improvements in measurement precision and accuracy. The McNemar test (p=0.0001) shows that the training has succeeded in reducing the number of cadres who are not precise and inaccurate in IMT and PWCR measurements. Despite the reduction in the number of cadres that are not precise in the IMT and the improvement in the accuracy of the PWCR, the final results show that there is still a need for improvement in the accuracy of the fluctuating PWCR measurements. To ensure that cadre skills remain optimal, it is recommended to carry out additional training sessions that focus on PWCR measurement techniques, as well as conduct regular monitoring and evaluation of measurement results. Implement a continuous training program with modules that are updated regularly to keep pace with the latest developments in measurement techniques. In addition, conduct periodic assessments to provide constructive feedback to cadres, as well as provide standardized measuring facilities and tools to support the accuracy of measurement results.

## DAFTAR PUSTAKA

Agarwal, S., Sripad, P., Johnson, C., Kirk, K., Bellows, B., Ana, J., Blaser, V., *et al.* (2019), "A conceptual framework for measuring community health workforce performance within primary health care systems", *Human Resources for Health*, Human Resources for Health, Vol. 17 No. 1, pp. 1–20, doi: 10.1186/s12960-019-0422-0.

Agustiningrum, R. and Kusbaryanto, K. (2019), "Efektifitas Diabetes Self Management Education Terhadap Self Care Penderita Diabetes Mellitus: A Literature Review", *Jurnal Keperawatan Respati Yogyakarta*, Vol. 6 No. 2, p. 558, doi: 10.35842/jkry.v6i2.309.

Asri, Mulyono, S. and Khasanah, U. (2020), "Pengaruh Pelatihan Kader Posbindu Terhadap Perilaku Deteksi Dini Hipertensi Pada Usia Dewasa", *Jurnal Kesehatan Panrita Husada*, Vol. 5 No. 1, pp. 43–52.

Azizan, F.N., Sri Rahayu, L. and Nur Aini, R. (2023), "Pengaruh Pelatihan Kader terhadap Peningkatan Keterampilan Pengukuran Tinggi Badan dan Penilaian Status Stunting pada Balita di Desa Kadubale, Kecamatan Banjar, Kabupaten Pandeglang Tahun 2022", *Jurnal Ilmu Gizi Dan Dietetik*, Vol. 2 No. 1, pp. 53–58, doi: 10.25182/jigd.2023.2.1.53-58.

Bragg, J.E., Miller-Cribbs, J., Gordon, J., Gaudet, J., Hellman, C. and Munoz, R.T. (2017), "Increasing Self-Efficacy and Building Hope Through Simulation Based Education.", *International Journal of Arts & Sciences*, Vol. 10 No. 2, pp. 535–543.

Destra, E., Anggraeni, N., Firmansyah, Y. and Santoso, A. (2023), "Waist To Hip Ratio in Cardiovascular", *MAHESA: Malahayati Health Student Journal*, Vol. 3 No. 6, pp. 1770–1781.

Fadjri, T.K. (2016), "Kualitas Hasil Penimbangan Berat Badan Balita oleh Kader Posyandu", *AcTion: Aceh Nutrition Journal*, Vol. 1 No. 2, p. 111, doi: 10.30867/action.v1i2.20.

Fajrin, D.H., Desmawati, Astriana, K., Chasanah, S.U. and Restile, R. (2016), *Gizi Kesehatan Masyarakat*, Vol. 19, Eureka Media Aksara.

Geniets, A., O'Donovan, J., Hakimi, L. and Winters, N. (2021), *Training for Community Health: Bridging the Global Health Care Gap.*, edited by Press., O.U.

Hardiyanti, R., Jus'at, I. and Angkasa, D. (2018), "Hubungan lama kerja menjadi kader, pengetahuan, pendidikan, pelatihan dengan presisi dan akurasi hasil penimbangan berat badan balita oleh kader Posyandu", *AcTion: Aceh Nutrition Journal*, Vol. 3 No. 1, p. 74, doi: 10.30867/action.v3i1.102.

Hariyanti, H.F. and Permana Putri, E.B. (2022), "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", *Journal of Public Health Research and Community Health Development*, Vol. 5 No. 2, pp. 117–125, doi: 10.20473/jphrecode.v5i2.25838.

Herlina, S. (2021), "Pelatihan Alat Ukur Data Stunting (Alur Danting) sebagai Upaya Peningkatan Pengetahuan dan Keterampilan Kader dalam Optimalisasi Pengukuran Deteksi Stunting (Denting)", *Jurnal Kebijakan Kesehatan Indonesia : JKKI*, Vol. 10 No. 3, pp. 1–5.

Himmawan, L.S. (2019), *Faktor Yang Berhubungan Dengan Pengetahuan Kader Posyandu Tentang 1000 Hari Pertama Kehidupan (HPK), Skripsi*, Vol. 15, BAnten.

Kaptiningsih, B., Suhartini, T. and Rahmat, N.N. (2023), "Hubungan Peran Kader Posbindu dengan Minat Masyarakat dalam Pelaksanaan Deteksi Dini Penyakit Tidak Menular", *Jurnal Keperawatan*, Vol. 15 No. 4, pp. 1835–1842.

Kemenkes RI. (2018), "Laporan Nasional Riset Kesehatan dasar 2018", *Badan Penelitian Dan Pengembangan Kesehatan*.

Khan, M.D., Ahmad, M.K., Alam, R., Khan, S., Jaiswal, G., Jahan, A. and Khan, M.M. (2023), "Association of central obesity with risk factors for cardiovascular disease in North Indian population: A case-control study", *Journal of Krishna Institute of Medical Sciences University*, Vol. 12 No. 2, pp. 81–93.

Kurniasari, E., Wardani, D.S., Putri, R. and Jannah, M. (2023), "Efektifitas Edukasi Menggunakan Media Audio Visual Dan E-Leaflet Terhadap Peningkatan Pengetahuan Kader Posyandu Dalam Pencegahan Stunting Di Masa Pandemi Covid-19", *Jurnal Ilmu Kebidanan Dan Kesehatan (Journal of Midwifery Science and Health)*, Vol. 14 No. 1, pp. 13–20, doi: 10.52299/jks.v14i1.146.

Lusiyana, N. (2020), "Optimalisasi peran kader posbindu dalam deteksi hipertensi di Posbindu Kedungpoh Tengah Wonosari Yogyakarta", *Jurnal Education and Development*, Vol. 8 No. 2, pp. 167–170.

Mocini, E., Cammarota, C., Frigerio, F., Muzzioli, L., Piciocchi, C., Lacalaprice, D., Buccolini, F., *et al.* (2023), "Digital Anthropometry: A Systematic Review on Precision, Reliability and Accuracy of Most Popular Existing Technologies", *Nutrients*, Vol. 15 No. 2, pp. 1–39, doi: 10.3390/nu15020302.

Munir, I. (2024), "Pelatihan Intensif Kader Kesehatan Sebagai Upaya Pencegahan Stunting Yang Efektif panjang terhadap kesehatan , pertumbuhan , dan perkembangan anak . Menurut Organisasi berbagai sektor , termasuk kesehatan , pendidikan , sosial , dan ekonomi . Salah satu p", *Jurnal Ilmu Kesehatan Dan Gizi (JIG)*, Vol. 2 No. 3, pp. 42–48, doi: https://doi.org/10.55606/jig.v2i3.3034.

Ngabonziza, S. (2019), *Exploration of Knowledge and Skills Development among Community Health Workers in Rwanda. Thesis*, Canada.

Noordiati, N. (2020), "Peningkatan Kapasitas Kader Posyandu Melalui Pelatihan Pemantauan Pertumbuhan dan Perkembangan Balita di Wilayah Kerja Puskesmas Kereng Bangkirai Kecamatan Sebangau Palangka Raya", *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, Vol. 5 No. 4, pp. 328–335, doi: 10.33084/pengabdianmu.v5i4.1345.

Nurayu, A.W. (2013), *Hubungan Tingkat Pengetahuan, Pendidikan, Usia Dan Lama Menjadi Kader Posyandu Dengan Kualitas Laporan Bulanan Data Kegiatan Posyandu, Sripsi*, Surakarta.

Profita, A.C. (2018), "Beberapa Faktor Yang Berhubungan Dengan Keaktifan Kader Posyandu Di Desa Pengadegan Kabupaten Banyumas", *Jurnal Administrasi Kesehatan Indonesia*, Vol. 6 No. 2, p. 68, doi: 10.20473/jaki.v6i2.2018.68-74.

Puji Lestari, Wenny Dwi Kurniati and Anisa Herdin Hidayati. (2023), "Peningkatan Keterampilan Kader Posyandu dalam Pengukuran Antropometri di Desa Meteseh, Boja, Kendal", *Poltekita: Jurnal Pengabdian Masyarakat*, Vol. 4 No. 2, pp. 594–601, doi: 10.33860/pjpm.v4i2.1720.

Purnami, L.A., Sedana, K.P., Dwijayanti, L.A. and Purniasih, N.K. (2020), "Kuesioner Pra Skrining Perkembangan (Kpsp) Sebagai Penilaian Tumbuh Kembang Balita: Pelatihan Kader Desa Girimas", *Jurnal Pengabdian Masyarakat Kesehatan*, Vol. 6 No. 2, pp. 71–74, doi: 10.33023/jpm.v6i2.602.

Rahmadi, A., Rusyantia, A. and Wahyuni, E.S. (2023), "Peningkatan Kapasitas Kader Posyandu tentang Antropometri, Pemantauan Pertumbuhan dan Makanan Balita Melalui Pelatihan dan Pendampingan dalam Rangka Pencegahan Stunting di Desa Sukamenanti, Kecamatan Bukit

Kemuning, Kabupaten Lampung Utara", *Jurnal Abdi Masyarakat Indonesia*, Vol. 3 No. 6, pp. 1811–1818, doi: 10.54082/jamsi.1027.

Shafiee, A., Nakhaee, Z., Bahri, R.A., Amini, M.J., Salehi, A., Jafarabady, K., Seighali, N., *et al.* (2024), "Global prevalence of obesity and overweight among medical students: a systematic review and meta-analysis", *BMC Public Health*, BioMed Central, Vol. 24 No. 1, pp. 1–9, doi: 10.1186/s12889-024-19184-4.

Suyatno, Fatimah, S. and Kartasurya, M.I. (2019), *Policy Brief Akurasi Pemantauan Status Gizi Di Posyandu Memprihatinkan*.

Tikasni, E., Utami, E. and Ariatmanto, D. (2024), "Analisis Akurasi Object Detection Menggunakan Tensorflow Untuk Pengenalan Bahasa Isyarat Tangan Menggunakan Metode SSD", *Jurnal Fasilkom*, Vol. 14 No. 2, pp. 385–393.

Vinci, A.S., Bavhtiar, A. and Parahita, I.G. (2022), "Efektivitas Edukasi mengenai PEncegahan Stunting kepada Kader: Systematic Literature Review", *Jurnal Endurance : Kajian Ilmiah Problema Kesehatan*, Vol. 7 No. 1, pp. 66–73, doi: http://doi.org/10.22216/endurance.v7i1.822.

Wahyuningsih, Winarsih and Marni. (2024), "Hubungan Keikutsertaan Pelatihan dengan kinerja Kader di Posyandu Jambukulon Klaten", *Jurnal Kebidanan*, Vol. 15 No. 01, pp. 56–65.

WHO. (2019), *Non Communicable Disease Country Profiles 2018*, World Health Organization, Geneva.

WHO. (2021), "Hypertension", Word Health Organization, Geneva.

Wong, M.C.S., Huang, J., Wang, J., Chan, P.S.F., Lok, V., Chen, X., Leung, C., *et al.* (2020), "Global, regional and time-trend prevalence of central obesity: a systematic review and meta-analysis of 13.2 million subjects", *European Journal of Epidemiology*, Springer Netherlands, Vol. 35 No. 7, pp. 673–683, doi: 10.1007/s10654-020-00650-3.

Zalela, Prasiwi, W.M. and Purnamawati, D. (2023), "Efektivitas Pelatihan Kader dalam Rangka Peningkatan Kompetensi dan KEteramilan Kader di Puskesmas Pasar Minggu", *Prosiding Seminar Nasional Kesehatan Masyarakat Universitas Muhammadiyah Surakarta*, pp. 145–157.

Zhu, Q., Huang, B., Li, Q., Huang, L., Shu, W., Xu, L., Deng, Q., *et al.* (2020), "Body mass index and waist-to-hip ratio misclassification of overweight and obesity in Chinese military personnel", *Journal of Physiological Anthropology*, Journal of Physiological Anthropology, Vol. 39 No. 1, p. 24, doi: 10.1186/s40101-020-00236-8.