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# Effectiveness of the AA-PoDiTa Application in Improving Posyandu Cadres' Knowledge and Skills in Child Growth and Development

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**ABSTRACT**

*Background: Stunting remains a major public health concern in Aceh, Indonesia. Posyandu cadres play an important role in monitoring child growth and identifying early signs of nutritional problems. However, manual recording systems and inconsistent anthropocentric measurement practices may limit the accuracy and effectiveness of growth monitoring. Digital health innovations combined with standardized training may help address these challenges. Objective: This study aimed to analyze the effect of the AA-PoDiTa (Digital Posyandu for Infants and Toddlers) application combined with WHO-standard anthropocentric training on Posyandu cadres' knowledge and practical skills. Methods: A quantitative pre-experimental study with a one-group pretest and post-test design was conducted among 20 active Posyandu cadres in Gampong Blang Teue, Lhokseumawe, Indonesia. Participants were selected using total sampling. The intervention consisted of eight training sessions conducted over six months (April–September 2026). Knowledge was assessed using a structured questionnaire, while practical skills were evaluated using an observation checklist. Data were analyzed using the Shapiro–Wilk test and Wilcoxon signed-rank test. Results: The mean knowledge score increased from 55.00 at pretest to 86.20 at post-test. Similarly, the mean practical skill score improved from 53.60 to 87.60. Both improvements were statistically significant ($p < 0.001$), with large effect sizes ($r \approx 0.88$). All participants demonstrated improvements in their knowledge and practical skills following the intervention. Conclusion: The combination of the AA-PoDiTa application and WHO-standard anthropocentric training significantly improved Posyandu cadres' knowledge and practical skills. This integrated approach offers a promising strategy for strengthening community-based growth monitoring, supporting Posyandu digitalization, and improving stunting prevention efforts.*

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## INTRODUCTION

Stunting, or short stature caused by chronic under nutrition, is one of the most sensitive indicators of failed human development. It reflects not only a long-term shortage of nutrient intake but also an accumulation of poverty, limited access to clean water and sanitation, weak maternal and child health services, and low family knowledge of child care and feeding (Black et al., 2013; UNICEF, 2013). Its consequences are largely irreversible when it is not addressed during the critical period. Children who are stunted early in life face a higher risk of delayed cognitive development, lower educational attainment, reduced adult economic productivity, and non-communicable diseases (Dewey & Begum, 2011; Victora et al., 2008). The first 1,000 days of life, from conception to a child's second birthday, are the most decisive window because linear growth and brain development reach their peak during this period (Bhutta et al., 2013). Accurate, routine, and timely growth monitoring is therefore a prerequisite for preventing stunting.

Indonesia has made progress in reducing stunting. The 2024 Indonesian Nutritional Status Survey (SSGI) recorded a national prevalence of 19.8%, down from 21.5% in 2023 and below the annual target of 20.1%, yet still close to the 20% public health threshold set by WHO and far from the 14.2% national target for 2029 (Badan Kebijakan Pembangunan Kesehatan Kementerian Kesehatan RI, 2025). The national figure conceals wide regional disparities. Aceh Province recorded a prevalence of 28.6%, placing it among the five provinces with the highest burden (Badan Kebijakan Pembangunan Kesehatan Kementerian Kesehatan RI, 2025). Lhokseumawe City declined from 28.1% in 2022 to 20.7% in 2023 (Badan Kebijakan Pembangunan Kesehatan Kementerian Kesehatan RI, 2024; Kementerian Kesehatan Republik Indonesia, 2022), but this level still falls in the "high" category of the public health classification proposed by de Onis et al. (2019). At the village level, 7 of 47 infants and toddlers (14.9%) in Gampong Blang Teue were stunted in 2026. Accelerating stunting reduction at the village (*gampong*) level therefore still requires strengthening at the front line of service delivery, namely the integrated health post (*Posyandu*).

*Posyandu* is a community-based health effort in which monthly weighing, length or height measurement, recording on the growth chart (*Kartu Menuju Sehat*, KMS), nutrition counselling, and early referral are carried out by volunteer cadres. The quality of child growth data at the national level thus ultimately depends on how accurately cadres measure and record at the village level. Anthropocentric measurement at *Posyandu* is often reported to fall short of standards: equipment is calibrated or unsuitable, children are poorly positioned during length measurement, results are arbitrarily rounded, and age is wrongly determined. Because nutritional status is classified by Z-score, an error of only one centimeter can change a child's classification. Dzandini et al. (2025) found that cadres' knowledge was significantly associated with their skill in measuring toddlers' height, although the association with weight-measurement skill did not reach statistical significance, indicating that technical skill is closely linked to a sound knowledge base. A second problem lies in recording. Most *Posyandu* still rely on manual registers and growth charts, which are prone to transcription

errors, delay reporting to the health center, hinder tracing of individual growth histories, and prevent rapid trend analysis.

Mobile health (m Health) offers a promising way forward. WHO (2011) defines m Health as medical and public health practice supported by mobile devices, and its later guideline recommends digital health records, decision support, and remote training for front line health workers as part of health system strengthening (WHO, 2019). Systematic reviews concluded that the use of mobile technology by community health workers is feasible and well accepted, with the most consistent benefits reported for data collection and communication (Braun et al., 2013), and that m Health strategies used by front line health workers in developing countries are feasible and effective, although most studies were small and short-term (Agarwal et al., 2015). A meta-analysis likewise showed that mobile health technologies can improve health service delivery processes, although the strength of evidence varies across outcomes (Free et al., 2013). In Indonesia, this direction is aligned with the electronic Community-Based Nutrition Recording and Reporting system (e-PPGBM) and with Presidential Regulation No. 72 of 2021 on accelerating stunting reduction (Peraturan Presiden Republik Indonesia Nomor 72 Tahun 2021). Indonesian studies have begun to evaluate digital applications for cadres. Febrina and Antarsih (2021) reported a significant increase in cadres' knowledge of early stunting detection after using the PPA cadre application, and Fitriani et al. (2022) found improvements in both knowledge and skills after training and use of the Si Centing application.

Despite these findings, several gaps remain in the available evidence. First, most studies measure only the cognitive domain (knowledge) and do not objectively assess skills through structured observation, even though the real output of *Posyandu* services is determined by practical skill. Second, effect sizes are rarely reported, so the practical strength of an intervention is difficult to judge and to compare across studies. Third, evidence from rural and coastal areas with limited technological infrastructure, which are the settings that need such interventions most, remains scarce.

To address these needs, the AA-PoDiTa (*Posyandu Digital untuk Bayi dan Balita*, "Digital Posyandu for Infants and Toddlers") application was developed as an Android-based tool designed for the working context of *Posyandu* cadres. It provides child data recording on a smartphone, automatic nutritional status analysis based on the WHO child growth standards (WHO, 2006) and Indonesian Minister of Health Regulation No. 2 of 2020 (Kementerian Kesehatan Republik Indonesia, 2020), growth chart visualization, and offline data management for areas with limited internet connectivity. AA-PoDiTa was developed by the research team.The application was introduced together with hands-on training in standardized anthropometric measurement, so that the intervention addressed both stages in which errors arise: data collection and data processing. This design is grounded in the PRECEDE–PROCEED model, in which knowledge is a predisposing factor, tools and skills are enabling factors, and mentoring and supervisor support are reinforcing factors that jointly determine health behavior (Green & Kreuter, 2005). Outcomes were evaluated at the learning level of the Kirkpatrick model, that is, changes in knowledge and skills (Kirkpatrick & Kirkpatrick, 2006).

Accordingly, this study aimed to analyze the effect of applying AA-PoDiTa combined with WHO-standard anthropometry training on the knowledge and skills of *Posyandu* cadres in monitoring child growth and development in Gampong Blang Teue, Blang Mangat District, Lhokseumawe City, and to

estimate the magnitude of that effect. The study differs from previous work in three ways. To the authors' knowledge, this is the first published evaluation of the effectiveness of AA-PoDiTa. AA-PoDiTa was developed during the first year of the community service program, and the present study evaluates its implementation in the second year. Both cognitive and psycho motor competencies were measured with instruments suited to each domain, rather than knowledge alone. The study was also conducted in a coastal Aceh village with limited digital infrastructure, so the offline feature of the application operated under real conditions. The study contributes empirical evidence, including effect sizes, for strengthening community-based digital health services and for expanding appropriate m Health interventions for stunting prevention in similar resource-limited settings.

## METHOD

This study used a quantitative approach with a pre-experimental *one-group pretest post-test design*. The design was chosen because all active *Posyandu* cadres in the study location were targets of a community service program, so forming a control group that did not receive the intervention was neither ethically nor practically feasible. Knowledge and skills were measured before (pre-test) and after (post-test) the intervention. The independent variable was the application of AA-PoDiTa combined with training in the use of WHO-standard anthropometric tools, and the dependent variables were cadres' knowledge and skills in child growth and development monitoring.

The study was conducted in Gampong Blang Teue, Blang Mangat District, Lhokseumawe City, Aceh Province, as part of the second-year community service program. The population comprised all active *Posyandu* cadres in the *gampong*. A *total sampling* technique was used, so every member of the population who met the criteria became a respondent, giving a sample of 20 cadres. The inclusion criteria were active cadre status, willingness to attend the entire series of activities, and a signed informed consent form. The study was conducted from April to September 2026 in one gampong (Gampong Blang Teue), where *Posyandu* sessions are held once a month. Seventeen respondents (85.0%) were categorized as adults and three (15.0%) as young adults aged 20–23 years. By education, 13 (65.0%) had completed senior high school, 5 (25.0%) junior high school, and 2 (10.0%) held a bachelor's degree. By occupation, 10 (50.0%) were housewives, 8 (40.0%) were traders, and 2 (10.0%) were teachers.

Knowledge was measured with a multiple-choice questionnaire developed from the WHO standards and Minister of Health Regulation No. 2 of 2020. Skills were measured with an observation checklist covering anthropocentric measurement procedures and the operation of AA-PoDiTa, in which each step was rated as performed correctly, performed imperfectly, or not performed. Both instruments had been tested for validity and reliability before use, and the same instruments were applied at pretest and post-test. Total scores were categorized as good (≥ 80), fair (60–79), or poor (< 60). The materials comprised Android smartphones with AA-PoDiTa installed, a digital scale and a stadiometer, training modules (slides, videos, and a practice guide), pretest and post-test questionnaires, and skill checklists.

AA-PoDiTa has four main features. The first is smartphone-based recording of each child's identity, date of birth, and weight and length or height at every visit. The second is automatic nutritional status analysis that calculates

Z-scores based on the WHO standards and Minister of Health Regulation No. 2 of 2020, which removes manual table reading, a known source of interpretation errors. The third is growth chart visualization that displays each child's growth trajectory over time. The fourth is offline data management, with synchronization when a network becomes available.

The study was carried out in five stages (Table 1). The training combined lectures with demonstrations and hands-on practice, following the principles of adult learning (Knowles, 1980) and the experiential learning cycle (Kolb, 1984): cadres observed demonstrations, discussed common measurement errors, learned the scientific basis of each procedure, and then practiced directly with the anthropocentric tools and the application. The training was delivered in eight sessions of 30 minutes each between April and September 2026 by trainers who were lecturers. The pretest was administered at the beginning of the first session and the post-test at the end of the final session.

**Table 1. Stages of the Research Procedure**

| Stage | Name | Activities |
|---|---|---|
| 1 | Preparation | Preliminary survey, permit processing, instrument trial, and activity scheduling |
| 2 | *Pretest* | Measurement of cadres' knowledge (questionnaire) and skills (observation checklist) before the intervention |
| 3 | Intervention | Training by lecture and hands-on practice in using standardized anthropocentric tools and the AA-PoDiTa application |
| 4 | *Post-test* | Re-measurement of knowledge and skills after the intervention using the same instruments |
| 5 | Field mentoring | Continuous support for cadres in using the application and measuring tools during routine *Posyandu* sessions |

Uni variate analysis was used to describe the mean, standard deviation, median (interquartile range, IQR), minimum, maximum, and category distribution of knowledge and skill scores. Normality was tested with the Shapiro–Wilk test (Shapiro & Wilk, 1965), which is suitable for small samples. Because the post-test data did not satisfy the normality assumption, bivariate analysis used the nonparametric Wilcoxon signed-rank test (Wilcoxon, 1945) with a significance level of $\alpha = 0.05$. Effect size was calculated as $r = Z/\sqrt{N}$ and interpreted according to Cohen (1988). The relationship between knowledge and skill scores was examined using Spearman's rank correlation coefficient ($r$s; Spearman, 1904) at pretest, at post-test, and for the change scores (post-test minus pretest), and was interpreted according to Cohen (1988).

All respondents received an explanation of the purpose, procedures, benefits, and risks of the study and signed an informed consent form. Confidentiality was maintained by using respondent codes, and participation was voluntary and without coercion. The study received ethical approval from the Health Research Ethics Committee (KEPK) of UNBP (No. 103/KEPK/UNBP/VIII/2026).

## RESULT AND DISCUSSION

This section presents the results of the pretest and post-test measurements, followed by the normality test and hypothesis test, and then discusses the findings in light of previous studies and the study context.

### Comparison of Pretest and Post-test Scores

Uni variate analysis showed a marked increase in both variables after the intervention (Table 2). The mean knowledge score rose from 55.00 at pretest to 86.20 at post-test, a difference of 31.20 points, and the mean skill score rose from 53.60 to 87.60, a difference of 34.00 points. All respondents (100%) improved their scores on both variables, and no respondent experienced a decline or remained unchanged.

**Table 2. Descriptive Statistics of Cadres' Knowledge and Skill Scores Before and After the Intervention (*n* = 20)**

| Variable | Time point | Mean ± SD | Median (IQR) | Min–Max | Mean difference (Δ) |
|---|---|---|---|---|---|
| Knowledge | Pretest | 55.00 ± 7.42 | 55.0 (52.0–57.0) | 43–67 | – |
| | Post-test | 86.20 ± 7.15 | 88.5 (85.3–89.0) | 70–97 | +31.20 |
| Skills | Pretest | 53.60 ± 7.82 | 54.0 (49.8–56.8) | 41–67 | – |
| | Post-test | 87.60 ± 7.04 | 89.0 (87.8–90.0) | 70–98 | +34.00 |

Note. SD = standard deviation; IQR = inter quartile range (Q1–Q3); Δ = post-test mean minus pretest mean.

### Distribution of Knowledge and Skill Categories

Before the intervention, most cadres were in the poor category. For knowledge, 15 respondents (75.0%) were in the poor category and 5 (25.0%) in the fair category, with none in the good category. The same pattern appeared for skills, with 15 respondents (75.0%) poor and 5 (25.0%) fair. After the intervention the distribution shifted across the board (Table 3). For knowledge, 17 respondents (85.0%) reached the good category and 3 (15.0%) were fair, while for skills 18 respondents (90.0%) reached the good category and 2 (10.0%) were fair. No respondent remained in the poor category on either variable.

**Table 3. Distribution of Knowledge and Skill Categories Before and After the Intervention (*n* = 20)**

| Category | Knowledge pre-test | Knowledge post-test | Skills pre-test | Skills post-test |
|---|---|---|---|---|
| Poor (< 60) | 15 (75.0%) | 0 (0.0%) | 15 (75.0%) | 0 (0.0%) |
| Fair (60–79) | 5 (25.0%) | 3 (15.0%) | 5 (25.0%) | 2 (10.0%) |
| Good (≥ 80) | 0 (0.0%) | 17 (85.0%) | 0 (0.0%) | 18 (90.0%) |

### Normality Test

The Shapiro–Wilk test showed that the pre-test data for both variables were normally distributed, for knowledge ($W$ = 0.905; $p$ = 0.052) and for skills ($W$ = 0.928; $p$ = 0.139). In contrast, the post-test data were not normally distributed, for knowledge ($W$ = 0.825; $p$ = 0.002) and for skills ($W$ = 0.821; $p$ = 0.002) (Table 4). The non-normality of the post-test data can be understood as a consequence of a ceiling effect, that is, respondents' scores clustering at the

high end after the intervention. Because one assumption of parametric testing was not met, the analysis proceeded with a non parametric test.

**Table 4. Results of the Shapiro–Wilk Normality Test**

| Data | *W* statistic | *p*-value | Remark |
|---|---|---|---|
| Knowledge pre-test | 0.905 | 0.052 | Normal |
| Knowledge post-test | 0.825 | 0.002 | Not normal |
| Skills pre-test | 0.928 | 0.139 | Normal |
| Skills post-test | 0.821 | 0.002 | Not normal |

## Hypothesis Testing and Effect Size

The Wilcoxon signed-rank test produced a statistic of $W = 0.000$ for both variables ($Z = -3.92$ for knowledge and $Z = -3.93$ for skills), indicating that no respondent's score changed in a negative direction. The *p*-values were 0.000088 for knowledge and 0.000086 for skills (Table 5). Both are far below the 0.05 significance level, so the null hypotheses were rejected and the alternative hypotheses accepted for both variables. The effect size, calculated as $r = Z/\sqrt{N}$, was approximately 0.88 for both variables. According to Cohen (1988), a value above 0.50 already represents a large effect, so 0.88 falls in the very large category. The intervention was therefore not only statistically significant but also of substantial practical strength.

**Table 5. Results of the Wilcoxon Signed-Rank Test and Effect Size**

| Variable | *W* statistic | *Z* | *p*-value | Effect size (*r*) | Decision |
|---|---|---|---|---|---|
| Knowledge (pre vs. post) | 0.000 | −3.92 | 0.000088 | ≈ 0.88 | H0 rejected |
| Skills (pre vs. post) | 0.000 | −3.93 | 0.000086 | ≈ 0.88 | H0 rejected |

Note. $r = Z/\sqrt{N}$; significance level $\alpha = 0.05$.

## Improvement in Cadres' Knowledge

The 31.20-point increase in mean knowledge shows that combining training with the AA-PoDiTa application increased cadres' understanding of growth monitoring concepts, anthropocentric indices, and the interpretation of nutritional status. This is consistent with Febrina and Antarsih (2021), who reported higher cadre knowledge after using a digital application for early stunting detection, and with Fitriani et al. (2022), who found similar results for the Si Centing application. Several mechanisms may explain the result. First, the training material was built around concrete problems that cadres face at *Posyandu*, consistent with the problem-centered orientation of adult learners (Knowles, 1980). Second, the application's automatic display of Z-scores and growth charts gave visual feedback that reinforced conceptual understanding: cadres did not merely memorize thresholds but saw directly how measurements were translated into nutritional status classifications. Third, the low baseline, with 75% of cadres in the poor category, left wide room for improvement.

## Improvement in Cadres' Skills

The 34.00-point improvement in skills was slightly larger than the improvement in knowledge, which is understandable given the large share of hands-on practice in the intervention. The intervention comprised eight 30-

minute sessions (four hours in total) led by lecturers, which combined demonstration with direct practice using the anthropocentric tools and the application. Psycho motor skills develop through stages from guided response to mechanism and complex overt response, which require repetition accompanied by feedback (Simpson, 1972). Practice with the digital scale and stadiometer, followed by field mentoring during routine *Posyandu* sessions, provided these conditions. Success in measuring independently may also have strengthened cadres' self-efficacy (Bandura, 1997), encouraging them to apply the new procedures consistently. The fact that 90% of cadres reached the good category for skills after the intervention, slightly higher than the 85% for knowledge, suggests that cadres' main barrier was not inability but the lack of opportunity to practice with standardized tools and adequate guidance.

**Relationship Between Knowledge and Skills**

Spearman's rank correlation showed a strong positive relationship between knowledge and skill scores at pretest ($rs = 0.81$, $p < 0.001$), at post-test ($rs = 0.79$, $p < 0.001$), and for the change scores ($rs = 0.70$, $p < 0.001$), all of which are large according to Cohen (1988). Cadres who knew more also performed better, and those who gained more knowledge also gained more skill. The parallel improvement in both variables is consistent with Dzandini et al. (2025), who found that cadres' knowledge was significantly associated with height-measurement skill but not with weight-measurement skill. Knowledge provides the understanding of why a procedure must be performed in a particular way, whereas skill ensures that this understanding is translated into accurate action. The practical implication is that cadre training consisting only of counselling, without practice using standardized tools, risks producing knowledge gains that do not translate into better measurement in the field. Conversely, providing a digital application without training in measurement procedures merely shifts errors from the calculation stage to the data collection stage, because the application would accurately compute Z-scores from incorrect measurements.

**Effect Size and Practical Meaning**

An effect size of $r \approx 0.88$ for both variables indicates a very large effect according to Cohen (1988). Reporting effect size is an important contribution of this study, since studies of this kind often report only *p*-values, which makes them difficult to compare and their practical relevance difficult to assess. However, such a large effect should be interpreted with caution. In a single-group design without a comparison group, effect sizes tend to be overestimated because they also capture factors other than the intervention, such as the learning effect of repeated testing and the Hawthorne effect.

**Relevance to the Regional and Policy Context**

The result carries particular meaning because Gampong Blang Teue represents a coastal setting with limited digital infrastructure. The offline data management feature of AA-PoDiTa appears to be an appropriate design element under such conditions, in line with the facilitating conditions emphasized in the unified theory of technology acceptance (Venkatesh et al., 2003), although this study did not test the feature separately. In terms of policy, the findings support the direction of digitalize nutrition recording mandated by Presidential Regulation No. 72 of 2021 and implemented through e-PPGBM. An application operated directly by cadres at the point of service has the potential to shorten the

recording chain, reduce copying errors, and give cadres immediate feedback on the data they collect.

The findings show that the accuracy of growth data at *Posyandu* can be strengthened at its source, by equipping cadres with both the competence to measure correctly and a tool that interprets the measurements automatically. This is important because early detection of growth faltering during the first 1,000 days depends on exactly this accuracy, and because the benefit reaches beyond the individual child to the quality of data used for planning stunting interventions at the village level.

## CONCLUSION

This study shows that applying the AA-PoDiTa application combined with WHO-standard anthropometry training is effective in improving the knowledge and skills of *Posyandu* cadres in Gampong Blang Teue. Before the intervention, most cadres were in the poor category for both knowledge (75.0%) and skills (75.0%), with mean scores of 55.00 and 53.60. After the intervention, mean scores rose to 86.20 and 87.60, and 85.0% and 90.0% of cadres reached the good category. The Wilcoxon signed-rank test showed significant differences for both variables ($p$ = 0.000088 and $p$ = 0.000086), with a very large effect size ($r$ ≈ 0.88), and all respondents (100%) improved their scores. This m Health-based intervention therefore has the potential to strengthen cadre capacity and to support the digitalization of *Posyandu* services in stunting prevention.

Further research should use a quasi-experimental design with a control group, a larger sample covering several *gampong*, and follow-up measurements three to six months after the intervention to assess the sustainability of the effect, as well as evaluation at the behavior and results levels of the Kirkpatrick model.

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## REFERENCES

Agarwal, S., Perry, H. B., Long, L. A., & Labrique, A. B. (2015). Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: Systematic review. *Tropical Medicine & International Health, 20*(8), 1003–1014. https://doi.org/10.1111/tmi.12525

Ardilla, A., Maulida, H., & Sutrisna, E. (2026). Hubungan Peran Aplikasi Google Sheet Dengan Penguatan Layanan Posyandu. *Jurnal Anoa Keperawatan Mandala Waluya*, *5*(1), 247-255. https://doi.org/10.54883/jakmw.v5i1.1414

Badan Kebijakan Pembangunan Kesehatan Kementerian Kesehatan RI. (2025). *Survei Status Gizi Indonesia (SSGI) 2024 dalam angka* [The 2024 Indonesian Nutritional Status Survey in figures]. Kementerian Kesehatan RI.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.

Bhutta, Z. A., Das, J. K., Rizvi, A., Gaffey, M. F., Walker, N., Horton, S., Webb, P., Lartey, A., & Black, R. E. (2013). Evidence-based interventions for improvement of maternal and child nutrition: What can be done and at

what cost? *The Lancet, 382*(9890), 452–477. https://doi.org/10.1016/S0140-6736(13)60996-4

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet, 382*(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X

Braun, R., Catalani, C., Wimbush, J., & Israelski, D. (2013). Community health workers and mobile technology: A systematic review of the literature. *PLoS ONE, 8*(6), e65772. https://doi.org/10.1371/journal.pone.0065772

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

de Onis, M., Borghi, E., Arimond, M., Webb, P., Croft, T., Saha, K., De-Regil, L. M., Thuita, F., Heidkamp, R., Krasevec, J., Hayashi, C., & Flores-Ayala, R. (2019). Prevalence thresholds for wasting, overweight and stunting in children under 5 years. *Public Health Nutrition, 22*(1), 175–179. https://doi.org/10.1017/S1368980018002434

Dewey, K. G., & Begum, K. (2011). Long-term consequences of stunting in early life. *Maternal & Child Nutrition, 7*(Suppl. 3), 5–18. https://doi.org/10.1111/j.1740-8709.2011.00349.x

Dzandini, P. B., Alamsah, D., Asmi, N. F., & Lestari, W. (2025). Hubungan tingkat pengetahuan terhadap keterampilan kader dalam pengukuran tinggi badan dan berat badan balita di Posyandu Cikarang Selatan [The relationship between knowledge level and cadres' skills in measuring toddlers' height and weight at Posyandu South Cikarang]. *Jurnal Ilmiah Kedokteran dan Kesehatan*.

Febrina, F. K., & Antarsih, N. R. (2021). Pengaruh Aplikasi PPA Kader terhadap pengetahuan kader tentang deteksi dini stunting [The effect of the PPA Kader application on cadres' knowledge of early stunting detection]. *Jurnal Kesehatan Manarang, 7*(Edisi Khusus), 37–44.

Fitriani, S., Zahra, A. S., & Rahmat, A. (2022). Efektivitas pelatihan dan penggunaan Aplikasi Si Centing terhadap pengetahuan dan keterampilan kader Posyandu [Effectiveness of training and use of the Si Centing application on Posyandu cadres' knowledge and skills]. *Jurnal Promkes: The Indonesian Journal of Health Promotion and Health Education, 10*(1), 24–29. https://doi.org/10.20473/jpk.V10.I1.2022.24-29

Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., Patel, V., & Haines, A. (2013). The effectiveness of mobile-health technologies to improve health care service delivery processes: A systematic review and meta-analysis. *PLoS Medicine, 10*(1), e1001363. https://doi.org/10.1371/journal.pmed.1001363

Green, L. W., & Kreuter, M. W. (2005). *Health program planning: An educational and ecological approach* (4th ed.). McGraw-Hill.

Kementerian Kesehatan Republik Indonesia. (2020). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2020 tentang Standar Antropometri Anak* [Minister of Health Regulation No. 2 of 2020 on Child Anthropometric Standards]. Kementerian Kesehatan RI.

Kirkpatrick, D. L., & Kirkpatrick, J. D. (2006). *Evaluating training programs: The four levels* (3rd ed.). Berrett-Koehler.

Knowles, M. S. (1980). *The modern practice of adult education: From pedagogy to andragogy* (Rev. ed.). Cambridge Adult Education.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Peraturan Presiden Republik Indonesia Nomor 72 Tahun 2021 tentang Percepatan Penurunan Stunting [Presidential Regulation No. 72 of 2021 on Accelerating Stunting Reduction]. (2021).

Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika, 52*(3–4), 591–611. https://doi.org/10.1093/biomet/52.3-4.591

Simpson, E. J. (1972). *The classification of educational objectives in the psychomotor domain*. Gryphon House.

UNICEF. (2013). *Improving child nutrition: The achievable imperative for global progress*. United Nations Children's Fund.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., & Sachdev, H. S. (2008). Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet, 371*(9609), 340–357. https://doi.org/10.1016/S0140-6736(07)61692-4

Wilcoxon, F. (1945). Individual comparisons by ranking methods. *Biometrics Bulletin, 1*(6), 80–83. https://doi.org/10.2307/3001968

World Health Organization. (2006). *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*. World Health Organization.

World Health Organization. (2011). *mHealth: New horizons for health through mobile technologies* (Global Observatory for eHealth Series, Vol. 3). World Health Organization.

World Health Organization. (2019). *WHO guideline: Recommendations on digital interventions for health system strengthening*. World Health Organization.