Journal of Community Engagement in Health
https://jceh.org/ https://doi.org/10.30994/jceh.v9i1.763
ISSN: 2620-3758 (print); 2620-3766 (online) Vol. 9 No. 1 March. Page 35-43

Data Driven Health Education for Adolescent Reproductive Readiness in Stunting Prevention at the TeFa Laboratory of PSDKU MIK Ngawi

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ABSTRACT
Stunting remains a major public health issue in Ngawi Regency, where the prevalence reaches 15.3%, indicating the need for targeted early prevention, especially among adolescents who face high risks of anemia and inadequate nutritional intake. This community service program aimed to strengthen the knowledge and readiness of adolescent health cadres through data-driven reproductive health education at the Teaching Factory Laboratory of PSDKU MIK Ngawi. Using a community-based participatory design, the program involved 26 cadres from 13 villages and included health education, digital literacy training, and the use of real adolescent health data. Pre-test and post-test instruments, structured observations, interviews, and digital data tools were used to assess changes in knowledge related to reproductive health, anemia, nutrition, and stunting prevention. The results showed a substantial improvement, with cadres in the good category increasing from 19% to 85% after the intervention. The average knowledge score rose from 62.31 to 83.85, and the Wilcoxon test produced a p-value below 0.001, indicating significant improvement. The biggest increase occurred in understanding the relationship between anemia and stunting, which improved by 42%, followed by better skills in interpreting adolescent health indicators for early detection. These findings demonstrate that integrating real health data with structured educational activities enhances cadres' comprehension, promotes evidence-based decision making, and strengthens their capacity to identify adolescents at risk. Overall, the program highlights the effectiveness of data-driven health education in supporting long-term stunting prevention efforts at the community level.

Keywords **:** Adolescent Reproductive Health, Data Driven Health Education, Stunting prevention

Received : November 27, 2025
Revised : March 12, 2026
Accepted : March 31, 2026

INTRODUCTION

Stunting remains a pressing public health issue across many regions of Indonesia, including Ngawi Regency (Jatimpedia, 2025). Reports from the local health office highlight persistent cases of adolescent anemia and nutritional vulnerability in several sub-districts,

notably Geneng, which may heighten future maternal and child health risks. Although stunting is typically identified in early childhood, its intergenerational roots often emerge much earlier—particularly during adolescence, a critical developmental stage that shapes reproductive health outcomes (Goudet et al., 2019; Islamy & Andriani, 2024; Mulyani et al., 2025).

Field observations in the Geneng Health Center area reveal that adolescent girls frequently present with low hemoglobin levels and inconsistent adherence to iron supplementation programs, mirroring national trends where anemia prevalence among adolescents remains around 30%. If left unaddressed, adolescent anemia increases the likelihood of pregnancy complications, including low birth weight and subsequent stunting (Ristica, 2013; Sari et al., 2022).

Community-based adolescent health posts (posyandu remaja) serve as strategic platforms for nutrition education, reproductive health counseling, and early anemia detection. However, their effectiveness is often constrained by cadre capacity. In practice, routinely collected health data—such as hemoglobin measurements, iron tablet adherence records, and nutritional status indicators—are frequently treated as administrative documentation rather than analytical resources for identifying risk patterns and planning targeted interventions (Hasanah et al., 2025). This gap underscores the need for innovative, data-driven approaches that strengthen both health literacy and data utilization at the community level.

The Teaching Factory (TeFa) Laboratory at PSDKU MIK Ngawi was selected as the intervention site due to its role as a practice-based learning center specializing in health information management. Unlike conventional stunting education programs that rely primarily on lectures or printed materials, this initiative integrates real adolescent health data into the learning process (Wicaksono et al., 2024). Through digital dashboards, graphical representations of hemoglobin trends, and interactive case simulations, adolescents and cadres are encouraged to interpret data patterns and connect them to reproductive health risks. This distinctive approach transforms routine health records into meaningful learning tools, fostering critical thinking and evidence-based decision making (Wicaksono et al., 2024).

Accordingly, this community service program was designed not only to deliver health education but also to enhance digital literacy and practical skills in adolescent health data analysis. By leveraging the TeFa Laboratory's infrastructure and expertise, the program seeks to strengthen cadre competency in early risk detection and targeted intervention planning (Nurhanifah & Maharani Putri, 2025). Ultimately, building adolescent reproductive health readiness through a data-oriented educational model is expected to contribute to sustainable, long-term stunting prevention efforts in Ngawi Regency (Hijrah et al., 2025).

METHOD

This community service program adopted a community-based participatory design to strengthen the capacity of adolescent health cadres through data-driven reproductive health education. The intervention was implemented at the Teaching Factory (TeFa) Laboratory of PSDKU MIK Ngawi and within the working area of the Geneng Public Health Center, Kabupaten Ngawi. Activities were conducted on 30 August 2025, followed by two weeks of structured mentoring. A total of 26 adolescent health cadres representing 13 villages were recruited using a total sampling approach. Inclusion criteria required cadres to be actively registered in the Geneng Public Health Center area, aged 15–24 years, with at least a junior high school (SMP) education or equivalent, able to read and operate basic smartphone applications, and willing to participate fully in training and mentoring sessions. Cadres who failed to complete both the pre-test and post-test were excluded from the final analysis.

Adolescent participants involved in simulation and mentoring sessions met the following criteria: aged 12–18 years, residing in the Geneng area, currently enrolled in junior or senior high school, and providing assent with parental or guardian consent when required.

Data collection employed structured observation sheets, semi-structured interview guides, training modules, and both digital and paper-based adolescent health data recording tools developed in the TeFa Laboratory. Knowledge improvement was assessed using a 25-item multiple-choice pre-test and post-test questionnaire covering reproductive health, anemia, balanced nutrition, stunting prevention, and basic digital literacy for health data utilization. Content validity was reviewed by three experts in reproductive health, nutrition, and health information management, yielding an item-level Content Validity Index (CVI) between 0.80 and 1.00, indicating strong relevance. A pilot test involving 15 adolescents outside the intervention area was conducted to evaluate clarity and reliability. Cronbach's alpha produced a coefficient of 0.82, demonstrating good internal consistency. Revisions were made based on expert feedback and pilot findings prior to implementation.

The intervention procedure comprised several stages. First, a field assessment was conducted through visits and interviews to identify priority problems. Next, training materials and simple digital dashboards were developed to visualize anonymized local adolescent health data, including hemoglobin records, iron tablet adherence, and nutritional indicators. The implementation phase involved interactive lectures, group discussions, data visualization exercises, and hands-on practice using de-identified adolescent health records. The subsequent mentoring phase ensured cadres could apply data recording, early risk identification, and evidence-based health communication skills in community settings. Data analysis employed descriptive statistics to summarize participant characteristics and mean knowledge scores, while differences between pre- and post-test results were evaluated using the Wilcoxon signed-rank test at a significance level of $p < 0.05$, given the non-normal distribution of data. Ethical principles were upheld throughout, including voluntary participation, informed consent, confidentiality, and anonymization of health data, in accordance with the community service ethics framework of Politeknik Negeri Jember. No invasive procedures were involved.

RESULTS

Table 1. Pre Test Results of Cadres' Knowledge on Reproductive Health and Stunting Prevention

No.	Category	Frequency	Percentage
1.	Good	5	19%
2.	Enough	11	42%
3.	Less	10	39%
	Total	**26**	**100%**

Before the intervention, only 19% of cadres demonstrated good knowledge of anemia, reproductive health, and stunting risk, while the majority were in the *enough* (42%) and *less* (39%) categories.

Table 2. Post Test Results of Cadres' Knowledge on Reproductive Health and Stunting Prevention

No.	Category	Frequency	Percentage
1.	Good	22	85%
2.	Enough	3	11%
3.	Less	1	4%
	Total	**26**	**100%**

After the intervention, 85% of cadres achieved the *good* category, showing a sharp increase from only 19% at the pre-test stage. This reflects a strong improvement in understanding anemia–stunting links, reproductive health concepts, and balanced nutrition.

Table 3. Wilcoxon Signed-Rank Test Analysis of Cadres' Knowledge Scores

Analysis Component	Value
Mean Pre-Test Score	62,31
Mean Post Test Score	83,85
Mean Score Different	21,54
Z-value (Wilcoxon)	-4,621
p-value	**< 0,001**
Interpretation	Significant

The Wilcoxon test showed a p-value < 0.001, indicating a statistically significant increase in cadre knowledge after the data-based reproductive health education at TeFa PSDKU MIK Ngawi.

Increase in adolescent health cadres' knowledge after the data-driven health education intervention showed highly significant results. Based on the pre test and post test findings, there was a notable improvement in the average knowledge score, shifting from initially limited understanding to a much stronger comprehension following the training activities conducted at the TeFa Laboratory of PSDKU MIK Ngawi. During the pretest, most cadres were categorized as "enough" and "less," reflecting limited understanding of reproductive health concepts, anemia, nutrition, and their relationship to stunting risk. However, after the intervention, the majority of cadres progressed into the "good" category, indicating a substantial improvement in knowledge.

The greatest increase in knowledge was observed in the cadres' understanding of the relationship between anemia and stunting risk. Prior to the training, many cadres did not yet understand the mechanism by which anemia in adolescent girls could contribute to high-risk pregnancy and increase the likelihood of giving birth to a stunted child. After participating in the structured, data driven educational sessions, this understanding improved by 42%, demonstrating that well-organized material delivery supported by real data can significantly enhance cadres' comprehension of reproductive health issues.

In addition, cadres' knowledge of utilizing adolescent health data for early detection also improved. Through training in data recording and interpretation, cadres gained a better understanding of key indicators such as hemoglobin levels, nutritional status, and iron tablet consumption, as well as how these data can be used to determine adolescent health risks. This improvement supports the strengthening of cadres' knowledge regarding the importance of evidence-based approaches in stunting prevention efforts.

Overall, these results indicate that training combining health education and digital data utilization effectively increased adolescent health cadres' knowledge in key aspects of reproductive health and stunting prevention. With improved conceptual understanding, cadres are now better prepared to perform educational roles in the community and are more capable of identifying adolescents who may be at risk of health problems.

DISCUSSION

The results of this community service activity demonstrate a substantial improvement in the knowledge of adolescent health cadres after participating in data-driven reproductive health education at the TeFa Laboratory of PSDKU MIK Ngawi. This enhancement indicates that the intervention effectively addresses the major gaps identified at the baseline, particularly

related to the cadres' limited understanding of reproductive health concepts, anemia, nutrition, and their relationship to stunting risk (Pratami et al., 2024; Sukmawati et al., 2025). The significant increase in post test scores shows that structured educational methods supported by real data strengthen the ability of cadres to interpret health information that is essential for preventive action.

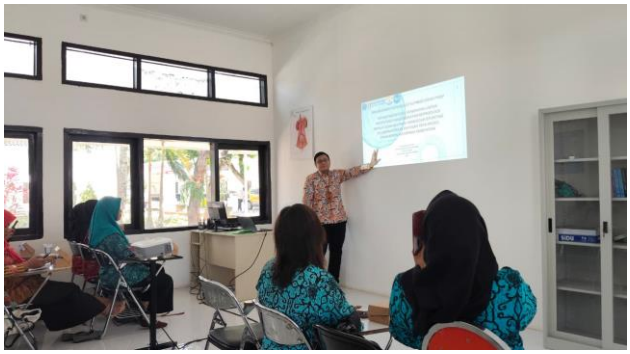

Figure 1. Delivering Health Education Material to Adolescent Posyandu Cadres on "Local Foods to Prevent Anemia".

One of the most notable findings is the improvement in cadres' comprehension of the relationship between anemia and stunting. Prior to the intervention, many cadres lacked awareness of how anemia experienced during adolescence could contribute to high-risk pregnancies and ultimately increase the likelihood of delivering stunted children. After the data-based educational intervention, their understanding increased by 42%, reflecting a deeper grasp of the biological and public health linkages involved. This finding aligns with previous studies indicating that increasing adolescent literacy on anemia is crucial to breaking the intergenerational cycle of malnutrition and stunting (Baxter et al., 2021; Meiyetriani & Utomo, 2025; Nadhiroh et al., 2023).

Digital data utilization also emerges as an important aspect of knowledge improvement. The training enabled cadres to better understand the purpose and interpretation of health indicators such as hemoglobin levels, body mass index, and iron tablet consumption. These competencies are essential for early detection of health risks among adolescents (Shao et al., 2024). The improved understanding supports the notion presented by Norman & Skinner (2006) that digital health literacy contributes significantly to community-based health decision making and behavioral change. The cadres' increased proficiency highlights how integrating health information systems into community settings reinforces their role in monitoring and follow up (Milanti et al., 2025).

Furthermore, the use of data visualization and practical case examples during the training sessions helps cadres comprehend complex concepts more quickly. This approach aligns with Green's Health Promotion Theory (1980), which emphasizes the importance of educational and environmental reinforcement in shaping health-related competencies. By combining theoretical knowledge with hands-on data analysis practice, cadres gain a stronger foundation for recognizing patterns and risk factors in adolescent health (Aldinger & Vince Whitman, 2009)

In addition to content mastery, the intervention strengthens cadres' ability to apply evidence-based thinking in their community roles. This shift is evidenced by the post-intervention mentoring logs, which show that cadres become more confident in identifying adolescents at risk and selecting appropriate follow-up actions (Hurtubise et al., 2021). The improvement mirrors findings from similar community-based programs showing that when

cadres understand data interpretation, their responsiveness and accuracy in community health promotion increase significantly (Widiasih et al., 2025).

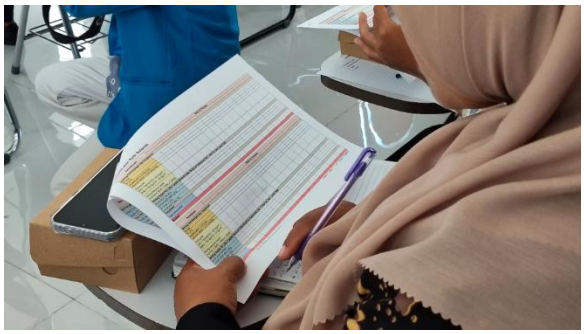

Figure 2. Adolescent Health Post Cadres Filling Out the Adolescent Health Assessment Instrument

The improvement in knowledge also supports broader stunting prevention efforts. Adolescents represent a critical target population, particularly adolescent girls who may become future mothers. Strengthening their understanding of nutrition, anemia, and reproductive health generates long-term benefits by reducing the likelihood of maternal and fetal complications. Several studies emphasize that adolescent-focused interventions, including data-informed education, produce meaningful impacts on reducing stunting (Mokoagow et al., 2024; Pratami et al., 2024). The findings from this program are therefore consistent with and add support to global literature on early stunting prevention.

Despite the overall positive outcomes, the findings also highlight areas requiring continued focus. For instance, although knowledge improved significantly, the ability to consistently apply data-driven decision-making in real community scenarios requires ongoing mentoring. This challenge mirrors what previous research notes, that cadres often need sustained supervision and practical exposure to fully internalize digital and analytical competencies (Elendu et al., 2024; Valtonen et al., 2025). Thus, while the intervention is effective, long-term strategies remain essential to maintain and expand these gains.

Finally, the results emphasize the critical role of TeFa-based learning environments in enhancing cadre competencies. The integration of technology, real data, and interactive learning methods provides a replicable model for other regions seeking to strengthen adolescent health programs (Suprapto et al., 2024). The success of this intervention suggests that data-driven community health education has potential to be scaled and adapted to various local contexts, particularly in rural areas where knowledge gaps and health risks remain significant (Askrening Askrening et al., 2025; Siswati et al., 2025).

Figure 3**.** The Person in Charge of the Integrated Primary Care (ILP) Adolescent Posyandu in the Working Area of Geneng Public Health Center Delivers Material and Reviews the Adolescent Health Examination Instrument

CONCLUSION

The findings of this community service activity demonstrate that data-driven reproductive health education delivered through the TeFa Laboratory of PSDKU MIK Ngawi significantly enhances the knowledge of adolescent health cadres. The substantial improvements observed in their understanding of anemia, nutrition, reproductive health concepts, and the relationship between these factors and stunting risk indicate that the intervention successfully addresses key gaps identified at baseline. These results reinforce the hypothesis that integrating real health data into educational activities strengthens cadres' cognitive abilities in interpreting health information, thereby supporting more effective preventive actions at the community level.

The intervention also reveals that structured learning combined with digital data utilization fosters deeper comprehension and equips cadres with a more evidence-based mindset. This shift is essential for early detection of adolescent health risks and for improving the quality of community health promotion conducted by cadres. The increased post-test scores and improvements across specific knowledge indicators confirm that the TeFa-based learning model is not only effective but holds potential for wider application as a prototype for adolescent health capacity-building programs.

Based on these findings, several recommendations can be offered. First, continuous mentoring is strongly advised to ensure cadres retain and consistently apply data-driven decision-making in real community contexts. Second, future programs may incorporate more advanced digital tools or dashboards to further strengthen cadres' analytical skills. Third, expanding the intervention to include schools and youth organizations could broaden its impact on adolescent health literacy. Lastly, researchers and practitioners are encouraged to adapt this model to other regions, especially areas with similar health challenges, as the approach has proven effective in improving the foundational knowledge necessary for stunting prevention.

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