



COMMUNITY SERVICE

Empowering Posyandu Cadres For Pneumonia Prevention: Smoking Exposure And Oximeter Training

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ABSTRACT

Background: Pneumonia remains a major cause of morbidity among toddlers in Indonesia, with household exposure to cigarette smoke acting as a significant and preventable risk factor. Posyandu cadres play a crucial role in community-based child health services; however, their capacity to screen environmental risks and perform early detection of respiratory compromise is often limited. Center, Simpang Kawat Community Health Center, and Paal X Community Health Center in 2024. This community service program aimed to strengthen the knowledge and practical skills of Posyandu cadres in pneumonia prevention through smoking exposure screening and pulse oximeter training

Method: A community-based intervention with a pre-test and post-test design was conducted among 20 Posyandu cadres in the working area of the Olak Kemang Community Health Centre, Jambi City. The intervention consisted of interactive health education on secondhand and thirdhand smoke, a humanistic approach using case-based discussions, hands-on training in pulse oximeter use, and the introduction of a household smoking exposure screening tool. Changes in cadres' knowledge were evaluated using structured questionnaires administered before and after the intervention.

Results: The average knowledge score increased from 65% at baseline to 86% after the intervention, representing an absolute increase of 21 percentage points and a relative improvement of 32.31%, exceeding the predefined success criterion of a $\geq 20\%$ increase.

Conclusion: The program was effective in enhancing Posyandu cadres' understanding of smoking-related health risks and their ability to perform early hypoxia detection using pulse oximetry. Strengthening cadre capacity through integrated and practical training may support community-based pneumonia prevention and promote healthier, smoke-free environments for toddlers

Keywords : Posyandu Cadres; Pneumonia Prevention; Secondhand Smoke; Pulse Oximeter; Community Empowerment

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INTRODUCTION

Pneumonia remains one of the leading causes of morbidity and mortality among children globally, particularly affecting those under five years of age. According to a systematic analysis from the Global Burden of Disease Study 2021, lower respiratory infections (LRIs), which prominently include pneumonia, present a significant health burden characterized by high incidence rates and a substantial contribution to childhood mortality, particularly in resource-limited settings [1]. The World Health Organization (WHO) and UNICEF's Global Action Plan aims to reduce mortality from pneumonia in children younger than five years to less than three deaths per 1,000 live births by 2025 [1].

Children under five are particularly vulnerable due to factors such as malnutrition, low breastfeeding rates, and environmental pollution, which exacerbate their susceptibility to severe pneumonia outcomes and infections caused by *Klebsiella pneumoniae* and *Streptococcus pneumoniae* [2]. The burden of pneumonia in toddlers is disproportionately higher in low-income regions, underscoring the critical need for targeted interventions and vaccination programs to mitigate this public health challenge.[3] Additionally, recent reports indicate an increase in pneumonia incidence potentially linked to changes in pathogen exposure and immune training due to the COVID-19 pandemic, highlighting shifts in the pediatric infectious disease landscape [4] and

necessitating ongoing monitoring and adaptive healthcare strategies [4].

Secondhand and thirdhand smoke are critical modifiable risk factors influencing health outcomes, particularly in children. Secondhand smoke (SHS), which includes the inhalation of smoke produced by others, has well-documented health consequences, leading to increased risks of respiratory infections, asthma exacerbation, and sudden infant death syndrome in children [5,6]. Furthermore, households often act as primary environments for children's exposure to SHS due to the prevalence of smoking among parents and caregivers [7,8].

On the other hand, thirdhand smoke (THS), the residual tobacco smoke contaminants that settle on surfaces, has garnered recognition for its longer-term health implications, particularly as children are more vulnerable due to their developing immune systems and behaviors, such as hand-to-mouth activity [9,10]. Ongoing exposure to THS can lead to an array of health issues, including neurological disorders, reinforcing the importance of smoke-free environments both during and after smoking events [11]. Adopting smoke-free homes not only reduces SHS exposure but also significantly minimizes the risks associated with THS, thus representing an actionable strategy for families and communities aiming to mitigate tobacco's harmful impact on children's health [12].

Posyandu cadres play a crucial role in community-based health prevention

initiatives, particularly regarding maternal and child health issues such as stunting and infectious diseases. As frontline health workers, these cadres serve as a bridge between health services and the community, facilitating nutrition education, health monitoring, and early intervention strategies through regular Posyandu (Integrated Health Service Post) programs [13,14]. Empowering these cadres with knowledge and skills is essential, as they conduct activities like monthly growth monitoring and provide health education on important topics such as breastfeeding, hygiene, and nutrition to prevent stunting and promote child health. [15] Programs aimed at enhancing their capabilities also focus on preventive care for diseases like tuberculosis, ensuring that cadres are equipped to identify symptoms and mobilize community resources effectively [16]. Furthermore, engaging cadres in continuous education and skill development empowers communities to adopt proactive health measures, ultimately improving health outcomes and reducing the incidence rates of preventable diseases [17]. Hence, the strategic involvement of Posyandu cadres is vital for fostering a culture of health awareness and prevention, critical in achieving national health goals and sustainable community health development [18].

Despite the strategic position of Posyandu cadres in community-based child health services, significant gaps remain in their capacity to identify environmental risk

factors and perform early detection of respiratory problems in toddlers. Field observations and preliminary assessments revealed that most cadres had limited understanding of the health impacts of secondhand and thirdhand cigarette smoke and lacked structured tools to screen household smoking exposure. Furthermore, cadres were generally unfamiliar with the use of pulse oximeters as a simple, non-invasive method for detecting early hypoxia, which is a critical indicator of pneumonia severity. These limitations reduce the effectiveness of early prevention efforts and delay appropriate referrals to primary health facilities.

Based on these identified gaps, a community service program was designed to strengthen the knowledge and practical skills of Posyandu cadres through an integrated, humanistic approach combining health education, hands-on oximeter training, and household smoking exposure screening. This program is novel in its integration of environmental risk awareness with early physiological detection using appropriate technology at the community level. By empowering cadres not only as health educators but also as active screeners of pneumonia risk, the program contributes to strengthening the primary health care system, promoting smoke-free home environments, and enhancing early pneumonia prevention among toddlers in high-risk communities.

METHOD

This community service activity employed a community-based intervention design using a pre-test and post-test approach to evaluate changes in Posyandu cadres' knowledge and skills following the educational and training program. The activity was conducted in the working area of the Olak Kemang Community Health Centre (Puskesmas), Jambi City, in collaboration with the Faculty of Medicine and Health Sciences, University of Jambi. The setting was selected due to its high prevalence of household smoking exposure and the active involvement of Posyandu cadres in toddler health services.

The participants consisted of 20 active Posyandu cadres who were directly involved in routine child health monitoring activities. Cadres were recruited through coordination with the Puskesmas and participated voluntarily after receiving a clear explanation of the program objectives and procedures. The intervention was designed to enhance cadres' capacity through an integrated approach combining health education, humanistic communication, and practical skills training.

The intervention included interactive education sessions addressing the health impacts of secondhand and thirdhand cigarette smoke on toddlers, particularly their association with respiratory infections and pneumonia. A humanistic approach was applied through case-based discussions and contextual examples from the local

community to strengthen cadres' empathy and awareness. This was followed by hands-on training on the use of pulse oximeters, during which cadres practiced measuring oxygen saturation (SpO₂) using standardized procedures and learned to interpret the results, with special attention given to identifying potential hypoxia when SpO₂ values were below 95%. In addition, cadres were introduced to a simple household-level smoking exposure screening sheet designed to support counseling and early risk identification during Posyandu activities.

Data collection was conducted using a structured knowledge questionnaire administered before (pre-test) and after (post-test) the intervention to assess changes in cadres' understanding of smoking exposure risks and oximeter use. The same instrument was used for both assessments to ensure comparability. Quantitative data were analyzed descriptively by comparing the average pre-test and post-test scores and calculating the relative percentage increase in knowledge. The program was considered successful if the improvement in average knowledge scores reached or exceeded 20% of the pre-test value, in accordance with the predefined program success indicators..

RESULT

The evaluation results demonstrated a substantial improvement in Posyandu cadres' knowledge following the implementation of the education and training program. Assessment using pre-test and

post-test questionnaires showed a clear increase in the average knowledge score related to cigarette smoke exposure risks and the use of pulse oximeters for early hypoxia detection.

As presented in Table 1, the average pre-test score of the cadres was 65%, indicating a moderate baseline level of knowledge prior to the intervention. After completing the interactive education and hands-on oximeter training, the average post-test score increased to 86%. This represents an absolute increase of 21 percentage points

and a relative improvement of 32.31% compared to the pre-test score.

The observed relative increase exceeded the predefined program success criterion of a minimum 20% improvement. These findings indicate that the intervention was effective in enhancing cadres' understanding of the health risks associated with household cigarette smoke exposure and their ability to perform early detection of potential respiratory compromise using pulse oximetry.

Table 1. Comparison of Pre-test and Post-test Knowledge Scores of Posyandu Cadres

Evaluation Indicator	Average Score (%)
Pre-test (Baseline Knowledge)	65
Post-test (Final Knowledge)	86
Absolute Increase	21
Relative Increase (%)	32.31

DISCUSSION

The improvement of knowledge plays a pivotal role in public health initiatives, particularly concerning the prevention of diseases such as pneumonia and stunting among children. Studies indicate that well-structured educational programs for families and health cadres significantly enhance understanding of risk factors and prevention strategies associated with these health issues. For instance, a study demonstrated that family education effectively raised awareness about pneumonia prevention, leading to actionable changes in behavior, such as increased motivation for environmental cleanliness,

complete immunizations, and optimal nutrition for toddlers [19]. Health education initiatives targeting Posyandu cadres have shown substantial benefits, as these cadres gained essential knowledge about stunting prevention, which equipped them to share effective prevention methods and support community health efforts [20]. The correlation between maternal knowledge and active engagement in health-seeking behavior underscores that informed mothers are more likely to pursue timely treatment for pneumonia, thereby potentially reducing morbidity and mortality rates.[21]Overall, a focus on knowledge dissemination among families

and health workers is crucial for fostering proactive health behaviors, ultimately contributing to the broader goal of improving child health outcomes and enhancing the effectiveness of community-based health interventions [14,22].

Interactive and hands-on training methods have demonstrated significant effectiveness in enhancing the abilities and confidence of Posyandu cadres, fostering their capacity for community health interventions, particularly in addressing malnutrition and stunting prevention. For example, targeted training programs that employ engaging techniques, such as role-playing and participatory learning, allow cadres to assimilate knowledge more effectively while also encouraging them to develop essential skills like screening for stunting and educating families about proper nutrition [23]. This approach not only bolsters their understanding but also empowers them to take proactive measures within their communities, thereby increasing their overall impact on public health.[14]

Furthermore, the process of humanistic empowerment—defined as nurturing personal growth, responsibility, and critical thinking—facilitates behavior change among cadres and the communities they serve[24]. By promoting open communication and collective decision-making, cadres become more engaged and assertive in their roles, enhancing their ability to mobilize resources and

disseminate health information effectively. [25] As a result, this integration of interactive training and humanistic empowerment not only transforms the capacity of health workers but also creates a ripple effect that positively influences health outcomes in the communities they serve. [26]

The strategic implementation of community-based pneumonia prevention initiatives, particularly through the involvement of Posyandu cadres, demonstrates significant potential for enhancing childhood health outcomes. Such initiatives not only offer vital educational resources and training for community health workers but also support the mobilization of families to recognize and respond to pneumonia symptoms promptly. [27] Research has shown that community-level education can effectively raise awareness about pneumonia prevention strategies, highlighting the importance of localized interventions in improving health literacy among caregivers [27]. When compared to previous community health interventions, village-based strategies have been shown to yield better engagement and outcomes. Recent studies indicate higher effectiveness ratings for awareness programs delivered directly within the community context [28]. This model aligns with historical findings that emphasize the role of community empowerment in driving behavioral change and care-seeking practices among populations dealing with respiratory

infections [29]. For example, the success of integrated health posts in enabling marginalized communities to access healthcare and educational support demonstrates that equipping local human resources to orchestrate health initiatives can lead to substantial improvements in disease outcomes. [28] Thus, advancing community-based pneumonia prevention programs is crucial for addressing immediate health concerns and fostering resilient, health-savvy communities capable of sustaining long-term health improvement [30].

CONCLUSION

This community service program demonstrated that an integrated approach combining health education, humanistic communication, and hands-on oximeter training effectively strengthened the capacity of Posyandu cadres in pneumonia

prevention. The significant improvement in knowledge scores from pre-test to post-test indicates that cadres gained a better understanding of the health risks associated with household cigarette smoke exposure and acquired practical skills for early hypoxia detection. By empowering cadres as active screeners and educators within the community, this program contributes to strengthening primary health care services, promoting smoke-free home environments, and supporting early preventive efforts to reduce pneumonia risk among toddlers in high-risk settings.

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REFERENCES

- [1] Bender R, Sirota SB, Swetschinski LR, Dominguez R-M V, Novotney A, Wool EE, et al. Global, Regional, and National Incidence and Mortality Burden of Non-Covid-19 Lower Respiratory Infections and Aetiologies, 1990–2021: A Systematic Analysis From the Global Burden of Disease Study 2021. *Lancet Infect Dis* 2024;24:974–1002. [https://doi.org/10.1016/s1473-3099\(24\)00176-2](https://doi.org/10.1016/s1473-3099(24)00176-2).
- [2] Li J, Xu L, Zuo A, Xu P, Xu K. The Global Burden of Klebsiella Pneumoniae-Associated Lower Respiratory Infection in 204 Countries and Territories, 1990–2021: Findings From the Global Burden of Disease Study 2021. *PLoS One* 2025;20:e0324151. <https://doi.org/10.1371/journal.pone.0324151>.
- [3] Zhu L, Li X, Liu EZ, Siu P, Zhai S, Pan C, et al. Beyond the Check-Up: How Well-Child Exams, Pediatric Specialists, and Provider Recommendations Can Close HPV Vaccine Gaps for Chinese American Teens 2025. <https://doi.org/10.21203/rs.3.rs-7221867/v1>.
- [4] Yu H, Hsu J. Editorial: Emerging Pneumonia and Acute Lower Respiratory Infections in Children, Volume II. *Front Pediatr* 2024;12. <https://doi.org/10.3389/fped.2024.1372533>.

- [5] Guan Q, Mai J, Teng K, Liu Z, Lin L, Zhou L, et al. Thirdhand Smoke Beliefs, Exposure Status and Associated Factors Among Young People in China: A Cross-Sectional Study. *Tob Induc Dis* 2023;21:1–10. <https://doi.org/10.18332/tid/171352>.
- [6] Schayck TS, Wetter DW, Otten R, Engels RCME, Kleinjan M. Program Uptake of a Parent-Tailored Telephone Smoking Cessation Counselling: An Examination of Recruitment Approaches. *Tob Prev Cessat* 2021;7:1–11. <https://doi.org/10.18332/tpc/133019>.
- [7] Lewinson T, Dasgupta A, Murphey JM, Onsando WM, Nagovich J. Tobacco in Hotels: A Study of Smoke Exposure and Resident Risk. *Tob Use Insights* 2024;17. <https://doi.org/10.1177/1179173x241272368>.
- [8] Matt GE, Greiner LH, Record RA, Wipfli H, Long J, Dodder NG, et al. Policy-Relevant Differences Between Secondhand and Thirdhand Smoke: Strengthening Protections From Involuntary Exposure to Tobacco Smoke Pollutants. *Tob Control* 2023;33:798–806. <https://doi.org/10.1136/tc-2023-057971>.
- [9] Matt GE, Merianos AL, Quintana PJE, Hoh E, Dodder NG, Mahabee-Gittens EM. Prevalence and Income-Related Disparities in Thirdhand Smoke Exposure to Children. *JAMA Netw Open* 2022;5:e2147184. <https://doi.org/10.1001/jamanetworkopen.2021.47184>.
- [10] Merianos AL, Jandarov R, Gordon JS, Lyons MS, Mahabee-Gittens EM. Healthcare Resources Attributable to Child Tobacco Smoke Exposure. *PLoS One* 2021;16:e0247179. <https://doi.org/10.1371/journal.pone.0247179>.
- [11] Ferguson KL, Krishnan S, Sullivan EK, Bhela S, Dozor AJ, Welter J. Counseling Tobacco Smoke Exposure Reduction Measures in Pediatrics: A Quality Improvement Project. *Pediatr Qual Saf* 2022;7:e588. <https://doi.org/10.1097/pq9.0000000000000588>.
- [12] Gupta N, Agarwal A, Singhal R, Jindal SK, Ali D, Wanale SG, et al. Removal of Incense Smoke and Corollary Particulate Matter Using a Portable Bipolar Air Ionizer in an Unventilated Setup. *Front Environ Sci* 2023;11. <https://doi.org/10.3389/fenvs.2023.1218283>.
- [13] Qodir A, Soelistyoningsih D, Daramatasia W, Wahyuningrum AD, Rachmadhani R, Yulianti SD. Empowerment Posyandu Cadres in the Transfer of Spinach-Based Technology for Early Stunting Prevention. *Abdimas Jurnal Pengabdian Masyarakat Universitas Merdeka Malang* 2024;9:1–11. <https://doi.org/10.26905/abdimas.v9i1.11898>.
- [14] Rahimah SB, Indriyanti RA, Dewi MK, Andriane Y, Fariyah SR, Wibowo PA. Feature of the Knowledge of the Posyandu Cadre School Participants Based on the Pattern of the Material Provided. *Kne Social Sciences* 2023. <https://doi.org/10.18502/kss.v8i18.14250>.
- [15] Setyawati A, Salomon GA, Nordianiwati N, Rahmadani RA, Herlina H. Meningkatkan Kapasitas Kader Posyandu Dalam Upaya Pencegahan Dan Penanganan Stunting. *Abdimas Polsaka* 2023;82–8. <https://doi.org/10.35816/abdimaspolsaka.v2i1.43>.
- [16] Purbasari AAD, Amrullah AA. Optimalisasi Pengetahuan Kader Tentang Pencegahan Penularan Penyakit Tuberkulosis Di Posyandu Bangau Bekasi Barat. *Unggulan* 2025;2:11–6. <https://doi.org/10.62951/unggulan.v2i3.1968>.
- [17] Maharrani T, Nugrahini EY, Pramudianti DN, Junaedi MD. Great Surabaya Cadres Play an Important Role in Achieving Health Programs in Surabaya, Indonesia. *Pan African Medical Journal* 2024;49. <https://doi.org/10.11604/pamj.2024.49.58.45183>.
- [18] Khasanah U, Esyuananik E, Laili AN, Saadah N. The Effect of Sensitive Interventions on Stunting Reduction Efforts. *Jurnal Berkala Epidemiologi* 2022. <https://doi.org/10.20473/jbe.v10i32022.274-282>.
- [19] Yulianingsih N, Riyani R, Lestari SR, Fauziani M, Wati SR, Wati IER, et al. Edukasi Keluarga: Pencegahan Pneumonia Pada Balita Di RSUD Bayu Asih Purwakarta Tahun 2025. *Jpbidkes* 2025;3:38–46. <https://doi.org/10.57214/jpbidkes.v3i3.240>.

- [20] Tyarini IA, Akib A, Ratnasari F, Setyaningsih TSA, Setyawati A. Health Education Lecture Method to Increase Posyandu Cadres' Knowledge About Stunting Prevention in Children. *Jurnal Ilmiah Kesehatan Sandi Husada* 2024;13:62–8. <https://doi.org/10.35816/jiskh.v13i1.1173>.
- [21] Permani NKD, Subanada IB, Windiani IGAT, Karyana IPG. Description of Mothers' Knowledge Levels About Pneumonia in Toddlers in Bebandem District, Karangasem Regency. *E-Jurnal Medika Udayana* 2025;14:50. <https://doi.org/10.24843/mu.2025.v14.i2.p09>.
- [22] Hasyanah U, Yuliawati S, Hestningsih R. Gambaran Perbedaan Karakteristik Petugas Puskesmas Dengan Cakupan Penemuan Pneumonia Balita Tertinggi Dan Terendah (Studi 10 Puskesmas Kabupaten Temanggung). *Jurnal Kesehatan Masyarakat* 2021;9:201–7. <https://doi.org/10.14710/jkm.v9i2.28680>.
- [23] Suarayasa K, Tiara AN, Kalebbi A. Empowering Posyandu Cadres in Stunting Prevention. *Media Publikasi Promosi Kesehatan Indonesia (Mppki)* 2024;7:1351–8. <https://doi.org/10.56338/mppki.v7i5.5346>.
- [24] Antarsih NR, Yantina D, Aticeh A. Empowering Health Cadres as a Toddler Posyandu Team to Improve the Knowledge and Skills of Cadres Through Counseling by Screening Toddlers So That Cadres and Families Can Detect Early and Refer to Stunting Cases That Have Increased During the COVID-19 Pan. *Engagement Jurnal Pengabdian Kepada Masyarakat* 2021;5:283–96. <https://doi.org/10.29062/engagement.v5i2.667>.
- [25] Siswati T, Paramashanti BA, Pramestuti N, Waris L. A Pooled Data Analysis to Determine Risk Factors of Childhood Stunting in Indonesia. *Journal of Nutrition College* 2023. <https://doi.org/10.14710/jnc.v12i1.35413>.
- [26] Rahmawati R, Hayat N, Ngulqiyah I, Rafianti I. Pengelolaan Dan Pemanfaatan Limbah Rumah Tangga Berbasis Pemberdayaan Masyarakat Madani Dasawisma: Sebuah Studi Kasus Di Desa Teluk Kecamatan Labuan Kabupaten Pandeglang, Indonesia 2023;1:8–22. <https://doi.org/10.53889/jskkm.v1i1.253>.
- [27] Selvi M, Vaithilingan S. Implementing Community-Based Strategies for Improved Pneumonia Care in Children: Insights From a Pilot Study. *Cureus* 2024. <https://doi.org/10.7759/cureus.58159>.
- [28] Newton-Lewis T, Bahety G. Evaluating the Effectiveness of Community Health Worker Home Visits on Infant Health: A Quasi-Experimental Evaluation of Home Based Newborn Care Plus in India. *J Glob Health* 2021;11. <https://doi.org/10.7189/jogh.11.04060>.
- [29] Relan P, Garbern SC, O'Reilly G, Bills CB, Schultz M, Kivlehan SM, et al. Emergency Care Interventions for Paediatric Severe Acute Respiratory Infections in Low- And Middle-Income Countries: A Systematic Review and Narrative Synthesis. *J Glob Health* 2023;13. <https://doi.org/10.7189/jogh.13.04065>.
- [30] Widiasih R, Rusyidi B, Maryam NNA, Sudrajat T. Pneumonia as a Life-Threatening Disease Among Under-Five Children: A Descriptive Phenomenology Study. *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini* 2023;7:4049–61. <https://doi.org/10.31004/obsesi.v7i4.4894>.