Jurnal Ilmiah Pengabdian Masyarakat Bidang Kesehatan

Volume 4, Issue 2, 90-100

e-ISSN: 2986-2698

https://ejournal.gomit.id/index.php/abdigermas

DOI: 10.58723/abdigermas.v4i2.710

Effects of Health Education on Knowledge and Preventive Behaviors Related to ARI and Pneumonia in Timor-Leste

Yarwin Yari*
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Hardin La Ramba
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Pdt. Daud Wiberdjohn Tafuli
Sekolah Tinggi Agama Kristen Kupang, INDONESIA

Nia Rosliany
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Rizqa Wahdini
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Ribka Sabarina Panjaitan
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Khalida Ziah Sibualamu
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Wagida Ahmed Nasor Abdelrahim
Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA

Article Info

Article history:

Received: April 20, 2026
Revised: May 11, 2026
Accepted: June 4, 2026

Keywords:

Acute Respiratory Infections;
Health Education;
Pneumonia;
Preventive Health Behavior;
Rural Population.

Abstract

Background: Respiratory tract infections, particularly Acute Respiratory Infections (ARI) and pneumonia, remain important public health concerns in rural communities with limited access to health information.
Aims: This community-based health education program aimed to assess changes in community knowledge and preventive behaviors related to ARI and pneumonia among adults in Vatuboro Village, Liquica District, Timor-Leste.
Methods: A pre-experimental one-group pretest–posttest design was used involving 20 participants selected through purposive sampling. The intervention consisted of interactive health education sessions, including lectures, group discussions, and demonstrations on respiratory disease prevention practices. Data were collected using structured questionnaires and analyzed using descriptive statistics and paired t-tests with a significance level of $p < 0.05$.
Results: The findings showed improvements in all measured variables following the intervention. The mean ARI knowledge score increased from 62.50 ± 8.40 to 82.75 ± 6.20 ($p < 0.001$), while ARI prevention behavior scores increased from 58.30 ± 7.90 to 75.10 ± 7.10 ($p = 0.001$). Similarly, pneumonia knowledge scores improved from 60.20 ± 9.10 to 80.60 ± 7.00 ($p < 0.001$), and pneumonia prevention behavior scores increased from 55.40 ± 8.70 to 72.80 ± 7.50 ($p = 0.001$). These findings suggest that community-based health education may contribute to improving knowledge and preventive behaviors related to ARI and pneumonia among rural adults. However, the results should be interpreted cautiously due to the small sample size and the absence of a control group.
Conclusion: Continuous and contextually appropriate health education programs are recommended to support community health literacy and respiratory disease prevention.

To cite this article: : Yari, Y., La Ramba, H., Tafuli, D. W., Nia Rosliany, Rizqa Wahdini, Panjaitan, R. S., Sibualamu, K. Z., & Wagida Ahmed Nasor Abdelrahim. (2026). Effects of Health Education on Knowledge and Preventive Behaviors Related to ARI and Pneumonia in Timor-Leste. *Jurnal Ilmiah Pengabdian Masyarakat Bidang Kesehatan (Abdigermas), 4(2)*, 90-100. https://doi.org/10.58723/abdigermas.v4i2.710

This article is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License ©2026 by author/s

INTRODUCTION

Respiratory tract infections remain a major global public health problem and continue to contribute substantially to morbidity worldwide. According to the Global Burden of Disease (GBD) 2021 analysis reported by the World Health Organization (WHO), upper respiratory infections (URIs) were identified as one of the leading causes of acute disease incidence globally, with approximately 12.8 billion new episodes reported in 2021 and a global incidence rate of 162,484.8 cases per 100,000 population. In addition, lower respiratory infections, including pneumonia, remain among the leading causes of mortality, particularly among children under five years old and

*** Corresponding author:**
Yarwin Yari, Sekolah Tinggi Ilmu Kesehatan RS Husada, INDONESIA. ✉ yarwinyari306@gmail.com

older adults in low- and middle-income countries. In Southeast Asia, respiratory infections continue to impose a considerable healthcare burden due to high population density, environmental exposure, inadequate sanitation, and disparities in healthcare access, especially in rural and low-resource settings (World Health Organization, 2026).

Timor-Leste is one of the countries that continues to face significant challenges related to respiratory infections. UNICEF data indicate that approximately 70% of individuals with symptoms of acute respiratory infection in Timor-Leste sought treatment or medical consultation at health facilities, reflecting the persistent burden of respiratory diseases within the community (UNICEF, 2026). Pneumonia also remains an important health concern among children and other vulnerable populations due to delayed treatment-seeking behavior, limited access to health education, and low preventive awareness (Ferdous et al., 2018; Pajuelo et al., 2018). These conditions indicate that respiratory tract infections remain an important public health concern in Timor-Leste, particularly in rural communities with limited access to health information and preventive services (Hammond et al., 2024).

Environmental and behavioral factors contribute substantially to the occurrence and transmission of respiratory tract infections and pneumonia (Moriyama et al., 2020). Poor household ventilation, exposure to indoor smoke, overcrowded living environments, inadequate environmental sanitation, and low adherence to clean and healthy living behaviors (PHBS) are recognized as important risk factors associated with respiratory infections (Meghji et al., 2021; Sadrizadeh et al., 2022). In addition, limited community understanding regarding early symptoms, warning signs, and preventive measures may increase the risk of delayed treatment and disease complications, particularly among children and older adults.

These conditions are also observed in Vatuboro Village, Liquica District, Timor-Leste, where most residents live in rural settings with limited access to health information and preventive healthcare services. Based on preliminary community observations, respiratory tract infections and pneumonia continue to be frequently reported, especially among vulnerable groups such as children and the elderly. Community members also demonstrate limited understanding regarding the differences between common respiratory tract infections and pneumonia, including the recognition of warning signs that require immediate medical attention. This situation may contribute to delayed healthcare-seeking behavior and increase the potential risk of disease complications.

Previous community-based health education programs have demonstrated positive impacts on improving public knowledge and preventive behaviors related to respiratory diseases (Brakema et al., 2020; Wang & Fang, 2020; Sadrizadeh et al., 2022). Studies have shown that health education interventions can increase awareness regarding environmental hygiene, cough etiquette, handwashing practices, and other preventive measures against respiratory infections (Han et al., 2021; M & Vaithilingan, 2024; Rukmasari et al., 2025). Participatory education programs have also been shown to improve pneumonia prevention practices, including immunization and reducing exposure to environmental risk factors (Belangi et al., 2025; Ricardi et al., 2026). Furthermore, educational methods combined with demonstrations and interactive discussions are considered more effective than conventional lecture methods in promoting behavioral change among the community (De Felice et al., 2021; Forsetlund et al., 2021; Zamiri & Esmaeili, 2024).

Nevertheless, several challenges remain in the implementation of promotive and preventive health education programs in rural communities. Existing educational activities are often conducted only temporarily, rely predominantly on one-way lecture methods, and are not sufficiently adapted to the socio-cultural context and educational needs of the local community. In addition, many programs focus primarily on theoretical knowledge transfer without adequately strengthening the community's practical ability to recognize warning signs, identify environmental risk factors, and apply preventive behaviors in daily life. This condition indicates the need for more contextual, participatory, and practice-oriented health education interventions in rural areas such as Vatuboro Village.

The novelty of this community service activity lies in the implementation of a community-based health education model that integrates interactive lectures, participatory discussions, and practical demonstrations adapted to the local context of Vatuboro Village. Unlike conventional educational approaches, this activity emphasizes not only knowledge improvement but also the

development of practical preventive skills and community participation in recognizing early symptoms, reducing environmental risk factors, and implementing healthy preventive behaviors related to respiratory tract infections and pneumonia in daily life.
Therefore, this community service activity was conducted to improve community knowledge and awareness regarding respiratory tract infections and pneumonia through interactive and participatory health education in Vatuboro Village, Timor-Leste. The activity focused on increasing community understanding of disease prevention, early symptom recognition, environmental risk factors, and healthy preventive behaviors in daily life.

METHOD

This community service activity employed a pre-experimental one-group pretest–posttest design to evaluate changes in community knowledge and preventive behaviors related to Acute Respiratory Infections (ARI) and pneumonia following a health education intervention. The activity was conducted in Vatuboro Village, Liquica District, Timor-Leste, involving adult community members selected through purposive sampling. Inclusion criteria consisted of residents aged 18 years or older who were willing to participate, attended the educational session, and were able to communicate effectively. Priority was given to vulnerable groups, including parents of young children and older adults. Participants who were unable to complete the educational session or failed to complete both pretest and posttest assessments were excluded. A total of 20 participants met the eligibility criteria and were included in the activity. Prior to participation, all respondents received an explanation regarding the objectives and procedures of the program, and verbal informed consent was obtained. Participation was voluntary, and all information collected was kept confidential and used solely for educational and evaluation purposes.

Data were collected using a structured questionnaire adapted from the instrument developed by Tambunan (2023) and Alfaqinisa (2015), which has previously been used to assess knowledge, attitudes, and behaviors related to pneumonia prevention. The questionnaire consisted of 14 knowledge items with true–false response options, eight attitude statements measured using a Likert scale, and several behavior-related items concerning smoking habits, household ventilation, and environmental hygiene. Instrument validity was evaluated using Pearson's Product Moment correlation on a pilot sample of 20 respondents with characteristics similar to the target population, demonstrating that all knowledge and attitude items met the validity criteria (r-count > r-table = 0.468). Reliability testing using Cronbach's alpha showed excellent internal consistency, with values of 0.913 for the knowledge questionnaire and 0.826 for the attitude questionnaire. Knowledge scores were calculated by assigning one point for each correct answer and zero for incorrect answers, while attitude and behavior scores were determined according to the respective response scales.

The intervention was implemented through a single community-based educational session lasting approximately five hours and consisted of pretest assessment, interactive health education on ARI and pneumonia, practical demonstrations of proper hand washing techniques and cough etiquette, group discussions, question-and-answer sessions, and posttest evaluation. Educational materials were supported by leaflets and visual aids to facilitate participant understanding. Data were analyzed using descriptive and inferential statistics. Respondent characteristics were summarized using frequencies and percentages, while changes in knowledge and preventive behavior before and after the intervention were assessed using paired t-tests following confirmation of normal data distribution through the Shapiro Wilk test. Statistical significance was established at $p < 0.05$. Although this approach provided valuable information regarding the effectiveness of the educational intervention, the findings should be interpreted cautiously because the activity involved a relatively small sample and did not include a control group, thereby limiting the generalizability of the results.

RESULTS AND DISCUSSION

Results

Data Demographics

Table 1. Distribution of Age, Sex and Occupation

Variable	Frequency	%
Age		
26 – 35 Years	2	10
36 – 45 Years	5	25
46 – 55 Years	5	25
56 – 65 Years	6	30
>65 Years	2	10
Total	20	100
Gender		
Male	5	25
Female	15	75
Total	20	100
Occupation		
Unemployed	11	55
Farmer	9	45
Total	20	100

Based on Table 1, the majority of respondents were aged 56–65 years (30%), followed by respondents aged 36–45 years and 46–55 years, each accounting for 25% of the total participants. Respondents aged 26–35 years and those older than 65 years each represented 10% of the sample. Female respondents predominated in this activity, accounting for 75% of participants, whereas male respondents represented 25%. In terms of occupation, most respondents were unemployed (55%), while 45% worked as farmers.

Overall, the respondent characteristics indicate that the participants were predominantly women in late adulthood to early elderly age groups, with rural occupational backgrounds. These demographic characteristics are relevant because they may influence health literacy, access to health information, and preventive health behaviors related to respiratory tract infections and pneumonia.

The predominance of female respondents may reflect women's active involvement in family health management and participation in community-based health activities. In addition, the relatively high proportion of older adults indicates that the intervention successfully reached population groups potentially vulnerable to respiratory infections and limited access to health information.

Figure 1. Health education activities

Comparison of Average Pre and Post Scores

Table 2. Comparison of Average Pre and Post Scores

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	p-value
ARI Knowledge	62.50 ± 8.40	82.75 ± 6.20	20.25	0.000
ARI Prevention	58.30 ± 7.90	75.10 ± 7.10	16.80	0.001
Pneumonia Knowledge	60.20 ± 9.10	80.60 ± 7.00	20.40	0.000
Pneumonia Prevention	55.40 ± 8.70	72.80 ± 7.50	17.40	0.001

Based on Table 2, all measured variables showed increased mean scores following the health education intervention. The largest improvement was observed in pneumonia knowledge, with a mean difference of 20.40 points, followed closely by ARI knowledge with a mean difference of 20.25 points.

The mean ARI knowledge score increased from 62.50 ± 8.40 during the pretest to 82.75 ± 6.20 during the posttest, with a statistically significant difference ($p < 0.001$). Similarly, the mean ARI prevention behavior score improved from 58.30 ± 7.90 to 75.10 ± 7.10 ($p = 0.001$).

In addition, pneumonia knowledge scores increased from 60.20 ± 9.10 before the intervention to 80.60 ± 7.00 after the intervention, showing a statistically significant improvement ($p < 0.001$). Pneumonia prevention behavior scores also improved from 55.40 ± 8.70 to 72.80 ± 7.50 ($p = 0.001$).

These findings indicate that the community-based health education intervention contributed to improvements in both knowledge and preventive behaviors related to ARI and pneumonia among adults in Vatuboro Village. The consistent increase across all variables suggests that interactive educational methods, including discussions and demonstrations, may enhance participants' understanding and encourage healthier preventive practices.

The improvements observed across all variables indicate that the educational intervention was effective in enhancing participants' understanding and awareness regarding respiratory infection prevention. The findings also suggest that interactive and community-based educational approaches may facilitate the adoption of healthier preventive practices in rural populations.

Figure 2. Health education activities

Discussion

Improvement in Knowledge Related to ARI and Pneumonia

The findings of this study indicate that the community-based health education intervention contributed to improved participants' knowledge regarding ARI and pneumonia. This improvement reflects better understanding of respiratory infections, including symptoms, transmission, risk factors, warning signs, and preventive measures.

The effectiveness of the intervention may be associated with the use of interactive and participatory educational methods. Educational activities involving lectures, demonstrations, and group discussions may facilitate better information retention and participant engagement compared with passive learning approaches. In rural communities such as Vatuboro Village, face-

to-face educational activities are particularly relevant because access to digital health information and formal healthcare services may remain limited.

These findings are consistent with previous studies reporting that health education can improve public knowledge regarding respiratory infection prevention. Health counseling using lectures, leaflets, and group discussions has been shown to improve respondents' knowledge scores (Yanti et al., 2025). Educational interventions in rural communities have also been reported to improve understanding of respiratory infection risk factors and household-level prevention practices (Roy et al., 2025). In addition, studies among mothers of children under five demonstrated increased knowledge after health education on respiratory infections (Ha Manh et al., 2023). Similar findings have also been reported in pneumonia-related education, where health counseling improved understanding of pneumonia prevention, warning signs, and the importance of early medical treatment (Ngere et al., 2025; Wijayanti et al., 2025).

However, previous studies have also shown that knowledge improvement is not always consistent or sustained over time. Some studies reported that educational interventions may be less effective among communities with low educational backgrounds or limited participation in health education activities (Ma et al., 2022). Other studies have reported that improvements in knowledge are not always significant, particularly in short-term interventions conducted without continuous reinforcement (Tong et al., 2022). Furthermore, increased knowledge may not always be followed by consistent improvements in preventive practices and long-term behavioral changes (Guastaferro et al., 2023). Other studies found that although knowledge may improve shortly after an intervention, the improvement may decline without continuous reinforcement (Rahardi & Dartanto, 2021; Nisa et al., 2019). Differences in intervention methods, duration, intensity, educational background, and socioeconomic conditions may explain variations in findings across studies.

Overall, the findings suggest that community-based health education may be an effective strategy for improving knowledge and awareness regarding ARI and pneumonia prevention. Improved knowledge is important as a foundation for strengthening preventive attitudes and encouraging healthier respiratory disease prevention behaviors within rural communities.

Improvement in Preventive Behaviors Related to ARI and Pneumonia

The findings of this study indicate that the health education intervention contributed to improvements in preventive behaviors related to ARI and pneumonia among participants. The observed behavioral changes suggest that participants were able not only to understand the educational material provided but also to apply preventive measures in their daily activities.

The improvement in preventive behaviors may be associated with the practical and participatory nature of the educational intervention. Demonstrations regarding handwashing practices, cough etiquette, environmental hygiene, household ventilation, and the avoidance of smoke exposure may have helped participants better understand the practical application of preventive measures within the household and community environment. Similar concerns regarding the importance of reducing smoke exposure have been reported by Bustos et al. (2025), who found that environmental smoke exposure was associated with respiratory symptoms and emphasized the need for preventive and educational strategies to protect community health. In rural communities such as Vatuboro Village, educational approaches tailored to local conditions, supported by family and social environments, may enhance behavioral adaptation and positive health outcomes (Rahmadhani et al., 2024).

These findings are consistent with previous studies reporting that health education interventions can significantly improve preventive practices related to respiratory diseases, including handwashing habits, cough etiquette, maintaining household ventilation, and environmental sanitation (Lange et al., 2022). Community-based educational interventions have also been shown to improve respiratory disease prevention behaviors in rural communities (Staten et al., 2025). In addition, educational programs targeting caregivers and families demonstrated positive effects on preventive health behaviors following health counseling interventions (Demeusy et al., 2021).

Similar findings have also been reported in pneumonia prevention studies. Previous studies in Indonesia demonstrated that educational interventions using leaflets and group discussions

improved maternal attitudes and preventive behaviors related to pneumonia prevention in children (Nuhan & Listyarini, 2024; Chang et al., 2021). Other studies also reported that health counseling regarding the dangers of cigarette smoke exposure was effective in encouraging healthier smoking behaviors within households (Yamada & Nakazawa, 2024). Furthermore, community-based educational interventions have been shown to improve environmental hygiene practices, household ventilation, and healthcare-seeking behavior related to respiratory symptoms (Rawat & Kumar, 2023).

However, previous studies have also reported inconsistent findings regarding behavioral improvement following educational interventions. Several studies suggest that although knowledge may improve significantly, behavioral changes are often more difficult to achieve and sustain over time. Some preventive behaviors may continue to be influenced by long-standing habits, environmental conditions, socioeconomic limitations, cultural factors, and family support systems (Yusuf & Fajri, 2022). Other studies have also shown that sustainable behavioral change generally requires continuous reinforcement and repeated health promotion activities (Schneider & Sanguinetti, 2021). In addition, some educational interventions have demonstrated significant improvements in knowledge without corresponding changes in preventive attitudes and behaviors (Isenaj et al., 2025). Similarly, good knowledge levels are not always directly associated with consistent preventive practices, particularly behaviors related to smoking habits within households (Muthmainnah et al., 2025).

In the context of this study, the observed improvements in preventive behaviors may have been influenced by the interactive and community-based nature of the intervention, which allowed participants to actively engage with the educational material and observe practical examples of healthy behaviors. The relatively close social interaction within rural communities may also support the dissemination and reinforcement of health messages among family and community members.

Overall, the findings suggest that community-based health education may be an effective promotive and preventive strategy for improving ARI and pneumonia prevention behaviors in rural communities. Educational interventions combining knowledge delivery with practical demonstrations and participatory discussions may support the adoption of healthier daily practices related to respiratory disease prevention.

Implications

This interactive, community-based educational intervention demonstrates that rural communities with limited access to information can be effectively empowered through face-to-face methods combined with practical demonstrations. The increased knowledge and behavior following the education provided a strong foundation for local health cadres to implement visual media and active community involvement in promoting cough etiquette and proper handwashing techniques at the household level.

Research Contribution

This activity contributes to the literature on health promotion in rural areas of developing countries like Timor-Leste. The program's novelty lies in the integration of lectures, participatory discussions, and demonstrations, specifically adapted to the local socio-cultural background. It demonstrates that a practice-oriented approach can strengthen communities' ability to recognize early warning signs of disease.

Limitations

The results of this activity should be interpreted with caution due to several limitations. The one-group pre-experimental design without a control group means that the improvement in scores cannot be attributed entirely to the intervention. Furthermore, the small sample size (20 participants) limits the generalizability of the results, and the short-term evaluation cannot guarantee the sustainability of behavior changes in the long term.

Suggestions

It is recommended that similar educational programs be implemented sustainably through regular reinforcement by village health cadres to maintain consistent healthy behaviors in the

community. For future research, it is recommended to expand the coverage area, increase the sample size, and implement a purely experimental design with a control group to more reliably measure the effectiveness of the intervention.

CONCLUSION

This community-based health education activity was associated with improvements in community knowledge and preventive behaviors related to Acute Respiratory Infections (ARI) and pneumonia among adults in Vatuboro Village, Timor-Leste. The findings suggest that interactive and participatory health education may help improve community understanding of respiratory disease prevention, early symptom recognition, environmental risk factors, and healthy preventive practices. However, these findings should be interpreted cautiously because the activity involved a small sample size and used a one-group pretest–posttest design without a control group. Therefore, the observed improvements cannot be attributed solely to the intervention. Continuous, contextually appropriate, and community-based health education programs are recommended to support respiratory disease prevention and improve health literacy in rural communities.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to the community members of Vatuboro Village, Liquica District, Timor-Leste, for their active participation and cooperation throughout this community service activity. We also extend our appreciation to the local authorities and community leaders for their support and assistance in facilitating the implementation of this program. Furthermore, the authors would like to acknowledge STIKes RS Husada for providing financial support for this research. We also thank all individuals and institutions involved in the preparation and implementation of the health education intervention, including those who contributed to data collection and logistical support. Their contributions were invaluable to the success of this activity.

AUTHOR CONTRIBUTION STATEMENT

YY conceptualized the study, designed the methodology, conducted data collection, performed data analysis, and drafted the manuscript. HL and DT contributed to study design, implementation of the community intervention, and supervision of field activities. NR and RW assisted in data collection, data analysis, and manuscript preparation. RP and KS contributed to literature review, data interpretation, and manuscript revision. WA provided critical review, validation of results, and final approval of the manuscript. All authors read and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors used Grammarly AI during the preparation of this manuscript for language editing, grammar checking, and improving readability. After using the tool, the authors carefully reviewed and edited the content as necessary and take full responsibility for the content of this publication. The authors confirm that all study design, data collection, data analysis, interpretation of results, and scientific conclusions were conducted solely by the authors without the assistance of artificial intelligence (AI).

CONFLICTS OF INTEREST

The authors declare that there are no financial, institutional, personal, or other conflicts of interest that could have influenced the conduct of this study, the analysis or interpretation of the data, the preparation of the manuscript, or the decision to publish the results..

REFERENCES

Alfaqinisa, R. (2015). *Hubungan Antara Tingkat Pengetahuan, Sikap, Dan Perilaku Orang Tua Tentang Pneumonia Dengan Tingkat Kekambuhan Pneumonia Pada Balita Di Wilayah Kerja Puskesmas Ngesrep Kota Semarang Tahun 2015* (Skripsi Sarjana Kesehatan Masyarakat, Universitas Negeri Semarang). Universitas Negeri Semarang. http://lib.unnes.ac.id

Arrieta-Cohen, M. C., Torres-Arizal, L. A., & Gómez-Yepes, R. L. (2024). Evaluating The Impact Of An Educational Intervention Using Project-Based Learning On Postpandemic Recovery in Rural Colombia. *Education Sciences*, *14*(12). https://doi.org/10.3390/educsci14121341

Belangi, S. P., Mahendika, D., Tawil, M. R., Ningsih, W., Rahagia, R., & Masyarakat, I. K. (2025). Effectiveness of Community Health Education Program In Improving Handwashing With Soap Behavior Among School-Age Children. In *Journal of Midwifery and Nursing* (Vol. 7, Number 1). https://doi.org/10.35335/jmn.v7i1.5907

Brakema, E. A., Gemert, F. van, Williams, S., Sooronbaev, T., Emilov, B., Mademilov, M., Tabyshova, A., An, P. L., Quỳnh, N. N., Hong, L. H. T. C., Đăng, T. N., Kleij, R. van der, Chavannes, N. H., Jong, C. de, Anastasaki, M., Akylbekov, A., Barton, A., Bertsias, A., Binh, P. D. U., … Warren, L. (2020). Implementing a context-driven awareness programme addressing household air pollution and tobacco: a FRESH AIR study. *npj Primary Care Respiratory Medicine*, *30*(1). https://doi.org/10.1038/s41533-020-00201-z

Bustos, E. H., Sánchez Núñez, J. A., & Piñeros Pardo, L. C. (2025). Analysis of health risks and conditions associated with smoke inhalation in wildfires. *Celebes Nursing Journal, 2*(2), 143–151. https://doi.org/10.70848/cnj.v2i2.53

Chang, C., Hwang, G., & Gau, M. (2021). Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training. *British Journal of Educational Technology*, *53*(1), 171–188. https://doi.org/10.1111/bjet.13158

De Felice, S., Vigliocco, G., & Hamilton, A. F. de C. (2021). Social interaction is a catalyst for adult human learning in online contexts. *Current Biology*, *31*(21), 4853-4859.e3. https://doi.org/10.1016/j.cub.2021.08.045

Demeusy, E. M., Handley, E. D., Manly, J. T., Sturm, R., & Toth, S. L. (2021). Building Healthy Children: A Preventive Intervention For High-Risk Young Families. *Development and Psychopathology*, *33*(2), 598–613. https://doi.org/10.1017/S0954579420001625

Ferdous, F., Ahmed, S., Das, S. K., Chisti, M. J., Nasrin, D., Kotloff, K. L., Levine, M. M., Nataro, J. P., Ma, E., Muhsen, K., Wagatsuma, Y., Ahmed, T., & Faruque, A. S. G. (2018). Pneumonia mortality and healthcare utilization in young children in rural Bangladesh: a prospective verbal autopsy study. *Tropical Medicine and Health*, *46*(1). https://doi.org/10.1186/s41182-018-0099-4

Forsetlund, L., O'Brien, M. A., Forsén, L., Reinar, L. M., Okwen, M. P., Horsley, T., & Rose, C. J. (2021). Continuing education meetings and workshops: effects on professional practice and healthcare outcomes. *Cochrane Database of Systematic Reviews*, *2021*(9). https://doi.org/10.1002/14651858.CD003030.pub3

Guastaferro, K., Shipe, S. L., Connell, C. M., Holloway, J. L., Pulido, M. L., & Noll, J. G. (2023). Knowledge Gains from the Implementation of a Child Sexual Abuse Prevention Program and the Future of School-Based Prevention Education. *Journal of Child Sexual Abuse*, *32*(7), 845–859. https://doi.org/10.1080/10538712.2023.2268618

Ha Manh, T., Le Thi Ai, M., Nguyen Tuan, A., & Le Viet, T. (2023). Knowledge, Attitudes And Practices Of Mothers During Care Of Children With Acute Respiratory Infections Under 5 Years Old. *International Journal of Africa Nursing Sciences*, *19*. https://doi.org/10.1016/j.ijans.2023.100613

Hammond, R., Cabral, A. H., Beckett, J., Quah, X. M., Rajaraman, N., Mathew, S., Gopalakrishnan, A., Pereira, M., Noronha, M. N., Pinto, B., Arcanjo, J. de J., dos Santos, C. G., Corte-Real de Oliveira, T. J., Bucens, I., & Hall, C. (2024). *Lessons Learnt Delivering A Novel Infectious Diseases National Training Programme To Timor-Leste's Primary Care Workforce. Annals of Global Health, 90*(1), 66. https://doi.org/10.5334/aogh.4352

Han, W., Yu, J. S., Park, S., & Kwon, M. S. (2021). A Systematic Review For Effective Preventive Public Education Of Respiratory Infection. In *International Journal of Environmental Research and Public Health* (Vol. 18, Number 8). MDPI AG. https://doi.org/10.3390/ijerph18083927

Isenaj, Z. S., Moshammer, H., Berisha, M., & Weitensfelder, L. (2025). Effect of an Educational Intervention on Pupil's Knowledge, Attitudes, Perceptions, and Behavior on Air Pollution in Public Schools in Pristina. *European Journal of Investigation in Health, Psychology and Education*, *15*(5). https://doi.org/10.3390/ejihpe15050069

Lange, S., Barnard, T. G., & Naicker, N. (2022). The Effect Of A Hand Hygiene Intervention On The Behaviour, Practices And Health Of Parents Of Preschool Children in South Africa.

Perspectives in Public Health, *142*(6), 338–346. https://doi.org/10.1177/17579139221123404

M, S., & Vaithilingan, S. (2024). Implementing Community-Based Strategies for Improved Pneumonia Care in Children: Insights From a Pilot Study. *Cureus*. https://doi.org/10.7759/cureus.58159

Ma, H., Papworth, S. K., Qian, J., & Turvey, S. T. (2022). The Medium Over The Message: Differential Knowledge Of Conservation Outreach Activities And Implications For Threatened Species. *Journal of Environmental Management*, *310*. https://doi.org/10.1016/j.jenvman.2022.114716

Meghji, J., Mortimer, K., Agustí, À., Allwood, B., Asher, I., Bateman, E. D., Bissell, K., Bolton, C. E., Bush, A., Celli, B. R., Chiang, C., Cruz, Á. A., Dinh-Xuan, A. T., Sony, A. El, Fong, K. M., Fujiwara, P. I., Gaga, M., García-Marcos, L., Halpin, D., … Marks, G. B. (2021). Improving lung health in low-income and middle-income countries: from challenges to solutions. *The Lancet*, *397*(10277), 928–940. https://doi.org/10.1016/s0140-6736(21)00458-x

Moriyama, M., Hugentobler, W., & Iwasaki, A. (2020). Seasonality of Respiratory Viral Infections. *Annual Review of Virology*, *7*(1), 83–101. https://doi.org/10.1146/annurev-virology-012420-022445

Muthmainnah, M., Kurnia, G. M., & Nugrahani, A. (2025). Determinants Of Smoking Prevention Behavior Of Senior High School Students: A Short Report. *Tobacco Induced Diseases*, *23*. https://doi.org/10.18332/tid/200748

Ngere, S. H., Olang'o, C., Ondeng'e, K., Ochola, K., Kimutai Sagam, C., Maixenchs, M., Oduor, P., Ochieng, B., & Nyambedha, E. (2025). Perceptions of Childhood Illness And Pneumonia Recognition: Implications For Health-Seeking Behaviour in Western Kenya. *Social Sciences and Humanities Open*, *12*. https://doi.org/10.1016/j.ssaho.2025.101979

Nisa, C. F., Bélanger, J. J., Schumpe, B. M., & Faller, D. G. (2019). Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change. *Nature Communications*, *10*(1). https://doi.org/10.1038/s41467-019-12457-2

Nuhan, H. G., & Listyarini, O. R. (2024). Pendidikan Kesehatan Menggunakan Media Leaflet Berpengaruh Terhadap Tingkat Pengetahuan Ibu Tentang Pneumonia Pada Balita di Poli Anak RS Bhayangkara Tk I Pusdokkes Polri Jakarta Timur. *Jurnal Ilmiah Kesehatan, 16(2).* Google Schoolar

Pajuelo, M. J., Anticona, C., Correa, M., Malpartida, H. M., Asayag, C. R., Seminario, J. R., Gilman, R. H., Murphy, L., Oberhelman, R. A., & Paz-Soldán, V. A. (2018). Delays in seeking and receiving health care services for pneumonia in children under five in the Peruvian Amazon: a mixed-methods study on caregivers' perceptions. *BMC Health Services Research*, *18*(1). https://doi.org/10.1186/s12913-018-2950-z

Poureslami, I., FitzGerald, J. M., Tregobov, N., Goldstein, R., Lougheed, M. D., & Gupta, S. (2022). Health literacy in asthma and chronic obstructive pulmonary disease (COPD) care: a narrative review and future directions. *Respiratory Research*, *23*(1). https://doi.org/10.1186/s12931-022-02290-5

Rahardi, F., & Dartanto, T. (2021). Growth Mindset, Delayed Gratification, And Learning Outcome: Evidence From A Field Survey Of Least-Advantaged Private Schools in Depok-Indonesia. *Heliyon*, *7*(4). https://doi.org/10.1016/j.heliyon.2021.e06681

Rahmadhani, V., Setiyadi, A., Wardani, N. S., & Pamungkas, I. G. (2024). Family and social support on successful treatment of pulmonary tuberculosis patients: A cross-sectional study. *Celebes Nursing Journal, 1*(1), 16–19. https://doi.org/10.70848/cnj.v1i1.3

Rawat, N., & Kumar, P. (2023). Interventions for Improving Indoor And Outdoor Air Quality In And Around Schools. In *Science of the Total Environment* (Vol. 858). Elsevier B.V. https://doi.org/10.1016/j.scitotenv.2022.159813

Ricardi, R., Pranata, K., Jenmartin, J. A., Anthonius, F., & Siregar, C. (2026). The Importance of Handwashing with Soap for the Health and National Defense Values of Students at Panunggangan 4 Elementary School. *SEHATMAS Journal*, *5*. https://doi.org/10.55123/sehatmas.v5i1.7170

Roy, S., Ilboudo, A. K., Tuan, M., & Klu, D. (2025). *Acute Respiratory Infections And Its Associated Risk Factors Among Children Aged 6–59 Months In Ghana: A Multinomial Regression Analysis Of The 2022 Demographic And Health Survey*. https://doi.org/10.3389/fpubh.2025.1518427

Rukmasari, E. A., Herman, R. Y., & Solehati, T. (2025). The Relationship Between Knowledge and Behavior in Preventing Acute Respiratory Infection (ARI) Among Students of SDN 017 Sekejati, Bandung City. In *International Journal of Science and Society* (Vol. 7). http://ijsoc.goacademica.com

Sadrizadeh, S., Yao, R., Feng, Y., Awbi, H., Bahnfleth, W. P., Bi, Y., Cao, G., Croitoru, C., Dear, R. de, Haghighat, F., Kumar, P., Malayeri, M., Nasiri, F., Ruud, M., Sadeghian, P., Wargocki, P., Xiong, J., Yu, W., & Li, B. (2022). Indoor air quality and health in schools: A critical review for developing the roadmap for the future school environment. *Journal of Building Engineering*, *57*, 104908. https://doi.org/10.1016/j.jobe.2022.104908

Schneider, S. M., & Sanguinetti, A. (2021). Positive Reinforcement Is Just The Beginning: Associative Learning Principles For Energy Efficiency And Climate Sustainability. In *Energy Research and Social Science* (Vol. 74). Elsevier Ltd. https://doi.org/10.1016/j.erss.2021.101958

Staten, T., Liu, P. H., Holt, C., & Alismail, A. (2025). Effectiveness of a Respiratory Therapist-Led, Community-Based Asthma Program In An Under Resourced Rural Border Town In California. *Respiratory Medicine*, *241*. https://doi.org/10.1016/j.rmed.2025.108071

Tambunan, A. S. (2023). *Perilaku pencegahan ISPA masyarakat di Puskesmas Gunung Tinggi tahun 2023* (Skripsi Sarjana Keperawatan, Sekolah Tinggi Ilmu Kesehatan Santa Elisabeth Medan). STIKes Santa Elisabeth Medan. Google Schoolar

Tong, D. H., Uyen, B. P., & Ngan, L. K. (2022). The Effectiveness Of Blended Learning On Students' Academic Achievement, Self-Study Skills And Learning Attitudes: A Quasi-Experiment Study In Teaching The Conventions For Coordinates In The Plane. *Heliyon*, *8*(12). https://doi.org/10.1016/j.heliyon.2022.e12657

United Nations Children's Fund. (2026). *UNICEF Data Explorer: Pneumonia Care Indicators in Timor-Leste*. UNICEF Data. https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=TLS.MNCH_PNEUCARE.&startPeriod=1970&endPeriod=2026

Wang, M., & Fang, H. (2020). The effect of health education on knowledge and behavior toward respiratory infectious diseases among students in Gansu, China: a quasi-natural experiment. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-08813-3

Wijayanti, F., Oktarina, N. D., & Trimawati. (2025). Effectiveness of Educational Videos in Improving Mothers' Attitudes Toward Pneumonia Prevention in Toddlers. *Journal of Integrated Health Research*, *1(3)*, 111–118. https://doi.org/10.70109/jinher.v1i3.24

World Health Organization. (2026). *Upper respiratory infections - Mortality DB*. WHO Mortality Database. https://platform.who.int/mortality/themes/theme-details/topics/indicator-groups/indicator-group-details/MDB/upper-respiratory-infections

Yamada, M., & Nakazawa, M. (2024). Status of Home-Based Secondhand Smoke Exposure Among Children And Its Association With Health Risks in Japan. *Preventive Medicine Reports*, *38*. https://doi.org/10.1016/j.pmedr.2023.102585

Yanti, T. D., Falah, M., Solihatin, Y., & Muttaqin, Z. (2025). The Effect Of Health Education Using Quartet Flashcard Media On Elementary School Children's Knowledge Of Diarrhea Prevention In Tasikmalaya. *Indonesian Journal for Health Sciences*, *9*(2), 72–78. https://doi.org/10.24269/ijhs.v9i2.11766

Yusuf, R., & Fajri, I. (2022). Differences in Behavior, Engagement And Environmental Knowledge On Waste Management For Science And Social Students Through The Campus Program. *Heliyon*, *8*(2). https://doi.org/10.1016/j.heliyon.2022.e08912

Zamiri, M., & Esmaeili, A. (2024). Methods and Technologies for Supporting Knowledge Sharing within Learning Communities: A Systematic Literature Review. In *Administrative Sciences* (Vol. 14, Number 1). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/admsci14010017