Nursing Journal
Volume 11, Issue 1, Page 285-291
e-ISSN: 2354-6050

https://ejurnal.poltekkesjakarta3.ac.id/index.php/JKep
DOI: https://doi.org/10.32668/jkep.v11i1.2328

Design of the HBA-10M Peer Education Model as an Effort to Prevent Recurrence of Pneumonia Against the Risk of Repeated Transmission in Toddlers Based on Artificial Intelligence

1st Nurti YK Gea, Ns., M.Kep., Sp.Kep.A.
2nd Rotua Suriyani, SKM.,M.Kes.
3rd Rakhmat Purnomo, S.Kom., S.Pd.,M.Kom

[1,2]STIKes Medistra Indonesia, Bekasi, Jawa Barat, Indonesia
[3]Universitas Bhayangkara, Bekasi, Jawa Barat, Indonesia

*email: nurtigeaa@gmail.com

Keywords:
Artificial Intelligence
Peer Education
Pneumonia in Toddlers
Prevention of Recurrence
Repeated Transmission

Abstract

Pneumonia remains a leading cause of mortality among children under five worldwide, with recurring cases significantly contributing to this burden. In Indonesia, pneumonia ranks as the second leading cause of infant death, with high rates of recurrence that impair child health. This study aims to develop and evaluate a Peer Education Model, HBA (Hygiene Behaviour Awareness), integrated with Artificial Intelligence (AI) to prevent recurrent pneumonia and reduce transmission risks in preschool children. The research adopts a quasi-experimental design with pre- and post-tests without a control group, involving 20 participants who were divided into two intervention groups. Data collection included a literature review, instrument development, prototype design, and implementation of the AI-based peer education intervention, conducted over two months with six sessions, followed by a four-month follow-up to assess pneumonia recurrence. Statistical analysis was conducted to evaluate the effectiveness of the intervention. The results are expected to demonstrate improved parental knowledge, behaviors, and adherence to pneumonia prevention steps, ultimately reducing recurrence rates. This innovative approach integrates digital technology and peer groups to enhance health literacy and early detection of at-risk children. The findings are expected to contribute to sustainable health efforts aligned with SDGs 3 and 4, emphasizing health promotion and quality education. The developed HBA-10M AI prototype will be published and protected by copyright, offering a scalable strategy for pneumonia prevention in similar contexts. This study highlights the potential of AI-supported peer education in improving child health outcomes and provides a model for community-based health interventions. Overall, this research offers a novel solution to mitigate recurrent pneumonia among vulnerable populations by combining technological innovation with peer-led health education.

Received: November 2025
Accepted: December 2025
Published: May 2026

INTRODUCTION

Pneumonia remains a significant global health threat, especially among children under five years of age. According to the World Health Organization (WHO), pneumonia accounts for approximately 16% of child deaths globally, translating to over 2 million fatalities each year, with the majority occurring in developing countries. In Indonesia, pneumonia is notably the second leading cause of death among infants and toddlers, characterized by a high incidence and propensity to recur post-treatment (1). Furthermore, environmental, sociodemographic, and parental knowledge factors significantly contribute to both the occurrence and recurrence of pneumonia in this demographic (2). This highlights the need to address knowledge gaps among parents, which is paramount in the fight against pneumonia (3).

Evidence suggests that health education plays a transformative role in improving parental knowledge and preventive behaviors related to pneumonia. However, traditional educational methods often face challenges in terms of sustainability and accessibility (4). Studies have demonstrated the effectiveness of various health education interventions. However,

challenges such as limited reach and low user engagement frequently hinder their success (5). Recent advancements in digital health interventions have shown promise, particularly in improving maternal and child health outcomes through enhanced accessibility and engagement (6). These digital approaches can potentially overcome barriers associated with conventional methods, leading to greater parental participation in preventive health behaviors, which is critical in managing recurrent pneumonia cases (7).

Integrating Artificial Intelligence (AI) into peer education models represents a pioneering strategy to enhance educational outreach and effectiveness. AI technologies have the potential to tailor educational content according to individual family needs while promoting practical preventive measures (8). Innovations in this area can facilitate sustained engagement in health education initiatives tailored to community contexts, which is essential for reducing recurrent pneumonia among young children. By leveraging AI and digital communication tools, health programs can maintain ongoing communication with parents and provide timely information. These approaches can effectively encourage health-promoting behaviors (Muafa et al., 2024). Thus, incorporating AI into health education strategies aligns with evolving community needs and enhances the sustainability of health interventions, particularly in combating diseases such as pneumonia among vulnerable populations (10).

The urgency of this research is grounded in the persistently high burden of recurrent pneumonia among children under five, which continues to contribute significantly to child morbidity and mortality, particularly in developing countries such as Indonesia. Despite ongoing health education efforts, gaps in parental knowledge, limited engagement, and the lack of sustainable educational delivery methods remain major barriers to effective prevention. The World Health Organization emphasizes that improving caregiver awareness and preventive practices is a critical strategy for reducing pneumonia-related deaths. However, conventional educational approaches often fail to provide the continuous and personalized support needed to achieve long-term behavioral change. Therefore, integrating Artificial Intelligence into peer education models, such as the HBA-10M model, represents an innovative and urgent solution to improve accessibility, personalize learning, sustain parental engagement, and ultimately reduce recurrent pneumonia among vulnerable children.

HBA-10M, or the Hygiene Behaviour Awareness–10M (Melakukan) model, consists of ten preventive actions: washing hands, keeping infants away from cigarette smoke and pollution, maintaining a clean environment, ensuring that children are fully vaccinated, maintaining a balanced diet, properly clearing mucus, ensuring treatment completion, keeping infants away from sick individuals, obtaining adequate rest, and avoiding the use of over-the-counter medications.

METHODS

This study employs an experimental pre-test and post-test without a control group design to evaluate the effectiveness of the Peer Education Model, HBA-10M, based on Artificial Intelligence in preventing recurrent pneumonia among children under five years old. The approach involves both quantitative analysis and intervention procedures to assess changes in parental behavior and knowledge.

A total of 20 parents of children under five years old exhibiting histories of pneumonia were recruited in two groups. Why are we divided into two groups? To maximize the effectiveness of the discussion and encourage mutual motivation in using the AI-based app. Inclusion criteria consisted of parents with children diagnosed with pneumonia within the last six months, willingness to participate, and access to mobile devices with internet connectivity. Exclusion criteria included

parents who are healthcare professionals or have prior specialized training related to pneumonia prevention.

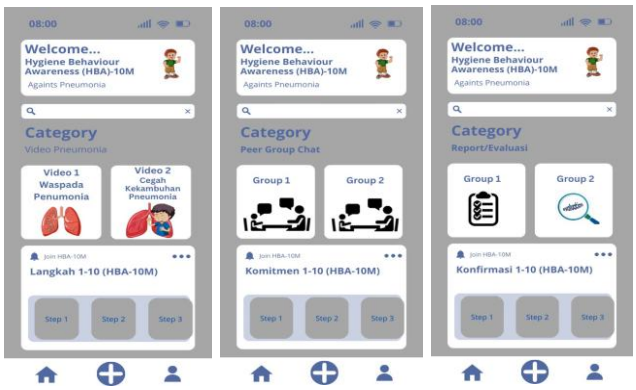
Participants were selected using purposive sampling to ensure that all met the study's inclusion criteria and could contribute relevant data regarding pneumonia prevention efforts. Data collection employed a structured questionnaire comprising three main sections:

1. **Demographic Data:** age, gender, education level, and socioeconomic status.
2. **Pneumonia Prevention Efforts:** measured using a checklist with 30 closed questions based on behaviors, knowledge, and environmental factors influencing pneumonia recurrence. using a 5-point Likert scale, with the following rating categories: (5 points: Strongly Agree / Always applied; 4 points: Agree / Often applied; 3 points: Neutral / Sometimes applied; 2 points: Disagree / Rarely applied; 1 point: Strongly Disagree / Never applied) with a cutoff point: it categorization threshold separating "Less" from "Good" prevention efforts was set at ≤132 points versus >132 points, respectively:
    1) "Less" Category: Score ≤ 132 points — indicating inadequate pneumonia prevention efforts
    2) "Good" Category: Score > 132 points — indicating adequate and satisfactory prevention efforts
3. **Knowledge and Attitude toward Pneumonia Prevention:** standardized scales evaluating understanding and perceptions. The questionnaire's contents aim to assess the parents' prevention efforts, awareness, and behavioral practices related to pneumonia.
4. **Instrument Validity and Reliability** The validity of the developed questionnaire was tested through expert validation, with a content validity index (CVI) calculated at 0.89, indicating good agreement among experts. For reliability, the instrument was pilot tested with 10 respondents, and Cronbach's alpha was 0.897, indicating high internal consistency.
5. **Interventional Procedures** The intervention involved four sessions of the Peer Education Model HBA-10M, delivered over two months (August–September 2025). The sessions included:
    1) Education about pneumonia and its prevention.
    2) Demonstrations of hygiene practices.
    3) Use of Artificial Intelligence-powered modules for customized guidance and reminders.

    The HBA-10M application module in this study is a core component of a digital intervention designed to support structured and measurable behavioral change. The HBA-10M consists of ten main modules covering health education, self-monitoring, motivational reinforcement, and time- and context-based reminders. Each module is structured progressively, starting with building foundational knowledge, setting individual goals, and ending with periodic evaluation of progress. The app also integrates adaptive features that allow for customization of content and interaction frequency based on user data, such as engagement levels, responses to materials, and consistency in following recommendations. For example, users showing a decline in activity will receive additional motivational encouragement and more frequent reminders, while active users will be provided with advanced materials and progressive challenges. Thus, HBA-10M functions not only as an educational tool but also as a responsive companion system tailored to individual needs, thereby enhancing the overall effectiveness of the intervention.

    Interactive discussions among peer groups are facilitated via digital platforms.

    The following is an illustration of the HBA-10 M prototype or module.



HBA-10 M prototype

This intervention was designed to enhance parents' knowledge and improve preventive behaviors based on the HBA-10M framework.

Follow-up assessments to determine whether the improvements in parents' behavior and knowledge are sustained over the long term will be conducted by community health workers and healthcare professionals across the broader study area and will be evaluated based on the incidence rates of new and recurrent pneumonia, particularly among the respondents.

Data were collected at baseline (pre-test) and following the intervention (post-test). Questionnaires were administered electronically or in person, and responses were recorded, coded, and entered into a database. Data editing and cleaning were performed to ensure accuracy, and data were categorized into qualitative and quantitative variables for analysis.

Data Analysis Statistical analysis involved:

a. Normality testing using the Kolmogorov–Smirnov test, with significance values of 0.245 for pre-test and 0.175 for post-test, both indicating the data were normally distributed (since $p > 0.05$).
b. Paired t-tests to compare pre- and post-intervention scores where data conform to normal distribution. The calculated t-value was 3.465 with a p-value of 0.003, indicating a statistically significant difference.
c. Non-parametric alternatives such as the Wilcoxon signed-rank test were used if data violated normality assumptions.
d. Analyses were conducted using standard computer programs suitable for statistical evaluation, without specifying proprietary software.

Ethical Considerations Prior to conducting the research, approval was obtained from the Health Research Ethics Committee of STIKes Medistra Indonesia, with Ethics Approval Recommendation Number 004317/KEP STIKes Medistra Indonesia/2025 STIKes Medistra Indonesia dated 9 August 2025. Participants received detailed information about the purpose of the study, procedures, and their rights, including confidentiality and the right to withdraw at any time without consequences. Informed written consent was obtained from all respondents.

The study was conducted at a community health center in Bekasi, Indonesia.

RESULTS AND DISCUSSION

Table 1. Distribution of Toddler Gender

Gender	Frequency	Percentage (%)
Male	7	35
Female	13	65
Total	20	100

The majority of the toddlers in this study were female, accounting for 65%, while males comprised 35%. This indicates a higher representation of female children in the sample.

Table 2. Distribution of Toddler Age

Age Group	Frequency	Percentage (%)
1-2.5 years	8	40
2.6-5 years	12	60
Total	20	100

Most children were aged between 2.6 and 5 years (60%), suggesting that the sample predominantly included slightly older toddlers.

Table 3. Parents' Prevention Efforts Prior to Intervention

Prevention Level	Frequency	Percentage (%)
Less	11	55
Good	9	45
Total	20	100

Before the intervention, more than half of the parents (55%) reported their pneumonia prevention efforts as inadequate ("Less"), whereas 45% considered their efforts sufficient ("Good").

Table 4. Parents' Prevention Efforts After Intervention

Prevention Level	Frequency	Percentage (%)
Less	4	20
Good	16	80
Total	20	100

Following the AI-supported peer education intervention, there was a significant improvement, with 80% of parents demonstrating good prevention efforts and only 20% still reporting less effort. This indicates a positive impact of the intervention on parental behaviour.

Table 5. Normality Test Results (Kolmogorov–Smirnov Test)

Test	Sig. Value	Distribution
Pre-test	0.245	Normal
Post-test	0.175	Normal

Both pre- and post-intervention data showed Sig. values greater than 0.05, indicating that these data are normally distributed, thus suitable for parametric statistical testing.

Table 6. Summary of the Peer Education HBA-10M Intervention Results

Intervention Group	Mean	Standard Deviation	Degrees of Freedom (df)	t-value	p-value
Pre-test	132,05	12,20	19	-3,465	*0,003*
Post-test	139,95	8,65			

The results demonstrated a significant effect of the HBA-10M peer education intervention on reducing the risk of pneumonia recurrence, with a t-value of 3.465 and a p-value of 0.003, indicating that the intervention positively affected parental behaviours and knowledge related to pneumonia prevention.

Discussion: The findings indicate that the majority of the respondents were female children, accounting for 65%, while the predominant age group was 2.6–5 years, comprising 60% of the sample (Tables 1 and 2) (11). These demographic characteristics are consistent with existing literature that suggests that girls and children within this age range are at a higher risk of recurrent pneumonia and subsequent transmission (13).

The distribution of demographic variables supports the theory that children aged 1–2.5 years are in a critical developmental stage in which their immune systems are still maturing, making them more susceptible to respiratory infections such as pneumonia (14). The intervention utilizing AI-based peer education through the HBA-10M application over a two-month period demonstrated a positive impact on improving parental health literacy and preventive behaviours, ultimately contributing to the reduction of pneumonia recurrence (15).

These promising results align with previous studies indicating that targeted education, particularly when delivered through technology and peer support, effectively enhances awareness and promotes caregiving practices among caregivers (16). The model implemented in this study—a peer education approach supported by AI—presents an innovative strategy that has the potential to reach broader populations, especially in communities with limited access to healthcare services (17). Technological solutions such as mobile applications can significantly enhance intervention efficiency and scalability, consistent with current trends in modern public health initiatives (9).

Overall, this study suggests that the AI-assisted peer education model has significant potential as an effective strategy to reduce the risk of recurrent pneumonia among young children while also improving parental health literacy. For sustained success, ongoing program evaluation, strengthened community engagement, and further development of the HBA-10M application are recommended to enhance usability and accessibility.

CONCLUSION

Based on the study findings, the AI-based HBA-10M Peer Education Model demonstrated a significant

impact on parental knowledge and pneumonia prevention efforts among children under five, with statistical analysis confirming its effectiveness. The intervention was found to be feasible and beneficial in improving hygiene behaviours and awareness, which are crucial for reducing pneumonia recurrence.

Future research is recommended to include larger sample sizes and more diverse settings to improve the generalizability of the findings, as well as incorporate long-term follow-up assessments to evaluate sustained behavioural changes (18). Additionally, further studies could investigate the integration of advanced AI technologies to personalize parental education and support, thereby further optimizing pneumonia prevention strategies.

ACKNOWLEDGMENT

We express our sincere gratitude to all individuals and institutions who contributed to the successful implementation of this research. Our sincere thanks are extended to the institutions that provided funding, including the Ministry of Education and Culture through the Research Grant Scheme under priority programs, which financially supported this study.

We gratefully acknowledge the support and facilities provided by Puskesmas Pengasinan Bekasi, where the research activities were conducted. We also extend our appreciation to the healthcare professionals, community members, and resource personnel who participated in and assisted with the data collection and intervention processes.

Special thanks are extended to academic colleagues, researchers, and facilitators who provided valuable insights, guidance, and expertise throughout the study. Their dedication and cooperation were instrumental in achieving the objectives of this research.

REFERENCES

1. Gea NYK, Nurhaeni N, Allenidekania A. Blow pinwheels improve oxygen saturation of preschool children with post-pneumonia in the outpatient pediatric department. La Pediatria Medica e Chirurgica. 2021 May 20;43(s1). doi:10.4081/pmc.2021.263
2. Indrayani M, Khairani, Fauza R. Efektivitas Pemberian Pendidikan Kesehatan Dengan Menggunakan Media Kalender Dalam Meningkatkan Pengetahuan Ibu Dalam Mendeteksi Dini Pneumonia Pada Balita Di Desa Secanggang Kab.Langkat. Jurnal Ilmiah Kebidanan Imelda. 2022 Sep 30;8(2):96–101. doi:10.52943/jikebi.v8i2.1125
3. Afidatul Muayani N, Putri RB. Parental Knowledge and the Incidence of Acute Respiratory Infections in Toddlers: A Cross-Sectional Study at Cilandak Health Center. Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal). 2025 Jul 8;11(3):368–74. doi:10.33755/jkk.v11i3.814
4. Sen DrT, Datta DrGC, Islam DrMMdZ, Islam DrA, Iqbal DrMJ, Mahzabin DrT. Socio-Demographic Determinants and Nutritional Status in Relation to Recurrent Pneumonia in Infants and Young Children. Scholars Journal of Applied Medical Sciences. 2025 Jan 3;13(01):340–7. doi:10.36347/sjams.2025.v13i02.009
5. Chand A, Ranjitkar UD. Perception and Healthcare Seeking Behavior in Acute Respiratory Infection among Parents of Children under Five attending a Tertiary Care Center of Banke. Journal of the Institute of Medicine Nepal. 2024 Aug 31;46(2):49–54. doi:10.59779/jiomnepal. 1319
6. Mustapha AY, Kolawole TO, Mbata AO, Tomoh BO, Forkuo AY, Kelvin-Agwu MC. Leveraging Mobile Health (mHealth) Applications for Improving Maternal and Child Health Outcomes: A Cross-Regional Study. Journal of Frontiers in Multidisciplinary Research. 2024;5(1):70–86. doi:10.54660/.IJFMR.2024.5.1.70-86
7. Khayal IS. The Need for Systems Thinking in Digital Health Transformation. INCOSE International Symposium. 2025 Jul 9;35(1):1465–78. doi:10.1002/iis2.70089

8. Yao Y, Cao J, Tan Z, Chen K. Developing a digital health competency assessment framework for public health services: a Delphi-AHP approach. Front Public Health. 2025 Jul 21;13. doi:10.3389/fpubh.2025.1634261
9. Muafa A, Al-Obadi S, Al-Saleem N, Taweili A, Al-Amri A. The Impact of Artificial Intelligence Applications on the Digital Transformation of Healthcare Delivery in Riyadh, Saudi Arabia (Opportunities and Challenges in Alignment with Vision 2030). Academic Journal of Research and Scientific Publishing. 2024 Mar 5;5(59):61–102. doi:10.52132/Ajrsp.e.2024.59.4
10. Afridi A, Nawaz K. Digital transformation in healthcare rehabilitation: A narrative review. Journal of Process Management and New Technologies. 2024;12(1–2):16–30. doi:10.5937/jpmnt12-48336
11. Neelima M, Prathyusha Y, Archana M, Praveenkumar T. Prospective Study on Identification of Risk Factors, Assessment of Respiratory Distress in Pediatrics. Int J Pharm Investig. 2022 Dec 20;13(1):37–42. doi:10.5530/223097131669
12. Sutriana VN, Sitaresmi MN, Wahab A. Risk factors for childhood pneumonia: a case-control study in a high-prevalence area in Indonesia. Clin Exp Pediatr. 2021 Nov 15;64(11):588–95. doi:10.3345/cep.2020.00339
13. Khan HJ. Risk Factors for the Development of Pneumonia Below 2 Years of Age. The Journal of Sylhet Women's Medical College. 2022 Jul 1;12(Number 02):38–45. doi:10.47648/jswmc2022v12-02-50
14. Chiappini E, Santamaria F, Marseglia GL, Marchisio P, Galli L, Cutrera R, et al. Prevention of recurrent respiratory infections. Ital J Pediatr. 2021 Dec 25;47(1):211. doi:10.1186/s13052-021-01150-0
15. Zhang X, Wen YJ, Han N, Jiang Y. The Effect of a Video-Assisted Health Education Program Followed by Peer Education on the Health Literacy of COVID-19 and Other Infectious Diseases Among School Children: Quasi-Randomized Controlled Trial. JMIR Hum Factors. 2024 Jan 29;11:e43943. doi:10.2196/43943
16. Mancone S, Corrado S, Tosti B, Spica G, Diotaiuti P. Integrating digital and interactive approaches in adolescent health literacy: a comprehensive review. Front Public Health. 2024 Oct 9;12. doi:10.3389/fpubh.2024.1387874
17. Tang Y, Diao H, Jin F, Pu Y, Wang H. The effect of peer education based on adolescent health education on the resilience of children and adolescents: A cluster randomized controlled trial. PLoS One. 2022 Feb 2;17(2):e0263012. doi:10.1371/journal.pone.0263012
18. Hoving MP, Brand PL. Causes of recurrent pneumonia in children in a general hospital. J Paediatr Child Health. 2023 Mar 26;49(3). doi:10.1111/jpc. 12114