



EFFECTIVENESS OF HEALTH PROMOTION MEDIA IN IMPROVING PULMONARY TUBERCULOSIS PATIENTS' KNOWLEDGE OF THE HOME ENVIRONMENT

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ABSTRAK

Tuberkulosis (TB) paru masih menjadi masalah kesehatan masyarakat di Indonesia. Pencegahan penularan di lingkungan rumah tangga tidak hanya memerlukan kepatuhan pengobatan, tetapi juga pengetahuan pasien mengenai kondisi lingkungan fisik rumah, seperti ventilasi, pencahayaan alami, dan kepadatan hunian. Penelitian ini bertujuan menganalisis perubahan pengetahuan pasien TB paru mengenai lingkungan fisik rumah setelah diberikan edukasi menggunakan media leaflet, lembar balik, dan video edukasi di wilayah kerja UPTD Puskesmas Banjar Agung. Penelitian menggunakan pendekatan kuantitatif dengan desain kuasi-eksperimental *pretest-posttest* yang melibatkan 54 pasien TB paru, masing-masing 18 peserta pada kelompok leaflet, lembar balik, dan video edukasi. Intervensi dilaksanakan pada November 2025–Januari 2026 dengan materi edukasi yang setara pada ketiga kelompok. Pengetahuan diukur menggunakan kuesioner sebelum dan sesudah intervensi, kemudian dianalisis menggunakan *paired-samples t-test* pada $\alpha = 0,05$. Hasil menunjukkan adanya peningkatan pengetahuan pada ketiga kelompok. Peningkatan pada kelompok video edukasi signifikan secara statistik ($p < 0,001$), sedangkan kelompok leaflet berada tepat pada batas signifikansi ($p = 0,050$) dan kelompok lembar balik tidak menunjukkan perubahan yang signifikan ($p = 0,160$). Berdasarkan analisis dalam masing-masing kelompok, video edukasi menunjukkan bukti statistik peningkatan pengetahuan yang paling kuat. Namun, hasil tersebut belum dapat diartikan sebagai bukti bahwa video secara statistik lebih efektif dibandingkan leaflet atau lembar balik karena tidak dilakukan analisis perbandingan perubahan antarkelompok. Edukasi berbasis video berpotensi digunakan sebagai media promosi kesehatan untuk memperkuat pengetahuan pasien TB paru mengenai lingkungan fisik rumah.

Kata kunci: lingkungan rumah, media promosi kesehatan, pengetahuan, TB paru, video edukasi

ABSTRACT

Pulmonary tuberculosis (TB) remains a major public health problem in Indonesia. Preventing household transmission requires not only treatment adherence but also patients' knowledge of physical home-environment conditions, including ventilation, natural lighting, and residential density. This study aimed to analyze changes in pulmonary TB patients' knowledge of the physical home environment following health education delivered through leaflets, flipcharts, and educational videos in the service area of UPTD Puskesmas Banjar Agung. A quantitative approach with a quasi-experimental *pretest-posttest* design was employed involving 54 pulmonary TB patients, with 18 participants assigned to each of the leaflet, flipchart, and educational video groups. The intervention was conducted from November 2025 to January 2026 using equivalent educational content across the three groups. Knowledge was measured



using a questionnaire before and after the intervention and analyzed using paired-samples t-tests at $\alpha = 0.05$. The results showed an increase in knowledge in all three groups. The increase in the educational video group was statistically significant ($p < 0.001$), whereas the leaflet group reached the significance threshold ($p = 0.050$), and the flipchart group did not show a statistically significant change ($p = 0.160$). Based on the within-group analyses, the educational video group showed the strongest statistical evidence of improvement. However, this finding does not establish that video was statistically more effective than leaflets or flipcharts because no direct between-group comparison of changes was performed. Educational videos may therefore be considered a health promotion medium to strengthen pulmonary TB patients' knowledge of the physical home environment.

Keywords: educational video, health promotion media, home environment, knowledge, pulmonary tuberculosis

INTRODUCTION

Tuberculosis (TB) remains one of the most persistent global public health threats. The World Health Organization (WHO, 2025) estimated that 10.7 million people developed TB in 2024, with Indonesia among the eight countries accounting for roughly two-thirds of the global burden. This scale of disease confirms that transmission control at the community and household level is not a peripheral concern but a central public health priority. Recent epidemiological evidence reinforces this point, linking TB incidence directly to population density and substandard residential conditions (Nes et al., 2024).

Indonesia's TB control strategy therefore cannot rely on curative treatment alone; it must integrate household-level transmission prevention. Physical housing conditions ventilation, natural lighting, air circulation, and occupant density are consistently identified as determinants of pulmonary TB transmission risk. Lestyaningsih (2021) emphasized ventilation and window placement, while Zulaikhah et al. (2019) demonstrated the interrelationship between knowledge, behavior, home environment, and TB transmission. More recent findings corroborate this pattern: overcrowded sleeping spaces and inadequate ventilation remain significant physical risk factors in primary-care settings (Sipayung et al., 2024), and a household-level analysis in Pekanbaru similarly found that human and home-environment factors jointly shape TB occurrence, reinforcing that the residential environment is not a background variable but an active transmission pathway that primary health services must directly address (Febrilia et al., 2022).

Improving the physical home environment, however, is contingent on whether patients actually understand the risks involved and the preventive actions available to them. Miharti (2022) reported a direct association between physical home conditions and patients' knowledge of pulmonary TB, underscoring that structural improvement without cognitive readiness is unlikely to be sustained. Health education is therefore not a supplementary activity but a prerequisite for translating environmental risk knowledge into household practice opening windows, maximizing natural light, and reducing occupant crowding where feasible. Communication, information, and education are accordingly positioned as core components of environmental health services (Kementerian Kesehatan Republik Indonesia, 2023). This is corroborated by a systematic review confirming that structured health education strategies are effective not only in raising TB knowledge but also in reducing the social stigma that often obstructs care-seeking and adherence (Rekawati & Nursasi, 2024), and by evidence from North



Minahasa showing that cadre-driven TB health education measurably strengthens treatment engagement at the community level (Kandou et al., 2024).

This need is acutely evident in the service area of UPTD Puskesmas Banjar Agung. Program data recorded 43 pulmonary TB patients under treatment in 2024, rising to 59 patients between January and September 2025 an upward trajectory that by itself justifies immediate strengthening of preventive education. Prior studies confirm that structured education measurably improves TB-related knowledge and preventive attitudes: WhatsApp-delivered health education increased knowledge and attitudes regarding transmission prevention in a primary-care setting (Yenti et al., 2023); education paired with medication-reminder tools improved both knowledge and treatment adherence (Reyaan et al., 2023); and general TB health education has been shown to shift both the knowledge and attitude of patients toward transmission-prevention behavior more broadly (Susanto et al., 2023). Even knowledge tied specifically to treatment adherence responds to educational intervention, as patients with higher TB-related knowledge demonstrate significantly better compliance with anti-tuberculosis medication regimens (Hasina et al., 2023). Collectively, this body of evidence confirms that health education is not merely beneficial but functionally necessary for comprehensive TB control.

The effectiveness of health education, however, is inseparable from the medium through which it is delivered. Leaflets offer concise, retainable, and rereadable information; flipcharts enable sequential, face-to-face explanation during counseling an advantage recently demonstrated in a community program where flipchart-based modules significantly raised TB knowledge scores among health cadres (Idris et al., 2025); and educational videos integrate visual, textual, and auditory channels to depict environmental conditions and preventive actions concretely. Video-based education has repeatedly improved TB-related knowledge (Latif & Tiala, 2022; Muthiah et al., 2025; Nuryadin & Banjarnahor, 2023), as has leaflet-based education (Pratiwi et al., 2022; Puspitasari, 2024; Yusserliyawati et al., 2024). Critically, a direct leaflet-versus-video comparison found that the two media do not produce equivalent knowledge and attitude outcomes (Putri et al., 2021) evidence that media choice is not interchangeable but consequential, and that claims of effectiveness for any single medium cannot be generalized across media types without direct comparison.

Despite this substantial body of work, a clear and specific research gap persists. First, the existing literature on health promotion media overwhelmingly targets *general* TB knowledge, transmission prevention broadly construed, treatment adherence, or attitudinal change not knowledge specifically anchored to the physical home environment as a modifiable risk domain. Second, comparative media studies to date have been structurally limited to two-way comparisons typically leaflet versus video leaving a three-way comparison of leaflets, flipcharts, and educational videos within a single pulmonary TB patient population empirically untested, despite flipcharts being independently shown to be effective in cadre-level TB education (Idris et al., 2025). Third, the environmental-risk literature identifying ventilation, lighting, density, and household conditions as TB determinants (Lestiyaningsih, 2021; Zulaikhah et al., 2019; Sipayung et al., 2024; Febrilia et al., 2022) has consistently treated these factors as *outcome* determinants of disease occurrence, not as a *target domain* for measurable, media-based knowledge intervention. No prior study has evaluated whether health education delivered through leaflet, flipchart, or video can systematically improve patients' understanding of these specific, modifiable household conditions. This study is positioned precisely at the intersection of these three gaps.

The novelty of this study therefore lies in its simultaneous, controlled evaluation of three health promotion media leaflets, flipcharts, and educational videos using equivalent educational content focused exclusively on the physical home environment among pulmonary TB patients in a primary-care setting. Rather than measuring general TB knowledge, this study isolates the practical, modifiable environmental dimensions patients can directly act upon: ventilation, natural lighting, air circulation, and residential density. In doing so, it produces the first direct three-media comparison of its kind on this specific knowledge domain, generating evidence with immediate translational value for primary healthcare facilities selecting and integrating promotion media into TB counseling programs.

Accordingly, this study aimed to analyze changes in pulmonary TB patients' knowledge of the physical home environment following health education using leaflets, flipcharts, and educational videos in the service area of UPTD Puskesmas Banjar Agung. The findings are expected to provide primary healthcare facilities with practical, media-specific evidence for integrating environmental health education into household-level TB prevention programs.

METHODS

This study employed a quantitative approach with a quasi-experimental *pretest-posttest* design involving three intervention groups. The study was conducted in the service area of UPTD Puskesmas Banjar Agung from November 2025 to January 2026. The participants were pulmonary tuberculosis (TB) patients receiving treatment and health services in the study area.

The study population consisted of pulmonary TB patients receiving treatment in the service area of UPTD Puskesmas Banjar Agung. A total of 54 pulmonary TB patients who met the predetermined inclusion and exclusion criteria participated in the study. Total sampling was used, meaning that all eligible pulmonary TB patients in the accessible study population were included as study participants. The inclusion criteria were pulmonary TB patients receiving treatment at UPTD Puskesmas Banjar Agung, willing to participate in the study, able to communicate effectively, and able to complete the knowledge questionnaire. Patients who were unable to participate in the health education intervention or complete the research instruments were excluded.

After participant recruitment, the 54 participants were randomly allocated into three intervention groups of 18 participants each: the leaflet group, the flipchart group, and the educational video group. Random allocation was used to reduce the potential for systematic differences in participant characteristics between the intervention groups. All three groups received health education containing equivalent material on physical home-environment conditions relevant to pulmonary TB transmission prevention. The educational material covered ventilation, natural lighting, air circulation, residential density, and household environmental management. The educational content was standardized across the three groups, while the delivery medium differed according to group assignment.

The leaflet group received the educational material through a printed leaflet. The flipchart group received face-to-face education using a flipchart containing sequential visual and written information. The educational video group received the same core educational material through an audiovisual video incorporating visual, textual, and auditory information. Before the intervention, participants in all three groups completed a knowledge questionnaire as a pretest. Each group subsequently received the assigned health education intervention. Following the intervention, the same questionnaire was administered as a posttest to assess changes in participants' knowledge of the physical home environment.

The primary outcome was knowledge of the physical home environment related to pulmonary TB prevention. Knowledge was assessed using a structured questionnaire administered before and after the intervention. The questionnaire covered participants' understanding of household environmental conditions relevant to TB prevention, including ventilation, natural lighting, air circulation, and residential density. The same questionnaire and measurement procedures were applied to all three groups to ensure consistency in the assessment of pretest and posttest knowledge.

Data were analyzed using descriptive and inferential statistical analyses. Descriptive analysis was used to summarize the knowledge scores of participants before and after the intervention in each group. Changes in knowledge within each intervention group were analyzed using the *paired-samples t-test* at a significance level of $\alpha = 0.05$.

A p-value ≤ 0.05 was considered statistically significant, indicating a significant change in knowledge between the pretest and posttest within the respective intervention group. Because the primary inferential analysis examined pretest-posttest changes separately within each group, the findings were interpreted as evidence of within-group change. The analysis did not include a direct statistical comparison of change scores or effect sizes among the three intervention groups. Therefore, differences in p-values between groups were not interpreted as definitive evidence that one educational medium was statistically more effective than another.

RESULTS AND DISCUSSION

Results

Changes in Knowledge Before and After the Intervention

The study involved 54 pulmonary TB patients who were randomly allocated into three intervention groups, with 18 participants in each group. The three groups received health education using different media, namely leaflets, flipcharts, and educational videos, with equivalent educational content focusing on the physical home environment. Knowledge was assessed before and after the intervention using the same questionnaire.

The pretest and posttest results were analyzed within each intervention group using a *paired-samples t-test*. The analysis was conducted to determine whether there was a statistically significant change in knowledge following the respective health promotion intervention. The results are presented in Table 1.

Table 1. Changes in Pulmonary TB Patients' Knowledge Following Health Promotion Using Different Media

Health medium	promotion	n	Direction of change	p-value	Interpretation
Leaflet		18	Increase	0.050	Significant at $\alpha = 0.05$ threshold
Flipchart		18	Increase	0.160	Not statistically significant
Educational video		18	Increase	<0.001	Statistically significant

Note. Analysis using *paired-samples t-test*; $\alpha = 0.05$.

As shown in Table 1, knowledge increased from pretest to posttest in all three intervention groups. However, the statistical significance of the changes differed across the groups. The educational video group demonstrated a statistically significant increase in knowledge ($p < 0.001$). The leaflet group reached the predetermined significance threshold ($p = 0.050$), while the flipchart group showed an increase that was not statistically significant ($p = 0.160$).

These findings indicate that the educational video and leaflet interventions were associated with statistically detectable within-group improvements in knowledge under the applied analysis, whereas the change in the flipchart group did not reach statistical significance. The educational video group had the smallest p-value and therefore showed the strongest statistical evidence of within-group improvement among the three groups. Nevertheless, the p-values from separate paired tests cannot be used to establish that the educational video was statistically more effective than the leaflet or flipchart. A direct comparison of the magnitude of change between groups would be required to make such a conclusion.

Summary of the Main Findings

The overall pattern of the pretest-posttest analysis is summarized in Table 2 to facilitate interpretation of the findings across the three intervention groups.

Table 2. Summary of Within-Group Statistical Findings

Intervention group	Sample size	Pretest–posttest change	Statistical significance	Main finding
Leaflet	18	Increased	$p = 0.050$	Change reached the $\alpha = 0.05$ threshold
Flipchart	18	Increased	$p = 0.160$	Change was not statistically significant
Educational video	18	Increased	$p < 0.001$	Change was statistically significant

Note. The table summarizes within-group paired-samples t-test results and does not represent a direct comparison of effect magnitude between intervention groups.

Table 2 shows that all three groups experienced an increase in knowledge following the intervention, but only the educational video group demonstrated a clearly statistically significant pretest-posttest change at the conventional 0.05 level. The leaflet group was exactly at the significance threshold, whereas the flipchart group did not reach statistical significance.

Because the study did not perform a direct between-group analysis, the results should be interpreted as evidence of changes occurring within each intervention group rather than as proof of superiority of one medium over another. The observed pattern provides an empirical basis for further comparison using change scores, effect sizes, or an appropriate between-group statistical test in future research.

Discussion

The findings showed that knowledge of the physical home environment increased after health education in all three intervention groups. However, the statistical evidence of the changes differed among the groups. The educational video group showed a statistically significant increase in knowledge ($p < 0.001$), the leaflet group reached the significance threshold ($p = 0.050$), and the flipchart group did not demonstrate a statistically significant change ($p = 0.160$). These findings indicate that different health promotion media may be associated with different patterns of knowledge change among pulmonary TB patients.

The statistically significant improvement in the educational video group may be related to the ability of audiovisual media to present health information through multiple forms of sensory stimulation. Information about ventilation, natural lighting, air circulation, and residential density can be relatively abstract when explained only through written descriptions. Videos can present these conditions through moving images, narration, text, and concrete examples, potentially making the information easier for patients to understand and relate to



their own household situations. This interpretation is consistent with Latif and Tiala (2022), who reported improved knowledge of pulmonary TB transmission prevention following video-based education. Similar findings were reported by Nuryadin and Banjarnahor (2023), who found significant improvements in pulmonary TB patients' knowledge following educational video exposure. Muthiah et al. (2025) also reported the effectiveness of animated video in increasing pulmonary TB-related knowledge.

The educational video may also provide an advantage by demonstrating preventive actions rather than merely describing them. For example, appropriate ventilation practices, the importance of opening windows, and the relationship between air circulation and household conditions can be demonstrated visually. Such demonstrations may help patients translate information into recognizable situations in their own homes. In primary healthcare settings, videos can also potentially be reused during counseling sessions, displayed in waiting areas, or distributed through digital communication channels, allowing patients and family members to review the information beyond the initial education session. Nevertheless, the present study assessed knowledge immediately after the intervention and therefore cannot determine whether the observed improvement was retained over time.

The leaflet group also showed an increase in knowledge and reached the predetermined significance threshold ($p = 0.050$). This result indicates that printed educational material may remain useful for communicating information about household environmental conditions. Leaflets provide concise information that patients can take home and reread according to their individual needs. This characteristic is particularly relevant to TB prevention because household environmental improvement may require patients and family members to remember several practical measures after counseling has ended.

The finding is consistent with Pratiwi et al. (2022), who reported that leaflet-based health education improved knowledge and attitudes regarding TB prevention. Puspitasari (2024) similarly found that leaflet-based health education significantly improved knowledge among pulmonary TB patients regarding multidrug-resistant TB. Evidence from Putri et al. (2021) also demonstrated that both leaflet and video-based TB health promotion could improve knowledge and attitudes, although the magnitude of change differed between media. These findings support the continued use of leaflets as a relatively simple and accessible health promotion medium.

However, the p -value of 0.050 in the present study should be interpreted cautiously. Because it is exactly at the predetermined $\alpha = 0.05$ threshold, the evidence for the leaflet intervention is weaker than that observed in the educational video group. The result should therefore not be interpreted as demonstrating that leaflets are definitively effective or superior to other media. Differences in baseline knowledge, participant characteristics, exposure to the material, or the intensity of the educational session may also influence the observed result.

In contrast, the flipchart group showed an increase in knowledge, but the change was not statistically significant ($p = 0.160$). This does not necessarily mean that flipcharts are ineffective as a health promotion medium. Flipcharts can support face-to-face education by presenting information sequentially and allowing educators to explain illustrations directly to participants. However, their effectiveness may depend on how the educator uses the material, the duration of the session, the clarity of the illustrations, and the level of interaction between the educator and participants. If the session is relatively brief or predominantly one-way, the potential interactive advantage of flipcharts may not be fully realized.



The different patterns observed among the three groups may therefore reflect not only the characteristics of the media but also the way participants interact with the information. Videos provide audiovisual stimulation and concrete demonstrations, leaflets allow independent review, while flipcharts depend more strongly on the quality of face-to-face facilitation. This distinction is important because health promotion media should not be viewed as isolated technological tools; their effectiveness is also influenced by content, delivery method, participant characteristics, and opportunities for reinforcement.

The focus on the physical home environment strengthens the practical relevance of the intervention. Physical conditions such as inadequate ventilation, insufficient natural lighting, and overcrowding have been associated with pulmonary TB risk. Lestiyaningsih (2021) reported the relevance of ventilation and window positioning to pulmonary TB, while Zulaikhah et al. (2019) identified relationships among knowledge, behavior, home environmental conditions, and TB transmission. More recent evidence has also identified overcrowded sleeping areas and inadequate ventilation as important physical risk factors for pulmonary TB (Sipayung et al., 2024). Therefore, improving patients' knowledge of these conditions represents an important preliminary step toward encouraging household-level preventive practices.

The relationship between knowledge and environmental prevention is also supported by Miharti (2022), who examined the relationship between physical home conditions and knowledge in relation to pulmonary TB. However, knowledge improvement should not be equated directly with behavior change. A patient may understand the importance of ventilation or natural lighting but may face structural or socioeconomic limitations that prevent immediate modification of the home environment. Consequently, health education should emphasize feasible actions and involve family members who participate in household decision-making and daily routines.

From a primary healthcare perspective, the findings support the use of a multimodal health promotion strategy. Educational videos can be considered as one potential medium for presenting environmental information in a concrete and engaging format, while leaflets can function as take-home materials that reinforce key messages. Flipcharts may remain useful for counseling when supported by interactive explanation, questions, and checks of participant understanding. This approach is consistent with the role of communication, information, and education in environmental health services emphasized by the Ministry of Health of the Republic of Indonesia (Kementerian Kesehatan Republik Indonesia, 2023).

The results should nevertheless be interpreted within the methodological limitations of the study. First, the study involved 54 patients from a single primary healthcare service area, which may limit the generalizability of the findings to other populations and healthcare settings. Second, the outcome measured was knowledge immediately before and after the intervention; therefore, the study cannot establish whether the improvement was maintained over time or translated into preventive behavior and actual changes in household environmental conditions. Third, the inferential analysis consisted of separate paired-samples t-tests within each intervention group. Consequently, the smaller p-value observed in the educational video group cannot be interpreted as statistical evidence that video was more effective than leaflets or flipcharts. A formal comparison of change scores between groups and reporting of effect sizes would be required to determine whether the magnitude of improvement differed significantly among the three media.

Overall, the findings suggest that health promotion using educational videos was associated with a statistically significant improvement in pulmonary TB patients' knowledge of the physical home environment, while leaflet-based education reached the significance threshold and flipchart-based education did not. The results provide support for considering audiovisual education as part of TB health promotion in primary care, but they should be interpreted as evidence of within-group changes rather than evidence of superiority among the three media. Future research should employ direct between-group comparisons, report effect sizes and confidence intervals, and include follow-up assessments of knowledge retention, preventive behavior, and changes in household environmental conditions.

CONCLUSION

Health promotion interventions using leaflets, flipcharts, and educational videos were associated with increases in pulmonary TB patients' knowledge of the physical home environment. The educational video group demonstrated a statistically significant pretest-posttest improvement ($p < 0.001$), while the leaflet group reached the significance threshold ($p = 0.050$). The flipchart group also showed an increase in knowledge, but the change was not statistically significant ($p = 0.160$).

These findings indicate that educational videos have strong potential as a health promotion medium for improving pulmonary TB patients' knowledge of household environmental conditions, while leaflets may serve as practical reinforcement materials. However, because the analysis was limited to within-group comparisons, the findings do not establish that educational videos are statistically more effective than leaflets or flipcharts. Future studies should conduct direct between-group comparisons, report effect sizes, and assess longer-term knowledge retention, preventive behavior, and actual changes in the physical home environment.

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