Effect of Structured Multicomponent Health Education on Tuberculosis Prevention Knowledge and Attitudes in Indonesian Primary Care: A Quasi-Experimental Study

Abstract

Aims: To evaluate baseline-adjusted between-group differences in tuberculosis (TB) prevention knowledge and attitudes following structured multicomponent health education in Indonesian primary care.

Methods: A non-randomized quasi-experimental pre-test-post-test control-group study was conducted at Lubuk Alung Health Center, Padang Pariaman, from November to December 2024. Forty registered patients with active TB were recruited purposively and allocated non-randomly to intervention (n=20) and control (n=20) groups. The intervention was a 15-20-minute structured education package integrating TB information with behavioral and household environmental risk-reduction messages; the control group received routine counseling. Knowledge was measured using 8 items scored 1-3 (total range 8-24), and attitude using 15 items scored 1-5 (total range 15-75). Separate ANCOVA models compared post-test scores between groups while adjusting for the corresponding pre-test score.

Findings: Mean knowledge increased from 17.25±2.10 to 20.45±1.57 in the intervention group and from 16.80±2.24 to 19.80±1.58 in the control group. The baseline-adjusted difference was 0.40 points (95% CI -0.27 to 1.08), $F(1,37)=1.47$, $p=0.233$, partial $\eta^2=0.038$. Mean attitude increased from 48.70±5.31 to 55.95±5.08 in the intervention group and from 45.20±4.07 to 49.20±3.75 in the control group. The baseline-adjusted attitude difference was 4.19 points (95% CI 2.23 to 6.16), $F(1,37)=18.72$, $p<0.001$, partial $\eta^2=0.336$; HC3 robust inference remained significant ($p=0.002$).

Conclusion: After adjustment for baseline scores, the intervention group had a significantly higher post-test attitude score than the control group, whereas the adjusted knowledge difference was not statistically significant. Because allocation was non-random, the findings indicate baseline-adjusted associations rather than definitive causal effects. The environmental component represented education and household-action messages; objective indoor environmental change was not measured.

Keywords: Tuberculosis; Health Education; Health Knowledge Attitudes Practice; Patient Education as Topic; Tuberculosis, Pulmonary.

Introduction

Tuberculosis (TB) remains a major communicable disease and a persistent public-health challenge, particularly in countries with high disease burden and constrained health-system resources. Its control requires timely diagnosis and effective treatment, but it also depends on patients and families understanding transmission, recognizing preventable risks, and applying feasible protective practices in daily life. Indonesia continues to be classified among the high-burden countries, and progress toward global incidence and mortality targets remains difficult [1, 2]. These circumstances make primary-care education an important complement to biomedical management.

The Directly Observed Treatment, Short-course strategy has long provided an organizational basis for TB treatment in Indonesia, although implementation quality and continuity remain challenging across service settings [3]. Education can reinforce this strategy by improving understanding of transmission, treatment adherence, cough etiquette, early care seeking, and protection of household contacts. Community-led education in Indonesia has previously improved knowledge and preventive behavior related to TB [4]. Recent Indonesian studies have also shown that mobile applications, web-based education, life-skills training, and worker empowerment can support medication adherence, knowledge, recognition of transmission risk, and preventive action [5-8]. Collectively, this evidence suggests that education is most useful when it is linked to actions that patients can perform during treatment and at home.

Household conditions are relevant because pulmonary TB is transmitted through the air and risk may increase with prolonged exposure in enclosed, crowded, or poorly ventilated spaces. Indoor smoke, dampness, limited sunlight, and inadequate sanitation may coexist with social and economic vulnerabilities that complicate prevention and recovery [9-12]. Environmental-control research has generally emphasized structural measures in health-care or congregate settings, whereas patients in resource-limited communities often need practical household-level guidance that can be applied without specialized equipment. Education cannot correct structural housing deficiencies, but it can clarify which low-cost actions are feasible and when broader institutional support is required.

Health education that combines biomedical information with behavioral and environmental messages may therefore be more useful than isolated factual instruction. Multicomponent interventions have improved health-related knowledge, behavior, and risk profiles in several populations, although their content, duration, and intensity vary considerably [13-16]. In TB care, a feasible primary-care package can translate technical recommendations into actions such as opening windows and doors, increasing sunlight entry, avoiding smoking indoors, reducing exposure to cooking smoke, practicing cough etiquette, and disposing of sputum safely. Such an intervention should be described accurately as structured multicomponent health education rather than as proof of lifestyle or physical environmental change unless those outcomes are directly measured.

Knowledge and attitude should also be treated as related but distinct outcomes. Factual knowledge can change after a short educational encounter, whereas attitude is shaped by prior beliefs, perceived benefits and barriers, social influence, and perceived control over the recommended behavior [17, 18]. A patient may understand that ventilation and smoke reduction are important but still be unable to change a crowded house or cooking arrangement. Consequently, an intervention-specific attitude effect should be inferred only when baseline differences are addressed and the change exceeds that observed under routine counseling. This distinction is particularly important in non-randomized studies.

Routine records from Padang Pariaman indicated a continuing increase in reported TB cases from 2020 to 2024, and Lubuk Alung Health Center recorded the highest number among local primary health-care facilities in 2024. Existing activities included routine counseling and other supportive services, but the continuing case burden suggested a need for more structured and actionable education. The present study therefore evaluated whether a brief multicomponent health-education package improved TB-prevention knowledge and attitudes among registered TB patients at Lubuk Alung Health Center. The intervention's distinctive feature was the integration of standard TB information with feasible household environmental risk-reduction messages delivered through routine primary-care contact. The primary outcomes were knowledge and attitude scores; objective ventilation, humidity, indoor particulate matter, room occupancy, and other physical environmental indicators were not measured.

Materials & Methods

Study Design and Setting

This quantitative study used a non-randomized quasi-experimental pre-test-post-test control-group design. It was conducted at Lubuk Alung Health Center in Padang Pariaman Regency, West Sumatra, Indonesia, between November and December 2024. The health center was selected because it served an area with a high recorded TB burden and provided routine treatment and counseling through primary-care and DOTS-related services.

Participants and Sampling

The study population comprised registered patients with active TB receiving care at Lubuk Alung Health Center during the study period. Eligibility required active TB, current registration at the health center, ability to complete the baseline assessment, receipt of the assigned education or routine counseling, and availability for post-test assessment. Persons without active TB, including those with latent infection only, were excluded. Purposive recruitment was used because the intervention was embedded in routine service contacts. Forty participants were enrolled and allocated non-randomly to an intervention group (n=20) or control group (n=20). No random sequence or allocation concealment was documented. All participants completed both assessments and were included in the analysis.

Sample Size Determination

No formal a priori power-based sample-size calculation was documented in the original study records. The achieved sample was determined by recruitment feasibility during the fixed November-December 2024 study period and comprised 40 participants, with 20 in each group. An achieved-sample sensitivity calculation for the revised ANCOVA model, assuming two groups, one baseline covariate, a two-sided α of 0.05, and 80% power, indicated that N=40 could detect an effect size of approximately f=0.455. This sensitivity analysis quantifies the capability of the available sample and is not presented as the original basis for recruitment [28].

Intervention and Control Conditions

The intervention group received a structured multicomponent health-education session lasting approximately 15-20 minutes. The package combined medical information about TB with behavioral and household environmental risk-reduction messages. A standardized session guide was supported by leaflets or posters and a brief illustrated module. Facilitators used concrete examples and simple demonstrations to show how participants could improve cross-ventilation by opening windows and doors, increase sunlight entry, reduce exposure to cigarette and cooking smoke, maintain basic household cleanliness, practice cough etiquette, and dispose of sputum and household waste safely. Participants also received take-home reminders and a checklist of feasible actions. The same core content and supporting materials were intended for participants in the intervention group so that message delivery remained consistent. The checklist functioned primarily as an education and reinforcement tool; this article does not report it as an independently validated environmental outcome. The control group received the routine counseling or standard care available at the health center without the structured environmental module. Because routine counseling could itself influence knowledge or attitude, the control condition was treated as an active comparison rather than as no intervention.

The intervention logic assumed a sequential educational pathway: specific information would first strengthen factual understanding, then increase recognition of household transmission risks, and finally support more favorable intentions toward preventive action. Knowledge was expected to respond more quickly than attitude because attitudes are influenced by prior experience, social norms, perceived feasibility, and material constraints. The brief session and reminders were therefore considered an initial educational exposure rather than a complete behavior-change program. Since this study did not include long-term follow-up, verified household-practice endpoints, or microbiological transmission outcomes, it was not designed to demonstrate sustained behavior change or reduced TB incidence.

Table 1. Content and delivery of the structured multicomponent health-education intervention

Component	**Operationalization**
TB medical information	Cause, transmission, common symptoms, treatment adherence, follow-up, and protection of household contacts.
Behavioral risk reduction	Cough etiquette, avoidance of smoking indoors, reduced close exposure where feasible, and reinforcement of treatment-related preventive behavior.
Household environmental actions	Opening windows and doors for cross-ventilation, increasing sunlight entry, reducing cooking-smoke exposure, maintaining cleanliness, and safe sputum and waste disposal.
Delivery and reinforcement	A structured 15-20-minute session supported by leaflets/posters, an illustrated module, practical examples, take-home reminders, and a simple household-action checklist.
Control condition	Routine counseling or standard care without the structured multicomponent environmental-risk module.

Outcome Measures

Knowledge and attitude were measured at baseline and post-test with a study-specific Tuberculosis Prevention Knowledge and Attitude Questionnaire. The participant-level master dataset retained 8 knowledge item codes (pre_pp1-pre_pp8 and post_pp1-post_pp8), each recorded as an ordered numeric value from 1 to 3. The knowledge total was the direct sum of the 8 item values, producing a possible range of 8-24. The dataset also retained 15 attitude item codes (pre_ps1-pre_ps15 and post_ps1-post_ps15), each recorded as an ordered numeric value from 1 to 5. The attitude total was the direct sum of the 15 item values, producing a possible range of 15-75. No reverse-coded scoring was identified in the supplied dataset. Higher totals indicated greater TB-prevention knowledge or a more favorable preventive attitude, and the same item-code structure was used at both measurement occasions.

At the scale level, the paper and intervention protocol documented content concerning TB transmission, treatment and adherence, protection of household contacts, cough etiquette, ventilation and sunlight, indoor smoke exposure, cleanliness, and safe sputum and waste disposal. Because the master dataset retained item codes and numeric responses but not the original verbatim item statements or verbal response anchors, no item-specific wording or one-to-one item-to-domain mapping was reconstructed. A separate household-action checklist was used as an educational reinforcement aid and was not analyzed as an independent validated outcome.

Table 2. Complete operational description and measurement performance of the study-specific questionnaire

Required element	Knowledge scale	Attitude scale
Instrument name/source	Study-specific Tuberculosis Prevention Knowledge and Attitude Questionnaire; no named external scale was identified in the supplied paper, master dataset, or archived study files.	Study-specific Tuberculosis Prevention Knowledge and Attitude Questionnaire; no named external scale was identified in the supplied paper, master dataset, or archived study files.
Number of items	8 items (K1-K8).	15 items (A1-A15).
Stored response format	Three ordered numeric categories coded 1, 2, and 3. The original verbal labels were not retained in the supplied sources.	Five ordered numeric categories coded 1-5. The original verbal labels were not retained in the supplied sources.
Item-content domains	Scale-level content documented in the paper/intervention protocol included TB transmission, treatment and adherence, household-contact protection, cough etiquette, ventilation/sunlight, indoor smoke reduction, cleanliness, and safe sputum/waste disposal. No one-to-one mapping of K1-K8 to individual domains is claimed without the original item sheet.	Scale-level content documented in the paper/intervention protocol concerned the perceived importance, willingness, intention, and feasibility of TB-prevention actions. No one-to-one mapping of A1-A15 to individual constructs is claimed without the original item sheet.
Scoring	Direct sum of the 8 stored item scores; no reverse coding identified.	Direct sum of the 15 stored item scores; no reverse coding identified.
Possible score range and interpretation	8-24; higher totals indicate greater TB-prevention knowledge.	15-75; higher totals indicate a more favorable TB-prevention attitude.
Measurement occasions	The same 8-item structure was used at baseline before group-specific education/routine counseling and at post-test after the intervention period.	The same 15-item structure was used at baseline before group-specific education/routine counseling and at post-test after the intervention period.
Language/adaptation record	The study was conducted in Indonesia, but the supplied files did not contain the original questionnaire language, translation, or cultural-adaptation documentation; these details are not inferred.	The study was conducted in Indonesia, but the supplied files did not contain the original questionnaire language, translation, or cultural-adaptation documentation; these details are not inferred.
Administration mode and exact interval	Baseline and post-test administration are documented; self-administration versus interviewer administration and the exact post-test interval were not retained.	Baseline and post-test administration are documented; self-administration versus interviewer administration and the exact post-test interval were not retained.

Required element	Knowledge scale	Attitude scale
Validity evidence available	The workbook retained group-specific item-total summaries. Pooled baseline reanalysis of all 40 participants yielded corrected item-total correlations of 0.266-0.648. No separate expert content-validity index file was supplied.	The workbook retained group-specific item-total summaries. Pooled baseline reanalysis of all 40 participants yielded corrected item-total correlations of 0.395-0.582. No separate expert content-validity index file was supplied.
Reliability sample and coefficient	Reanalysis of the 40 baseline study responses (not a separate documented pilot sample): Cronbach's alpha=0.673.	Reanalysis of the 40 baseline study responses (not a separate documented pilot sample): Cronbach's alpha=0.841.
Related household-action checklist	Used as an educational reinforcement aid; not analyzed as an independent outcome.	Used as an educational reinforcement aid; not analyzed as an independent outcome.

Data Collection and Quality Control

Baseline questionnaires were administered before group-specific education or routine counseling, and post-test questionnaires were administered after the intervention period using the same item set and scoring rules. The master dataset contained complete paired knowledge and attitude records for all 40 participants. Data quality checks confirmed that each reported total equaled the direct sum of its constituent item scores. Intervention materials were standardized through a session guide, visual aids, an illustrated module, reminders, and the household-action checklist. Blinding was not documented and was unlikely in an educational intervention; self-reported responses may therefore have been affected by social-desirability or expectancy bias.

Study Flow

All 40 enrolled participants completed baseline and post-intervention assessments. The study flow is shown in Figure 1.

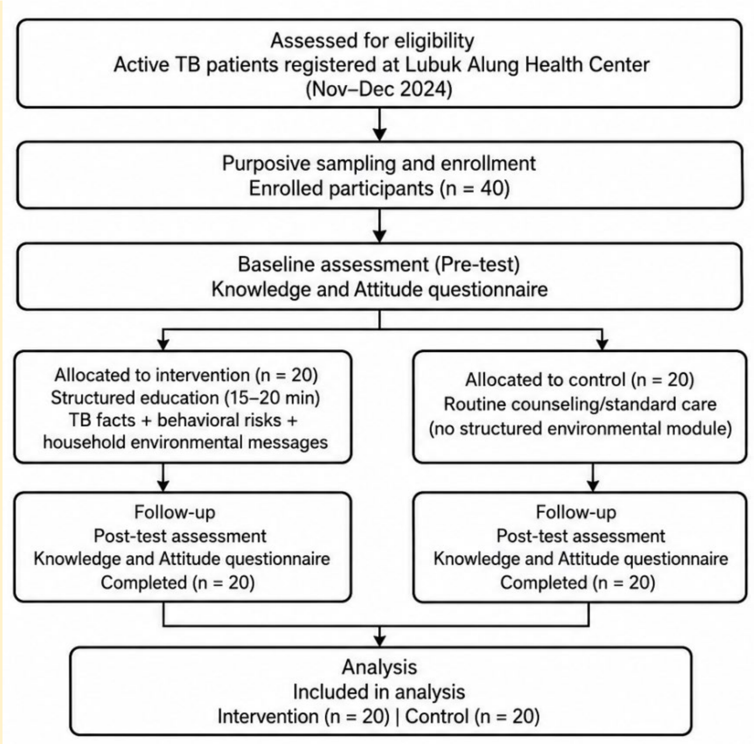

Figure 1. Participant flow through enrollment, non-random group allocation, follow-up, and analysis (n=20 per group).

Statistical Analysis

Continuous outcomes were summarized as mean±standard deviation. The primary analysis used two separate analyses of covariance (ANCOVA): post-test knowledge was modeled with study group as the fixed factor and pre-test knowledge as the covariate; post-test attitude was modeled with study group as the fixed factor and pre-test attitude as the covariate [26,27]. Adjusted marginal means were estimated at the overall mean of the corresponding baseline score. Results are reported as adjusted between-group differences, 95% confidence intervals, F statistics with degrees of freedom, two-sided p values, and partial eta-squared.

Linearity was evaluated from baseline-outcome relationships; homogeneity of regression slopes was assessed using group-by-baseline interaction terms; residual normality was assessed using the Shapiro-Wilk test; and equality of residual variances was assessed using Levene's test. The slope interactions were non-significant for knowledge ($p=0.878$) and attitude ($p=0.560$), and residual normality was supported ($p=0.612$ and $p=0.568$). Residual variances were homogeneous for knowledge ($p=0.215$) but not for attitude ($p=0.005$); therefore, HC3 heteroscedasticity-consistent standard errors were used as a sensitivity analysis for attitude [31]. Statistical significance was set at $p<0.05$. Analyses were performed in Python 3.13 using statsmodels 0.14.6.

Ethical Considerations

Ethical approval was granted by the Ethics Committee of Padang Pariaman District Hospital (RSUD Padang Pariaman), approval No. 082/0250/III/2024. Written informed consent was obtained before participation. Participants were informed that participation was voluntary and that confidentiality and privacy would be protected. Data were analyzed and reported in aggregate form.

Findings

Knowledge Outcome

Mean knowledge increased from 17.25±2.10 at baseline to 20.45±1.57 at post-test in the intervention group and from 16.80±2.24 to 19.80±1.58 in the control group. The corresponding unadjusted mean changes were 3.20±2.04 and 3.00±1.81 points. After adjustment for pre-test knowledge, the adjusted post-test means were 20.33 for the intervention group and 19.92 for the control group. The adjusted difference was 0.40 points (95% CI -0.27 to 1.08), $F(1,37)=1.47$, $p=0.233$, partial $\eta^2=0.038$. Thus, the baseline-adjusted knowledge difference was not statistically significant.

Attitude Outcome

Mean attitude increased from 48.70±5.31 at baseline to 55.95±5.08 at post-test in the intervention group and from 45.20±4.07 to 49.20±3.75 in the control group. The corresponding unadjusted mean changes were 7.25±3.92 and 4.00±1.97 points. After adjustment for pre-test attitude, the adjusted post-test means were 54.67 for the intervention group and 50.48 for the control group. The adjusted difference was 4.19 points (95% CI 2.23 to 6.16), $F(1,37)=18.72$, $p<0.001$, partial $\eta^2=0.336$. HC3 robust inference confirmed the group difference (robust 95% CI 1.71 to 6.68; $p=0.002$).

The unadjusted intervention-control contrast in mean change was 0.20 points for knowledge and 3.25 points for attitude. Descriptive pre-test, post-test, and change scores are presented in Table 3, while baseline-adjusted ANCOVA results are presented in Table 4.

Table 3. Descriptive pre-test, post-test, and change scores for knowledge and attitude

Outcome and group	Pre-test mean±SD	Post-test mean±SD	Mean change±SD	Interpretation
Knowledge - Intervention	17.25±2.10	20.45±1.57	3.20±2.04	Increase
Knowledge - Control	16.80±2.24	19.80±1.58	3.00±1.81	Increase
Attitude - Intervention	48.70±5.31	55.95±5.08	7.25±3.92	Larger increase
Attitude - Control	45.20±4.07	49.20±3.75	4.00±1.97	Increase

Note: Values are unadjusted mean±SD. Mean change was calculated for each participant as post-test minus pre-test.

ANCOVA Results

Separate ANCOVA models were fitted for knowledge and attitude. Table 4 presents adjusted marginal means and baseline-adjusted group effects.

Table 4. Baseline-adjusted ANCOVA results

Outcome	Adjusted mean Intervention	Adjusted mean Control	Adjusted difference	95% CI	F (df)	p value	Partial η^2
Knowledge	20.33	19.92	0.40	-0.27 to 1.08	1.47 (1,37)	0.233	0.038
Attitude	54.67	50.48	4.19	2.23 to 6.16	18.72 (1,37)	<0.001	0.336
Attitude, HC3 sensitivity	54.67	50.48	4.19	1.71 to 6.68	—	0.002	—
Model specification	Post-test outcome	Group factor	Baseline covariate	Two-sided 95% CI	Type II SS	α=0.05	—

Note: Adjusted means were estimated at the overall baseline mean (knowledge=17.025; attitude=46.950). For attitude, the HC3 robust sensitivity analysis gave an adjusted difference of 4.19 points (95% CI 1.71-6.68; p=0.002), confirming the conventional ANCOVA conclusion.

Interpretation of Environmental Content

The intervention explicitly addressed ventilation, sunlight, indoor smoke, cleanliness, and safe disposal practices. These components increased the practical relevance of the education package, but they should not be interpreted as measured improvement in the physical indoor environment. No direct data were available on air-exchange rates, humidity, particulate matter, room occupancy, or standardized environmental observations. Accordingly, the findings support changes in knowledge and educational exposure rather than verified environmental modification.

Discussion

This non-randomized study evaluated a brief structured education package using baseline-adjusted ANCOVA. Both groups showed substantial increases in knowledge, and the adjusted difference between groups was small and not statistically significant. Therefore, the revised analysis does not support an intervention-specific knowledge effect. The improvement in both groups may reflect routine counseling, repeated testing, concurrent clinical contact, or other time-related influences. Indonesian studies have reported benefits from targeted TB education [4-7], but the present data indicate that the additional structured package did not produce a detectable knowledge advantage beyond the active control condition.

The intervention nevertheless provided clinically relevant and actionable content by linking TB transmission and treatment information to household conditions and preventive practices. Participants were shown how ventilation and sunlight could be improved, how indoor smoke exposure could be reduced, and how cough etiquette and safe sputum disposal could be practiced. Comparable task-oriented approaches have been used in TB worker empowerment and multicomponent health-education programs [8,13-16]. The absence of a statistically significant adjusted knowledge difference does not imply that the content lacked value; rather, it indicates that the incremental knowledge benefit over routine counseling was not demonstrated in this sample.

The attitude outcome showed a different pattern. Although the intervention group started with a higher mean attitude score, ANCOVA adjusted explicitly for this baseline difference and identified a 4.19-point adjusted post-test advantage. The result remained statistically significant with HC3 robust standard errors, which were used because residual variances differed between groups. The finding is compatible with an intervention-related improvement in preventive attitudes, but non-random allocation means that residual confounding cannot be excluded [27]. Attitudes are influenced by prior beliefs, perceived benefits and barriers, social influence, and perceived behavioral control [17,18]; the structured, practical household content may have strengthened these motivational components beyond routine counseling.

The adjusted effect estimates clarify the distinction between statistical and practical interpretation. For knowledge, the adjusted difference was only 0.40 points on an 8-24 scale, with a confidence interval crossing zero and a small partial η^2 of 0.038. For attitude, the adjusted difference was 4.19 points on a 15-75 scale, with partial η^2=0.336. These estimates, together with their confidence intervals, are more informative than separate within-group significance tests, which can lead to misleading conclusions in pre-test-post-test studies [26,33].

Previous reviews and intervention studies have shown that health education can improve TB-related knowledge and preventive behavior, particularly when educational media are understandable, reinforced, and responsive to patients' circumstances [19-22]. Nevertheless, improvement in knowledge or attitude does not automatically establish sustained behavior change. In the present study, the household checklist was used as an educational reinforcement tool, but detailed practice outcomes were not reported as validated endpoints. Longer follow-up, direct household observation, and repeated assessments would be needed to determine whether participants maintained ventilation, smoke-reduction, hygiene, and sputum-disposal practices. Future reports should also provide questionnaire item counts, score ranges, content-validity evidence, reliability coefficients, and the timing of post-test measurement.

The environmental component should be positioned carefully. Natural ventilation and upper-room ultraviolet germicidal irradiation can reduce airborne transmission risk in high-risk indoor settings, and improved ventilation has been associated with outbreak control [23-25]. Those studies involved physical environmental interventions and direct control measures. The present study instead translated environmental principles into household education. Its contribution is therefore behavioral and educational rather than engineering-based. This distinction is important because claiming environmental improvement without objective measurements would overstate the evidence. A stronger follow-up study could pair education with direct measurements of ventilation, humidity, particulate matter, room occupancy, and observed household practices.

From a primary-care perspective, the intervention is feasible because it is brief, uses low-cost educational materials, and can be integrated into existing TB service contacts. Health workers could deliver the core package during treatment visits, involve family members as treatment supporters, and use short reminders at subsequent appointments. The content may also be adapted to local housing patterns and common sources of indoor smoke. However, implementation should not become a substitute for structural action. Households with severe crowding, inadequate housing, or reliance on biomass fuel may be unable to modify conditions through education alone. Health education should therefore complement, not replace, social protection, housing improvement, smoking cessation, nutritional support, and broader TB-control measures.

The study has several limitations. The sample of 40 participants was small, selected purposively from one health center, and not supported by a documented a priori power calculation; the sensitivity analysis indicated that only relatively large effects could be detected reliably. Group allocation was non-random, so ANCOVA reduced measured baseline imbalance but could not eliminate unmeasured confounding. The knowledge scale showed modest internal consistency (alpha=0.673), which may have reduced precision, whereas attitude reliability was good (alpha=0.841). The electronic master dataset did not preserve the verbatim item wording, verbal response anchors, language/adaptation record, administration mode, exact post-test interval, a separate pilot dataset, or expert content-validity documentation. These elements are therefore reported as unavailable rather than reconstructed as historical facts. Objective household environmental conditions, sustained practices, treatment adherence, and TB transmission outcomes were not measured.

Future studies should calculate sample size prospectively using a prespecified primary outcome, clinically meaningful effect, expected baseline-follow-up correlation, α level, desired power, and allowance for attrition [28]. Random allocation or stronger quasi-experimental methods should be used where feasible, with complete reporting of questionnaire wording, response anchors, content-validity procedures, external validation, intervention fidelity, and follow-up timing. Multicenter recruitment and longer follow-up would improve generalizability and determine whether attitude changes translate into sustained preventive behavior.

Conclusion

After adjustment for baseline scores, structured multicomponent health education was associated with a significantly higher post-test attitude score than routine counseling, with a 4.19-point adjusted difference. In contrast, the adjusted post-test knowledge difference was small and not statistically significant. The intervention integrated standard TB information with practical household messages concerning ventilation, sunlight, indoor smoke, cough etiquette, and safe sputum and waste disposal, but objective environmental change was not measured. Because allocation was non-random and the sample was small, the results should be interpreted as baseline-adjusted associations rather than definitive causal effects. Larger, prospectively powered and preferably randomized studies are required.