Health Education Strategies for Tuberculosis Treatment Adherence: A Scoping Review

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Abstract

Background: Adhering to tuberculosis (TB) treatment is vital for preventing the spread of the disease and the rise of drug-resistant strains. However, low adherence rates remain challenging, reflecting the public's limited understanding of the importance of completing treatment, underscoring the need for better health education.

Objective: This scoping review aims to explore and synthesize existing health education strategies designed to enhance adherence to tuberculosis treatment.

Methods: A scoping review using Arksey and O'Malley was conducted. Relevant articles published within the last 10 years, from 2014 to 2024, were selected for this review. The research literature was gathered from six databases: PubMed, Science Direct, Sage, Cochrane Library, ProQuest, and Google Scholar. The Joanna Briggs Institute guidelines were used for data extraction.

Results: Out of 1,213 studies reviewed, 14 articles were included in this analysis. This review identifies five key themes related to health education strategies: the purpose of health education, the media of intervention, the methods of intervention, the duration of intervention, and the outcomes of education.

Conclusion: Effective health education strategies to promote treatment adherence among tuberculosis patients can significantly improve patient compliance. A wider adoption of these strategies will help control tuberculosis and achieve global elimination goals. In the future, telemedicine and tele-nursing will be vital for enhancing adherence in areas with limited healthcare access.

Keywords: *Health education, patients' compliance, strategies, treatment adherence, tuberculosis treatment.*

INTRODUCTION

Globally, Tuberculosis (TB) is the leading cause of death [1, 2]. TB is a severe and complex infectious disease that is transmitted between people *via* the air [3]. 10.6 million people were diagnosed with TB worldwide according to reports by the World Health Organization (WHO) in 2020. This number was an increase of about 600,000 cases compared to 2020. Of these, 6.4 million cases are receiving treatment, whereas 4.2 million remain undiagnosed or unreported [4]. TB has played a significant role in increasing the global disease burden and causing economic losses. The absence of a definitive gold standard for diagnosis makes early detection of TB infection particularly challenging [5, 6].

Ten million tuberculosis cases and approximately 1.8 million deaths [7]. Non-adherence to treatment remains a significant challenge in tuberculosis prevention and control [8]. Adherence to pulmonary tuberculosis treatment reduces mortality rates and avoids prolonged illness, transmission, and multidrug-resistant TB, and subsequent treatment failure [7, 9]. Treatment adherence is essential for tuberculosis control [10]. Treatment adherence has significant economic and therapeutic implications, as non-adherent patients are at a higher risk of developing complications that impact their health status and overall quality of life [11]. Intensive community health promotion and routine patient education by healthcare providers can help address this issue [12]. Rigorous public health education focused on risk factors and TB treatment is needed to improve adherence [2]. Health education is essential for empowering patients and fostering their contribution to tuberculosis control [13].

Various research findings on strategies to improve adherence have been conducted across multiple countries. Non-adherence is the primary factor contributing to the failure of treatment regimens [14]. Non-adherence to treatment presents a challenge influenced by numerous factors, some of which reduce cure rates, increase transmission, and incur high costs, thus posing a barrier to tuberculosis control [15, 16]. Health education interventions for tuberculosis patients have been widely studied; however, few have applied health education specifically to monitor patients and improve treatment adherence. Therefore, research is needed to summarize existing studies on health education interventions to facilitate the identification of practical approaches to enhance treatment adherence among tuberculosis patients. Hence, this study aims to explore and synthesize existing health education strategies designed to improve adherence to tuberculosis treatment.

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Table 1: Search keywords used across electronic databases for identifying relevant studies.

No.	Database	Keywords	Articles	Access data
1.	PubMed	(((((((tuberculosis patients[Title/Abstract]) OR (patients with pulmonary tuberculosis[Title/Abstract])) OR (TB suffers[Title/Abstract])) AND (health education[Title/Abstract])) OR (patient education[Title/Abstract])) OR (medical adherence[Title/Abstract])) OR (treatment compliance[Title/Abstract])) OR (educational interventions[Title/Abstract])	667	20 May 2024
2.	Science Direct	("tuberculosis patients" OR "patients with pulmonary tuberculosis" OR "TB suffers") AND ("health education" OR "patient education" OR "medical adherence" OR "treatment compliance" OR "educational interventions")	48	20 May 2024
3.	Sage	tuberculosis patient OR patients with pulmonary tuberculosis OR TB suffers AND health education OR patient education OR medical adherence OR treatment compliance OR educational interventions	86	21 May 2024
4.	Cochrane Library	tuberculosis patient OR patients with pulmonary tuberculosis OR TB suffers in Title Abstract Keyword AND health education OR patient education OR medical adherence OR treatment compliance OR educational interventions in Title Abstract Keyword	6	21 May 2024
5.	ProQuest	("tuberculosis patients" OR "patients with pulmonary tuberculosis" OR "TB suffers") AND ("health education" OR "patient education" OR "medical adherence" OR "treatment compliance" OR "educational interventions")	274	21 May 2024
6.	Google Scholar	("tuberculosis patients" OR "patients with pulmonary tuberculosis" OR "TB suffers") AND ("health education" OR "patient education" OR "medical adherence" OR "treatment compliance" OR "educational interventions") AND ("hospital setting" OR "healthcare facilities")	132	21 May 2024

METHODS

The Arksey and O'Malley methodological framework was used to conduct this scoping review. The step included identifying the research question, selecting relevant articles, extracting data, mapping the data, and summarizing the findings [17, 18]. Although this framework is widely adopted, it has been critiqued for its limited methodological detail and potential ambiguity, which may lead to inconsistent application across studies. To address these concerns, guidance from Levac, Colquhoun, & O'Brien (2010) was also considered to strengthen the methodological rigor of this review [19]. Additionally, the Preferred Reporting Items for Systematic Reviews and Meta-analysis Scoping Review (PRISMA ScR) guidelines were used as a complementary checklist to ensure transparent and uniform reporting, recognizing that they serve as a reporting guideline rather than a methodological framework [20, 21]. Below are the five steps:

Stage 1: Identifying the Research Question

The research question in this review was: " Health education strategies used by tuberculosis patients to improve treatment adherence."

Stage 2: Selecting Relevant Articles

This stage explores the health education methods tuberculosis patients use to improve treatment adherence, based on the scientific literature. This scoping review utilizes keywords including "tuberculosis patient OR patients with pulmonary tuberculosis OR TB sufferers AND health education OR patient education OR medical adherence OR treatment compliance OR educational interventions." An initial search was conducted to review titles, abstracts, and content to identify relevant studies.

To ensure comprehensive coverage of relevant literature, we searched multiple electronic databases for this scoping review, including PubMed, ScienceDirect, Sage, the Cochrane Library, ProQuest, and Google Scholar. This database was used because it provides extensive access to peer-reviewed studies in medicine, nursing, and public health, thereby minimizing the risk of missing essential publications. The keywords and article search results are presented in Table **1**.

Stage 3: Selecting Articles and Data Extraction

This scoping review's inclusion and exclusion criteria were guided by the Population, Concept, and Context (PCC) framework [20]. The Population was defined as adults aged 18 years and older who had been diagnosed with tuberculosis, as this group represents most of the TB cases and faces specific adherence challenges compared to pediatric patients. The Concept focused on health education strategies, reflecting the central role of educational intervention in promoting treatment adherence. The Context was global, allowing the review to capture diverse approaches and strategies implemented across different health systems and cultural settings. The article search covered the period from 2014 to 2024, a total of 10 years. The inclusion criteria for this scoping review are presented in Table **2**.

The process of article retrieval from six databases was documented during this scoping review. The titles identified from the article search were downloaded into Mendeley, duplicates were removed, and the remaining titles were exported to Rayyan [21]. A total of 1.213 relevant articles were retrieved using the selected keywords. After removing duplicates, the number was reduced to 1.192 articles, with 939 eliminated: 925 for irrelevant titles and 14 for not being in English.

Table 2: Inclusion and exclusion criteria for selecting eligibility articles.

PCC	Inclusion
Population	Studies focused on adult (≥ 18 years and over) tuberculosis patients.
Concept	Health education
Context	Global/the whole world

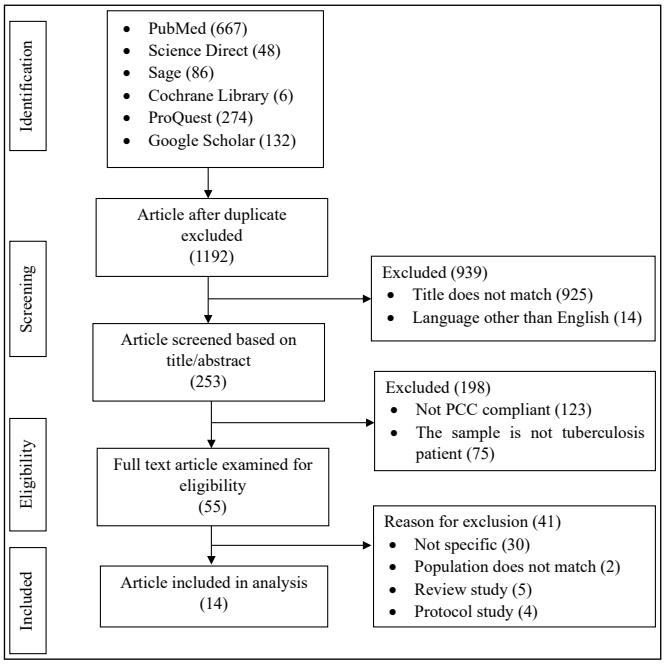

Fig. (1): PRISMA flowchart (Tricco *et al.*, 2018).

The articles were then screened based on titles and abstracts, resulting in 55 articles, with 198 articles excluded. These exclusions included 123 articles that did not meet the PCC criteria and 75 articles unrelated to adult patients with tuberculosis. Subsequently, full-text articles were reviewed for relevance, leaving 14 and 41 excluded. These included 30 articles unrelated to health education, two that did not focus on TB patients aged 18 years and older, five review articles, and four protocol studies. Team members NP, SH, and KAE used the PCC keyword to select studies and reviewed articles using a standard format. We aligned our perspectives and resolved discrepancies in selection and extraction.

The PRISMA ScR flowchart illustrates the process of searching and selecting articles, as shown in Fig. **(1)**.

Stage 4: Mapping Data

Data were extracted to include key information such as the study location, research design, objectives, and sample. The domains used for data extraction included author, year, country, article title, design, respondents/ participants, and outcomes. The collected literature was then analyzed according to the inclusion and exclusion criteria established by all researchers, followed by mapping the articles based on their characteristics.

Stage 5: Summarizing the Findings

Several articles served as the basis for data collection, focusing on the analysis of health education interventions to improve treatment adherence among tuberculosis patients. Identifying key themes was essential in reporting the analysis results. To clarify, the team developed the themes using an inductive approach. They independently repeated their readings and coding before discussing alignment perspectives and addressing discrepancies.

RESULTS

Study Characteristics

Of the 14 studies analyzed, there were three studies conducted in Ethiopia [22-24], two studies in Iran [25, 26], then one study each from Malaysia [27], South Africa [28], Nigeria [29], Myanmar [30], Spain [31], China [32], Saudi Arabia [33], El Salvador [34], and Indonesia [35]. Some studies were analyzed using randomized controlled trials; others used cross-sectional and quasi-experimental designs. The sample size in each study varies. The most significant number of case studies was 1916 respondents [34]. The article's summary is presented in Table **3**.

Table 3: Characteristics of the included studies.

No.	Author, Year, Country	Title	Aim	Sample and Design	Findings
1	(Saidi & Manaf, 2023) Malaysia [27]	Effectiveness of family support health education intervention to improve health-related quality of life among pulmonary tuberculosis patients in Melaka, Malaysia	This study assesses the effectiveness of the FASTEN Family Support Health Education intervention in improving HRQoL among PTB patients in Melaka compared to conventional management.	Eighty-eight respondents participated in a single-blinded, randomized controlled trial from September 2019 to April 2021.	The FASTEN intervention is a health education program targeting TB disease, primarily aiming to actively involve patients' family members and relatives in managing PTB cases. Although all participants experienced improved HRQol after six months of treatment, those who participated in the FASTEN program showed even greater improvements improvement.
2	(Matakanye *et al.*, 2021) Limpoppo Province, South Africa [28]	Knowledge, beliefs, and perceptions of TB and its treatment amongst TB patients in the Limpopo Province, South Africa	This study evaluated TB patients' knowledge, beliefs, and perceptions regarding TB and its treatment in the Limpopo Province.	Sample of 207 TB patients was collected between June 2020 and September 2020, using a quantitative descriptive design.	These findings highlight the need for health education initiatives to deliver accurate information, enhance understanding of TB, and correct misconceptions among community patients.
3	(Adane *et al.*, 2017) Ethiopia [24]	Tuberculosis knowledge, attitudes and practices among northern Ethiopian prisoners: Implications for TB control efforts	This study assessed the level of knowledge, attitudes and practices (KAP) of prisoners about TB in eight northern Ethiopian prisons.	Sample 615 prisoners March and May 2016 Data were collected cross-sectionally.	All the study prisons require health education interventions that address causes and help translate knowledge into practice.

No.	Author, Year, Country	Title	Aim	Sample and Design	Findings
4	(Adisa *et al.*, 2021) Southwest Nigeria [29]	Knowledge about tuberculosis, treatment adherence and outcome among ambulatory patients with drug-sensitive tuberculosis in two directly-observed treatment centres in Southwest Nigeria	This study assessed knowledge about TB and possible reasons for treatment non-adherence among drug-sensitive TB(DS-TB) patients, as well as evaluated treatment outcomes for the DS-TB managed Whitin a 5 year.	Sample of 140 ambulatory DS-TB patients collected over eight consecutive weeks between January and March 2019. The study used a mixed-method design that included a cross-sectional approach.	Over five years, nearly half the patients were cured, about 10% died, and the treatment success rate of 79% is roughly 12% below the WHO target.
5	(Oo *et al.*, 2020) Myanmar [30]	Delayed care-seeking and its underlying factors among patients with tuberculosis in Yangon, Myanmar	This study was conducted to estimate the proportion of patients with TB who delayed care-seeking and and to identify underlying factors.	A total of 346 patients were chosen as eligible respondents From 1 April to 30 April 2015.	The results from this study provide useful comprehensive information addressing underlying factors associated with delayed care-seeking behaviors. These can be used to advance health education interventions regarding TB and strengthen early diagnosis of TB within community settings.
6	(Johari *et al.*, 2014) Isfahan, Iran [26]	Factors related to adopting healthy behaviors by patients with tuberculosis in Isfahan: Application of health belief model	The purpose of the present study to investigated factors related with adopting health behaviors by patients with tuberculosis based on the health belief model.	The present cross-sectional study was performed on 196 patients with tuberculosis. The Pearson test was used to study the correlation between independent variables and adopting a healthy behavior.	Direct relationship was found between adopting healthy behavior and scores of knowledge, perceived susceptibility and perceived benefit. Although the results of the study can be the basis of educational interventions, any generalizations should be performed cautiously.
7	(Tola *et al.*, 2016) Iran [25]	Psychological and education intervention to improve tuberculosis treatment adherence in Ethiopia based on health belief model: Cluster randomized controlled trial	This study aimed to evaluate the impact of psychological counseling and educational intervention on tuberculosis (TB) treatment adherence based on Health Belief Model (HBM).	698 TB patients, on treatment for one to two months, were enrolled. A cluster RCT was conducted in Addis Ababa from May to December 2014.	Psychological counseling and educational interventions based on HBM significantly reduced treatment non-adherence in the intervention group. Providing psychological counseling and health education to TB patients during treatment is recommended. To be most effective, these interventions should be guided by behavioral theories and integrated into standard TB care protocols.
8	(Plans-rubi *et al.*, 2024) Catalonia, Spain [31]	Factors associated with Non-adherence to Tuberculosis preventive treatment among adult contacts of pulmonary tuberculosis cases with latent tuberculosis infection in Catalonia, Spain, in 2019-2012	The aim of this study was to identify factors associated with non-adherence to tuberculosis (TB) preventive treatment among contacts with latent TB infection for new cases of pulmonary TB cases reported in Catalonia in 2019-2021.	A cross-sectional study assessed adherence to TB preventive treatment among contacts aged 18+ of new pulmonary TB cases in Catalonia from Jan 1, 2019, to June 30, 2021.	Adherence to tuberculosis preventive treatment among adult contacts of pulmonary tuberculosis cases with latent tuberculosis infection should be enhanced through the recommendation of short-term treatment regimens and the development of health education initiatives, with particular emphasis on contacts who exhibit factors associated with non-adherence to therapy.
9	(Chen *et al.*, 2020) China [32]	The effects of family, society and national policy support on treatment adherence among newly diagnosed tuberculosis patients: a cross-sectional study	The current study evaluated treatment adherence among newly diagnosed TB patients in Dalian, north-eastern China, and determined the effects of family, society and national policy support factors on treatment adherence.	A total of 481 newly diagnosed TB patients were enrolled. A cross-sectional survey was conducted among these patients at the outpatient department of Dalian Tuberculosis Hospital from September 2019 to January 2020.	The results showed that non-adherence was common among newly diagnosed TB patients. Factors improving adherence included family supervision, spiritual encouragement, a strong doctor-patient relationship, good TB knowledge, and policy support. To boost adherence, training for medical staff, better health education, and increased financial aid are recommended.

No.	Author, Year, Country	Title	Aim	Sample and Design	Findings
10.	(Al-sahafi *et al.*, 2021) Saudi Arabia [33]	Treatment outcomes among tuberculosis patients in Jeddah, Saudi Arabia: Results of a community mobile outreach directly observed treatment, Short-course (DOTS) project, compared to a standard facility-based DOTS: A randomized controlled trial	The objective of this study was compared the effectiveness of the community mobile outreach approach in improving treatment outcomes (success rate) among local tuberculosis patients with those being treated with a facility-based directly observed treatment, short-course (DOTS).	a blind randomized controlled trial with 200 newly diagnosed TB patients from November 2017 to November 2018.	The study indicated that most participants were satisfied with how the Public Health Department monitored the mobile outreach teams. Additionally, every participant in both groups expressed their satisfaction with the health education provided.
11	(Wilson *et al.*, 2016) El Salvador [34]	Tuberculosis patient and family education through videography in El Salvador	assess a videography-based TB education program can be implemented in busy, resource-limited outpatient clinics to improve TB understanding, treatment, and the efficiency of evaluations and contact investigations.	An observational pilot study includes 1916 patients and family members.	The study shows videography-based TB education works well in busy, resource-limited outpatient settings, offering an efficient, low-cost way to improve patient understanding, acceptance, and compliance with TB treatment. This pilot study encourages further evaluation of its positive, sustainable impact in under-resourced clinics.
12	(Amare *et al.*, 2022) Southwest Ethiopia [22]	Assessment of knowledge, attitude and practices of tuberculosis patients towards DOTs regimen in Jimma Health Center, Jimma Zone, Southwest Ethiopia	This study aimed to assess tuberculosis patients' knowledge, attitude, and practices towards the DOTs regimen at Jimma health center. It also evaluated their attitudes towards factors, modern, and traditional medicine.	The study involved 150 participants in a cross-sectional design conducted from June 20 to September 19, 2016.	This research indicates that patients generally have limited knowledge and attitudes towards TB and its treatment. Consequently, it is essential to implement health education and awareness campaigns using various mobilization methods to improve understanding among patients.
13	(Gebregergs & Alemu, 2015) Northern Ethiopia [23]	Household contact screening adherence among tuberculosis patients in Northern Ethiopia	This study investigated household contact screening adherence and associated factors among tuberculosis patients in Amhara region, Ethiopia.	A cross-sectional study was carried out between April 10 and June 30, 2013, involving 418 patients receiving treatment at a tuberculosis clinic.	Religion, family income, contacts, TB type, health education, and TB knowledge significantly linked to adherence. Widespread TB awareness and ongoing health education are recommended. The connection between religion and adherence needs further study.
14	(Sukartini *et al.*, 2020) Indonesia [35]	The effect of health education through brainstorming and booklet method on behavior in prevention of pulmonary TB transmission	This study aims to analyze the effect of health education through brainstorming and booklets on client behavior in preventing TB transmission.	January to March 2017 with a sample of 30 respondents. This research used a quasi-experimental design with a pre-posttest control group design.	This study concluded that health education through brainstorming and booklets could improve the client's knowledge, attitudes and actions in preventing pulmonary tuberculosis transmission. Health education through brainstorming and booklets become an alternative method of health education in preventing TB transmission.

The Health Education Strategies Themes

The existing health education strategies designed to enhance adherence to tuberculosis treatment are categorized into five themes, as described in Table **4**.

Purpose of Health Education

The purpose of health education includes enhancing knowledge [22-24, 29, 31, 32, 34, 35], increasing interest [27, 30, 34, 35], promoting healthy behavior [23, 25-27, 32, 34, 35], and attitude change [24-26, 28-30, 33, 35]. These objectives outline the educational framework for patients with pulmonary tuberculosis to help them adhere to their treatment regimen.

Media of Intervention

We have identified several media used in delivering health education that have a positive impact on its delivery. The intervention media included print media such as booklets and pamphlets [22, 27, 35]. While electronic media utilized videos and phone reminders [27, 34].

Methods of Intervention

We have identified the methods used in education delivery to achieve goals and facilitate the education process. These methods include face-to-face interactions. [22-26, 28-33]. Mobile phone communication [27] and digital versatility [34].

Table 4: Summary of health education strategies to improve treatment adherence among pulmonary tuberculosis patients.

No.	Topic	Findings
1	Purpose of health education	Enhancing knowledge [22-24, 29, 31, 32, 34, 35] Increasing interest [27, 30, 34, 35] Promoting healthy behavior [23, 25-27, 32, 34, 35] Attitude change [24-26, 28-30, 33, 35]
2	Media of intervention	Print media: Booklet [22, 27] Pamphlet [35] Electronic media: Videography [27] Phone reminder [34]
3	Methods of intervention	The methods we identified include face-to-face interactions [22-26, 28-33] Mobile phone communication [27] Digital versatile [33]
4	Duration of intervention	Duration: 6 months [26, 31, 33] 2 months [24, 23] 1 year [34] 21 days [30] 1 month [25] 4 months [25, 28.32] Session: 8 session [29] 3 session [27] 2 session [35]
5	Outcome education	Treatment adherence: The adherence to tuberculosis remains low [22, 24, 28, 31, 32] Improvement in treatment adherence [23-25, 27, 30, 34, 35] Treatment success: Treatment success rates increased [25, 29, 33] Achievement of therapeutic goals [34]

Duration of Intervention

The duration of health education provision varies greatly, ranging from 21 days to 1 year [22-26, 28, 30-34]. Although most articles do not specify the number of sessions per week or month for delivering health education, three articles report education delivered in 2, 3, and 8 sessions [27, 29, 35].

Outcome Education

In health education outcomes, the group receiving health education interventions improved in treatment adherence [22, 26, 27, 30, 34, 35]. Treatment success rates increased [25, 29, 33]. And achievement of therapeutic goals [34]. However, some articles report that compliance remains low [23, 24, 28, 31, 32].

DISCUSSION

This review examined how health education impacts adherence to tuberculosis treatment across different countries. Non-compliance continues to be a key factor resulting in relapse and the development of drug resistance [36]. A significant challenge in tuberculosis research is developing accurate methods to measure how well patients stick to their treatment [37].

Traditional methods, like health education programs, continue to be effective in enhancing TB awareness and care [38, 39]. For instance, Sukartini *et al.* [35] showed that brainstorming and booklet-based interventions improved patients' knowledge, attitudes, and preventive behaviors. These results suggest that culturally tailored, ongoing health education can enhance community awareness and patient compliance, particularly when factors such as religion, family income, and social support are considered [35]. Recent studies underscore the importance of digital and media-based education. [22] reported that patients possessed limited knowledge and held negative attitudes toward TB, highlighting the need for various awareness strategies. Videography-focused education has proven effective in resource-constrained outpatient settings by enhancing understanding, acceptance, and adherence at a cost-efficient rate [22].

Family-centered and theory-driven strategies also enhance adherence. Interventions grounded in the Health Belief Model (HBM) have demonstrated effectiveness in reducing non-adherence by increasing patients' awareness of their susceptibility and the benefits of treatment. [25, 26]. Similarly, family involvement, as in the FASTEN program, actively engages relatives in supporting TB patients [27]. Evidence suggests that expanding health worker training, strengthening patient and family education, and ensuring adequate financial support can further enhance adherence [31-33].

Contextual barriers such as delayed care-seeking [30] and misconceptions about TB [28] highlight the importance of accurate, context-specific health education interventions in prisons [24, 29]. The results demonstrate that targeted education can enhance timely diagnosis and encourage healthy behaviors. These findings highlight the importance of not only providing knowledge through health education but also addressing behavioral and structural obstacles to compliance. In conclusion, maintaining adherence is crucial for recovery and preventing drug resistance. Successful approaches include strict adherence to therapy, robust family support, personalized health education, and ongoing monitoring by healthcare professionals.

LIMITATIONS

This scoping review identified 14 articles across six databases, focusing on population-based health education to improve treatment adherence in pulmonary tuberculosis. It does not examine long-term effects or factors such as family support and medication side effects, which may lead to overlooked studies and limit the understanding of health education's impact. Despite aiming to include all relevant studies, the complexity of treatment adherence is influenced by numerous factors.

CONCLUSION

The results of our review show that effective education on treatment adherence in tuberculosis patients can significantly improve adherence to treatment regimens. By providing clear information about the importance of completing the entire duration of treatment, the risk of drug resistance, and the consequences of non-

compliance, patients become more motivated to follow treatment instructions precisely. In addition, education that involves family and community, along with ongoing support from health workers, can strengthen the support system for patients, thereby increasing the chances of recovery and reducing the spread of disease.

RECOMMENDATIONS

The scoping review aims to enhance our understanding of how health education can improve treatment adherence among patients with pulmonary tuberculosis. In the future, it is recommended that health centers use this scoping review as a guide for patient education on pulmonary tuberculosis. Additionally, various methods, such as leveraging health technology, can be implemented to deliver face-to-face health education and provide continuous support and information to patients.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

AUTHORS' CONTRIBUTION

Nasrawati Patta, Suni Hariati, Kadek Ayu Erika: Conception and design

Nasrawati Patta, Suni Hariati, Kadek Ayu Erika: Analysis and interpretation of the data

Nasrawati Patta, Suni Hariati: Drafting of the article

Suni Hariati, Kadek Ayu Erika: Critical revision of the article for important intellectual content

Nasrawati Patta, Suni Hariati, Kadek Ayu Erika: Final approval of the article

Nasrawati Patta: Provision of study materials or patients

Suni Hariati: Statistical expertise

Suni Hariati: Obtaining funding

Nasrawati Patta: Administrative, technical, or logistic support

Nasrawati Patta: Collection and assembly of data

GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work the authors limitedly used ChatGPT (GPT-4, OpenAI) to get language suggestions and do minor proofreading in some parts of the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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