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Original Article

Role of mothers in preventing tuberculosis in children: A scoping review

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Abstract

Tuberculosis (TB) remains a significant global health challenge, especially for children. The aim of this scoping review was to investigate the role of mothers in preventing childhood TB transmission and highlight effective strategies and associated barriers. A systematic literature search was conducted using PubMed, Web of Science, and Scopus, covering articles up to January 17, 2024. The search included keywords like "mother," "parents," "care," "prevention," and "tuberculosis." Eligibility criteria included peer-reviewed articles on maternal health interventions for TB prevention in children and published in English. The study selection process involved screening titles and abstracts, followed by full-text reviews by Rayyan Artificial Intelligence (AI). Eighteen studies were analyzed, revealing the crucial roles of mothers and healthcare workers in TB prevention. The results indicated that in South Africa, only 47% of eligible pregnant women underwent Mantoux testing, with lower rates in rural areas. The isoniazid preventive therapy (IPT) uptake rate was 79%, with geographical variations. Barriers included insufficient patient information, inadequate screening facilities, and healthcare providers' knowledge gaps. Parental involvement, particularly by mothers, is vital for adherence to TB preventive measures. Challenges in integrating TB case-finding with antenatal care and prevention of mother-to-child transmission (PMTCT) services included inconsistent screening and healthcare worker shortages. Enhancing health services, reducing stigma, and integrating TB prevention into existing programs are essential. In conclusion, this review underscores that effective childhood TB prevention requires a coordinated approach that incorporates the efforts of the mother and healthcare worker. Addressing barriers such as contact tracing gaps and diagnostic delays, alongside enhancing maternal health education and support, is essential for improving TB prevention and management. Targeted interventions and collaborative efforts are needed to reduce transmission and improve health outcomes, particularly in bridging rural-urban disparities.

Keywords: Children, mother, healthcare, prevention, tuberculosis

Introduction

Tuberculosis (TB) is the 13th leading cause of mortality and is the infectious disease with the greatest worldwide mortality rate [1,2]. In 2020, an estimated 10 million individuals were affected with tuberculosis, leading to 1.5 million deaths [2,3]. While men were disproportionately affected by TB, accounting for 56% of global TB infections in 2020, the high proportion of women in their reproductive years with TB remains concerning [2]. There is a growing amount of evidence about TB during pregnancy and the significance of early detection of TB. Several studies emphasize the issue of delayed diagnosis of TB caused by atypical symptoms that occur during pregnancy [4]. In

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low-income countries, TB has a substantial role in maternal mortality [5-7], leading to an increased likelihood of ectopic pregnancy, early birth, and perinatal mortality in infected women [8].

TB is also the leading cause of morbidity and mortality in individuals with human immunodeficiency virus (HIV) [3], particularly affecting women of reproductive age (15–49 years) [9]. The incidence of TB is greater among pregnant women who are also living with HIV compared to pregnant women without HIV [10,11]. Pregnant women co-infected with HIV and TB are at an elevated risk of experiencing problems, including low birth weight, preeclampsia, and preterm delivery [11,12].

According to the Global TB Report 2023, 8.75% of the total treated cases of TB during 2018–2022 were children under the age of 15 (3.5 out of 40 million cases). Additionally, 115,000 children were among the 1.5 million people diagnosed with drug-resistant TB. In 2022, TB was responsible for 183,000 deaths (95% uncertainty interval (UI): 164,000–202,000) among HIV-negative children, accounting for 16% of the global total. Among children with HIV, an estimated 31,000 (95%UI: 26,000–37,000) deaths occurred due to TB, representing 18% of the global total [13]. These figures highlight the significant burden of TB on children and the ongoing high transmission rates within communities. Younger children who have a co-infection with HIV are more likely to develop the disease after being infected and are at a higher risk of acquiring disseminated forms of tuberculosis and dying [3,4,14]. Africa has a prevalence of pediatric TB cases that is approximately one-third of the total global cases. The incidence rate in Africa is 29–34 cases per 100,000 people, which is twice the global average of 2.7 instances [2,7].

The main challenge in diagnosing active TB in children is the problem of establishing a precise and reliable diagnosis. Due to the lack of distinct symptoms, children find it difficult to produce sputum, resulting in the predominance of paucibacillary disease in their cases [6,14]. The Xpert *Mycobacterium tuberculosis*/Rifampicin (MTB/RIF) assay represents a significant advance in the diagnosis of TB [8]. The sensitivity of Xpert is reduced in children compared to adults, while the assay does contribute to increasing the number of children with a confirmed diagnosis of TB [9]. Nevertheless, its application is restricted due to the challenge children face in generating sputum. The primary factors contributing to the low notification rate of pediatric TB cases to national TB programs (NTPs) are the difficulties in detecting and diagnosing the disease. As a result, only 39% of the estimated cases are reported, leaving the majority of affected children misdiagnosed or unreported [2]. Furthermore, the simultaneous presence of TB and HIV among women of reproductive age (15–49 years) presents additional risks. Pregnant women who have HIV are more likely to develop TB and face related issues like giving birth to underweight babies and premature delivery. The worldwide prevalence of tuberculosis in children under the age of 15 is still high, with more than one million cases diagnosed and notable death rates. This emphasizes the urgent requirement for efficient ways to prevent and cure pediatric TB.

Children, particularly those younger or co-infected with HIV, are at an elevated risk of progressing to active TB disease, facing higher rates of disseminated TB and mortality [15]. The diagnostic challenges in pediatric TB, marked by non-specific symptoms and the difficulties in sputum collection, hinder the effective identification and treatment of the disease, resulting in a significant gap in case detection [16,17]. The aim of this scoping review was to explore the essential role of mother healthcare in preventing TB in children, addressing the challenges of early TB diagnosis and treatment in pregnant women, and implementing effective TB prevention strategies among children.

Methods

Study design

This scoping review was conducted using a systematic literature search that included articles published up to January 17, 2024. The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [18], which provided a structured framework for conducting and reporting the review. To identify relevant studies, The PICOS framework, which consisted of population, intervention, comparator, outcomes, and study design, was utilized. After identifying potentially relevant studies [19,20], all selected articles

were imported into a reference manager software to identify and remove duplicate records, ensuring a clean dataset for further analysis.

Search strategy

The systematic literature search was performed using PubMed, Web of Science, and Scopus databases. The search strategy included both controlled vocabulary (e.g., Medical Subject Headings (MeSH) terms) and relevant keywords such as "mother," "parents," "care," "prevention," and "tuberculosis." The specific search terms used included combinations of keywords such as "mother," "parents," "care," "healthcare," "prevention," and "tuberculosis" (**Supplementary Data**). This comprehensive search strategy was designed to capture a wide range of studies addressing the role of mothers in preventing TB in children. The search process was iterative, with refinements made to ensure the inclusion of all relevant studies.

Eligibility criteria

The eligibility criteria for this scoping review were designed to identify relevant studies on the mother's healthcare for the prevention of children towards TB while ensuring a focused and comprehensive approach. The inclusion criteria encompassed a variety of study types, including those focused on maternal healthcare interventions aimed at preventing TB in children, encompassing various interventions such as maternal education, nutritional support, vaccination programs, and prenatal care. Only articles published in peer-reviewed journals were considered to ensure the credibility and quality of the included studies. Studies had to be available in English and involve human participants, specifically targeting mothers and their children. The exclusion criteria were employed to exclude review articles, meta-analyses, animal studies, and studies that did not specifically focus on TB prevention or did not involve maternal healthcare. Non-English articles, editorial pieces, commentaries, and opinion pieces that did not present original research data were also excluded to maintain the focus and rigor of the review.

Study selection

The study selection process was thorough and multi-staged to minimize bias. Initially, the titles and abstracts of all identified articles were screened for relevance, excluding those that did not meet the inclusion criteria using Rayyan AI software [21]. A full-text review was conducted to confirm the eligibility of articles that passed this initial screening. Throughout this process, any discrepancies or uncertainties were resolved through discussion among the reviewers, and when necessary, a third reviewer was consulted to reach a consensus. This rigorous selection process ensured that only relevant and high-quality studies were included in the review. The synthesis comprised developing a detailed overview of the study's characteristics and conducting a thematic analysis of the reported outcomes in Microsoft Office Excel 2019, utilizing a standardized template. The data contained information on the author, year, country, title, study design, population or participants, intervention, length of intervention, comparison and control group, and outcome.

Data extraction

Data extraction was conducted using a standardized form to ensure consistency and comprehensiveness. Detailed information was collected on various aspects of each study, including authors, year of publication, country, and study design. Additionally, data on the population or participants, interventions, duration of interventions, and outcomes or results were gathered. The studies included a range of designs, such as prospective cohort studies, cross-sectional studies, mixed-method studies, case reports, retrospective follow-up studies, and randomized controlled trials (RCTs). The population varied across studies, including pregnant women with HIV, parents of children, HIV-positive pregnant women, and community mothers. Interventions encompassed electronic databases, delivery of antenatal and prevention of mother-to-child transmission (PMTCT) services, interviews, house-to-house surveys, online surveys, and educational programs. The duration of interventions ranged from specific months or years to continuous periods spanning decades. The outcomes or results focused on various aspects such as TB screening, uptake of isoniazid prevention therapy, TB knowledge, self-efficacy, adherence to TB treatment, and factors influencing TB risk.

Results

Study selection

The search and selection process for the scoping review yielded 763 records from PubMed (n=390), Web of Science (n=76), and Scopus (n=297). After removing 192 duplicates, 571 records remained for screening, with 541 excluded for reasons such as inappropriate population, study design, and study protocols, as well as irrelevance. This left 30 studies for retrieval, all of which were successfully obtained and assessed for eligibility. Twelve reports were excluded for not involving any intervention, not being published in open-access journals, or not being in English. Finally, 18 studies met the inclusion criteria and were included in the review, offering insights into maternal healthcare interventions aimed at preventing tuberculosis in children, such as maternal education, nutritional support, vaccination programs, and prenatal care (**Figure 1**). These studies underscored the effectiveness and challenges of various strategies in preventing TB among children through maternal health care initiatives.

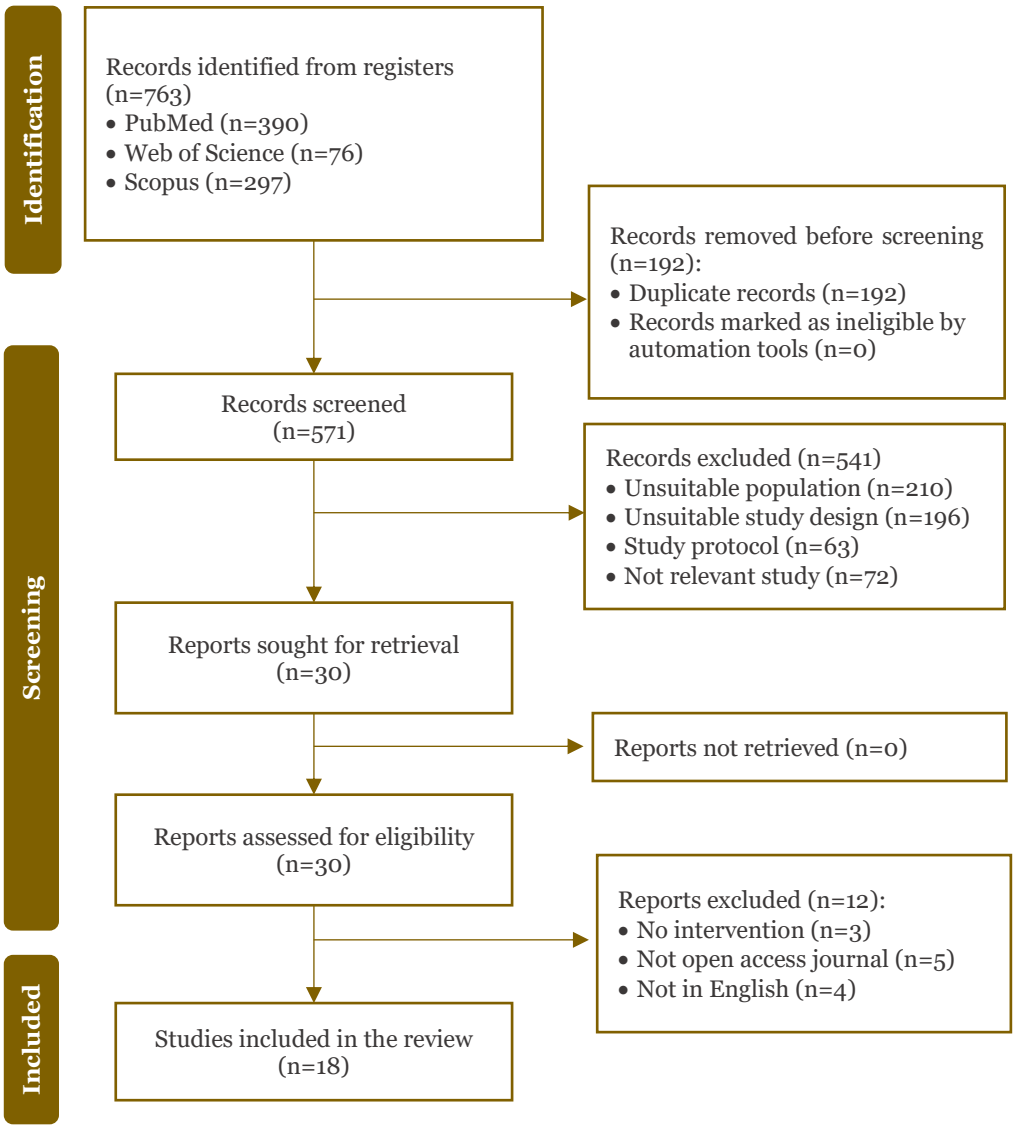

Figure 1. Flowchart diagram of the selection process.

Characteristics of the included studies

A total of 18 articles were reviewed, focusing on various prevention and education programs affecting TB transmission, including contact investigation (CI), isoniazid preventive therapy (IPT) by health workers and the community, the role of mothers and families, the use of isoniazid therapy in children, medication adherence, and the management of HIV-positive pregnant women with TB (**Table 1**).

Table 1. Studies in maternal healthcare among low-income pregnant women

Author	Year	Country	Study design	Population	Data collection method	Outcome
Adeniyi *et al.* [22]	2019	South Africa	Prospective cohort study	Pregnant women with HIV	Electronic database of the East London Prospective Cohort Study (ELPCS)	The Mantoux tests and the use of IPT were more prevalent in semi-urban and urban regions as opposed to rural areas
Gounder *et al.*[23]	2012	South Africa	Cross-sectional operational study	Pregnant women ≥18 years of age	Delivery of antenatal and PMTCT services	Integration of TB screening, administration of IPT, and antiretroviral medication with PMTCT was recommended
Rood *et al.* [24]	2017	The Netherlands	Cross-sectional and retrospective study	Female aged 15–49 years	Interview	Enhancing the overall understanding of the efficacy of anti-tuberculosis medication will aid in reducing the stigma associated with TB in the country
Singh *et al.* [25]	2017	India	A mixed-method design, starting with a quantitative phase that involved analyzing secondary data and conducting a house-to-house survey, followed by a qualitative phase consisting of interviews	All child contacts of TB patients aged <6 years who were registered between January and March 2015 (quantitative analysis). The study conducted interviews with healthcare providers who deal with TB and parents of children affected by the disease (qualitative analysis)	Assessment of program paperwork, a complete house survey to detect positive TB cases, and interviews with healthcare professionals and parents	The analysis of the interviews showed that the main obstacles to the adoption of IPT were a lack of awareness and risk perception among parents, a complicated screening process, shortages of isoniazid medication, insufficient understanding among healthcare practitioners, and inadequate programmatic monitoring
Liang *et al.* [26]	2021	China	Online cross-sectional survey	Parents of children attending kindergarten, elementary school, and middle school in Shajing Area, Bao'an District, Guangdong Province	Online survey	Chinese parents who possessed a high level of knowledge and self-efficacy in managing TB were more likely to seek prompt treatment for TB and follow the prescribed regimens given by doctors. However, an excessive amount of information and self-efficacy had a negative impact on their intentions to do so. Excessive levels of self-efficacy in self-management and health knowledge may have negative consequences
Kaona *et al.* [27]	2004	Zambia	Cross-sectional	Male TB patients 30–39 years, and female TB patients 20–29 years	Interviewed using a pre-tested structured questionnaire	Most male respondents diagnosed with TB tended to be of advanced age and possessed higher levels of education compared to their female counterparts
Skinner *et al.* [28]	2013	South Africa	Interviews	Two parents of children adherent to IPT and two staff members from three primary healthcare clinics in high TB prevalence communities	In-depth interviews with the paper questionnaires	Positive attitudes towards IPT; barriers due to misinformation, stigma, and social issues. Challenges such as staff shortages and lengthy waiting times. Efforts to adhere despite difficulties; need for improved clinic services and support
Ryu *et al.* [29]	2021	Japan	Case report	Premature twins born to a mother with miliary TB	Observation and collection of medical data from patient medical records	The twins can be isolated quickly and shorten the infectious period

Author	Year	Country	Study design	Population	Data collection method	Outcome
Geremew *et al.* [30]	2023	Ethiopia	Institution-based retrospective	All pregnant women registered with ART for life in Pawe Regency	Retrospective	High incidence of TB in pregnant women infected with HIV
Uwimana and Jackson [31]	2013	South Africa	Cross-sectional	Pregnant women ≥18 years of age	Exit interviews and review of PMTCT facility routine data from the district health information system	TB case finding among HIV-infected pregnant women is still suboptimal
Mutyambizi *et al.* [32]	2021	South Africa	Descriptive analysis	Children aged <15 years, adults	Use of monthly aggregated data from the District Health Information System (DHIS)	Establish the effect of the second wave and subsequent waves on HIV-, TB- and PMTCT-related health services
Uwimana *et al.* [33]	2012	South Africa	Case study	Mothers with TB	Facility and NGO audits, a household survey (n=3867), 33 key informant interviews with provincial, district, facility, and NGO managers, and six CCW and patient focus group discussions	Most contracted NGOs in South Africa provided TB or HIV support and care with little support for PMTCT, and only a small percentage of facilities' TB and HIV patients at the community level received support from CCWs
Nordholm *et al.* [34]	2022	Denmark	Case-control	Pregnant or post-partum women from the general population without TB and non-pregnant/non-postpartum women with TB	Analyzed risk factors for TB in pregnant and postpartum women	Identified 392 TB cases in pregnant/post-partum women, predominantly migrants with lower socio-economic status and shorter time since immigration, highlighting socio-economic and demographic factors influencing TB risk
Van Schalkwyk *et al.* [35]	2013	Switzerland	Case report	Women of childbearing age (15-49 years) make up 26.2%, and about 40% of the population are children under 15 years of age	Demographic and health survey	The study found that 70% of people with HIV/AIDS received antiretroviral therapy (ART), with improved retention and survival. Comprehensive PMTCT services were available at 88% of antenatal care facilities. HIV testing and counseling programs showed a decline in HIV infection rates, and case fatality rates for HIV/AIDS patients decreased, especially in children. TB notifications and HIV/TB co-infection rates increased, but HIV testing and co-trimoxazole preventive therapy coverage for co-infected patients exceeded 80%

Author	Year	Country	Study design	Population	Data collection method	Outcome
Moronkeji *et al.* [36]	2019	Nigeria	Observational	HIV-positive pregnant women enrolled for PMTCT service	Survey and data analysis	Key considerations in implementing HIV-TB integrated services into the PMTCT services are the effectiveness of community health worker care, counseling, health education and promotion, TB screening, stigma & discrimination, and fear of meeting known persons
Ávila *et al.* [37]	2016	Colombia	RCT	Community mothers from Cartagena, Colombia	Controlled and randomized prevention trial	Effectiveness of an educational program on improving knowledge about childhood TB
Mikirtichan and Dzharman [38]	2005	Russia	Observational	Preschool children infected with *Mycobacterium tuberculosis* and their parents	Questionnaire	Parents' awareness and knowledge of TB
Susilawaty *et al.* [39]	2022	Indonesia	Cross-sectional observational study	Mothers with at-risk children under five	Questionnaire test and data analysis	Association between mothers' knowledge and behavior regarding TB and children's attitudes toward seeking TB treatment

ART: antiretroviral therapy; CCW: community care worker; DHIS: district health information system; HIV: human immunodeficiency virus; IPT: isoniazid preventive therapy; NGO: non-governmental organization; PMTCT: prevention of mother-to-child transmission; TB: tuberculosis; TPT: tuberculosis preventive therapy; RCT: randomized controlled trial

In the Eastern Cape, South Africa, only 47% of eligible pregnant women underwent Mantoux testing, with significant geographic variation. Pregnant women in rural areas had lower odds of receiving the Mantoux test compared to those in urban areas. The IPT uptake rate was 79%, also with significant geographical variation. Women with HIV, low education levels, and those living in rural communities were less likely to undergo Mantoux testing, highlighting the need to address rural-urban inequality in IPT and Mantoux test uptake [22]. In Bhopal, Central India, there were unsatisfactory screening and initiation of IPT among pediatric contacts of BTA-positive TB cases. Barriers included the lack of information for patients, inadequate screening facilities, drug supply issues, inadequate knowledge among healthcare providers, and poor IPT monitoring [25].

A study reported that among 150 women who were interviewed, 112 (75%) of them received information about TB symptoms, and 56% were screened for TB. Major barriers to TB-PMTCT service integration included a lack of trained health workers, supervision, and service delivery issues. No isoniazid prophylaxis was given to PMTCT clients with latent TB infection [31]. Another study found that 29.8% of TB patients did not adhere to their treatment schedule, even when feeling better. Factors contributing to non-adherence included lack of knowledge about treatment benefits, running out of medication, family roles, and misconceptions about TB transmission [27].

The role of parents and clinic staff is critical in ensuring children's adherence to IPT for TB, emphasizing the importance of parental acceptance, understanding of therapy, and community support. Despite barriers such as stigma, social issues, and access to care, some parents demonstrated a strong commitment to their children's health. Recommendations included improving health services, reducing stigma, and integrating IPT into existing programs to improve adherence. Importance of family support, education, and community involvement in promoting adherence to IPT for tuberculosis prevention [28].

Integration of active TB case-finding with antenatal care and PMTCT is feasible, but there are implementation challenges. Although most women invited for TB screening agreed to be screened, only 44.7% of women presenting for antenatal care at the study clinics were enrolled [23]. The routine clinical staff has shown inconsistency in providing TB screening to all eligible women, potentially favoring the screening of women who were judged to have a higher likelihood of contracting TB [23]. Furthermore, PMTCT nurses failed to examine almost 15% of individuals suspected of having tuberculosis despite obtaining positive screening outcomes. The sole symptom that consistently indicated a successful collection of sputum specimens was the generation of sputum, while persistently poor weight gain indicated a failure in collecting sputum specimens [23]. Therefore, this reduces the amount of time patients have to wait and the workload of the staff while maximizing the efficiency of patient flow and the delivery of services. Furthermore, it is necessary to employ distinct approaches in order to test HIV-positive and HIV-negative pregnant women for TB with greater accuracy and cost-effectiveness [23]. Screening for tuberculosis infection and active TB is suggested for pregnant women at risk to avoid future cases, as they are a particularly vulnerable group. While the cases did not exhibit any indications of more severe tuberculosis symptoms compared to the control group, and there was no rise in maternal death rates among the cases, there seems to be an elevated risk of tuberculosis in pregnant women who were migrants, particularly those of African origin [34].

A study comparing treatment success rates between family Directly Observed Therapy (DOT) and non-family DOT in Gujarat, India, confirmed that family-based DOT is not inferior to non-family DOT in achieving treatment success rates [40]. Women with suboptimal antiretroviral therapy (ART) adherence had a 3.17 times higher risk of TB than the adherent women. Strengthening TB preventive therapy and supporting adherence is crucial to reducing TB incidence among HIV-infected pregnant women [30]. Meanwhile, excessive knowledge or self-efficacy can reduce the intention to seek treatment and adhere to medical regimens, providing insights into designing more effective health education programs [26].

The impact of the COVID-19 lockdown on TB and HIV indicators was mixed in the Mopani district in South Africa, with significant declines in health service utilization, HIV testing, and ART initiation. Maintaining essential health services during the pandemic is crucial to prevent negative impacts [32], and reinforced by the findings that TB and HIV cases accounted for more

than 50% of the disease burden in the audited facilities, and only 11% of patients received support from non-governmental organizations/community-based organizations (NGOs/CBOs) [31]. In Lagos, Nigeria, HIV-TB integrated services showed good knowledge of HIV transmission and antiretroviral therapy but negative perceptions of healthcare workers. Recommendations included increasing the number of healthcare workers, improving client health education, and addressing stigma and discrimination [36].

Tuberculosis preventive treatment (TPT) delivery in children was considered successful, as evidenced by significant improvements in TPT initiation and completion rates, especially in children under five years of age [41]. The TPT delivery model involving women-led Iddirs should be scaled up to improve TB care in Ethiopia. Iddirs are traditional, membership-based local associations in Ethiopia that support members during times of adversity [41,42]. Engaging mothers and local community support groups through Iddirs has proven effective in improving TPT services, as evidenced by a high increase in treatment completion among children under five years [41]. The results suggested that engaging groups can complement the efforts of health workers and improve health outcomes in communities. However, further research is needed to understand how this model can be sustained without external support [41].

Several factors contribute to tuberculosis stigma and TB-related treatment-seeking behaviors. A study in the Netherlands by Rood *et al*. identified that TB stigma is influenced by various factors such as individual attitudes, national socio-economic conditions, TB-HIV burden, HIV stigma, and awareness of the efficacy of TB treatment [24]. The results suggested that efforts to reduce TB stigma may be more effective through joint campaigns to reduce TB and HIV stigma. Emphasis on context-appropriate messages and interventions is needed to address TB and HIV stigma and promote better treatment-seeking behaviors [24]. Thus, mothers' knowledge and attitudes towards TB significantly influence their treatment-seeking behavior for children at risk of TB. Improving counseling and education can help mothers seek appropriate treatment for their children [39].

Discussion

The findings indicated that mothers and healthcare workers play the most important roles in preventing childhood TB. Healthcare workers (HCWs) in TB clinics play an important role in implementing strategies, but it is essential to recognize the foundational role of mothers in these efforts. Mothers are at the forefront of TB prevention efforts for children. Mothers' role is crucial for early recognition of TB symptoms, managing preventive treatments, and fostering a TB-safe environment at home [43]. Educational initiatives, such as community-based workshops and health education campaigns, are designed to enhance mothers' knowledge about TB symptoms, transmission, and prevention strategies [14,44]. Programs that educate mothers about recognizing symptoms such as persistent cough, weight loss, or fever can lead to early diagnosis and treatment, preventing the spread of TB [43].

Mothers' healthcare for TB prevention can take various forms. Structured educational programs, both in-person and digital, help mothers understand the importance of early TB detection [45] and adherence to preventive treatments like IPT [46]. Screening services are often integrated into regular maternal and child health services, allowing for early identification of TB risk factors [25]. These programs are typically provided by HCWs, including nurses, doctors, and community health workers, in clinics, community health centers, and through outreach initiatives. HCWs are integral in delivering maternal healthcare, offering education, conducting screenings, and supporting preventive measures [47]. The effectiveness of maternal healthcare interventions is reflected in improved maternal knowledge and awareness about TB [45]. Studies also demonstrated that informed mothers are more likely to adhere to IPT regimens, significantly reducing TB incidence in children [25,48-50]. In regions with well-established effective maternal healthcare programs, improvements in maternal education have been associated with better TB risk management and reduced transmission [47]. While Indonesia has made significant strides in maternal healthcare, the effectiveness of these programs in specifically managing TB risk still requires further evaluation [47]. It is important to note that less attention is often given to HIV-negative TB patients, which can impact overall TB prevention efforts [51].

Another factor in the increasing TB incidence is the rate of transmission from household contacts to community members and vice versa. As one can imagine, sharing a bedroom between a contact and a tuberculosis patient increases the chances of transmission. Therefore, it is crucial to accurately identify active tuberculosis cases and estimate the likelihood of tuberculosis transmission to avoid transmission [52]. Mothers play a vital healthcare role in creating a TB-safe environment for their children. This includes practices such as ensuring proper ventilation, maintaining good hygiene, and minimizing close contact with individuals who are actively ill with TB [53]. Living conditions, including ventilation and time spent indoors, significantly impact TB transmission [53]. Mothers can implement these practices by keeping living areas well-ventilated and educating their children about basic hygiene measures such as handwashing. Mothers can implement these practices by keeping living areas well-ventilated and educating their children about basic hygiene measures such as handwashing [54].

Health programs that empower mothers, including educational initiatives and community outreach, are integral to maternal healthcare for TB prevention. These programs significantly improve mothers' knowledge about TB, leading to better health outcomes for children by enhancing early detection and adherence to preventive measures like IPT [39,46]. Integrating such programs into maternal healthcare ensures comprehensive support for effective TB management [47]. A mother's personal experiences with TB or caring for a family member with the disease also play a significant role in her motivation to adhere to TB prevention measures. Providing resources and support to mothers can enhance their ability to manage TB risks and promote adherence to preventive therapies [14].

Effective TB prevention strategy requires a coordinated approach that integrates the efforts of both mothers and HCWs [33,55]. HCWs should support mothers by providing clear information about TB prevention and management, while mothers must engage actively in these strategies to create a TB-safe environment for their children [55]. Regular interactions between HCWs and mothers, where HCWs provide ongoing education and support, can enhance the overall effectiveness of TB prevention programs [55].

Households with HIV-negative TB patients who completed the TB program and received active case-finding efforts (ACF) have higher TB incidence rates than those with HIV-positive TB patients aged one to five years. This paradox highlights the critical need for ongoing education for medical personnel and strategic family outreach, including consistent appointment scheduling and contingency plans for unforeseen challenges [56]. Effective TB prevention requires maintaining regular contact with families and providing them with the tools and knowledge needed for early detection and management of TB cases [57]. Exposure to TB is influenced by proximity to TB carriers in the home. The risk of TB among household contacts is significantly higher for those in daily contact with an infected person for more than 18 hours [58]. Additionally, not all contacts with symptoms may also present at treatment centers. Some contacts may have tuberculosis infection but are asymptomatic. Screening all household contacts of asymptomatic TB patients can help identify new TB cases early and minimize transmission [59]. In TB-endemic areas, IPT efficacy can be affected by the duration of exposure to TB and disease severity, with parental involvement and personal experiences with TB being associated with better adherence to IPT regimens [60,61].

To the best of our knowledge, this is the first review to identify articles on strategies to prevent childhood TB transmission with a focus on maternal healthcare. This comprehensive scoping review highlights the critical role of mothers in TB prevention and provides a detailed overview of effective strategies and associated barriers. However, this study has certain limitations, including the inclusion of studies from countries with varying TB burdens, which may affect the generalizability of the findings. Additionally, other diseases that may impact the success of TB prevention programs were not addressed.

Conclusion

This scoping review highlights the pivotal role of mothers in preventing childhood tuberculosis transmission and identifies effective strategies for achieving this goal. Key aspects include educating mothers about TB symptoms, facilitating early diagnosis, and ensuring adherence to isoniazid preventive therapy are essential for reducing TB incidence among children. The review

also pointed out the importance of addressing constraints such as incomplete contact tracing, delays in diagnosis, the need for continuous education for medical personnel, planned family outreach, and consistent contact with families to improve TB prevention. To address these challenges, it is vital to create a TB-safe environment through improved living conditions, reduced exposure risks, and enhanced parental knowledge. Moreover, this review suggested the importance of targeted interventions, robust support systems, and collaborative efforts between mothers and healthcare workers to enhance adherence to preventive measures and the integrated efforts to reduce TB stigma, improve health education, and ensure equitable access to TB prevention services. These strategies are fundamental to curbing childhood TB transmission and improving health outcomes for affected populations.

Ethics approval

Not required.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Supplementary data supporting the findings of this study is available from the following link: https://doi.org/10.6084/m9.figshare.26298799.v2. Please contact the corresponding author if you require further details or additional information.

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