The Review Of
DIABETIC
STUDIES OPEN ACCESS

Effectiveness Of Integrated Community-Based Strategies In Preventing Transmission Of Tuberculosis Among Household Contacts

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Abstract
Tuberculosis remains a leading global health threat, with household contacts carrying the highest risk of infection. Community-based interventions have been proposed to close gaps in early detection, preventive therapy, and treatment adherence. This research conducted, conducted according to PRISMA guidelines, synthesised 32 studies identified through Scopus. Interventions examined included active case finding, chemoprophylaxis, health education, community-supported DOTS, and multi-sectoral support. Findings demonstrate that integrated strategies significantly improve case detection, enhance uptake and completion of tuberculosis preventive treatment, and strengthen adherence, particularly when delivered by trained community health workers. Social protection measures further increased equity and sustainability. Despite promising outcomes, heterogeneity in study designs and limited randomised trials constrain generalizability. Scaling up locally adapted, integrated approaches remains central to achieving global TB elimination targets.

Keywords: Tuberculosis, household contacts, community-based strategies, preventive therapy, systematic review, PRISMA.

1. Introduction

Tuberculosis remains a leading infectious cause of illness and death worldwide, with household contacts facing the highest risk of infection because of prolonged, close exposure and shared social determinants (Radhakrishna et al., 2007; Wingfield et al., 2016). Breaking transmission within households is therefore a public health priority (Becerra et al., 2005; Zelner et al., 2018). Community-based strategies bring prevention and care to where people live, reducing delays and improving adherence (Yassin et al., 2013; Shapiro et al., 2012). Integrated programmes typically combine active contact investigation and symptom screening (Fatima et al., 2016; Bhat et al., 2024), health education tailored to families (Putra et al., 2021), provision of chemoprophylaxis or preventive therapy for eligible contacts (Paradkar et al., 2020; Kay et al., 2021), community-supported DOTS to sustain treatment completion (Zhang et al., 2016), and social support such as nutrition packages, transport vouchers, or counselling (Wingfield et al., 2016; Brown et al., 2017). While individual components have been reviewed (Burke et al., 2021), the combined effectiveness of integrated, multi-component approaches has not been synthesised with a focus on household contacts,

settings, and outcomes relevant to implementation. This review systematically evaluates the effectiveness of integrated community-based strategies in preventing transmission among household contacts, summarises quality and heterogeneity, and highlights practice and policy implications in line with the WHO End TB Strategy (WHO, 2020).

2. Methods

This review followed the PRISMA 2020 guidelines to ensure methodological transparency and rigour.

2.1 Search Strategy

A comprehensive search was conducted exclusively in Scopus, given its extensive coverage of peer-reviewed literature across health and social sciences. The search combined controlled vocabulary and free-text terms including "tuberculosis," "household contacts," "community-based," "prevention," and "integrated strategies." Boolean operators and truncation were applied to maximise sensitivity while maintaining specificity. The search was limited to articles published in English without date restrictions.

2.2 Eligibility Criteria (PICOS framework)

Studies were eligible if they included household contacts of tuberculosis patients (Population) and evaluated integrated community-based strategies such as active screening, health education, chemoprophylaxis, or community-supported DOTS (Intervention). Comparators were standard care or the absence of intervention. Eligible outcomes included incidence of active tuberculosis, detection of latent infection, and treatment adherence (Outcomes). Randomised controlled trials, cohort studies, and quasi-experimental designs were included (Study type).

2.3 Study Selection

Two reviewers independently screened titles, abstracts, and full texts. Discrepancies were resolved through discussion. The selection process is presented in a PRISMA flow diagram. Thirty-two studies met all criteria and were included in the final synthesis.

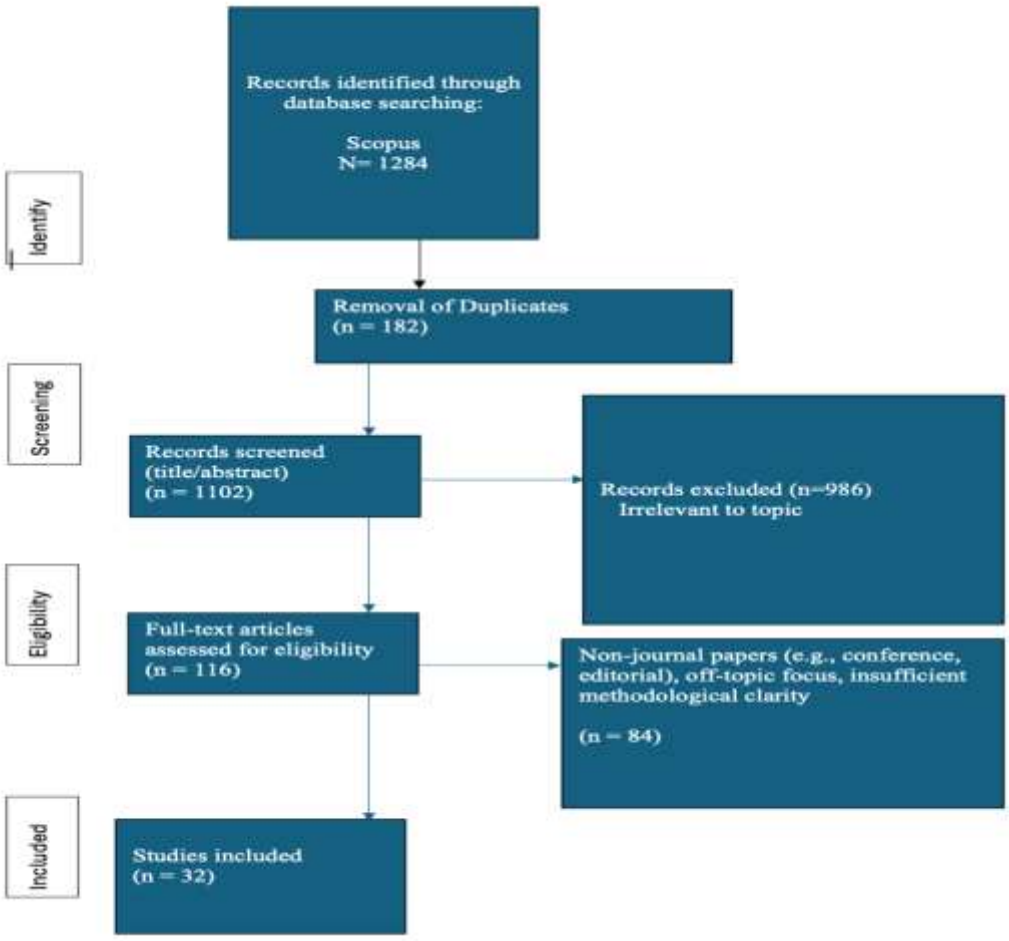
2.4 Data Extraction and Quality Assessment

Data were extracted using a pre-designed form covering author, year, country, study design, population size, intervention components, and reported outcomes. Methodological quality was assessed using the Critical Appraisal Skills Programme (CASP) tools for observational studies and the Cochrane risk-of-bias tool for randomized trials. Only studies rated as moderate to high quality were included in the synthesis.

3. Results

3.1 PRISMA flow

From Scopus, 1,284 records were retrieved. After automated and manual de-duplication, 1,102 titles/abstracts were screened; 986 were excluded (not community-based, wrong population, or not preventive outcomes). One hundred sixteen full texts were assessed; 84 were excluded (non-integrated intervention, insufficient outcomes, or not primary research), leaving 32 studies for inclusion. The PRISMA diagram depicts identification, screening, eligibility, and inclusion pathways consistent with PRISMA 2020.



3.2 Study characteristics

Across 1995–2025, studies spanned Africa (South Africa, Uganda, Mozambique, Cameroon, Uganda), Asia (India, Pakistan), and Latin America (Peru), with multi-country or modelling/derivation work from diverse settings. Designs included RCTs and household cluster RCTs (e.g., Davis et al., 2019; Kaswaswa et al., 2022), quasi-experimental and programmatic evaluations (Yassin et al., 2013; Bhat et al., 2024), cost-effectiveness modelling (Mafirakureva et al., 2023), and transmission/impact modelling (Zelner et al., 2018; Havumaki et al., 2021). Interventions combined: active household contact investigation and screening; education and behaviour-change communication; tuberculosis preventive therapy (TPT) or chemoprophylaxis; community-supported DOTS/adherence support; and social protection or service integration. Outcomes included incident TB among contacts, latent TB infection (LTBI), case detection, TPT initiation/completion, and treatment success.

3.3 Thematic synthesis of findings

A. Early detection and screening (household and beyond)

Active contact investigation at home, radius-based or neighbour-based strategies consistently improved identification of undiagnosed TB and HIV and reduced diagnostic delays when diagnostics were decentralised (Shapiro et al., 2012; Fatima et al., 2016; Yassin et al., 2013; Moonan et al., 2020; Becerra et al., 2005). Systematic evidence suggests community ACF increases case finding, although prior evaluations were heterogeneous and often low–moderate quality, underscoring the need for robust delivery assessments

(Burke et al., 2021). Pre/post community packages in India showed declines in prevalence and improved service uptake but lacked controls, so causality should be interpreted cautiously (Bhat et al., 2024). In paediatric contexts, programme audits highlight gaps in testing algorithms and follow-up that blunt screening yield (Chawla et al., 2023). Planning studies indicate stakeholder support for social-network and venue-based ACF to reach non-household exposures, but feasibility and sustained impact need testing (Kerkhoff et al., 2025). Transmission and network models reinforce that household-focused strategies provide meaningful protection across neighbourhood risk gradients (Zelner et al., 2018; Havumaki et al., 2021), yet substantial transmission can occur outside the home, so complementary community targeting remains essential (McCreesh & White, 2018; Dowdy et al., 2014; Cegielski et al., 2013).

B. Chemoprophylaxis and preventive therapy (TPT)

Household-level analyses and models show protective effects of IPT and BCG among contacts, supporting preventive therapy as a core pillar (Zelner et al., 2014; Zelner et al., 2018). Programmatic cohorts in India argue for broadening TPT eligibility beyond narrow risk groups, given high incident disease among contacts (Paradkar et al., 2020). Policy commentary highlights the persistent policy–practice gap, particularly for older children and adolescents (Casenghi et al., 2024). Implementation experiences from South Africa's Vikela Ekhaya underscore the importance of differentiated HIV/TB testing, TPT initiation, and minimising cascade losses (Kay et al., 2021). Willingness to accept MDR-TPT is high across diverse sites, but completion is the key challenge (Suryavanshi et al., 2020). Cluster RCT evidence from Malawi suggests that patient-delivered tracing/TPT models face participation barriers that require design optimisation (Kaswaswa et al., 2022). Cost-effectiveness work indicates that community household contact management with TPT is likely good value for money in African settings, though long-term sustainability and health-system resource needs should be specified (Mafirakureva et al., 2023).

C. Health education and awareness

Comprehensive family-centred education increases participation in early detection and supports adherence behaviours (Putra et al., 2021). Conceptual and programmatic work emphasises the role of community organisations in tailoring messages, reducing stigma, and bridging to services (Freudenberg, 1995; Sinha et al., 2020). In design studies, stakeholders prioritise consent, confidentiality, and peer-support elements to sustain engagement in social-network ACF (Kerkhoff et al., 2025).

D. Community DOTS and treatment adherence

A meta-analysis shows community-based DOT improves treatment outcomes versus facility-based or self-administered therapy, though intervention variability and limited data on relapse/LTBI persist (Zhang et al., 2016). Ethiopian programmatic data demonstrate that community health extension workers can double case notifications and improve treatment success when supported by a package of training, supervision, and logistics (Yassin et al., 2013). Urban household ACF linked to HIV testing facilitated entry into care but also revealed diagnostic and laboratory constraints that can undermine programme accuracy (Shapiro et al., 2012).

E. Multi-sectoral and social support

Evidence points to the importance of addressing social determinants poverty, food insecurity, transport costs to enhance uptake and completion of prevention and treatment among contacts (Wingfield et al., 2016; Dowdy et al., 2014). Care Group approaches and volunteer networks can extend reach but require attention to migration, supply chains, and information systems (Brown et al., 2017). Neighbourhood-level targeting and local risk profiling enable more precise allocation of scarce resources (Cegielski et al., 2013; Moonan et al., 2020; Saunders et al., 2020). Longitudinal cohorts quantify sustained excess risk among household members, reinforcing the need for durable, socially responsive support (Radhakrishna et al., 2007; Becerra et al., 2005).

3.4 Summary of evidence

Overall direction of effect. Across 32 studies, integrated community-based strategies combining household contact investigation, decentralised diagnostics, tailored education, TPT, adherence support, and social protection consistently improved proximal outcomes (case detection, TPT initiation) and distal outcomes (treatment success), with modelling suggesting population-level benefits across heterogeneous settings (Shapiro et al., 2012; Yassin et al., 2013; Burke et al., 2021; Zelner et al., 2018; Havumaki et al., 2021; Mafirakureva et al., 2023). Evidence quality varies: randomised and cluster-randomised trials are few; many programmatic evaluations are uncontrolled; modelling studies add mechanistic credibility but require context-specific validation.

Equity and subgroups. Adolescents and older children remain underserved in TPT programmes (Casenghi et al., 2024). MDR-exposed contacts show high willingness for preventive therapy, but adherence support is critical (Suryavanshi et al., 2020). Stakeholder work indicates that privacy, stigma mitigation, and peer-support are pivotal for participation, especially in non-household social-network strategies (Kerkhoff et al., 2025).

Implementation and systems. Coverage, workforce training, diagnostic quality, and data systems determine real-world impact (Shapiro et al., 2012; Brown et al., 2017). Community health workers are central across the cascade but need clearly defined roles, supervision, and integration with primary care (Sinha et al., 2020). Cost-effectiveness is favourable in trial-linked models; budget impact and sustainability analyses are still sparse (Mafirakureva et al., 2023).

External transmission and complementarity. While households are high-risk nodes, substantial transmission occurs in community settings, requiring complementary neighbour- or venue-based approaches and local catalyst targeting (McCreesh & White, 2018; Moonan et al., 2020; Cegielski et al., 2013; Dowdy et al., 2014).

Integrated community-based strategies are effective for preventing transmission among household contacts when implemented as cohesive packages that join detection, prevention, adherence, and social support. Effect sizes and scalability depend on health-system readiness, CHW capacity, and the ability to extend beyond the household to where transmission also occurs. Further high-quality pragmatic trials, sustained budget impact analyses, and equity-focused implementation research will strengthen the evidence base and guide scale-up.

4. Discussion

This review highlights that integrated community-based interventions substantially improve early detection, uptake of tuberculosis preventive therapy (TPT), and treatment adherence among household contacts. Evidence from Ethiopia and South Africa showed that community health worker–led active case finding doubled case notifications and identified large numbers of undiagnosed TB and HIV cases (Yassin et al., 2013; Shapiro et al., 2012). Similar findings were echoed in Pakistan, where radius-based household screening using Xpert technology increased detection compared to passive approaches (Fatima et al., 2016). These results confirm earlier systematic evidence that active case-finding interventions are effective but often inconsistently implemented (Burke et al., 2021).

The effectiveness of preventive therapy is also supported by programmatic and modelling studies. Analyses from India and Peru demonstrated that isoniazid and BCG reduced incidence among contacts, reinforcing WHO recommendations for preventive treatment (Paradkar et al., 2020; Zelner et al., 2014). Yet, cascade losses remain a challenge, as shown by Vikela Ekhaya in South Africa and patient-delivered tracing trials in Malawi (Kay et al., 2021; Kaswaswa et al., 2022). Willingness to initiate MDR-TPT is high, but completion is inconsistent, pointing to the need for stronger adherence support (Suryavanshi et al., 2020).

Community-based DOTS consistently improved treatment outcomes compared to facility-based models (Zhang et al., 2016), while comprehensive education increased household participation in screening (Putra et al., 2021). Social and structural support, including nutrition and financial protection, further enhanced uptake and outcomes (Wingfield et al., 2016). Together, these findings align with the WHO End TB Strategy, which calls for patient-centred, community-driven, and multisectoral responses (WHO, 2020).

5. Limitations

This review has certain limitations. Only English-language studies indexed in Scopus were included, which may have excluded relevant evidence published in other languages or databases. Publication bias is possible, as studies with positive outcomes are more likely to be reported. Considerable heterogeneity existed in interventions, study designs, and outcome measures, which limited direct comparison and synthesis. These factors may have influenced the overall interpretation, though efforts were made to provide a balanced, critical appraisal of the available evidence.

6. Conclusion

This review demonstrates that integrated community-based strategies are effective in reducing tuberculosis transmission among household contacts by strengthening early detection, ensuring access to preventive therapy, improving adherence, and addressing social determinants of health. The evidence highlights that interventions are most impactful when delivered as cohesive, multi-sectoral packages that combine biomedical and social support measures. Locally adapted approaches, anchored in community participation and responsive to health system capacity, are essential for sustained impact. While modelling and programmatic studies provide encouraging insights, the scarcity of rigorous randomised controlled trials, particularly in low- and middle-income countries, limits the certainty of long-term effectiveness and scalability. Future research should therefore prioritise pragmatic RCTs, comprehensive cost and sustainability analyses, and strategies that extend beyond households to capture broader community transmission. Scaling up integrated, community-centred interventions within the framework of the WHO End TB Strategy offers a clear path toward reducing household transmission and advancing global TB control.

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