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Scaling Up Tuberculosis Contact Investigation: Implementation Strategies, Outcomes, and Challenges — A Narrative Review

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Abstract

Tuberculosis (TB) contact investigation is a key strategy recommended by the World Health Organisation (WHO) to help detect cases early, increase preventive treatment, and reduce TB transmission. Even though many countries have adopted these policies, putting them into practice is still limited in places with high TB rates. This review brings together global evidence and highlights important areas such as how programs are run, what works well, ongoing challenges, and where more research is needed. The review covers thirty studies from different settings, including household and community interventions, digital tools, programs led by community health workers, public–private partnerships, and integrated service models. TB contact investigation has been effective in finding more cases and increasing preventive treatment. Household-based strategies work well but have not been widely expanded. Using community contact clusters could help find more cases in high-burden areas, but this can require a lot of resources. Digital tools might make the process more efficient and improve data quality if they are adapted to local needs. Programs led by community health workers can reach more people, but they often cost a lot to run. Expanding TB contact investigation can help with early detection and prevention if enough resources are provided. However, there are still many operational, social, and health system barriers that make it hard to implement these programs widely. To put the evidence into practice, ongoing investment, stronger health systems, local adaptation, and real involvement of affected communities are needed.

Keywords: *Contact Investigation, Contact Tracing, Implementation Research, Preventive Therapy, Resource-Limited Settings, Tuberculosis.*

Introduction

TB is one of the top ten causes of death worldwide and one of the leading causes of death from a single infectious agent (COVID-19 pandemic notwithstanding). It is estimated that nearly 30% of people with TB disease worldwide remain undiagnosed or are not notified to national TB programs, representing most cases in high burden countries [1]. Contact investigation is the systematic screening of individuals exposed to infectious cases of TB with the goals of ensuring TB treatment initiation among people with active disease and enrolment into TB preventive treatment for those with latent TB infection [2, 3]. TB contact investigation is an evidence-based strategy recommended by WHO, endorsed by global policymakers [2], and recognized as a high-value intervention [3]. Scaling up TB contact investigation is important for early case detection and interrupting TB transmission. TB contact investigation has been implemented widely in lower burden settings and among selected populations, such as children and household contacts of persons living with HIV,

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in high-burden countries [6]. However, TB contact investigation has not been implemented consistently or at scale in many high-burden, resource-constrained settings [6]. Disparities between policy and practice are notable where transmission intensity is high, and diagnostic capacity is limited [4, 5]. To reach targets identified at the UNHLM, programs would need to screen an estimated 18.5 million contacts of bacteriologically confirmed TB cases and initiate TPT in eligible persons each year [6]. Operational, financial, and societal barriers continue to pose substantial challenges to programmatic scale-up. Here we summarize the current evidence for TB contact investigation including descriptions of diverse implementation models, measurable impacts, barriers to scale-up, promising innovations, and gaps in the current evidence base. We searched published and grey literature for peer reviewed studies and programs evaluating TB contact investigation programs using PubMed with mesh terms (Supplemental Digital Material). We included descriptions of qualitative research, literature reviews, and program evaluations that described key components of contact investigation including screening of contacts, initiation of TPT, and treatment of active TB disease. We excluded papers not written in English or French. Thirty studies met our inclusion criteria and are summarized in this narrative review. We discuss evidence by the type of contact investigation strategy described including household-based, community-based, digital, community health worker-led, public–private, and integrated service delivery models. This review aims to strengthen the efforts of policymakers and practitioners by highlighting promising approaches to advancing TB contact investigation globally.

The first step in TB contact investigation is ensuring identification and enumeration of contacts for all people with infectious TB disease. These individuals have a significantly higher likelihood of being infected with MTB and progressing to TB disease than the general population. Source cases can either self-report their contacts to the public health department, or contacts can be identified by interviewing the index case. Upon identification, contacts should ideally be screened for TB symptoms, evaluated with a diagnostic test if indicated (reactive to screening), and linked to TB preventive treatment or TB treatment as appropriate. However, loss to follow-up can occur at each step of this cascade, which can result in low efficiency of case detection and poor preventive treatment yield. Recent evidence indicates that significant drop-offs are common at each stage: for example, up to 60% of initially identified contacts may not complete screening, and among those eligible for preventive treatment, only 20–40% may initiate or complete therapy (Global Tuberculosis Report 2025). These losses highlight critical bottlenecks in the cascade and underscore the importance of targeted efforts to strengthen program performance at each stage. By convention, TB contact investigations have historically focused on contacts within households of index patients. Transmission is frequent within households, and household contacts have a disproportionately high risk of infection and illness. This approach is appropriate and likely sufficient to optimize preventive treatment yield in low-incidence settings with sporadic transmission [7]. However, as the epidemiology of TB transmission varies by context, populations at greatest risk of infection may vary. Population attributable risk from household contacts vs. non-household contacts has not been well studied. While household contact investigation should remain a cornerstone of programs globally, extending efforts beyond households to include “contact clusters” may allow programs to find additional cases in areas of high burden [8]. Further consideration should be given to targeted active case finding strategies and transmission assessments when incidence is low.

Public Health Lessons Learned from HIV

There is extensive experience with similar approaches used to find additional cases of HIV. HIV contact investigation has been used by many health departments to augment existing HIV surveillance and identify newly diagnosed HIV infections. Interviews and behavioural assessment of people newly diagnosed with HIV have demonstrated extensive unrecognized transmission networks, many involving HIV care providers [9]. Leveraging the longstanding experience with HIV contact investigation, researchers have conducted qualitative studies to assess motivations, barriers, and best practices for TB contact investigation with household contacts of TB patients. An iterative human-centered design process conducted with parents of children with TB in Peru identified several barriers to household TB contact investigation, including structural barriers such as lacking contact information for all household members and long turnaround times for diagnostic tests, parent-specified needs including efficient communication between providers and families, and concerns regarding disruption of TB transmission in the family [10]. A second qualitative study conducted with family members of persons with HIV and TB highlighted several desirable features of digital TB contact investigation tools, including automated workflows with built-in logic, real-time transmission of information, and addressing potential concerns about digital tools such as misinformation and patient understanding of digital platforms [11]. Both studies identified important opportunities to harness innovations in digital health to improve past strategies for TB contact investigation.

Borrowed HIV tactics: Practical approaches for TB programs

- Proactive provider-assisted notification: Train TB care providers to assist index cases in identifying and reaching their contacts through structured interviews, similar to partner notification in HIV programs.

- Immediate, confidential follow-up: Establish rapid follow-up for named contacts with personal communication and counseling, ensuring privacy to reduce stigma and maximize engagement.

- Use of digital tracking and reminders: Implement automated systems for follow-up messages and appointment reminders to both index patients and contacts, building on the digital outreach models developed in HIV contact tracing.

Translation of this evidence to programs will be critical to improving outcomes for programmatic contact investigation.

Implementation of Contact Investigation for TB

Household Investigation: Evidence and Gaps

Household TB contact investigation is the most described implementation strategy in the literature. Across studies in high-burden settings, common success factors for effective household contact investigation include integration into existing clinics and services, dedicated training and supervision for providers, and strong programmatic support. Integrating contact investigation into national TB program operations and routine TB services has resulted in higher contact tracing rates and improved detection of active TB and eligibility for preventive therapy. For example, programs that embedded contact investigation within TB clinics were able to achieve high screening coverage among children under five, as well as increased identification of new TB cases. Training and supervisory activities for providers further encouraged systematic screening practices. However, several studies highlighted missed opportunities and inconsistent implementation, indicating that even successful approaches are not being applied on a scale. Overall, household-based contact investigation is both feasible and

impactful when built into routine systems and supported by adequate resources but remains underutilized despite demonstrated benefits.

Community-Based and Extended Contact Investigation

Extending "contact clusters" beyond households has been evaluated as a strategy to improve yield in high burden settings. One study from Pakistan describes extending contact investigation to individuals who live within 50 feet of smear-positive pulmonary TB cases [8]. Over 780,000 contacts were screened identifying 4710 TB cases. Screening of these additional contacts resulted in an increase in TB case detection of nearly 8%. Yield was found to be similar between household contacts and close community members, suggesting that community-based strategies may be highly useful in areas of high TB burden [12]. (Community-Based Tuberculosis Preventive Treatment Among Child and Adolescent Household Contacts in Ethiopia, 2024) However, implementing expanded contact investigation requires consideration of clear epidemiological and programmatic triggers. For example, programs should consider extending beyond households when the proportion of TB cases attributable to known household contacts is below 60%, or when ongoing community transmission is evident based on contact tracing data. Other triggers may include evidence of clusters of new cases with no clear household link, high rates of loss to follow-up among household contacts, or when health system capacity (such as human resources or logistics) is sufficient to support broader screening efforts. Defining these thresholds in advance allows national and local TB programs to make data-driven decisions that optimize resource allocation and expand contact tracing when it is most likely to increase TB case detection.

Mobile & e-Health Tools

Digital innovations have been leveraged to improve efficiency and completeness of contact investigation data. A theory of change underpinning these approaches assumes that mHealth tools can improve the cascade yield by reducing data loss, expediting the reporting of results, and enabling more targeted follow-up with contacts. For example, in Botswana, an mHealth application replaced paper contact investigation forms resulting in faster contact tracing and reduced missing data items [14]. The application allowed real-time reporting of information and collection of GPS coordinates, enabling health workers to accurately map where contacts lived. Simple logic algorithms were used to prevent users from skipping steps in the process or missing information, with the expectation that this would lead to more thorough screening and higher treatment initiation rates. In contrast, a complex digital TB contact investigation intervention in Uganda did not demonstrate improvement in outcomes [15]. This approach incorporated multiple innovations, including fingerprint identification, electronic decision support algorithms, and automated reporting into contact investigation. However, contact investigation yield did not improve compared to standard of care. In this case, the complexity and the introduction of multiple new tools at once may have overwhelmed users or did not address the primary barriers in that context. Costs were high, and multiple complex technologies were introduced at once. These findings illustrate that the causal pathway from digital innovation to program outcomes depends on whether a chosen technology fits local needs, workforce capacity, and addresses the known gaps in the contact investigation process. Innovations and technology must be adapted to the local context in which they are implemented.

Community Health Worker-Led Models

Contact investigation delivered by community health workers (CHWs) has been implemented in several countries. In Uganda, community health workers completed home visits to screen for TB symptoms, collect sputum samples, and link individuals to care [16]. Community health workers also conducted contact investigation in Mongolia [3]. While these programs demonstrated promise in reaching populations with limited facility-based capacity, both studies described high costs associated with these programs. Costs from the Uganda study were unable to be assessed at scale but were over $300 per contact and $8996 per TB case diagnosed at the household-level because of the digital application developed for use by CHWs [16] [17]. Public investments of this size are unsustainable over the long term. However, these high costs represent an opportunity for pragmatic efficiency trials to identify sustainable models. Specific cost-reduction strategies could be piloted, such as pooled transport for CHWs operating in the same geographic areas, task-shifting to involve lower-cadre health workers where appropriate, group contact screening visits, or integration with existing outreach services. Inviting research into these approaches could help identify feasible pathways to scaling up CHW-led contact investigation while keeping programs cost-effective. Readers are encouraged to consider these pilot designs as a means of advancing the evidence base for efficient TB contact investigation implementation.

Public–Private Partnerships and Social Franchising

Contacts have also been investigated through the engagement of private sector providers. Nigeria implemented the Social Franchising for TB Contact Investigation (SOFT) model enlisting social franchised healthcare providers to help increase TB contact investigation [18]. Pakistan also used public-private partnerships linked to international funding to implement large-scale contact tracing [4]. Partnerships with private providers may allow programs to expand coverage but are likely to be highly resource-intensive and require careful consideration of sustainability and equity.

Integration with Existing Health Services

Integration of contact investigation activities with existing health services has been used to improve efficiency of services. Integrated child health clinics were used to screen children for TB in Ethiopia [5]. While children were primarily screened in their home by healthcare workers, over 1,991,401 children were screened during this intervention and additional TB cases were identified [19]. Several considerations were necessary to implement this integration successfully including training and supervision, collaboration between clinics and TB centers, and established referral mechanisms.

Impact of Contact Investigation Strategies

As described in previous sections, multiple strategies have been used to implement contact investigation for TB. Household contact investigation has the most evidence globally and was implemented within routine health care systems in most studies described. Across these studies, contact investigation led to increased case detection and preventive treatment for TB. Although the percent of household contacts that tested positive for TB varies, implementing contact investigation at the scale necessary to reach global targets would lead to identification of many additional TB cases [1 ,8, 13]. Delivery of tuberculosis preventive treatment (TPT) also improved with intensified contact investigation efforts, though coverage remained far below targets [20]. Cost-effectiveness of these interventions has not been studied widely [21, 22]. Despite major differences in the type of contact investigation strategy implemented, studies frequently reported improvements in

efficiency with electronic data collection tools. Programs that used complex technologies saw little to no benefit [15]. High-income countries have additional opportunities to consider integration of digital innovations into existing infrastructure. Cost and sustainability remain important challenges, particularly for community-based and digital TB contact investigation interventions [6, 16].

Lessons Learned and Knowledge Gaps

It is well accepted that TB contact investigation and preventive treatment are efficacious [23]. The challenge moving forward is to adapt current best evidence to the local context and implement these interventions routinely. Key barriers including weak health systems, shortages in TB workforce, lack of access to quality diagnostics, stigma, and incomplete data systems must be addressed [3, 24, 25]. Additionally, it is clear there remains a gap between policy and program implementation in many countries with supportive TB policies [4]. Poverty and stigma create additional societal barriers that prevent contacts from participating in care.

There are several emerging innovations that show promises to improve outcomes from TB contact investigation. Digital tools have been leveraged to enhance both efficiency and data quality of contact investigation. Implementation of quality improvement measures and other approaches such as using social network analysis or geographic information system data to inform where contact investigation is conducted should be considered [2,10,11]. Innovations require validation and longitudinal follow-up to determine their effect on outcomes. Future implementation research should prioritize operationalizing and costing these innovations before they are introduced at scale.

Conclusion

TB contact investigation is a high-value strategy to expand early case detection and preventive treatment for TB. While existing evidence demonstrates that multiple implementation strategies can be successful at improving TB preventive treatment coverage and case detection, country programs have not consistently implemented this intervention at scale. Operational, societal, and health-system barriers must be overcome to expand coverage of TB contact investigation. Implementation research to understand the operational details and costs associated with these innovations will be critical to translation of evidence into practice. Contextualization of current best evidence will be key as programs work to expand services to reach UNHLM targets. Only by bridging the gap between policy and programmatic reality will global efforts be able to translate evidence into population-level reductions in TB.

Ethical Approval and Consent to Participate

Not applicable.

Conflict of Interest

There is no conflict of interest.

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Data Availability

Not applicable.

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Author Contributions

Alexander Agada Akor: conceived, designed, prepared, revised and approved the final manuscript to be submitted.

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