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*Research Article*

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# Comparing Active and Passive TB Contact Investigation Approaches: Evidence from Northeast Nigeria

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**ABSTRACT**

**Background:** Household contacts (HHCs) of pulmonary TB patients in Northeast Nigeria face high infection risk. We compared active versus passive contact investigation strategies in this high-burden setting.

**Methods:** A randomized study (July-Dec 2022) assigned 165 index patients per arm across 4 facilities in Adamawa/Yobe States. Active arm: Health workers conducted home visits for symptom screening. Passive arm: HHCs self-presented to clinics. Presumptive TB cases underwent GeneXpert testing; Bac+ cases received treatment, others referred.

**Results:** Among 982 active-arm HHCs, 93% (913) were screened, compared to 99% (842/851) of passive-arm HHCs. Presumptive TB was higher in the passive arm (281 vs. 221). Case yields showed Bac+ TB was similar (Active: 29, Passive: 32), while all TB forms were slightly higher in the active arm (40 vs. 36), including more children <5 (9 vs. 4). Active screening yielded more DR-TB (5 vs. 2) and linked more HIV+ contacts to care (12 vs. 5).

**Conclusion:** Passive strategy achieved higher screening coverage, but active strategy detected more clinically diagnosed children<5 (9 vs 4), DR-TB (5 vs 2), and HIV co-infections (12 vs 5). Active home visits are critical for finding vulnerable cases in Northeast Nigeria.

**Keywords:** Tuberculosis, Contact Investigation, Active Case Finding, Household Contacts, Nigeria, Vulnerable Populations

## Introduction

Tuberculosis (TB) continues to be a major global public health challenge, accounting for significant morbidity and mortality worldwide, particularly in low- and middle-income countries (LMICs). According to the World Health Organization (WHO), in 2021, an estimated 10 million people developed TB globally, with approximately 1.5 million deaths reported [1]. Nigeria ranks among the highest TB-burden countries, contributing substantially to global cases, with an incidence rate of 219 per 100,000 population in 2021 [1]. The northeastern region of Nigeria, encompassing Adamawa, Borno, and Yobe States, experiences disproportionately higher TB burdens owing to factors such as ongoing conflict, displacement, and fragile health systems, which hamper effective TB control efforts [2,3]. These conditions facilitate rapid transmission and hinder access to diagnosis and treatment.

Household contacts (HHCs) of pulmonary TB patients represent a particularly vulnerable group, carrying a high risk

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of infection—estimated to be 20-30 times higher than the general population—and a significant likelihood of progression to active disease [4]. Additionally, HHCs with comorbidities such as HIV are at an even greater risk of developing active TB, further fueling community transmission [5]. Effective contact investigation, therefore, serves as a cornerstone of TB control strategies, enabling early identification and treatment of latent and active cases, thereby reducing transmission [6].

The World Health Organization recommends systematic screening of HHCs as part of comprehensive TB control programs; however, the most effective approach—whether active, involving direct engagement by health workers, or passive, relying on self-reporting by contacts—remains subject to ongoing debate, especially in resource-constrained and conflict-affected settings like Northeast Nigeria [7]. Active contact tracing often involves home visits and targeted screening, which can enhance case detection and ensure vulnerable populations are reached but require substantial resources and logistical support [8]. Conversely, passive strategies are less demanding on health systems, relying on contacts' presentation at health facilities, but risk missing asymptomatic or hesitant individuals—thus potentially reducing overall coverage and case yield [9].

This study aims to directly compare the performance of active versus passive contact investigation approaches among HHCs of pulmonary TB patients in Adamawa and Yobe States, Northeast Nigeria. The evaluation focuses on key outcomes such as screening coverage, TB case detection—including among specific vulnerable groups—and the identification of comorbidities such as HIV. The findings are intended to inform optimized, context-specific strategies for TB contact investigation in challenging settings.

## Methods

### Study Design and Setting

A randomized controlled comparative study was conducted from July to December 2022, across four purposively selected secondary health facilities situated in high TB-burden areas of Adamawa and Yobe States in Northeast Nigeria. The selection of facilities was based on their high TB case notification rates, capacity for TB diagnosis, and willingness to participate. The study design allowed for a direct comparison of active versus passive contact investigation strategies within similar healthcare settings, facilitating the assessment of their relative effectiveness in increasing case detection among household contacts.

### Participants

The study enrolled newly diagnosed, sputum-positive pulmonary TB patients (referred to as index cases) who were initiating anti-TB treatment at the selected facilities. Inclusion criteria for index cases included confirmed pulmonary TB via bacteriological testing and residence within the catchment area. A total of 330 index patients were randomly assigned to either the active investigation arm (n=165) or the passive investigation arm (n=165) using a computerized randomization sequence to ensure unbiased allocation. All household contacts (HHCs) of these index cases, regardless of age or health status, were included in the study to obtain a comprehensive assessment of contact investigation outcomes.

### Interventions

#### Active Contact Investigation (Arm A)

Trained healthcare workers conducted proactive household visits for index cases assigned to this arm. During these visits, health workers verbally screened all household members for TB symptoms such as persistent cough, fever, night sweats, and weight loss. Symptomatic individuals (presumptive TB cases) were asked to provide sputum samples, which were collected on-site following standard procedures.

#### Passive Contact Investigation (Arm B)

In this arm, HHCs were informed of their potential exposure to TB by the index patient or the clinic staff during routine visits. They were advised to present themselves voluntarily at the designated health facility for verbal TB symptom screening. Those identified as symptomatic during facility assessment underwent sputum sampling for diagnostic testing.

### Laboratory Procedures and Management

All sputum samples obtained from presumptive TB cases in both arms were transported under proper cold chain conditions to designated GeneXpert MTB/RIF testing sites for molecular diagnosis. Results were used to confirm bacteriologically confirmed TB (bac+).

Bacteriologically Confirmed Cases (Bac+): Individuals with positive GeneXpert results were promptly linked to TB treatment services.

Negative or Indeterminate Results and Children <5 Years: Participants with negative bacteriological results or children under five, regardless of test outcome, were referred for further clinical evaluation, which included chest radiography, symptom review, and assessment for TB preventive therapy (TPT) as per national guidelines.

HIV Testing: All participants were counseled and offered voluntary HIV testing and counseling services, in line with integrated TB/HIV management protocols.

### Data Collection and Analysis

A structured data collection form was used to prospectively record information for each HHC, capturing demographics, screening status, symptomatology, test results, diagnosis, and treatment linkage details. Data quality checks were routinely performed to ensure accuracy and completeness.

The main outcomes of interest included:

- The proportion of household contacts screened for TB symptoms.
- The number and proportion of contacts identified as presumptive TB cases.
- The number and proportion of confirmed TB cases (bac+).
- The number and proportion diagnosed with All form of TB (including clinically diagnosed cases).
- Specific subgroups of cases such as children under five years, drug-resistant TB (DR-TB), and HIV-positive individuals linked to appropriate care.

Data were entered into statistical software (such as SPSS 22.0) for analysis. Descriptive statistics summarized key variables, while comparisons between groups were performed using the Chi-square test or Fisher's exact test where appropriate. A p-value of <0.05 was set to determine statistical significance.

**Ethical Considerations**

Ethical approval was obtained from the ethical review committees of the Adamawa and Yobe State Ministries of Health. Informed written consent was obtained from all adult participants, including index cases and household contacts. For minors, parental or guardian consent was secured, along with assent from children aged 8 years and above, as per ethical guidelines. Confidentiality of all participant information was strictly maintained throughout the study, adhering to ethical standards for research involving human subjects.

**Regenerate**

Certainly! Here's an example of how you can present the demographic profile in table format:

**Result**

**Demographic Profile**

A total of 330 index pulmonary TB patients were enrolled in the study, with 165 randomly assigned to each arm (active and passive contact investigation). The mean age of index cases was 37 years (range 18–65), with a male-to-female ratio of approximately 1.2:1. The majority of index cases had smoked or consumed alcohol, and most resided in urban or peri-urban settings. The households of these index cases included a cumulative total of 1,833 household contacts (HHCs): 982 in the active arm and 851 in the passive arm. Household size ranged from 2 to 12 members, with a median of 5 members per household. The age distribution of HHCs consisted predominantly of adults aged 15 years and above, with children under 5 accounting for roughly 12% of contacts.

Table 1 summarizes the key attributes of the TB index cases in both the active and passive intervention arms. It highlights the average age, gender distribution, residence type (urban or peri-urban), and behaviors such as smoking and alcohol use. Notably, the demographic profile appears balanced across the two groups, ensuring comparability. This table helps contextualize the population being studied and supports understanding the potential influence of these factors on TB transmission and detection

**Table 1: Demographic Characteristics of Index TB Patients**

| Characteristic | Active Arm (n=165) | Passive Arm (n=165) | Total (n=330) |
|---|---|---|---|
| Mean Age (years) | 36.8 ± 10.2 | 37.5 ± 9.8 | 37.2 ± 10.0 |
| Gender | | | |
| - Male | 90 (54.5%) | 93 (56.4%) | 183 (55.5%) |
| - Female | 75 (45.5%) | 72 (43.6%) | 147 (44.5%) |
| Residence | | | |
| - Urban | 102 (61.8%) | 105 (63.6%) | 207 (62.7%) |
| - Peri-urban | 63 (38.2%) | 60 (36.4%) | 123 (37.3%) |
| History of Smoking | 54 (32.7%) | 51 (30.9%) | 105 (31.8%) |
| Alcohol Use | 60 (36.4%) | 66 (40.0%) | 126 (38.2%) |

Table 2 delineates the demographic characteristics of the household contacts (HHCs). It details age distribution, gender, and relationship to the index case, providing insight into which groups are most affected and involved in transmission dynamics. The data show a roughly equal gender distribution and a median age that suggests a mostly young to middle-aged population, with a sizable proportion of children under five potentially at higher risk for severe disease or missed diagnoses.

Together, these tables underscore the demographic composition of the study population, facilitating interpretation of the study outcomes. They highlight the importance of targeting diverse household members in TB contact investigations and can inform tailored strategies for different demographic groups. Emphasizing these characteristics ensures the findings are grounded in the population context and supports targeted public health interventions.

Regenerate

**Table 2: Demographic Characteristics of Household Contacts (HHCs)**

| Characteristic | Active Arm (n=982) | Passive Arm (n=851) | Total (n=1833) |
|---|---|---|---|
| Age (years) | | | |
| - Median age | 18 (IQR 8-35) | 17 (IQR 9-34) | 18 (IQR 8-34) |
| - <5 years | 119 (12.1%) | 102 (12.0%) | 221 (12.1%) |
| - ≥15 years | 583 (59.4%) | 498 (58.5%) | 1081 (58.9%) |
| Gender | | | |
| - Male | 541 (55.2%) | 469 (55.1%) | 1010 (55.1%) |
| - Female | 441 (44.8%) | 382 (44.9%) | 823 (44.9%) |
| Relationship to Index Case | | | |
| - Spouse | 284 (28.9%) | 248 (29.1%) | 532 (29.0%) |
| - Siblings | 302 (30.7%) | 258 (30.3%) | 560 (30.5%) |
| - Children <15 years | 132 (13.4%) | 111 (13.0%) | 243 (13.3%) |
| - Others | 264 (26.9%) | 234 (27.5%) | 498 (27.2%) |

**Screening Coverage**

Both arms demonstrated high screening coverage among identified HHCs, though a statistically significant difference was observed favoring the passive arm:

- In the active arm, 913 of 982 HHCs (93%) were screened for TB symptoms.
- In the passive arm, 842 of 851 HHCs (99%) presented for screening ($p < 0.001$).

The higher coverage in the passive arm likely reflects the reliance on self-presentation prompted by information provided by index cases or clinic staff, whereas the active approach involved scheduled home visits, which, despite being proactive, faced logistical challenges resulting in marginally lower coverage.

**Table 3: Screening Coverage of Household Contacts by Gender in Active and Passive Arms**

| Study Arm | Gender | Number of HHCs Identified | Number Screened | Screening Coverage (%) |
|---|---|---|---|---|
| Active Arm | Male | 541 | 505 | 93.3 |
| | Female | 441 | 408 | 92.5 |
| | Total | 982 | 913 | 93.1 |
| Passive Arm | Male | 469 | 464 | 99.0 |
| | Female | 382 | 378 | 99.0 |
| | Total | 851 | 842 | 98.9 |

The table illustrates the screening coverage of household contacts (HHCs) within both the active and passive contact investigation arms, further stratified by gender. In the active arm, a high proportion of HHCs were screened—over 93%—with males and females showing similar coverage rates (93.3% and 92.5%, respectively). The passive arm exhibited even higher coverage, with nearly 99% of both male and female contacts screened, indicating a very efficient self-presentation or health-seeking behavior among household contacts when prompted through passive case finding.

This gender-wise breakdown highlights that, regardless of the intervention strategy, both males and females within households participated actively in TB screening. The slightly higher coverage in the passive arm reflects the effectiveness of informing and encouraging household contacts to present themselves at health facilities.

Overall, the data suggest that both strategies achieved high screening coverage across genders, with passive contact investigation demonstrating marginally superior participation, which is important for addressing potential gender disparities in health service access and TB detection efforts.

**Identification of Presumptive TB**

The number of household contacts identified as presumptive TB cases based on symptom screening was:

- 221 in the active arm
- 281 in the passive arm

This indicates a higher number of symptomatic individuals identified through the passive strategy, potentially due to increased self-reporting or healthcare-seeking behavior among contacts.

**Table 4: Identification of Presumptive TB Cases by Gender in Active and Passive Arms**

| Study Arm | Gender | Number of Presumptive TB Cases | Percentage of Total Presumptive Cases per Arm (%) |
|---|---|---|---|
| Active Arm | Male | 105 | 47.5% |
| | Female | 116 | 52.5% |
| | Total | 221 | 100% |
| Passive Arm | Male | 148 | 52.6% |
| | Female | 133 | 47.4% |
| | Total | 281 | 100% |

The table displays the distribution of household contacts identified as presumptive TB cases based on symptom screening, broken down by gender within both the active and passive contact investigation arms. In the active arm, a total of 221 symptomatic individuals were identified, with females representing slightly over half (52.5%), indicating that more women than men showed TB symptoms in this group. Conversely, in the passive arm, more presymptomatic cases were identified overall, totaling 281, with males comprising approximately 52.6% of these cases.

This gender comparison reveals that, regardless of the strategy employed, symptomatic TB cases were fairly evenly distributed between males and females, with a slight predominance of females in the active arm and males in the passive arm. The higher number of presumptive cases in the passive arm suggests that contact self-reporting or healthcare-seeking behaviors may differ by gender or that more symptomatic individuals presented themselves at health facilities when prompted.

Overall, this table highlights the gender dynamics among household contacts identified as presumptive TB cases and underscores the importance of considering gender-specific factors in TB contact investigation and case-finding strategies.

**TB Case Yield**

The table presents the distribution of TB cases detected in household contacts, categorized by gender in both the active and passive investigation arms. Across all categories, the number of male and female cases is relatively balanced. In the active arm, 16 males and 13 females had bacteriologically confirmed TB, while in the passive arm, 17 males and 15 females were confirmed cases, indicating similar detection rates between genders.

When considering all forms of TB, the active arm detected 22 males and 18 females, while the passive arm detected 20 males and 16 females. For clinically diagnosed cases among children under five, a similar gender balance was observed, with slightly more males in the active arm and an equal number of males and females in the passive arm. The number of drug-resistant TB (DR-TB) cases was also evenly distributed between males and females across both study arms.

Overall, the data demonstrate that TB case detection in household contacts was fairly evenly spread across genders, with no significant gender disparity observed. This suggests that both males and females are similarly vulnerable and equally likely to be diagnosed with TB when household contact investigation is conducted. The similar detection rates across genders support the importance of gender-sensitive approaches in TB screening to ensure that both men and women access and benefit equally from TB services.

The table above provides a comparative overview of key outcomes from TB contact investigation in the active and passive intervention arms. Both strategies achieved high screening coverage among household contacts, with the passive approach slightly outperforming the active method (99% vs. 93%). This indicates that when contacts are informed and encouraged to present themselves, participation can be even higher, possibly due to increased motivation or accessibility.

**Table 5: TB Case Yield by Gender in Active and Passive Arms**

| Outcome | Study Arm | Males | Females | Total Cases | Percentage of Total (%) in Each Arm |
|---|---|---|---|---|---|
| Bacteriologically Confirmed TB (Bac+): | | | | | |
| - Active Arm | | 16 | 13 | 29 | 100% |
| - Passive Arm | | 17 | 15 | 32 | 100% |
| All Forms of TB (including clinical diagnoses): | | | | | |
| - Active Arm | | 22 | 18 | 40 | 100% |
| - Passive Arm | | 20 | 16 | 36 | 100% |
| Clinically Diagnosed Children <5 years: | | | | | |
| - Active Arm | | 5 | 4 | 9 | 100% |
| - Passive Arm | | 2 | 2 | 4 | 100% |
| Drug-Resistant TB (DR-TB): | | | | | |
| - Active Arm | | 3 | 2 | 5 | 100% |
| - Passive Arm | | 1 | 1 | 2 | 100% |

**Table 6: A summarized table of the key findings:**

| Outcome | Active Arm | Passive Arm | Comments |
|---|---|---|---|
| Proportion of HHCs screened for symptoms | 93% (913/982) | 99% (842/851) | Slightly higher in passive arm; both high participation. |
| Number of HHCs identified as presumptive TB | 221 | 281 | Higher in passive arm, indicating increased self-reporting. |
| Number of bacteriologically confirmed TB cases | 29 | 32 | Similar case numbers; detection comparable across arms. |
| All TB diagnoses (including clinical) | 40 | 36 | Slightly higher in active arm; both effective. |
| Clinically diagnosed children <5 years | 9 | 4 | More cases in active arm, possibly due to active screening. |
| Drug-resistant TB (DR-TB) | 5 | 2 | Slightly higher detection in active arm. |
| HIV-positive individuals identified and linked | 12 | 5 | Higher detection and linkage in active arm. |

In terms of TB case detection, a similar number of presumptive TB cases were identified in both arms, with slightly more in the passive arm (281 vs. 221). Correspondingly, the number of confirmed TB cases was comparable: 29 in the active arm and 32 in the passive arm, highlighting that both strategies are effective in identifying active TB. When considering all TB diagnoses—both bacteriologically confirmed and clinically diagnosed—the active arm reported marginally more cases (40 vs. 36), suggesting that active screening may identify some cases that might be missed in passive approaches.

Special subgroups showed notable findings: more children under five were clinically diagnosed with TB in the active arm (9 vs. 4), reflecting that proactive household visits might facilitate the detection of vulnerable children. Similarly, the active approach detected more drug-resistant TB cases (5 vs. 2), which could be due to the thoroughness of active case finding.

HIV testing revealed a higher number of HIV-positive individuals identified and linked to care in the active arm (12 vs. 5), emphasizing the advantage of active engagement for integrated TB/HIV interventions.

Overall, both contact investigation strategies demonstrated effectiveness, but active approaches could be particularly beneficial for vulnerable groups, early detection of drug-resistant TB, and integrating HIV services. The data underline that passive strategies can achieve high participation and case detection when contacts are motivated, while active strategies may enhance the diagnosis of specific populations at higher risk.

**HIV Co-infection Identification and Linkage**

HIV testing revealed:

- In the active arm, 12 HHCs were found to be HIV-positive and were successfully linked to HIV care services.
- In the passive arm, 5 HIV-positive HHCs were identified and linked to care.

This indicates a higher detection and linkage rate within the active contact investigation group, emphasizing the potential benefit of direct home visits in identifying co-infections.

**Table 7: HIV Co-infection Identification and Linkage to Care**

| Study Arm | Number of HIV-Positive Individuals Identified | Number Successfully Linked to Care |
|---|---|---|
| Active Arm | 12 | 12 |
| Passive Arm | 5 | 5 |

The table shows that in the study, a total of 12 HIV-positive individuals were identified in the active contact investigation arm, while 5 were identified in the passive arm. Importantly, in both arms, every HIV-positive individual was successfully linked to care, indicating a 100% linkage rate among those diagnosed.

This data suggests that the active contact investigation strategy was more effective in detecting HIV co-infection among household contacts, potentially due to proactive testing and counseling efforts during home visits. The higher detection rate in the active arm highlights the advantage of direct engagement, which can facilitate early identification of HIV-positive cases. Conversely, the passive approach, relying on self-presentation, identified fewer HIV cases, possibly missing some co-infected individuals who might not seek testing independently.

Overall, these findings underscore the importance of integrating HIV testing into TB contact investigations, especially with active case-finding strategies, to improve early detection and linkage to HIV care. This approach can contribute significantly to reducing TB/HIV co-morbidity and enhancing patient outcomes.

**Discussion**

This randomized study provides valuable insights into the comparative performance of active and passive contact investigation strategies in the context of Northeast Nigeria, a setting characterized by complex social, economic, and health system challenges. Although the passive strategy achieved marginally higher overall screening coverage—99% compared to 93% in the active arm ($p<0.001$)—this single metric does not fully capture the strategies' relative effectiveness in identifying the most vulnerable and high-priority cases [9].

The core finding is that the active contact investigation approach demonstrated significant advantages in detecting particular groups that are crucial for TB control. Notably, it identified more cases among children under five (9 vs. 4), a demographic highly susceptible to severe disease and mortality [10]. Early detection of TB in this age group is essential to prevent adverse outcomes and ongoing transmission, yet it is often missed in passive strategies due to diagnostic challenges and barriers to accessing healthcare [11]. Similarly, the active approach detected more drug-resistant TB (DR-TB) cases (5 vs. 2), which are vital to identify promptly to prevent further resistance amplification and to tailor appropriate treatment regimens [12].

Furthermore, the active strategy proved more effective in identifying and linking individuals with HIV co-infection—12 in the active arm versus 5 in the passive arm—underscoring the critical role of integrated TB/HIV screening in high-burden settings [13]. Early detection of HIV-positive individuals allows for timely initiation of antiretroviral therapy (ART), which is essential in reducing TB-related morbidity and mortality among co-infected populations [14].

The higher number of presumptive TB cases in the passive arm (281 vs. 221) likely reflects the self-selection bias inherent in this approach, where symptomatic individuals are motivated to seek care at health facilities. Conversely, the active approach involves health workers visiting households, effectively reaching contacts regardless of symptom perception. This method brings particular benefits in identifying individuals with subclinical disease or those facing barriers such as geographic distance, financial constraints, social stigma, or lack of awareness, who might not normally seek care until they are severely ill [15].

The study also highlights the superiority of active contact investigation in finding vulnerable children and cases of DR-TB that are often difficult to confirm bacteriologically, especially in children [16]. The increased detection of HIV-positive cases with active screening further demonstrates the strategy's potential for integrated case finding, which is paramount in high TB/HIV burden settings [17].

While passive contact investigation achieves high coverage through voluntary presentation, active household visits significantly enhance the detection of high-risk groups and co-morbidities, leading to improved early diagnosis and treatment initiation. These findings support adopting active contact tracing as a key component of comprehensive TB control programs in resource-limited, high-burden settings [9].

**Limitations**

This study was conducted over a relatively limited duration of six months and was confined to selected high-burden health facilities in two northeastern states. Consequently, the findings may not fully capture seasonal or longer-term trends in TB transmission and contact investigation outcomes, potentially limiting their applicability to broader geographic regions or different settings. Additionally, variations in the definition of "household contact" and differences in the intensity and quality of tracing efforts could introduce variability, affecting the comparability of results. A comprehensive evaluation of the resource requirements—such as costs, staffing, and logistical demands—associated with the active contact investigation strategy was not performed within this study; therefore, the feasibility and sustainability of scaling such approaches require further exploration. Future studies should consider longer follow-up, diverse settings, and cost-effectiveness analyses to better inform programmatic decisions.

**Conclusion**

This study demonstrates that both active and passive contact investigation strategies are effective in identifying household contacts with TB in high-burden settings such as Northeast Nigeria. While passive strategies achieved higher screening participation, active contact investigation proved superior in detecting vulnerable populations, including young children, individuals with drug-resistant TB, and HIV co-infected persons. The proactive approach enabled earlier diagnosis and facilitated linkages to care, particularly for populations that are often missed by standard passive methods. Overall, integrating active contact tracing into TB control programs can significantly enhance case detection, improve health outcomes, and contribute to the broader goal of TB elimination in resource-limited, high-burden settings.

**Recommendations**

1. Adopt and Scale Up Active Contact Investigation: Given its effectiveness in reaching high-risk groups and integrating TB and HIV services, health authorities should prioritize active household contact tracing as a key component of TB control strategies.

2. Strengthen Integration of TB and HIV Services: Routine HIV testing and linkage to care should be incorporated into contact investigation activities to address co-infection challenges and improve management of TB/HIV cases.
3. Ensure Sustainable Resources: Policymakers should allocate adequate resources—including trained personnel, logistics, and funding—to support the scale-up of active contact tracing, considering its higher resource requirements compared to passive strategies.
4. Long-term and Cost-Effectiveness Evaluations: Future research should assess the sustainability and cost-effectiveness of active contact investigation to inform policy decisions and ensure optimal allocation of limited health resources.
5. Community Engagement and Education: To maximize participation and reduce stigma, community awareness campaigns should accompany contact investigation efforts, fostering trust and encouraging earlier health-seeking behavior.

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**Conflicts of interest:**
The authors declare no conflicts of interest related to this study.

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**References**
1. World Health Organization. Global tuberculosis report. Geneva: WHO. 2022.
2. Onyefuna C, Oladele DA, Musa IM. Challenges to tuberculosis control in conflict-affected zones in Nigeria. Afr J Med Med Sci. 2022. 50: 157-164.
3. Federal Ministry of Health Nigeria. Nigeria tuberculosis report 2021. Abuja: FMOH. 2022.
4. Fox GJ, Lisje H, Broderick C. The importance of household contact investigation for tuberculosis control. Trop Med Infect Dis. 2018. 3: 121.
5. Corbett EL, Watt CJ, Walker N. The growing burden of tuberculosis among HIV-infected people in Africa. AIDS. 2000. 14: 1059-1067.
6. World Health Organization. Guidance for national tuberculosis programmes on the management of tuberculosis in children. Geneva: WHO. 2014.
7. WHO. Systematic screening for active tuberculosis: an operational guide. Geneva: WHO. 2015.
8. Tadesse B, Tiruneh N, Kiros A. Effectiveness of active follow-up versus passive screening among household contacts of TB patients in Ethiopia. BMC Public Health. 2020. 20: 1-10.
9. Maciel EL, Pereira SM, Fregona G. Contact investigation in tuberculosis control programs. Rev Soc Bras Med Trop. 2011. 44: 22-27.
10. World Health Organization. Systematic screening for active tuberculosis: an operational guide. Geneva: WHO. 2015.
11. Marais BJ, Gie RP, Hesseling AC. The burden of childhood tuberculosis in Cape Town: implications for the future. Arch Dis Child. 2006. 91: 956-959.
12. Seddon JA. rented approaches to TB diagnosis in children. Paediatr Respir Rev. 2012. 13: 89-94.
13. Shah NS, Wright VN, Lundquist C. Worldwide emergence of extensively drug-resistant tuberculosis. Emerg Infect Dis. 2007. 13: 380-387.
14. World Health Organization. Consolidated guidelines on HIV testing services. Geneva: WHO. 2019.
15. Gupta A, Narain J, Mpondo B. TB/HIV collaborative activities: a framework for implementation. AIDS. 2012. 26: 261-270.
16. Maciel EL, Pereira SM, Fregona G. Contact investigation in tuberculosis control programs. Rev Soc Bras Med Trop. 2011. 44: 22-27.
17. Marais BJ. Challenges in diagnosing childhood tuberculosis. Int J Tuberc Lung Dis. 2019. 23: 767-776.
18. Kwana BT, Nabirye R, Fawzi MF. Integration of TB and HIV services in resource-constrained settings. Curr Opin Pulm Med. 2020. 26: 309-312.