# Factors Associated with Health Facility-Based Active Tuberculosis Case Finding Yield in Murang'a County, Kenya

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## Abstract

**BACKGROUND**

An estimated 40% of TB cases in Kenya are undiagnosed and untreated, leading to ongoing transmission in the community. While the introduction of the active case-finding strategy, by the National TB program, has shown improved yield and ensured early detection, health facilities continue to report varying yields. The objective was to assess factors associated with health facility-based active TB case finding yield in Murang'a County.

**METHODOLOGY**

This was a cross-sectional study conducted in 39 health facilities in two sub-counties in Murang'a County. Data was sourced in two folds; Aggregate data on TB screening was abstracted from TIBU, a TB surveillance system and Kenya Health Information Systems (KHIS) for the period between January to March 2022; Checklists were used to obtain data on health facilities. Bivariate and multivariate analyses were done to measure associations using R software.

**RESULTS**

A total of 153,180 clients visited the health facilities with 131,446 (86%) screened for TB and 4865 (4%) identified as presumptive TB cases. Overall, 174 (6%) of 2688 investigated presumptive cases were diagnosed with TB.

Out of the 39 TB diagnostic sites, 8(20%) had a yield rate of 10% or higher. There were statistically significant correlations between higher yield rates and the availability of link assistants (adjusted IRR 6.39 CI: 3.85-11.1, p-value 0.001), Maragua sub-County (adjusted IRR 2.20 CI: 1.52-3.24, p-value 0.001), Level III (adjusted IRR 14.1 CI: 7.92-26.5, p-value 0.001), and level IV facilities (adjusted IRR 15.8 CI 9.01-29.6, p-value 0.001).

**CONCLUSION AND RECOMMENDATIONS**

Having link assistants, the level of the facility and the Sub-County were associated with higher yields in TB case identification. Complementing TB symptom screening at the facility level with clinical evaluation would help improve the identification of true presumptive cases.

*Keywords: Tuberculosis, TB Screening, Diagnosis, Active Case Finding Yield, Kenya*

## Introduction

Tuberculosis (TB) is a disease caused by an infectious agent (Mycobacterium tuberculosis) with a global estimate of 10.6 million people diagnosed in 2021 and 1.6 million deaths recorded(1). Asia and Sub-Saharan African countries account for about 80% of the global TB burden(2). Globally, only 6.4 million (63%) of the 10.6 million people with TB were notified in 2021 which is a 10% increase from 5.8 million people that were diagnosed and reported in 2020(3). Gaps in TB case detection and treatment have contributed to a high burden of undiagnosed TB cases, for

instance in West and Central Africa where regional estimates indicate that more than half of people with TB are unreported or missing(4). According to the WHO TB Progress 2023 report, the African region records the highest variation between the estimated number of TB cases and the number of notified cases (5). East African countries have reported low case detection rates despite adopting the WHO End TB strategy(6,7). Kenya is among the top ten countries that accounted for ≥90% of the global reduction in case notification of people newly diagnosed with TB in 2020 and 2021(1).

The WHO End TB strategy targets the reduction of incidence by 10% per year by 2025(1). To achieve the ambitious target, strategies to identify persons with active TB are very critical. As such, systematic screening (while utilizing the active case finding (ACF) approach) for TB has been adopted globally as a way of ensuring persons with TB symptoms receive prompt investigations and improved yield among people seeking care. The Kenya National Strategic Plan (NSP) for Tuberculosis 2023 prioritizes approaches to improve TB case finding through facility-based screening among other interventions. The document highlights that nationally, only 40% of targeted notifications were reported from the previous strategic plan. The end-term review report indicated that in 2021, the proportion of people tested for presumptive TB was 51% against a target of 80%. The NSP identifies sub-optimal implementation of FB-ACF in facilities as one major gap in TB case finding (8).

Facility-based Active Case Finding (FB-ACF) involves systematically searching for TB in all individuals who present to the health facility irrespective of the reasons for care seeking(9). The symptoms being checked include cough of any duration, unintended weight loss, drenching night sweats, hotness of the body and chest pain(10,11).

According to the Kenya National Prevalence Survey (2015/2016) report, about 40% of all persons infected with TB are not diagnosed and hence are not given timely treatment(12,13). Following these findings, the ACF strategy was piloted in Kenya to reduce barriers to early TB case detection, including delay in presentation to a health facility, identification of a person as a presumptive TB case, and timely diagnosis and subsequent initiation of treatment. This showed significant promise with TB case notifications increasing by more than 10% in both 2017 and 2018, compared to the preceding year (14). This was then rolled out in all counties including Murang'a County. In 2021, Murang'a County notified a total of 1,900 TB cases bringing the County's TB case notification rate (CNR) to 175/100,000(15). This was a slight increase from the previous year where 1846 cases were recorded (CNR, 174/100,000) (16). The sustained gain was attributed to at least 6 (out of 8) sub-counties in the County that had increased case finding compared to the previous year. Gatanga sub-county had the second lowest notification rate of 129/100,000 and Murang'a south sub-county had the second highest CNR of 202/100000 population.

Given the lack of documented evidence on the association between health facility factors and active TB case detection rates in Kenya, this study aimed to assess the factors influencing the yield rates achieved by health facilities during facility-based active case finding. The evidence generated will be used to improve TB screening, active TB case detection rates and notification at the health facility level through the identification of gaps and leakages in the TB diagnosis cascade.

## Materials and Methods
### Study area and setting

This study was conducted in healthcare facilities from 2 sub-counties (Gatanga and Maragua) in Murang'a County, Kenya. The 2 sub-counties have a total of 88 healthcare facilities, 39 of which are TB diagnostic sites. The study covered all 39 TB diagnostic sites, among which 24 were from Gatanga Sub-county and 15 from Maragua Sub-county (Table 1 showing the characteristics of the facilities). Murang'a County is one of the 47 counties in Kenya with 7 sub-counties. In 2021,

the County had an estimated total population of 1,103,095(17).

## Inclusion and exclusion

TB diagnostic Health facilities in Gatanga and Maragua sub-counties were included in the study. Any TB diagnostic site that had not submitted the ACF monthly reports for the period under review was excluded from the study.

## Study design

This was a retrospective cross-sectional study, which utilized retrospective data on ACF and primary data on characteristics of the TB diagnostic sites.

## Operational definitions

- **Linkage service.** Is a service where patients are linked to the next service at every step of care by either community health volunteers (CHVs) peer educators or designated health care workers referred to as link assistants.

- **Yield rate.** This was calculated by dividing the number of TB cases by the number of investigated presumptive cases expressed as a percentage. The yield rate (which is the study outcome variable) was categorized into two, <10% and ≥10%. The facilities with ≥10% were coded as 1 indicating having the desired yield. According to the integrated guideline for tuberculosis, leprosy, and lung disease 2021, at least 10% of patients who are suspected of having tuberculosis should be diagnosed with the disease (Bacteriologically confirmed and clinically diagnosed).

- **TB diagnostic site.** This is a health facility with TB screening, testing and treatment services where such a facility can process a TB diagnostic test either at the site or sample delivery to another facility for processing.

- **TB/ACF focal person.** This is a frontline healthcare provider in a health facility who is spearheading FB-ACF activities in liaison with TB coordinators. The health worker can be either a clinician or a nurse(10).

## Data collection

The research utilized both primary and secondary datasets. First, aggregate data was sourced from TIBU, the national TB surveillance system and from the Kenya Health Information System (KHIS) for the period between January and March 2022. Data sourced from TIBU included the number of clients screened for TB, clients identified as TB presumptive cases, presumed TB cases investigated and confirmed TB case variables while data sourced from KHIS included the number of respiratory system infections. Further, a checklist was administered to TB/ACF focal persons for the 39 TB diagnostic sites through a phone call to collect information on the characteristics and features of the health facilities. The checklist was a simplified version of a Facility Baseline assessment tool for the TB program(18). The data collected using the checklist included information on whether the facility had documented targets for presumed TB cases, use of sample networking services, availability of link assistants, and characters of the health facility such as sub-county, typology and ownership.

## Data management and analyses

Data was imported into R software (version 4.3.1) (19) for cleaning and analysis. Demographic and clinical characteristics were described in terms of tables (with frequencies and percentages) and figures. Further, bivariate and multivariate poison regression analysis was done to measure associations where a two-sided p-value<0.05 was considered significant(19).

## Ethical considerations

The study was approved by the Amref Ethics Review Committee – Ethical certificate number ESRC P1320/2022. Authorization to abstract and use data from the selected sites was sought from the Murang'a County Health Department. To ensure confidentiality, data was stored in password-protected MS Excel worksheets to ensure only authorized access.

## Results

A total of 39 TB diagnostic sites from 2 sub-counties participated in the study for the

period between January – March 2022. Among the TB diagnostic sites, 62% (24) were from Gatanga sub-county and 38% (15) were from Maragua sub-County.

Overall, 69% (27) of TB diagnostic sites were level II hospitals, 21% (8) were level III hospitals, and 10% (4) were level IV hospitals. The majority of the health facilities were government facilities (33, 85%) while Faith-based and Private facilities were (2, 5%) and (4,10%), respectively. From 23% (9) of the health facilities there were documented targets for presumptive cases whereas, from 77% (30) of the health facilities, there were no documented targets for presumptive cases.

Out of 39 health facilities, 5(13%) had link assistants, the Gatanga sub-county had 2(8%) and the Maragua sub-county had 3(20%) of their facilities with link assistants as shown in Table 1.

## Overall FB-ACF performance

On aggregate, 153,180 clients visited the 39 health facilities, where 86% (131,446/153,180) were screened for TB and 4% (4865/131,446) were presumptive TB cases. Out of all the clients visiting the health facilities, 17% (25,440/153,180) presented with respiratory system infections for both sub-counties. Of the 4865 presumptive TB cases, 55% (2688) were investigated and of these,6% (174) TB cases were detected. Of the 174 cases, 70% (121) were bacteriologically confirmed and 30% (53) were clinically diagnosed. The yield rate for the Gatanga sub-county was higher at 10% with the Maragua sub-county recording a 5% yield. Figure 1.

*Table 1:*
*Descriptive analyses of health facilities characteristics by sub-county*

| Characteristic | Category | Gatanga Sub-County (24,62%) | Maragua Sub-County (15,38%) | Total (39, 100%) |
|---|---|---|---|---|
| Health Facility Level | Level II | 17 (71%) | 10(67%) | 27(69%) |
| | Level III | 6(25%) | 2(13%) | 8(21%) |
| | Level IV | 1(4%) | 3(20%) | 4(10%) |
| Facility Sector | Faith-Based | 1(4%) | 1(7%) | 2(5%) |
| | Public | 22(92%) | 11(73%) | 33(85%) |
| | Private | 1(4%) | 3(20%) | 4(10%) |
| Availability of Link Assistants | Yes | 2(8%) | 3(20%) | 5(13%) |
| | No | 22(92%) | 12(80%) | 34(87%) |
| Documented targets for Presumptive TB cases | Yes | 5(21%) | 4(27%) | 9(23%) |
| | No | 19(79%) | 11(73%) | 30(77%) |

*Table 2:*
*Health facilities characteristics by yield rate*

| Health facilities Characteristics | | Frequency(%) | Yield rate <10% | Yield rate ≥10 % |
|---|---|---|---|---|
| Availability of link assistants | No | 34 (87.2%) | 29 (85.29%) | 5 (14.71%) |
| | Yes | 5 (12.8%) | 2 (40.00%) | 3 (60.00%) |
| Screening rate per facility | <90% | 9 (23.1%) | 4 (44.44%) | 5 (55.56%) |
| | ≥90% | 30 (76.9%) | 27 (90.00%) | 3 (10.00%) |
| Presumptive TB cases Investigated | <90% | 15 (38.5%) | 14(93.33%) | 1(6.67%) |
| | ≥90% | 24(61.5%) | 17(70.83%) | 7(29.17%) |
| Documented targets for presumptive cases | No | 30 (76.9%) | 23 (76.67%) | 7 (23.33%) |
| | Yes | 9 (23.1%) | 8 (88.89%) | 1 (11.11%) |
| Facility Level | Level 2 | 27(69.2%) | 25(92.6%) | 2(7.4%) |
| | Level 3 | 8(20.5%) | 4(50.0%) | 4(50.0%) |
| | Level 4 | 4(10.3%) | 2(50.0%) | 2(50.0%) |
| Sub-County | Gatanga | 24(61.5%) | 18(58.1%) | 6(75.0%) |
| | Maragua | 15(38.5%) | 13(41.9%) | 2(25.0%) |

## TB cases yield rate descriptions and analyses

A total of 8 health facilities had a yield of ≥10% where 75% (6) were from the Gatanga sub-County and 25%(2) were from the Maragua sub-County. Out of the 8 facilities, 38% (3) had link assistants, and 63% (5) did not have link assistants. Of the 8 health facilities with link assistants, Level III facilities were 50% (4) and Level II and Level IV facilities were 25%, respectively (2) facilities each as shown in Table 2.

*Table 3:*
*Crude and Adjusted Poisson regression analyses of the factors associated with yield rates*

|  | Characteristic | Crude IRR | 95% CI | p-value | Adjusted IRR | 95% C | p-value |
|---|---|---|---|---|---|---|---|
| Link assistants | No | — | — |  | — | — |  |
|  | Yes | 10.9 | 8.03, 14.8 | <0.001 | 6.39 | 3.85, 11.1 | <0.001 |
| Percent screened | <90% | — | — |  | — | — |  |
|  | ≥90% | 0.11 | 0.08, 0.15 | <0.001 | 0.77 | 0.41, 1.44 | 0.4 |
| Percent Investigated | <90% | — | — |  | — | — |  |
|  | ≥90% | 2.57 | 1.79, 3.80 | <0.001 | 0.56 | 0.30, 1.01 | 0.059 |
| Documented targets for presumptive cases | No | — | — |  | — | — |  |
|  | Yes | 0.29 | 0.16, 0.48 | <0.001 | 1.28 | 0.63, 2.51 | 0.5 |
| Sub-County | Gatanga | — | — |  | — | — |  |
|  | Maragua | 2.32 | 1.72, 3.15 | <0.001 | 2.20 | 1.52, 3.24 | <0.001 |
| Facility_level | Level 2 | — | — |  | — | — |  |
|  | Level 3 | 11.5 | 6.86, 20.4 | <0.001 | 14.1 | 7.92, 26.5 | <0.001 |
|  | Level 4 | 39.3 | 24.2, 68.1 | <0.001 | 15.8 | 9.01, 29.6 | <0.001 |
|  |  |  | [1]IRR = Incidence Rate Ratio, CI = Confidence Interval | | | | |
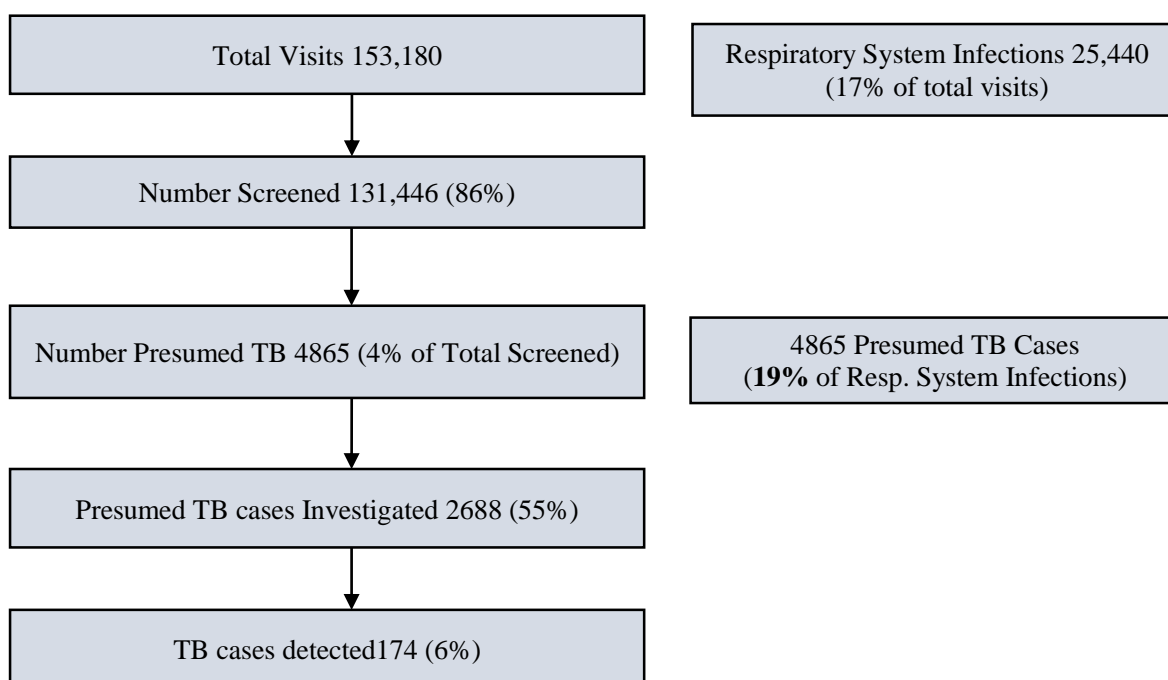


*Figure 1:*
*Overall TB diagnosis cascade*

## Significant factors associated with better yields

The analysis presented in Table 3 provides insight into the factors associated with better yield rates in health facilities based on Poisson regression. Health facilities with linkage assistants (adjusted IRR 6.39 CI 3.85-11.1, p-value 0.001), facility in Maragua sub-County (adjusted IRR 2.20 CI 1.52-3.24, p-value 0.001), being a Level III (adjusted IRR 14.1 CI 7.92-26.5, p-value 0.001) and level IV facilities (adjusted IRR 15.8 CI 9.01-29.6, p-value 0.001), were significantly associated with better yield rates. However, the proportion of clients screened, the proportion of TB cases investigated, and having documented targets for presumed TB cases had no significant association with yield rates after adjustment as shown in Table 3.

## Discussion

The study's findings offer a view of how well Facility-Based Active Case Finding (FB-ACF) works in Murang'a County, Kenya, at identifying tuberculosis (TB) cases. The results identify areas where interventions might be improved to improve TB case detection, revealing both wins and challenges in the application of FB-ACF.

The study findings show that the proportion of presumed TB cases was less than a third of respiratory system infections reported in that period. The lower-than-expected yield rate, especially in the Maragua sub-county, points to possible shortcomings in the TB screening and diagnostic process. Despite the National TB screening guidelines(10) recommending that 60%-80% of respiratory infections be presumed TB cases, the study found a much lower proportion, which aligns with previous research highlighting systemic gaps in TB case identification. While TB symptom screening was done in all service delivery locations, the study by P.F. Kweza et al. revealed that the majority of patients accessing healthcare facilities with TB-related symptoms were missed by the health system, possibly suggesting leakage in the TB case detection cascade(20).

In this study, findings also showed that the proportion of clients screened, the proportion of TB cases investigated, and having documented targets for presumptive TB cases did not significantly affect yield rates in TB case detection after adjustment. This differs from another study which identified having targets for presumptive TB cases as a best practice in improving case finding(21). Our study is therefore a reflection of possible gaps in the screening of clients provided by health workers to identify potential TB cases. The findings suggest that improving yield rates requires more comprehensive clinical examinations and history-taking to identify genuine presumptive cases, even while more presumptive cases are discovered. A prior study suggested using a triage test instead of a symptom questionnaire since it could function more effectively (22). These findings also highlight the importance of specific facility characteristics and support systems in enhancing yield rates, while some factors that initially seem important may not have a significant impact after accounting for other variables.

The variations in yield rates between the Gatanga and Maragua sub-counties suggest that regional differences may influence TB case identification. Factors such as local health infrastructure, staff training, and community awareness could contribute to these differences. The variations in outcomes are similar to the findings of a study where program quality and efficiency in ACF (PQE-ACF) was used in 250 different health facilities from 10 counties (23). Targeted interventions in areas with lower yield rates may help address specific challenges faced in those regions.

The findings show a complex picture of factors associated with case-finding rates in the various health facilities with some characteristics having strong associations. However, adjustments reveal further the intricate relationships among them. One of the most significant findings is the association

between the presence of link assistants and higher yield rates. Facilities with link assistants were six times more likely to achieve better yield rates. This is consistent with another study in Uganda where link facilitators were associated with better yields in TB case detection thus underscoring the crucial role of link assistants in enhancing the process of TB case detection(24). Link assistants contribute to patient education and facilitate smoother transitions through the diagnostic process, thus improving the likelihood of identifying and confirming TB cases.

While Facility-based active case finding (FB-ACF) is an intervention aimed at supplementing passive TB case finding by including other interventions like patient education, FB-ACF is hampered by high patient workload in understaffed health facilities. With a yield of 6%, where only just about half of presumptive cases were investigated, the study findings concur with the findings of a study done by Kagujje Id M et.al which recommended improving the completion of provider-initiated TB symptom screening and diagnosis cascade(25). A further study to evaluate the leakages in TB screening and diagnosis cascade completion will help to identify viable interventions that can increase the yield rate and improve TB case detection.

The findings of this study show that higher-level facilities (Level III and Level IV) had significantly better yield rates compared to lower-level facilities (Level II). This finding suggests that higher-level facilities, which typically have more resources and specialized staff, may be better equipped to handle the complexities of TB diagnosis. In another study where program quality and efficiency in ACF (PQE-ACF) was applied in different health facilities, a yield of eleven percent was achieved in a level IV facility where 84% of the presumptive cases were investigated with the study recommending guided documentation of ACF activities to improve TB screening yield rates(23). Health facilities in the sub-counties with GeneXpert MTB/RIF diagnostic testing which is the preferred first test of choice for TB diagnosis were more likely to have better yields. This could mean that availability and access to advanced diagnostic tools, such as GeneXpert MTB/RIF is a positive predictor for better yields in TB case detection.

## Study limitations

The study relied on some of the data that was provided by healthcare providers which could have had recall bias.

## Conclusion

As a result, we conclude that health facilities with link assistants and level III and IV facilities as factors associated with higher yields in facility-based active TB case-finding efforts.

## Recommendations

We recommend that symptom screening to identify presumed TB cases need to be enhanced to include further clinical evaluations and not only asking the four cardinal signs. Upon identifying presumptive TB cases, a health facility should ensure that all patients presumed to have TB undergo further investigations to reduce the chances of missing a TB case. Enhancing efforts towards access to GeneXpert testing by health facilities can improve TB diagnosis performance. Tailoring interventions to address specific challenges in different sub-counties can help in achieving better rates of TB case detection across health facilities.

Overall, the study highlights the need for a multifaceted approach to TB case detection, incorporating both improved screening practices and supportive interventions like link assistants to achieve better yields in case identification. Further research should focus on identifying and addressing specific barriers in the TB diagnosis cascade to enhance the effectiveness of TB control programs.

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**Conflict of Interest.** The authors declare no competing interest

**Availability of data statement.** Data used in this study is held by the author and can be availed for access upon a written request.

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