

# Improving TB Case Detection in Vulnerable Urban Populations Through Integrated Health Services: Evidence from Korle Klottey and La Dadekotopon Districts in Greater Accra Region, Ghana

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## ABSTRACT

**Background:** Tuberculosis (TB) diagnosis is costly and require extensive resources and human expertise and can be clinically or bacteriologically evidence. Integrated community-based health services offer an opportunity to improve TB case detection while addressing other priority health needs.

**Objective:** This study assessed the contribution of integrated community-based health services to improving tuberculosis case detection among vulnerable populations in the Korle Klottey and La Dadekotopon districts of the Greater Accra Region, Ghana.

**Methods:** A community-based screening intervention was conducted among residents of urban informal settlements. Data were collected using structured paper-based tools, entered into Microsoft Excel, and analysed using R software. Descriptive statistics summarised service uptake and the TB diagnostic cascade, while bivariate and multivariate logistic regression analyses were used to identify factors associated with bacteriologically confirmed TB.

**Results:** A total of 1,243 participants were screened, with 894 identified as presumptive TB cases. Of these, 546 sputum samples were collected, and 347 participants undertook chest X-ray. 26 X-rays were suggestive of TB, and 87 participants were bacteriologically confirmed as TB positive by GeneXpert MTB, and 95.6% of bacteriologically and clinically confirmed cases were initiated on treatment. Uptake of integrated services was high, with 77.7% tested for HIV and 71.2% tested for malaria. Logistic regression analysis showed that migrant status was the only factor independently associated with bacteriologically confirmed TB, with migrants having significantly lower odds of confirmed TB compared to non-migrants (aOR = 0.57; 95% CI: 0.36–0.92).

**Conclusion:** Integrated community-based screening improved TB case detection and enabled delivery of essential health services in vulnerable urban settings, supporting its scale-up as a key strategy for strengthening urban TB control.

## List of Abbreviations

AOR	: Adjusted odds ratio	MTB	: Mycobacterium tuberculosis
CI	: Confidence interval	NCDS	: Non-communicable diseases
HIV	: Human Immunodeficiency Virus	TB	: Tuberculosis
LMICS	: Low- and middle-income countries	UOR	: Unadjusted odds ratio
		WHO	: World Health Organization

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**Keywords:** Tuberculosis, Community-Based Screening, Integrated Health Services, Vulnerable Urban Populations, Case Detection

## Introduction

Tuberculosis (TB) diagnosis is costly and require extensive resources and human expertise and can be clinically or bacteriologically diagnosed. It remains one of the leading infectious causes of morbidity and mortality globally, with a disproportionate burden borne by low- and middle-income countries in the Sub-Saharan Africa. The Global Fund and the Stop TB Partnership Geneva, alongside other international organisations have made extensive financial, logistical and experts' commitments towards the fight against TB in the world, however, TB case detection continues to lag behind estimated incidence, especially among vulnerable populations residing in densely populated urban settings [1]. These populations are often characterised by poverty, overcrowding, high population mobility, informal employment, and a high prevalence of comorbidities such as HIV, diabetes mellitus, and other non-communicable diseases, all of which compound barriers to timely TB diagnosis and care.

Urban areas are often assumed to have better physical access to health services, however, access alone does not translate into effective health seeking behaviour, particularly for socially marginalised groups. Fragmented service delivery, weak referral linkages, stigma, opportunity costs, and limited integration of TB services into routine points of care continue to undermine early diagnosis [2].

TB is strongly associated with poverty, job insecurity, and social exclusion, which creates fear of economic loss following diagnosis [3]. As a result, many people are reluctant to undergo TB testing or initiate treatment even when they test positive, due to concerns about loss of income, workplace discrimination, and social stigma. In response to this challenge, the Ghana National TB Voice Network, with support from the National Tuberculosis Control Programme, implemented integrated health screening activities among key and vulnerable populations in the Korle Klottey and La Dadekotopon districts of the Greater Accra Region. This integrated approach was designed to reduce stigma, normalise TB screening within broader health checks, and encourage wider participation in TB testing by embedding it within multi-disease screening platforms. The intervention combined TB screening with HIV testing, malaria testing, blood sugar and blood pressure checks, and employed a mobile X-ray van to facilitate on-the-spot TB diagnosis.

Many studies in Ghana and across Africa have highlighted the critical role of integrated health services in improving TB case detection among people living with HIV and other high-risk groups. Studies examining TB and HIV integration consistently demonstrate that while policy frameworks for integration exist, their implementation is constrained by health system bottlenecks, including human resource shortages, inadequate infrastructure, and poor coordination across service units [4,5]. Qualitative evidence from co-infected patients further reveals that fragmented care pathways, multiple clinic visits, and weak patient-provider communication discourage service utilisation and contribute to missed diagnostic opportunities [4]. Similar

challenges have been documented in the implementation of TB screening guidelines within HIV clinics, where adherence to recommended screening protocols remains uneven due to workload pressures and limited diagnostic capacity [6,7].

Systematic reviews from low- and middle-income countries show that integrating TB services with diabetes and other chronic disease care can enhance case finding, reduce patient costs, and improve continuity of care [8,9]. Evidence from urban primary healthcare facilities in Zambia demonstrates that systematic TB screening at outpatient entry points can significantly increase case detection without overwhelming health workers when appropriately designed and supported [10]. These is consistent with experiences from emergency and acute care settings in Ghana, where high patient volumes and undifferentiated presentations offer critical but underutilised opportunities for early TB identification [11].

Geographical and spatial analyses further reveal that TB risk and service accessibility are unevenly distributed, even within ostensibly well-served urban and peri-urban areas. Studies from Ghana indicate that physical proximity to TB diagnostic facilities does not necessarily equate to effective access, particularly when transport costs, clinic congestion, and socio-cultural barriers are considered [12]. More so, recent geospatial analyses have demonstrated significant intra-district clustering of TB incidence and treatment outcomes which emphasize the need for place-specific and integrated responses tailored to local risk profiles [13]. These insights are relevant for metropolitan districts such as Korle Klottey and La Dadekotopon, where health service utilisation patterns are shaped by daily population inflows and outflows linked to commerce and employment.

At the community level, stigma, misconceptions about TB, and fear of social exclusion continue to delay care seeking and limit acceptance of screening services. Studies from Accra and other urban centres in Ghana show that patients' experiences of care are strongly influenced by the quality of psychosocial support, confidentiality, and respect within health facilities [14,15]. Health service providers likewise report challenges related to patient adherence, competing livelihood demands, and weak follow-up systems, emphasizing the importance of integrated, patient-centred models that extend beyond biomedical diagnosis to address social determinants of health [16,17]. Community-based approaches, including the engagement of trained volunteers and peer supporters, have been shown to complement facility-based services by strengthening linkage to care and reducing losses along the TB care cascade [18,19].

While Ghana has made significant progress in expanding TB services to private providers and non-state actors, evidence suggests that the full potential of these initiatives is yet to be realised in urban settings. An interrupted time series evaluation of private-sector engagement demonstrated measurable gains in TB notifications but also highlighted the need for stronger integration with public health reporting systems and sustained supervision [20]. Similarly, multi-country evidence from Sub-Saharan Africa indicates that intensified and integrated case-finding approaches, within routine child and adult health services, can significantly improve detection among underserved populations when implemented at scale [21].

This intervention therefore examines the contribution of integrated health services to improving TB case detection in the Korle Klottey and La Dadekotopon districts of the Greater Accra Region.

## Method and Materials

### Study Area

The intervention was conducted in slum and ghetto communities within the Korle Klottey and La Dadekotopon districts of the Greater Accra Region, Ghana, areas characterised by high population density, socio-economic vulnerability, and limited engagement with conventional facility-based TB diagnostic services.

### Study Design and Period

This intervention adopted a community-based public health intervention design using an active case-finding approach integrated with multi-disease health screening services. The intervention was implemented as a cross-sectional implementation study within routine community outreach activities, with the primary objective of improving tuberculosis case detection among vulnerable and marginalised urban populations. The design was practice-oriented and aligned with real-world programme implementation, focusing on generating actionable evidence to inform TB control strategies in high-burden urban settings.

An integrated community screening model was employed, combining active TB screening with HIV testing, malaria testing, blood sugar measurement, and blood pressure checks. To facilitate timely diagnosis, a mobile chest X-ray unit was deployed to screening sites, complemented by bacteriological testing using GeneXpert MTB for confirmatory diagnosis. The intervention was delivered by trained nurses from ART clinics and DOTS centres, supported by radiographers and community-based TB Champions who led mobilisation and demand creation activities. The intervention took place from Thursday March 20, 2025 to Saturday March 29, 2025 in the La Dadekotopon district and from Friday April 4, 2025 to Sunday April 13, 2025 in the Korle Klottey district.

### Source Population

The population for this study includes all people living, working, or present within slum and ghetto communities in the Korle Klottey and La Dadekotopon districts of the Greater Accra Region, Ghana at the time of the screening, irrespective of their health-seeking behaviour or prior engagement with TB services. This population includes permanent residents, informal workers, traders, transport operators, and other highly mobile groups who regularly interact within these urban spaces.

### Eligibility Criteria

Participants were eligible for inclusion if they resided in, worked in, or were present and available in the selected areas and voluntarily participated in the integrated community health screening, including tuberculosis screening, during the intervention period. Only participants who willingly consented to be screened were included in the study. Participants were excluded if they declined to be screened.

## Sample Size Determination

This study did not employ a priori statistical sample size estimation, as it was implemented as a community-based public health intervention using a total enumeration approach. The sample size was therefore determined by the number of participants who voluntarily presented and participated in the integrated health screening activities conducted in the Korle Klottey and La Dadekotopon districts during the intervention period.

All eligible participants who attended the community outreach screening points and underwent TB screening as part of the integrated service package were included in the study. This approach is consistent with active case-finding interventions in real-world programmatic settings, where the primary objective is to maximise coverage among high-risk populations rather than to achieve a predetermined statistically powered sample.

## Study Variables

### Dependent Variable

The dependent variable for this study was TB case detection, operationalised as bacteriologically confirmed TB status among participants who participated in the integrated community screening. This variable was dichotomised as:

TB positive: Participants with bacteriological confirmation of TB using GeneXpert MTB

TB negative: Participants who tested negative on bacteriological assessment

### Independent Variables

The independent variables comprised socio-demographic characteristics, contextual factors, and service-related variables that were hypothesised to influence TB case detection outcomes.

#### Socio-demographic variables included:

Sex (male, female)

Age group (18–29, 30–39, 40–49, 50–59, ≥60 years)

Marital status (married or cohabiting, single, separated or divorced, widowed)

Educational level (no formal education, primary, junior high, senior high, tertiary)

Occupation (artisan or apprentice, casual labour, domestic work, informal trading, transport work, unemployed, other)

Migrant status (migrant, non-migrant)

#### Geographic and settlement-related variables included:

District of screening (Korle Klottey, La Dadekotopon)

Settlement type (slum, ghetto)

#### Service delivery and screening pathway variables included:

TB symptom screening status (yes, no)

Presumptive TB status following screening (yes, no)

Sputum sample collection (yes, no)

Chest X-ray examination (yes, no)

Chest X-ray result suggestive of TB (yes, no)

## Data Collection Tool and Process

Data were collected using a structured, paper-based data collection tool developed specifically for the integrated community-based TB screening intervention. The tool was designed to capture information on participants' socio-demographic characteristics,

TB symptom screening, presumptive TB status, diagnostic procedures undertaken, and final TB diagnostic outcomes. In addition, data on other integrated health services provided during the screening, including HIV testing, malaria testing, blood pressure measurement, and blood sugar assessment, were recorded.

Data collection was conducted at designated community screening points within slum and ghetto settlements in the Korle Klottey and La Dadekotopon districts. Trained healthcare personnel, including nurses from ART clinics and directly DOT centres, completed the paper-based forms contemporaneously during screening activities. Chest X-ray results and bacteriological findings from GeneXpert MTB testing were recorded as they became available. Completed forms were reviewed daily to ensure completeness before secure storage for subsequent data entry.

### Data Quality Control

Several measures were implemented to ensure the accuracy, completeness, and reliability of the data collected. Data collectors received orientation and on-site supervision on the proper completion of the paper-based tools, including standardised definitions for key variables such as presumptive TB and bacteriologically confirmed TB. Supervisors conducted routine checks of completed forms during the screening period to identify missing fields, inconsistencies, or implausible values, which were clarified promptly with data collectors where possible.

Following field data collection, all paper-based records were double-checked prior to data entry. Data were entered into Microsoft Excel using a predefined data template with restricted formats and validation checks to minimise entry errors. The dataset was subsequently cleaned through range checks, logical consistency checks, and verification against original paper forms. Any discrepancies identified during data cleaning were resolved through reference to the original data collection tools.

### Statistical Analysis

After data entry and cleaning in Microsoft Excel, the dataset was exported and transformed for statistical analysis using R software. Data transformation included variable recoding, categorisation of continuous variables where appropriate, and creation of derived variables relevant to the TB screening cascade.

Descriptive statistical analyses were conducted to summarise participants' socio-demographic characteristics, service uptake, and screening outcomes. Categorical variables were summarised using frequencies and percentages. Bivariate analyses were performed to explore associations between independent variables and bacteriologically confirmed TB status, with results presented as odds ratios and corresponding 95 percent confidence intervals.

Logistic regression models were fitted to identify factors independently associated with bacteriologically confirmed TB. Statistical significance was assessed at the five percent level. All analyses were conducted using R, and results were presented in tables and figures to illustrate screening coverage, diagnostic yield, and factors associated with TB detection.

## Result

### Socio-Demographic Characteristics

The result on the socio-demographic characteristics of the participants in Table 1, revealed that majority 693(55.75%) of the participants were males, compared to 550(44.25%) who were females. Also, majority 461(37.09%) of the participants were between 30-39 year of age, and 577(46.42%) of the participants were single. Again, the result shows that majority 343(27.59%) of the participants were Junior High School leavers and 318(25.58%) were engaged in informal trading businesses. More so, 518(41.67%) of the participants were migrants who indicated they are from Nigeria, Togo, Cote D'Ivoire, Central Africa Republic among many other Africa countries. Many of them are residing in La Dadekotopon district 636(51.17%) as compared to those residing in Korle Klottey district 607(48.83%). The results also shows that more residents 819(65.89%) in the slums areas participated in the screening process compared to those from the ghettos 424(34.11%).

**Table 1: Socio-Demographic Characteristics of Participants in Integrated Community TB Screening (N = 1,243), Accra, Ghana.**

Variable	Category	Frequency (n)	Percentage (%)
Sex	Female	550	44.25
	Male	693	55.75
Age group (years)	18–29	456	36.69
	30–39	461	37.09
	40–49	252	20.27
	50–59	64	5.15
	≥60	10	0.8
Marital status	Married/ Cohabiting	514	41.35
	Separated/ Divorced	112	9.01
	Single	577	46.42
	Widowed	40	3.22
Educational level	No formal education	228	18.34
	Primary	339	27.27
	Junior High	343	27.59
	Senior High	259	20.84
	Tertiary	74	5.95
Occupation	Artisan/ Apprentice	231	18.58
	Casual labour	220	17.7
	Domestic work	117	9.41
	Informal trading	318	25.58
	Transport (driver/loader)	145	11.67
	Unemployed	129	10.38
	Other	83	6.68
Migrant status	No	725	58.33
	Yes	518	41.67

District	Korle Klottey	607	48.83
	La Dadekotopon	636	51.17
Settlement type	Ghetto	424	34.11
	Slum	819	65.89

### Community Screening Service Uptake

The results presented in Table 2 summarise the TB screening cascade and other integrated health services delivered during the community-based screening exercise, disaggregated by sex. Overall, participation was higher among males (693, 55.8%) than females (550, 44.2%), with largely comparable service uptake patterns observed between the two groups.

More so, majority of participants underwent HIV testing, with 966 (77.7%) participants tested during the outreach. Uptake was comparable between females (78.0%) and males (77.5%), indicating equitable access to HIV services within the integrated screening model. This high coverage emphasize the effectiveness of combining TB screening with HIV services in community settings. For personal privacy, the result of the HIV testing was made known to only the participants who underwent the testing and that data is not included in this analysis.

Similarly, malaria testing was conducted for 885 (71.2%) participants, with slightly higher uptake among males (72.2%) compared to females (70.0%). This shows the relevance of integrating malaria services into community outreach activities, particularly in urban settings where febrile illnesses are common and differential diagnosis is essential.

Furthermore, blood pressure assessment revealed that 467 (37.6%) participants had elevated or high blood pressure, with similar proportions among females (38.0%) and males (37.2%). In addition, blood sugar screening identified raised blood glucose levels in 182 (14.6%) participants, with a higher proportion observed among males (16.0%) than females (12.9%). These findings indicate a significant burden of undiagnosed or poorly controlled non-communicable disease risk within the screened population.

**Table 2: Community TB Screening and Health Services Delivered During Community Screening, by Sex (N = 1,243)**

Service Variable	Category	Female (n = 550)	Male (n = 693)	Total (N = 1,243)
Symptom screening	No	346 (62.9%)	402 (58.0%)	748 (60.2%)
	Yes	204 (37.1%)	291 (42.0%)	495 (39.8%)
Presumptive TB	No	169 (30.7%)	180 (26.0%)	349 (28.1%)
	Yes	381 (69.3%)	513 (74.0%)	894 (71.9%)
Sputum collection	No	313 (56.9%)	384 (55.4%)	697 (56.1%)
	Yes	237 (43.1%)	309 (44.6%)	546 (43.9%)

Chest X-ray performed	No	411 (74.7%)	485 (70.0%)	896 (72.1%)
	Yes	139 (25.3%)	208 (30.0%)	347 (27.9%)
X-ray suggestive of TB	No	538 (97.8%)	679 (98.0%)	1,217 (97.9%)
	Yes	12 (2.2%)	14 (2.0%)	26 (2.1%)
GeneXpert MTB positive	No	512 (93.1%)	644 (92.9%)	1,156 (93.0%)
	Yes	38 (6.9%)	49 (7.1%)	87 (7.0%)
Treatment initiated	No	503 (91.5%)	632 (91.2%)	1,135 (91.3%)
	Yes	47 (8.5%)	61 (8.8%)	108 (8.7%)
HIV test conducted	No	121 (22.0%)	156 (22.5%)	277 (22.3%)
	Yes	429 (78.0%)	537 (77.5%)	966 (77.7%)
Malaria test conducted	No	165 (30.0%)	193 (27.8%)	358 (28.8%)
	Yes	385 (70.0%)	500 (72.2%)	885 (71.2%)
Blood pressure category	Normal	341 (62.0%)	435 (62.8%)	776 (62.4%)
	Elevated/High	209 (38.0%)	258 (37.2%)	467 (37.6%)
Blood sugar category	Normal	479 (87.1%)	582 (84.0%)	1,061 (85.4%)
	Raised	71 (12.9%)	111 (16.0%)	182 (14.6%)

### TB Cascade

Figure 1 illustrates the TB screening and diagnostic cascade achieved through the integrated community-based intervention. A total of 1,243 participants were screened, of whom 894 were identified as presumptive TB cases. This initial high yield demonstrates effective community mobilisation and symptom screening in high-risk urban settings. From those identified as presumptive cases, 546 participants provided sputum samples, while 347 participants who could not produce sputum samples were made to take chest X-ray examination. Out of this number, 26 participants had chest X-ray findings suggestive of TB, reflecting the specificity of radiological screening. Bacteriological confirmation using GeneXpert identified 87 TB-positive cases. 108 (95.58%) of both bacteriologically and clinically confirmed cases were initiated on TB treatment whereas 5(4.42%) of the participants declined. The cascade highlights improved case detection and linkage to care, while also revealing points of diagnostic drop-off that are critical for strengthening TB programmes in similar urban informal settlements.

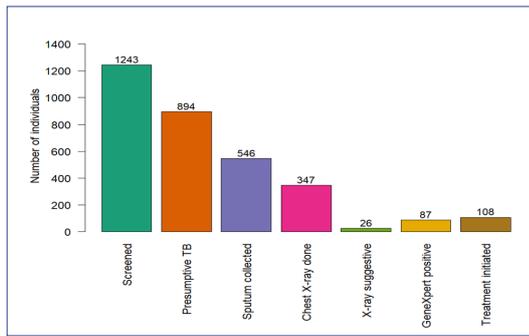


Figure 1: TB Screening Cascade

**Risk Factors associated with Bacteriologically Confirmed Tuberculosis Among Participants Screened in Urban Informal Settlements**

The results in Table 3 present findings from a logistic regression analysis assessing factors associated with bacteriologically confirmed TB cases. The result shows that, there was strong consistency between the unadjusted and adjusted models, with

**Table 3: Factors Associated with Bacteriologically Confirmed Tuberculosis Among Participants Screened in Urban Informal Settlements**

Variable	Univariate logistic regression		Multivariate logistic regression	
	Unadjusted Odds Ratio(95% CI)	P-value	Adjusted Odds Ratio (95% CI)	P-value
<b>Gender</b>				
Female (Ref)	1		1	
Male	1.03 (0.66, 1.59)	0.9117	1.03 (0.66, 1.61)	0.8955
<b>Age group</b>				
18–29 (Ref)	1		1	
30–39	1.57 (0.92, 2.67)	0.0955	1.65 (0.96, 2.82)	0.0685
40–49	1.72 (0.94, 3.14)	0.0760	1.79 (0.97, 3.28)	0.0612
50–59	0.89 (0.26, 3.03)	0.8460	0.89 (0.26, 3.09)	0.8585
60+	2.00 (0.24, 16.44)	0.5190	1.74 (0.20, 14.76)	0.6123
<b>Marital status</b>				
Married/Cohabiting (Ref)	1		1	
Separated/Divorced	1.06 (0.50, 2.27)	0.8717	1.10 (0.51, 2.38)	0.8039
Single	0.86 (0.54, 1.36)	0.5193	0.86 (0.54, 1.38)	0.5376
Widowed	0.31 (0.04, 2.33)	0.2568	0.31 (0.04, 2.34)	0.2554
<b>Education level</b>				
Junior High (Ref)	1		1	
No formal education	0.80 (0.41, 1.56)	0.5099	0.78 (0.39, 1.53)	0.4679
Primary	0.93 (0.52, 1.65)	0.8020	0.96 (0.53, 1.71)	0.8791
Senior High	0.97 (0.52, 1.79)	0.9102	0.89 (0.48, 1.67)	0.7183
Tertiary	0.70 (0.24, 2.06)	0.5135	0.73 (0.24, 2.18)	0.5713
<b>Occupation</b>				
Artisan/Apprentice (Ref)	1		1	
Casual labour	0.99 (0.49, 2.01)	0.9718	1.05 (0.51, 2.15)	0.8924
Domestic work	0.68 (0.26, 1.77)	0.4311	0.75 (0.28, 1.98)	0.5634
Informal trading	0.76 (0.38, 1.50)	0.4224	0.81 (0.40, 1.62)	0.5487
Other	0.81 (0.29, 2.26)	0.6832	0.88 (0.31, 2.51)	0.8166
Transport (driver/loader)	1.35 (0.64, 2.82)	0.4321	1.41 (0.66, 2.99)	0.3745

only limited changes observed after controlling for potential confounders.

From both the univariate and multivariate analysis, migrant status was the only variable that was statistically significant. Migrants had significantly lower odds of bacteriologically confirmed TB compared to non-migrants in the unadjusted model (uOR = 0.58; 95% CI: 0.36–0.92) and this association remained unchanged after adjustment (aOR = 0.57; 95% CI: 0.36–0.92). This indicates a strong and independent protective association of migrant status with bacteriologically confirmed TB.

However, with respect to age, participants aged 30–39 years and 40–49 years showed higher odds of TB compared to those aged 18–29 years in both models. Nevertheless, the direction of association remained positive, but the magnitude of effect increased slightly after adjustment, moving closer to statistical significance. However, neither age group reached statistical significance in either the unadjusted or adjusted models.

Unemployed	1.17 (0.53, 2.59)	0.6918	1.23 (0.55, 2.76)	0.6076
<b>Migrant status</b>				
No (Ref)	1		1	
Yes	0.58 (0.36, 0.92)	0.0221	0.57 (0.36, 0.92)	0.0223
<b>District</b>				
Korle Klottey (Ref)	1		1	
La Dadekotopon	1.38 (0.89, 2.15)	0.1506	1.41 (0.90, 2.20)	0.1358
<b>Settlement type</b>				
Ghetto (Ref)	1		1	
Slum	0.98 (0.62, 1.55)	0.9395	0.97 (0.61, 1.55)	0.8974

## Discussion

This study demonstrates the effectiveness of integrated community-based screening in improving tuberculosis case detection while simultaneously delivering essential health services in vulnerable urban informal settlements in Accra. The high number of participants screened and the large proportion identified as presumptive TB cases highlight the value of active case-finding approaches in reaching populations that may not routinely access facility-based care, consistent with evidence from community-wide TB screening interventions [22-24].

The TB diagnostic cascade showed strong initial yields, with significant progression from symptom screening to bacteriological confirmation using GeneXpert. The high proportion of confirmed and clinically diagnosed cases initiated on treatment reflects effective linkage to care, a critical success factor for community-based TB programmes. Similar findings have been reported in large-scale community screening studies, which demonstrate that decentralised diagnostic approaches can significantly improve TB detection and treatment initiation in high-risk settings [23,24]. Nonetheless, attrition along the diagnostic pathway, particularly between presumptive TB identification and completion of confirmatory testing, indicate operational challenges also documented in other community-based interventions [22].

The integration of non-TB health services added considerable value to the intervention. High uptake of HIV and malaria testing illustrates the acceptability and feasibility of bundled service delivery in community settings. Furthermore, the identification of elevated blood pressure and raised blood sugar among a significant proportion of participants reveals an underlying burden of non-communicable disease risk that would likely remain undetected without integrated screening. These findings support growing evidence that integrated models addressing both communicable and non-communicable conditions enhance the public health impact of community outreach programmes [22,25].

Analysis of factors associated with bacteriologically confirmed TB showed that migrant status was the only variable significantly associated with TB detection in both unadjusted and adjusted models, with migrants exhibiting lower odds of confirmed TB. This finding aligns with evidence that TB risk among migrant populations is context-specific and influenced by access to targeted screening and community-based services [26]. The lack of significant associations for other variables suggests that shared environmental and structural conditions in urban

informal settlements may play a more dominant role in shaping TB risk than individual socio-demographic characteristics alone, as reported in similar high-density settings [25-32].

## Limitations of the Study

This study utilised programme data from a community-based intervention, which limits causal inference due to the absence of a comparison group. Data were collected using paper-based tools, increasing the potential for reporting or transcription errors despite quality control measures. Additionally, some losses occurred along the diagnostic cascade, which may have led to underestimation of tuberculosis burden. Finally, the findings are context-specific to selected urban informal settlements and may not be generalisable to other settings.

## Conclusion

This study demonstrates that integrated community-based screening is an effective approach for improving tuberculosis case detection and delivering essential health services in vulnerable urban informal settlements. The intervention achieved high screening coverage, identified previously undiagnosed TB cases, and ensured strong linkage to treatment. Integrating TB services with HIV, malaria, and non-communicable disease screening enhanced service uptake and public health value. These findings support the scale-up of integrated, community-based strategies as a key component of urban TB control efforts in Ghana and similar settings.

## Recommendations

Integrated community-based screening should be scaled up in urban informal settlements to enhance early tuberculosis detection and access to essential health services. TB programmes should strengthen diagnostic continuity along the screening cascade, particularly sputum collection and radiological follow-up. Integration of TB services with HIV, malaria, and non-communicable disease screening should be institutionalised to maximise public health impact. Finally, targeted engagement of vulnerable and mobile populations should be sustained to ensure equitable access to TB prevention, diagnosis, and care.

## Ethical Clearance

This study utilised data generated from a routine public health intervention implemented as part of programme activities. As such, formal ethical review by an institutional review board was not required. Official authorisation to use the data for analysis and dissemination was obtained from the implementing organisation, the Ghana National TB Voice Network. The data were analysed strictly for public health and research purposes, with due regard

for confidentiality, anonymity, and ethical principles governing the use of programme data.

### Informed Consent

Informed consent was obtained from all participants prior to their inclusion in the community screening activities. Before data collection and service delivery, participants were provided with clear information about the purpose of the screening, the procedures involved, potential benefits and minimal risks, and their right to decline or withdraw at any stage without any consequences to their access to health services. Consent was obtained verbally, in line with routine public health outreach practices, and was documented on the paper-based data collection tools. All participants were assured of confidentiality and the use of collected data solely for public health and research purposes.

### Authors' Contribution

All authors contributed to the conception, implementation, analysis, and interpretation of the study. The lead author coordinated the intervention, oversaw data collection and analysis, and drafted the manuscript. Co-authors contributed to study design, field implementation, data interpretation, and critical revision of the manuscript. All authors approved the final manuscript and take responsibility for its content.

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### Competing of Interests

Authors declare that they have no competing of interests.

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### Availability of data

We do not have the permission to share this data.

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