

# Missed Opportunities in Tuberculosis Investigation and Associated Factors at Public Health Facilities in Uganda

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## Research Article

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# **Abstract**

## **Background**

The incidence of tuberculosis (TB) is high in Uganda; yet, TB case detection is low. A recent national TB prevalence survey revealed that only 16% of presumptive TB patients seeking care at health facilities were offered sputum microscopy or chest-X ray (CXR). The objective of this study was to determine the magnitude of, and patient factors associated with missed opportunities in TB investigation at public health facilities of Wakiso District in Uganda.

## **Methods**

A facility-based cross-sectional survey was conducted at 10 high volume public health facilities offering comprehensive TB services in Wakiso, Uganda, among adults ( $\geq 18$  years) with at least one symptom suggestive of TB predefined according to World Health Organisation criteria. Using exit interviews, data on demographics, TB symptoms, and clinical data relevant to TB were collected. A missed opportunity in TB investigation was defined as a patient with symptoms suggestive of TB who did not have sputum and/or CXR evaluation to rule out TB. Poisson regression analysis was performed to determine factors associated with missed opportunities in TB investigation using STATA 14.

## **Results**

Two hundred forty seven presumptive TB patients were recruited into this study exiting at antiretroviral therapy (ART) clinics ( $n=132$ ) or general outpatient clinics ( $n=115$ ) at public health facilities. Majority of participants were females (161/247, 65.2%) and the mean +SD age was 35.1 + 11.5 years. Sputum and/or CXR were not requested from 138 (55.9%) patients with symptoms suggestive of TB disease. Patients who did not inform health workers about TB related symptoms were more likely to miss a TB investigation (adjusted prevalence ratio: 1.68, 95%CI: 1.36-2.08,  $P<0.001$ ).

## **Conclusion:**

A large proportion of patients with symptoms suggestive of TB did not have sputum and/ or CXR requested for investigation. Patients who did not inform health workers about their TB related symptoms were more likely to miss having sputum and/ or CXR requested. We recommend studies to explore barriers and facilitators of disclosure of TB symptoms to enable formulation of effective interventions to empower people to improve likelihood of disclosing TB related symptoms.

# **Introduction**

Tuberculosis (TB) is a global public health problem and a leading cause of death from an infectious agent<sup>1</sup>. In 2018, it was estimated that there were 10 million new TB cases worldwide and 1.5 million TB deaths<sup>1</sup>. About 24% of these TB cases were in sub-Saharan Africa and sub-Saharan Africa accounts for about 86% of the global TB/HIV burden<sup>1</sup>.

The United Nation's Sustainable Development Goals (SDGs) and the End TB strategy aim to end TB by 2030<sup>2</sup>. Early diagnosis of TB is a critical component of the End TB interventions<sup>2</sup>. Despite roll out of new diagnostic tools such as GeneXpert to improve diagnosis, TB cases are still missed globally. In 2018, about 3 million people with TB were either missed or not reported and only one in three people with drug resistant TB accessed care<sup>1</sup>. Missed TB cases result in delayed treatment and premature death, complications, community and nosocomial transmission, and catastrophic costs for families<sup>9,10</sup>.

With a reported prevalence of 273/100,000 persons<sup>3</sup>, Uganda National TB and Leprosy Control Program adopted the World Health Organization (WHO) recommendation to systematically screen all persons seeking healthcare in settings where TB prevalence in general population is greater than 100/100,000 persons<sup>7,8</sup>. However, the recent prevalence study found that only 16% of patients with symptoms suggestive of TB who visited health facilities were investigated for TB by sputum microscopy or Chest X-ray (CXR)<sup>3</sup>. Similar observations were reported from South Africa and India<sup>4-6</sup>.

Previous studies on factors associated with missed TB cases in health facilities revealed that: health system factors such as lack of training, low staff motivation, and high workload; and contextual factors including time and cost borne by patients to seek and complete TB evaluation, poor health literacy, and stigma against patients contribute to missed opportunities in TB investigation at public health facilities<sup>12</sup>.

A study done at clinics participating in a cluster randomised trial found that patient factors associated with TB investigation include increasing number of symptoms such as longer duration of cough, unintentional weight loss, and night sweats and reporting symptoms to healthcare worker<sup>13</sup>.

There is a dearth of knowledge on patient factors associated with missed TB investigation among adults with TB related symptoms in public health facilities in resource limited settings. The objective of this study was to determine the magnitude of, and patient factors associated with missed opportunities in TB investigation at public health facilities in a peri-urban district in Central Uganda.

## Methods

### Study design and setting

This was a cross-sectional study conducted between April and June 2018 among adults who presented with symptoms suggestive of TB predefined according to the world health organisation (WHO) criteria exiting 10 high volume public health facilities in Wakiso district in Uganda. It had a population estimated to be 2.5 million in 2018<sup>15</sup>. About 60% of this population live in the urban areas<sup>14</sup>. Since 2010, interventions have been implemented to improve the case detection rate in the district. The interventions included: the DETECT child TB project; and roll out of national TB/HIV guidelines<sup>16</sup>. However, TB case detection rate is still at 57%<sup>16</sup>.

Wakiso district has seven health subdistricts namely Entebbe, Busiro South, Busiro North, Busiro East, Kyadondo North, Kyadondo South, and Kyadondo East. It hosts 67 public health facilities that offer free comprehensive primary health care services including screening and testing for Tuberculosis (TB). TB screening and testing services are expected to be offered at all care entry points especially outpatient, HIV/ART clinic, and Maternal Child Health departments.

## **Study population**

The study population included adults exiting the public health facilities at two care entry points; HIV/ART clinic and outpatient department. We included in all adults aged 18 years and above with at least one symptom suggestive of TB predefined according to WHO criteria (i.e. cough for more than 2 weeks, night sweats, weight loss, and fever). In addition, for people living with HIV, we included patients presenting with cough of any duration. Patients who had sputum sent for TB investigation prior to current visit and TB patients who were already on treatment were excluded from the study.

## **Sample Size**

We calculated a sample size of 255 clients using Kish-Leslie (1965) formula for cross sectional studies<sup>17</sup>. According to a study to evaluate TB diagnostic practices at five primary care health facilities in Uganda for one year, proportion of patients with symptoms suggestive of TB offered sputum examination was 21%<sup>3</sup>. Hence  $p = 0.21$ ,  $q = 0.79$ ,  $d$  (acceptable degree of error) = 0.05,  $z$  (standard normal value corresponding to 95% confidence interval) = 1.96.

## **Sampling procedure**

Four health sub-districts were randomly selected from seven health sub districts. We then purposively selected 10 high volume health centres from the four health sub districts. They included Entebbe Hospital, Kasangati Health Centre IV, Wakiso Health Centre IV, Kajjansi Health centre IV, Buwambo Health Centre IV, Bweyogerere Health Centre III, Kiira Health Centre III, Nabweru Health centre III, Nsangi Health centre III, and Nakawuka Health Centre III. Each high-volume facility received an average of 98 (range 61-160) clients per day. The number of patients to be interviewed at each facility was determined by proportionate to size sampling. This depended on the average number of daily outpatient attendance over the last three months.

## **Data collection**

Patients were screened consecutively for interviews as they exited the different clinicians' rooms at OPD and HIV clinics. An interviewer administered structured questionnaire was used to collect data on demographics, TB symptoms, and other clinical data relevant to TB. Participants were also asked if they had sputum and/ or a chest x-ray (CXR) requested by a healthcare worker at that visit. If sputum and/ or CXR had not been requested, they were referred back to the clinic staff for appropriate investigations.

## **Quality Control**

The questionnaire used was pretested in two public health facilities and these were not part of the study sample. Research assistants were trained and supervised during data collection. Filled questionnaires were reviewed daily to check for completeness and consistency

## Data analysis

Data were entered in Epidata version 3.1 database (EpiData database, Odense, Denmark). Data were cleaned and exported to Stata v14 (StataCorp LP, College Station, TX, USA) for analysis.

Continuous variables were described using means, or medians and the corresponding standard deviations or the interquartile ranges respectively while categorical variables were described using frequencies and percentages. The proportion of missed opportunities in TB investigation was calculated by dividing the number of patients with symptoms suggestive of TB who did not have sputum examination and/or CXR requested to rule out TB by the total number of patients with symptoms suggestive of TB.

At bivariate analysis, modified Poisson regression was used to identify factors significantly associated with the outcome. A  $p<0.05$  was used as level of significance at the 95% confidence interval (95% CI) to test this association. Prevalence ratio was used as the measure of association. At Multivariate analysis, factors associated with the primary outcome at bivariate analysis were included in a multivariable model and adjusted prevalence ratios and 95% CI were estimated. A  $p<0.2$  was used as a cut off to determine which variables to carry for multiple modified Poisson regression model to build the final model. Forward regression technique was used to build the multiple modified Poisson regression model while assessing the model variables for significance at  $p<0.05$  and 95% CI. An adjusted R<sup>2</sup> was generated for the final model to determine to what extent the factors were associated with the outcome of interest.

## Ethical considerations

Ethical approval was obtained from Makerere University School of Public Health Research and Ethics Committee (FWA00011353). Wakiso District Health Office provided approval and permission to perform the study in the public health facilities. Informed consent was obtained from all participants before divulging any information and collection of data. All methods were carried out in accordance with relevant guidelines and regulations.

# Results

## Characteristics of the respondents

From April 2018 to June 2018, we screened 1543 adults upon exiting public health facilities of whom 261 were eligible (Fig 1). Fourteen declined enrollment and 247 were enrolled.

The mean  $\pm$ SD age was  $35.1 \pm 11.5$  years, 161(65.2%) were female, 120 (48.6%) had primary education level and 93 (37.6%) were in full-time employment. Almost half, 132/247 (53.4%) of the respondents were

enrolled from the ART clinic, and 128 (51.8%) resided in urban areas.

Majority (191/247, 77.3%) of the patients had cough and most (116/191, 60.7%) of them had had cough for between 2 and 4 weeks. Only 23/247(9.3%) had the four classical symptoms of TB. Majority (226/247, 91.5%) of the patients knew their HIV status; with more than half (144/226, 63.7%) being HIV positive and 139/144 (96.5%) were on ART. Table 1 summarizes the socio-demographic and clinical characteristics of the patients.

### **Missed opportunities for TB investigation**

Among the 247 participants, 138 (55.9%) had at least one symptom suggestive of TB disease but were not offered sputum and/or CXR investigations. Overall, 160/247 (64.8%) reported TB related symptoms to health workers. Less than half (103/247, 41.7%) of the patients were asked to provide sputum for microscopy and only 19/247 (7.7%) were offered a CXR. Another 13/247 (5 %) were asked to provide both sputum for microscopy and Chest X-ray.

### **Factors associated with Missed Opportunities for TB investigation**

Only duration of cough (APR; 0.69, 95%CI; 0.56-0.86, p<0.001) and not informing the health worker about TB symptoms (APR; 1.68, 95%CI; 1.36-2.08, P<0.001) were significantly associated with missed opportunities of TB investigation. (Table 2).

## **Discussion**

TB is a preventable and curable infectious disease that continues to infect and claim the lives of a significant number of individuals globally. Early identification of symptoms and appropriate investigations are important for early diagnosis and institution of anti-tuberculosis regimen. TB case detection rates has remained low especially in the developing world, including Uganda<sup>1</sup>. This study determined patient factors associated with missed opportunities in TB investigation at public health facilities.

Our study reported a high prevalence of missed opportunities for TB investigations. However, this was relatively lower than what was reported during the Uganda national prevalence survey<sup>3</sup>. The proportion of patients with cough who were not asked by health workers for sputum in this study was relatively lower than what was reported in other studies conducted in Uganda, Ghana, and South Africa that ranged from 75-90%<sup>18-20</sup>. This could be attributed to improved knowledge and vigilance by the health workers through different interventions such as facility-based trainings and mentorships by the government and its partners. The proportion of missed opportunities for TB investigation is still high suggesting gaps in the TB case finding initiatives. Interventions to enhance TB case finding at the health facility need to be implemented.

This study found that reporting symptoms to health worker was associated with having sputum sent for TB for investigation and/or CXR. Similar findings were reported in South Africa where reporting symptoms to health workers was one of the strongest factors associated with having sputum sent for TB investigations<sup>4</sup>. This implies that patients who are empowered to disclose their symptoms were more likely to undergo TB evaluation. Further studies are needed to assess why some patients do not disclose their TB related symptoms and interventions to improve likelihood of patients with TB symptoms informing health workers of their symptoms to enhance TB investigation.

Our study found that patients with cough for more than 2 weeks were less likely to miss investigation compared to those with cough less than two weeks. This was because cough is the most common symptom of TB patients presented to health workers. This finding was not in agreement with a study in South Africa where cough duration was not statistically significant for TB investigation<sup>5</sup>. This implies that patients with symptoms suggestive of TB other than cough for more than 2 weeks were likely to be missed. Moreover, the majority of the study participants were HIV positive who should be screened for TB regardless of the duration of cough. Efforts to enhance community awareness about other TB symptoms such as weight loss, evening fevers and night sweats is critical in promoting case detection and treatment.

Unlike other studies that reported that having more than one symptom increased the likelihood of being tested for TB, we found that the number of symptoms a patient had was not statistically significant for TB investigations<sup>4</sup>.

The study has some limitations. This was a cross sectional study that mainly depended on self-reported responses that could be affected by recall bias. Additionally, this being a cross sectional study, we did not infer causality. We focused majorly on two entry points at the public health facility – Outpatient Department and HIV care clinic, which may affect generalizability of our findings at the public health facility.

## Conclusion

The study showed a high proportion of the patients with symptoms suggestive of TB disease did not have sputum and/or CXR requested for TB investigation, which translated into a high prevalence of missed opportunities for TB investigations. Patients who did not inform health workers about their symptoms and those that had shorter duration of cough were more likely to miss TB investigations, which highlights a critical knowledge gap among the patients and clinicians. We recommend studies to explore barriers and facilitators of disclosure of TB symptoms to enable formulation of effective interventions to empower people to improve likelihood of disclosing TB related symptoms.

## Declarations

### Ethics approval and consent to participate

Ethical approval was obtained from Makerere University School of Public Health Research and Ethics Committee (FWA00011353). Informed consent was obtained from all participants before divulging any information and collection of data. All methods were carried out in accordance with relevant guidelines and regulations.

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The datasets used during this study are available from the corresponding author on request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

None.

### **Authors' contributions**

All authors significantly contributed to the conceptualization, data collection, data analysis and interpretation, drafting and final approval of the manuscript.

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## Tables

**Table 1; Socio-demographic and clinical characteristics of the respondents**

<b>Characteristic</b>	<b>Frequency N=247</b>	<b>Percentage (%)</b>
<b>Entry point</b>		
ART Clinic	132	53.4
OPD	115	46.6
<b>Residence</b>		
Urban	128	51.8
Rural	119	48.2
<b>Sex</b>		
Female	161	65.2
Male	86	34.8
<b>Age</b>		
18-29	93	37.65
30-39	74	29.96
40-49	51	20.65
50 and above	29	11.74
<b>Education level</b>		
None	31	12.6
Primary	120	48.6
Secondary	82	33.2
Tertiary	14	5.7
<b>Employment status</b>		
Employed full-time	93	37.6
Employed part-time	55	22.3
Unemployed	69	27.9
Student	6	2.4
Other*	24	9.7
<b>Marital status</b>		
Married	69	27.9
Cohabiting	69	27.9

Single	53	21.5
Divorced	42	17.0
Widow	14	5.7
<b>Distance to health facility</b>		
<1km	33	13.4
1-5km	93	37.6
<5km	121	49.0
<b>Tuberculosis Symptoms</b>		
Cough	191	77.3
<b>Duration had the cough (n=191)</b>		
Less than 2 weeks	13	6.8
2 weeks to 4 weeks	116	60.7
>4 weeks	62	32.5
Persistent fevers	107	43.3
<b>Duration has had the persistent fevers (n=107)</b>		
Less than 2 weeks	22	20.6
2 weeks to 4 weeks	65	60.7
>4 weeks	20	18.7
Night sweats	95	38.5
<b>Duration of excessive sweats (n=95)</b>		
Less than 2 weeks	11	11.6
2 weeks to 4 weeks	35	36.8
>4 weeks	49	51.6

Unintentional weight loss	95	38.5
<b>Duration of unintentional weight loss (n = 95)</b>		
Less than 2 weeks	17	17.9
2 weeks to 4 weeks	36	37.9
>4 weeks	42	44.2
<b>Patients who knews their HIV status</b>	226	91.5
<b>HIV Positive</b>	144	63.7
<b>HIV positive on Anti-retroviral therapy</b>	139	96.5
<b>Patients who were referred to Health facility</b>	31	12.5
<b>Reason for visiting the facility</b>		
Getting Anti-retroviral drugs	109	44.1
Get treatment for cough	86	34.8
Others	52	21.1

Other\* (Farmer, commercial motorcycle transporters, Business, casual laborer)

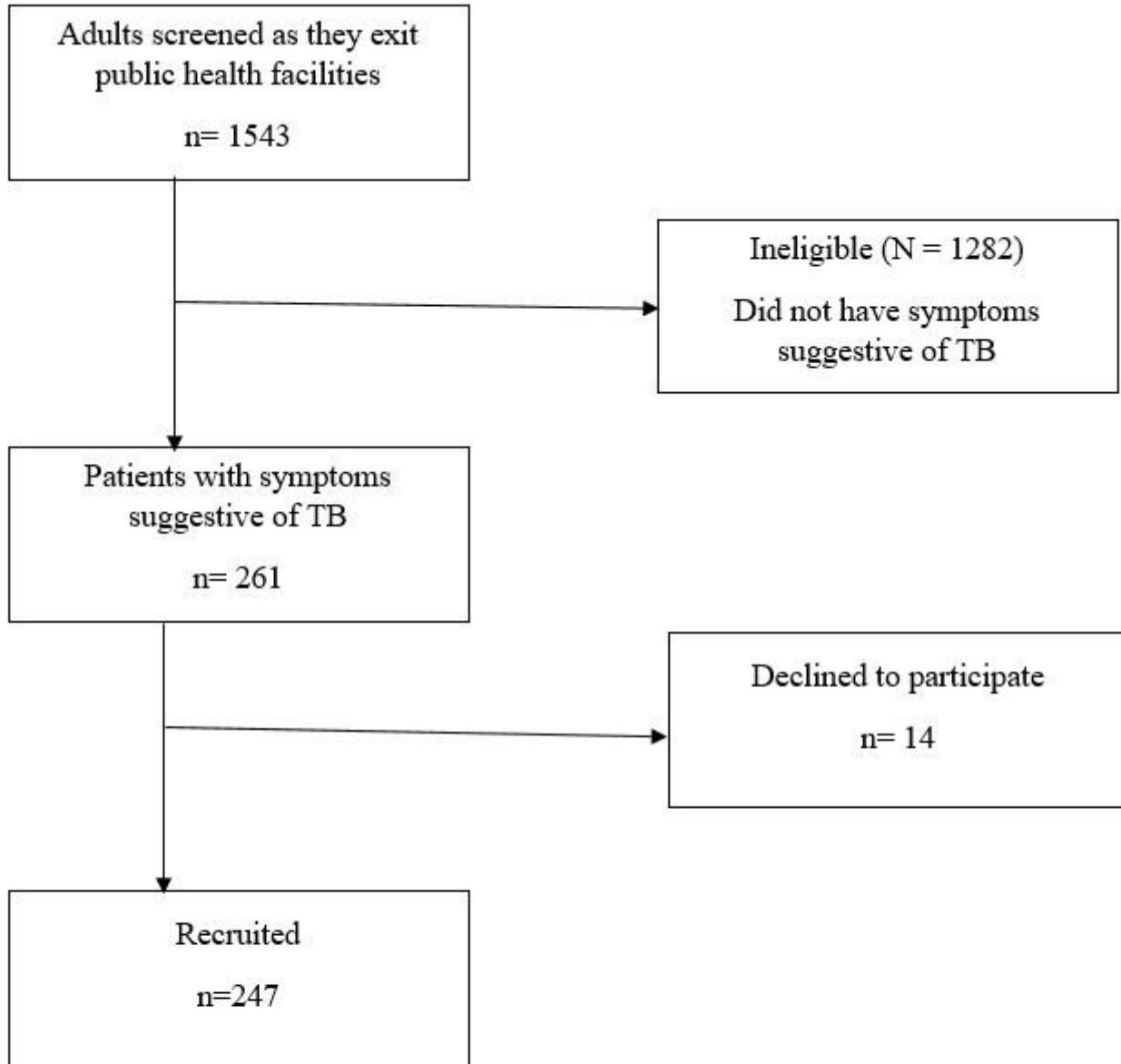
**Table 2: Factors Associated with Missed opportunities of TB investigations**

Variable	Missed Opportunities		PR (95%CI)	APR (95%CI)	P-value
	No (n=109)	Yes (n=138)			
<b>Sex</b>					
Male	45(42.3)	41(29.7)	1.0		
Female	64(58.7)	97(70.3)	1.26(0.98-1.63)	1.26(0.99-1.61)	0.101
<b>Age</b>					
18-29	38(34.9)	55(39.9)	1.0		
30-39	32(29.4)	42(30.4)	0.96(0.74-1.25)	1.20(0.93-1.56)	0.157
40-49	27(24.8)	24(17.4)	0.80(0.57-1.11)	0.92(0.67-1.27)	0.615
50 and above	12(11.0)	17(12.3)	0.99(0.70-1.41)	1.27(0.87-1.87)	0.220
<b>Education level</b>					
None	17(15.6)	14(10.1)	1.0		
Primary	52(47.7)	68(49.3)	1.25(0.83-1.91)	1.23(0.83-1.84)	0.301
Secondary and above	40(36.7)	56(40.6)	1.29(0.85-1.97)	1.20(0.80-1.77)	0.380
<b>Married</b>					
Yes	58(53.2)	80(58.0)	1.0		
No	51(46.8)	58(42.0)	0.92(0.73-1.15)	0.93(0.75-1.17)	0.545
<b>Cough duration</b>					
Less than 2 weeks	16(14.7)	53(38.4)	1.0		
2 weeks and more	93(85.3)	85(61.6)	0.62(0.51-0.76)	0.69(0.56-0.86)	0.001*
<b>Persistent fever duration</b>					
Less than 2 weeks	62(56.9)	100(72.5)	1.0		
2 weeks and more	47(43.1)	38(27.5)	0.72(0.55-0.95)	0.83 (0.611-1.12)	0.224
<b>Number of symptoms</b>					

One	30(27.5)	64(46.4)	1.0		
Two	39(35.8)	49(35.5)	0.82(0.65-1.03)	0.99(0.76-1.29)	0.949
Three	27(24.8)	15(10.9)	0.52(0.34-0.81)	0.70(0.45-1.10)	0.122
Four	13(11.9)	10(7.25)	0.64(0.39-1.04)	0.89(0.55-1.45)	0.642
<b>Informed health worker of TB symptoms</b>					
Yes	91(83.5)	69(50.0)	1.0	1.0	
No	18(16.5)	69(50.0)	<b>1.83(1.49-2.26)</b>	<b>1.68(1.36-2.08)</b>	<b>0.000*</b>

\*PR – prevalence ratio, APR – adjusted prevalence ratio

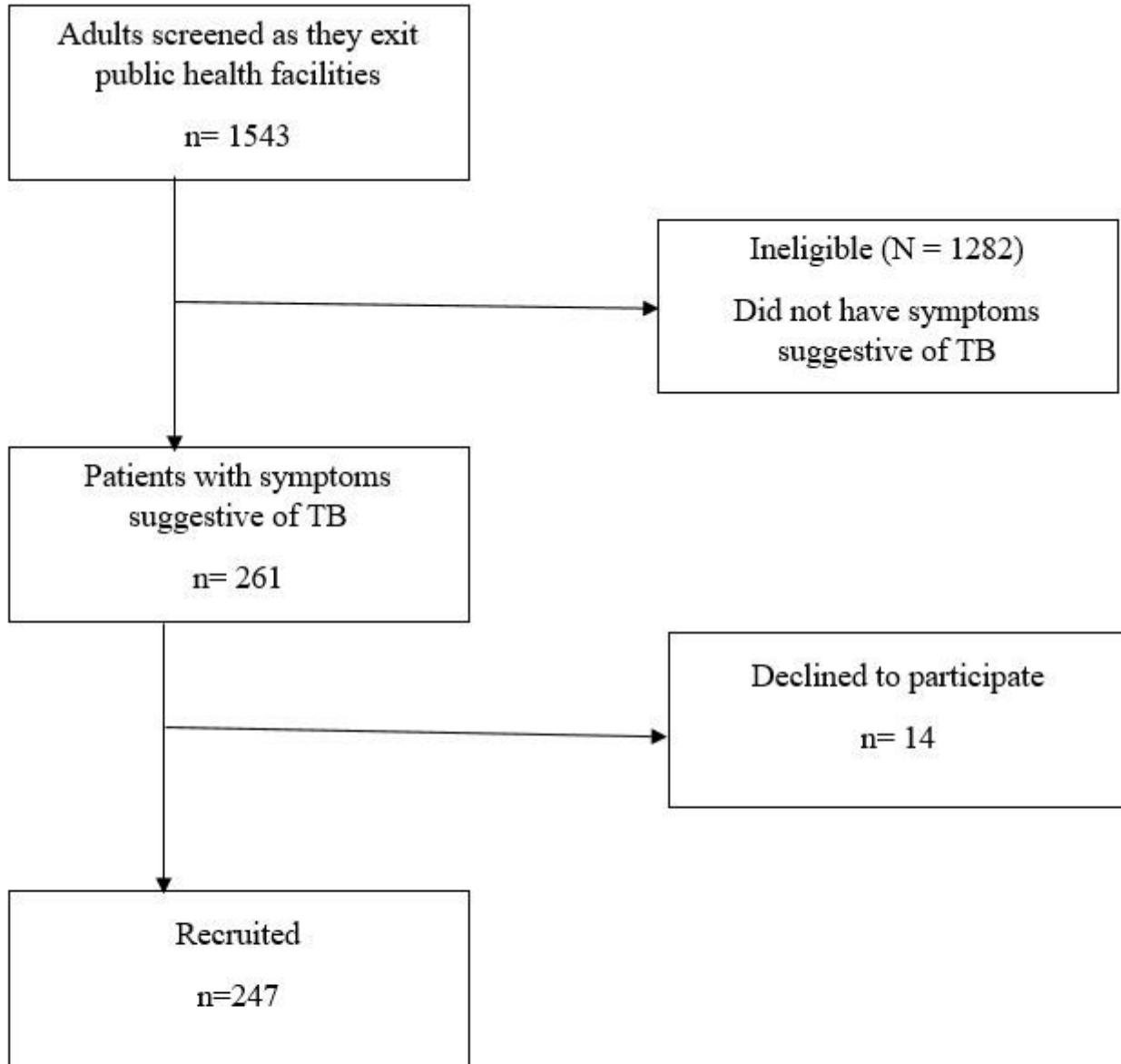
## Figures



**Note:** *Table 1 Socio-demographic and clinical characteristics of respondents included in the study (placed at end of document)*

**Figure 1**

Flowchart showing respondents included in the study



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**Figure 1**

Flowchart showing respondents included in the study