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Community-Based Active Case Finding to Increase Tuberculosis Case Detection and Treatment Success Rate in High Tuberculosis Burden Areas of Arsi Zone, Oromia

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Abstract: *Background*: More than 9 million new cases of tuberculosis (TB) occur per year and about two million people die of TB. The probable cause of death is delay in diagnosis, low case detection rate and treatment success rate. Due to the low potential of tuberculosis (TB) microscopic examination and the need to increase rate of new TB case identification is also increased. *Objective*: To determine magnitude of active tuberculosis cases, evaluate the performance of LED-FM and X-pert MTB/RIF assay and characterize treatment outcome *Methods*: The door-to-door survey for TB in high TB burden areas of Arsi zone was performed. The participants were screened based on typical TB symptoms. The sputum samples were collected and transported to the laboratories. Culture, LED-FM and X-pert MTB/RIF assay were performed to confirm tuberculosis infection. Result was communicated through cell phone or short message system (SMS) for issuing of positive results. The health extension worker would contact diagnosed patients referred to their local health center for care. Finally, the performance of diagnostic tests, case detection rate and treatment success were determined. *Result*: In this study 344 pulmonary TB suspected study participants were involved from the three study sites. Based on the LED microscope results the general prevalence of pulmonary TB among the current study participants was 2.3%. On the other hand Gene X-pert MTB/RIF assay could show that 9 (2.6%) of the study participants became positive for pulmonary TB cases. There was 1 (0.3%) discordant result between the two assay methods. LED microscope missed one TB suspected case which was detected by Gen X-pert MTB/RIF assay and then confirmed by LJ culture media and become positive for pulmonary TB. Hence, the overall prevalence of pulmonary TB in our current study became 2.6% with 95% CI (1.2-4.5) using LJ culture media as tiebreaker. Of 344 study participants in this study, 9 (2.6%) were positive for pulmonary TB and given first line anti-TB drugs. Of the nine pulmonary TB test positive study participants who had prescribed with first line anti-TB drugs in which 2 (22.2%) were known to be cured as well as 7 (77.8%) had completed the treatment regimen prescribed for them.

Keywords: MTB, Active Case Finding, Treatment Outcome

1. Introduction

Each year, more than nine million new cases of tuberculosis (TB) occur and about two million people die of TB. As a result of the interaction between TB and human immunodeficiency virus (HIV) infection, TB incidence is rising in sub-Saharan Africa [10]. TB is among the leading causes of death and sickness in Ethiopia [7]. One of the most important reasons for the high number of TB-related deaths in low-income countries is low case detection rate and lack of ideal diagnostic tests. Up to date, Culture is the gold standard for TB diagnosis. However, it requires expensive and sophisticated laboratory facilities, and it is not able to provide a rapid result for the clinical management of severe cases. Conventional light microscopic screening of Ziehl Neelsen (ZN) stained sputum smears is still the mainstay of TB diagnosis in rural settings. But conventional light microscopy has lower sensitivity particularly in HIV-positive patients, extra pulmonary TB

cases, children and patients with low bacterial load [14].

Fluorescence microscopy (FM) using auramine-stained sputum smears has been developed to overcome the limitation of conventional light microscopy and better performances were reported [7]. However, the cost of FM could not allow their widely implementation in most TB-burden resource-limited settings. As a result cheaper FMs with light-emitting diodes (LED) are made available and recommended by the WHO as an alternative to the expensive FM [9, 14]. Despite this WHO endorsement the LED-FM technology is less employed for TB diagnosis in many areas [15]. Ethiopia which is one of the top-five high TB-burden countries in Africa [12] has the LED-FM facility in some of its hospitals but the tool is at best underutilized. Various technical challenges such as quality control, acceptability, and ease may be possible factors for the reluctance of local authorities and laboratory staff in introducing the tool. In fact some studies recorded lower specificity of LED-FM compared to conventional microscopy [16]. It was suggested that this comparatively lower LED-FM might be attributed to the WHO advocates [14] stating low threshold for positivity of FM (≥1 acid-fast bacillus/smear). LED-FM performance can possibly be impacted by sputum processing and only limited studies addressed this factor. Therefore, further studies are warranted to evaluate the optimal technical conditions to fully implement this technology under different endemic settings and patient conditions. Studies undertaken in several TB endemic localities demonstrated the high sensitivity and specificity of Xpert MTB assay for detecting Pulmonary TB. The additional advantage of this test is its ability to diagnose drug susceptibility which could only be diagnosed from the growth of the acid-fat bacteria in culture taking as long as six weeks and needs high bio-safety labs and costly previously. The determination of drug susceptibility is particularly relevant because *M. tuberculosis* becomes increasingly resistant to two of the major anti-tuberculosis drugs, isoniazide and rifampicin leading to the rapid global emergence of multi-drug-resistant tuberculosis (MDR-TB]. As a result, the WHO has recommended the Xpert MTB/RIF assay for national TB programmes in low-income countries in December 2010 as a new rapid TB test. However, these data come from clinical trials, and information about the performance of Xpert MTB/RIF in real life situations is desirable before its worldwide implementation [2, 12, 14].

There was no as such combined TB control program in Ethiopia before 1992; after 1992 the country started new program to consider accessible rural communities that enable the country to reach about 71% geographic areas. 95% of the health institutions give DOTs serves in Ethiopia; but 40% of the population can't access the health service. The available data show that the annual incidence and prevalence of all forms of TB is 356 and 533 per 10^5 populations, respectively. The case notification rate for all forms TB is 166 per 10^5 populations [13, 16]. The annual incidence of smear positive TB is 155 cases 10^5 populations. The case notification of smear positive TB cases is 56 per 10^5 populations. The case detection rate of all forms and smear positive cases is 47% and 36% respectively. The proportion of patients who are cured and completed treatment (treatment success rate) is about 76% [7]. With the current low TB case detection and treatment success in Ethiopia [15]; it is better to evaluate the performance of LED-FM and Xpert MTB/RIF assay which was not evaluated yet in the country. Therefore the aim of this study is to assess the diagnostic performance of LED-FM and Xpert MTB/RIF for the diagnosis of TB compared with the gold standard culture. Since both LED and Xpert MTB/RIF instruments are available at Asella, College of Health Sciences. Because of high prevalence of TB cases in selected districts of Arsi zone, I have developed an interest to do to find active TB cases and treatment success on the basis of the performance of these two equipments. The aim of this study would be to evaluate the performance of LED-FM and X pert MTB/RIF assay for active case finding of TB in the community and determine its impact on TB case detection, treatment uptake and outcome.

2. Material and Methods

2.1. Study Area

Arsi zone is located south east to Addis Ababa, capital city of Ethiopia, in Oromia regional state. Asella is its major administrates seat and has 24 rural districts with their small respective towns. Arsi zone is the most populated zone in Oromia with about 3.1 million peoples within an area of 21,120 km^2 which means 148 peoples per km. as data indicate 89% and 11% peoples have been living rural and urban, respectively. Data show again 70% of the zonal population live two-hours walking distance from the public health facility [11]. Out of 24 rural districts, four district with high TB prevalence's [9] namely Dodota ($314.2/10^5$), Hetosa ($162.9/10^5$), Lode Hitosa ($146.7/10^5$), Merti ($171.1/10^5$). The first districts were considered for the current study.

2.2. Study Design

A cross-sectional study was conducted. Trained health care providers and Health extension workers would perform door-to-door surveillance of tuberculosis case. Training that focuses on symptoms and transmission of TB, how to identify TB suspects, how to collect, label, store and transport sputum specimens, administer DOT, and follow patients during treatment was given to them for five days. They would screen all available household members for symptoms suggestive of TB, defined as any cough, unintentional weight loss, fever, night sweats or hemoptysis. All consenting adults aged 15 or more with a positive TB symptom screen (any of the above) were interviewed using a standardized questionnaire in the local language. Cases detected during the survey who had already started TB treatment would not be considered as actively detected cases.

2.3. Sample Size

The sample size was determined using the formula for estimating a single population proportion [3].

That means,

$$n = \frac{(Z\,\alpha/2)^2\,p\,(1-p)}{d^2}$$

Where: n is the required sample size, the value of Z in the standard normal distribution that corresponds to α-level 0.05, p is assuming proportion of LED fluorescent microscopy or Xpert MTB/RIF performances for the diagnosis of TB patient, d the margin of error (precision) =5%. Considering the previous study the p value is 0.34 for LED fluorescent microscopy as reported by Abdissa *et al* [1] and 0.075 for Xpert MTB/RIF as reported from Fantahun *et al* [5]. Thus n can be 344 or 107 taking in to account the two scenarios. Then the sample size for the study was 344 considering the maximum achievable value from the previous prevalence of tuberculosis determined using the two cases. The suspected participants were recruited prospectively in a consecutive manner until the estimated sample size was obtained. Socio-demographic and clinical data were obtained through pre-tested structured questionnaires.

2.4. Sample Collection

Trained health care provider and health extension worker would collect the specimens at home according to the following scheme: (Spot – Morning _Spot)). At least 4-5mL sputum sample was collected after a deep productive cough from each participants. Then the patient was instructed by health professionals to make ready morning sputum in another container. After collecting morning sputum sample, the third container was again given to the suspected individual to provide the second spot sputum sample. The total of three sputum samples were collected from suspected TB cases. The participants were instructed on how to produce a good quality sputum specimen following a standard operating procedure [8]. The containers were closed tightly after sputum collection. Specimens were transported daily to the health center, where all cases were registered in the ‘‘sputum’’ registry and health center staff would prepare the slides. Subsequently, the concerned health professional would facilitate the transport of slides and specimens to the Asella teaching and referral hospital. Fresh specimens for Xpert and culture (when indicated) were packed in secured, cool boxes and brought to Asella teaching and referral hospital.

2.5. Sample Processing

Sputum samples were smeared on new and clean frosted slides, stained with staining reagents and then examined with LED-FM. Laboratory procedure. Direct examination for acid-fast bacilli were done with LED fluorescence microscopes using auramine O staining and potassium permanganate counterstaining and a single gene X-pert assay was done on a random spot or morning specimen according to the manufacturer instructions. A single culture would be performed on Lowenstein- Jensen, LJ for all participants following standard operating procedures of the laboratory. Cultures would be considered negative if no growth obtained after 8 weeks.

2.6. Sample Analysis and Quality Control

The first spot sputum samples were diagnosed with LED fluorescent microscopy on the same collection day. Both the morning and the second spot sputum samples were again diagnosed with LED microscopy. The quality control for LED microscopy can be done according to the protocol given by FIND [1]. But the morning sputum samples were further diagnosed with X-pert MTB/RIF assay and half of the samples were stored in the refrigerator (2-8°C) for the maximum of seven days. Each tests were conducted according to the protocol given by Cepheid [2] to ensure the quality control of X-per MTB/RIF assay. Finally, the remaining samples were transported, in cold chain, from Asella teaching and referral hospital laboratory to the Oromia regional TB laboratory for culture. The quality of the Lowenstein-Jensen (LJ) medium to grow Mycobacteria was checked as per the protocol already used [4].

2.7. Patient Management and Follow-up

As soon as available, positive results from smear microscopy or X-pert by short message system (SMS) to the respective extension worker, who (ideally within 24 h) contacted the participant either directly or via the community health volunteer. Smear or X-pert positive TB patients would be referred to the health center for initiation of TB treatment at their earliest convenience. Written results would be distributed to the health center at least once a week, including negative results. Incase smear microscopy was negative but TB symptoms persisted, individuals would be advised to contact the community health worker. They would be asked to submit two more sputum specimens (for repeat smear and X-pert), and referred for further diagnostic work-up including chest radiography as per national policy.

2.8. TB Treatment and Its Outcomes

First-line anti-TB drugs were started for all bacteriologically-positive cases as well as for individuals with a high clinical suspicion of smear-negative or extra-pulmonary TB according to the DOTS-strategy [14]. Extension health worker would actively track patients who would drop out after diagnosis, or interrupt treatment and encourage them to initiate or complete TB treatment. Treatment outcomes were abstracted from the health centers or hospital treatment registers in the first place. We reported treatment outcomes as cured, treatment completed, treatment failed, died, lost to follow-up, or not evaluated which are in line with the latest World Health Organization's definitions [15].

2.9. Data Analysis

Patients’ demographic and clinical characteristics were described in terms of percentages, and medians. We calculated frequencies, proportions and 95% confidence intervals (95% CI). The results of laboratory tests entered into SPSS version 20 and analyzed. Sensitivity, specificity, negative predicative value, positive predicative value of

LED-microscopy and X-pert MTB/RIF were calculated against the gold standard. The proportion for case detection and treatment outcomes was assessed.

2.10. Ethical Considerations

Ethical approval was obtained from the College of Health Sciences, Arsi University. The purpose and benefit of the study was explained to each study subject and those who give Informed consent was included in the study.

3. Results

Active community based TB case finding research study was conducted in Oromia regional state Arsi zone at three study sites namely Dodota, Sire and Hetosa districts. In this study 344 pulmonary TB suspected study participants were involved from the three study sites. Among the study participants 138 (40.1%) were males and 206 (59.9%) were female participants. Marital status of the current study participants was single 44 (12.8%), married 273 (79.4%), divorced 7 (2.0%) and widowed 20 (5.8%). 201 (58.4%) of the respondents have no formal education, 3 (0.9%) respondents have literacy class only, 121 (35.2%) respondents have attended elementary school, 17 (4.9%) respondents followed high school education and 2 (0.6%) of the them have college and above education level. Of the 344 our study participants, 92 (26.7%) were urban residents and the remaining 252 (73.7%) were rural residents Occupation distribution of the respondents was employee 8 (2.3%), laborer 49 (14.2%), pensioner 5 (1.5%), student 39 (11.3%), house wife 158 (45.9%), non-worker 28 (8.1%) and other 57 (16.6%). The age of the study participants was range from 8 to 88 years with mean of 44.34 and standard deviation of 19.5. 103 (29.9%) of the respondents had 1-3 family members, 196 (57.0%) of them had 4-7 family members, whereas 45 (13.1%) of the respondents had greater than seven family members during data collection period of the current study, table 1.

Of 344 study participants 196 (57%) had responded that they had been living in the house that had only 1-2 rooms, 104 (30.2%) of the respondents had been living in the house with 3-4 rooms whereas the remained 44 (12.8%) study participants had been living in the house which had greater than 4 rooms. 101 (29.4%) study participants responded that their homes are less than two kilometers away from the health institution located in their vicinity; 84 (24.4%) of the respondents lived 3-5kms away from the health institutions which found in their localities. Other 85 (24.7%) of the respondents were 6-10kms away from health institutions find in their areas of living; likewise, the remained 74 (21.5%) of them did respond that they must go more than 10kms to reach at health institutions in their surroundings. Of all study participants, 17 (4.9%) were smokers, 93 (27%) of them had habit of consuming different types of alcohols. Regarding the general health status of the respondents, 2 (0.6%) had known to have confirmed HIV infection, 4 (1.2%) had history of liver diseases, 39 (11.3%) had history of renal diseases, and 4 (1.2%) had history of other diseases, table 2.

Table 1. *Demographic data distribution of the study participants June, 2018.*

Demographic Factors		Count	Column N%
Gender of the respondent	Male	138	40.1%
	Female	206	59.9%
	Total	344	100.0%
Marriage status of the respondent	Single	44	12.8%
	Married	273	79.4%
	Divorced	7	2.0%
	Widowed	20	5.8%
	Total	344	100.0%
Education status of the respondent	No formal school	201	58.4%
	Elementary school only	121	35.2%
	High school	17	4.9%
	College and above	2	0.6%
	Literacy class only	3	0.9%
	Total	344	100.0%
Residency of the respondent	Urban	92	26.7%
	Rural	252	73.3%
	Total	344	100.0%
occupation of the respondent	Employee	8	2.3%
	Laborer	49	14.2%
	Pensioner	5	1.5%
	Student	39	11.3%
	House wife	158	45.9%
	Non-worker	28	8.1%
	Other	57	16.6%
	Total	344	100.0%
Number of family members of the respondent	1-3	103	29.9%
	4-7	196	57.0%
	>7	45	13.1%
	Total	344	100.0%

Table 2. *Distribution of risk factors and history of previous TB and other illness of the respondents, June, 2018.*

Risk factors and previous illness	Responses	Count	Column N%
Smoking status of the respondent	Yes	18	5.2%
	No	326	94.8%
	Total	344	100.0%
Alcohol consumption of the respondent	Yes	93	27.0%
	No	251	73.0%
	Total	344	100.0%
Sick from diabetics	Yes	0	0.0%
	No	344	100.0%
	Total	344	100.0%
Sick from HIV/AIDS	Yes	2	0.6%
	No	342	99.4%
	Total	344	100.0%
History of liver disease	Yes	4	1.2%
	No	340	98.8%
	Total	344	100.0%
History of renal disease	Yes	39	11.3%
	no	305	88.7%
	Total	344	100.0%
History of other type of disease	Yes	4	1.2%
	No	340	98.8%
	Total	344	100.0%
History of previous TB disease	Yes	28	8.1%
	No	316	91.9%
	Total	344	100.0%

In respect to clinical sign and symptoms among the current study participants, 339 (98.5%) of the respondents had history of coughing more than two weeks, 92 (26.7%) had sputum tunged with blood, 194 (56.4%) had history of

unknown fever, 304 (88.4%) had history of night sweatiness, 274 (79.7%) had history of difficulty of breathing, 275 (79.9%) had history of chest pain, 216 (62.8%) had history weight loss, 50 (14.5%) had history of enlarged lymph nodes whereas 28 (8.1%) had history of previous TB cases, table 3. LED microscope based analysis of the sputum samples collected from the current study participants showed that eight (8) out of the 344 participants were positive with moderate (1+) to most (2+ to 3+) TB bacilli. This means that based on the LED microscope results the general prevalence of pulmonary TB among the current study participants was 2.3%. On the other hand Gene X-pert MTB/RIF assay could show that 9 (2.6%) of the study participants became positive for pulmonary TB cases. There was 1 (0.3%) discordant result between the two assay methods. LED microscope missed one TB suspected case which was detected by Gen X-pert MTB/RIF assay and then confirmed by LJ culture media and become positive for pulmonary TB. Hence, the overall prevalence of pulmonary TB in our current study became 2.6% with 95% CI (1.2-4.5) using LJ culture media as tiebreaker between the two assay methods (LED microscope and Gene x-pert/. As to our protocol we used all sputum samples collected from the study participants which have concordant results between LED microscope and Gene x-pert MTB/RIF assay results were not to be cultured on the LJ media. Any discordant result between the two assays must be undergone culturing on the LJ culture media to break the tie between the two assay methods, table 4.

Table 3. *History of clinical sign and symptoms of the study participants, June, 2018.*

Clinical Sign and Symptom	Responses	Count	Column N%
Coughing more than two weeks	Yes	339	98.5%
	No	5	1.5%
	Total	344	100.0%
Sputum tunged with blood	Yes	92	26.7%
	No	252	73.3%
	Total	344	100.0%
History of unknown fever	Yes	194	56.4%
	No	150	43.6%
	Total	344	100.0%
History of night sweatiness	Yes	304	88.4%
	No	40	11.6%
	Total	344	100.0%
History of difficulty of breathing	Yes	274	79.7%
	No	70	20.3%
	Total	344	100.0%
History of chest pain	Yes	275	79.9%
	No	67	19.5%
	11	2	0.6%
	Total	344	100.0%
History of weight loss	Yes	216	62.8%
	No	128	37.2%
	Total	344	100.0%
History of enlarged lymph node	Yes	50	14.5%
	No	294	85.5%
	Total	344	100.0%

Table 4. *Result of sputum analysis by LED microscope, Gene X-pert MTB/RIF assay and culture on LJ culture media, June, 2018.*

Culture growth and Gene x-pert result				LED microscope result			
				smear negative	Moderate (1)	Most (2-3+)	Total
				Count (Column N%)	Count (Column N%)	Count (Column N%)	Count (Column N%)
Culture growth on LJ media	growth seen	X-pert MTB/RIF assay result	Detected and sensitive	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)
	Not needed	X-pert MTB/RIF assay result	Detected and sensitive	0 (0.0%)	2 (100.0%)	6 (100.0%)	8 (2.3%)
			Not detected	335 (100.0%)	0 (0.0%)	0 (0.0%)	335 (97.7%)

As to the treatment given and treatment outcome in the current study, of 344 study participants in this study, 9 (2.6%) were positive for pulmonary TB and given first line anti-TB drugs. Of the nine pulmonary TB test positive study participants who had prescribed with first line anti-TB drugs in which 2 (22.2%) were known to be cured as well as 7 (77.8%) had completed the treatment regimen prescribed for them, table 5. Gender based distribution of pulmonary tuberculosis (PTB) was 4 (2.9%) among males and 5 (2.4%) among females this study participants. The odds of PTB positivity among males was 1.2 times than females counter parts; (AOR=1.2, 95%CI=0.32-6.33). On other hand PTB was 1 (14.3%) in divorced, 7 (2.6%) in married and 1 (2.3%) in single individuals who had been participated in this study. Likewise, PTB distribution was significantly associated with level of education of the study participants. In such a way, PTB was 5 (2.5%) in individuals who had not attended formal education, 3 (2.5%) among individuals who had attended only elementary schools, 1 (5.6%) among study participants who had attended high schools and no PTB infection was examined among study participants who attended college and above educational levels. In this case the large chi-square statistics (27.8) and its smaller significance level ($p<0.000$) indicates that it is very unlikely that level of education of an individual and PTB positivity are independent of each other. Thus, it can be clearly stated that as the level of education of a person increased awareness to ward means of mycobacterium transmission and means of protection are expected to be increased so that the rate of being positive for PTB becomes decreased. In our study we could identify that 6 (6.9%) urban residents become positive for PTB in this study; whereas prevalence of pulmonary TB was 3 (1.2%) among rural residents who had involved in the current study. Hence, urban residents who participated in this

study were 5.7 times more likely become PTB positive when compared to the rural counter parts; AOR=5.7, (95%CI=1.42-23.66). Occupational wise distribution of PTB, house wives 5 (3.2%), laborer 2 (4.1%), employee 1 (12.5%) and other work 1 (1.8%). 5 (2.6%) study participants who had 4-7 family members had become PTB positive compared to those participants who had family members 1-3 in their homes. 2 (2.2%) of study participants who had history of alcohol consumption became positive for PTB, table 6.

Table 5. *Treatment given versus its outcome, June, 2018.*

		Treatment given							
		1st line drugs		2nd line drugs		Not needed		Total	
		Count	Column N%	Count	Column N%	Count	Column N%	Count	Column N%
Treatment outcome	cured	2	22.2%	0	0.0%	0	0.0%	2	0.6%
	completed	7	77.8%	0	0.0%	0	0.0%	7	2.0%
	failed	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Died	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Lost to follow up	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Not evaluated	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Not applicable	0	0.0%	0	0.0%	335	100.0%	335	97.4%

Table 6. *Distribution of pulmonary TB positivity in relation to Socio-demographic features of the study participants, June, 2018.*

Socio-demographic factors		Pulmonary TB				AOR (95%CI)	Chi-square test	P-value
		positive		negative				
		Count	Row N%	Count	Row N%			
Gender of the respondent	Male	4	2.9%	134	97.1%	1.2 (0.32-6.33)	0.72	0.788
	Female	5	2.4%	201	97.6%			
Marriage status of the respondent	Single	1	2.3%	43	97.7%		4.3	0.231
	Married	7	2.6%	266	97.4%			
	Divorced	1	14.3%	6	85.7%			
	Widowed	0	0.0%	20	100%			
Education status of the respondent	No formal school	5	2.5%	196	97.5%		27.8	0.000
	Elementary school only	3	2.5%	118	97.5%			
	High school	1	5.9%	16	94.1%			
	College and above	0	0.0%	2	100.0%			
	Literacy class only	0	0.0%	3	100.0%			
	Total	9	2.6%	335	97.4%			
Residency of the respondent	Urban	6	6.9%	86	93.1%	5.7 (1.42-23.66)	7.5	0.006
	Rural	3	1.2%	249	98.8%			
Current occupation of the respondent	Employee	1	12.5%	7	87.5%	1	5.8	0.45
	Laborer	2	4.1%	47	95.9%			
	Pensioner	0	0.0%	5	100.0%			
	Student	0	0.0%	39	100.0%			
	House wife	5	3.2%	153	96.8%			
	Non-worker	0	0.0%	28	100.0%			
	Other	1	1.8%	56	98.2%			
	Total	9	2.6%	335	97.4%			
No of family members of the respondent	1-3	4	3.9%	99	96.1%		1.86	0.934
	4-7	5	2.6%	191	97.4%			
	>7	0	0.0%	45	100.0%			
	Total	9	2.6%	335	97.4%			
Alcohol consumption of the respondent	Yes	2	2.2%	91	97.8%	0.8 (0.2-3.8)	0.109	0.742
	No	7	2.8%	244	97.2%			

There was no PTB infection seen among study participants had history of previous sickness from diabetic mellitus, HIV/AIDS and other types of diseases such as Acute feveral illness (AFI). 25% of individuals who had history of liver disease was positive for PTB in which individuals who had liver disease were 14 times more likely to became PTB positive, table 7. 7 out of 332 (2.1%) study participants who had history of coughing more than two weeks became positive for PTB in which individual with such clinical symptom became 1.6 more likely to be PTB positive compared to the counter parts, AOR=1.6, (95%CI=0.9-4.7, p<0.000). Thus, history of coughing more than two weeks is statistically significant associated to PTB. 88 study participants had history of sputum tunged with blood of which 4 (4.3%) became positive for pulmonary TB in the current study. Individuals had history of sputum tunged with blood were 2.2 times at risk to become PTB positive in comparison to the counter parts, AOR=2.2, (95%CI=0.6-8.0, p<0.224). In similar fashion, study participants with history of unknown fever 3 out of 191 or 1.5% were positive for PTB in this study in which having history of unknown fever associated to PTB positivity 0.3 times than those with such clinical symptom; AOR=0.39, (95%CI=0.1-1.5, p<0.157). All study participants with certain clinical symptoms like

History of night sweatiness, difficulty of breathing, chest pain and weight loss became positive for PTB. Of which history of weight loss was statistically significantly associated with PTB positivity in this study; chi-square test=5.48, p<0.019. 6 out of 44 or 12% study participants with history of enlarged lymph nodes become positive for PTB whish is statistically significant, AOR=12, (95%CI=2.7-51.3, p<0.000). The larger the chi-square statistic (20.22) and its small significance level (p<0.000) indicates that it is unlikely that history of enlarged lymph nodes and pulmonary TB positivity are independent of each other. It can be clearly stated that there is a strong association between history of enlarged lymph nodes and positive PTB, table 8.

Table 7. *Distributions of pulmonary TB in association with other sickness among the study participants, June, 2018.*

History of Previous sickness		Pulmonary TB				AOR (95%CI)	Chi-square	P-value
		positive		negative				
		Count	Row N%	Count	Row N%			
Sick from diabetics	Yes	0	0.0%	0	0.0%			
	No	9	2.6%	335	97.4%	1		
	Total	9	2.6%	335	97.4%			
Sick from HIV/AIDS	Yes	0	0.0%	2	100.0%			
	No	9	2.6%	333	97.4%	1.03 (1.01-1.5)	0.54	0.816
	Total	9	2.6%	335	97.4%			
History of liver disease	Yes	1	25.0%	3	75.0%			
	No	8	2.4%	332	97.6%	14 (5.0-56.0)	8.00	0.005
	Total	9	2.6%	335	97.4%			
History of renal disease	Yes	2	5.1%	37	94.9%			
	no	7	2.3%	298	97.7%	2.3 (0.5-11.5)	1.089	0.297
	Total	9	2.6%	335	97.4%			
History of other type of disease	Yes	0	0.0%	4	100.0%			
	No	9	2.6%	331	97.4%	1.03 (1.01-1.05)	0.109	0.742
	Total	9	2.6%	335	97.4%			

Table 8. *Distribution of pulmonary TB among the study participants in association with history of clinical symptoms, June, 2018.*

History of clinical symptoms		Pulmonary TB				AOR (95%C)	Chi-square test	P-value
		positive		negative				
		Count	Row N%	Count	Row N%			
Coughing more than two weeks	Yes	7	2.1%	332	97.9%			
	No	2	40.0%	3	60.0%	1.6 (0.9-4.7)	27.8	0.000
	Total	9	2.6%	335	97.4%			
Sputum tunged with blood	Yes	4	4.3%	88	95.7%			
	No	5	2.0%	247	98.0%	2.2 (0.6-8.0)	1.48	0.224
	Total	9	2.6%	335	97.4%			
History of unknown fever	Yes	3	1.5%	191	98.5%			
	No	6	4.0%	144	96.0%	0.39 (0.1-1.5)	2.0	0.157
	Total	9	2.6%	335	97.4%			
History of night sweatiness	Yes	9	3.0%	295	97.0%			
	No	0	0.0%	40	100.0%	0.97 (0.95-0.99)	1.22	0.270
	Total	9	2.6%	335	97.4%			
History of difficulty of breathing	Yes	9	3.3%	265	96.7%			
	No	0	0.0%	70	100.0%	0.97 (0.94-0.99)	2.36	0.124
	Total	9	2.6%	335	97.4%			
History of chest pain	Yes	9	3.3%	266	96.7%			
	No	0	0.0%	69	100.0%	1	2.32	0.314
	Total	9	2.6%	335	97.4%			
History of weight loss	Yes	9	4.2%	207	95.8%			
	No	0	0.0%	128	100.0%	0.96 (0.93-0.99)	5.48	0.019
	Total	9	2.6%	335	97.4%			
History of enlarged lymph node	Yes	6	12.0%	44	88.0%			
	No	3	1.0%	291	99.0%	12 (2.7-51.3)	20.22	0.000
	Total	9	2.6%	335	97.4%			
History of previous TB infection	Yes	0	0.0%	28	100.0%			
	No	9	2.8%	307	97.2%	1.03 (1.01-1.05)	0.82	0.366
	Total	9	2.6%	335	97.4%			

4. Discussion

It is recommended that early diagnosis and treatment of TB has substantial outcome in reducing the transmission, its endemicity and cost of controlling TB. This study shows that active community-based case finding is feasible on a limited budget and that the yield can be high. In this study we

conduct community based TB case finding by using the three TB diagnosing modalities which are LED florescent microscope, gene x-pert, and culture as a confirmatory if there is discordant results between the first two methods. LED microscopic based examination of sputum samples collected from individuals who had history of coughing more than two weeks in the community was 2.3%. Whereas, Gene x-pert based analysis of the sample was revealed that 2.6% of the samples were positive for PTB. There was one discordant result between led florescent microscope and gene x-pert methods of sputum analysis. This discordant result was cultured on LJ culture media and became positive for MTB bacilli. Thus, the overall community based prevalence of pulmonary TB became 2.6% in the current study. All the cases that we could detect in this study were new PTB cases which were not come to the health facility. There was no default or previously TB infected individuals tested positive for pulmonary TB in our study. So, active case finding/ACF/ is very crucial especially in areas with high burden TB prevalence. In recent years, active case finding has been conducted in several high-burden countries, including Nepal, Cambodia, India, and Zimbabwe. In this study we analyzed only pulmonary TB cases extra pulmonary cases were not considered. Our find is in agreement with studies conducted in Ethiopia [22], South Africa [15], and Iran [23]. However, it is lower than other studies conducted in Ethiopia [5, 18], Nepal [19], South Africa [24, 26], Peru [26] and Nigeria [27]. On the other hand, we observed in our study that the outcome of the current study is higher than the finding of other studies from Ethiopia [20, 21], china [19], and New Guinea [17].

In our study we could observe that PTB was more prevalent in urban residents than the rural counter parts in which urban to rural ratio of PTB was 5.7:1. This may be due to exposure difference between the two groups in which in urban area there may high risk of exposure in the day to day activities of the study participants in which they might face asymptomatical carriers who can transmit the bacilli. There is other community based study that reached on the same conclusion that urban residents who were involved in that study were more affected compared to the rural counter parts [5, 11]. Prevalence of PTB was higher among male study participants than females with male to female ratio being 1.2:1. This finding is again in agreement with study results (8, 18) in which the same genders were more affected. The males to females ratio was lower in our finding compared to study conducted in Nepal [19]. This might be due to shorter period of the study or due to smaller sample size in our case. However, it is higher than research finding [17]. We observed that Pulmonary TB was highly prevalent among divorced women (14%) followed by married house wives (2.6%) than other female study participants. Similar study finding was reported from [8]. But lower than study finding reported from Peru [25]. In our study individuals who had no formal education were more affected with PTB compared to others with higher education levels. Similar study finding was reported from South Africa [24]. However, this is lower than study conducted in Ethiopia [5, 24]. We could find that PTB was highly prevalent (12.5%) among employed individuals than other study participants with different occupational activities. This finding is in agreement with research conducted in Iran [23]. However, it is lower than study from South Africa (28) and higher than research result from china (19). we did not observe PTB among the current study participants who did repose to the questionnaires having diabetic mellitus, HIV/AIDS and AFI during the study time. There were comparable study findings [5, 8]. Research reports from different countries had come up with different outcomes [24, 25]. Individuals who had liver, or renal diseases had high prevalence of PTB which was statistically significant. Studies [24, 15] reported similar results among individuals with similar diseases conditions. Study from [18, 23] reported different prevalence of PTB among these groups of individuals. In our active TB case finding study, most clinical symptoms which were complained by the respondents were associated with PTB positive cases in which seven PTB cases had coughing of more than two weeks, 4.3% cases had history of hemoptysis, 1.5% cases had history of fever, all or 9 (100%) cases of PTB had history of night sweatiness, difficulty of breathing, chest pain, and unknown cause of weight loss. 12% cases of PTB in the current study had history of enlarged lymph nodes. We could not observe PTB among study participants who had history of previous TB cases. All cases who had examined and become positive for PTB were new cases. Similar study conducted in Ethiopia and other countries [22, 26] reported comparable results. Whereas, our finding report result which is lower than other's study finding in association with some clinical symptoms but higher with other symptoms.

In assessing the treatment outcome of the treatment outcome the current study finding, we observed that 22.2% of individuals who were positive for PTB and took first line anti-TB drugs steak to the national TB treatment guide line were cured as we assessed from the health institution TB registration log book entered by the health professionals. This finding is also in agreement with study outcome [13, 14]. However, it is lower than research reported [4, 19] and higher when compared to study findings [23, 24]. This difference might be due to sample size, social difference, nutritional factors, genetic makeup that influence the immune reconstitution of an individuals and drug susceptibility of MTB variations. On the other hand, 78.8% cases had completed the prescribed first line anti-TB drugs during the study time. This is similar with study finding from south Africa [24, 26]. we did not see any resistant strains to the first line drugs prescribed to the patient in our finding. This is in opposite to other findings [4]. When we compare the case detection rate of LED florescent microscope 2.3% and gene X-pert 2.6%. Based on this difference in detecting the real positive PTB cases, LED florescent microscope has 88.8% sensitivity and 100% and 100% specificity. Whereas, gene X-pert has 100% sensitivity and 100% specificity to detect and identify PTB cases. This finding is almost similar with study results [1, 6]. The discordance ratio between the two assay methods is 11.5:1 which means we may miss almost 12 cases of PTB if we depend only on LED microscope sputum

examination for PTB diagnosis method. So that, combing the two assay especially during active case finding result in more yield than using LED microscope only. This is again comparable with result from LED microscope and gene X-pert MTB/RIF comparative study from Nepal [19]. However, research findings reported different discordance ratio between the two assays.

5. Conclusion and Recommendation

Current passive TB case finding approaches are insufficient to meet ambitious TB elimination targets, especially in endemic areas where the bulk of the "missing 3.5 million cases" reside. Until new breakthroughs in disease prevention occur, significant improvements in case detection will be essential if the global TB epidemic is to be overcome. Active Case Finding (ACF) interventions are likely to be feasible in all settings, but the scale and focus of these interventions will need to be contextualized and will inevitably be limited by available resources. When designing an ACF strategy, TB control programs should begin with easily identifiable high-risk target groups and then widen their scope of activities as resources allow. Further research is imperative to determine the most feasible and cost-effective ACF approaches in different settings. This study showed that the like hood and success of ACF with the use of GenX-pert as an additional diagnostic tool in the setting of a well-functioning TB program in rural Ethiopia. Application of these techniques revealed that TB prevalence was substantially higher than had been identified using routine passive staining technique in the communities targeted. Active community-based screening of this nature can add significant value to TB case detection and should be considered as a complementary strategy in high TB burden areas like in our case.

Authors' Disclosure

The authors declare that they have no competing interests.

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