Original Article

Determinants of Sputum Smear Positivity among Tuberculosis Suspected Patients in Bahir Dar City, Northwest Ethiopia

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Abstract

Background: Tuberculosis (TB), caused by mycobacterium tuberculosis, remains key global public health concern in terms of morbidity, mortality and cost for care. **Objective:** The study aimed at assessing sputum smear positivity and associated factors among TB suspected patients in Bahir Dar City, Ethiopia. **Methods:** Facility based cross sectional study was conducted among 283 TB suspected patients in2016. Data were collected using structured interviewer administered questionnaire, and processing of the leftover sputum samples. Spot-morning-spot sputum samples were collected, processed, and examined using Olympus microscope. Patients were grouped as positive if two sputum smears became positive. Data were edited and analysed using the SPSS verssion22. Various descriptive statistics were computed and factors to smear positivity were identified by multivariable logistic regression analysis and odds ratio at 95%CI and p-value <0.05 were considered to determine presence of statistical association. **Results:** A total of 283 TB suspects, 142(50.2%) male, were included in the study. Over half (55.8%) of them were under <35 years age category, and majority (70.3%) were Orthodox Christians. Over a third (35.7%) respondents had no education, and 72.4% of them were unemployed. The prevalence of smear positive pulmonary TB among participants was 43(15.2%) or (1519/100000). Younger age, cough ≥ 2weeks, no education, purulent sputum, HIV/AIDS, sputum collection orientation, sputum coughed from lung and staining quality were statistically significant (p-value <0.05) and showing positive association with smear positivity. **Conclusions:** This study showed the presence of high smear positive pulmonary TB among TB suspected patients. This clearly indicates that TB continues important public health challenge in Ethiopia. Patient factors, duration of cough, sample related characteristics, laboratory personnel related factors, and being HIV/AIDS patient statistical significant factors to sputum smear positivity. Improving TB suspected screening, staining quality, sample collection, and adherence to the national TB laboratory standards is crucial to increase smear positivity.

Keywords: Tuberculosis; Smear positivity; TB suspects; Bahir Dar City; Ethiopia

Abbreviations: AOR: Adjusted Odds Ratio, CI; Confidence Interval, COR; Crude Odds Ratio, DOTS; Directly Observed Treatment Short Course Chemotherapy, PTB; Pulmonary Tuberculosis, SPSS; Statistical Package Software For Social Sciences, TB; Tuberculosis and WHO; World Health Organization.

Introduction

Tuberculosis is a chronic infectious disease caused by various strains of mycobacterium, mainly Mycobacterium Tuberculosis, usually attacks the lung, but can also affect other parts of the body. [1-3] Main source of infection is untreated smear-positive pulmonary tuberculosis patients. [2,4] It remains as one of the top major public health problems worldwide and leading cause of mortality among people living with HIV/AIDS. Based on the 2016 WHO report, there were 10.4 million new TB cases globally in 2015: 5.9 million (56%) men, 3.5 million (34%) women and 1.0 million (10%) children. India, Indonesia, China, Nigeria, Pakistan and South Africa accounted 60% of world's TB. Similarly, there were an estimated 1.4 million TB deaths among HIV negative people and an additional 0.4 million deaths from people living with HIV/AIDS. [3]

Although TB is a global public health concern, it is largely affecting countries with poor socioeconomic conditions. [3,5-11] Developing world shared the global burden with highest rates; 56% of global cases in Asia and 28% in Africa. [12] Top African countries with high TB burden were Nigeria (570 000), South Africa (45000), Democratic Republic of Congo (240000), and Ethiopia (200000) TB cases. [3] As suggested by literatures, the high TB burden in Africa is related to low community awareness, resource shortage, poor healthcare services/availability, comorbidities such as HIV/AIDS, malaria, Diabetes Mellitus, and geographic inaccessibility. [3,5-7,9-12]

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Despite several interventions including providing TB detection and treatment services in both public and private healthcare facilities. [4,13,14] TB continues major public health concern in Ethiopia. [15] Research findings from different parts of Ethiopia supported the presence of high TB prevalence among TB suspected patients: 7.3% in Arsi zone, [9] 19.4% in Gamo Gofa, [16] 14.2% in Metehara hospital, [17] 4.6% in Southern Ethiopia [18] and 9.2% from south East Ethiopia. [19] In summary, based on various studies, TB prevalence ranges from 1.8 in Afar [20] to 21% in Eastern Ethiopia. [21]

One of the high TB burden Regions in Ethiopia is Amhara Regional State with 51% over all TB case detection rate which is lower than the national 61%. Different community and facility based studies showed that TB is major public health problem in Amhara Region: 4.5% in Dabat, [22] 155-203 per 100000 in West Gojjam, [23] 6.2% in Dessie hospital, [24] and 2.6% in Dessie and Debre Birhan. [25]

TB prevalence of TB is assumed to be high in Bahir Dar City since it is highly populated as a result of more street people and high migration from the rural settings [26] in addition to the permanent residents of 284,020 population, [27] and there is high patients flow from all parts of Amhara Region and nearby Regions like the Benishangual Gumuze (Metekel zone) as regular or referral cases to Felege hiwot Referral hospital (public), and Gambi and Adinas private hospitals. [28] The concern of high TB prevalence is also supported by few previous studies in Bahir Dar City. [29,30] Except few retrospective studies, [29,30] little is known about TB prevalence of the City using the primary data as facility and community based studies. Based on the 2016 Amhara Regional Health Bureau annual report, Bahir Dar zuria Woreda including Bahir Dar City were areas with higher TB reports. [28] On the other hand, there are private hospitals, higher and medium clinics providing TB detection and anti TB treatment services, [28] but TB prevalence among those private healthcare facilities was not studied before. TB prevalence status of both the public and private healthcare facilities needs to be known to talk about TB prevalence status of Bahir Dar City and gave appropriate and timely interventions.

Therefore, this study aimed at assessing the prevalence of sputum smear pulmonary TB and associated factors among TB suspected patients attending health facilities in Bahir Dar City, Northwest Ethiopia. Since pulmonary TB is the primary source to TB infection, we preferred to study on smear pulmonary TB. Findings of this study will be important to TB control program offices at the Amhara Regional health bureau, studied health facilities, City administration, and nongovernmental organizations to know prevalence of pulmonary TB and its associated factors so that they will have targeted intervention plans both at the public and private health facilities to improve smear positivity.

Methods and Materials

Study design and period

A facility based cross sectional study was conducted in 2016 to determine sputum smear pulmonary TB prevalence and associated factors among TB suspected patients visiting health facilities (Public and Private) in Bahir Dar City, Northwest Ethiopia.

Study area and setting

Bahir Dar City, the capital city of Amhara Regional State, is located 565 kilo meters in the Northwest of Addis Ababa, the capital city of Ethiopia. The City has nine urban and twelve rural Kebeles, the smallest administrative levels in Ethiopia. The City has an estimated total population of 284,020 (138,151 males, 145,869 females). [27,29] There are 18; two public hospitals, two private hospitals, 11 public health centres and 3 private higher clinics providing DOTs services in the City Administration. [28]

Sample size and sampling techniques

The sample size of this study was determined using Epi Info version7 considering the following assumptions: smear positivity rate (p) =21%, [21] 95% CI= ±1.96, degree of precision: 5% and 10% on-response rate. Then, the final sample size became 283. There were 18 total public and private health facilities offering TB diagnostic and treatment services in Bahir Dar City. Due to resource constraints, two-third (12 of total 18) facilities were included in the study through simple random selection technique. Thus, two public hospitals, 5 health centres, 2 private hospitals and 3 private higher clinics were recruited. Sample size to each health facility was allocated proportionally based on previous TB suspected patients visited each health facility. Hence, the sample size proportion was 168 from public and 115 from private health facilities. Pulmonary TB suspected patients aged >15 years were included in the study until we attained the required sample. Patients came for follow-up, gene expert and culture were excluded since our objective was prevalence of smear positive pulmonary TB.

Data collection tools and procedures

Pretested structured interviewer administered questionnaire was used to collect data on socio demographic (age, sex, residence, marital status, income, education, occupation…), cough duration, previous contact with TB cases, and facility service related data. Three consecutive left over sputum samples (spot-morning-spot) were used to determine the sputum smear PTB positivity among TB suspected patients. Simultaneously, records of TB suspects were reviewed from laboratory TB registration books to cross check sputum smear findings. One laboratory technologist supervisor and four laboratory technicians (data collectors) were participated in data collection after taking one day training. Data collectors did exit interview on TB suspected patients and reviewing TB laboratory registration logbooks for previous slide results. The three leftover sputum samples per TB suspect were processed using acid fast bacilli staining technique and examined through Olympus microscope.

TB suspects were grouped under pulmonary TB positives if two sputum slides read positive for mycobacterium TB [4] and after proved by senior laboratory technicians. However, in some cases, only one slide may become positive and be impossible

to bring additional samples. In that situation, a patient was considered positive with careful rechecking of slide reading, processing another slide from that leftover sample, and other patient evidences. Sputum source is a site from which sputum was collected (mouth or lung) and it was evaluated through observation of patients while collecting sputum samples. Staining quality can be defined as processing the smearing and staining steps as per the WHO staining standards. Sputum volume is the amount of sputum sample collected as per the WHO standard (minimum of 2-4 ml) required to process. [31]

Quality assurance

Data collectors and supervisors took a full day training on study objectives, data collection procedures and data confidentiality prior to actual data collection time. Pretesting of questionnaire, conducting supportive supervision of data collectors, processing and reading of leftover sputum as per WHO/national TB processing guideline, rereading of sputum smears by senior laboratory technicians who have more experiences on TB slide reading, and frequent manual and computer data edition were major tasks performed to assure data quality.

Data analysis

Data were edited and analysed using the SPSS verssion22. Various descriptive statistics were computed to describe study objectives. Bivariate and multivariable logistic regression analyses were employed to identify factors associated with sputum smear positivity. Variable associations on bivariate analysis were tested by the multivariable logistic regression analysis to control the confounding effect. The association between sputum smear positivity and independent variables was described using the odds ratio at 95% confidence interval (CI) and P-value < 0.05.

Ethical clearance

Ethical clearance was taken from the Bahir Dar University College of Medicine and Health Sciences Ethical Review Committee, and a support letter from Amhara Regional Health bureau. Informed consent was obtained from facility administrators and patients. Participation was fully voluntarily and patients of discordant results were, counselled and started anti TB treatment.

Results

Socio-demographic characteristics of TB suspected patients

Of the total 283 PTB suspected patients participated, half (50.2%) were male, 55.8% were under < 35 years age category, and 70.3% Orthodox Christians. Less than half (45.6% and 48.6%) of the respondents were married and had primary school education, respectively. About 54.8% of the respondents were from urban settings, and 27.6% were occupationally employed either at government or nongovernmental offices [Table 1].

Table 1: Socio-demographic characteristics of PTB suspects in Bahir Dar town, Ethiopia, 2016.

Variables	Response	Frequency (%)	Sputum smear positivity	
			Positive (%)	Negative (%)
Sex	Male	142 (50.2)	22 (15.5)	120 (84.5)
	Female	141 (49.8)	21 (14.9)	120 (84.5)
Age in years	<35	158 (55.8)	32 (11.3)	126 (44.5)
	≥35	125 (44.2)	11 (3.9)	114 (40.3)
Religion	Christians	199 (70.3)	31 (11.0)	168 (59.4)
	Muslims	84 (29.7)	12 (4.2)	72 (25.4)
Residence	Rural	128 (45.2)	23 (8.1)	105 (37.1)
	Urban	155 (54.8)	20 (7.1)	135 (47.7)
Marital status	Single	110 (38.9)	15 (5.3)	95 (33.5)
	Married	137 (48.4)	24 (8.5)	113 (40.0)
	Divorced	20 (7.1)	2 (0.7)	18 (6.4)
	Widowed	16 (5.7)	2 (0.7)	14 (4.9)
Education level	No education	101 (35.7)	10 (3.5)	91 (32.2)
	Only primary school	129 (45.6)	23 (8.1)	106 (37.5)
	Secondary and above	53 (18.7)	10 (3.5)	43 (15.2)
Occupation	Employed	78 (27.6)	9 (3.2)	69 (24.4)
	Un employed	205 (72.4)	34 (12.0)	171 (60.4)

Prevalence of smear positive pulmonary tuberculosis

The majority (71.7%) of the respondents gave three consecutive sputum samples. The rest 36(12.7%) and 44(15.5%) respondents knew their TB status using only morning and first spot sputum samples, respectively. The overall sputum smear positivity rate of PTB suspected patients was 43(15.2%) or 1519/100000 people. The proportion of smear positivity higher, 23(53.5%), among males, and 74.4% among younger age groups (<35 years of age). regarding TB positivity distribution per number of sputum samples, 26(60.5%) were by three consecutive sputum samples, 7(16.3%) only by spot, and 10(23.2%) were contributed only by morning sputum samples. The proportion of smear positivity was higher, 24(55.8%), in the private health facilities. Likewise, smear positivity was 36(83.7%) among respondents who had cough ≥ 2weeks [Table 2]. During the study, we found two discordant (1false negative and 1 false positive) results while comparing with routine procedures conducted by the health facility staffs.

Factors associated with sputum smear positivity

The multivariable logistic regression analysis identified important factors associated with smear positivity [Table 3]. The odds of being smear positive was 2.24 times more among respondents under <35 years age category compared to the odds of respondents ≥30 years age category (AOR=2.24, 95% CI= [1.18-4.15]). Respondents with no education were double times more likely to be TB smear positive compared to respondents

Table 2: Smear positivity rate among TB suspected patients in Bahir Dar Town, Ethiopia, 2016.

Variables	Response	Smear positivity		Total (%)
		Positive (%)	Negative (%)	
Number of sputum samples collected	Only 1st spot	7 (2.5)	37 (13.1)	44 (15.6)
	Only morning	10 (3.5)	26 (9.2)	36 (12.7)
	Spot-morning-spot	26 (9.2)	177 (62.5)	203 (71.7)
Sex	Male	23 (8.1)	119 (42.0)	142 (50.2)
	Female	20 (7.1)	121 (42.8)	141 (49.8)
Age in years	< 35	32 (11.3)	126 (44.5)	158 (55.8)
	≥ 35	11 (3.9)	114 (40.3)	125 (44.2)
Number of slides per individual	One slide	17 (6.0)	63 (22.3)	80 (28.3)
	Three slide	26 (9.2)	177 (62.5)	203 (71.7)
Health facility type	Private	24 (8.5)	91 (32.2)	115 (40.6)
	Governmental	19 (6.7)	149 (52.7)	168 (59.4)
Chough duration	< 2 weeks	7 (2.5)	147 (51.9)	154 (54.4)
	≥ 2 weeks	36 (12.7)	93 (32.9)	129 (45.6)
Previous TB contact	Yes	9 (3.2)	46 (16.3)	55 (19.4)
	No	34 (12.0)	194 (68.6)	228 (80.6)

Table 3: Factors associated with smear positivity in Bahir Dar Town, Northwest Ethiopia, 2016.

Variables	Response	Smear Positivity		COR 95% CI	AOR 95% CI
		Positive (%)	Negative (%)		
Sex	Male	23 (8.1)	119 (42.0)	1.17 (0.58-2.35)	0.84 (0.31-2.26)
	Female	20 (7.1)	121 (42.8)	1	1
Age in years	<35	32 (11.3)	126 (44.5)	2.63 (1.21-5.84)	2.24 (1.18-4.15)
	≥ 35	11 (3.9)	114 (40.3)	1	1
Religion	Christians	31 (11.0)	168 (59.4)	1.11 (0.51-2.43)	2.51 (0.81-7.80)
	Muslims	12 (4.2)	72 (25.4)	1	1
Education level	No education	9 (3.2)	92 (32.5)	2.38 (0.82-6.95)	2.13 (1.18-7.21)
	Only primary school	24 (8.5)	105 (37.1)	1.98 (0.41-2.42)	1.88 (0.49-7.10)
	Secondary school plus	10 (3.5)	43 (15.2)	1	1
Residence	Rural	21 (7.4)	107 (37.8)	1.19 (0.59-2.38)	1.12 (0.37-2.26)
	Urban	22 (7.8)	133 (47.0)	1	1
Occupation	Employed	10 (3.5)	68 (24.0)	1	1
	Unemployed	33 (11.7)	172 (60.8)	1.30 (0.58-30)	0.62 (0.12-2.10)
Health facility type	Private	24 (8.5)	91 (32.2)	2.07 (1.02-4.19)	1.56 (0.77-3.72)
	Governmental	19 (6.7)	149 (52.7)	1	1
Chough duration	< 2 weeks	7 (2.5)	147 (51.9)	1	1
	≥2 weeks	36 (12.7)	93 (32.9)	8.13 (3.3-20.96)	3.34 (1.51-10.21)
Previous TB contact	Yes	9 (3.2)	46 (16.3)	1.12 (0.46-2.64)	0.65 (0.18-2.45)
	No	34 (12.0)	194 (68.6)	1	1
Having SOP	Yes	35 (12.4)	216 (76.3)	0.49 (0.19-1.28)	0.44 (0.16-1.19)
	No	8 (2.8)	24 (8.5)	1	1
Sputum volume	≤ 4 ml	16 (5.7)	185 (65.4)	1	1
	> 4 ml	27 (9.5)	55 (19.4)	5.68 (2.7-11.97)	2.36 (0.77-7.24)
Bloody sputum	Yes	17 (6.0)	69 (24.4)	1.62 (0.78-3.33)	1.55 (0.52-2.28)
	No	26 (9.2)	171 (60.4)	1	1
Purulent sputum	Yes	16 (5.7)	52 (18.4)	2.14 (1.16-4.50)	1.8 (1.09-4.15)
	No	27 (9.5)	188 (66.4)	1	1
HIV/AIDS status	Positive	7 (2.5)	12 (4.2)	3.69 (1.2-10.98)	2.41 (1.06-6.20)
	Negative	36 (12.7)	228 (80.6)	1	1
Having diabetes mellitus	Yes	3 (1.1)	8 (2.8)	2.17 (0.44-9.56)	1.91 (0.28-4.93)
	No	40 (14.1)	232 (82.0)	1	1
Sputum collection orientation given	Yes	35 (12.4)	124 (43.8)	4.09 (1.73-10.1)	3.12 (1.48-7.51)
	No	8 (2.8)	116 (41.0)	1	1
Sputum source	From mouth area	4 (1.4)	80 (28.3)	1	1
	Deeply from lung	39 (13.8)	160 (56.5)	4.88 (1.59-16.7)	2.14 (1.38-8.22)
Staining quality	Good	38 (13.4)	170 (60.1)	3.13 (1.12-9.46)	1.8 (1.06-5.32)
	Poor	5 (1.8)	70 (24.7)	1	1

under secondary education and above category (AOR= 2.13, 95% CI= [1.18-10.11]). Similarly, the odds of being TB smear positive was 3.34 times more compared to the odds of respondents with ≥ 2 weeks cough (AOR=3.34, 95% CI= [1.51-10.21], and 2.41 times among respondents with co morbidity (HIV/AIDS) (AOR= 2.41, 95%CI= [1.06-6.20]). Respondent who got sputum sample collection orientation were triple times to be TB smear positive than their counterparts (AOR=3.12, 95% CI- [1.48-7.51]). Sputum samples processed as per the WHO standard/quality staining/ were 1.8 times more likely to give positive results compare to samples with poor staining quality [Table 3].

Discussion

In this study, the sputum smear positivity rate was found to be 15.2% (1519 per 100000), which clearly showed that TB continued public health problem despite interventions. It is also possible to say it will continue even more than this burden since more undiagnosed TB cases are living within the community. Therefore, the TB control program need to use special strategies such as community based awareness creation, early screening, scale up of screening to the high risk population groups and settings to reach the community at large and start screening for TB of any patient coming for healthcare services.

The prevalence was slightly higher compared to study findings from Peru (7.3%) [32] and Ghana (13%). [33] This variation may be resulted from differences in community awareness, facility setups, information access, education level, DOTs strength and health professionals' commitment. It was also higher compared to different study findings from Ethiopia: Arsi (7.3%), [9] Methehara (14.2%), [17] Dessie (6.2%), [24] Southern Ethiopia (4.6%), [18] Balegoba (9.2%), [19] North Gondar (4.9%), [22] Dessie and Debre Birban (2.9%), [25] Western Amhara (12.8%), [34] and private clinics in Amhara Region (9.1%). [35] It could be due to time period variation which will lead to differences in interventions by health extension workers, NGOs, health development armies, influence of media and community leaders. In addition, quality (rechecking and reprocessing) and including the private health facilities may contribute more to the current prevalence.

On contrary, the TB smear positivity was lower compared to studies from Rwanda; 17.3%, [36] and Ethiopia; 19.4%, [16] 21% [21] and 21.3%. [30] Variations in study setups (private vs only public), community involvement, study area (rural vs urban), methods (direct smear vs culture), community awareness, and staffs' commitment could be justifications to this variation.

Based on this study, the proportion of sputum smear positivity was higher in private health facilities. In addition, the two discordant results were also detected on samples collected from the private health facilities. Unless intervention is made, rate of discordant will be more than this, and the situation will be worsen since majority of the patients preferred to visit private health facilities. This could probably be linked with staining quality, timing for staining and reading of slides, reagents quality, competency of laboratory personnel, and poor documentation. This finding indicated the need to do targeted interventions such as supportive supervision, refreshment trainings, and conducting internal/external quality assurance activities to health facilities, particularly to the private health facilities.

Younger respondents; aged <35 years were double times more likely to be PTB positive compared to respondents with ≥ 35 years age category (AOR=2.24, 95% CI= [1.18-4.15]). This is very gander message to the resource limited countries including Ethiopia since the younger population are primary sources to their economy. It is supported with study findings from Rwanda, [36] Peru [32] and Ethiopia [17] where younger populations were more likely to be PTB positive. Possible explanations for the situation could be being in the productive age (risky to unsafe sexual practices that will exposed them to HIV), highly movable (high chance of getting contact with PTB cases), and being at high interactive age to more exposing conditions such as gathering of people with unknown status for drinking of alcohol, chewing of khat, cigarette smoking and the like. These conditions may make the situation serious; people will get TB, transmit TB, and be immune susceptible as a consequence of substance abuse. [37-41]

The above situation was found to be different from study findings in Nigeria [42] and Ethiopia [17,19] where elder respondents had more chance to be PTB positive. This could be due to age related impaired immunity, malnutrition, poor personal behaviours (smoking, alcohol intake) and poor physical exercise. In addition, elders passed most of their times at home/cloudy places which is favourable to TB transmission compared to the outdoors. [43]

The odd of being sputum smear positive was double among respondents with no education than the odds of respondents with secondary school and above education [Table 3]. It is supported by various studies. [12,17,21,42] This is because educated individuals will have better understanding on health messages and information seeking behaviours than their counter parts. They may also have chance of taking trainings on TB either during their regular education or on job training. This clearly shows that TB control programs need to work at the community levels.

This study revealed that PTB positivity was higher among HIV positive patients (AOR=2.4, 95% CI= [1.06-6.20]) than HIV-negatives. This clearly shows the importance of early screening at the community, and among HIV/AIDS patients to increase smear positivity and enhance the performance of TB control programs. Evidences from Tanzania, [44] Rwanda [36] and Ethiopia [19,45] supported this finding. Most of the time HIV patients are PTB negatives due to salivary nature of their sputum because of unable to cough deeply from the lung and sputum production due to impaired immunity. But, in this study, the situation was opposite to the reality. The possible explanation to this discrepancy could be the presence of High HIV prevalence at the lower HIV/AIDs stage and presence of high TB-HIV prevalence.

In this study, respondents who had ≥2 weeks cough were three times more likely to be PTB positive than their counter parts (AOR=3.34, 95% CI= [1.51-10.21]). It is similar with study findings in Peru, [32] India [46] and Ethiopia. [18,19,24] The potential justification to this may be sputum productivity/conversion period since infection, and coughing for ≥2weeks is a period for probable symptom of TB infection as per the WHO TB guideline. [1,4]

Sputum sample collection orientation was significant factor to smear positivity among PTB suspects. The odd of being smear PTB positive is 3 times among those who got sample collection

orientation compared to the odds of their counter parts; AOR = 3.12, 95% CI= [1.48-7.51]. Sample quality is a determinant factors to sputum smear positivity. [3] If patients get proper sample collection orientation prior to the data collection, they will probably bring representative sample (volume and type) through deep coughing from lung. Hence, chance of being smear positive will be increased compared to samples collected without orientation. Thus, laboratory personnel need to work more on providing appropriate information on how to collect sputum samples to the TB suspected patients.

Based on this study, samples deeply coughed from lung showed statistical association with smear positivity; AOR=2.14, 95% CI= [1.38-8.22] compared to the non-lung samples. As we know, TB primarily affects the lung and the primary sample to diagnose PTB is sputum from the lung. Hence, the probability of being smear positive for mycobacterium TB becomes lower among samples collected outside the lung. Similarly, staining quality was statistically significant to sputum smear positivity [Table 3]. It is obvious that quality of stain is key factor to determine smear positivity rate. If staining procedure is poor and not including all requirements as stated by the WHO or national staining standard, the probability of being false negative or false positive of the processed sample will be higher as a result of artefacts. Timing of staining and decolourization also has great impact on bacterial staining and identification; missing to detect TB/recognising artefacts as TB bacteria.

Conclusions and Recommendations

In conclusion, this study revealed high sputum smear positivity among pulmonary TB suspected patients health facilities in Bahir Dar City. This clearly shows that TB continues important public health challenge in Ethiopia since respondents are from different localities. Proportion of sputum smear positivity was higher on respondents from private health facilities, which requires special attention on quality of TB services. Patient factors, cough duration, specimen characteristics, HIV confection, and laboratory personnel related factors significant variables showing statistical association with smear positivity. Improving community based awareness, early TB and TB-HIV screening and treatment services, patient orientation on sample collection, and adherence of laboratory personnel with WHO/ or national TB diagnosis guideline is crucial to improve sputum smear positivity. Further large scale triangulated study is needed to identify factors why PTB continues major public health problem in Ethiopia with the presence of TB program interventions.

Authors' Contributions

GA: participated in design, data collection, analysis and paper write up. MAA: edited research design, did analysis and prepare the manuscript. Both authors approved the submission.

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Conflict of Interest

All authors disclose that there was no conflict of interest.

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