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Magnitude of extrapulmonary tuberculosis and its associated factors among TB suspected patients at Wolkite University specialized hospital in central Ethiopia

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The prevalence of extra-pulmonary tuberculosis (EPTB) is on the rise in Ethiopia, necessitating effective management and preventive strategies. A crucial aspect of combating EPTB is the continuous identification of its contributing factors and monitoring its prevalence. So, this study aims to assess the magnitude of EPTB and identify associated factors among tuberculosis-suspected patients at Wolkite University Specialized Hospital in Central Ethiopia. An institution-based prospective cross-sectional study was conducted from March 1 to August 31, 2024, in Wolkite University Specialized Hospital (WKUSH) in Ethiopia. A total of 400 presumptive EPTB cases were included in the study using a convenience sampling technique. Samples of body fluid like cerebrospinal fluid, pleural fluid, pericardial fluid, peritoneal fluid, and pus (abscess) were collected and processed by Xpert MTB/RIF assay. A pre-tested structured questionnaire was used to collect sociodemographic variables such as gender, age, residence, marital status, and clinical data like HIV status, history of pulmonary tuberculosis, and other comorbidities. Data were entered through Epidata version 3.1 and analyzed using SPSS software version 23. Descriptive statistics like frequency and percentage were calculated. Binary logistic regression analysis was done to determine the presence of a statistically significant association between independent variables and EPTB status. Statistical significance was declared at p-value ≤ 0.05 at 95% confidence interval. About 29.5% (118/400) of the participants were HIV positive, while about 33.7% (135/400) of the total participants had chronic illnesses other than HIV/AIDS. Our study found that the overall prevalence of EPTB detected by the Xpert MTB/RIF assay was 18.8% (75/400) among all presumptive EPTB cases. The most common forms of EPTB identified were pleural tuberculosis (23%), followed by TB lymphadenitis (20%) and bone tuberculosis (20%). Participants who were HIV positive (AOR = 16.3, 95% CI 8.5–33.0) and those with a prior history of pulmonary TB (AOR = 5.8, 95% CI 2.5–13.2) were more likely to be EPTB positive compared to HIV-negative participants and those without a history of pulmonary TB. The overall prevalence of EPTB is high in Wolkite University Specialized Hospital. EPTB were found to be significantly associated with being HIV positive and having a history of pulmonary TB. So, early screening for EPTB, along with evaluating the factors associated with the risk of EPTB in suspected patients, is essential for prompt treatment. This approach is crucial to reduce the severity, mortality, and morbidity associated with the disease.

Tuberculosis (TB) is a chronic communicable disease that is a major cause of morbidity and mortality worldwide. It is also the leading cause of death from a single infectious agent. Globally, according to the 2020 World Health Organization (WHO) report, there were about 10 million TB cases and 1.4 million TB deaths in 2019. Out of the

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total estimated number of TB cases in 2019, around 25% occurred in the Africa Region. Ethiopia stands 12th with an estimated TB incidence of 157 per 1000 individuals among the 30 high-TB burden countries[1].

Although Mycobacterium tuberculosis (MTB) typically affects the lungs and causes pulmonary tuberculosis (PTB), it can also affect other body parts and cause extra-pulmonary tuberculosis, including renal tuberculosis, pleuritis, peritonitis, lymphadenitis, and meningitis[2].

In developed countries with extensive diagnostic and reporting systems, EPTB accounts for 11% to 22% of reported TB cases[3,4] however the rate is higher in countries with high TB incidence[5,6]. Ethiopia has a high rate of EPTB, accounting for more than 30% of all TB cases reported, according to the WHO report[1]. Several studies in Ethiopia has reported a high proportion of EPTB cases out of the total reported TB cases such as 40% and 49.8% in Jimma and Addis Ababa Ethiopia respectively[7,8].

Currently, various studies indicate that EPTB is linked to a significantly elevated risk of mortality[9,10]. Previous studies conducted in Ethiopia, including studies in Addis Ababa and Mekelle, revealed a higher mortality rate among patients with EPTB compared to those with pulmonary tuberculosis (PTB). Furthermore, EPTB was identified as a significant predictor of mortality across all tuberculosis cases[11,12]. However, global awareness and attention to this serious health issue remain markedly inadequate in comparison to that given to pulmonary tuberculosis.

The main way to achieve the end-TB strategy and to reduce the burden of EPTB is to implement comprehensive and targeted preventive measures. The foundation of these effective preventive strategies lies in accurately identifying the main risk factors associated with EPTB, as understanding these factors can lead to improved screening protocols and timely interventions. Since EPTB often presents significant diagnostic challenges for healthcare professionals, necessitating a greater degree of suspicion, particularly in populations with known risk factors like HIV and a history of pulmonary TB[13]. By prioritizing the identification of these risk factors, our study contributes to optimizing diagnostic approaches, which can lead to earlier treatment initiation. Furthermore, support systems and interventions aimed at at-risk populations can play a significant role in prevention. A comprehensive literature on EPTB identifies HIV infection, low CD4 count, female gender, younger and elderly age, and poverty as the main risk factors associated with this disease[14]. Whereas in Ethiopia, various studies have identified additional significant risk factors for EPTB[5,15]. These include a previous history of tuberculosis, close contact with individuals diagnosed with active tuberculosis, a history of underlying chronic diseases, and economic factors such as low income level. These findings underscore the complex interplay of immunological, demographic, and socio-economic factors that contribute to the susceptibility to EPTB.

Early diagnosis of EPTB is essential for improving patient outcomes, as it allows for timely treatment that significantly reduces mortality and morbidity associated with the disease[16]. However, reducing the incidence and mortality of extrapulmonary tuberculosis requires not only the enhancement of diagnostic and therapeutic measures but also the identification and intervention targeting the underlying determinants of extrapulmonary tuberculosis cases[1]. WKUSH is the only teaching hospital and high-level healthcare facility in the Gurage Zone, serving a catchment area of over 4 million people. This makes it essential for addressing the healthcare needs of a historically underrepresented population in relation to EPTB research. However, the prevalence and specific risk factors associated with EPTB in this area remain unidentified. Therefore, this research aims to evaluate the magnitude of extrapulmonary tuberculosis and its associated factors among suspected patients in this unique setting. Understanding these regional variations is crucial for developing effective public health strategies.

Furthermore, this research holds significant implications for understanding and addressing EPTB in Ethiopia, a country with a high burden of the disease. By providing critical insights into the prevalence and associated risk factors of EPTB, the study aims to inform targeted public health strategies that can effectively reduce incidence and mortality rates. The identification of specific risk factors will enhance diagnostic approaches, enabling healthcare professionals to recognize EPTB more promptly, thereby facilitating earlier treatment. Lastly, the findings are expected to guide policymakers in resource allocation and support systems for at-risk populations, ultimately improving healthcare delivery.

Methods

Study design and period

Institution based cross-sectional study was conducted from March 1 to August 31, 2024.

Study setting

The study was conducted at WKUSH. WKUSH, located in Gubre Sub-city, Wolkite Town, Gurage, in central Ethiopia, is situated approximately 172 km from Addis Ababa, the capital city. Established in 2018, the hospital serves as a teaching facility for health science students, aiming to equip them with practical skills and produce qualified health professionals. WKUSH provides healthcare services to a catchment population of around 4 million people. The Xpert MTB/RIF test was carried out at microbiology laboratory of WKUSH, specifically in the Gene Xpert room. The Xpert MTB/RIF test service began at the hospital in 2019.

Sample size and sampling procedures

The study population includes all clinically presumptive EPTB cases who visited Wolkite University specialized hospital. The minimum representative sample size was determined by using the single population proportion formula $N = Z^2P\,(1\text{-}P)/d^2$[17], where N is the number of presumptive EPTB cases, Z is standard normal distribution value at 95% CI which is 1.96, P is the prevalence of EPTB = 39.5[18], and d is the margin of error that is taken as 5%. Accordingly, the estimated numbers of participants were 365. However, by considering 10% non-response rate about 400 presumptive EPTB cases who visited Wolkite University Specialized Hospital during the study period were enrolled consecutively.

Data collection and laboratory tests

Patients were included based on clinical suspicion of EPTB. Presumptive EPTB case is an individual with signs and symptoms of EPTB such as chronic lymphadenitis and body fluid accumulations with clinical suspicion of extrapulmonary tuberculosis. Socio demographic and clinical data was collected using a structured questionnaire administered by the interviewer. The questionnaire was developed based on prior literature. Three medical laboratory technologists were recruited for data collection, while a medical microbiologist was employed to oversee the process.

From 400 participants body fluids such as cerebrospinal fluid, pleural fluid, pericardial fluid, peritoneal fluid, and pus (abscess) were collected in different wards according to standard operating procedure. Each sample was processed for Xpert MTB/RIF test in Wolkite University Specialized Hospital microbiology laboratory.

Additionally, Participants' medical records were reviewed to assess their HIV status, other comorbidities, previous history of PTB diseases and the clinician's decision to start anti-TB treatment (ATT).

Xpert MTB/RIF test

The Xpert MTB/RIF assay was performed according to the standard operating procedures. At the beginning, sample reagent was added in a 2:1 ratio to patient specimen. Then, the mixture was vortexed and incubated at room temperature for about 15 min. Finally, two ml of the reagent sample mixture was transferred to an Xpert cartridge using a Pasteur pipette, the cartridge was loaded onto Xpert machine (Gene Xpert- Dx System version 4.4a, Cepheid Company, 904 Caribbean Drive, CA 940,889, USA) and results was automatically generated after 1 h and 50 min[19].

Quality assurance

The questionnaire was pretested before the actual study began to make sure that the questions were appropriate and understandable. Xpert MTB/RIF assay has its own internal quality control system which was used during the investigation process. All laboratory tests were done according to the standard operating procedures (SOP).

Data management and analysis

Data were entered through Epidata version 3.1 and analyzed using SPSS software package version 22 (S1 File). Descriptive statistics were used for the analysis of patient characteristics. Bivariate and multivariable logistic regression analysis was done to determine the presence of a statistically significant association between independent variables and the outcome variable which is the presence of EPTB. All independent variables that were associated with the outcome variable in the bivariate analysis ($P \leq 0.25$) were included in the multivariable logistic regression model. Hosmer -Lemeshow of the goodness of fit test was checked to verify the model fitness (p-value = 0.43) and multicollinearity was assessed and all independent variables were not collinear (VIF < 10). Odds Ratio (OR), p value, and their 95% Confidence Intervals (CI) were calculated and the result was considered statistically significant at $P \leq 0.05$.

Ethics consideration

Before the study begins, ethical clearance was obtained from the ethical review committee of Wolkite University (Ref No. WKU IRB 400/2024), and the support letter was received from the school of medical laboratory sciences. The study protocol was approved by the mentioned institutional review committee, ensuring adherence to ethical guidelines in research. Official written permission letter was obtained from Wolkite University Specialized Hospital, and participants were provided with written informed consent before the interview. Formal written consent was obtained from the parent or guardian for participants under the age of 18. Privacy and confidentiality were ensured, and the participants were told that they have the right to refuse participation. The results of patients were reported to physicians directly. All methods were performed in accordance with the relevant guidelines and regulations.

Results

Sociodemographic and clinical characteristics

In this study, majority 221 (55.3%) 209 of the participants were males and about 138(34.5%) were on the age group between 31 and 45 year. About 223(55.7%) of the participants resides in rural areas. Our study found that 356(89%) and 348(87%) participants had no TB contact and history of previous pulmonary TB infection respectively. A total of 118 (29.5%) of the participants were HIV positive. About 135(33.7%) of the total participants had chronic illness other than HIV/AIDS. Regarding to the marital status, majority of the study participants were married 212(53%). Regarding the type of specimen the majority 128(32%) was pleural fluid followed by 121(30.2%) peritoneal fluid (Table 1).

Prevalence of extrapulmonary tuberculosis

Out of 400 EPTB suspected clients, about 75(18.8%), and 39(9.8%) were positive for EPTB by Xpert MTB/RIF assay and fluorescent microscopy respectively.

In this study the proportion of smear positive EPTB was 52% whereas the rest 48% was smear negative EPTB. The prevalence of EPTB among male and female cases was 33/221(14.9%) and 42/179 (23.2%) respectively. From the total EPTB positive cases the highest proportion was females (56%). The highest prevalence of EPTB was observed among the age group of 16–30, 34/100 (34%) and urban dwellers, 40/177(22.6%) (Table 1). From the total EPTB confirmed patients, about 53(70.6%), 38(50.6%) and 32(42.6%) of them were experienced weight loss, cough and fever respectively.

A total of 87(21.8%) cerebrospinal fluid, 128(32%) pleural fluid, 6(1.5%) pericardial fluid, 121(30.2%) peritoneal fluid and 58(14.5%) pus (abscess) were examined for EPTB infections. The prevalence of EPTB

Variables	Frequency (%)	Xpert result	
		Positive	Negative
Gender			
Male	221 (55.3%)	33 (14.9%)	188 (88.1%)
Female	179 (44.7%)	42 (23.4%)	137 (76.6%)
Age			
0–15	59 (14.8%)	12 (20.3%)	47 (79.7%)
16–30	100 (25%)	34 (34%)	66 (66%)
31–45	138 (34.5%)	18 (13%)	120 (87%)
>45	103 (25.7%)	11 (10.7%)	92 (89.3%)
Residence			
Urban	177 (44.3%)	40 (22.6%)	137 (77.4%)
Rural	223 (55.7%)	35 (15.7%)	188 (84.3%)
Marital status			
Single	127 (31.7%)	34 (26.8%)	93 (73.2%)
Married	212 (53%)	35 (16.5%)	177 (83.5%)
Divorced	32 (8%)	6 (18.8%)	26 (81.2%)
Widowed	29 (7.3%)	0	29 (100%)
TB contact			
Yes	44 (11%)	9 (20.4%)	35 (79.6%)
No	356 (89%)	66 (18.5%)	290 (81.5%)
History of pulmonary TB			
Yes	52 (13%)	25 (48%)	27 (52%)
No	348 (87%)	50 (14.4%)	298 (85.6%)
HIV status			
Positive	118 (29.5%)	59 (50%)	59 (50%)
Negative	282 (70.5%)	16 (5.7%)	266 (94.3%)
Chronic illness other than HIV			
Yes	135 (33.7%)	21 (15.6%)	114 (84.4%)
No	265 (66.3%)	54 (20.4%)	211 (79.6%)
Sample types			
Pleural fluid	128 (32%)	17 (13.3%)	111 (86.7%)
Peritoneal fluid	121 (30.2%)	6 (5%)	115 (95%)
CSF	87 (21.8%)	11 (12.6%)	76 (87.4%)
Abscess	58 (14.5%)	41 (70.7%)	17 (29.3%)
Pericardial fluid	6 (1.6%)	0	6

Table 1. Sociodemographic and clinical characteristics of presumptive EPTB cases at Wolkite University Specialized Hospital from March 1 to August 31, 2024.

among abscess, CSF, pleural fluid and peritoneal fluid were 41/58 (70.7%), 11/87(12.6%), 17/128(13.3%) and 6/121(5%) respectively (Table 1).

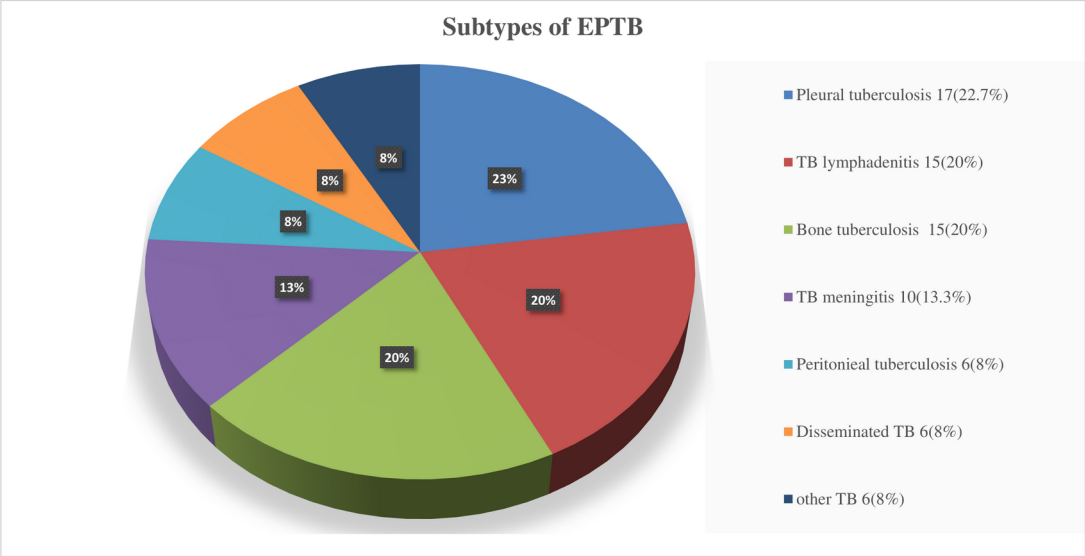
Subtypes of extra-pulmonary tuberculosis

Among the total cases of EPTB studied, pleural tuberculosis was the most prevalent, accounting for 23% (17 cases) of the total. This was followed by tuberculosis lymphadenitis and bone tuberculosis, each representing 20% (15 cases) of the EPTB cases (Fig. 1).

Factors associated with EPTB cases at Wolkite University specialized hospital

In bivariate logistic regression analysis sex, residence, history of pulmonary TB, HIV status, and chronic diseases other than HIV were independent variables found to have association with EPTB status. However, after the confounding variables adjusted in multivariable logistic regression only history of pulmonary TB and HIV status was found to be significantly associated with EPTB status.

In our study, those participants who had history of pulmonary TB were 5.8 times [AOR = 5.8, 95%CI (2.5–13.2)] more likely to have EPTB than those who don't have history of pulmonary TB. Participants who were HIV positive were 16.3 times more likely to be EPTB positive than those participants who were HIV negative [AOR = 16.3, 95%CI (8.5–33.0)] (Table 2).



Note: Other TB includes 3 endometrial TB and 3 tuberculoma of breast cases

Fig. 1. Subtypes of confirmed EPTB among presumptive EPTB cases at Wolkite University Specialized Hospital.

Variables	Freq	EPTB status (Xpert MTB/RIF)		COR (95%CI)	*p*-value	AOR (95%CI)	*p*-value
		Positive No (%)	Negative No (%)				
Sex							
Male	221	33 (14.9%)	188 (88.1%)	Ref		Ref	
Female	179	42 (23.4%)	137 (76.6%)	1.7 (1.06–3.05)	0.031	1.58 (0.83–3)	0.16
Residence							
Urban	177	40 (22.6%)	137 (77.4%)	Ref		Ref	
Rural	223	35 (15.7%)	188 (84.3%)	0.64 (0.4–1.14)	0.08	0.76 (0.39–1.46)	0.41
History of pulmonary TB							
Yes	52	25 (48%)	27 (52%)	5.5 (2.7–9.7)	< 0.001	5.75 (2.5–13.2)	**< 0.001**
No	348	50 (14.4%)	298 (85.6%)	Ref			
HIV							
Positive	118	59 (50%)	59 (50%)	15.2 (8.1–28.6)	< 0.001	16.3 (8.5–33.0)	**< 0.001**
Negative	282	16 (5.7%)	266 (94.3%)	Ref			
Chronic diseases other than HIV							
Yes	135	21 (15.6%)	114 (84.4%)	0.7 (0.4–1.3)	0.25	0.58 (0.29–1.2)	**0.143**
No	265	54 (20.4%)	211 (79.6%)	Ref			

Table 2. Factors associated with EPTB among presumptive EPTB cases at Wolkite University Specialized Hospital from March 1 to August 31, 2024. Significant values are in [bold].

Discussion

In this study, we assessed the prevalence of extrapulmonary tuberculosis among suspected cases at Wolkite University Specialized Hospital, along with the associated factors influencing its occurrence. EPTB remains a significant public health challenge, particularly in high-burden countries like Ethiopia, where the interplay of tuberculosis and co-morbid conditions, such as HIV/AIDS, exacerbates the complexity of diagnosis and treatment. Understanding the prevalence and underlying determinants of EPTB is crucial for the development of targeted health interventions and resource allocation.

In our study, we observed an overall prevalence of EPTB diagnosed through the Xpert MTB/RIF assay, which stood at 18.8% (75 out of 400 tested individuals). This high prevalence of EPTB in our study indicates that a considerable number of individuals in the population are at risk of experiencing the severe consequences of EPTB. These consequences can include increased healthcare costs, prolonged hospital stays, and potentially higher mortality rates, as EPTB is often associated with greater morbidity and mortality compared to pulmonary TB[20]. The high prevalence of EPTB in our study could be due to several factors. Firstly, increased HIV prevalence significantly impacts susceptibility, as individuals with HIV are more vulnerable to EPTB due to compromised immune systems[21], Socioeconomic factors also play a crucial role; poverty, malnutrition, and inadequate access to healthcare have been shown to correlate with higher TB rates, including EPTB[14]. Furthermore, changes in diagnostic practices have resulted in more cases being identified and reported, which may contribute to the apparent increase[6]. Our findings highlight the urgent need for targeted healthcare strategies, enhanced surveillance, and improved diagnostic protocols to effectively address the significant burden of extrapulmonary tuberculosis in the population.

This finding aligns closely with previous research conducted at Jimma University Medical Center, which reported a prevalence of 15.6%[6]. However, our results indicate a significantly lower prevalence compared to a study conducted in Gondar, where a prevalence of 29.8% was noted[15]. The differences in EPTB prevalence between studies may be attributed to variations in the types and proportions of specimens collected, as well as the laboratory techniques employed. In our study, we utilized the Xpert MTB/RIF assay, while the previous study in Gondar relied on culture methods. Research indicates that the sensitivity of the Xpert MTB/RIF assay for diagnosing EPTB is lower than that of culture tests due to the presence of PCR inhibitors and the paucibacillary nature of non-respiratory specimens[22].

Additionally, the majority of specimens analyzed in the Gondar study were lymph nodes, whereas our research primarily focused on pleural fluid, followed by peritoneal fluid. It is important to note that the sensitivity of the Xpert MTB/RIF and culture assay is generally higher for lymph node specimens compared to other body fluids[18]. This disparity in specimen type could contribute to the observed differences in EPTB prevalence rates between the studies[5,6,15].

Our research indicates that the most common subtype of extrapulmonary tuberculosis is pleural TB, accounting for 23%, followed closely by TB lymphadenitis and bone tuberculosis, each at 20%. Similar finding was reported from a study in Dessie and Gondar Ethiopia[5,15].

Pleural TB, being the most common subtype in our study, highlights the need for customized treatment strategies, especially in regions with high prevalence, such as Ethiopia. A study by Singh et al.[23] emphasizes that the use of corticosteroids, in addition to the standard anti-TB drugs, could become an essential part of managing pleural TB to avoid unnecessary complications.

Understanding the prevalence of different EPTB subtypes is also crucial for optimizing resource allocation, improving clinical practices, and enhancing health outcomes for affected individuals. A study conducted in China[24] highlights the importance of tailoring resource distribution according to the specific epidemiological patterns of EPTB in various regions, which leads to more effective management of the disease.

Moreover, assessing the prevalence of EPTB subtypes plays a crucial role in TB surveillance and policy development. For instance, in areas where pleural TB is common, targeted screening for pleural effusions in individuals showing TB symptoms or with known TB exposure could be implemented. A study conducted in Addis Ababa[25] emphasized that understanding the local distribution of EPTB subtypes helps inform more effective strategic planning for TB prevention and control, ultimately leading to better health outcomes.

In our study, alongside the confirmed cases of EPTB, we identified approximately 43 additional cases that were treated empirically for tuberculosis based on clinical signs and symptoms. Notably, these patients tested negative for tuberculosis using the Xpert MTB/RIF assay, which, while offering improved sensitivity for diagnosing TB in sputum samples, is less effective for body fluid specimens[26].

The successful treatment responses of these Xpert MTB/RIF negative TB patients highlight a significant number of undiagnosed or misclassified EPTB cases, largely attributable to the limitations of current diagnostic methods. This situation underscores the considerable challenges in accurately diagnosing EPTB and suggests that existing techniques may lead to false negatives, complicating patient management and prolonging disease transmission. Consequently, there is an urgent need for the development of advanced diagnostic tools that enhance EPTB detection and improve sensitivity, ensuring timely interventions for affected individuals and ultimately contributing to better treatment outcomes and effective tuberculosis control efforts within the community.

In our study, we found that participants with a history of pulmonary tuberculosis were 5.8 times more likely to develop extrapulmonary tuberculosis compared to those without such a history. This significant association underscores the increased risk of EPTB in individuals who have previously experienced pulmonary TB, suggesting that the disease may predispose patients to the development of TB in other parts of the body.

These findings align with similar research conducted in Ethiopia and sub-Saharan Africa, where studies have also reported a heightened risk of EPTB among individuals with a history of pulmonary TB[5,27]. This pattern may be attributed to several factors, including the potential for residual TB bacilli in the body following pulmonary infection, which could later manifest as EPTB[28]. Additionally, the immune system may be compromised or altered following an initial pulmonary TB infection, making individuals more susceptible to the spread of the bacteria to extrapulmonary sites.

Our study also found that participants who were HIV positive had a 16.3 times greater likelihood of being positive for extrapulmonary tuberculosis compared to those who were HIV negative. This finding was supported by a study conducted in DeKalb, Texas, Arkansas[29–31]. This could be due to the fact that HIV virus affects the body immune system cell which will expose the body to different infections, with EPTB being one of the opportunistic

infection[21,32]. A study in Gondar Ethiopia also reports that HIV infection and previous history of pulmonary TB as the most common significant factor for developing EPTB[15].

Finally, the novelty of this study lies in its comprehensive assessment of the prevalence and risk factors associated with EPTB within the specific context of WKUSH, a critical healthcare facility in a high-burden region of Ethiopia. By identifying an EPTB prevalence of 18.8% among suspected cases, this research highlights a significant public health challenge, particularly in populations with high rates of co-morbidities such as HIV. Unlike previous studies that primarily focused on pulmonary tuberculosis, this investigation sheds light on EPTB, revealing unique regional dynamics and risk factors, including the heightened likelihood of EPTB among individuals with a history of pulmonary TB and those who are HIV positive. Furthermore, the study emphasizes the limitations of current diagnostic methods, such as the Xpert MTB/RIF assay, in detecting EPTB, thereby underscoring the urgent need for improved diagnostic tools. These findings not only contribute to the existing literature on tuberculosis but also provide vital insights for public health strategies aimed at enhancing screening, prevention, and management of EPTB in underrepresented populations.

Limitation of the study

Our study has limitations. Firstly, as a cross-sectional study, it is important to note that we cannot establish causal relationships between the variables examined. While direct causality cannot be inferred, we tried to support our findings by referencing relevant literature that has established relationships in similar contexts. Additionally, the use of convenience sampling techniques may have introduced selection bias. Finally, due to resource limitations, we did not use Xpert Ultra or MGIT culture for EPTB-negative cases, which may have contributed to a lower detection rate of EPTB.

Conclusion and recommendation

The overall prevalence of EPTB in Wolkite University Specialized Hospital. EPTB were found to be significantly associated with being HIV positive and having history of previous pulmonary TB. The findings of this research highlights the critical need for strengthened screening, monitoring, and integrated management of TB and HIV to prevent the development of EPTB in these high-risk populations. Public health programs should prioritize early and comprehensive TB screening, including the use of more sensitive diagnostic tools, for individuals living with HIV and those with a history of pulmonary TB.

Data availability

All relevant data are available within the paper (S1 file).

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Author contributions
A.S: protocol development, data collection, data analysis, and manuscript preparation; R.D: Supervision and Protocol development; G.A.M: data analysis, laboratory protocol development, and data collection; A.H.H: Data analysis, and laboratory protocol development; BFH: data collection and data analysis; SA: supervision during data collection and manuscript preparation. All authors read and approved the final version of the manuscript.

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Declarations

Competing interests
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