Vietnam Journal of Community Medicine, Vol. 67, English version No. 1, 2026, 143-147

PREVALENCE OF AFB POSITIVITY AMONG INPATIENTS IN THE INFECTIOUS DISEASE DEPARTMENT AT TRA VINH GENERAL HOSPITAL

Huynh Phuong Duy[1*], Ngo Anh Duy[1], Do Thi Phuong Thao[2]

[1]College of Medicine and Pharmacy, Tra Vinh University - 126 Nguyen Thien Thanh, Block 4, Hoa Thuan Ward, Vinh Long Province, Vietnam
[2]Tan Hiep Medical Center - Tan Hiep Commune, An Giang Province, Vietnam

Received: 08/04/2026
Revised: 18/05/2026; Accepted: 26/05/2026

ABSTRACT

Objectives: To determine the rate of acid-fast bacilli (AFB)-positive results and associated factors among inpatients with AFB test orders in the Infectious Disease Department of Tra Vinh General Hospital from January to September 2023.

Methods: A cross-sectional descriptive study combined with retrospective data collection was conducted on 157 inpatients who had AFB sputum smear tests ordered from the Infectious Disease Department. Data were collected from medical records, laboratory results, and structured questionnaires. AFB smears were performed using the Ziehl-Neelsen staining method. Statistical analysis was conducted using Stata 14.0; Poisson regression was used to calculate prevalence ratios (PR) with 95% confidence intervals (CI).

Results: Of 157 patients, 19 (12.10%) tested AFB-positive. Among positive cases, AFB (1+) accounted for 52.63%, AFB (2+) for 21.05%, and AFB (3+) for 26.32%. Factors significantly associated with AFB positivity included: urban residence (PR = 3.16; 95% CI: 1.35–7.37; p = 0.018), hypertension (PR = 3.22; 95% CI: 1.27–8.19; p = 0.041), diabetes mellitus (PR = 4.75; 95% CI: 2.15–10.50; p = 0.001), alcohol consumption (PR = 3.14; 95% CI: 1.37–7.19; p = 0.005), regular alcohol use (PR = 5.52; 95% CI: 2.30–13.24; p < 0.001), cigarette smoking (PR = 3.26; 95% CI: 1.44–7.37; p = 0.007), and heavy smoking (PR = 5.27; 95% CI: 1.85–14.98; p = 0.002). No significant association was found between AFB positivity and age, sex, occupation, BMI, or tuberculosis history.

Conclusion: The AFB-positive rate in the Infectious Disease Department was 12.10%. Diabetes mellitus, hypertension, alcohol use, and smoking were significant risk factors. Early AFB screening in high-risk patients is warranted.

Keywords: AFB, tuberculosis, inpatients, Infectious Disease Department, Tra Vinh.

1. INTRODUCTION

Tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis (M. tuberculosis), in which pulmonary TB is the most common form (accounting for 80–85%) and represents the primary source of transmission in the community [3]. According to the World Health Organization (WHO) report in 2022, an estimated 10.6 million people developed TB and 1.6 million died from the disease in 2021 [11]. Vietnam remains among the 30 countries with the highest TB burden worldwide, ranking 11th, with approximately 169,000 incident cases and 12,000 TB-related deaths reported in 2021 [9].

Co-infection with M. tuberculosis among hospitalized patients is a growing concern, as it increases the risk of complications, prolongs hospital stay, and raises treatment costs. In infectious disease departments, TB co-infection in patients with underlying conditions such as diabetes mellitus, HIV infection, chronic lung diseases, and liver diseases has become increasingly prevalent. However, to date, no comprehensive study in Vietnam has assessed the prevalence of acid-fast bacilli (AFB) positivity among inpatients in the infectious disease department of a provincial general hospital.

Based on this context, the present study was conducted with two objectives: (1) to determine the prevalence of AFB positivity and classify AFB grading among inpatients indicated for AFB testing in the Infectious Diseases Department of Tra Vinh General Hospital; and (2) to describe factors associated with AFB positivity in this population.

2. MATERIALS AND METHODS

2.1. Study design

A descriptive cross-sectional study with retrospective components was conducted.

2.2. Study setting and period

The study was carried out from January 2023 to September 2023 at the Microbiology Unit, Department of Laboratory Medicine, and the Infectious Diseases Department, Tra Vinh General Hospital.

2.3. Study population and sample size

- ***Inclusion criteria:*** Inpatients in the Infectious Diseases Department who were indicated for AFB testing, had specimens stored in the Microbiology Unit, and consented to participate in the study.

- ***Exclusion criteria:*** Patients whose AFB test indications were not from the Infectious Diseases Department; those who refused participation or were unable to communicate.

*Corresponding author
Email: duyhuynh41@tvu.edu.vn **Phone:** (+84) 384991181 **Https:**//doi.org/10.52163/yhc.v67iE1.5228

The sample size was calculated using the formula for estimating a proportion, with p = 0.4861 (prevalence of M. tuberculosis infection reported by the National Tuberculosis Control Program in 2018 [2]), a 95% confidence level, and a margin of error of d = 0.08. The minimum required sample size was 150. A total of 157 eligible samples were ultimately included in the study.

2.4. Study variables

The dependent variables were AFB test results (negative/positive) and AFB grading (1+, 2+, 3+). Independent variables included demographic characteristics (age, sex, residence, occupation); anthropometric indicators (BMI, blood pressure); comorbidities (lung diseases, HIV infection, diabetes mellitus, liver diseases, bacterial infections, viral infections); risk behaviors (alcohol consumption, smoking); and history of tuberculosis.

2.5. AFB laboratory procedure

Sputum specimens were stained and examined microscopically using the Ziehl–Neelsen (ZN) method. Results were interpreted according to the 2020 guidelines of the Ministry of Health [1]: negative (0 AFB/100 fields); positive corresponding to 1–9 AFB/100 fields (exact number recorded), 10–99 AFB/100 fields (1+), 1–10 AFB/field in ≥50 fields (2+), and >10 AFB/field in ≥20 fields (3+). A positive diagnosis was confirmed when there were ≥2 positive smears from two different sputum samples, or one positive smear combined with chest X-ray findings suggestive of TB.

2.6. Data management and analysis

Data were entered using Microsoft Excel and analyzed with Stata version 14.0. Descriptive statistics included frequencies and percentages for categorical variables, and means ± standard deviations for continuous variables. Analytical statistics included chi-square test or Fisher's exact test, and Poisson regression to estimate prevalence ratios (PRs) with 95% confidence intervals (95% CIs). Statistical significance was set at $p < 0.05$.

2.7. Ethical considerations

The study was approved by the Institutional Review Board of Tra Vinh University (Approval No. 215/GCT-HĐĐĐ, dated June 18, 2023). All personal information was kept confidential. Participation was voluntary, and participants had the right to withdraw from the study at any time.

3. RESULTS AND DISCUSSION

3.1 General characteristics of the study population

Table 1. Socio-demographic characteristics of the study participants (n = 157)

Characteristics	n	%
Mean age: 61.18 ± 16.74 years (range: 17–92)		
Age group		
< 35 years	17	10.83
35 – 59 years	41	26.11
≥ 60 years	99	63.06
Sex		
Male	98	62.42
Female	59	37.58
Residence		
Rural	137	87.26
Urban	20	12.74
Occupation		
Farmer	33	21.02
Worker	26	16.56
Government employee	12	7.64
Housewife	28	17.84
Others	58	36.94

Comment: The mean age of the patients was 61,18 ± 16,74 years (range: 17–92 years). The ≥60-year age group accounted for the highest proportion (63.06%). Males comprised 62.42% of the study population, higher than females (37.58%), with a male-to-female ratio of approximately 1.66. The majority of patients resided in rural areas (87.26%). Regarding occupation, the "Others" category (including elderly individuals no longer working and the unemployed) accounted for the highest proportion (36.94%), followed by farmers (21.02%).

Discussion: These findings are consistent with the study by Tran Ngoc Dung et al. (2020) conducted in Dong Thap, which reported a mean age of 52 ± 16.32 years and a predominance of males (75.3%). The difference in mean age may reflect the increasing prevalence of chronic diseases with advancing age in the study setting [4]. Elderly patients often experience age-related immune decline and accumulate multiple comorbidities, which facilitate the invasion and progression of Mycobacterium tuberculosis infection.

3.2. The AFB test results

Table 2. AFB results and grading classification (n = 157)

AFB Results	n	%
AFB negative	138	87.90
AFB positive	19	12.10
AFB (1+)	10	52.63*
AFB (2+)	4	21.05*
AFB (3+)	5	26.32*

**: Percentages calculated based on 19 AFB-positive cases.*

Comment: The AFB positivity rate was 12.10% (19/157 cases). Among the positive samples, the (1+) grade accounted for the highest proportion (52.63%), followed by (3+) at 26.32% and (2+) at 21.05%. The rate of AFB-negative cases was 7.30 times higher than that of positive cases.

Discussion: The AFB positivity rate of 12.10% in this study is lower than those reported in specialized tuberculosis (TB) facilities. This finding is consistent with the clinical setting, as Tra Vinh General Hospital is not a dedicated TB treatment center; patients are admitted for various medical conditions, with only a subset presenting with TB co-infection. A study by Nguyen Loc et al. (2019) recorded a new pulmonary TB AFB(+) detection rate of 50.96/100,000 population in Tan Phu district [6], while Y. Pang et al. (2019) reported that 62.6% of inpatients in

China had pulmonary TB [12]. These discrepancies clearly reflect differences in study populations and healthcare settings.

3.3. Factors associated with the AFB positivity rate

Table 3. Association between socio-demographic factors and the AFB positivity rate

Variables	AFB (–) n (%)	AFB (+) n (%)	PR (KTC 95%)	p
Age group				
< 60 years	48 (82.76)	10 (17.24)	0.53 (0.23–1.22)	0.13
≥ 60 years	90 (90.91)	9 (9.09)	1	
Sex				
Male	86 (87.76)	12 (12.24)	0.97 (0.40–2.32)	0.94
Female	52 (88.14)	7 (11.86)	1	
Residence				
Urban	14 (70.00)	6 (30.00)	3.16 (1.35–7.37)	0.018*
Rural	124 (90.51)	13 (9.49)	1	
Occupation				
Farmer	9 (75.00)	3 (25.00)	2.06 (0.54–7.94)	0.29
Worker	21 (80.77)	5 (19.23)	1.59 (0.47–5.34)	0.46
Government employee	29 (87.88)	4 (12.12)	1	
Housewife	25 (89.29)	3 (10.71)	0.88 (0.21–3.64)	0.86
Others	54 (93.10)	4 (6.90)	0.57 (0.15–2.14)	0.40

**: Statistically significant (p < 0.05); Fisher's exact test was used.*

Comment: Patients residing in urban areas had a 3.16 times higher risk of testing AFB positive compared to those in rural areas (PR = 3.16; 95% CI: 1.35–7.37; p = 0.018). No statistically significant associations were found between age, gender, or occupation and the AFB positivity rate (p > 0.05).

Discussion: The findings regarding place of residence in this study differ from those of Tran Ngoc Dung et al. (2020) in Dong Thap, where the prevalence of TB was higher in rural areas than in urban ones [4]. This discrepancy may be attributed to local demographic characteristics: urban areas in Tra Vinh have a high concentration of migrant workers and laborers from other provinces, leading to increased exposure to sources of infection in crowded, confined environments with poor ventilation.

Table 4. Association between demographic factors and AFB positivity rate

Variables	AFB (–) n (%)	AFB (+) n (%)	PR (KTC 95%)	p
BMI Classification				
Underweight (< 18,5)	8 (100)	0 (0)	–	–
Normal weight (18,5–22,9)	96 (88.89)	12 (11.11)	1	
Overweight – Obese (≥ 23,0)	34 (82.93)	7 (17.07)	1.53 (0.65–3.64)	0.31
Blood Pressure				
Normal	130 (89.66)	15 (10.34)	1	
Hypertension	8 (66.67)	4 (33.33)	3.22 (1.27–8.19)	0.041*

**: Fisher's exact test*

Comment: Patients with hypertension had a 3.22-fold higher risk of AFB positivity compared to those with normal blood pressure (PR = 3.22; 95% CI: 1.27–8.19; p = 0.041). No statistically significant association was found between BMI and AFB positivity. Notably, no AFB-positive cases were observed in the underweight BMI group.

Discussion: Chronic hypertension may impair circulatory and lymphatic function, leading to a weakened immune response and thereby facilitating the invasion or reactivation of Mycobacterium tuberculosis. Additionally, cardiovascular comorbidities commonly associated with hypertension (such as heart failure and myocardial ischemia) may further contribute to systemic immune suppression.

Table 5. Association between comorbid conditions and AFB positivity

Comorbid conditions	AFB (–) n (%)	AFB (+) n (%)	PR (KTC 95%)	p
Lung disease				
No	22 (88.00)	3 (12.00)	1.01 (0.32–3.21)	1.00*
Yes	116 (87.88)	16 (12.12)	1	
HIV infection				
No	135 (87.66)	19 (12.34)	–	1.00*
Yes	3 (100)	0 (0)	–	
Diabetes mellitus				
No	122 (92.42)	10 (7.58)	1	
Yes	16 (64.00)	9 (36.00)	4.75 (2.15–10.50)	0.001*

Comorbid conditions	AFB (–) n (%)	AFB (+) n (%)	PR (KTC 95%)	p
Liver disease				
No	134 (88.16)	18 (11.84)	1	
Yes	4 (80.00)	1 (20.00)	1.68 (0.28–10.28)	0.48*
Bacterial infections				
No	129 (87.76)	18 (12.24)	1	
Yes	9 (90.00)	1 (10.00)	0.82 (0.12–5.51)	1.00*
Viral infections				
No	125 (87.41)	18 (12.59)	1	
Yes	13 (92.86)	1 (7.14)	0.57 (0.08–3.94)	1.00*
Multimorbidity (≥ 2 comorbid conditions)				
< 2 conditions	33 (97.06)	1 (2.94)	1	
≥ 2 conditions	105 (85.37)	18 (14.63)	4.98 (0.69–35.95)	0.077
Presence of fever				
No	30 (93.75)	2 (6.25)	1	
Yes	108 (86.40)	17 (13.60)	2.18 (0.53–8.94)	0.37

**: Fisher's exact test.*

Comment: Diabetes mellitus was the only comorbidity significantly associated with AFB positivity. Patients with diabetes had a 4.75-fold higher risk of AFB positivity compared to non-diabetic patients (PR = 4.75; 95% CI: 2.15–10.50; p = 0.001). The prevalence of AFB positivity was 36.00% in the diabetic group, compared to 7.58% in the non-diabetic group.

Discussion: These findings are consistent with several national and international studies. Jeon C.Y. et al. (2008) reported that patients with diabetes had a 3.11-fold increased risk of active tuberculosis (RR = 3.11; 95% CI: 2.27–4.26) [8]. Nguyen Thi Trang et al. (2021) reported a TB–diabetes comorbidity rate of 26.5% at Hai Phong Lung Hospital [7]. Diabetes mellitus impairs macrophage function, reduces the ability to eliminate intracellular pathogens, and creates a metabolic environment favorable for the growth of Mycobacterium tuberculosis.

Table 6. Association between alcohol consumption and AFB positivity

Alcohol consumption habits	AFB (–) n (%)	AFB (+) n (%)	PR (KTC 95%)	p
Non-drinker	107 (92.24)	9 (7.76)	1	
Drinker	31 (75.61)	10 (24.39)	3.14 (1.37–7.19)	0.005
Level of alcohol consumption				
Non-drinker	107 (92.24)	9 (7.76)	1	
Occasional drinking	23 (85.19)	4 (14.81)	1.91 (0.63–5.76)	0.25
Regular drinking	8 (57.14)	6 (42.86)	5.52 (2.30–13.24)	< 0.001

Comment: Patients with alcohol consumption had a 3.14-fold higher risk of AFB positivity compared to non-drinkers (PR = 3.14; 95% CI: 1.37–7.19; p = 0.005). Notably, those with regular alcohol consumption had a 5.52-fold higher risk (PR = 5.52; 95% CI: 2.30–13.24; p < 0.001), with an AFB positivity rate reaching 42.86%.

Discussion: These findings are consistent with the study by Tran Thanh Hung et al. (2021), which reported that alcohol consumption increased the risk of recurrent pulmonary tuberculosis by 3.4 times (p < 0.001) [5]. The underlying mechanisms include alcohol-induced damage to Kupffer cells (hepatic macrophages), impairment of innate immunity, increased oxidative stress in the alveoli, and reduced phagocytic capacity of alveolar macrophages—the first line of defense against Mycobacterium tuberculosis.

Table 7. Association between smoking habits and AFB positivity

Smoking habits	AFB (–) n (%)	AFB (+) n (%)	PR (KTC 95%)	p
Non-smoker	113 (91.87)	10 (8.13)	1	
Smoker	25 (73.53)	9 (26.47)	3.26 (1.44–7.37)	0.007*
Smoking intensity				
Non-smoker	113 (91.87)	10 (8.13)	1	
Occasional smoking (< 3 cigarettes/ day)	21 (77.78)	6 (22.22)	2.73 (1.08–6.90)	0.033
Regular smoking (≥ 3 cigarettes/ day)	4 (57.14)	3 (42.86)	5.27 (1.85–14.98)	0,002

**: Fisher's exact test.*

Comment: Smoking was significantly associated with AFB positivity. Smokers had a 3.26-fold higher risk of AFB positivity compared to non-smokers (PR = 3.26; 95% CI: 1.44–7.37; p = 0.007). The strength of association increased with smoking frequency: occasional smoking (PR = 2.73, p = 0.033) and regular smoking (PR = 5.27; 95% CI: 1.85–14.98; p = 0.002).

Discussion: These findings are consistent with the study by de Vargas K.R. et al. (2021), which reported a significantly higher AFB positivity rate among heavy smokers (89.7%) compared to non-smokers (66.7%), p < 0.0001 [10]. Smoking damages the respiratory epithelium, reduces mucociliary clearance, impairs

alveolar macrophage function, and suppresses cell-mediated immunity—key defense mechanisms against Mycobacterium tuberculosis.

Table 8. Association between history of tuberculosis and AFB positivity

History of tuberculosis	AFB (–) n (%)	AFB (+) n (%)	p
No history of tuberculosis	125 (86.81)	19 (13.19)	
Currently on tuberculosis treatment	11 (100.00)	0 (0)	> 0,05*
Previously treated and cured	2 (100.00)	0 (0)	

**: Fisher's exact test*

Comment: No statistically significant association was found between history of tuberculosis and AFB positivity (p > 0.05). Patients who were currently receiving anti-tuberculosis treatment or had previously completed treatment all showed negative AFB results, which may be attributed to the reduction in bacterial load following anti-tuberculosis therapy.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

This study, conducted on 157 inpatients in the Infectious Diseases Department of Tra Vinh General Hospital, found that the prevalence of AFB positivity was 12.10% (19/157). Among the positive cases, AFB (1+) accounted for 52.63%, AFB (2+) for 21.05%, and AFB (3+) for 26.32%.

Factors significantly associated with AFB positivity included urban residence (PR = 3.16; p = 0.018), hypertension (PR = 3.22; p = 0.041), diabetes mellitus (PR = 4.75; p = 0.001), alcohol consumption (PR = 3.14; p = 0.005), regular alcohol use (PR = 5.52; p < 0.001), smoking (PR = 3.26; p = 0.007), and regular smoking (PR = 5.27; p = 0.002). No significant associations were found between AFB positivity and age, sex, occupation, BMI, other comorbidities (HIV infection, liver disease, lung disease), or history of tuberculosis.

4.2. Recommendations

Early tuberculosis screening using acid-fast bacilli (AFB) testing should be strengthened among patients with high-risk factors, including those with hypertension, alcohol use, and smoking. In particular, patients with diabetes mellitus—despite routine screening and follow-up—require careful monitoring and timely diagnosis when complications or abnormal clinical manifestations arise. Regular blood pressure monitoring and counseling on behavioral modifications (reducing alcohol consumption and smoking cessation) should be implemented for hospitalized patients. Future studies should include larger sample sizes and be conducted in specialized tuberculosis facilities to better elucidate the associated factors.

REFERENCES

[1] Ministry of Health (2020). Guidelines for the diagnosis, treatment, and prevention of tuberculosis. Decision No. 1314/QĐ-BYT, Hanoi, March 24, 2020

[2] Ministry of Health (2024). Decision No. 162/QĐ-BYT dated January 19, 2024 on the issuance of the professional guideline "Guidelines for diagnosis, treatment, and prevention of tuberculosis". Hanoi, Vietnam.

[3] Department of Tuberculosis (2006). Tuberculosis Pathology. Medical Publishing House, Hanoi, pp. 1–30.

[4] Tran Ngoc Dung, Nguyen Huu Thanh, Nguyen Khoa Thi, et al. (2023). Prevalence and epidemiological characteristics of new tuberculosis cases in Dong Thap Province. Vietnam Medical Journal, No. 524 – March – Issue 1B – 2023.

[5] Tran Thanh Hung, Tran Ngoc Dung, Pham Thi Tam (2021). Factors associated with recurrent pulmonary tuberculosis in Can Tho City, 2011–2016. Can Tho Journal of Medicine and Pharmacy, (34).

[6] Nguyen Loc, Le Thanh Tai (2019). Study on the situation and treatment outcomes of new AFB-positive pulmonary tuberculosis in Tan Phu District, Dong Nai Province. Can Tho Journal of Medicine and Pharmacy – Issue 29/2020.

[7] Nguyen Thi Trang, Nguyen Duc Tho (2021). Clinical and paraclinical characteristics of AFB-positive pulmonary tuberculosis in elderly patients at Hai Phong Lung Hospital, 2018–2019. Vietnam Medical Journal, Volume 503 – June – Special Issue – 2021

[8] Jeon CY, Murray MB (2008). Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. PLoS Medicine, 5(7): e152. https://doi.org/10.1371/journal.pmed.0050152

[9] Chakaya J, et al. (2022). The WHO Global Tuberculosis 2021 Report – not so good news and turning the tide back to End TB. International Journal of Infectious Diseases, 124(Suppl 1): S26–S29. https://doi.org/10.1016/j.ijid.2022.03.011

[10] de Vargas KR, et al. (2021). Smoking prevalence and effects on treatment outcomes in patients with tuberculosis. Revista da Associação Médica Brasileira, 67(3): 406–410. https://doi.org/10.1590/1806-9282.20200825

[11] Bagcchi S (2023). WHO's Global Tuberculosis Report 2022. The Lancet Microbe, 4(1): e20. https://doi.org/10.1016/S2666-5247(22)00359-7

[12] Pang Y, et al. (2019). Epidemiology of extrapulmonary tuberculosis among inpatients, China, 2008–2017. Emerging Infectious Diseases, 25(3): 457–464. https://doi.org/10.3201/eid2503.180572