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**Research Article**



# Prevalence of latent tuberculosis infection among healthcare workers in Albania

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## Abstract

Approximately 26% of the global population is estimated to be infected with latent tuberculosis. Healthcare workers are at higher risk due to continuous exposure to patients with active tuberculosis. To date, no published data exists on the prevalence of latent tuberculosis infection among healthcare workers in Albania. This study represents the first analysis aiming to assess the risk of TB infection within this group.
The cross-sectional study was conducted from July to December 2023 to assess the prevalence of latent tuberculosis infection among healthcare workers in Albania. Participants underwent interviews on demographic, social and exposure factors, as well as tuberculin skin testing to determine the presence of infection. Of the healthcare workers in the field of tuberculosis, only 20% were included in the study. Of the 706 healthcare workers included in the study, Of these, 217 (30.7%) were male and 489 (69.3%) were female, with a mean age of 45.7 years. 486 (68.8%) underwent the TST test. Latent infection was detected in 38 persons, representing a prevalence of 7.8% (95% CI: 5.8%–10.6%). The risk of latent tuberculosis infection was significantly associated with age ≥40 years and working time over 5 years ($p < 0.05$). About 79% (n=30) of the affected personnel started treatment for latent infection, while 21% (n=8) refused treatment. None of the participants tested positive for active tuberculosis. The prevalence of latent tuberculosis infection among healthcare workers in Albania appears lower compared to international reports, potentially reflecting the effectiveness of national TB control measures implemented after the COVID-19 pandemic. Continued strengthening of preventive strategies, including regular monitoring, professional training, and control measures in high-risk environments, is recommended.

**Keywords;** tuberculosis, latent tuberculosis infection, healthcare workers, tuberculin test, prevalence

## 1. Introduction

Tuberculosis (TB) continues to be a challenging disease, ranking as one of the top 10 causes of mortality worldwide, despite significant successes in its control. The state of

the host's immune response determines the manifestation of the disease symptoms, which range from a latent clinical phase in which the immune system is able to keep the pathogen under control to active TB, in which the Mycobacterium tuberculosis bacteria overwhelm the host's immune cells, causing the disease.

Latent tuberculous infection (LTBI) is a condition characterized by a dynamic equilibrium between the bacteria and the host, in which the pathogen is not completely eliminated from the body. A person with LTBI does not show clinical signs, has no radiological changes or bacteriological evidence of the disease, and is not infectious to others.

Historically, TB has long been a known risk to healthcare workers, especially nurses Globally, it is estimated that approximately one-third of the world's population is infected with ILTB. In Albania, according to a study conducted in 2008, about 7% of eighth-grade school students were found to have latent TB infection with the highest prevalence in Peshkopi (around 12%) and lowest in Vlora (under 1%). Although only 5–10% of cases of LTBIprogress to the active form of the disease, their impact on public health, especially among healthcare workers, is significant and cannot be neglected.

Transmission of tuberculosis in healthcare settings has been reported in almost every country in the world, regardless of the local incidence of the disease. Transmission occurs most frequently in cases of undiagnosed or inadequately treated TB. The risk of transmission is influenced by the prevalence of TB - the number of patients exposed, and the effectiveness of infection control measures.

According to the World Health Organization (WHO), systematic testing and treatment of LTBI should be considered for health workers in upper-middle-income countries, such as Albania, and with a TB incidence lower than 100 cases per 100,000 inhabitants. In these conditions, prophylactic treatment of ILTBL constitutes one of the main pillars in the global efforts to eliminate tuberculosis.

Regarding the incidence of TB, the relative risk for developing the disease in countries with low, medium and high incidence is 2.42; 2.45; and 3.68, respectively. Meanwhile, the annual rate of reactivation of LTBIin this group varies from 0.40% to 1.20%.

Historically, TB has been a known risk for health care workers, especially nurses. It is estimated that more than 50% of workers in this sector globally are infected with ILTBL, exposing them to an increased risk of developing active TB. These workers are 2 to 3 times more likely to develop active TB than the general population. In Albania, no study has been conducted to date to assess the prevalence of latent tuberculosis infection among healthcare workers, both in secondary and tertiary hospitals and in primary care centers.

Conducting a study on the surveillance of latent tuberculosis infection among healthcare personnel in healthcare institutions in the country aims to determine the extent of infection and morbidity in this group, in order to design effective measures for TB control in hospital and outpatient settings.

Healthcare workers are particularly at risk of contracting TB due to their constant exposure to infected patients. Other risk factors include inadequate use of protective measures (such as N95 masks), insufficient ventilation of work environments, and exposure during procedures such as sputum induction or bronchoscopy. One of the

main goals of testing for LTBIis to increase awareness among healthcare workers of the real risk of infection during contact with patients. If protocols for the prevention of respiratory infections in healthcare institutions are not strictly implemented, the risk of infection and development of the disease in this group will be considerable. In this sense, the specific objectives of the study are:

- to determine the prevalence of ITBL among workers in healthcare in public institutions;
- to identify risk factors for latent infection, including occupational exposure, duration of work in healthcare, specialty, contact with patients with active TB;
- to assess the level of awareness and implementation of preventive measures against TB infection in healthcare institutions, including respiratory infection control protocols;
- to monitor TB surveillance in healthcare institutions dealing with the diagnosis, treatment and prevention of TB in Albania;
- Strengthening infection control measures in health institutions and reflecting them in infection control prevention strategies in health workers;
- Addressing the needs for strengthening the capacities of health professionals in the field of TB prevention and control;
- Building a national database on TB in healthcare workers which will serve as a starting point for long-term public health policies towards the elimination of TB.

## 2. Research methods

The prospective study included healthcare workers and support staff working in health care institutions, mainly staff working in the field of tuberculosis. The selection of study participants was carried out during the period July-August 2023. The study was conducted in Hospitals, Dispensaries and Health Centers, Bulqizë, Dibër, Mat, Durrës, Kavajë, Lushnje, Berat, Fier, Vlorë Elbasan, Gramsh, Librazhd, Korçë, Pogradec Gjirokastër, Sarandë, Tepelenë, Përmet, Tiranë, Kurbin, Mirditë, Krujë, Lezhë, Shkodër, Kukës, Tropojë and Pukë.

706 participants were included in the study.The study included healthcare staff who diagnose and treat patients with TB, such as:

- healthcare workers who have more frequent and direct contact with the patient;
- healthcare workers who have a longer duration of work;
- healthcare workers who have contact with TB patients;
- healthcare workers who work in settings without infection control precautions.

Healthcare workers involved in the study are: doctors, nurses, pharmacists. laboratory technicians, administrative staff and other employees. The tuberculin skin test indicates whether a person is infected with the mycobacterium tuberculosis. Testing of healthcare personnel for Latent TB Infection was performed with the Tuberculin PPD test

Reliable administration and reading of the TST requires: standardization of procedures, training, supervision and practice. Conduct training sessions for all staff involved in the study

## 3. Analysis

As part of the study to assess latent tuberculosis infection in health care institution employees, a questionnaire was designed and used, which included detailed information on the demographic and professional characteristics of the participants. The questionnaire contained data on age, gender, residence, profession, country and sector of work, as well as the number of years of experience in the field of TB. The questionnaire was completed by the participants after they had been previously informed about the purpose of the study and had given their consent to participate in the study by signing the consent form. Although all 706 participants completed the questionnaire, a part of them, specifically 222 people, refused to undergo PPD testing, despite having initially agreed to be included in the study. This fact indicates possible challenges in the acceptability of testing, which may be related to fear of the result or other psychological factors. Health staff involved in conducting the study were trained for objectives, methodology, ethical considerations, proper application and reading of the PPD test, data collection, and documentation procedures of the study.

The division of roles within the working group played a key role in ensuring a coordinated and efficient process. The study coordinator was responsible for overseeing the implementation across all districts during the September–November 2023 period. This included supervising the nursing teams, supporting the proper application of the PPD test, managing and interpreting collected data, and contributing to the final report. Nurses in the field were tasked for applying the PPD test to health personnel for the period September - November 2023 for all districts it covers.Their work was essential to the standardization and quality control of the study procedures across all participating districts.

Monitoring and coordination of the study for the period September - November 2023, for all districts where the study is applied; The risk of LTBIis directly related to increasing age. The reason for the increasing age of LTBIis related to a prolonged exposure to MTB infection. The exact explanation of why LTBIwas high at the age of 51–60 years cannot be given in this study, as it requires another study with a larger scope and larger participation. Consequently, further research is required to better understand the association of LTBIwith age. It is known that more years of employment working in high-risk areas of TB are important cumulative factors for acquiring TB infection. All HCWs with positive LTBI underwent CXR examination and the CXR results were normal. Those HCWs with positive LTBI who had sputum underwent AFB microscopy and subsequently, their results were negative. In conclusion, there were no active TB cases among HCWs with ILTB.

Therefore, with our limited health resources, it is recommended to improve infection control measures at least in high-risk workplaces. In this study, in terms of occupation, the group of doctors was not a risk factor for ILTB.

On the other hand, doctors work in outpatient and inpatient health settings, which causes them to be more prone to infections, including TB. And this remains to be

discovered in other more detailed studies including other factors in the study.
In this study, although the prevalence of LTBIamong nurses was (4.2%), it was not statistically significant. In our study, we did not find any case of active TB among health workers with ILTB. Apparently, the high socio-economic status of HCWs, compared to the general population, has been the cause of the low incidence of TB in health staff.
However, healthcare workers (HCWs) who lack sufficient medical knowledge refuse to take the drugs claiming that INH damages the liver. HCWs are at increased risk of active and latent tuberculosis infection (LTBI) compared to the general population. Despite existing guidelines for the prevention and management of LTBI, little is known about why HCWs who test positive for LTBI refuse treatment.
To represent all HCWs for tuberculin skin testing across the country, the study requires more than a year of time, however, the data from this study are of great value for increasing attention to TB control among healthcare personnel and measures that will be taken for infection control in healthcare facilities
Infection prevention and control is the responsibility of everyone working in healthcare facilities and it is important that nurses, doctors, support staff and managers all work together to ensure a safe environment for patients, healthcare workers and visitors.
It is estimated that more than 50% of healthcare workers globally have LTBI, making them more at risk of developing active TB. Furthermore, healthcare workers are two to three times more likely to develop active TB than the general population.
The prevalence of LTBIamong healthcare workers in healthcare facilities in Albania is low at around 8% and this reflects the good epidemiological situation of TB in our country. as well as the appropriate measures for TB infection control.
Despite the low prevalence of LTBIamong healthcare workers, we strongly recommend that every healthcare worker working in institutions dealing with the diagnosis or treatment of TB, before starting work, perform the PPD test and chest X-ray to assess his/her health status.
Healthcare workers should be aware of the nature of the potential health risks in TB laboratories and have access to experts for consultation. Appropriate documentation of PPD and chest X-ray examinations should be maintained, confidentiality maintained, and periodic monitoring should be performed as necessary. The use of IGRAs (compared to TSTs) is associated with increased rates of LTBI treatment in healthcare workers. Available cost-effectiveness studies provide strong evidence to support the use of IGRAs in screening healthcare workers

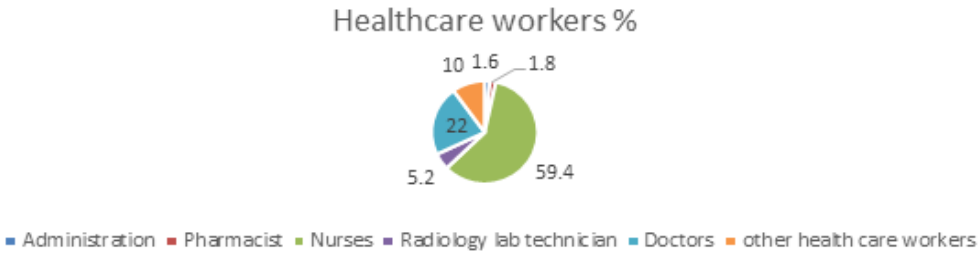
### *3.1 Tuberculin test application*

The TST is performed by injecting PPD into the ⅓ inner surface of the forearm according to the Mantoux method. The PPD substance is injected into the skin with a tuberculin syringe without cleaning the skin with alcohol;
After administering the TST, there is no need to cover the injection site. Mild itching or swelling may occur. These are normal reactions and do not require any treatment. These reactions usually resolve within a week;

The injection site should not be irritated, should be kept clean and dry. No creams or adhesive bandages should be applied;
d) The TST should be read within 48-72 hours after the injection. The reaction should be measured in millimeters of induration (strong swelling). Each nurse assigned to the coverage areas was provided with PPD test kits, syringes, PPD vial storage boxes, bags, pens, and patient and testing consent forms.
Tuberculin (PPD) vials were provided by the project "For scaling up and ensuring sustainability of the national response to TB and HIV/AIDS".
The start of the testing of healthcare personnel began at the beginning of September and lasted until November 2023. Each nurse in the respective area, the day before, prepared the list of people who would perform the test.
At first, each person was offered a consent form, after he/she read it and expressed his/her desire to perform the PPD test by signing the form. Then, the PPD test form was filled out based on all the variables included in it.
The PPD test was applied to the person, repeating once again the rules, that it should not be wet with water or rubbed. After 48 -72 hours, the person had the test result read by the nurse.
Every day that the nurses read the result, they noted it on the form and then sent it to the nurse coordinator.
The nurse coordinator received daily PPD test reading data from the nurses, and the results were entered into the TB database (SPSS). At the end of the week, nurse coordinator.
provided information on the entire progress of the study process in each area.
During the study, according to nurses coordinator, there were also difficulties in applying the PPD, since even though they are health personnel and employees of health institutions, they hesitated or, in most cases, refused. No problems were identified in the technique of applying the PPD in all cases where it was applied, since the nurses were selected based on their professional experience in years in applying the PPD test. Data analysis was performed using the SPSS statistical program.

## 4. **Results**

706 health workers participated in the study, of whom 217 were male (30.7%) and 489 were female (69.3%). The average age of the participants in the study is 45.7 years. 78 (11%) from district dispensaries participated in the study, 167 (23.8%) from health centers, 369 (62.4%) from regional hospitals and 92 (13%) from the "Shefqet Ndroqi" University Hospital.
According to the age groups 20-30 years 97 (14%), 31-40 years 153 (22%), 41-50 years 147 (30%), 51-60 years 253 (36%). According to the participation in the study in the districts, the highest number is in Tirana with 200 (28.3%) followed by Shkodra with 49 (6.9%), Durrës 50 (7%), Lezha with 35 (4.9%), Korça 34 (4.8 The health workers in the study were 11 (1.6%) administrative workers, 12 (1.8%) pharmacists, 420 (59.4%) nurses, 37 (5.2%) laboratory technicians, 154 (21.8%) doctors, and 71 (10%) other employees.%) and other districts with 1-4%.




Of the 706 healthcare workers included in the study, 220 (31%) refused to be tested for latent TB infection even though they had previously agreed to be included in the study based on the consent forms. Of the refusals, 11 (1.5%) were pharmacists, 100 (14%) were nurses, 11 (1.5%) were laboratory technicians, 97 (13.8%) were physicians, and 1 (0.2%) was others healthcare workers Of the tests performed on 486 healthcare workers, 381 (78.4%) had a negative tuberculin test result of 0-4 mm, 67 (13.8%) had a negative tuberculin test result of 5-9 mm, 36 (7.4%) had a positive tuberculin test result of 10-15 mm and 2 (0.4%) had a positive tuberculin test result of over 15 mm. Of the healthcare workers, 49 (6.9%) had been previously tested for latent TB infection, but had been negative.

PPD tests were performed mostly for documentation purposes or when they started work. Family members or other persons in the family or close contacts reported that only 6 (0.8%) of them had. According to the years of work in the institution, it turned out that they were tested with the PPD test, from 1-5 years 226 (32%), 6-10 years 107 (15%), 11-15 years 99 (14%). 16-20 years 52 (7.4%), 21-25 years 58 (12%), over 25 years 137 (19%).

Positive tuberculin test result for 1-5 years of work 10 health workers with positive PPD 10-15 mm, from 6-10 years 7 health workers with positive PPD 10-15 mm, with 11-15 years of work 7 health workers with positive PPD 10-20 mm. From 16-20 years of work 4 health workers with positive PPD 10-15 mm, from 21-25 years of work 2 with positive PPD with result 10-15 mm, and over 25 years of work 8 employees with positive PPD with result 10-15 mm. As can be seen, LTBIpositivity is in the years 1-5 years, 6-10 years and over 25 years.

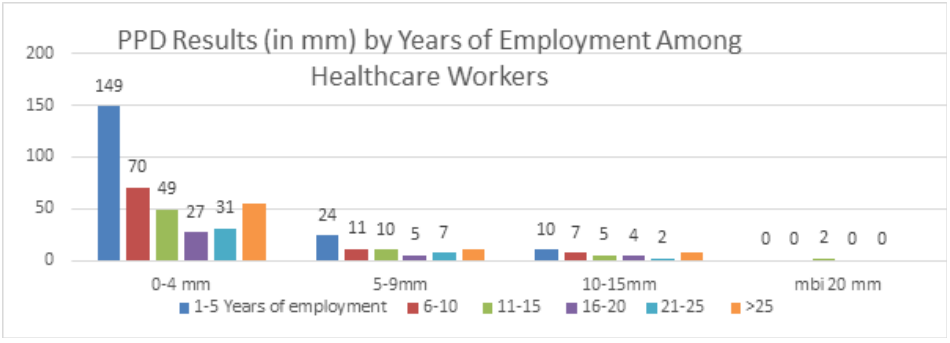



Figure 1; PPD results by years of employment among Healthcare workers

Tuberculin test positivity was observed in 3 cases among individuals aged 20–30 years, 3 cases in the 31–40 age group, 11 cases in the 41–50 age group, 18 cases in the 51–60 age group, and 3 cases in those over 60 years old. As shown, the highest positivity was observed among individuals aged 41–60 years.

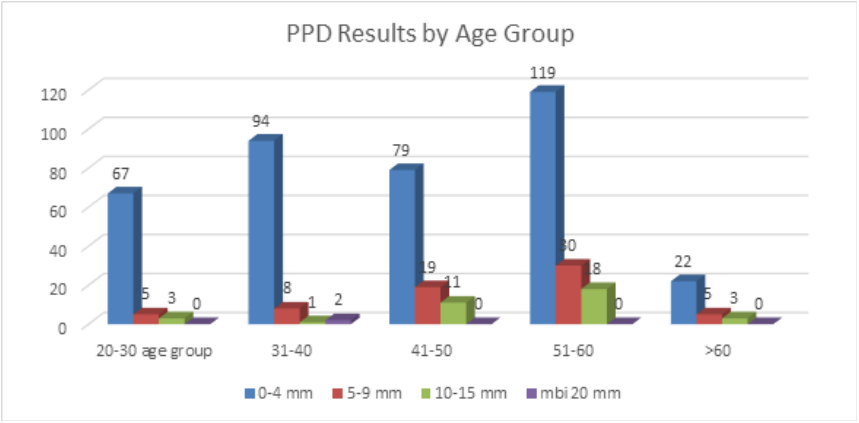



Figure 2; PPD result by age group

Tuberculin test positivity by profession: nurses 21 (4.2%), laboratory technicians 2 (0.4%), doctors 5 (1%), administrative staff 1 (0.2%), and other healthcare workers 9 (1.7%)

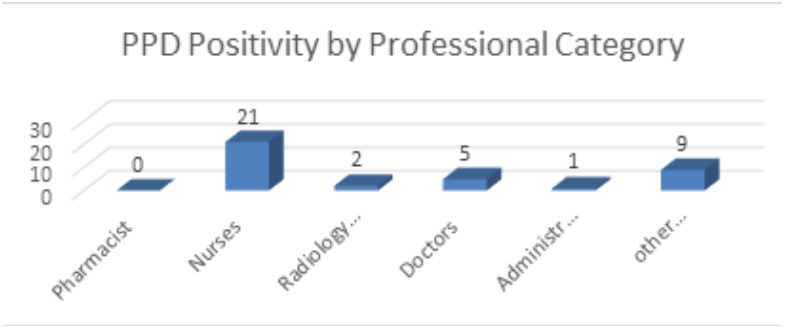



Figure 3; PPD positivity by professional category

Tuberculin test positivity by gender: 30 female cases and 7 male cases. This is also related to the higher participation of the female gender, about 69.3%, in the study. Of the 38 workers who tested positive for PPD, only 30 (79%) of them agreed to start treatment for latent TB infection; 8 (21%) of them did not agree, as they claim to have worked for over 20 years and have not had problems with TB disease. Screening and exploring the determinants of LTBIamong HCWs is an important measure to reduce the incidence of tuberculosis. In this study, the prevalence of LTBI in HCWs was 7.8%. The prevalence of LTBI increases with the duration of employment (>5 years)

and also with increasing age (>40 years). Specifically, one variable, i.e., the age group 51–60 years, was a significant predictor of LTBIamong healthcare workers.

## 5. Conclusion

The findings of this study highlight the presence of LTBI among HCWs, with a recorded prevalence of 7.8%, a figure that remains below the global average. It is important to note, however, that only 20% of healthcare personnel were included in the study, primarily those directly involved in tuberculosis TB related services. Despite the relatively low prevalence, LTBI among HCWs should not be overlooked, particularly given the continued risk of transmission in TB specific clinical environments. Public healthcare institutions featured favorable environmental conditions, including spacious, well-ventilated areas with abundant natural lighting factors that are crucial in minimizing the transmission of airborne pathogens such as Mycobacterium tuberculosis. Adequate ventilation and natural light contribute to improved air circulation and reduce the accumulation of infectious particles, thereby lowering the risk of TB spread. However, the study identified a significant shortcoming in the use of personal protective equipment. Healthcare workers were found to commonly use standard surgical masks, which offer limited protection by filtering only large respiratory droplets. These masks are inadequate in preventing the inhalation of fine aerosolized particles that carry TB bacteria. To effectively protect against airborne transmission, the use of certified respirators such as N95 or FFP2/FFP3 is essential. This situation underscores critical gaps in infection control practices. These include insufficient PPE supply, lack of proper training, and weak enforcement of safety protocols. The study also found a significant correlation between LTBI positivity and years of professional experience. This suggests that prolonged occupational exposure in TB-endemic environments increases the likelihood of acquiring latent infection. Nurses, in particular, exhibited higher LTBI rates due to their continuous and close contact with TB patients, especially in high-incidence settings. Routine screening for LTBI among healthcare workers is a vital preventive measure. Early detection enables timely intervention, reduces the risk of disease progression, and minimizes further transmission. Additionally, routine testing raises awareness, promotes adherence to infection control protocols, and helps protect both HCWs and the patients they serve. There is an urgent need to develop, implement, and regularly revise national policies aimed at safeguarding healthcare personnel from TB. These policies should align with international standards, such as those set by the World Health Organization (WHO), and recognize healthcare workers as a high-priority group in TB prevention and control efforts.

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