PREVALENCE OF LATENT TUBERCULOSIS INFECTION AMONG MEDICAL STUDENTS: A SYSTEMATIC REVIEW AND ITS EMPIRICAL IMPLICATIONS

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Abstract
Latent tuberculosis infection (LTBI) constitutes a silent but significant reservoir of *Mycobacterium tuberculosis*, representing a key challenge in global TB control. Medical students, due to their exposure during clinical training and contact with possible infectious patients, are a particularly vulnerable group. This manuscript systematically reviews data on LTBI prevalence among medical (and healthcare) students from existing literature, analyzes associated risk factors, discusses the empirical implications of a high LTBI burden, and provides concrete recommendations for prevention, screening, and education in medical schools.
Keywords: latent tuberculosis infection, medical students, prevalence, tuberculin skin test

Introduction
Tuberculosis (TB) remains a significant public health problem worldwide. While active tuberculosis gets the primary attention in control programs, the latent *Mycobacterium tuberculosis* infection (LTBI) constitutes a large hidden reservoir that can reactivate under immunosuppression or other risk conditions.
Medical students — due to their clinical rotations, exposure to hospital environments, and direct contact with patients — represent a particularly vulnerable group. Despite their training, they may not always adhere to optimal infection control practices or consistently use personal protective equipment (PPE). Thus, assessing the prevalence of LTBI in this population is critical from both educational and public health perspectives.
The objectives of this review are:

1. To summarize the evidence on LTBI prevalence among medical and other undergraduate healthcare students.
2. To identify key risk factors contributing to LTBI in this population.

3. To discuss policy-level, empirical, and educational implications of a high LTBI burden among students.
4. To propose practical recommendations for screening, prevention, and curriculum changes in medical institutions.

Methods

A systematic search was conducted in several online databases — PubMed, Scopus, Web of Science, and EMBASE — using combinations of the following keywords: “latent tuberculosis infection”, “LTBI”, “medical students”, “healthcare students”, “tuberculin skin test”, and “interferon gamma release assay (IGRA)”.

Inclusion criteria for selecting studies:

Participants: Undergraduate medical or healthcare students (nursing, allied health).

Designs: Cross-sectional, retrospective / prospective cohort, or systematic reviews / meta-analyses.

Diagnostic tests used: TST (tuberculin skin test) and/or IGRA.

Data extraction process included: countries of study, TB burden context, sample sizes, methodology (type of test, cut-off for positivity), prevalence of LTBI, and identified risk factors. Study quality was evaluated according to standard frameworks, focusing on sampling, test interpretation, and risk of bias.

Results

Prevalence of LTBI among healthcare students

A major systematic review by Ismail et al. (2022) included 14 studies of medical and nursing students. In high-burden TB countries, the pooled LTBI prevalence was 38.2% by TST and 20.6% by IGRA; in intermediate-burden contexts — ~16.7% (TST) and ~4.7% (IGRA); and in low-burden settings — ~2.8% and ~1.1%, respectively [1].

A meta-analysis (22 studies) of undergraduate health students reported a pooled prevalence of 12.53% LTBI [2].

In Italy, a cross-sectional screening of 3,374 healthcare students (medical and other) showed 128 TST-positive, and among them, 34 had positive IGRA [9].

In Malaysia, a study of 171 clinical-year medical students reported a 3.5% TST positivity and 0.6% IGRA positivity.

Incidence / Conversion during clinical training

A retrospective cohort study of 2,000 health-science students found that 10% of initially TST-negative students converted to positive after their clinical training. Importantly, medicine students had a 76% increased odds of conversion compared to other health disciplines [4].

Other epidemiological insights

In a study in Johannesburg, South Africa, the LTBI prevalence among medical students measured by TST and IGRA was 26.6% (TST) and 15.2% (IGRA), versus much higher among healthcare workers [10].

Among all HCWs in high-burden countries, a meta-analysis reported very high LTBI prevalence — pooled ~47% by TST [11].

For broader student populations (college students), a recent meta-analysis (50 studies) indicates 20% TST positivity and 9% IGRA positivity; risk factors

included older age, no BCG vaccination, contact with TB, clinical training, and overweight/obesity.

Discussion

The prevalence of LTBI among medical and healthcare students is not negligible. Depending on the regional TB burden and the diagnostic method, this can range from a few percent in low-burden settings to tens of percent in high-burden countries. High TST positivity in some studies may be influenced by prior BCG vaccination or exposure to non-tuberculous mycobacteria, making IGRA a more specific, though costlier, option.

The cohort data demonstrating conversion during clinical rotations strongly suggest real risk of infection during medical training, not just pre-existing latent infection. This underlines the occupational-like risk for students in clinical environments.

Conclusion

Medical students are a high-risk population for latent tuberculosis infection due to their exposure during clinical training. The prevalence data, drawn from multiple studies globally, suggest that LTBI among students is not trivial and may be acquired during training. Proactive measures — screening, preventive therapy, education, and infection control — are essential to protect this group and reduce future TB burden. By addressing LTBI in medical student populations, institutions contribute not only to individual health but also to broader TB elimination goals.

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