Volume 3, Issue 7, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

RELATIONSHIP BETWEEN THE KNOWLEDGE AND PRACTICE TOWARDS RISK FACTORS AND PREVENTION OF TUBERCULOSIS AMONG HEALTHCARE WORKERS

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DOI: https://doi.org/10.5281/zenodo.17157411

Keywords
Tuberculosis, healthcare workers, knowledge, practice, infection control, patient safety, occupational health.

Article History
Received: 27 June 2025
Accepted: 07 September 2025
Published: 19 September 2025

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Abstract

Background: *Tuberculosis (TB) remains a significant global health threat and a major occupational hazard for healthcare workers (HCWs). Effective TB control relies heavily on HCWs' knowledge and adherence to infection prevention practices, yet gaps in these areas can facilitate nosocomial transmission and compromise patient safety.*

Aim: *This study aimed to assess the relationship between knowledge and practice towards the risk factors and prevention of tuberculosis among healthcare workers in Lahore, Pakistan.*

Methods: *A descriptive cross-sectional study was conducted with 145 nursing students and healthcare workers selected via purposive sampling. Data were collected using a structured questionnaire and an observational checklist, assessing demographic details, TB knowledge (transmission, symptoms, treatment), and self-reported practices (mask usage, sputum handling). Data analysis was performed using SPSS version 24, employing descriptive statistics.*

Results: *Participants demonstrated strong knowledge of TB transmission (89.0%) and diagnostic methods (73.1%). However, significant gaps were identified in understanding anti-TB drug side effects (33.1%) and treatment duration (57.2%). While most reported good respiratory hygiene (75.2%), consistent mask usage was lower (62.1%). A critical finding was that 59.3% reported handling sputum specimens while sick, indicating a serious breach of safety protocols.*

Conclusion: *While foundational knowledge of TB is adequate, critical gaps persist in pharmacovigilance and consistent safe practices. This disconnects between knowledge and practice undermines occupational safety and TB control efforts, highlighting an urgent need for enhanced training focused on treatment protocols and strict enforcement of infection control policies.*

INTRODUCTION

Tuberculosis (TB) is an infectious type of disease that is caused by Mycobacterium tuberculosis and which is spread by way of air droplets (Godreuil, Tazi, & Bañuls, 2007). Latent Tuberculosis Infection (LTBI)

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ISSN: (e) 3007-1607 (p) 3007-1593

is a condition when the bacteria progress without symptoms in the body but can still result in its active forms with the onset of the disease in the future (Rathod, 2020). Multi-Drug Resistant Tuberculosis (MDR-TB) develops when TB bacteria are resistant to at least 2 of the most potent anti-TB medications: isoniazid and rifampicin (MacLean, 2022). TB Infection Control (TBIC) can be described as a series of administrative, environmental, and personal protective controls developed to mitigate the risk of TB spreading in health care facilities (Ismail, Reffin, Wan Puteh, and Hassan, 2021). Health Care Workers (HCWs) refer to professionals like nurses, doctors, and support people that are at risk of occupational exposure to the TB illness during the provision of care to patients (Kiragu, 2022).

Tuberculosis is the cause of morbidity and mortality of a number of people in the world. In 2013, according to the World Health Organization (WHO), the number of new TB cases was 9 million, and the number of deaths amounted to 1.5 million (Kiziltaş & Babalik, 2023). Although there is advancement in control of TB in the world, there is still high prevalence of TB in low and middle income countries. The mean rate of TB incidence in Europe was 2.7 per annum between 2004 and 2008 (Farina, 2023). Latent TB infection among healthcare workers is disproportionately high with an estimate of 57 percent whereas active TB among HCWs has been observed to be 1.7 percent as compared to the general population of 0.3 percent (Adjei, 2018).

One of the known occupational hazards of healthcare workers is tuberculosis because of the close and frequent contacts with sick people (Coleman, Martinez, Theron, Wood, and Marais, 2022). Researchers have indicated that delayed diagnosis, poor infection control measures, and ineffective treatment strategies have contributed to the spread of nosocomial transmission (Islam, 2022). Particularly at risk are certain groups such as the laboratory personnel, morgue technicians and nurses (Kiragu, 2022). There is also the increase of drug-resistant TB strains that makes infection control more difficult and endangers HCWs.

Medical institutions in the high burden states do not have a proper TB infection control policy, which puts HCWs at risk that are avoidable (Saria, 2020). Although advanced countries have introduced regular TB screening and preventive metrics in the form of interferon-gamma release assays (IGRAs), they are not in resource-constrained environments (Masilo, 2019). Traditional tuberculosis skin tests (TSTs) cannot be easily interpreted in countries with high Bacillus Calmette–Guerin (BCG) inoculation, and this limits their usefulness as screening methods (Varghese, 2020).

Nurses play a central role in the TB control because they have direct and long-term interaction with hospitalized and ambulatory TB patients (Villar et al., 2021). The Revised National Tuberculosis Control Program (RNTCP) and Directly Observed Treatment, Short Course (DOTS) are some of the programs that include nurses in diagnosis, treatment, counseling, and health education (Rajalakshmi, Amzad Basha, and Asif Jamal, 2023). Their practices, attitude and knowledge (KAP) can play a big role in the effectiveness of TB management and prevention strategies.

Past researches have indicated that the healthcare personnel usually exhibit poor knowledge, negative attitudes, and practices towards TB prevention and management (Islam, 2022). The problem of insufficient knowledge about the prevention of TB infection poses not only a risk to the workplace but also influences the safety of patients and community infection (Chikovore et al., 2020). It has been reported that there is misconception and stigma of TB among HCWs, further compromising the effective use of TB control measures (Farina, 2023).

It is important to strengthen the knowledge and practices of HCWs to control TB. The main ways to ensure the reduction of nosocomial TB spread include training programs, frequent screening, and enhanced infection control strategies (Fox, Redwood, Chang, & Ho, 2021). The knowledge of the level of awareness of nurses working in general and TB-specialized hospitals constitutes an insight into the existing gaps and facilitates specific interventions. The assessment of the knowledge, attitudes, and practices of nurses is thus important in coming up with effective TB prevention and control programs.

Methodology

The study employed a descriptive cross-sectional design to assess the relationship between knowledge

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ISSN: (e) 3007-1607 (p) 3007-1593

and practices toward risk factors and prevention of tuberculosis among healthcare workers. It was conducted in the Department of Nursing at Superior University, Lahore. A purposive sampling technique was used to recruit participants, focusing on nursing students enrolled in the morning classes of the university. The study lasted approximately nine months, allowing sufficient time for data collection, analysis, and reporting. The sample size was calculated using Slovin's formula, taking into account the total population size of eligible students and a predetermined margin of error. The sample size was 145. The study population consisted of nursing students from the Superior University Nursing Department, Lahore. Inclusion criteria were limited to morning-class students, while evening/weekend students, teachers, and other staff were excluded.

Data Collection

Ethical approval was obtained from the Ethical Committee of Superior University, Lahore. Written informed consent was secured from all participants prior to data collection. Participants were informed about the objectives, the voluntary nature of participation, and their right to withdraw at any time. Confidentiality was maintained by anonymizing responses and securing data on a password-protected device.

Data were gathered using an adapted questionnaire and checklist. The questionnaire had three sections: demographic characteristics (age, gender, education, experience, role, and exposure to TB training), a knowledge questionnaire assessing understanding of TB transmission, symptoms, diagnosis, treatment, and prevention, and an observational checklist for practices including mask usage, cough etiquette, and handling of sputum samples. The knowledge questionnaire followed Bloom's (1968) cut-off point to categorize knowledge into good (80–100%), average (60–79%), and poor (<59%). Practices were categorized as competent (≥85%) or incompetent (<85%). Data collection was carried out after obtaining informed consent, with assurances of confidentiality, anonymity, and voluntary participation.

Data Analysis

Collected data were analyzed using SPSS Version 24. Descriptive statistics, including frequencies and percentages, summarized categorical variables, while mean and standard deviation described continuous variables. The relationship between knowledge and practice levels was also explored.

Results and Analysis

The demographic profile shows that most participants were aged 25–30 years (86.9%), with nearly equal representation of males (49%) and females (51%). The majority held a bachelor's degree (77.2%) and were working as nurses (89%). Over half of the participants had less than one year of experience (55.2%), indicating a relatively young and early-career workforce. All respondents were Pakistani nationals [Table 1].

Table 1: Demographic Characteristics of Participants (n = 145)

Variable	Category	Frequency	Percentage
Age	25–30 years	126	86.9%
	30–35 years	18	12.4%
	35–40 years	1	0.7%
Gender	Male	71	49.0%
	Female	74	51.0%
Nationality	Pakistani	145	100.0%
Education Level	Diploma	32	22.1%
	Bachelor	112	77.2%
	Master	1	0.7%
Occupation	Nurses	129	89.0%
	Physicians	16	11.0%

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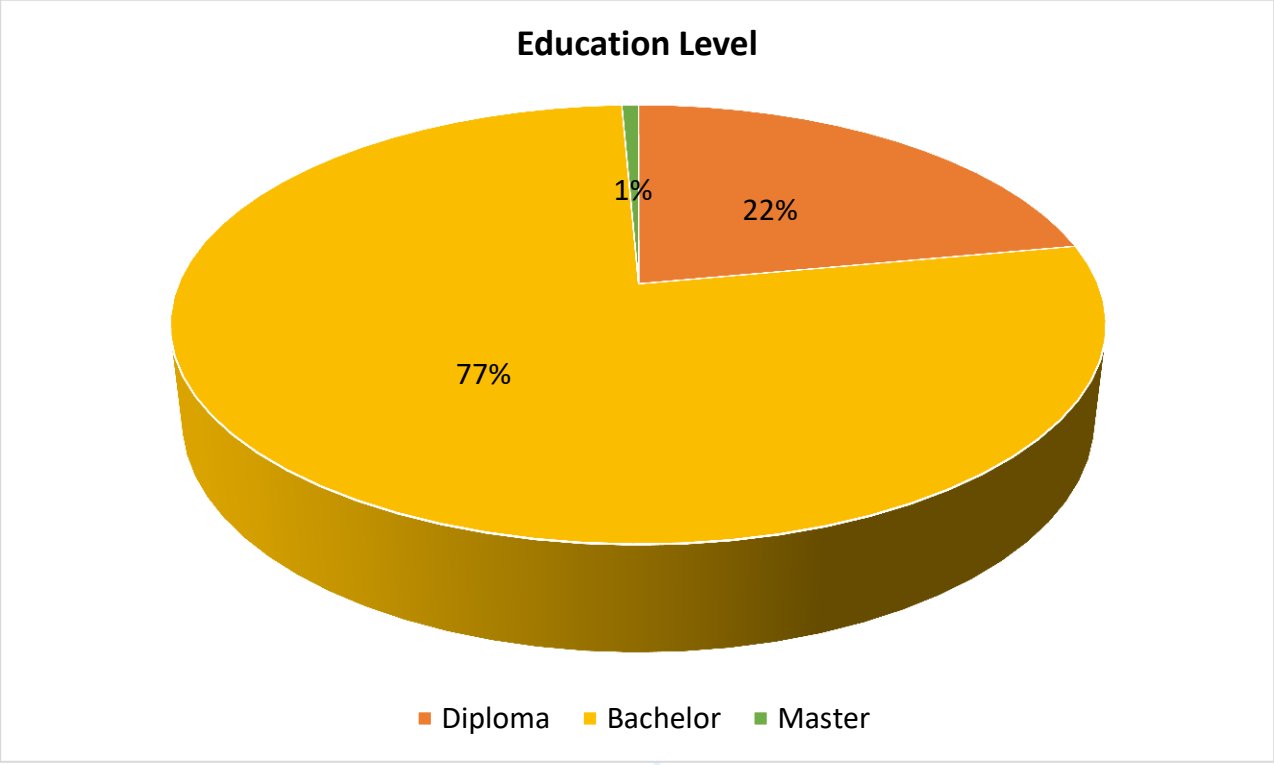
ISSN: (e) 3007-1607 (p) 3007-1593

Current Position Length	<1 year	80	55.2%
	1–5 years	55	37.9%
	>5–10 years	10	6.9%

The educational profile shows that the majority of participants held a bachelor's degree (77.2%), while 22.1% had a diploma and only 0.7% had a master's degree. This indicates that most respondents were formally educated at the undergraduate level, reflecting a moderately qualified group, though higher-level academic training was limited [Figure 1].

Figure 1: Education Level of Study Participants



The results show that most participants had good knowledge of TB transmission (89%) and diagnostic examination (73.1%), but awareness of TB symptoms was lower (68.3%). Only 33.1% knew about common adverse drug reactions, indicating a major knowledge gap. While 71% recognized TB as a curable disease, fewer participants understood treatment duration (57.2%) or correct actions during adverse reactions (51%). Overall, knowledge was moderate, with significant deficiencies in drug-related aspects of TB care [Table 2].

Table 2: Knowledge of Healthcare Workers Regarding Tuberculosis (n = 145)

Knowledge Question	Yes	No
Do you know the primary transmission of TB?	129 (89.0%)	16 (11.0%)
Do you know the symptoms of TB?	99 (68.3%)	46 (31.7%)
Do you know the necessary examination for TB?	106 (73.1%)	39 (26.9%)
Do you know about common adverse reactions of anti-TB drugs?	48 (33.1%)	97 (66.9%)
Do you know the most critical measure for curing TB?	90 (62.1%)	55 (37.9%)
Do you know how long TB patients need to take medicine?	83 (57.2%)	62 (42.8%)
Do you know whether TB can be cured?	103 (71.0%)	42 (29.0%)

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ISSN: (e) 3007-1607 (p) 3007-1593

Do you know what should be done due to adverse drug reactions?	74 (51.0%)	71 (49.0%)

The practice findings indicate that most participants had actively learned about TB (80.7%) and followed preventive behaviors such as covering mouth and nose in the TB ward (75.2%). However, only 62.1% consistently wore masks, showing a gap in protective practice. Nearly half (49%) reported observing patients missing TB doses, highlighting treatment adherence challenges. Additionally, 59.3% handled sputum specimens while sick, reflecting unsafe practices that increase infection risk [Table 3].

Table 3: Practices of Healthcare Workers Regarding Tuberculosis (n = 145)

Practice Question	Yes	No
Have you actively learned about TB?	117 (80.7%)	28 (19.3%)
Do you wear a mask when going to the TB ward?	90 (62.1%)	55 (37.9%)
Do you cover your mouth and nose when speaking, coughing, or sneezing in the TB ward?	109 (75.2%)	36 (24.8%)
Have you ever seen a patient who missed a dose during TB treatment?	71 (49.0%)	74 (51.0%)
Have you ever handled a sputum specimen while sick?	86 (59.3%)	59 (40.7%)

The overall results reveal that participants demonstrated strong knowledge of TB transmission (89%) but showed poor awareness of drug side effects (33.1%) and treatment duration (57.2%). Preventive practices such as mask use (62.1%) and covering mouth/nose (75.2%) were followed moderately, though not consistently. Unsafe practices like handling sputum while sick (59.3%) highlight serious infection risks. These findings suggest that while basic knowledge and prevention behaviors were adequate, critical gaps remain in drug-related knowledge and safe clinical practices.

Table 4: Summary of Key Knowledge and Practice Gaps

Aspect	Adequate Level	Inadequate Level
Knowledge of TB transmission	89.0%	11.0%
Knowledge of TB symptoms	68.3%	31.7%
Knowledge of drug side effects	33.1%	66.9%
Knowledge of treatment duration	57.2%	42.8%
Use of masks in TB ward	62.1%	37.9%
Covering mouth/nose	75.2%	24.8%
Handling sputum while sick	59.3%	40.7%

Discussion

This paper has discussed the connection between knowledge and practice about the risks of tuberculosis and its prevention among people in the healthcare field, showing the strength and significant gaps. The results show that although there was great awareness among the respondents on the routes of transmissions of the TB infection and the diagnostic procedures, there were great gaps in the respondents knowledge regarding anti-TB drug side effects and the duration of treatment. These findings are in line with the existing literature, including the study by Alotaibi et al. (2019), who also reported the same; in this case, healthcare workers (HCWs) were generally well-informed about TB transmission, yet the knowledge on multidrug-resistant TB (MDR-TB) and latent TB infection (LTBI) showed significant gaps. This comparison indicates that there is a long-term, extensive problem in TB education which cuts across geographical and institutional lines.

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ISSN: (e) 3007-1607 (p) 3007-1593

Nonetheless, the present research is in contrast to the discovery of Vigenschow et al. (2021), who have found that the general level of knowledge among the HCWs in Gabon was higher. This inconsistency can be explained by the variation in the populations of the study; the current sample was mainly comprised of young and relatively unexperienced nurses, many of whom had not more than a year of experience in their current job, other studies could have sampled more experienced healthcare professionals. This is where demographic variables, including professional experience and the particular job, can contribute to the knowledge level of TB management in the HCWs significantly.

Concerning actual compliance to infection control measures, the findings were contradictory. Most of the interviewed citizens stated that they use masks and good respiratory hygiene in TB wards regularly, which can be correlated with administrative and personal protective measures against TB infection suggested by the WHO (World Health Organization, 2021). However, there is alarming percentage of the participants who confessed to dealing with sputum samples when they themselves are not feeling well, which goes against the established guidelines on infection prevention directly and risky to people to transmit the infection. This observation is especially concerning compared to the research by Islam (2022) that highlighted that such practice lapses are the critical enabler of the transmissions of TB in medical facilities.

The fact that about 50 percent of the participants had observed patients who had forgotten to take TB medication is a serious issue that raises a problem on treatment compliance. This is consistent with the rest of the literature which shows that drug resistance, including MDR-TB, is a significant result of medication non- adherence (Jindani et al., 2023). The observation that this problem has been witnessed even in the lower sections of healthcare workers, who are expected to teach and observe patients, implies that there is a systemic malfunction towards patient support and monitoring systems within the clinical settings in which these respondents work.

The current research is similar to the appeal to improve occupational safety training due to the specificity of the research to nurses carried out by Bhebhe, Van Rooyen, and Steinberg (2019). Both reports utilized that knowledge is present, but does not necessarily lead to safe practice which demonstrates that other determinants rather than knowledge such as workplace culture, availability of resources and implementation of institutional policy are vital in determining the impact of the practice. This implies that interventions should be broader than knowledge dissemination to enable them to target these more widespread systemic and environmental factors.

One of the strengths of this study is the fact that it targeted a particular and under-studied demographic (mainly, young and degree-qualified nurses in a university environment). This is beneficial in understanding how ready new graduates in the healthcare workforce are. Nevertheless, this narrows down the generalizability of the results in terms of more experienced practitioners or specialists in other specialties. The next generation of research ought to be represented by a more varied group of healthcare professions and experience levels to create a more comprehensive picture of TB knowledge and practice in the whole healthcare field.

To sum up, the results of the current research fit into an existing literature that demonstrates that an adequate level of foundational knowledge about TB is quite frequent among medical workers, but there still are significant gaps in key aspects that directly influence patient safety and effectiveness of treatment, e.g. pharmacovigilance and strict compliance with infection control measures. These gaps also create a critical requirement of specific, ongoing, professional development programs that are specifically tailored to meet these gaps. Moreover, medical facilities need to enhance their administrative and environmental management to make sure that the knowledge is successfully translated into the stable practice and the occupational risk of TB is reduced as well as the overall outcome of patient care is improved.

Conclusion

In conclusion, this study reveals that while healthcare workers possess strong foundational knowledge regarding TB transmission and diagnosis, significant gaps persist in their understanding of treatment protocols, particularly drug side effects and

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ISSN: (e) 3007-1607 (p) 3007-1593

duration, and these knowledge shortcomings contribute to risky practices such as handling infectious materials while ill and failing to ensure patient adherence, highlighting a critical disconnect between knowledge and practice that undermines both occupational safety and effective TB control and necessitating targeted interventions to bridge this gap.

Recommendations

- **Implement enhanced TB education modules** for healthcare students and workers, focusing specifically on drug side effects, treatment duration, and infection control protocols.
- **Introduce mandatory, regular hands-on training** workshops to translate theoretical knowledge into consistent practical skills, such as proper PPE use and sputum handling procedures.
- **Strengthen institutional policies** to enforce strict adherence to safety protocols, including policies that prevent staff from handling specimens when they are unwell.
- **Develop robust patient support systems**, including improved counseling and reminder strategies, to address the issue of missed medication doses and improve treatment adherence.
- **Conduct further research** to explore the systemic and cultural barriers that lead to the observed gap between knowledge and practice among healthcare workers.

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