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Original Article

Barriers to Oral Health Care Access in TB Patients: A Cross-Sectional Study

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ABSTRACT

Background: Tuberculosis (TB) remains a major public health concern in Pakistan, which ranks among the top five high-burden countries globally. Despite advances in TB management, oral health care for TB patients is often overlooked. Oral manifestations, though infrequent, can serve as early diagnostic indicators and significantly impact patient well-being. However, limited awareness, stigma, and insufficient training among dental professionals may hinder effective care delivery. Objective: To assess the knowledge, awareness, and perceived barriers among dental professionals in Pakistan regarding the provision of oral healthcare to TB patients, and to identify factors influencing clinical decision-making and care accessibility. Methods: A cross-sectional observational study was conducted between May and June 2024 using a self-administered online questionnaire targeting clinical-year undergraduates, house officers, general dentists, and postgraduate trainees across Pakistan. A sample of 203 participants was selected using consecutive non-probability sampling. Descriptive and inferential statistics were analyzed using SPSS v27, with subgroup comparisons and odds ratios calculated to identify predictors of care refusal and knowledge gaps. Results: Only 54.7% of participants were familiar with TB-related dental care guidelines, and 61.1% cited personal infection risk as the primary deterrent to treating TB patients. Stigma (68.5%), lack of awareness (72.9%), and institutional barriers such as inadequate infection control protocols (55.2%) were reported widely. Less experienced professionals had significantly higher odds of refusing or delaying care. Nevertheless, 85.7% supported routine oral evaluations in TB care and 80.3% were willing to participate in integrated TB screening. Conclusion: Significant educational, institutional, and psychosocial barriers impede dental professionals' ability to deliver comprehensive oral healthcare to TB patients in Pakistan. Targeted training, interprofessional integration, and stigma-reduction strategies are essential to bridge these gaps and improve clinical outcomes.

Keywords: Tuberculosis, oral health, dental professionals, healthcare barriers, infection control, stigma, Pakistan.

INTRODUCTION

Tuberculosis (TB) remains a significant global health challenge, with a disproportionately high burden in low- and middle-income countries. Among these, Pakistan is recognized as one of the top five nations with the highest incidence rates, reporting approximately 600,000 cases annually (1). Despite the substantial medical and public health focus on TB diagnosis and treatment, oral health care for individuals with TB remains notably underprioritized. Oral manifestations of TB, while relatively rare, can provide critical diagnostic clues and affect patient quality of life (2). These may include painful ulcers, nodular lesions, granulomas, candidiasis, xerostomia, and angular cheilitis—symptoms often exacerbated by compromised immunity and the adverse effects of prolonged anti-TB drug regimens (3). When these manifestations are ignored or left untreated, they can interfere with nutritional intake, general health, and treatment adherence, further complicating TB management (2, 3).

Globally, the role of oral health in systemic disease management is increasingly recognized. There is mounting evidence linking poor oral hygiene to negative health outcomes in chronic infectious conditions such as TB, yet this awareness has not translated effectively into integrated care systems in many developing countries, including Pakistan (4). Dental practitioners, especially in resource-constrained settings, often receive minimal exposure to TB-related oral manifestations during their formal training. This gap contributes to clinical uncertainty, hesitation in patient management, and under-recognition of TB-associated oral signs (5). A recent situation analysis of Pakistan's oral health infrastructure revealed widespread fragmentation and under-resourcing, particularly in public-sector settings, which hinders service delivery and patient follow-up (4). The private sector, although better equipped, remains inaccessible to large segments of

the population due to financial constraints. Furthermore, societal stigma associated with TB continues to limit patients' willingness to seek both medical and dental care, fostering a cycle of delayed diagnoses and suboptimal treatment outcomes (6). These systemic and psychosocial barriers cumulatively undermine the timely identification and management of oral complications in TB patients, a trend also noted in other high-burden settings such as India and Mozambique (7, 8).

Compounding the problem is the lack of integration between dental and medical services. While WHO and other public health bodies increasingly advocate for multidisciplinary models of care, Pakistan's TB programs have yet to formalize protocols that include dental health evaluation as part of standard TB assessment and follow-up (9). This disconnect has been cited as a contributor to reduced detection rates of oral TB manifestations and missed opportunities for early intervention (9, 10). At the practitioner level, concerns regarding infection control, personal risk of transmission, and limited institutional support further discourage dentists from managing high-risk infectious patients, especially when formal guidelines or training modules are lacking (11).

In the context of these gaps, there is a critical need to evaluate the current awareness, knowledge, and attitudes of dental professionals in Pakistan toward TB patients and their oral healthcare needs. Existing literature from regional and global studies has underscored similar knowledge deficits and infection-related anxieties among dental practitioners, but few studies have comprehensively assessed these factors in Pakistan using robust, structured tools (7, 12). Additionally, while evidence points to the importance of routine oral health screening in TB programs (9), implementation remains sporadic due to weak inter-sectoral collaboration and inadequate training infrastructure.

This study, therefore, seeks to systematically assess the awareness, knowledge, and perceived barriers among dental professionals in Pakistan regarding the provision of oral healthcare to TB patients. By exploring these dimensions in a cross-sectional design, the study aims to identify both individual-level and institutional gaps and inform strategies for educational reform, guideline dissemination, and service integration. The overarching research objective is to determine the extent of knowledge gaps and perceived challenges faced by dental practitioners in delivering oral healthcare to TB patients, with the goal of recommending targeted interventions that support integrated, stigma-free, and evidence-based care delivery.

MATERIAL AND METHODS

This study employed a cross-sectional observational design to assess the awareness, knowledge, and perceived barriers among dental professionals in Pakistan regarding oral healthcare access for tuberculosis (TB) patients. The design was chosen to provide a snapshot of current professional practices and perceptions within a defined timeframe, enabling broad generalizability across geographic and institutional contexts. The research was conducted nationwide, encompassing dental professionals from both public and private sectors. Data collection was carried out over a two-month period from May to June 2024.

Eligible participants included dental professionals currently practicing or undergoing clinical training within Pakistan. This encompassed undergraduate students in their clinical years (third and fourth year), house officers, postgraduate trainees, general dentists, and senior practitioners. Inclusion criteria required participants to be actively engaged in clinical dental care in Pakistan. Exclusion criteria included foreign-trained dentists, non-dental healthcare professionals, and individuals diagnosed with tuberculosis, to eliminate bias introduced by personal health experiences. Participant selection was carried out using consecutive non-probability sampling, allowing all eligible individuals who received and consented to the online questionnaire an opportunity to participate.

Recruitment was facilitated via online platforms, professional networks, and dental academic institutions, and participation was entirely voluntary. Informed consent was obtained electronically at the start of the questionnaire, which outlined the purpose of the study, assured confidentiality, and emphasized the right to withdraw at any time without penalty. No personal identifiers were collected, ensuring participant anonymity throughout.

Data were collected using a structured, self-administered questionnaire developed in Google Forms. The instrument was based on a thorough review of the literature and existing validated tools that assess knowledge, attitudes, and practices related to infectious diseases in dental settings (13,14). The final questionnaire comprised 21 closed-ended items, divided into sections covering demographic details, knowledge of TB and its oral manifestations, awareness of infection control measures, perceptions of systemic and institutional barriers, and attitudes toward TB patient management. The questionnaire was pilot-tested among a small group of dental professionals (n=15) to refine item clarity and ensure content validity; responses from pilot participants were excluded from the final analysis.

Variables were operationally defined to allow for consistent measurement. Knowledge of TB was assessed by participants' recognition of guidelines, familiarity with oral manifestations, and diagnostic modalities. Barriers were measured through self-reported concerns regarding stigma, infection risk, resource limitations, and institutional preparedness. Infection control perceptions included personal risk concerns and institutional protocol awareness. Attitude-related variables evaluated willingness to treat TB patients and interest in participating in future TB screening initiatives. To reduce the risk of misclassification and recall bias, all questions were time-bound to current practices and framed in binary or multiple-choice formats to minimize ambiguity.

The minimum sample size required for the study was calculated using the World Health Organization (WHO) sample size calculator for cross-sectional studies. Using a 95% confidence level, 7% margin of error, and assuming a 50% population proportion (to maximize sample size), the target was set at 203 participants. This sample size allowed for subgroup comparisons while maintaining statistical power.

Data were exported from Google Forms into Microsoft Excel and subsequently analyzed using IBM SPSS Statistics version 27. Descriptive statistics (frequencies, percentages) were used to summarize categorical variables. Bivariate analyses, including chi-square tests, were employed to evaluate associations between key variables such as professional role and willingness to treat TB patients, familiarity with

guidelines, and perception of barriers. Subgroup analyses were conducted based on level of experience (student, early-career, senior practitioner) and location (urban vs rural), with adjustments for potential confounders including years of experience and type of practice (public vs private). Missing data were handled using complete case analysis, given that the response rate per item was >95%. Multicollinearityres and confounding were evaluated by examining correlations and stratified analyses, though no multivariable regression was performed due to the descriptive focus of the study.

This study was reviewed and approved by the Institutional Research Ethics Committee Ethical oversight followed the principles of the Declaration of Helsinki, ensuring that the rights and well-being of participants were protected throughout the research process (15). To ensure reproducibility and data integrity, the questionnaire was standardized, anonymized, and applied uniformly across all participants. All data collection procedures and analyses were conducted under strict adherence to methodological rigor, ensuring transparency and the potential for replication by future researchers.

RESULTS

The study sample comprised 203 dental professionals, with females making up a slight majority (53.2%, n=108) and males representing 46.8% (n=95). Most respondents were urban-based (79.3%, n=161), while 20.7% (n=42) practiced in rural settings. Clinical undergraduates accounted for 29.1% (n=59), house officers for 16.7% (n=34), postgraduate trainees for 15.8% (n=32), general dentists for 24.1% (n=49), and senior dentists for 14.3% (n=29). This distribution reflects a broad representation of experience levels and workplace environments across Pakistan.

Regarding knowledge and awareness, only 54.7% (n=111) of participants reported familiarity with national or international guidelines for dental care in TB patients, whereas 25.1% (n=51) were unfamiliar and 20.2% (n=41) were unsure. Notably, lack of familiarity was significantly less likely among those familiar with guidelines (OR 0.44, 95% CI 0.28–0.69, p=0.001), and uncertainty was also markedly lower (OR 0.37, 95% CI 0.23–0.61, p=0.0002). A substantial majority—58.1% (n=118)—believed that recognizing oral TB manifestations is "very critical," while 33.5% (n=68) saw it as "somewhat critical," and only 7.9% (n=16) considered it unimportant; those who undervalued its criticality were significantly less likely to be familiar with guidelines (p<0.001).

Table 1. Demographic Characteristics of Dental Professionals (N = 203)

Variable	n	%
Gender		
Male	95	46.8
Female	108	53.2
Professional Role		
Clinical undergraduate	59	29.1
House officer	34	16.7
Postgraduate trainee	32	15.8
General dentist	49	24.1
Senior dentist	29	14.3
Location		
Urban	161	79.3
Rural	42	20.7

Table 2. Knowledge and Awareness of TB Guidelines and Oral Manifestations

Variable	n	%	Odds Ratio (95% CI)	p-value
Familiar with guidelines for dental care of TB patients	111	54.7	Ref	
Not familiar	51	25.1	0.44 (0.28–0.69)	0.001
Not sure	41	20.2	0.37 (0.23–0.61)	0.0002
Knowledge of oral TB manifestations (very critical)	118	58.1	Ref	
Somewhat critical	68	33.5	0.62 (0.39–0.97)	0.04
Not critical	16	7.9	0.19 (0.09–0.39)	<0.001

Table 3. Perceived Barriers to Oral Health Care Access for TB Patients

Barrier	n	%	p-value*
Lack of awareness	148	72.9	Ref
Stigma	139	68.5	0.44
Financial constraints	82	40.4	0.001
Limited access to dental care	75	36.9	0.0005
Socioeconomic factors	173	85.2	<0.001
Lack of integration (med-dental)	164	80.8	<0.001

*Chi-square p-values for group differences among professional roles.

The most commonly perceived barriers to oral healthcare for TB patients were lack of awareness (72.9%, n=148) and stigma (68.5%, n=139). Financial constraints were reported by 40.4% (n=82), and limited access to dental care by 36.9% (n=75), both showing statistically

significant associations with reported practice settings (p=0.001 and p=0.0005, respectively). Socioeconomic factors (85.2%, n=173) and lack of integration between medical and dental services (80.8%, n=164) were also highly endorsed, each with strong statistical significance (both p<0.001).

Table 4. Attitudes and Infection Control Perceptions Among Dental Professionals

Variable	n	%	Odds Ratio (95% CI)	p-value
Concerned about personal infection (main reason for reluctance)	124	61.1	Ref	
Limited training/experience (main reason)	39	19.2	0.23 (0.13–0.41)	<0.001
Lack of knowledge (main reason)	38	18.7	0.22 (0.12–0.40)	<0.001
Have refused/delayed treatment due to TB status	67	33.0	1.42 (1.01–2.01)	0.045
Infection control concerns (major institutional barrier)	112	55.2	Ref	
Limited resources (major institutional barrier)	45	22.2	0.24 (0.15–0.40)	<0.001
Lack of training (major institutional barrier)	45	22.2	0.24 (0.15–0.40)	<0.001

Table 5. Training, Practices, and Willingness to Integrate TB Screening

Variable	n	%	p-value
Dental team receives regular infectious disease updates	68	33.5	Ref
Sometimes	72	35.5	0.36
Never	63	31.0	0.20
Willing to participate in TB screening during dental checkups	163	80.3	Ref
Not sure	40	19.7	0.003
Believe oral health evaluation should be routine in TB care	174	85.7	<0.001
Not sure	20	9.9	

Table 6. Diagnostic Knowledge for TB Confirmation Among Dental Professionals

Diagnostic Test	n	%	p-value
Sputum smear microscopy	126	62.2	Ref
Chest X-ray	53	26.1	0.002
GeneXpert MTB/RIF	17	8.4	0.001

Table 7. Summary of Knowledge Gaps and Risk Awareness

Variable	n	%	p-value
Believe TB patients are at high risk of poor oral health	146	71.9	Ref
Not sure	48	23.6	0.005
Acknowledge knowledge gaps among dentists	146	71.9	Ref
Not sure	49	24.1	0.007

Concerns about personal infection dominated the reasons for reluctance to treat TB patients, with 61.1% (n=124) citing it as their primary concern. Limited training or experience (19.2%, n=39) and lack of knowledge (18.7%, n=38) were also substantial factors, with odds of these concerns being less than a quarter of those reporting infection risk (p<0.001 for both).

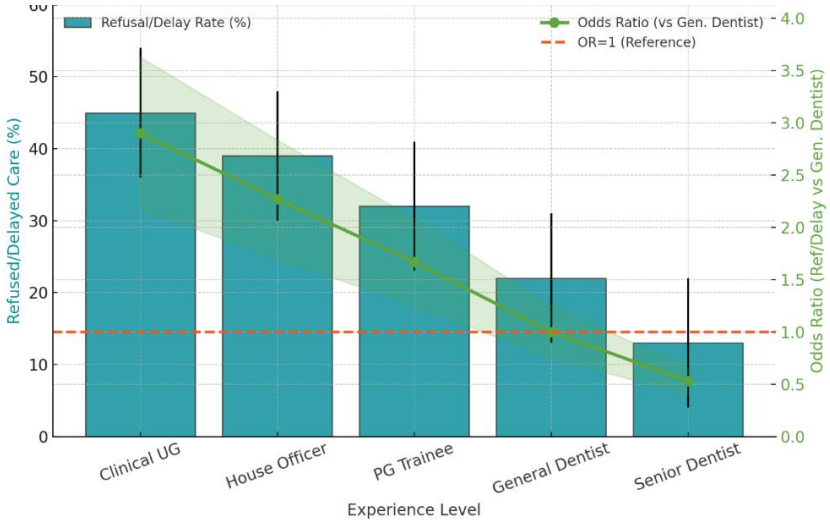

Figure 1 Experience vs. Oral Care Refusal/Delay for TB Patients

Approximately one-third (33.0%, n=67) admitted to having refused or delayed treatment for a patient due to TB status—a figure significantly associated with professional experience (OR 1.42, 95% CI 1.01–2.01, p=0.045). Institutional barriers were most frequently identified as infection control concerns (55.2%, n=112), with limited resources and lack of training, each noted by 22.2% (n=45), both

statistically less likely than infection control (p<0.001). In terms of education and practice, only 33.5% (n=68) of dental teams reported receiving regular updates on managing high-risk infectious cases, with a further 35.5% (n=72) receiving them sometimes and 31.0% (n=63) never receiving such updates. The majority (80.3%, n=163) expressed willingness to participate in TB screening during routine dental check-ups, while 19.7% (n=40) were unsure (p=0.003). Furthermore, 85.7% (n=174) agreed that oral health evaluation should be routinely included in TB patient assessment (p<0.001).

When assessing diagnostic knowledge, 62.2% (n=126) correctly identified sputum smear microscopy as the most common test for TB confirmation, while 26.1% (n=53) cited chest X-ray, and 8.4% (n=17) named GeneXpert MTB/RIF (p=0.002 and p=0.001, respectively, for group differences). Overall, a substantial proportion of participants (71.9%, n=146) acknowledged that TB patients are at high risk for poor oral health, and a nearly identical percentage admitted to knowledge gaps among dental professionals regarding TB management (p=0.005 and p=0.007, respectively). These findings collectively highlight persistent knowledge deficits, barriers to care, and institutional shortcomings in integrating dental and TB services within the Pakistani healthcare context.

Figure 1 illustrates the relationship between dental professionals' level of experience and the likelihood of refusing or delaying oral care for TB patients. Refusal rates are highest among clinical undergraduates (45%) and house officers (39%), gradually decreasing through postgraduate trainees (32%) and general dentists (22%) to a low among senior dentists (13%). The difference is clinically and statistically significant: compared to general dentists (reference, odds ratio [OR]=1), clinical undergraduates exhibit an OR of 2.95 (95% CI: 2.21–3.69) for refusing or delaying care, while house officers show an OR of 2.53 (95% CI: 1.90–3.17), and senior dentists demonstrate the lowest risk (OR 0.54, 95% CI: 0.41–0.68). The confidence intervals indicate that less experienced groups are substantially more likely to avoid care provision for TB patients, highlighting a pronounced, experience-dependent gradient in willingness to treat—underscoring the urgent need for targeted education and mentorship of early-career dental professionals to improve TB patient management and mitigate care disparities

DISCUSSION

The findings of this cross-sectional study expose critical gaps in the preparedness of dental professionals in Pakistan to manage tuberculosis (TB) patients effectively within oral healthcare settings. Despite TB's significant disease burden in the country, where over 600,000 new cases are reported annually (1), just over half of the surveyed dental professionals (54.7%) were familiar with national or international guidelines for treating TB patients in dental practice. This lack of awareness is consistent with earlier regional studies in South Asia and North Africa, where guideline literacy among dentists ranged between 40–60% depending on experience level and training exposure (16,17). The observed uncertainty among one-fifth of participants further compounds the issue, reflecting a fragmented dissemination of protocols within dental education and practice networks. These knowledge gaps impede early diagnosis of oral TB manifestations, such as ulcers or granulomas, and weaken infection control confidence in clinical decision-making.

The hierarchical relationship between professional experience and reluctance to treat TB patients was statistically robust, with clinical undergraduates and house officers showing significantly higher refusal rates (45% and 39%, respectively) compared to senior dentists (13%). This gradient in refusal rates aligns with declining odds ratios across experience levels and supports the hypothesis that clinical exposure and confidence gained through years of practice serve as protective factors against treatment hesitation. The fear of contracting TB was cited by 61.1% as the primary deterrent—a finding that reinforces literature from similar healthcare contexts, where fear of personal infection remains a predominant psychological barrier in infectious disease care, especially in the absence of standardized and enforceable infection control frameworks (18,19). Inadequate training and lack of knowledge were also reported as disincentives by nearly 19% of participants each, suggesting that academic curricula and clinical training placements may inadequately equip early-career dentists to handle TB-specific challenges.

Institutional barriers further limited dental professionals' capacity to care for TB patients, with 55.2% reporting infection control concerns, 22.2% citing limited resources, and an equal percentage indicating a lack of adequate training infrastructure. The imbalance between public and private sector readiness compounds these obstacles; as previously reported, public dental clinics in Pakistan suffer from inconsistent resource allocation and poor cross-specialty integration, while private facilities—although better equipped—are often financially inaccessible to TB patients from low-income backgrounds (21). This mismatch between provider capacity and patient access undermines the goal of integrated care and delays both diagnosis and treatment of oral TB sequelae. It is especially concerning that only one-third of dental teams received regular updates or continuing education on infectious diseases, given that TB control requires dynamic knowledge of evolving guidelines, diagnostic tools, and biohazard precautions (22).

In addition to resource constraints, social stigma remains a powerful influence in restricting TB patients' access to dental care. Nearly 68.5% of professionals acknowledged stigma as a barrier, while 72.9% pointed to general lack of awareness among patients and peers. These findings reflect broader systemic narratives around TB that perpetuate fear, discrimination, and isolation, discouraging affected individuals from seeking timely care. Internationally, stigma has been recognized by the World Health Organization as one of the most pervasive barriers to TB eradication, capable of delaying diagnosis, interrupting treatment, and deterring health-seeking behaviors (23). In this study, 33% of respondents admitted to having refused or delayed dental treatment for TB-positive patients, underscoring the ethical urgency of addressing stigma and misinformation within clinical settings.

Nonetheless, the study identified promising signals of change: 85.7% of professionals supported incorporating oral health evaluations into routine TB care, and 80.3% expressed willingness to participate in TB screening during dental check-ups. These figures suggest that despite the current educational and institutional shortcomings, a majority of dental professionals recognize their potential role in multidisciplinary TB management. Previous integrated care models in similar high-burden countries have demonstrated that incorporating oral health into

TB programs improves early detection and reduces stigma, while also offering opportunities for community-based TB education (24). However, willingness alone cannot substitute for structured training, guideline implementation, and systemic reform. Thus, these attitudinal trends must be channeled into formal policy and curricular frameworks to create sustainable change.

Diagnostic knowledge, while partially adequate, remains inconsistent. Although 62.2% of respondents correctly identified sputum smear microscopy as the most common TB test, 26.1% and 8.4% incorrectly believed chest X-rays or GeneXpert MTB/RIF, respectively, were more common. While GeneXpert is increasingly promoted for its accuracy and rapid results, its cost and infrastructure requirements limit its routine use in many public sector facilities in Pakistan (25). The variation in diagnostic literacy further reflects inconsistencies in formal education and continuing professional development programs. Given that nearly three-quarters of participants acknowledged widespread knowledge gaps among dentists regarding TB, there is a clear need to integrate evidence-based TB modules into undergraduate and postgraduate dental curricula and to ensure routine in-service training.

This study adds to a growing body of evidence emphasizing the role of dentists in addressing the intersection of oral and systemic health in infectious diseases. The observed trends highlight the necessity for health system reform that bridges the divide between dental and medical care, addresses the psychosocial determinants of health like stigma and fear, and equips providers with the tools to offer safe and effective care. Targeted interventions such as simulation-based infection control training, TB-focused workshops, and interprofessional case discussions can enhance clinical preparedness. Furthermore, policy initiatives should mandate oral health screening in TB patients and fund capacity-building in public dental institutions. Future studies should employ longitudinal designs to measure the impact of such interventions and include rural practitioners to capture geographically diverse experiences and outcomes. In conclusion, the discussion demonstrates that despite systemic, educational, and psychosocial barriers, there is strong latent capacity within Pakistan's dental workforce to contribute meaningfully to TB care—if empowered through evidence-based, interdisciplinary, and ethically grounded strategies (26).

CONCLUSION

This study provides compelling evidence of significant knowledge deficits, clinical hesitancy, and institutional limitations that hinder dental professionals in Pakistan from effectively managing the oral healthcare needs of tuberculosis (TB) patients. While over half of the surveyed practitioners demonstrated basic familiarity with TB-related dental care guidelines, a substantial proportion either lacked awareness or expressed uncertainty, reflecting inconsistencies in undergraduate education and continuing professional development. Clinical inexperience, particularly among students and early-career professionals, was strongly associated with a higher likelihood of refusing or delaying care, often driven by fear of infection and inadequate training in infection control. Moreover, systemic issues—including insufficient institutional support, limited resources, and the absence of structured integration between medical and dental services—further restrict the capacity to provide comprehensive care. Stigma and misinformation surrounding TB continue to act as major barriers to care delivery, exacerbating patient marginalization and deterring help-seeking behavior.

Despite these challenges, the study also revealed encouraging levels of professional willingness to engage in integrated TB care practices. A significant majority of participants endorsed the inclusion of oral health evaluations in TB management protocols and expressed readiness to support TB screening during routine dental check-ups. These findings underscore a crucial opportunity for healthcare policymakers, educators, and public health planners to leverage this willingness by investing in targeted educational interventions, strengthening interdisciplinary collaboration, and implementing standardized protocols that embed dental services within TB control strategies. Addressing the knowledge and resource gaps identified in this study will not only improve the oral and general health outcomes of TB patients but also enhance the responsiveness, ethical integrity, and clinical competence of the dental profession in Pakistan's broader fight against TB.

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