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Assessing Patient Safety Culture in Pakistani Dental Hospitals: A Study Using the DOSOPS Questionnaire

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ABSTRACT

Objective: This cross-sectional study assessed the patient safety culture (PSC) in Pakistani dental hospitals using an adapted version of the Dental Office Survey on Patient Safety Culture (DOSOPS), aiming to evaluate variations in professional and gender-based perspectives across four provinces.
Methods: A total of 449 participants, including faculty dentists, advanced graduate students, clinical dental students, and support staff, from dental hospitals in Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan, were recruited through non-probability purposive sampling. The DOSOPS questionnaire was culturally adapted and validated for the local context. Internal consistency was confirmed with Cronbach's $\alpha = 0.86$. Descriptive and inferential statistical analyses were conducted using SPSS. Group differences were tested using Mann–Whitney U, Kruskal–Wallis H, chi-square, and logistic regression analyses.
Results: Of the respondents, 80.2% were female. Female participants reported significantly higher safety culture scores than males ($p = 0.0077$). While job role differences in overall PSC scores were not statistically significant ($p = 0.0632$), faculty and graduate students tended to report more favorable perceptions compared to administrative and support staff. Incident reporting behaviors varied significantly by job role ($p < 0.01$), with gender-based differences noted in equipment malfunction ($p = 0.0253$) and medication ordering ($p = 0.0036$). Logistic regression identified male gender as a significant predictor of lower safety culture perception (OR = 0.553, $p = 0.038$).
Conclusion: Pakistani dental hospitals exhibit a generally positive safety culture with strong internal consistency across measured domains. However, perceptual differences by gender and professional hierarchy reflect underlying sociocultural dynamics, such as authority gradients and communication norms, that influence safety behavior. These findings underscore the importance of addressing hierarchical structures and reporting barriers to improve safety culture in dental care environments.

Keywords: Cross-sectional studies; Dental clinics; Gender identity; Patient safety; Safety management

Introduction

Patient safety is a cornerstone of quality healthcare delivery, encompassing both the prevention of avoidable harm and the proactive management of risks inherent in medical care. The World Health Organization (WHO) has recognized patient safety as a global health priority, particularly in resource-constrained settings where systemic vulnerabilities are often magnified. [1] In dentistry, patient safety concerns are amplified due to the invasive nature of procedures, frequent use of sedation or anesthesia, and high patient throughput.[2] These characteristics underscore the critical need for a robust Patient Safety Culture (PSC), a construct that reflects the shared values, attitudes, and behaviors within healthcare organizations that prioritize transparency, accountability, and continuous learning.

Theoretical models provide a useful lens for understanding PSC. Reason's Swiss Cheese Model conceptualizes adverse events as the culmination of latent organizational failures that align through gaps in defenses such as training, supervision, or equipment maintenance.[3] Complementing this, the Agency for Healthcare Research and Quality (AHRQ) Safety Culture Framework operationalizes PSC into measurable domains, including teamwork, communication openness, non-punitive response to error, and organizational learning.[4]

Globally, PSC has emerged as a vital determinant of healthcare outcomes, yet remains under-investigated in dentistry, particularly within low- and middle-income countries (LMICs). Research from Malaysia, Turkey, Brazil, and Ethiopia has consistently revealed disparities in safety perceptions based on profession and gender.[5, 6] Nurses, for example, frequently report higher awareness and greater engagement with safety protocols compared to dentists or physicians, a difference attributed to their structured team roles and communication practices.[7] Gender dynamics also shape PSC; women tend to exhibit greater communication openness and risk sensitivity, often aligning more closely with institutional safety priorities.[8] These patterns are reinforced by recent studies published in *BMJ Open Quality* and *BMC Health Services Research* (2020–2024), which highlight psychological safety, interdisciplinary collaboration, and leadership engagement as key predictors of high PSC scores.

In Pakistan, the dental healthcare system presents a distinct and underexplored context for PSC inquiry. Institutional variability, entrenched clinical hierarchies, and limited infrastructure for incident reporting pose significant challenges to cultivating a mature safety culture. These structural and sociocultural constraints not only affect communication and error reporting but also perpetuate authority gradients that can undermine patient safety. To date, scholarly work on PSC in Pakistani dental settings remains sparse. A recent study investigated perceptions of safety culture among undergraduate dental students, providing useful insights into educational perspectives; however, it did not address the broader institutional or interdisciplinary dimensions of PSC within clinical environments.[9] This paucity of national data highlights a significant gap in the literature and underscores the need for multi-stakeholder assessments across dental hospitals in the country.

Several instruments have been developed to measure patient safety culture across various healthcare environments, each differing in scope, item structure, and target population. The most widely used is the Hospital Survey on Patient Safety Culture (HSOPS), introduced in 2004, comprising 42 items across 12 dimensions.[10] The Safety Attitudes Questionnaire (SAQ), consisting of 60 items, emphasizes staff perceptions and teamwork climate.[11] The Medical Office Survey on Patient Safety Culture (MOSPSC) contains 38 core items and targets primary care settings.[12] Meanwhile, the King's Patient Safety Measure (KPSM) offers a brief, 10-item patient-centered tool. Although these instruments have been extensively validated in hospital and outpatient contexts, they often require adaptation for dental environments due to content limitations, item phrasing, and contextual misalignment. The Dental Office Survey on Patient Safety Culture (DOSOPS), introduced in 2010 as a specialized adaptation of the MOSPSC, contains 58 items spanning 10 domains specifically relevant to dental practice, including patient tracking, infection control, and administrative communication.[13] Its structured focus on dental workflows makes it particularly effective for capturing discipline-specific safety dynamics. DOSOPS has since been employed in multiple international studies in

Indonesia, Thailand, and Ethiopia, though its application in South Asia remains limited.

To address the existing gaps in the literature, particularly the limited investigation of patient safety culture in dental settings within low- and middle-income countries, this study aims to assess the prevailing patient safety culture across dental hospitals in Pakistan using an adapted version of the DOSOPS instrument.

Materials and Methods

Study Design and Setting

This study employed a cross-sectional analytic design, conducted over 12 months from June 2024 to June 2025. The research was carried out across selected public and private dental hospitals in all four provinces of Pakistan: Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan. A cross-sectional design was chosen to capture a snapshot of existing perceptions and attitudes related to patient safety culture (PSC), enabling the identification of institutional strengths and potential areas for improvement across diverse clinical environments.

Participants and Sampling Strategy

A non-probability, purposive sampling strategy was used to recruit participants who were directly or indirectly involved in dental care delivery. The target population included faculty dentists, advanced graduate (postgraduate) students, clinical dental students, hygienists, dental assistants, sterilization staff, and administrative personnel. Participants were selected based on their roles within hospital settings and their anticipated exposure to or involvement in patient safety practices. While purposive sampling ensured the inclusion of informed respondents, it may limit the generalizability of findings due to the absence of randomization.

The minimum required sample size was calculated using Cochran's formula for cross-sectional studies, assuming a 5% margin of error and 95% confidence interval. To account for potential non-response, oversampling was employed. Of the surveys distributed, 449 fully completed responses met eligibility criteria and were retained for analysis.

Instrument Adaptation and Validation

Data collection was based on the Dental Office Survey on Patient Safety Culture (DOSOPS), a 58-item instrument originally developed by the Agency for Healthcare Research and Quality (AHRQ). DOSOPS, an adaptation of the Medical Office Survey on Patient Safety Culture (MOSPSC), is specifically designed for dental settings and evaluates ten safety domains, including communication, teamwork, patient tracking, and organizational learning. To ensure cultural relevance and content validity within the Pakistani healthcare context, the questionnaire underwent a multi-stage adaptation process.

Initially, the tool was translated into Urdu and then back-translated into English by two independent bilingual experts to preserve semantic and conceptual integrity. Following this, an expert panel consisting of senior dentists, academic researchers, and public health professionals reviewed the translated instrument for contextual clarity and alignment with local clinical practices. Minor terminological adjustments were made where necessary, particularly in items referencing administrative workflows uncommon in Pakistani dental setups.

A pilot test was conducted with 30 dental professionals, representing a mix of faculty, postgraduate students, and support staff. Feedback from the pilot was used to refine the language and improve item clarity. Internal consistency of the final adapted tool was assessed using Cronbach's alpha, yielding a coefficient of 0.86, which demonstrated high internal reliability across items. Due to resource limitations, exploratory or confirmatory factor analysis was not conducted, though future studies are planned to evaluate the tool's construct validity further.

Data Collection and Ethical Considerations

Survey data were collected through a combination of online (Google Forms) and paper-based questionnaires distributed during departmental meetings and clinical rotations. Participation was voluntary, and informed consent was implied upon survey completion. No personal identifiers were collected, and respondents were assured of anonymity and confidentiality throughout the study. Completed forms were anonymized and stored securely in password-

protected digital files and locked physical storage cabinets, accessible only to the principal investigators.

Ethical approval was obtained from the Institutional Review Committee of Riphah International University, Islamabad (Approval Date: 04/12/2024). All research activities were conducted in accordance with the Declaration of Helsinki and its later amendments on ethical principles for human research.

Statistical Analysis

All data were analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize demographic variables and domain-level scores. Composite PSC scores were generated by averaging responses to the 58 Likert-type items from the DOSOPS instrument. The internal consistency of the composite scale was reconfirmed using Cronbach's alpha.

To test for differences in PSC perceptions across demographic and professional subgroups, several non-parametric statistical tests were applied. The Mann–Whitney U test was used to assess differences between two independent groups, such as gender. The Kruskal–Wallis H test was employed to evaluate differences among multiple occupational groups. To assess associations between professional or gender categories and specific types of reported safety incidents, chi-square tests of independence were conducted.

In addition, a binary logistic regression model was constructed to identify predictors of low PSC perception. The dependent variable was dichotomized using a median split of the composite safety score, with scores below the median coded as "low PSC." Predictor variables in the model included gender, job role, years of experience, and number of weekly work hours. Odds ratios (OR) with 95% confidence intervals (CI) were calculated, and significance was assessed at a p-value threshold of <0.05.

All assumptions for statistical tests were evaluated before analysis. Since the PSC scores were not normally distributed, non-parametric tests were deemed appropriate. Missing data were minimal and were handled via listwise deletion. The logistic regression model was peer-reviewed by a qualified biostatistician to ensure methodological accuracy and interpretability.

Results

A total of 449 responses were analyzed. Of these, the majority of respondents identified as female (80.2%), while male participants accounted for 19.8%. Regarding professional roles, advanced graduate students (33.8%), faculty dentists (30.7%), and dental students (30.3%) represented the primary groups. Participants reported varied experiences in their current dental office settings, with durations ranging from less than 2 months to over 6 years. Most respondents worked between 5 to 40 hours per week, and represented diverse departments, including operative dentistry, orthodontics, and others (Table 1).

Table 1: Demographics of participants

Variable	Category	Count	Percentage
Gender	Female	360	26.7
	Male	89	6.6
Position	Advanced Graduate Student	152	11.3
	Faculty Dentist (DDS/DMD)	138	10.2
	Dental Student	136	10.1
	Other clinical or support staff (dental assistant, nurse, sterilization staff, technician, Lab staff, Other)	9	0.7
	Administrative or Clerical Staff (Billing staff, referral staff, medical record keeper, practice manager, clinic administrator, office administrator, receptionist, scheduler, Other)	8	0.6
	Hygienist	6	0.4
Department	Operative and restorative dentistry	143	10.6

Orthodontics	135	10	
Oral Surgery	74	5.5	
Prosthodontics	39	2.9	
Outpatient department	32	2.4	
Periodontology	26	1.9	

The internal consistency of the safety culture scale was assessed using Cronbach's alpha. The composite scale included all Likert-type items addressing teamwork, communication, training, and error prevention. The resulting Cronbach's alpha was 0.86, indicating excellent internal reliability. This supports the validity of using a composite score for group comparisons and regression modeling.

Group-based comparisons were conducted to explore differences in safety culture perceptions by gender and professional role. The non-parametric Mann–Whitney U test revealed a statistically significant difference in safety culture scores between male and female respondents (U = 16,786, p = 0.0077). The mean composite score was higher for female respondents, suggesting that females reported a more positive perception or greater awareness of safety culture compared to males.

A Kruskal–Wallis H test was used to compare safety culture scores across job roles, including faculty dentists, advanced graduate students, dental students, and other clinical or administrative staff. While the overall result was not statistically significant at the 0.05 level (H = 10.46, p = 0.0632), the distribution of scores suggested some variability. Specifically, faculty dentists and graduate students tended to report slightly higher safety culture scores, whereas administrative and support staff tended to report lower scores. Although these differences did not reach significance, the trend may indicate varying levels of exposure to or engagement with safety culture training and practices across professional roles (Table 2).

Table 2: Group Comparisons of Safety Culture Scores by Gender and Job Role with Statistical Test Results

Comparison	Group	Count	Mean	Std	Statistical test	*p*-value
Gender	Female	353	3.28	0.42	U = 16786.00	**0.0077**
	Male	80	3.4	0.45		
Job Role	Administrative or Clerical Staff (Billing staff, referral staff, medical record keeper, practice manager, clinic administrator, office administrator, receptionist, scheduler, Other)	8	3.66	0.33	H = 10.46	0.0632
	Advanced Graduate Student	146	3.33	0.49		
	Dental Student	132	3.27	0.47		
	Faculty Dentist (DDS/DMD)	132	3.27	0.28		
	Hygienist	6	3.5	0.55		
	Other clinical or support staff (dental assistant, nurse, sterilization staff, technician, Lab staff, Other)	9	3.1	0.07		

Note: U = Mann–Whitney U statistic; H = Kruskal–Wallis test statistic. Values indicate the degree of difference in safety culture scores between groups. Significant *p*-values (< 0.05) are in bold.

Chi-square tests of independence were performed to evaluate whether the frequency of reported patient safety incidents differed significantly by gender and job role. The analysis focused on key incident categories such as appointment delays, record misidentification, equipment malfunction, prescription errors, and test follow-ups.

The results indicated that job role was significantly associated with reporting frequencies for all tested incident types ($p < 0.01$ across most categories), suggesting that perceptions or experiences of safety-related events vary substantially among different professional groups. For example, reports of equipment malfunction were more frequent among some roles than others ($\chi^2 = 71.96$, $p < 0.0001$).

In contrast, gender differences were less consistent, with only a few incidents showing statistically significant variation. Notably, equipment issues ($\chi^2 = 12.81$, $p = 0.0253$) and prescription clarification calls ($\chi^2 = 15.63$, $p = 0.0036$) differed significantly between male and female respondents, indicating potential disparities in how safety events are encountered or reported (Table 3).

Table 3: Chi-Square Tests of Safety Incident Frequencies by Gender and Job Role

Incident (Abbreviated)	χ^2 (Gender)	p (Gender)	χ^2 (Job Role)	p (Job Role)
Appointment Delay	5.52	0.3555	60.29	**0.0001**
Wrong Chart Used	7.32	0.1980	54.95	**0.0005**
Chart Not Available	7.08	0.2150	65.96	**0.0000**
Equipment Malfunction	12.81	0.0253	71.96	**0.0000**
Prescription Clarification	15.63	0.0036	39.03	**0.0066**

Note: Significant values are in bold, where $p < 0.05$. χ^2 = Chi-square test statistic

To identify predictors of low safety culture perception, a binary logistic regression model was fitted using a median split of the composite safety culture score. The dependent variable was whether the respondent reported below-median safety culture (coded as 1). Independent variables included gender, job role, work experience duration, and weekly work hours.

The model revealed that gender was a significant predictor of safety culture perception. Specifically, male respondents had significantly higher odds of reporting lower safety culture compared to females (OR = 0.553, $p = 0.038$), suggesting a more positive perception among female participants.

No statistically significant associations were found for job role, experience duration, or work hours. Although the model included large odds ratios for job roles, these results were unstable (with infinite upper confidence intervals) and non-significant ($p > 0.05$), likely due to sparse data or multicollinearity (Table 4).

Table 4: Logistic Regression Predicting Low Safety Culture Scores

Predictor	Odds Ratio (OR)	95% CI (Lower – Upper)	p-value
Intercept	0.000	$0.000 - \infty$	1.000
Male (vs Female)	0.553	$0.316 - 0.967$	**0.038**
Adv. Graduate Student (vs Admin/Other)	$\sim 1.45 \times 10^{11}$	$0.000 - \infty$	1.000
Dental Student	$\sim 1.21 \times 10^{11}$	$0.000 - \infty$	1.000
Faculty Dentist (DDS/DMD)	$\sim 9.69 \times 10^{10}$	$0.000 - \infty$	1.000

Note: OR < 1 indicates decreased odds of reporting low safety culture. Significant p-values (< 0.05) are in bold.

Discussion

This study represents a pioneering effort to assess patient safety culture (PSC) in Pakistani dental hospitals using the DOSOPS instrument. It provides critical insights into how safety is perceived across multiple professional roles in a healthcare system characterized by resource constraints, hierarchical structures, and limited institutional standardization. By applying validated theoretical models, Reason's Swiss Cheese Model and the AHRQ Safety Culture Framework, the findings illuminate the organizational and

behavioral dimensions that shape patient safety perceptions in dental settings.

Consistent with international evidence, gender differences emerged as a key determinant of PSC. Female respondents reported significantly higher safety culture scores, a pattern observed in studies from Taiwan and Malaysia, where women were found to exhibit stronger engagement with protocols, greater transparency in communication, and higher risk sensitivity.[8, 14] This may be explained by higher compliance with procedural norms or greater involvement in administrative coordination, areas closely linked to safety awareness. Additionally, faculty and postgraduate students reported more favorable safety perceptions compared to support and administrative staff, mirroring global trends identified in Brazil and Ethiopia, where clinical roles were more aligned with patient-facing responsibilities and thus more immersed in safety training and reporting practices.[15]

In contrast, the study diverges from findings in some hospital-based PSC studies, such as in the United States and Nigeria, where administrative staff reported comparable or even higher safety scores than clinical personnel.[16, 17] These differences may stem from contextual factors: in Pakistan, entrenched professional hierarchies and top-down communication norms may limit support staff involvement in safety discourse and feedback mechanisms. Moreover, underrepresentation of these roles in structured training programs may contribute to lower engagement and reduced confidence in safety systems. The significant association between gender and incident reporting, particularly regarding equipment malfunctions and prescription clarifications, underscores the influence of social norms and authority gradients in shaping reporting behaviors.

Only one published study to date has investigated patient safety culture in the dental sector in Pakistan, focusing exclusively on undergraduate dental students.[9] While that research offered foundational insight into awareness levels in academic settings, it did not address interprofessional dynamics or institutional variables. The present study expands on this by including a wide spectrum of staff and applying validated metrics across geographically and administratively diverse hospitals, making it the most comprehensive examination of dental PSC in the Pakistani context to date.

The differential findings across job roles and incident types suggest the influence of institutional silos and variable leadership engagement, issues highlighted by other researchers, who found that psychological safety and managerial support were critical for high PSC scores. These organizational enablers are often weak in LMICs due to resource and policy limitations, making the promotion of a "just culture" and flattening of professional hierarchies particularly urgent.

Several limitations warrant careful consideration. First, the cross-sectional design of this study limits its ability to establish causality or observe changes in safety culture over time. Longitudinal research would be better suited to assess the sustainability of improvements following targeted interventions. Second, the study employed non-probability purposive sampling, which, although appropriate for capturing informed perspectives from those directly involved in patient care, constrains the representativeness of the findings. This introduces a risk of sampling bias and limits the generalizability of results to broader dental healthcare settings in Pakistan or other low- and middle-income countries (LMICs). Third, the underrepresentation of specific professional groups, such as administrative staff, hygienists, and support personnel, reduced the statistical power for subgroup analyses and may have skewed the interpretation of role-based safety perceptions. Given that these groups often play pivotal but underrecognized roles in safety processes, their limited inclusion restricts the comprehensiveness of insights. Fourth, generalizability remains a challenge, as the sample was drawn from select institutions in Pakistan. Institutional heterogeneity across provinces, regarding staffing models, leadership cultures, and infrastructure, further complicates the extrapolation of findings. Finally, the study included limited qualitative input, as the free-text responses were too sparse to allow for thematic analysis. This constrained the ability to interpret the motivations, behaviors, or emotional dimensions underlying the quantitative trends, especially concerning gender-based and hierarchical safety dynamics.

Future research should prioritize longitudinal study designs to track how safety culture evolves in response to interventions over time. This approach would facilitate causal inference and help assess the durability of improvements. Additionally, intervention-based studies, such as those examining the impact of structured safety training, leadership engagement initiatives, or communication enhancement programs, are needed to translate findings into actionable change. Such interventions should be tailored to dismantle hierarchical barriers, foster a just culture, and improve safety reporting confidence across all professional groups. Adopting a mixed-methods approach, combining DOSOPS quantitative data with in-depth qualitative interviews or focus groups, would yield richer insights into the organizational and behavioral factors influencing safety attitudes. This could help uncover the hidden cultural and psychological dynamics, such as fear of blame, authority gradients, or peer norms, that shape safety behavior. Moreover, cross-country and inter-institutional benchmarking using standardized tools like DOSOPS can help establish comparative baselines and reveal best practices. Learning from high-reliability organizations globally, particularly those that have successfully implemented flattening hierarchies and non-punitive reporting systems, can inform locally adapted strategies.

Ultimately, understanding the sociocultural barriers to error reporting, particularly those influenced by gender and professional role, is essential. Addressing these through inclusive training, leadership mentoring, and policy reform will be critical for cultivating a mature and resilient patient safety culture in dental healthcare, both within Pakistan and beyond.

Conclusion

Pakistani dental hospitals exhibit a generally positive safety culture with strong internal consistency across measured domains. However, perceptual differences by gender and professional hierarchy reflect underlying sociocultural dynamics, such as authority gradients and communication norms, that influence safety behavior. These findings underscore the importance of addressing hierarchical structures and reporting barriers to improve safety culture in dental care environments.

Data Availability Statement

All relevant data are within the manuscript. Additional data supporting this study are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare that they have no financial, institutional, or personal relationships that could be perceived as influencing the work reported in this paper.

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