

Original Article

Knowledge, Practices and Perspectives of Infection Control Among Undergraduate Dentistry Students in Karachi, Pakistan

Faisal Rehan¹, Syed Fareed Mohsin¹, Sumera Qasim^{3*}, Hareem Sattar⁴, Zohaib Ahmed⁴, M. Ali Sheikh⁵, Mohammed Sohail Memon⁶

¹ Centre for Rural Dentistry and Oral Health, Orange Campus. Charles Sturt University. Australia

² Department of Oral and Maxillofacial Diagnostic Sciences, College of Dentistry, Qassim University, Buraydah, Saudi Arabia

³ Department of Pharmacology, College of Pharmacy, Jouf University, Sakaka, Saudi Arabia

⁴ Shahida Islam dental college, Lodhran, Pakistan

⁵ Almuhaidd Dental Group, Saudi Arabia

⁶ School of Dentistry, University of Sydney, NSW, Australia

* Corresponding Author: Sumera Qasim, Email: sumeraqasim3@gmail.com

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Abstract

Background: The present study aimed to assess the knowledge, attitudes, and practices regarding infection control measures among undergraduate dental students at various dental schools in Karachi, Pakistan.

Methods: A cross-sectional study was conducted with 550 third- and fourth-year undergraduate dental students. Data were collected using a closed-ended, self-administered questionnaire covering infection control practices, sterilization techniques, and vaccination status. The questionnaire also assessed students' attitudes toward infection control, including perceptions of personal responsibility, risk awareness, and confidence in adhering to preventive protocols. The survey was conducted from August to September 2016 across eight dental colleges in Karachi. Participants were selected using convenience sampling based on their accessibility and willingness to participate.

Results: A majority of students reported adherence to key infection control practices, with 96.8% washing hands after contamination and 93.5% consistently wearing gloves. However, the use of personal protective equipment was less prevalent, as only 30.0% of students reported always wearing eye protection. Regarding vaccination, 57.5% of students were vaccinated against hepatitis B, while vaccination rates for tetanus (3.3%) and tuberculosis (1.0%) were notably low. Furthermore, 6.0% of participants reported having received no vaccinations at all.

Conclusion: While most undergraduate dental students in Karachi adhere to basic infection control procedures, significant gaps exist in universal immunization and the consistent use of protective barriers. These findings underscore the need for targeted educational programs and vaccination initiatives to enhance infection control compliance and ensure the safety of both dental professionals and their patients.

Key Words: Dental students, infection control, sterilization, protective barriers, vaccination, hepatitis B, dental schools, cross-sectional survey

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Introduction

Infection control is paramount for ensuring the safety of both patients and practitioners in all dental settings. Dental procedures frequently involve contact with saliva, blood, and sharp instruments, placing dental professionals at continuous risk of

exposure to infectious agents. Consequently, global health authorities emphasize that consistent adherence to infection control standards—including proper sterilization, the use of personal protective equipment (PPE), and vaccination—is essential to prevent disease transmission (1).

The high frequency of contact with infectious agents in the oral cavity, including those in blood, saliva, and respiratory secretions, necessitates strict infection control measures. Dental treatments inherently increase the risk of transmitting diseases between patients and dental professionals due to the use of sharp instruments and close proximity to mucosal membranes (2). In the absence of effective infection control measures, diseases such as hepatitis B and C, tuberculosis, HIV, and other viral or bacterial infections can spread. To mitigate this risk, it is essential to use sterile instruments, wear PPE (e.g., masks, gloves, and gowns), and rigorously follow hygiene protocols (2).

Infection prevention relies on a multifaceted approach to ensure protection. This includes frequent hand hygiene, consistent use of PPE, proper sterilization of dental tools, and safe disposal of contaminated waste. Immunization against prevalent illnesses, particularly hepatitis B, is strongly endorsed by global health organizations such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) (3). However, despite these clearly articulated guidelines, adherence to infection control protocols may vary, especially among students who are still developing their clinical competencies. Understanding how dental students perceive and implement these measures provides valuable insight into their preparedness for clinical practice.

Assessing students' knowledge, attitudes, and compliance helps identify areas that require reinforcement through educational programs and institutional policies. Previous investigations in Pakistan and neighboring countries have reported variable levels of infection control awareness among dental students, highlighting persistent gaps in compliance and understanding of preventive measures. Studies conducted in Rawalpindi and Punjab, for example, have identified inconsistent use of protective barriers and incomplete vaccination coverage among dental undergraduates (4, 5). These gaps can be attributed to several factors. Curricular design, the timing and intensity of clinical exposure, and the consistency of institutional policies can strongly shape students' day-to-day infection control behavior. While early theoretical instruction often builds sound knowledge, limited supervised practice, time pressure during clinical rotations, and variable

role-modeling by clinicians may reduce the consistent use of PPE. Furthermore, institutional factors, such as reliable access to protective equipment, routine compliance audits, and clear vaccination requirements at enrollment, also play a critical role in influencing adherence. Recognizing these structural drivers helps explain why high knowledge does not always translate into uniform practice.

Few studies have comprehensively assessed both knowledge and practical adherence within the same cohort, particularly in the context of Karachi's diverse dental institutions. Addressing this gap, the present study aims to provide a more complete evaluation of students' knowledge, attitudes, and behaviors toward infection control. Therefore, this study was designed to assess the knowledge, attitudes, and practices related to infection control among undergraduate dental students in Karachi, Pakistan. By evaluating their implementation of protective barriers, sterilization protocols, hand hygiene practices, and immunization status, this research aims to uncover deficiencies in infection control knowledge and practices, thereby offering insights into how dental education programs can enhance infection control training and better equip graduates for the demands of professional dental practice.

Methods and Materials

Study Design and Setting

A cross-sectional study was conducted from August to September 2016 to assess infection control knowledge and practices among undergraduate dental students in Karachi, Pakistan. The study was carried out at eight distinct dental institutions located across the city.

Study Population and Sampling

The target population consisted of third- and fourth-year undergraduate dental students from the participating institutions. These students were selected because they had completed foundational pre-clinical coursework and had commenced regular clinical training, ensuring adequate exposure to infection control procedures and patient interaction. Participants were recruited using a convenience sampling method based on their accessibility and willingness to participate.

A total of 580 self-administered, closed-ended questionnaires were distributed to students. The paper-based forms were completed individually during scheduled class sessions without researcher supervision. Of these, 550 completed questionnaires were returned, yielding a high response rate of 94.8%.

Data Collection Instrument

The questionnaire was designed to collect data on a range of topics related to infection control, including awareness of sterilization and disinfection procedures, use of personal protective equipment (PPE), vaccination status, and perceived workplace risks. The questionnaire items were adapted from a previously validated instrument (6). To ensure clarity, content validity, and relevance to the study objectives, the questionnaire was pre-tested on a small group of dental students, and refinements were made based on their feedback. Response options for infection control practices were based on a four-point Likert scale: "always," "often," "occasionally," and "never."

Inclusion and Exclusion Criteria

- **Inclusion Criteria:** All third- and fourth-year undergraduate dental students (both male and female) from the eight selected institutions who were present during data collection and consented to participate were included in the study.
- **Exclusion Criteria:** House officers, senior dental professionals, and students from earlier years of study were excluded to maintain the focus on the undergraduate cohort. Clinical settings outside of the academic institutions, such as affiliated clinics and hospitals, were also not included in the study.

Ethical Considerations

All participants were informed about the objectives of the study. Written consent was obtained from all participants before data collection, and anonymity was assured. Participation was entirely voluntary. In accordance with institutional policy, formal ethics approval was deemed not required for this minimal-risk study involving anonymous questionnaires.

Results

Demographic Characteristics of Study Participants

A total of 550 undergraduate dental students from eight colleges in Karachi participated in the study. The sample comprised 176 male (32.0%) and 374 female (68.0%) students, indicating a higher proportion of female participants. The distribution across academic years was nearly even, with 260 students (47.3%) from the third year and 290 students (52.7%) from the fourth year as shown in figure 1.

Infection Control Practices Among Dental Students

The survey assessed the frequency of adherence to various infection control protocols among dental students. A large majority of students reported complying with key infection control measures. Notably, 96.8% of participants reported always washing their hands after contamination, and 76.3% consistently washed their hands before and after each patient examination. Furthermore, the majority of students indicated that they always wore gloves (93.5%) and a surgical mask (80.8%) during clinical procedures.

In contrast, the use of additional protective barriers, such as eye protection and surgical gowns, was less consistent. Only 30.0% of students reported always wearing eye protection, and fewer than half (49.0%) stated that they always wore a surgical gown. Similarly, while 48.8% of participants reported always wearing a surgical cap, the remainder did so less frequently or not at all.

Instrument sterilization practices were widely followed, with 94.4% of students reporting that they always sterilized their instruments and 96.4% reporting that they always changed gloves between patients. However, the use of pre-procedural oral mouth rinses was considerably lower; only 28.5% of students always used a mouth rinse before procedures, while the majority reported using it only occasionally or never (Table 1).

Overall, students demonstrated a positive attitude toward infection control. The majority acknowledged that infection control is a shared professional responsibility and considered strict compliance essential for ensuring patient safety. However, a small proportion of students expressed

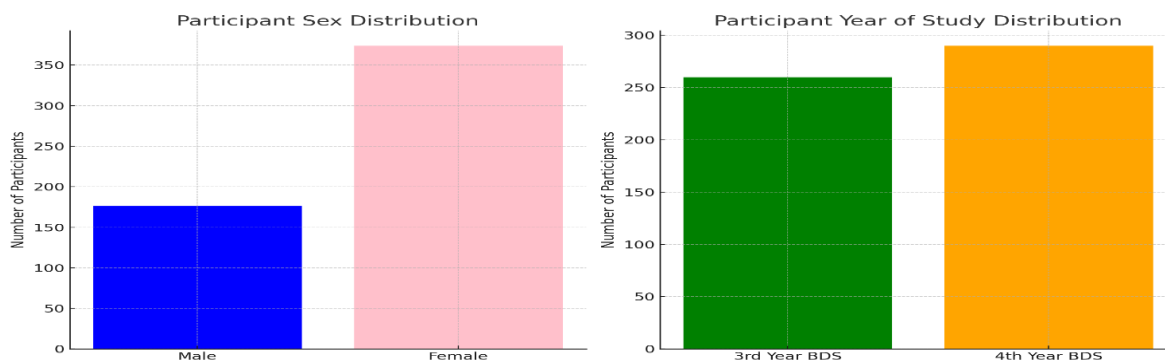


Figure 1. Distribution of undergraduate dental students by gender and year of study

Table 1. Infection control practices reported by undergraduate dental students in Karachi

Practice	Always (%)	Often (%)	Sometimes (%)	Never (%)
Wash hands prior & afterward examination	419 (76.3)	89 (16.3)	29 (5.3)	13 (2.3)
Wash hands after contamination	532 (96.8)	8 (1.5)	8 (1.5)	2 (0.3)
Wear gloves	514 (93.5)	26 (4.8)	7 (1.3)	3 (0.5)
Wear eye protectors	165 (30.0)	128 (23.3)	129 (23.5)	128 (23.3)
Wear surgical mask	444 (80.8)	69 (12.5)	25 (4.5)	12 (2.3)
Wear surgical gown	269 (49.0)	47 (8.5)	81 (14.8)	153 (27.8)
Wear surgical cap	268 (48.8)	77 (14.0)	123 (22.3)	82 (15.0)
Prefer oral mouth rinse	157 (28.5)	117 (21.3)	161 (29.3)	115 (21.0)
Sterilized instruments	519 (94.4)	21 (3.8)	7 (1.3)	3 (0.6)
Change gloves	530 (96.4)	11 (2.0)	2 (0.4)	7 (1.3)

uncertainty regarding the necessity of using all protective barriers for every patient, reflecting gaps in awareness and risk perception.

Vaccination Status of Study Participants

The vaccination status of undergraduate dental students was assessed, revealing varying levels of immunization against key infectious diseases. As shown in Figure 2, a majority of participants (57.5%, n=316) reported being vaccinated against hepatitis B. In contrast, only a small proportion reported being vaccinated against tetanus (3.3%, n=18) and tuberculosis (1.0%, n=5). It is important to note that tuberculosis vaccination (BCG) is typically administered during infancy in Pakistan; therefore,

these responses reflect students' recollection of childhood vaccination rather than current immunization status.

Combinations of vaccinations were also reported. Over one-tenth of participants (14.3%, n=78) reported being vaccinated against both hepatitis B and tetanus, while 3.3% (n=18) had received vaccinations against both hepatitis B and tuberculosis. Only 0.3% (n=2) of students reported being vaccinated against both tetanus and tuberculosis.

Furthermore, 14.5% (n=80) of students reported receiving vaccinations against all three diseases (hepatitis B, tuberculosis, and tetanus).

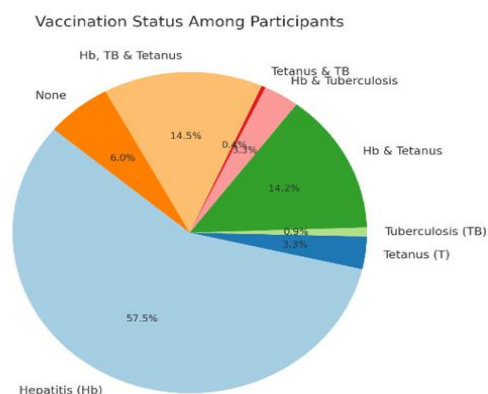


Figure 2. Vaccination status of undergraduate dental students against key infectious diseases

Notably, 6.0% (n=33) of participants indicated that they had not received any vaccinations.

Discussion

Infection control is a critical aspect of the medical profession, benefiting both patients and healthcare professional (7). Dental professionals are at a considerable risk of infection from blood-borne pathogens because they frequently encounter blood and saliva that may be contaminated. Moreover, the potential for needle stick injuries adds to this risk (8). For dental practitioners, following infection control protocols is essential, even during their graduation practice. It requires a solid understanding, hands-on experience, and a dedicated mindset from practitioners to effectively apply these infection control practices.

The findings of this study reveal important insights into the infection control practices and vaccination status of undergraduate dental students in Karachi. Infection control is a cornerstone of clinical dental practice, protecting both patients and practitioners from potential cross-infection. The present study provides meaningful insight into the knowledge, attitudes, and practices of infection control among undergraduate dental students in Karachi.

The high adherence to hand hygiene and glove use observed in this study suggests that the basic principles of infection control are well emphasized during early dental training. However, inconsistent use of protective barriers such as eye shields, caps, and gowns indicates that infection control protocols

may not be uniformly reinforced in clinical settings. Similar findings have been reported among dental students in other countries, where practical inconvenience, limited supervision, and insufficient institutional monitoring were associated with partial compliance with PPE standards (8, 9). These findings highlight that infection control behavior is not determined by knowledge alone but also influenced by institutional culture, perceived risk, and accessibility of protective resources.

The strong compliance with hepatitis B vaccination among participants is encouraging and reflects ongoing awareness of occupational safety. Nevertheless, the very low tetanus and tuberculosis vaccination rates are concerning. Both vaccines are included in Pakistan's National Immunization Program and are recommended by the Pakistan Dental Council (PDC) for healthcare workers (10). The gap likely reflects a lack of institutional follow-up or poor student awareness rather than policy omission. Universities could strengthen compliance through periodic vaccination drives, integration of immunization checks into student registration processes, and closer coordination with public health authorities.

While most students recognized the importance of infection control, the persistence of unsafe practices, such as irregular PPE use or incomplete vaccination, suggests gaps in attitude and behavioral translation. Similar attitudinal inconsistencies have been identified in previous regional studies, where perceived low infection risk and time constraints were cited as barriers to compliance (4, 5). To overcome these limitations, infection control education should extend beyond theoretical instruction to include behavior-focused interventions such as interactive workshops, simulation-based training, and regular feedback from clinical supervisors.

Finally, adherence to institutional and international Guidelines is crucial for maintaining consistent standards. Reinforcing existing frameworks such as the Pakistan Dental Council's Infection Control Guidelines for Dental Practitioners and Students and the World Health Organization's Infection Prevention and Control Guidelines can help standardize practices across educational institutions (11, 12). Embedding these principles into undergraduate curricula and continuous

professional development programs could significantly improve compliance and foster a culture of accountability and safety.

In conclusion, while the findings indicate a solid foundation in infection control practices among dental students, there is a clear need for further emphasis on the consistent use of protective barriers and comprehensive vaccination coverage. Strengthening these areas will not only enhance student safety but also ensure that they are better prepared to provide high-quality care in their future professional roles.

Conclusion

This study demonstrates that undergraduate dental students in Karachi generally adhere well to key infection control protocols, with high rates of self-reported glove use, hand hygiene, and instrument sterilization. However, the findings highlight a need for improvement, particularly in the consistent use of protective barriers and immunization against diseases such as tuberculosis and tetanus. To enhance the safety of both dental professionals and patients, dental institutions must emphasize the importance of adhering to comprehensive infection control protocols and ensure that all students have received the necessary vaccinations. Regular seminars and immunization drives can play a key role in reinforcing these essential practices. Addressing these gaps will not only improve clinical safety but also better prepare dental students for the demands of their future professional careers.

Declarations

Ethical Approval and Consent to Participate

All participants were informed about the objectives of the study. Written consent was obtained from all participants before data collection, and anonymity was assured. Participation was entirely voluntary. In accordance with institutional policy, formal ethics approval was deemed not required for this minimal-risk study involving anonymous questionnaires.

Availability of Data and Materials

All dataset pertaining to this study will be available

upon a reasonable request from the corresponding author.

Competing Interests

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Authors' Contributions

Faisal Rehan and Sumera Qasim contributed to the study conception and design. Material preparation, data collection, and investigation were performed by Syed Fareed Mohsin, Hareem Sattar, and Zohaib Ahmed. Data analysis and interpretation were performed by Faisal Rehan, Zohaib Ahmed, and M. Ali Sheikh. The first draft of the manuscript was written by Syed Fareed Mohsin, and all authors commented on previous versions of the manuscript. Sumera Qasim, M. Ali Sheikh, and Mohammed Sohail Memon critically revised the work for important intellectual content. All authors read and approved the final manuscript.

Declaration of Generative Artificial Intelligence (AI) Utilization

The authors acknowledge the use of artificial intelligence (AI) tools, specifically ChatGPT (OpenAI) and Grammarly, during the preparation of this manuscript. These tools were employed exclusively for language editing, grammar correction, and formatting assistance to improve readability. No AI tools were used to generate, analyze, or interpret data, nor to formulate scientific conclusions. Following the use of these AI-assisted technologies, the authors thoroughly reviewed, revised, and verified all content. The authors assume full responsibility for the final version of this manuscript and the integrity of the work presented.

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