

Assessing the Knowledge and Adherence of Dental Students to Cross-Infection Control Measures

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ABSTRACT

Background: Cross-infection control is extremely pivotal to halt the propagation of contiguous diseases amongst people as they pose a tremendously increasing disease burden on our health care system. Therefore, this study aimed to assess the knowledge and adherence to cross-infection control measures among dental students studying in public and private institutions of Karachi.

Methods: This descriptive study was performed among dental students of public and private sector dental colleges in Karachi from January 2020 – February 2020. The questionnaire assessed the knowledge and adherence of dental students toward cross-infection control protocols during their clinical rotations. Chi-square test was used to analyze the relationship between students' knowledge and practice regarding cross-infection control measures.

Results: A total of 202 students participated in this study. The students demonstrated adequate knowledge of cross-infection control measures. However, the practice of wearing gloves was positive (98%) in contrast to the use of masks (79%), gowns (46%), and eyewear (13%). A statistically significant relation was seen in their knowledge and attitude toward hand hygiene. The immunization status of students from both government (72%) and private (88%) sectors raised concerns. Although students demonstrated good practice of measures to avoid transmission of contagious diseases ($p < 0.001$) the use of environmental barrier (36%) ($p = 0.047$) and disinfection (37%) of the working surface is warranted.

Conclusion: The overall knowledge of cross-infection control was satisfactory among dental students. Efforts are needed to improve the degree of compliance with recognized policies for improving the attitude of students regarding cross-infection measures.

Keywords: Cross Infection Control, Dental Student, Public and Private Sector, Transmissible Disease.

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INTRODUCTION

Infectious diseases have been a major public health problem and a global burden on healthcare systems. Cross infection is a term that expresses the transmission of infections from patient to health care provider/auxiliary staff, or from health care provider to their staff and similarly to patient either directly or by contaminating the clinical environment¹. Dental Clinics are a potential source of cross-infection due to direct contact with blood, saliva, and contaminated instruments with the body secretion. Needle stick injuries are also common if the contaminated instruments are not handled with care. The splattering and aerosols generated due to the functioning of dental instruments also assist in the propagation of infectious microbes and diseases^{2,3}.

The control of cross-infection and cross-contamination has thus become a major concern in dentistry owing to constant exposure of infectious agents in the dental environment and the responsibility therefore lies on the health care professionals to follow a stringent cross-infection control routine in their practice for protection and preventing transmission of infectious diseases⁴. The cross-infection protocols recommended by the Occupational Safety and Health Administration (OSHA) for hospitals and clinical practices apply the use of personal protective equipment for hands such as gloves, for clothes, a white coat/apron, a mask to cover the nose, and eyewear to protect the eyes. Proper cleaning and disinfection of dental units and flooring and proper sterilization of all used dental equipments (motor and manual) by autoclave. Adequate disposal of disposal items like syringes, needles, cartridges, and patients' contaminated materials (like cotton, gauze pieces, etc.)^{5,6}. Cross-infection protocols must never be overlooked or ignored.

The discipline of infection control has experienced a renaissance during the last two decades which was stimulated by the emergence of the AIDS epidemic in the 1980s⁷. This, in turn, led to recommendations by the US Centers for Disease Control and Prevention (CDC) for more rigorous precautions concerning the prevention of Human Immunodeficiency Virus (HIV) transmission and following isolation precaution guidelines in healthcare settings⁷.

Dentists have the highest risk of acquiring cross-infection among health professionals; with 2.5- to 6-fold higher experience of hepatitis B among dentists⁸. Dental Practices in Pakistan have been identified as a potential risk factor in transmission of infectious diseases especially Hepatitis B & C, tuberculosis, and HIV predominantly due to poor level of infection control practice and lack of awareness among unqualified practitioners and auxiliaries⁹. It is the dental staff and students in particular who are prone to these detriments due to their inadequate

knowledge and the nature of work which also play a role in the dissemination of these diseases¹⁰.

Abhinav Singh et al., reported that the level of knowledge and practice of infection control measures was poor among dental students while the attitude was positive, but greater compliance was needed¹¹. However, in Karachi, Pakistan favorable results were found on knowledge regarding infection control among dental students but emphasized the need to transfer that knowledge into daily practice¹²⁻¹³. Among all factors needle stick injury is the most common source of accidental exposure among dental students¹⁴ and that poor knowledge, attitude, and practices regarding infection control was common among senior dental professionals as compared to house officers and junior professionals¹⁵⁻¹⁶.

Although there is enough scientific support for knowledge and awareness of dental health care professionals regarding infection control, research comparing the practicing behavior of public and private dental students is limited. Therefore, the objective of this study was to obtain comprehensive information regarding OSHA guidelines corresponding to cross-infection among the study population and assess its application by adherence in their daily practice. The study also aimed to compare the level of knowledge regarding infection control practices among dental students in public and private sector teaching hospitals in Karachi.

METHODS

This descriptive, cross-sectional research study was executed among third and final-year undergraduate dental students from Jan to Feb 2020. The sample size extracted via the Online Open Epi Software v3.0 sample size calculator was n=250 keeping the confidence level at 95% with a 5% margin of error. However, about 202 students' proforma were found to be complete and thus processed for data analysis. The response rate was 80.8%. The research data was obtained from the following public and private dental colleges of Karachi: Dow University of Health Sciences (DUHS), Karachi Medical and Dental College (KMDC), Altamash Institute of Dental Medicine (AIDM), and Bahria University Medical & Dental College (BUMDC) by non-probability convenience sampling technique.

Dental students of the 3rd and final BDS program, both genders, who have been allocated in the clinical department rotations in OPDs, with at least 6 months' experience in patient handling, and showing a willingness to participate in the research study were included in the study. However, dental students in preclinical years (1st and 2nd years) and having less than 6 months of clinical experience along with Postgraduate trainees, General Dental Practitioners, and those students unwilling to participate in the study were

excluded. All the participants enrolled in the study signed an informed consent form.

Prior permission to collect data was obtained from the respective institutional heads while the study was approved by the Ethics Review Committee of BUMDC reference # ERC 13/2020. A self-administered closed-ended questionnaire comprising 23 questions adapted from a previous study¹⁴ and with slight modifications was employed for data collection. The collected data was analyzed by SPSS version 23. The descriptive data was represented using percentages and frequencies. Correlation among knowledge, attitudes, and practice between public and private sector institutes was assessed by the Chi-Square test and Fisher Exact Test. A p-value of ≤ 0.05 was considered to be significant.

RESULTS

In this study, a total of 202 completed questionnaires were received from students belonging to government and private institutions. The results of students' knowledge and attitudes are tabulated.

Figure 1 displays the knowledge and attitude of students toward personal protection protocol. A positive result was seen regarding the use of gloves by both government 73 (96%) and private students 124 (98.4%) in contrast to other personal protection gear which was notably low. The use of masks was more frequently practiced in private colleges n=106/126 (84%) as compared to government n=53/76 (70%).

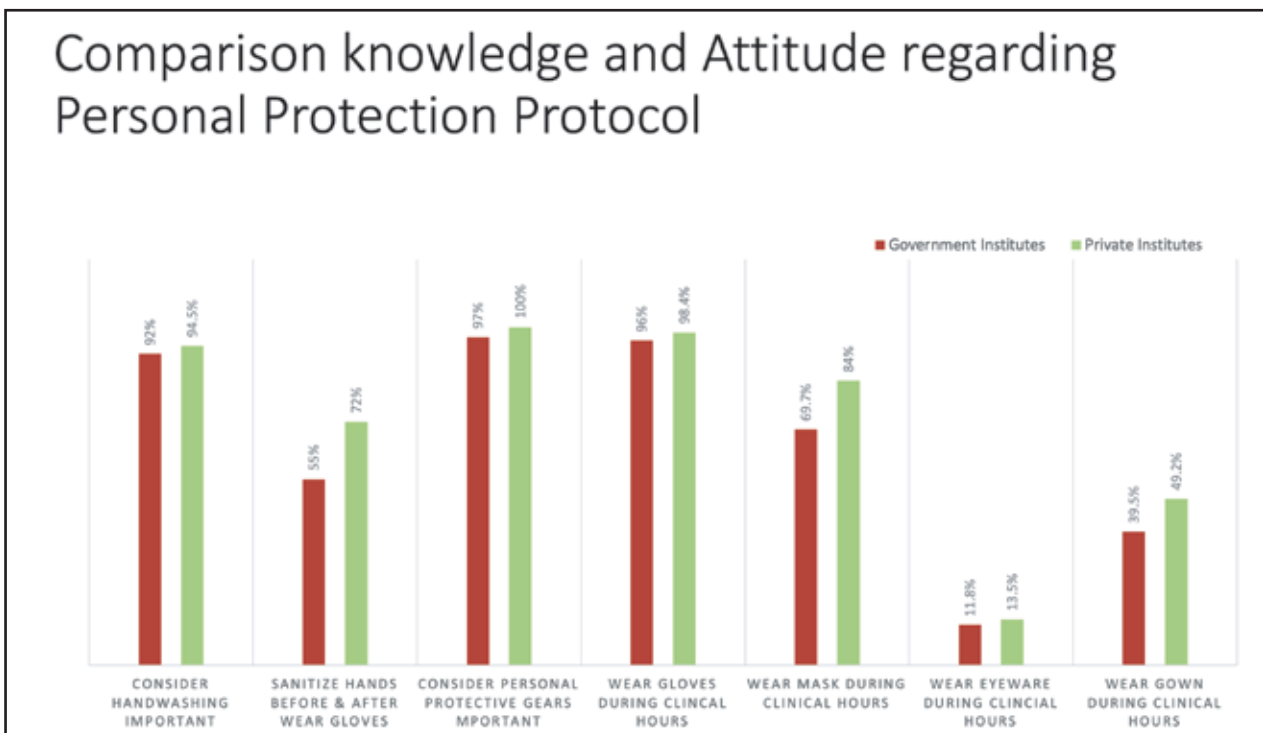


Figure 1: Comparison of knowledge and attitude regarding personal protection protocol among public and private sector dental students

Table 1 depicts the knowledge and attitude of students to cross-infection control measures. It is noteworthy to mention that nearly all of the students were aware of the term cross infection control n= 199/202. Knowledge regarding cross-infection control as well as cross-infection practices was found to be better in males as compared to females. A good percentage of students 54 (71%)

from government institutions had attended an educational session cross infection in contrast to private institutions 58 (46%). Nearly one-third of all the students 59 (29%) were unaware of standard precaution guidelines by OSHA despite being part of their curriculum. Also, the immunization status against Hepatitis B of students in a public institute was low 16/29 (55%).

Table 1: Knowledge of students regarding cross-infection control measures/protocol.

Variables	Response	Gender		Type of Institution	
		Male (25) n (%)	Female (177) n (%)	Public (76) n (%)	Private (126) n (%)
Understanding cross-infection control	Yes	25 (100)	174 (98.3)	74 (97)	125(99)
	No	0	3 (1.6)	2 (2.6)	1 (0.7)
Sessions on cross-infection guidelines	Yes	14 (56)	98 (55.4)	54 (71)	58 (46)
	No	11 (44)	79 (44.6)	20 (26)	67 (53)
OSHA guidelines awareness	Yes	12 (48)	131 (74)	47 (62)	96 (76)
	No	12 (48)	33 (18.6)	16 (21)	29 (23)
	Don't know	1 (2)	13 (7.3)	13(28)	1
Importance of environmental barriers	Yes	23 (92)	160 (90.4)	68 (89)	115(91)
	No	1 (4)	14 (7.9)	6 (8)	9 (7)
	Don't know	1 (4)	3 (1.7)	2 (3)	2 (2)
Safety measures for needle stick injury	Yes	23 (92)	154 (87)	66 (87)	111 (88)
	No	2 (8)	21 (11.9)	7 (9)	8 (6)
Immunized against Hepatitis B	Yes	21 (84)	145 (81.9)	55 (72)	111(88)
	No	4 (16)	32 (18)	13 (14)	7 (5)
Methods of sterilization	Yes	25 (100)	171 (96.6)	71 (93)	125(99)
	No	0	5 (2.9)	4 (5)	1 (1)
	Don't know	0	1 (0.6)	1 (1)	0

Descriptive statistics, n= frequency, % = percentage

The protocol of changing gloves for every patient was routinely followed by all the students 194 (98%) while contradictory results were seen regarding changing masks for every patient 93 (46%). Practices such as the use of new gloves for every patient 100% / 98%, taking extra precautions against communicable diseases 100% / 98% and needle stick injuries 92%

/ 91%, always disinfecting instruments 96% / 90% and history take as precautionary measures 92% / 96% against the spread of diseases were higher in males as compared to females and amongst students of private institutes in comparison to public institutes (table 2).

Table 2: Attitude, and adherence of students regarding cross-infection control measures/ protocol.

Variables	Response	Gender		Type of Institution	
		Male (25) n (%)	Female (177) n (%)	Public (76) n (%)	Private (126) n (%)
Environmental barrier usage	Always	10 (40)	65 (36.7)	25 (33)	50 (40)
	Sometimes	11 (44)	86 (48.6)	36 (47)	61 (48)
	Never	4 (16)	26 (14.7)	15 (20)	15 (12)
Change of environmental barrier	After every patient	9 (36)	71 (40)	35 (45)	46 (36)
	Once daily	11 (44)	55 (31)	13 (17)	53 (42)
	Weekly	2 (8)	19 (10.7)	10 (13)	11 (9)
Precautions using needles and other sharp instruments	Always	23 (92)	162 (91.5)	71 (93)	114 (91)
	Sometimes	1 (4)	11 (6.2)	3 (4)	9 (7)
	Never	1 (4)	4 (2.2)	0	0
Method of sterilization	Autoclave	24 (96)	169 (95.4)	74 (97)	119(94)
	Dry heat	1 (4)	7 (3.6)	7 (9)	7 (5)
Disinfecting the instruments	Always	24 (96)	143 (80.8)	54 (71)	113(90)
	Sometimes	0	25 (14)	16 (21)	9 (7)
	Never	1 (4)	9 (5.1)	0	0
Disinfecting the working surface	Always	14 (56)	62 (35)	28 (37)	48 (38)
	Sometimes	9 (36)	76 (43)	32 (42)	53 (42)
	Never	2 (8)	39 (22)	16 (21)	25 (20)
Taking medical history before treatment	Always	23 (92)	156 (88)	58 (76)	121(96)
	Sometimes	2 (8)	19 (10.7)	16 (21)	5 (4)
	Never	0	2 (1.1)	2 (3)	6 (5)
Extra precautions for communicable disease patients	Always	25 (100)	172 (97)	74 (97)	123(98)
	Sometimes	0	4 (2.2)	1 (1)	3 (2)
	Never	0	1 (0.6)	0	0
New gloves	Always	25 (100)	169 (95)	70 (92)	124(98)
	Sometimes	0	8 (4.5)	6 (8)	2 (2)
New mask	Always	9 (36)	84 (47.5)	37 (49)	56 (44)
	Sometimes	15 (60)	80 (45.2)	33 (43)	62 (49)
	Never	1 (4)	13 (7.4)	6 (8)	8 (6)

Descriptive statistics, n= frequency, % = percentage

The practice of frequent hand washing was highest among dental students. This also proved to be statistically significant ($p=0.003^*$) when associated with their knowledge of hand hygiene. The students showed varying responses to the use of environmental barriers but whenever practiced, it was strictly changed after every patient. When this was correlated with their knowledge, a statistically significant ($p=0.047^*$) relationship was found. The disinfection

of instruments was regularly practiced 167 (83%) and showed a significant result ($p=0.016^*$) when correlated with their knowledge of cross-infection control. A thorough medical history taking was carried out by the majority of students 179/202 (88.6%) and extra precautions were taken for patients with transmissible diseases. This practice was also found to be statistically significant ($p=0.001^*$) (Table 3).

Table 3: Correlation between knowledge and attitude of dental students

Knowledge Variables	Attitude n=202				p-value
	Always	Sometimes	Never	Total	
Understanding cross-infection control	Disinfecting the instruments				$b<0.043^*$
	166	23	10	199	
	Taking medical history before treatment				$b<0.001^*$
	177	21	1	199	
Extra precautions for communicable disease patients				$b<0.001^*$	
195	4	0	199		
OSHA guidelines awareness	Separate sterilized instruments for each patient				0.270
	137	5	1	143	
	New mask for every patient				$a0.687$
	70	64	9	143	
	New gloves for every patient				$a0.220$
	136	7	0	143	
Importance of hand washing	Immunized against Hepatitis B				$a0.271$
	119	15	9	143	
	Wash/sanitize hands				0.753
Importance of environmental barriers e.g., plastic covering of equipment and surfaces	Wash/sanitize hands				$b0.047^*$
	130	50	8	188	
	Environmental barrier usage				$a0.120$
	71	88	24	184	
Change of environmental barrier					
Safety measures for needle stick injury	After every patient	Once daily	Weekly	Total	
	75	61	17	153	
Safety measures for needle stick injury	Precautions using needles and other sharp instruments				$b<0.001^*$
	170	5	2	177	

a) Fischer Exact test, b) X2 Test, Significant p-value < 0.05*.

DISCUSSION

Most infectious diseases that colonize the oral cavity and respiratory tract, including the novel coronavirus, can be transmitted in a dental clinic. A High percentage of affected people worldwide visit dental clinics, which, in turn, poses a risk of exposure and disease-contraction by dentists and other staff members¹⁷. This study assessed the knowledge of students and their corresponding practicing behavior concerning cross-infection control in government and private hospital settings. The overall knowledge of cross-infection control was satisfactory among dental students and similar findings were reported by other studies in Pakistan^{12,13}. The contributing factors could be curriculum emphasis and educational seminars conducted during their graduate program. Also, professional guidelines are set by the institute and regulatory bodies. Dental students are typically taught to adhere to these guidelines, ensuring they are well-informed about the best practices

in infection control.

Upon comparing our findings regarding the use of personal protective gear with other studies, both similarities and differences were observed. In our study, the percentage of participants wearing gloves was 98%, which aligns with a study conducted in Saudi Arabia¹⁷. However, variations were noted in the utilization of masks, gowns, and eyewear. In our study, the respective percentages were 79%, 46%, and 13%, whereas in a study by Halavani *et al*, they were 93%, 98%, and 60.7%¹⁸. These discrepancies indicate a lack of sufficient understanding regarding the importance of eye protection, considering the potential transmission of diseases through aerosols and blood. Nevertheless, other studies conducted in Pakistan demonstrated similar compliance with personal protection against infections^{12,13}. This underscores the necessity to enforce rules and regulations, with educational institutions

ensuring strict adherence to protocols by students.

Hands serve as the primary reservoir for numerous pathogens, highlighting the utmost significance of hand hygiene in preventing infections. Handwashing is considered a fundamental and effective method for infection prevention¹⁹. In response to the COVID-19 pandemic, the World Health Organization (WHO) has recommended a comprehensive handwashing approach, involving washing hands with soap and water for a minimum of 20 seconds, followed by the use of alcohol-based hand rub (ABHR) for visibly soiled hands²⁰.

In our present study, we found that students were well aware of the importance of hand hygiene, with an impressive awareness rate of 94%. Their adherence to the standard hand hygiene protocol was 72% in private schools and 55% in government schools, as observed in the study by Waheed Tahir *et al.* conducted in a government setup, which reported a compliance rate of 74%¹³. In contrast, Marium *et al.* reported a higher compliance rate of 94% with hand hygiene in a private institute¹⁹. Similarly, a study conducted in India by Bommireddy *et al.* demonstrated a compliance rate of 59% in handwashing practices among dental practitioners²¹. While the majority of students in our study changed gloves between patients, it was noted that not all consistently followed proper handwashing protocols, as also reported by Noura A. *et al.*¹⁷. This indicates a lack of institutional emphasis and guidelines regarding hand hygiene. To address this concern, we recommend reinforcing proper handwashing techniques among students and considering placing educational posters in handwashing areas, which would serve as useful reminders.

Although the participants in our study believed that environmental barriers such as plastic wrapping for dental units were important the practice was not very consistent, with only 33% in government and 39% in private. Similar results were seen for the disinfection of the working surface. This finding also concurs with past studies^{12,13, 19, 22}. However, studies by Halawani *et al.* and Chang HC *et al.* show significantly improved compliance with the environment disinfection protocol post-COVID-19^{18,23}. This suggests that the basics of infection control should be overemphasized by continuous lectures and training sessions.

Our study revealed excellent knowledge and attitudes of students towards handling and disposing of needles. Also, a thorough medical history and patients with communicable diseases were treated according to OSHA guidelines. This finding is similar to previous studies^{13,15,24}. However, the immunization status of students was found to be 72% and 88% in government and private institutes respectively.

Similar results were seen in previous studies in the subcontinent^{12,13,25}. A study conducted by Elagib MFA *et al.* in Sudan and Saudi also reported a low percentage of post-HBV serology²⁶. This finding suggests that the institute should make hep B vaccination proof mandatory for all students and a booster dose before starting clinical practice/rotations. A study by Alharbi *et al.* found that 93.1% of their undergraduate students were vaccinated due to this regulation followed by the college²⁷.

Nonetheless, this study involved both government and private colleges therefore it displays more variability. The dissimilarity in the attitude of participants may be due to a person's own beliefs, thoughts, and behavioral aspects. The lack of resources and adherence to strict institutional policy, particularly in the government sector could also play a role.

One of the limitations of this study was the method used to assess the practice of infection control guidelines which is based on students' subjective self-assessment. Also, the generalizability of the findings is constrained by the convenience sample of dental students and the limited sample size. Another limitation was the absence of qualitative data due to the limited time available during data gathering. This was a multi-center study (being carried out in private and public sector dental colleges of Karachi), which will help us elucidate the level of knowledge and practice regarding cross-infection control procedures among undergraduate dental students. It will help the institutes identify the awareness and practice of cross-infection protocols being practiced at their institutes and will also help to learn and share information with other institutes for the best interest of their students and patients' safety. It will also allow the conduct of regular workshops to enhance and improve awareness among future dentists.

CONCLUSION

The students from both public and private institutes reported good knowledge indicating that cross-infection control guidelines are outlined by OSHA. Lack of adherence to the guidelines at certain levels spotlights the need for an evaluation program as a means of assuring compliance with recognized policy in clinical practice. This will help create a safe environment for both the practitioners and the patients and help build patients' trust in doctors and healthcare facilities.

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CONFLICT OF INTEREST

Authors declare no conflict of interest

ETHICAL APPROVAL

The study was approved by the Ethics Review Committee of BUMDC reference # ERC 13/2020.

PATIENT CONSENT

Written and verbal consent was taken by all participants before handing out the questionnaire.

AUTHORS CONTRIBUTION

AS was responsible for the literature research, concept, and design of the study. AS and RB performed data collection and manuscript writing. RB conducted a statistical analysis and reviewed the final manuscript. KFR supervised the research work and provided final proofreading.

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