

A descriptive study on Bulgarian preclinical dental students' knowledge and attitude towards coronavirus disease 2019 precautions and cross-infection control practices

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Original Article

Abstract

BACKGROUND AND AIM: One year after the novel coronavirus pandemic, there is a sustained risk of further global spread and most countries continue to impose preventive measures to mitigate the spread of coronavirus disease 2019 (COVID-19). The current situation outlined a specific reformulation of dental education in Medical University of Sofia, Sofia, Bulgaria – initial transition of face-to-face classes towards electronic learning (e-learning) processes, and subsequently, a transition from online teaching toward hybrid education. Therefore, the aim of the present study was to investigate preclinical dental students' knowledge and attitude towards COVID-19 precautions as well as cross-infection control strategies.

METHODS: This descriptive cross-sectional study was conducted online on 258 out of 516 preclinical dental students at the School of Dental Medicine, Sofia, using a self-administered questionnaire. Survey items were grouped in 3 general sections: educational experiences, students' knowledge and perceptions of COVID-19 precautions and sources of relevant information as well as students' personal experiences during the current pandemic.

RESULTS: A total of 169 students participated in the study (response rate: 65.5%). Of them, 98 (57.9%) were second-year students, 42.6% were men, and their mean age was 21 ± 1 years. Almost one-third of the participants indicated violation of disinfection and sterilization protocols (28.9%) and the presence of aerosol-generating procedures (27.2%) as the most important COVID-19 predisposing factors in dental practice. Vaccination was suggested as the most effective way of prevention against the COVID-19. Proposed infection control practices included strict cleaning, disinfection, and sterilization (87.6%), personal protective equipment (PPE) (85.8%), frequent ventilation (53.3%), and treatment after a negative polymerase chain reaction (PCR) (or other) test (46.2%). Social media was considered as the main source for pandemic-related information (68.0%).

CONCLUSION: In the light of COVID-19, dental students demonstrated a satisfactory level of knowledge regarding standard precautions in dental practice; however, more attention should be paid to additional transmission-based precautions to ensure the safety of educational and working environment.

KEYWORDS: COVID-19; Cross Infection; Dental Students; Hybrid Education; Prevention and Control

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In January 2020, the World Health Organization (WHO) declared the novel coronavirus outbreak as a public health emergency of international concern (PHEIC). On March 11, 2020, it declared a pandemic, pointing to the over 118000 cases of the coronavirus illness in over 110 countries and territories around the world. One year after the pandemic, there is a

sustained risk of further global spread, indicating more than 121848070 confirmed cases with more than 2692235 associated global deaths in 192 countries and regions all over the world.¹ Due to the present pandemic, most countries imposed preventive measures to mitigate the spread of coronavirus disease 2019 (COVID-19). Keeping social distance between human beings, quarantine, and

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lockdown measures were the most important and effective strategies for many countries.^{2,3} Bulgaria was not an exclusion. Since the outbreak of the COVID-19 pandemic, there have been altogether three lockdowns (in March 2020, November 2020, and March 2021) necessitated by the complicated epidemiological conditions representing rapid change and dissemination of the disease. Among these precautions, face-to-face education was disrupted. All universities, including Medical University of Sofia, Sofia, Bulgaria, had to change in-person training into online education. The evidence in the current literature suggests that virtual teaching is a time- and cost-effective educational tool in the field of dentistry, providing continuous education and opportunity to improve and develop it in the future.⁴⁻⁶

Besides its obvious advantages as a well-accepted strategy for higher education during the COVID-19 pandemic, the main disadvantage of online dental education is reduced students' learning motivation and concerns about interruption of clinical activities.^{5,7} Unlike medical education, dental training requires appropriate physical setting and dental equipment which cannot be ensured by electronic learning (e-learning) only. Lacking practical activities may lead to a serious skill deficit, resulting in negative consequences on students' future realization as dentists.^{8,9} High levels of anxiety related to these issues amongst Bulgarian dental students were justified during the summer 2019/2020 and winter 2020/2021 terms, in-person education was suspended, and e-learning platforms were used to teach theoretical content only. Despite the emerging of rapidly evolving COVID-19 situation through the second semester of the academic year of 2020/2021, the Bulgarian government permitted practical training of medical and dental students. While in-person learning process in the universities in Bulgaria was terminated, exceptions were allowed for practical activities in clinical disciplines,

teaching practice (clinical internship), undergraduate internship, and state exams of students in regulated health professions in the professional fields of "Medicine", "Dental Medicine", and "Nursing", as well as state exams for acquiring a specialty in the healthcare system, in strict compliance with accepted preventive measures. Therefore, the current COVID-19 pandemic outlined a specific reformulation of dental education in Medical University of Sofia - initial transition of face-to-face classes towards e-learning and e-teaching processes, and subsequently, a transition from online teaching towards hybrid education. Currently, theoretical disciplines are taught via Google classroom online platform, but practical clinical and preclinical disciplines require face-to-face training.

Dentists as healthcare professionals are classified in the very high-risk category because of the nature of the profession.^{10,11} In general, working in the oral cavity and the presence of aerosol-generating procedures significantly increase the risk of acquiring infectious diseases, including COVID-19.¹²⁻¹⁴ In the scenario of the COVID-19 crisis and implementation of hybrid dental education in which in-person teaching is applied for both simulation and clinical environments, dental educators and students have been challenged to continue and ensure safe learning process. Therefore, dental students' current awareness towards the COVID-19 prevention measures is essential. The aim of the present study was to investigate preclinical dental students' knowledge and attitude towards the COVID-19 precautions as well as improvement of cross-infection control strategies. The results of this study could be useful for other dental schools, educators, students, administrators, policy makers, and public health professionals as provided information regarding dental students' perspectives on coronavirus predisposing factors and prevention measures may contribute to the development of dental education in the context of infection prevention and control

improvement in the COVID-19 era.

Methods

This descriptive cross-sectional study was conducted at School of Dental Medicine, Medical University of Sofia, as a part of internal survey. A 6-year full theoretical and practical training was applied for both Bulgarian and English-speaking students for acquiring a dental medicine doctoral (DMD) master's degree.

The study was conducted online among second- and third-year preclinical dental students. A self-administered questionnaire was administered to 258 out of 516 students (136 Bulgarian and 122 English-speaking). A convenience sampling technique was used. The students were given preliminary information including the purpose of the research, the time involved, assessment of minimal risk, benefits of participating in this study, contact for questions about the research, and contact for questions about rights as a research participant. Completion of the survey was voluntary and anonymous with no incentives offered for taking part in it. The respondents were instructed to answer the questions honestly and were informed that their refusal to participate would not affect their grades. No identifying information was collected. Instructions accompanying the survey served as the "implied" informed consent form, whereby a statement contained in them indicated that completing and giving back the survey implied individual consent to participate in the research. The surveys were distributed at the end of the regularly scheduled classes in December 2020, during the last two weeks of the winter term, to students who were not absent due to illness, external rotations, or personal reasons. The window for survey completion ran 4 weeks (from December 21, 2020 to January 17, 2021). Remainder was sent at the end of the second week. This survey did not ask for any identifiable information and was conducted in full accordance with the World Medical Association (WMA) Declaration of Helsinki. As

it involves educational tests, surveys, interview procedures, or observation of public behavior, the Committee for Ethics of Scientific Research to the Medical University (CESRMUS) reviewed and considered this study as an exempt application [Institutional Review Board (IRB) letter of approval: N1141/19.04.2021].

The questionnaire was pretested for its validity and reliability. The chosen samples and size and the techniques used to measure reliability and validity were as follows: the study was independently piloted at the same time by two researchers on two groups of 9 third-year students during regularly-scheduled online classes in Dental Public Health. Written forms of the questionnaire were administered to the respondents. The results by the different raters were the same and they showed that the questionnaire had high inter-rater reliability. In one week, the researchers interviewed the same students on the same topic. The results were not different compared to written forms; therefore, the parallel forms reliability of the questionnaire was high. The questionnaire was translated into English and provided to English-speaking students. Bulgarian students completed the survey items in Bulgarian language. The type of questions and their content, number, and categories were independently reviewed by authors to improve question clarity, question content, "skip patterns", format, content validity, and face validity of the measurement.

The self-administered survey included questions concerning the students' background (such as gender, country of origin, and year at university), as well as their educational experiences of distance learning and pandemic-related personal experiences. The survey instrument was a self-administered online questionnaire which consisted of 19 questions incorporating 57 items. Survey items were grouped in 3 general sections: (1) educational experiences related to the students' perspectives on the implementation and self-assessment of the

effectiveness of online learning due to severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) or COVID-19, (2) the students' knowledge and perceptions of the COVID-19 pandemic consisting of several close-ended questions and one open-ended question, and (3) personal experiences concerning the students' opinion of government generally-accepted measures and their adequacy to address the problem as well as students' intention for getting vaccinated. In the present study, the authors focused on the second part of the questionnaire aiming to investigate and assess dental students' current knowledge of COVID-19 precautions and sources of relevant information. The knowledge questions were categorized to assess the students' knowledge of: a) the most predisposing factor for the spread of the COVID-19 in dental practice - close-ended question with 5 items, b) the most effective prevention measures in dental practice - multiple choice close-ended question with 9 items, and c) the most effective means of prevention in society - close-ended question with 6 items. To assess preferred information sources about the COVID-19 pandemic, a 7-item multiple-choice question was used. In addition, one open-ended question was included in the survey to assess the students'

opinion of the psychological impact of pandemic on the public health. The reliability of the knowledge section (a, b, c) of the COVID-19 questionnaire was $\alpha = 0.80$.

The obtained data were analyzed using descriptive statistical methods by SPSS software (version 20, IBM Corporation, Armonk, NY, USA). The results of the study regarding relevant item responses were presented as frequency distributions (number, percent) of dental students according to basic categorical variables.

Results

A total of 169 (77 Bulgarian and 92 English-speaking) dental students participated in the study (response rate: 65.5%). Of them, 98 (57.9%) were second-year students, 42.6% were men, and their mean age was 21 ± 1 years. The vast majority of the participants were students from Bulgaria, United Kingdom (UK), Greece, Germany, and Italy. Further socio-demographic information is presented in table 1.

When asked to determine the most important COVID-19 predisposing factor in dental practice, almost one-third of the respondents ($n = 49, 28.9\%$) indicated violation of disinfection and sterilization protocols (Table 2).

Table 1. Demographic characteristics of the respondents ($n = 169$)

Demographic data	Gender [n (%)]			Year in program [n (%)]			
	Men	Women	Total	2 nd year	3 rd year	Total	
Country of origin	Bulgaria	23 (29.9)	54 (70.1)	77 (100)	47 (61.1)	30 (38.9)	77 (100)
	Greece	11 (40.7)	16 (59.3)	27 (100)	14 (51.9)	13 (48.1)	27 (100)
	UK	19 (57.6)	14 (42.4)	33 (100)	17 (51.5)	16 (48.5)	33 (100)
	Germany	5 (50.0)	5 (50.0)	10 (100)	8 (80.0)	2 (20.0)	10 (100)
	Ireland	2 (66.7)	1 (33.3)	3 (100)	3 (100)	-	3 (100)
	Denmark	2 (100)	-	2 (100)	2 (100)	-	2 (100)
	Norway	2 (66.7)	1 (33.3)	3 (100)	1 (33.3)	2 (66.7)	3 (100)
	Sweden	-	1 (100)	1 (100)	1 (100)	-	1 (100)
	Italy	4 (80.0)	1 (20.0)	5 (100)	1 (20.0)	4 (80.0)	5 (100)
	Cyprus	-	1 (100)	1 (100)	1 (100)	-	1 (100)
	Ukraine	-	1 (100)	1 (100)	-	1 (100)	1 (100)
	Egypt	-	1 (100)	1 (100)	1 (100)	-	1 (100)
	Livan	1 (100)	-	1 (100)	-	1 (100)	1 (100)
	Kuwait	2 (100)	-	2 (100)	-	2 (100)	2 (100)
	Syria	-	1 (100)	1 (100)	1 (100)	-	1 (100)
	Pakistan	1 (100)	-	1 (100)	1 (100)	-	1 (100)
Total [n (%)]	72 (42.6)	97 (57.4)	169 (100)	98 (57.9)	71 (42.1)	169 (100)	

UK: United Kingdom

Table 2. Dental students' awareness of coronavirus disease 2019 (COVID-19) predisposing factors in dental practice (n = 169)

	COVID-19 predisposing factors in dental practice	Second-year dental students [n (%)]	Third-year dental students [n (%)]	Total [n (%)]
What do you think is the most predisposing factor for the spread of COVID-19 in dental practice?	Carelessly taken anamnesis	8 (4.7)	9 (5.3)	17 (10.1)
	Aerosols (operation with high-speed handpieces, ultrasonic scaler, water-air syringe)	33 (19.5)	13 (7.7)	46 (27.2)
	Violation of disinfection and sterilization protocols	24 (14.2)	25 (14.8)	49 (28.9)
	Inefficiency of disinfectant materials	12 (7.1)	6 (3.6)	18 (10.7)
	Increased risk of infection (work with sharp instruments, close contact with patients)	21 (12.4)	18 (10.7)	39 (23.1)

COVID-19: Coronavirus disease 2019

Similar results were observed regarding students' opinion of the presence of aerosol-generating procedures (operation with high-speed handpieces, ultrasonic scaler, water-air syringe, etc.) (n = 46, 27.2%). Of them, more than two-thirds (n = 33, 71.7%) were second-year students. Almost one-fourth of the respondents (n = 39, 23.1%) thought that work with sharp instruments and close contact with patients might significantly increase the risk of infection.

Dental students' knowledge of the

COVID-19 precautions was assessed in the background of two basic aspects: awareness of the most effective means of prevention against COVID-19 in society and infection control measures in dental practice. One-third of the participants in the study (n = 56, 33.1%) reported vaccination as the most effective way of prevention against the COVID-19 (Table 3). Quarantine and lockdown measures were suggested by 47 ones (27.8%), of which almost two-thirds (n = 29, 61.7%) were second-year students.

Table 3. Dental students' knowledge of coronavirus disease 2019 (COVID-19) precautions (n = 169)

	COVID-19 precautions	Second-year dental students [n (%)]	Third-year dental students [n (%)]	Total [n (%)]
What do you think is the most effective COVID-19 precaution?	Wearing a mask	10 (5.9)	8 (4.7)	18 (10.7)
	Frequent hand washing	5 (2.9)	3 (1.8)	8 (4.7)
	Keeping your distance	12 (7.1)	9 (5.3)	21 (12.4)
	Quarantine/isolation	29 (17.2)	18 (10.7)	47 (27.8)
	Vaccine	27 (15.9)	29 (17.2)	56 (33.1)
What do you think are the most effective prevention measures against COVID-19 in dental practice?	Adequate government measures	15 (8.9)	4 (2.4)	19 (11.2)
	Infection control practices			
	Measuring the patient's temperature	16 (9.5)	12 (7.1)	28 (16.6)
	Treatment after a negative PCR (or other) test	42 (24.9)	36 (21.3)	78 (46.2)
	Use of mouthwash before starting treatment	2 (1.2)	9 (5.3)	11 (6.5)
	Cleaning, disinfection, sterilization	88 (52.1)	60 (35.5)	148 (87.6)
	Use of PPE (masks, safety glasses, shields, clothing)	85 (50.3)	60 (35.5)	145 (85.8)
	Frequent ventilation of dental office and sterilization of the air in it	56 (33.1)	34 (20.1)	90 (53.3)
	Working with a rubber dam	-	1 (0.6)	1 (0.6)
	Work with aspiration	3 (1.8)	-	3 (1.8)
Reduction of turbine (high-speed) handpiece operation	2 (1.2)	1 (0.6)	3 (1.8)	

COVID-19: Coronavirus disease 2019; PPE: Personal protective equipment; PCR: Polymerase chain reaction

The vast majority of the respondents ($n = 143$, 84.6%) answered "yes" to the question "whether they thought that lockdown could lead to mental problems (stress, anxiety, depression) in many people" (Figure 1).

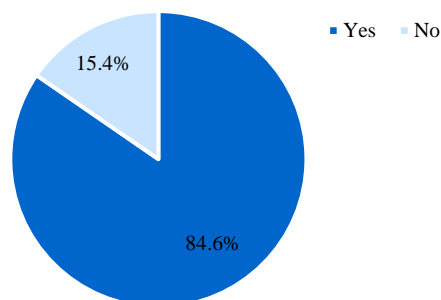


Figure 1. Do you think lockdown will lead to mental problems (stress, anxiety, depression) in many people?

A large number of the students reported that social isolation might negatively affect the psyche of all people. Besides this answer, many other risk groups were determined: all individuals accustomed to an intensive lifestyle, parents working hard to make ends meet, university students studying intensive courses, doctors on the front line, people who have lost their relatives or jobs, people with a history of mental illness, emotionally unstable individuals, disabled people, high-risk patients, preschool-aged children, adolescents, young and elderly people, people living alone and suffering from isolophobia, extroverts, and

all people who were affected socially and economically by the anti-COVID-19 measures.

Regarding students' attitude towards cross-infection prevention measures during dental treatment, most of the respondents ($n = 148$, 87.6%) underlined the importance of strict cleaning, disinfection, and sterilization procedures, as well as the use of personal protective equipment (PPE) (masks, gloves, safety glasses, face protective shields, clothing) [145 (85.8%)]. Besides these standard measures, half of the participants ($n = 90$, 53.3%) suggested extra measures such as frequent ventilation and sterilization of the air in the dental office, as well as treatment after a negative polymerase chain reaction (PCR) test (or other tests) [78 (46.2%)]. Standard cross-infection control practices such as using the dental aspiration systems and working with rubber dam were reported by an insignificant share of the respondents, 3 (1.8%) and 1 (0.6%), respectively (Table 3).

Finally, the respondents were asked to point out where they got information about the COVID-19 pandemic. More than two-thirds of them ($n = 115$, 68.0%) considered social media (TV, radio, etc.) the main source for pandemic-related information. Moreover, social networks (Facebook, Tweeter, Instagram, etc.), COVID-19 website, scientific papers, the WHO website, and the University were mentioned as additional sources of information (Figure 2).

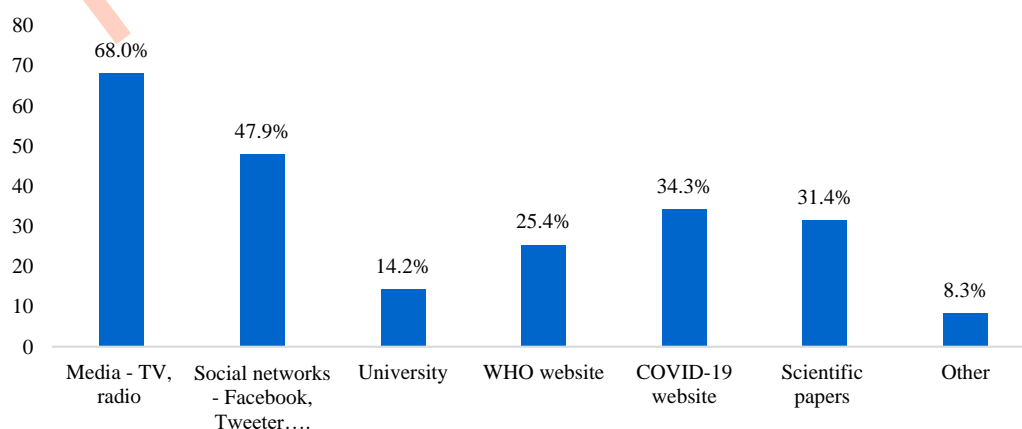


Figure 2. Where do you get information about the coronavirus disease 2019 (COVID-19) pandemic from?

14 students (8.3%) suggested other answers such as friends, family, and medical personnel directly involved. A second-year student shared her personal experiences of the coronavirus pandemic with the following statement: "I worked in a COVID-19 test center and got much information from the doctors there".

Discussion

The present study discusses dental students' pandemic-related responses regarding COVID-19 precautions and cross-infection control measures in the background of hybrid education implemented during the summer 2020/2021 semester at Medical University of Sofia. Since the outbreak of COVID-19, many dental schools around the world have changed traditional in-person training and implemented their distance education curriculum to provide safe learning environment. Besides all advantages and disadvantages of online teaching,^{4,15} there has been an existing agreement on this issue that it will adversely affect all dental clinical disciplines.^{8,11,16} Therefore, adoption of dynamic hybrid strategies that combine online distance learning, virtual reality-based simulation, and haptic technology together with traditional direct clinical training on real patients can be very helpful for skills training.^{3,17} Under these circumstances and during outbreaks of infectious diseases such as COVID-19, dental students' awareness and attitudes related to infection control measures are of particular importance. According to the study of Ghai, dental students should adopt adequate knowledge to protect themselves and prevent the infection from disseminating even before they see their first patient.¹⁸ The findings of this study indicated a relatively satisfactory level of preclinical dental students' knowledge regarding cross-infection precautions. However, this knowledge should be further improved as only one in ten students suggested that gaps in thorough medical history may contribute to COVID-19 cross-infection. In addition, it was

not surprising that second-year students did not take into account so much the significance of anamnesis in clinical practice as they have not entered into it yet. Similarly, some studies reported a fair level of knowledge towards COVID-19 precautions and infection control practices among dental students, especially the junior ones.^{14,19,20} In the present study, the majority of students believed that violation of cross-infection protocols and the nature of the dental profession—production of aerosols, frequent exposure to saliva, blood, and other body fluids as well as face-to-face communication with the patients—were the major sources for disease transmission. The same results were found by Jum'ah et al.⁸ and Loch et al.¹¹ (2020), indicating that universal protective equipment was not effective for prevention.

In 1996, the Centers for Disease Control and Prevention (CDC) expanded the concept "universal precautions" and changed the term to "standard precautions".²¹ Clearly and comprehensively written policies, protocols, and guidelines related to dental infection control can bring benefits to students' knowledge and skills development.²¹⁻²³ It was found that the participants in this study demonstrated a general understanding of preventive measures. As shown by data analysis, the importance of disinfection and sterilization protocol as well as the use of PPE were assumed by the majority of the dental students as the most significant measures for prevention of disease transmission and cross-infection control. In addition, more than half of the respondents suggested proper room ventilation as required extra-precautionary measures against disease exposure. Similar results were reported in the current literature, underlining the importance of the use of surgical masks, gloves, protective shields, frequent hand antiseptic usage, and correct protocol for hand washing.²⁴⁻²⁷ Nonetheless, a worrying fact was observed in the present study. Students' knowledge of the use of rubber dams and dental aspiration systems during treatment was barely adequate.

Additionally, only 11 persons suggested the use of mouthwash before treatment as an extra precaution against COVID-19 transmission. The latter preventive measure should not be underestimated as it has been well comprehended that pre-operative antimicrobial mouth rinses reduce the number of microorganisms in aerosols and drops during dental procedures.²⁸

When discussing dental students' opinion of safety behavior during the COVID-19 outbreaks and relevant preventive measures, vaccinations and lockdown measures were indicated as one of the most effective ways for prevention. It is not surprising that quarantine and lockdown measures were approved mainly by second-year students as they are engaged in less practical classes and interruption of in-person training would not affect their education to a great extent. In contrast, in a study by Mustafa et al. regarding the measures that should be taken against coronavirus transmission, maintaining good hand hygiene was indicated by 95.8%, wearing a face mask in the crowd by 83.2%, and vaccination by only 11.2%.²⁹

Although lockdown and stay-at-home policies have been employed to counteract the spreading of the virus, the current evidence suggests that they have negative psychological impacts on public mental health and might cause several related mental health issues.^{30,31} Moreover, some authors reported that the COVID-19 outbreak has induced public and global mental health crisis and a huge psychosocial experiment in the background of a psychiatric epidemic co-occurring with the COVID-19 pandemic.^{32,33} In this study, dental students were asked to response to the question "in their opinion, whether lockdown would lead to mental problems among general population". Most of the participants (84.6%) felt positive and precisely indicated many heterogeneous risk groups in this relation. Such groups have also been widely discussed by the scholars during the pandemic, emphasizing the need to develop and adopt multi-pronged strategies to address

the existing psychological challenges among these risk groups: children and adolescents,³⁴⁻³⁷ young people and adults,³⁸⁻⁴⁰ elderly population,⁴¹⁻⁴⁶ healthcare workers, especially those on the frontline,^{39,47-50} students,^{51,52} people with mental disorders,^{50,53} and vulnerable populations including the homeless, migrants, imprisoned populations, and people living with disabilities.⁵⁴ In a review by Hossain et al., several factors associated with mental health problems during the COVID-19 pandemic were found, including age, gender, marital status, educational level, occupational status, income, place of residence, comorbid physical and mental health problems, coping styles, stigma, psychological support, exposure to the COVID-19-related news and social media, etc.³³ As previously stated in the literature, social media was considered as the main source of information during the pandemic.^{24,29} The present study showed the same results, indicating that TV, radio, and personal social networks along with COVID-19 website and scientific papers were students' most preferred choices for COVID-19-related information. On the other hand, media has underlined COVID-19 as rather an exclusive threat; in addition, it was found that frequent exposure to social media was positively associated with high odds of anxiety, depression, distress, and panic.⁵⁵ Therefore, trust in these information sources should be carefully considered if they provide scientific-based information to the general public,^{56,57} and thus, avoiding misinformation and negative consequences of coronavirus "infodemic".⁵⁵

The present study provides an insight on dental students' current knowledge and perceptions on the novel coronavirus precautions and infection control strategies in dental practice. Provided information might be of interest to other healthcare students, educators, administrators, and public health professionals. However, this study had some limitations. One of these limitations is that it provided information from one dental school only. Another limitation is that in this study,

preclinical dental students' opinions were assessed without investigating clinical students' awareness and attitudes, which could provide more objective perspectives. The other limitation is that this paper presents a descriptive cross-sectional study, providing a snapshot of the situation in time as well as reporting the results without statistical tests. Even though it was not the aim of the study, the associations with different variables such as gender, year at university, and country of origin might be explored and discussed in further investigations.

Conclusion

In this study, dental students demonstrated satisfactory level of knowledge regarding basic precautions in the context of the nature of dental work; however, this knowledge should be further improved. In the light of the COVID-19 pandemic, more attention is needed on additional transmission-based

precautions to ensure safety of educational and working environment. In general, dental students showed a predominantly positive attitude towards coronavirus vaccination and lockdown measures which could play an important role in their overall perceptions and handling with the current complicated situation. Proper dental education focused on prevention and infection control practices is needed to ensure adequate knowledge and positive personal perspectives which would contribute to the most developing skills and mastering effective coping strategies as well as the opportunity for their future application and improvement.

Conflict of Interests

Authors have no conflict of interest.

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References

1. Johns Hopkins University and Medicine. COVID-19 Map - Johns Hopkins Coronavirus Resource Center [Online]. [cited 2020]; Available from: URL: <https://coronavirus.jhu.edu/map.html>
2. Chang TY, Hong G, Paganelli C, Phantumvanit P, Chang WJ, Shieh YS, et al. Innovation of dental education during COVID-19 pandemic. *J Dent Sci* 2021; 16(1): 15-20.
3. Haroon Z, Azad AA, Sharif M, Aslam A, Arshad K, Rafiq S. COVID-19 Era: Challenges and Solutions in Dental Education. *J Coll Physicians Surg Pak* 2020; 30(10): 129-31.
4. Wilcha RJ. Effectiveness of virtual medical teaching during the COVID-19 Crisis: Systematic review. *JMIR Med Educ* 2020; 6(2): e20963.
5. Wang K, Zhang L, Ye L. A nationwide survey of online teaching strategies in dental education in China. *J Dent Educ* 2021; 85(2): 128-34.
6. Al-Taweel FB, Abdulkareem AA, Gul SS, Alshami ML. Evaluation of technology-based learning by dental students during the pandemic outbreak of coronavirus disease 2019. *Eur J Dent Educ* 2021; 25(1): 183-90.
7. Machado RA, Bonan PRF, Perez DEDC, Martelli JH. COVID-19 pandemic and the impact on dental education: Discussing current and future perspectives. *Braz Oral Res* 2020; 34: e083.
8. Jum'ah AA, Elsalem L, Loch C, Schwass D, Brunton PA. Perception of health and educational risks amongst dental students and educators in the era of COVID-19. *Eur J Dent Educ* 2021; 25(3): 506-15.
9. Agius AM, Gatt G, Vento ZE, Busuttill A, Gainza-Cirauqui ML, Cortes ARG, et al. Self-reported dental student stressors and experiences during the COVID-19 pandemic. *J Dent Educ* 2021; 85(2): 208-15.
10. Deery C. The COVID-19 pandemic: Implications for dental education. *Evid Based Dent* 2020; 21(2): 46-7.
11. Loch C, Kuan IBJ, Elsalem L, Schwass D, Brunton PA, Jum'ah A. COVID-19 and dental clinical practice: Students and clinical staff perceptions of health risks and educational impact. *J Dent Educ* 2021; 85(1): 44-52.
12. Sukumar S, Dracopoulos SA, Martin FE. Dental education in the time of SARS-CoV-2. *Eur J Dent Educ* 2021; 25(2): 325-31.
13. Majeed MM, Durrani MS, Bashir MB, Ahmed M. COVID-19 and dental education in Pakistan. *J Coll Physicians Surg Pak* 2020; 30(10): 115-7.
14. Al JR, Al SM, Al OD, Al OS. Awareness toward COVID-19 precautions among different levels of dental students in King Saud University, Riyadh, Saudi Arabia. *J Multidiscip Healthc* 2020; 13: 1317-24.

15. Amir LR, Tanti I, Maharani DA, Wimardhani YS, Julia V, Sulijaya B, et al. Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. *BMC Med Educ* 2020; 20(1): 392.
16. Elangovan S, Mahrous A, Marchini L. Disruptions during a pandemic: Gaps identified and lessons learned. *J Dent Educ* 2020; 84(11): 1270-4.
17. Haridy R, Abdalla MA, Kaisarly D, Gezawi ME. A cross-sectional multicenter survey on the future of dental education in the era of COVID-19: Alternatives and implications. *J Dent Educ* 2021; 85(4): 483-93.
18. Ghai S. Are dental schools adequately preparing dental students to face outbreaks of infectious diseases such as COVID-19? *J Dent Educ* 2020; 84(6): 631-3.
19. Esmaeelinejad M, Mirmohammadkhani M, Naghipour A, Hasanian S, Khorasani S. Knowledge and attitudes of Iranian dental students regarding infection control during the COVID-19 pandemic. *Braz Oral Res* 2020; 34: e121.
20. Umeizudike KA, Isiekwe IG, Fadeju AD, Akinboboye BO, Aladenika ET. Nigerian undergraduate dental students' knowledge, perception, and attitude to COVID-19 and infection control practices. *J Dent Educ* 2021; 85(2): 187-96.
21. Kohn WG, Collins AS, Cleveland JL, Harte JA, Eklund KJ, Malvitz DM. Guidelines for infection control in dental health-care settings - 2003. *MMWR* 2003; 52(RR-17): 1-61.
22. Miller CH. *Infection Control and management of hazardous materials for the dental team*. 5th ed. Philadelphia, PA: Elsevier; 2013.
23. Palenik CJ. Dental instrument sterilization: A six-step process. *J Contemp Dent Pract* 2001; 2(1): 84.
24. Ali S, Alam BF, Farooqi F, Almas K, Noreen S. Dental and medical students' knowledge and attitude toward COVID-19: A cross-sectional study from Pakistan. *Eur J Dent* 2020; 14(S 01): S97-S104.
25. Atas O, Talo YT. Evaluation of knowledge, attitudes, and clinical education of dental students about COVID-19 pandemic. *PeerJ* 2020; 8: e9575.
26. Aragao MGB, Gomes FIF, Pinho Maia Paixao-de-Melo, Corona SAM. Brazilian dental students and COVID-19: A survey on knowledge and perceptions. *Eur J Dent Educ* 2021.
27. Sharaf RF, Kabel N. Awareness and knowledge of undergraduate dental students about the signs and symptoms of Corona viral infection (COVID-19), and the required infection control measures to prevent its spread. *Bull Natl Res Cent* 2021; 45(1): 32.
28. Vergara-Buenaventura A, Castro-Ruiz C. Use of mouthwashes against COVID-19 in dentistry. *Br J Oral Maxillofac Surg* 2020; 58(8): 924-7.
29. Mustafa RM, Alrabadi NN, Alshali RZ, Khader YS, Ahmad DM. Knowledge, Attitude, behavior, and stress related to COVID-19 among undergraduate health care students in Jordan. *Eur J Dent* 2020; 14(S 01): S50-S55.
30. Dong L, Bouey J. public mental health crisis during COVID-19 Pandemic, China. *Emerg Infect Dis* 2020; 26(7): 1616-8.
31. Torales J, O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. *Int J Soc Psychiatry* 2020; 66(4): 317-20.
32. Jakovljevic M, Bjedov S, Jaksic N, Jakovljevic I. COVID-19 pandemia and public and global mental health from the perspective of global health securit. *Psychiatr Danub* 2020; 32(1): 6-14.
33. Hossain MM, Tasnim S, Sultana A, Faizah F, Mazumder H, Zou L, et al. Epidemiology of mental health problems in COVID-19: A review. *F1000Res* 2020; 9: 636.
34. Nearchou F, Flinn C, Niland R, Subramaniam SS, Hennessy E. Exploring the impact of COVID-19 on mental health outcomes in children and adolescents: A systematic review. *Int J Environ Res Public Health* 2020; 17(22).
35. Hertz MF, Barrios LC. Adolescent mental health, COVID-19, and the value of school-community partnerships. *Inj Prev* 2021; 27(1): 85-6.
36. Tang S, Xiang M, Cheung T, Xiang YT. Mental health and its correlates among children and adolescents during COVID-19 school closure: The importance of parent-child discussion. *J Affect Disord* 2021; 279: 353-60.
37. Guessoum SB, Lachal J, Radjack R, Carretier E, Minassian S, Benoit L, et al. Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. *Psychiatry Res* 2020; 291: 113264.
38. Silva Junior FJGD, Sales JCES, Monteiro CFS, Costa APC, Campos LRB, Miranda PIG, et al. Impact of COVID-19 pandemic on mental health of young people and adults: a systematic review protocol of observational studies. *BMJ Open* 2020; 10(7): e039426.
39. Huang Y, Zhao N. Retraction notice to "Chinese mental health burden during the COVID-19 pandemic" [*Asian J. Psychiatr.* 51 (2020) 102052]. *Asian J Psychiatr* 2020; 54: 102482.
40. Riedel-Heller S, Richter D. COVID-19 Pandemic and Mental Health of the General Public: Is there a Tsunami of Mental Disorders? *Psychiatr Prax* 2020; 47(8): 452-6. [In German].
41. Wong SYS, Zhang D, Sit RWS, Yip BHK, Chung RY, Wong CKM, et al. Impact of COVID-19 on loneliness, mental health, and health service utilisation: A prospective cohort study of older adults with multimorbidity in primary care. *Br J Gen Pract* 2020; 70(700): e817-e824.

42. Webb L. COVID-19 lockdown: A perfect storm for older people's mental health. *J Psychiatr Ment Health Nurs* 2021; 28(2): 300.
43. El Hayek S, Cheaito MA, Nofal M, Abdelrahman D, Adra A, Al Shamli S, et al. Geriatric mental health and COVID-19: An Eye-Opener to the Situation of the Arab Countries in the Middle East and North Africa Region. *Am J Geriatr Psychiatry* 2020; 28(10): 1058-69.
44. Lee K, Jeong GC, Yim J. Consideration of the psychological and mental health of the elderly during COVID-19: A theoretical review. *Int J Environ Res Public Health* 2020; 17(21).
45. Gustavsson J, Beckman L. Compliance to recommendations and mental health consequences among elderly in Sweden during the Initial Phase of the COVID-19 Pandemic-A Cross Sectional Online Survey. *Int J Environ Res Public Health* 2020; 17(15).
46. Sepulveda-Loyola W, Rodriguez-Sanchez I, Perez-Rodriguez P, Ganz F, Torralba R, Oliveira DV, et al. Impact of social isolation due to COVID-19 on health in older people: Mental and physical effects and recommendations. *J Nutr Health Aging* 2020; 24(9): 938-47.
47. Suryavanshi N, Kadam A, Dhumal G, Nimkar S, Mave V, Gupta A, et al. Mental health and quality of life among healthcare professionals during the COVID-19 pandemic in India. *Brain Behav* 2020; 10(11): e01837.
48. Giorgi G, Lecca LI, Alessio F, Finstad GL, Bondanini G, Lulli LG, et al. COVID-19-related mental health effects in the workplace: A narrative review. *Int J Environ Res Public Health* 2020; 17(21).
49. Muller AE, Hafstad EV, Himmels JPW, Smedslund G, Flottorp S, Stensland SO, et al. The mental health impact of the covid-19 pandemic on healthcare workers, and interventions to help them: A rapid systematic review. *Psychiatry Res* 2020; 293: 113441.
50. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain Behav Immun* 2020; 89: 531-42.
51. Wang X, Hegde S, Son C, Keller B, Smith A, Sasangohar F. Investigating mental health of us college students during the COVID-19 pandemic: Cross-sectional survey study. *J Med Internet Res* 2020; 22(9): e22817.
52. Elmer T, Mepham K, Stadtfeld C. Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *PLoS One* 2020; 15(7): e0236337.
53. Pan KY, Kok AAL, Eikelenboom M, Horsfall M, Jorg F, Luteijn RA, et al. The mental health impact of the COVID-19 pandemic on people with and without depressive, anxiety, or obsessive-compulsive disorders: A longitudinal study of three Dutch case-control cohorts. *Lancet Psychiatry* 2021; 8(2): 121-9.
54. Mesa VC, Franco OH, Gomez RC, Abel T. COVID-19: The forgotten priorities of the pandemic. *Maturitas* 2020; 136: 38-41.
55. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, et al. Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One* 2020; 15(4): e0231924.
56. Qiao S, Friedman DB, Tam CC, Zeng C, Li X. Vaccine acceptance among college students in South Carolina: Do information sources and trust in information make a difference? medRxiv 2020.
57. Rzymiski P, Borkowski L, Drag M, Flisiak R, Jemielity J, Krajewski J, et al. The strategies to support the COVID-19 vaccination with evidence-based communication and tackling misinformation. *Vaccines (Basel)* 2021; 9(2).