

COVID-19 outbreak- Beliefs and practices among dental professionals of Riyadh, Saudi Arabia-A Cross-sectional study

Brote COVID-19 - Creencias y prácticas entre los profesionales de la odontología de Riyadh, Arabia Saudí - Estudio transversal

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Abstract

Background: Covid-19 virus has caused unparalleled hastening of infection transmission to healthcare workers including dental professionals worldwide. This study examined dental professional's knowledge, awareness, and practice during the Covid-19 outbreak in Riyadh.

Materials and methods: A cross-sectional study was conducted among dental professionals of government and private dental hospitals and medical centers in the Riyadh region through an electronic survey. A self-designed questionnaire designed in English and comprised of a series of questions pertaining to socio-demographic characteristics, the awareness of dental professionals towards COVID-19, and infection control in dental clinics. Knowledge, awareness, and practice scores were considered as primary outcome variables. The data were imported into SPSS and the p-value was set at < 0.05 as significant statistically.

Results: Out of 381, 171 (44.88%) were aged >45 years and the respondents were predominantly females 247 (64.83%) compared to males 134 (35.17%). More than half of the respondents were dentists 234 (61.42%) and 258 (67.72%) having experience of >10 years. Most of the respondents 270 (70.90%) were practicing under COVID-19 guidelines. Age >45 years, females, dental profession, years of working experience, and dental professionals working in a military hospital under the government sector were statistically significant ($p < 0.001$) for good knowledge, awareness, and practice scores.

Conclusion: Dental professionals of Riyadh had excellent knowledge, positive awareness, and good practices regarding COVID-19 measures to be taken in dental clinics.

Keywords: Coronavirus, knowledge, practice, dental professionals, infection control, beliefs.

Resumen

Antecedentes: El virus Covid-19 ha causado una aceleración sin precedentes de la transmisión de la infección a los trabajadores sanitarios, incluidos los profesionales dentales, en todo el mundo. Este estudio examinó los conocimientos, la concienciación y la práctica de los profesionales dentales durante el brote de Covid-19 en Riyadh.

Materiales y métodos: Se llevó a cabo un estudio transversal entre los profesionales dentales de hospitales dentales y centros médicos gubernamentales y privados de la región de Riyadh mediante una encuesta electrónica. Se utilizó un cuestionario de diseño propio, redactado en inglés y compuesto por una serie de preguntas relativas a las características sociodemográficas, la concienciación de los profesionales de la odontología respecto al COVID-19 y el control de la infección en las clínicas dentales. Las puntuaciones de conocimiento, concienciación y práctica se consideraron variables de resultado primarias. Los datos se importaron al SPSS y el valor p se fijó en $< 0,05$ como significativo estadísticamente.

Resultados: De un total de 381, 171 (44,88%) tenían más de 45 años y entre los encuestados predominaban las mujeres, 247 (64,83%), frente a los hombres, 134 (35,17%). Más de la mitad de los encuestados eran dentistas 234 (61,42%) y 258 (67,72%) tenían una experiencia de más de 10 años. La mayoría de los encuestados, 270 (70,90%), ejercían según las directrices COVID-19. La edad >45 años, el sexo femenino, la profesión de odontólogo, los años de experiencia laboral y los profesionales de la odontología que trabajaban en un hospital militar del sector gubernamental fueron estadísticamente significativos ($p < 0,001$) para las puntuaciones de buen conocimiento, concienciación y práctica.

Conclusión: Los profesionales de la odontología de Riyadh tenían un conocimiento excelente, una concienciación positiva y buenas prácticas en relación con las medidas de COVID-19 que deben adoptarse en las clínicas dentales.

Palabras clave: Coronavirus, conocimiento, práctica, profesionales dentales, control de la infección, creencias.

Introduction

Severe Acute Respiratory Coronavirus 2 (SARS-CoV-2) causes COVID-19 disease which appeared first among patients visiting the wet market, that contains some wildlife species in Wuhan City, Hubei Province of China, in December 2019. Since then, large outbreaks are being reported in other Chinese Provinces and many nearby countries eventually spreading across the globe¹. On 30 Jan 2020, the World Health Organization (WHO) International Health Regulation (IHR) emergency committee declared the disease a Public Health Emergency of International Concern (PHEIC) due to its novel nature and spreading rapidly nationally and internationally. On 11 March 2020, WHO declared it as a worldwide Pandemic. A citizen of Saudi returning from Iran through Bahrain was tested positive for Covid-19 and on the 2nd of March 2020, the Ministry of Health reported it as the first case in Saudi Arabia².

Saudi Ministry of Health has recommended following social distancing and adopting sanitary habits and also to self-quarantine for 14 days if an individual has arrived from outside the kingdom. The classical routes of transmitting coronavirus include direct droplets while coughing, sneezing, and contact with oral, nasal, and eye mucous membranes³. General population can get anxious and create ruckus during epidemics and pandemics due to less knowledge about the emerging disease. Awareness, Attitude, and practice have been studied in many previous epidemics such as swine influenza, Middle East Respiratory Syndrome (MERS), and Dengue fever. The spread and transmission of viruses can be reduced by being aware of the disease and having positive attitudes and practices to stop the progression of the virus further⁴.

Among the infected individuals with covid-19, healthcare professionals represent 9% due to close interaction with patients with covid-19. Due to the direct exposure to saliva and blood, dental practitioners are also at high risks of contracting COVID-19. To “flatten the curve” during this first outbreak, many countries have issued quarantine measures, and for time being dentists have been instructed to provide emergency treatments only⁵.

Occupational Safety and Health Administration (OSHA), specified dental professionals at high-risk exposure category for nosocomial infection, due to droplets/aerosols generated during dental procedures⁶. Likewise, the New York Times in March 2020 in their work entitled “The worker who faces the greatest coronavirus risk”, mentioned dental professionals as utmost exposed workers, compared to nurses and general physicians⁷. To decrease the risk of contamination and spread from COVID-19, dental health care workers should take appropriate measures for preventing and entertain a high level of awareness regarding COVID-19⁸. In countries/regions affected by COVID-19, infection control protocols for dental practices should be implemented on

an urgent basis by following guidelines recommended by the Centers for Disease Control and Prevention (CDC), the American Dental Association (ADA), and WHO for dentists and dental staff to control the spread of COVID-19^{9,10}. Infection and transmission from droplets/aerosols generated during dental procedures in dental clinics and hospitals can be prevented by taking personal precautions (mask, goggles, face shields, and protective outerwear, etc.) by the dental professionals¹¹.

In a Cross-sectional study conducted by Kamran et al.¹² in Pakistan, most of the dentists were aware of the CDC guidelines and designation of dentist and level of awareness had a potential correlation ($p = 0.01$). Further study by Nasser et al.¹³ among Lebanese dentists who had good knowledge (91.3%), and good practice (58.7%) regarding COVID-19. Another cross-sectional study by Ruba et al.¹⁴ among Dentists reported having satisfactory knowledge and a positive attitude towards COVID-19.

Though cases of coronavirus transmission in a dental setting were not reported in Saudi Arabia, dental professionals should always upgrade themselves regarding hazards challenging their current practice. In Riyadh, there is no empirical data regarding dental professional's knowledge, awareness, and practice during COVID-19. Therefore, evaluating their knowledge is crucial in identifying the existing gaps. With this background, the present study aimed to assess dental professionals' knowledge, awareness, and practice during the Covid-19 outbreak in Riyadh, Saudi Arabia.

The aim of the study was to assess the knowledge, awareness, and practice of dentists toward Covid-19 in Riyadh, Saudi Arabia,

Materials and methods

Study design: A Cross-sectional study employed using a self-reported questionnaire.

Source population: The source population comprised dental health care professionals in the Riyadh region of Saudi Arabia.

Study population: The study population comprised registered dental professionals which include dentists, dental hygienists, and assistants who are registered under the Saudi council of health specialists.

Study setting: The present study was an electronic survey conducted among dental professionals via a link attached to a mass e-mail distribution.

Study period: 4 months from 20 December 2020 to March 20, 2020

Sample size: The sample size was 387

Sampling technique: Non-probability convenience sampling

Sample size calculation:

The sample size is calculated based on the proportion of

awareness of COVID_19 from a study by Yousuf et al.¹⁵ and using the formula of

$$\frac{z^2 p(1-p)}{d}$$

Z = Standard normal variate at 5% type 1 error = 1.96

P = 0.70

D = maximum acceptable error=0.05

$$\frac{(1.96)^2 \times 0.70(1-0.70)}{0.05 \times 0.05} = 323$$

Non response rate = 20%

Estimated sample size = 323+64 = 387

Ethical and informed consent: Ethical permission was obtained from Institutional Review Board (IRB) in the Riyadh region. Electronic informed consent was obtained from all the participants to avoid anonymity and voluntary participation. They were explained in detail the information present in the questionnaire.

Inclusion criteria:

- Registered dentists, dental assistants, hygienists working at government and private hospitals, clinics and, medical centers,

Exclusion criteria:

- Not completed the questionnaire in the given period.
- Whose contact information was missing.

Data collection: The questions on the survey were developed after reviewing pertinent literature and the international guidelines. A self-designed questionnaire was designed in English and comprised of a series of questions pertaining to socio-demographic characteristics, the awareness of dental professionals towards COVID-19, and infection control in dental clinics. The questionnaire was delivered to the study subject via email and What's App (social media application through Google forms link.

Components of the questionnaire:

-The survey was structured multiple-choice questionnaire divided into sections:
- Section 1: Dental professionals demographic and profession-related characteristics (gender, age, type of dental professionals, years of practice, workplace.)
- Section 2: questions related to dental professionals knowledge and awareness COVID-19 (incubation period, the symptoms of the disease, the mode of transmission of COVID-19, and infection control measures for preventing COVID-19 e.g hygiene practices, etc

Validity and reliability of questionnaire:

- A specialist in infectious and communicable diseases was consulted to verify the content of the questionnaire.
- The questionnaire was pre-tested for validity and reliability.

Study variables: Knowledge, awareness, and practice scores were considered as primary outcome variables. Age, gender, dental profession, years of working and working sector were considered as explanatory variables.

Statistical analysis: Data collection and entry were done in Microsoft excel and was analyzed using SPSS¹⁶ package version 25. Descriptive statistics were presented as means and standard deviations (SD) for continuous variables and frequency and percentages for categorical variables. A Chi-square test was used to check the association between KAP scores and socio-demographic factors. A P-value of less than 0.05 was considered significant.

Results

The final analysis included 381 respondents.

Respondents characteristics

Table I shows respondents' socio-demographic data of which the majority of 171 (44.88%) participants were aged >45 years, and were predominantly females 247 (64.83%) compared to males 134 (35.17%). More than half of the respondents were dentists 234 (61.42%). The study consisted of a majority of 361 (94.75%) working in the government sector (military hospital, Universities clinics, or ministry health center) and 258 (67.72%) having experience of >10 years.

Knowledge about the COVID-19 Infection

Table II represents the dental professional knowledge regarding COVID-19 and almost 268 (70.3%) had good knowledge about the Incubation Period, Symptoms, and Mode of Transmission of the COVID-19 Infection. The mean total knowledge score was 10.84. When asked about the incubation period, 122 (32.0%) participants have reported the correct answer. The majority 377 (99.0%) responded to fever and cough as prodromal symptoms of Covid-19. In addition, the majority 373 (97.9%) were known modes of transmission.

Awareness for Preventing COVID-19 Transmission

Table III shows the dental professional awareness regarding COVID-19. Out of the 381 dental professionals, the majority 215 (56.40%) dental professionals were aware of preventing COVID-19 Transmission in Dental Clinics. The mean total awareness score was 6.62. When they were asked about, Personal Protective Equipment's (PPE) worn during Aerosol generating procedures GP, 243 (63.78%) respondents were aware of PPE importance. Almost all dentists 366 (96.1%) reported that importance of physical distancing, hand hygiene, universal masking, and respiratory etiquette to decrease the possibility of transmitting infections to patients and themselves.

The practice of COVID-19 guidelines.

Table IV reports the dental professional practice during COVID-19. Out of the 381 dental professionals, the majority 270 (70.90%) we're practicing under COVID-19 guidelines. The mean total practice score was 14.90. The majority of the dental professional reported that cleaning hands frequently, cleaning and disinfecting surfaces in contact with suspected patients, and wearing personal protective equipment can help in preventing transmission of COVID-19 (**Table IV**).

Association of knowledge, awareness, and practice scores with demographic data

Table V shows the level of knowledge, awareness, and practice as per socio-demographic factors. The levels of knowledge, awareness, and practice scores were significantly associated ($p < 0.001$) for >45 years age, females, dental profession, years of working experience, dental professionals working in a military hospital under government sector.

Table I: Summary of demographic parameter.

Demographic parameter	Summary
Age	
25-35	79 (20.73%)
> 35-45	131 (34.38%)
> 45	171 (44.88%)
Gender	
Female	247 (64.83%)
Male	134 (35.17%)
Type of dental professional	
Dentist	234 (61.42%)
Dental assistant	100 (26.25%)
Dental hygienist	36 (9.45%)
Others	11 (2.89%)
Years of experience	
> 10 years	258 (67.72%)
> 5 years-10	73 (19.16%)
up to 5 years	50 (13.12%)
Which sector do you work	
Private	20 (5.25%)
Governmental	361 (94.75%)
Which government facility	
Military hospital	187 (49.08%)
Ministry of health	97 (25.46%)
Universities clinics	77 (20.21%)
Others	20 (5.25%)

Table II: Summary of knowledge regarding COVID 19.

Knowledge parameters	Correct answer
What is the incubation period days of Covid 19 Infection	122 (32.0%)
Symptoms of Covid 19 infection include	
Fever	377 (99.0%)
Cough	374 (98.2%)
Short of breath	371 (97.4%)
May present without symptoms	345 (90.6%)
Diarrhea	320 (84.0%)
Running nose	298 (78.2%)
Skin rash	174 (45.7%)
What is the mode of transmission of Covid 19 infection?	
Droplet (Coughing and Sneezing)	373 (97.9%)
Close contact with others(handshaking, hugging)	364 (95.5%)
Contact with surfaces (doorknobs and tables)	354 (92.9%)
Airborne (airplane travel)	294 (77.2%)
Can dental health professional get infected by an asymptomatic patient	363 (95.28%)
Mean total Knowledge Score	10.84 ± 1.56
Poor knowledge (<11)	113 (29.7%)
Good knowledge (>=11)	268 (70.3%)

Table III: Summary of Awareness of COVID 19.

Awareness	Correct answer
Personal Protective Equipment's (PPE) that should be worn by a dental health professional during AGP	243 (63.78%)
Since the dentist is always physically close to the patient, he needs to wear a high efficient respirator (e.g N 95) all the time during his work in the dental clinic	61 (16.01%)
What are the points that we should follow to decrease the chance of transmission of Covid-19 between HCWs?	
• Physical distancing	366 (96.1%)
• Hand hygiene	366 (96.1%)
• Universal masking	344 (90.3%)
• Respiratory etiquette	294 (77.2%)
It is acceptable to clean and disinfect the face shield or protective goggles during extended use and reuse and dispose of only when it is damaged or difficult to see through	141 (37.01%)
It is possible to use the same high-efficiency respirator (N95) or other personal protective equipment PPE by more than one health worker	356 (93.44%)
According to your opinion, Covid-19 is	
Serious respiratory infection.	352 (92.39%)
Routinely mild respiratory infection	
Mean total awareness score	6.62 ± 1.07
Poor awareness (<7)	166 (43.60%)
Good awareness (>=7)	215 (56.40%)

Table IV: Summary of practice related questions.

Practice related questions	Correct answer
Can the female dental professional wear (niqab) instead of the surgical mask as preventive measures for COVID 19	346 (90.8%)
Are medical glasses considered as a substitute for face shield or goggles	188 (49.3%)
The correct sequence of donning wearing of PPE	287 (75.33%)
The correct sequence of doffing take off the PPE	77 (20.21%)
To save resources, we can use the surgical gloves for more than one patient or wash and disinfect them to be reused	357 (93.70%)
Measures for prevention of COVID 19 transmission in dental clinics include	
Frequently clean hands by using soap and water or alcohol-based hand rub	371 (97.4%)
Personal protective equipment such as dental goggles, masks, and gloves.	361 (94.8%)
Routinely clean and disinfect surfaces in contact with known or suspected patients	354 (92.9%)
Wearing a surgical mask directly on the face then high-efficiency respirators like N95 over it.	265 (69.55%)
How can we reduce the exposure to patients' fluids or secretions while providing dental care in dental clinics?	
Use of high-speed suction devices	348 (91.3%)
Use of rubber dam inside the patient's mouth	347 (91.1%)
Reducing the follow-up visits for the patient unless necessary	343 (90.0%)
Arranging seating in the waiting area to a safe distance of at least one meter	331 (86.9%)
Use of absorbent materials such as sterile cotton or gauze	305 (80.1%)
Use of manual filling or scaling tools instead of the high-speed handpiece or ultrasonic	303 (79.5%)
Personal and clinic hygiene practices include	
Clean hand with an alcohol-based rub or soap and water	377 (99%)
Disinfecting the lab work area every day	353 (92.7%)
Thoroughly cleaning the chairs saliva ejector with disinfectant	347 (91.1%)
Routinely clean and disinfect clinic surfaces every three days	298 (78.2%)
Fumigation of dental operatory once a week	297 (78.0%)
Total Practice Score	14.90 ± 1.90
Poor practice (<15)	111 (29.10%)
Good practice (>=15)	270 (70.90%)

Table V: Comparison of demographic parameters between Total knowledge score, awareness score, and practice score (N=381).

		Total knowledge score		Total awareness score		Total practice score	
		Poor (<11)	Good (>=11)	Poor (<7)	Good (>=7)	Poor (<15)	Good (>=15)
Age	25-35 (N=79)	39 (49.37%)	40 (50.63%)	39 (49.37%)	40 (50.63%)	36 (45.57%)	43 (54.43%)
	>35 -45 (N=131)	43 (32.82%)	88 (67.18%)	51 (38.93%)	80 (61.07%)	36 (27.48%)	95 (72.52%)
	>45 (N=171)	31 (18.13%)	140 (81.87%)	76 (44.44%)	95 (55.56%)	39 (22.81%)	132 (77.19%)
	p value	<0.001		0.320		<0.001	
Gender	Female (N=247)	57 (23.08%)	190 (76.92%)	110 (44.53%)	137 (55.47%)	70 (28.34%)	177 (71.66%)
	Male (N=134)	56 (41.79%)	78 (58.21%)	56 (41.79%)	78 (58.21%)	41 (30.6%)	93 (69.4%)
	p value	<0.001		0.606		0.643	
Type of dental professional	Dental assistant (N=100)	22 (22%)	78 (78%)	37 (37%)	63 (63%)	35 (35%)	65 (65%)
	Dental hygienist (N=36)	4 (11.11%)	32 (88.89%)	26 (72.22%)	10 (27.78%)	5 (13.89%)	31 (86.11%)
	Dentist (N=234)	82 (35.04%)	152 (64.96%)	97 (41.45%)	137 (58.55%)	65 (27.78%)	169 (72.22%)
	Others (N=11)	5 (45.45%)	6 (54.55%)	6 (54.55%)	5 (45.45%)	6 (54.55%)	5 (45.45%)
	p value	0.004		0.002		0.025	
Years of experience	Up to 5 years (N=50)	25 (50%)	25 (50%)	24 (48%)	26 (52%)	25 (50%)	25 (50%)
	> 5 Years-10 (N=73)	19 (26.03%)	54 (73.97%)	33 (45.21%)	40 (54.79%)	18 (24.66%)	55 (75.34%)
	>10 years (N=258)	69 (26.74%)	189 (73.26%)	109 (42.25%)	149 (57.75%)	68 (26.36%)	190 (73.64%)
	p value	0.003		0.718		0.002	
Which sector do you work	Governmental (N=361)	108 (29.92%)	253 (70.08%)	158 (43.77%)	203 (56.23%)	104 (28.81%)	257 (71.19%)
	Private (N=20)	5 (25%)	15 (75%)	8 (40%)	12 (60%)	7 (35%)	13 (65%)
	p value	0.639	0.741	0.553			
Which Government Facility	Military hospital (N=187)	50 (26.74%)	137 (73.26%)	83 (44.39%)	104 (55.61%)	56 (29.95%)	131 (70.05%)
	Ministry of health (N=97)	25 (25.77%)	72 (74.23%)	46 (47.42%)	51 (52.58%)	27 (27.84%)	70 (72.16%)
	Universities Clinics (N=77)	33 (42.86%)	44 (57.14%)	29 (37.66%)	48 (62.34%)	21 (27.27%)	56 (72.73%)
	Others (N=20)	5 (25%)	15 (75%)	8 (40%)	12 (60%)	7 (35%)	13 (65%)
	p value	0.044		0.608		0.896	

Discussion

Several infectious diseases have been treated the human health¹⁷⁻²². SARS-COVID disease caused higher morbidity and mortality in the last century²³⁻²⁶. The present study examined dental professional's knowledge, awareness, and practice during the COVID-19 outbreak in Riyadh, Saudi Arabia. Out of 381, 171 (44.88%) were aged >45 years and the respondents were predominantly females 247 (64.83%) compared to males 134 (35.17%). More than half of the respondents were dentists 234 (61.42%) and 258 (67.72%) having experience of >10 years. Most of the respondents 270 (70.90%) were practicing under COVID-19 guidelines. Age >45 years, females, dental profession, years of working experience, and dental professionals working in a military hospital under the government sector were statistically significant ($p < 0.001$) for good knowledge, awareness, and practice scores.

The current study revealed that 381 dentists participated and submitted the form. This optimum number was filled by working and non-working dental professionals since it was distributed electronically. This finding can be compared to a similar KAP study by Duruk et al.¹¹ where 1,454 participants out of (n=1,958) responded to the survey considering the COVID-19 outbreak as a worrisome issue to be looked into.

Increasing age has a potential impact on the knowledge of dental health professionals about COVID-19. This can be compared to a countrywide survey in Saudi Arabia by Abdurrahman et al. 27 regarding knowledge, attitude, and practice of health care professionals, where the middle and elderly age group were more knowledgeable when compared to a younger age. Most of the respondents 247 (64.83%) were females compared to males 134 (35.17%). This finding can be compared to a pilot study by Cintia et al.²⁸ where out of 400 dentists, (64.5%) were women and 27% were in the age group of 36-45 years.

In the present study majority of dental health professionals, 361 (94.75%) were working in the government (public) sector (military hospital, or ministry health center) and 258 (67.72%) having experience of >10 years. This finding is contrary to De Stefani et al. 29 where more than 90% of the respondents were working as private practitioners, confirming that the National Healthcare System and University Departments of Italy offered a lesser part of dental treatments. (6.10%).

Important in this study is that dental professionals had excellent knowledge about the Incubation Period, Symptoms, and Mode of Transmission of the COVID-19

Infection which was significant statistically ($p < 0.001$). This finding was very much similar to a study in Turkey by Fatih et al.³⁰ where the results showed satisfactory knowledge regarding COVID-19 etiology and symptoms. In the present study, the majority 377 (99.0%) reported fever and cough as prodromal symptoms of COVID-19 and were aware of modes of transmission. This finding is in contrast to Quadri et al.³¹ where dental health care workers in Saudi Arabia had adequate knowledge regarding COVID-19 symptoms of common cold/flu.

Dental professionals are first-line providers of dental emergency care and should be well prepared to tackle any emergency related to oral and maxillofacial infections from localized dentoalveolar abscesses to deep-neck space infections or more severe cases of necrotizing fasciitis³². Considering the present situation, WHO labeled emergency dental procedures must be given priority until the COVID-19 outbreak subsides. Guidelines released by the Ministry of health and infection prevention and control department of Saudi Arabia should be circulated among all registered dental professionals during COVID-19 pandemic so that the dental professionals have information and awareness regarding disease management approaches. In response to an epidemic or pandemic, these guidelines should be implemented and practiced by covering a wider range of programs that focus on education and personal counseling of health care professionals.

The major strength of this study is that it addressed a very crucial problem faced by all dental health care professionals in many countries across the globe during this pandemic.

The main limitation of the study is its design which is Cross-sectional in nature and hence a temporal relationship

cannot be established. The data was collected briefly in less time, due to the advancing pandemic. There might be recall bias in the study as it was based on self-reported information. The answers given by the respondents may differ evolving research and potential therapy of COVID-19. The guidelines provided by each country are different and so are the precautions taken by a specific country that might affect the survey outcome. Hence, the findings should be generalized cautiously. Further, longitudinal studies are recommended that provide cause and effect relationships between demographic factors of dental professionals and their level of knowledge, awareness, and practice during the Covid-19 outbreak.

Conclusion

In conclusion, it can be said that dental professionals, had ample knowledge about COVID-19 in terms of the incubation period, symptoms, mode of transmission, and prevention of disease. Awareness on using PPE (personal protective equipment) handwashing, making, and hygiene protocols were specific and clear. Guidelines released by the Ministry of health and infection prevention and control department of Saudi Arabia had an essential part in spreading information about COVID-19 to health care and dental health care professionals which they practice on day to day basis since the pandemic. The study recommends comprehensive training programs by the infection prevention and control department during and even after the outbreak to provide scientifically proven clinical awareness among all health care professionals and other associated clinical and non-clinical staff.

Conflict of interests

The authors have no conflict of interest.

References

1. Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, Xing F, Liu J, Yip CC, Poon RW, Tsoi HW. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *The Lancet*. 2020 Feb 15;395(10223):514-23.
2. Ahmed MA, Jouhar R, Ahmed N, Adnan S, Aftab M, Zafar MS, et al. Fear and practice modifications among dentists to combat novel coronavirus disease (COVID-19) outbreak. *Int J Environ Res Public Health*. 2020;17(8).
3. Shahin SY, Bugshan AS, Almulhim KS, AlSharief MS, Al-Dulajjan YA, Siddiqui I, et al. Knowledge of dentists, dental auxiliaries, and students regarding the COVID-19 pandemic in Saudi Arabia: a cross-sectional survey. *BMC Oral Health*. 2020;20(1):1-8.
4. Alahdal H, Basingab F, Alotaibi R. An analytical study on the awareness, attitude and practice during the COVID-19 pandemic in Riyadh, Saudi Arabia. *J Infect Public Health*. 2020;13(10):1446-52.
5. Passarelli PC, Rella E, Manicone PF, Garcia-Godoy F, D'Addona A. The impact of the COVID-19 infection in dentistry. *Exp Biol Med*. 2020;245(11):940-4.
6. Occupational Safety and Health Administration Official Website. Occupational Safety and Health Administration Official Website. Worker exposure risk to COVID-19. Published 2020. <https://www.osha.gov/Publications/OSHA3993.pdf>. Accessed 4 April 2021 2020;
7. L. G. The workers who face the greatest coronavirus risk. *The New York Times*. Published 2020. <https://www.nytimes.com/interactive/2020/03/15/business/economy/coronavirus-worker-risk.html>. Accessed 4 April 2021. *New York Times*. 2020;
8. Sabino-Silva R, Jardim ACG SW. Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. *Clin Oral Investig*. 2020;24(4):1619-21. *Clin Oral Investig*. 2020;24(4):1619-21.
9. Organization WH. WHO Clinical management of severe acute respiratory infection when novel coronavirus (nCoV) infection is suspected. 2020 2020;
10. Kohn WG, Harte JA, Malvitz DM, Collins AS, Cleveland JL EK. Guidelines for infection control in dental health care settings—2003. *J Am Dent Assoc*. 2004 Jan;135(1):33-47. <https://doi.org/10.14219/jada.archive.2004.0019>. *J Am Dent Assoc*. 2004;135(1):33-47.

11. Duruk G, Gümüşboğa ZŞ, Çolak C. Investigation of Turkish dentists' clinical attitudes and behaviors towards the COVID-19 pandemic: A survey study. *Braz Oral Res.* 2020;34.
12. Kamran R, Saba K, Azam S. Impact of COVID-19 on Pakistani dentists: a nationwide cross-sectional study. *BMC Oral Health.* 2021;21(1):59.
13. Nasser Z, Fares Y, Daoud R, Abou-Abbas L. Assessment of knowledge and practice of dentists towards Coronavirus Disease (COVID-19): a cross-sectional survey from Lebanon. *BMC Oral Health.* 2020;20(1):1-9.
14. Mustafa RM, Alshali RZ, Bukhary DM. Dentists' knowledge, attitudes, and awareness of infection control measures during COVID-19 outbreak: A cross-sectional study in Saudi Arabia. *Int J Environ Res Public Health.* 2020;17(23):1-14.
15. Khader Y, Al Nsour M, Al-Batayneh OB, Saadeh R, Bashier H, Alfaqih M, et al. Dentists' awareness, perception, and attitude regarding COVID-19 and infection control: Cross-sectional study among Jordanian dentists. *JMIR Public Heal Surveill.* 2020;6(2).
16. Armonk NIC. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. 2017;
17. Ranjbar R, Farsani FY, Dehkordi FS. Phenotypic analysis of antibiotic resistance and genotypic study of the *vacA*, *cagA*, *iceA*, *oipA* and *babA* genotypes of the *Helicobacter pylori* strains isolated from raw milk. *Antimicrobial Resistance & Infection Control.* 2018 Dec;7(1):1-4.
18. Dehkordi FS. Prevalence study of Bovine viral diarrhea virus by evaluation of antigen capture ELISA and RT-PCR assay in Bovine, Ovine, Caprine, Buffalo and Camel aborted fetuses in Iran. *AMB express.* 2011 Dec;1(1):1-6.
19. Nejat S, Momtaz H, Yadegari M, Nejat S, Safarpour Dehkordi F, Khamesipour F. Seasonal, geographical, age and breed distributions of equine viral arteritis in Iran. *Kafkas Univ Vet Fak Derg.* 2015 January 1;21(1):111-6.
20. Dehkordi FS, Saberian S, Momtaz H. Detection and segregation of *Brucella abortus* and *Brucella melitensis* in Aborted Bovine, Ovine, Caprine, Buffaloes and Camelid Fetuses by application of conventional and real-time polymerase chain reaction. *The Thai Journal of Veterinary Medicine.* 2012 March 1;42(1):13.
21. Ranjbar R, Seif A, Dehkordi FS. Prevalence of antibiotic resistance and distribution of virulence factors in the shiga toxigenic *Escherichia coli* recovered from hospital food. *Jundishapur Journal of Microbiology.* 2019;12(5):8.
22. Rahi A, Kazemeini H, Jafariaskari S, Seif A, Hosseini S, Dehkordi FS. Genotypic and phenotypic-based assessment of antibiotic resistance and profile of staphylococcal cassette chromosome *mec* in the methicillin-resistant *Staphylococcus aureus* recovered from raw milk. *Infection and drug resistance.* 2020;13:273.
23. Mirzaie A, Halaji M, Dehkordi FS, Ranjbar R, Noorbazargan H. A narrative literature review on traditional medicine options for treatment of corona virus disease 2019 (COVID-19). *Complementary therapies in clinical practice.* 2020 August 1;40:101214.
24. Halaji M, Farahani A, Ranjbar R, Heiat M, Dehkordi FS. Emerging coronaviruses: first SARS, second MERS and third SARS-CoV-2: epidemiological updates of COVID-19. *Infez Med.* 2020;28(suppl):6-17.
25. Sheikhshahrokh A, Ranjbar R, Saeidi E, Dehkordi FS, Heiat M, Ghasemi-Dehkordi P, Goodarzi H. Frontier therapeutics and vaccine strategies for sars-cov-2 (COVID-19): A review. *Iranian Journal of Public Health.* 2020 July 11.
26. Ranjbar R, Mahmoodzadeh Hosseini H, Safarpour Dehkordi F. A review on biochemical and immunological biomarkers used for laboratory diagnosis of SARS-CoV-2 (COVID-19). *The Open Microbiology Journal.* 2020 December 15;14(1).
27. Alduraywish AA, Srivastava KC, Shrivastava D, Sghaireen MG, Alsharari AF, Al-Johani K, et al. A countrywide survey in Saudi Arabia regarding the knowledge and attitude of health care professionals about coronavirus disease (COVID-19). *Int J Environ Res Public Health.* 2020;17(20):1-15.
28. Chamorro-Petronacci C, Carreras-Presas CM, Sanz-Marchena A, Rodríguez-Fernández MA, Suárez-Quintanilla JM, Rivas-Mundiña B, et al. Assessment of the economic and health-care impact of covid-19 (Sars-cov-2) on public and private dental surgeries in Spain: A pilot study. *Int J Environ Res Public Health.* 2020;17(14):1-9.
29. De Stefani A, Bruno G, Mutinelli S, Gracco A. COVID-19 outbreak perception in Italian dentists. *Int J Environ Res Public Health.* 2020;17(11):3-9.
30. Karayürek F, Çirakoğlu NY, Gülses A, Ayna M. Awareness and knowledge of sars-cov-2 infection among dental professionals according to the Turkish national dental guidelines. *Int J Environ Res Public Health.* 2021;18(2):1-13.
31. Quadri MFA, Jafer MA, Shafer A. Since January 2020 Elsevier has created a COVID-19 resource center with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource center is hosted on Elsevier Connect, the company's public news and information 2020;(January).
32. Dave, M.; Seoudi, N.; Coulthard P. Urgent dental care for patients during the COVID-19 pandemic. *Lancet* 2020, 395, 1257. *Lancet* (London, England). 2020;395:1257.