

Original Research Article

Oral and dental health comorbidity in COVID-19 era: social aspects and impacts on community dentistry in Saudi Arabia

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ABSTRACT

Background: The World Health Organization (WHO) announced COVID-19 a public health emergency of global concern. The most vulnerable populations are elderly and/or medically compromised people. It is recommended that non-emergency and elective procedures be postponed while dental clinics remain open to patients with urgent needs. Providing oral-health instruction is important to limit the needs of patients to leave their homes for treatment. The aim of this study is to evaluate the knowledge and behaviour of residents in Saudi Arabia towards their oral health during the COVID-19 outbreak.

Methods: This study was a cross-sectional descriptive survey. Data was collected through online self-administration of the questionnaire on the Google forms platform. Any relationships between the variables were analysed using Pearson's chi-squared test. A p value less than 0.05 was considered statistically significant.

Results: This study included 1000 participants. 70.7% reported that their oral-health care practices became worse during the COVID-19 pandemic. Participants' medical histories revealed that 17.8% had multiple chronic illnesses. Of all respondents, 48.2% believed that COVID-19 is a serious health problem and only 33.4% of respondents were aware that only emergency treatment is being offered at dental clinics during the COVID-19 pandemic.

Conclusions: An alarming percentage of participants do not see COVID-19 as threatening to their health. A number of people needed urgent treatment but preferred to stay home because of fear and anxiety connected to the pandemic. The lack of information can lead to the exacerbation of such fear, which in turn causes individuals to neglect their oral health.

Keywords: Outbreak, Pandemic, Knowledge, Attitude, Behaviour, KSA, Systemic diseases, Medically compromised patient

INTRODUCTION

Coronavirus infectious disease 2019 (COVID-19) is a viral pneumonia first recognized in Wuhan city, China on 17 November 2019.¹ The causative agent of COVID-19 is

severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), one of several coronaviruses discovered.²

The World Health Organization (WHO), on 30 January 2020, pronounced COVID-19 a public health emergency

of global concern, and the disease soon and became a challenging problem for all countries worldwide.³ According to the WHO and centres for disease control and prevention (CDC), the virus is thought to spread primarily through person-to-person transmission between individuals in direct contact and through respiratory droplets (within about 6 feet); some recent studies have also suggested that COVID-19 may be spread by asymptomatic carriers.⁴ The most common signs and symptoms that appear in infected individuals are fever, sore throat and dry cough. The disease may either resolve spontaneously or progress to a fatal condition.³

The Kingdom of Saudi Arabia, initiating an early response, applied immediate protective measures to prevent COVID-19 transmission amongst its population even before the first case in the Kingdom, which was reported on 2 March 2020, occurred. The Saudi government suspended all air flights and personal events, closed workplaces (excluding police forces and hospitals) and encouraged residents to stay safely at home.⁵

The most vulnerable populations, as announced by the Saudi ministry of health, are the elderly, diabetics, and patients afflicted with obesity, hypertension, cardiac disease, chest and respiratory diseases, immunodeficiency, human immunodeficiency virus (HIV), cancer and kidney disease.⁶

Older adults and those who are medically compromised, in other words, are at greater risk than other persons of severe illness and mortality associated with SARS-CoV-2.⁷ Initial symptoms of immunodeficiency may be observed in the oral cavity, as it is a common site of bacterial infections.⁸ Numerous studies demonstrate the links between oral health and quality of life.^{9,10} Oral diseases can affect dental functions and social interactions; for example, dental decay may cause impaired chewing, decreased appetite, sleep problems and poor performance at school or work.⁹

Gingivitis and periodontitis are the most common inflammatory diseases amongst adults and individuals with impaired immunity.¹⁰ Periodontal (gum) disease is also the most common cause of tooth loss among adults in the United States. According to the CDC, nearly half (46%) of adults aged 30 years and older have some form of periodontal disease.¹¹

Additionally, there has been a dramatic increase in the number of patients seeking treatment for dental pain in emergency rooms throughout the United States. According to the American dental association, there were more than two million visits to emergency rooms for dental problems in 2010.¹² This number will grow even larger if emergency rooms remain the only option for treatment or if patients' levels of pain or infection are aggravated to the point of necessitating hospital admission.

Emergency room physicians treat pain and infection, but they do not perform restorative procedures or tooth

extractions. As a result, the causes of patients' visits are not treated, but another problem may arise, which is exposure to SARS-CoV-2.

Opening dental clinics to all patients is not a solution. Dental procedures involve the use of instruments that create droplets, which are the primary means through which SARS-CoV-2 is transmitted. Such droplets can land on nearby operatory surfaces or be ingested by dental-care team members, creating a high risk of cross-contamination. Accordingly, the deep concern of the American dental hygienists' association for the health and well-being of the public, dental hygienists and the entire dental team has led it to strongly recommend that non-emergency and elective procedures be postponed while dental clinics remain open to patients with urgent needs.¹³ As has been noted, oral diseases are mostly preventable conditions.¹⁴

Providing oral-health instruction and promoting dental hygiene via different media channels is crucial because such instruction and promotion can be important contributors to limiting the needs of patients to leave their homes in order to seek treatment.¹⁵ Global healthcare accreditation (GHA) patients who remain at home instead of visiting dental clinics or emergency rooms will be less likely to contract COVID-19 or to transmit the virus to others. Moreover, pharmacies should provide home-prevention and interim-treatment solutions, such as dental mirrors, scalers and temporary fillings, that can be easily utilised by individuals in the convenience of their homes. In this study, we will discuss the knowledge of residents of Saudi Arabia -both healthy individuals and patients with systemic illnesses -concerning the availability of emergency dental procedures. We will also focus on residents' behaviour towards their oral health during the COVID-19 outbreak in the Kingdom of Saudi Arabia.

METHODS

This study was a cross-sectional descriptive survey of 1,000 residents of the kingdom of Saudi Arabia. The study was conducted during the first two weeks of July, from 2 July 2020 to 14 July 2020. To be part of the sample, respondents were required to fulfil each of the following inclusion criteria: Anyone unwilling to participate, younger than 15 years old or not living in Saudi Arabia was excluded. A questionnaire was designed to assess the behaviour, attitude and knowledge of both healthy individuals and patients with systemic illness towards dental and oral health during the COVID-19 pandemic. The questionnaire was piloted with 50 patients to determine its validity. The study was approved by the ethics committee of the University of Hail. Informed consent was given by each eligible participant before the questionnaire was administered. The investigators informed willing participants in detail about the research project and its consequences. The data was collected through online self-administration of the questionnaire on the Google forms platform, by snowball sampling

technique. The questionnaire was given in both Arabic and English and consisted of multiple-choice questions.

The questionnaire contained twenty-one questions, divided into three sections. The first section collected participants' demographic information, such as gender, age, nationality, level of education, monthly income and region of residence. The second section assessed past and present medical history, including questions about the COVID-19 pandemic and respondents' eating habits during that time. The final section asked questions to measure participants' knowledge and behaviour of their own oral and dental health care before and during the COVID-19 pandemic. This section also asked participants about the availability of emergency dental management.

The obtained data was recorded and cleaned in Microsoft excel and was then transferred to IBM statistical package for the social sciences (SPSS) statistics 23 for statistical analysis. Continuous variables were tested for normality; a Shapiro-Wilk test ($p < 0.05$) showed that the data was normally distributed. Frequencies and percentages were used to present categorical data, and any relationships between the categorical item variables were analysed using Pearson's chi-squared test. A p value less than 0.05 was considered statistically significant.

RESULTS

The study was conducted by way of an online questionnaire sent to residents of various provinces of the Kingdom of Saudi Arabia. We received and analysed a total of 1,000 completed responses. Respondents to the questionnaire were 36.5% male and 63.5% female (Figure 1). Participants' ages were distributed as follows: 22.4% were ≤ 25 years old; 42.1% were 26–45; 31.8% were 46–65; 3.7% were ≥ 65 (Figure 2). More than half of participants (55.1%) reported changing their eating habits during the COVID-19 pandemic. This change had a statistically significant association with graduate-level-or-higher educational attainment ($p = 0.002$) (Table 1), as well as a statistically significant association with monthly incomes greater than 9,000 SAR ($p = 0.001$) (Table 2). In our study, 75.7% of participants reported that they brushed their teeth daily at least once; daily brushing was statistically significantly associated with being female rather than male ($p < 0.001$) (Table 3). A comparison of brushing habits between different age groups revealed that participants younger than 45 were more likely than other age groups to have brushed at least once per day ($p = 0.005$) (Table 3). It was also found that participants with education attainment at the graduate level or higher were more likely than those with less education to have brushed at least once per day ($p < 0.001$) (Table 1). Participants who had incomes greater than 12,000 SAR per month were more likely to have brushed at least once per day than those who with monthly incomes less than 12,000 ($p = 0.003$) (Table 2).

When we recorded the frequency of routine dental check-ups, we found that only 28% of participants had

maintained the typical frequency of their check-ups; maintaining this frequency was significantly associated with graduate-level-or-higher education ($p = 0.031$) (Table 1). Participants' responses showed that 44.8% visited the dentist at least once per any period shorter than 1 year (i.e. visited more than once per year), 22.2% visited once per year, 13.8% did so once every two years, 5.7% visited once every 3 years and 13.5% visited just once in more than 3 years. Visiting the dentist more than once per year displayed a statistically significant association with being female ($p < 0.001$) (Table 3); males were less likely to visit the dentist more than once per year. Making dental visits more than once per year was also significantly associated with being 25 years old or younger ($p = 0.014$) (Table 4), being of Saudi nationality ($p = 0.024$) (Table 5) and having a graduate-level education or higher ($p < 0.001$) (Table 1). The data showed that 55.3% of respondents had experienced tooth loss. A history of tooth loss displayed a statistically significant association with being older than 46 ($p < 0.001$) (Table 4) and also with having a sub-graduate education level ($p = 0.016$) (Table 1).

Regarding oral-health care practices during the COVID-19 pandemic, 25% reported that their care practices had 'improved'; 70.7% reported that it became worse, and 4.3% reported no change. Oral-health care presented a statistically significant association with income: participants with incomes lower than 3,000 Saudi Riyal (SAR) were more likely than participants with higher incomes to report that their oral-care practices became worse ($p = 0.016$) (Table 2). During the COVID-19 pandemic, 15.8% of respondents made a visit to the dentist. Such visits were statistically significantly associated with nationality, with non-Saudi people visiting more often than their Saudi counterparts ($p = 0.005$) (Table 5). Participants' self-reported medical histories revealed that 17.8% had multiple chronic illnesses. Of all participants, 4.5% had diabetes mellitus alone, 3.8% had hypertension alone, 0.6% had cardiovascular diseases alone, 4.1% had blood disorders, 2.2% had thyroid conditions, 4% had orthopaedic problems, 3.7% had asthma, 0.2% had malignancy, 0.2% had immunodeficiencies and 0.2% had epilepsy. A comparison of the relationship of different chronic diseases with oral hygiene and oral-care practices revealed that tooth loss was more prevalent amongst participants who had multiple chronic diseases ($p < 0.001$) (Table 6). When we examined participants' tobacco-smoking practices, we found that 13.5% increased their smoking during the COVID-19 pandemic, whereas 15.4% reported continuing to smoke at the same rates. These findings displayed a statistically significant association being male ($p < 0.001$), being either 26–45 or 46–65 years old ($p < 0.001$), having graduate-level-or-higher educational attainment ($p < 0.001$) and having an income greater than 6,000 SAR per month ($p = 0.042$) (Table 7). Of all respondents, 48.2% believed that COVID-19 is a serious health problem. An assessment of the relationships between these statements, the various socio-demographic characteristics revealed that the statement was not correlated with any demographic factor except for level of

education. Participants with educational attainment at the high school level or above were comparatively more likely than those with lower levels of education to feel that COVID-19 is a serious health problem ($p=0.010$) (Table 8). When we assessed the reasons for participants' visits to the dentist during this pandemic, we found that 8.6% had visited for a routine dental check-up, while 7.2% had visited for emergency dental care. Concerning respondents' reported reasons not to visit, 50.2% stated that a visit was not necessary; 19.9% stated that a visit was

not urgent. Only 33.4% of respondents were aware that only emergency treatment is being offered at dental clinics during the COVID-19 pandemic (Table 9). Possession of this knowledge was statistically significantly associated with participants' ages and incomes. Participants aged 25 years or younger were more likely than other age groups to agree that only emergency treatments are being offered at dental clinics during the COVID-19 pandemic ($p=0.013$). Participants who had monthly incomes of 6,000 SAR and less were also more likely to agree ($p=0.007$) (Table 10).

Table 1: Relationship between education and oral hygiene practices.

Oral hygiene practices		Education (%)					P value
		Primary school	Middle school	High school	Graduate	Non-educated	
Change in eating habits during COVID-19	Yes	1.6	1.3	17.1	78.8	1.3	0.002
	No	2.4	4.0	17.6	71.9	4.0	
Tooth brushing daily	Yes	2.1	2.1	15.6	79.0	1.2	<0.001
	No	1.6	3.7	22.6	65.4	6.6	
Routine dental checkup	Yes	2.5	2.5	18.6	76.4	0.0	0.031
	No	1.8	2.5	16.8	75.4	3.5	
Frequency of visit to dentist (years)	<1	2.5	1.8	16.3	78.6	0.9	<0.001
	1	0.0	1.4	20.3	74.8	3.6	
	2	0.7	5.8	16.7	76.1	0.7	
	3	3.5	5.3	17.5	68.4	5.3	
	>3	4.4	2.2	16.3	70.4	6.7	
History of teeth loss	Yes	2.7	2.5	17.4	73.6	3.8	0.016
	No	1.1	2.5	17.2	78.3	0.9	
Care of oral/dental health during COVID-19	Improved	0.0	2.4	20.4	76.0	1.2	0.056
	Became worse	2.4	2.5	16.3	75.8	3.0	
	No didn't change	7.0	2.3	16.3	72.1	2.3	
Visit dentist during COVID-19	Yes	4.4	3.2	20.9	69.6	1.9	0.076
	No	1.5	2.4	16.6	76.8	2.6	

Table 2: Relationship between income and oral hygiene practices.

Oral hygiene practices		Income in SAR (%)						P value
		<3K	3K-6K	>6K-9K	>9K-12K	>12K-15K	>15	
Change in eating habits during COVID-19	Yes	22.3	11.1	9.6	14.3	20.5	22.1	0.001
	No	33.2	9.8	11.4	13.8	14.5	17.4	
Tooth brushing daily	Yes	26.2	10.4	8.9	13.7	19.9	20.9	0.003
	No	30.5	10.7	15.2	15.2	11.1	17.3	
Routine dental checkup	Yes	26.1	11.4	7.9	14.3	18.2	22.1	0.570
	No	27.6	10.1	11.4	14.0	17.6	19.2	
Frequency of visit to dentist (years)	<1	28.1	9.2	10.9	14.1	18.3	19.4	0.571
	1	24.8	14.0	11.3	15.3	17.6	17.1	
	2	20.3	8.7	10.1	18.1	17.4	25.4	
	3	33.3	8.8	7.0	10.5	19.3	21.1	
	>3	32.6	11.9	8.9	9.6	16.3	20.7	
History of teeth loss	Yes	20.1	9.8	12.3	15.7	19.3	22.8	<0.001
	No	36.0	11.4	8.1	12.1	15.9	16.6	
Care of oral/dental health during COVID-19	Improved	20.4	10.8	12.0	14.8	19.2	22.8	0.016
	Became worse	29.1	9.6	9.6	14.0	17.8	19.8	
	No didn't change	34.9	23.3	14.0	11.6	9.3	7.0	

Continued.

Oral hygiene practices		Income in SAR (%)						P value
		<3K	3K-6K	>6K-9K	>9K-12K	>12K-15K	>15	
Visit dentist during COVID-19	Yes	26.6	13.3	10.8	10.1	17.7	21.5	0.584
	No	27.3	10.0	10.3	14.8	17.8	19.7	

Table 3: Relationship between gender and oral hygiene practices.

Oral hygiene practices		Gender (%)		P value
		Male	Female	
Change in eating habits during COVID-19	Yes	38.80	61.20	0.089
	No	33.60	66.40	
Tooth brushing daily	Yes	31.70	68.30	<0.001
	No	51.40	48.60	
Routine dental checkup	Yes	33.90	66.10	0.292
	No	37.50	62.50	
Frequency of visit to dentist (years)	<1	32.60	67.40	0.005
	1	37.40	62.60	
	2	47.10	52.90	
	3	49.10	50.90	
	>3	31.90	68.10	
History of teeth loss	Yes	35.30	64.70	0.366
	No	38.00	62.00	
Care of oral/dental health during COVID-19	Improved	38.80	61.20	0.338
	Became worse	35.20	64.80	
	No didn't change	44.20	55.80	
Visit dentist during COVID-19	Yes	39.90	60.10	0.377
	No	35.90	64.10	

Table 4: Relationship between age and oral hygiene practices.

Oral hygiene practices		Age (%)				P value
		≤25	26-45	46-65	≥66	
Change in eating habits during COVID-19	Yes	20.9	43.7	32.3	3.1	0.332
Tooth brushing daily	Yes	22.6	43.1	31.8	2.5	0.005
Routine dental checkup	Yes	23.6	41.1	32.9	2.5	0.575
Frequency of visit to dentist (years)	<1	25.0	41.7	31.5	1.8	0.014
	1	21.2	45.0	29.7	4.1	
	2	14.5	47.1	34.8	3.6	
	3	19.3	40.4	35.1	5.3	
	>3	25.2	34.1	31.9	8.9	
History of teeth loss	Yes	10.7	43.6	39.8	6.0	<0.001
Care of oral/dental health during COVID-19	Improved	18.8	47.2	31.2	2.8	0.081
	Became worse	22.9	40.2	32.7	4.2	
	No didn't change	34.9	44.2	20.9	0.0	
Visit dentist during COVID-19	Yes	22.8	40.5	36.1	0.6	0.113
	No	22.3	42.4	31.0	4.3	

Table 5: Relationship between nationality and dentist visiting.

Dentist visiting		Nationality (%)		P value
		Saudi	Non-Saudi	
Frequency of visit to dentist (years)	<1	97.3	2.7	0.024
	1	100.0	0.0	
	2	100.0	0.0	
	3	100.0	0.0	
	>3	98.5	1.5	

Continued.

Dentist visiting		Nationality (%)		P value
		Saudi	Non-Saudi	
Visit dentist during COVID-19	Yes	96.2	3.8	0.005
	No	99.0	1.0	

Table 6: Relationship of medical history with oral hygiene practices.

Oral hygiene practices		Medical problems												P value
		DM	HT-N	CV-Ds	Blood disorders	Thyroid	Orthopedic	Asthma	Malignancy	ID-Ds	Epilepsy	NR-MH	Multiple	
Change in eating habits during COVID-19	Yes	5.6	4.5	0.2	4.0	2.5	3.4	3.3	0.4	0.0	0.4	58.3	17.4	0.111
	No	3.1	2.9	1.1	4.2	1.8	4.7	4.2	0.0	0.4	0.0	59.2	18.3	
Tooth brushing daily	Yes	4.4	3.3	0.8	4.6	2.5	3.7	4.1	0.3	0.3	0.3	59.8	16.0	0.083
	No	4.9	5.3	0.0	2.5	1.2	4.9	2.5	0.0	0.0	0.0	55.1	23.5	
Routine dental checkup	Yes	6.8	4.6	1.4	5.0	1.4	5.7	5.4	0.0	0.7	0.4	52.9	15.7	0.005
	No	3.6	3.5	0.3	3.8	2.5	3.3	3.1	0.3	0.0	0.1	61.0	18.6	
Frequency of visit to dentist (years)	<1	5.1	4.0	0.7	5.6	2.5	4.5	4.7	0.2	0.4	0.2	55.1	17.0	0.401
	1	3.2	4.1	0.0	2.3	2.3	1.8	4.1	0.0	0.0	0.0	65.8	16.7	
	2	4.3	4.3	0.7	2.2	0.7	7.2	2.9	0.7	0.0	0.0	62.3	14.5	
	3	7.0	1.8	0.0	8.8	1.8	1.8	1.8	0.0	0.0	0.0	54.4	22.8	
	>3	3.7	3.0	1.5	2.2	3.0	3.7	1.5	0.0	0.0	0.7	57.0	23.7	
History of teeth loss	Yes	4.9	5.6	0.2	3.3	2.0	5.6	2.0	0.2	0.0	0.2	53.2	23.0	<0.001
	No	4.0	1.6	1.1	5.1	2.5	2.0	5.8	0.2	0.4	0.2	65.5	11.4	
Care of oral/dental health during COVID-19	Yes better	6.8	4.4	0.0	2.4	1.2	2.0	5.2	0.0	0.0	0.0	55.2	22.8	0.072
	Yes worse	3.8	3.7	0.8	4.4	2.5	4.8	2.8	0.3	0.3	0.3	59.8	16.4	
	No didn't change	2.3	2.3	0.0	9.3	2.3	2.3	9.3	0.0	0.0	0.0	60.5	11.6	
Visit dentist during COVID-19	Yes	5.1	4.4	0.0	3.2	1.3	3.8	4.4	0.0	0.0	0.0	53.8	24.1	0.631
	No	4.4	3.7	0.7	4.3	2.4	4.0	3.6	0.2	0.2	0.2	59.6	16.6	

Table 7: Smoking habits during COVID-19 and their relationship between sociodemographic characteristics.

% %		Smoking during COVID-19			P value
		Yes	No change	Not a smoker	
Gender	Male	34.5	16.4	49.9	<0.001
	Female	1.7	15.1	83.3	
Age	≤25	11.6	8.9	79.5	<0.001
	26-45	16.8	15.1	68.4	
	46-65	12.4	17.5	70.4	
	≥66	0.0	45.7	56.8	
Level of education	Primary school	5.6	27.8	70.0	<0.001
	Middle school	16.0	12.0	72.0	
	High school	11.8	25.9	63.0	
	Graduate	14.6	12.4	73.2	
	Non-educated	0.0	36.0	64.0	
Income	<3K	8.1	12.9	79.0	0.042
	3K-6K	12.5	19.2	68.6	
	>6K-9K	16.3	16.3	67.3	
	>9K-12K	16.4	14.3	69.5	
	>12K-15K	17.8	20.1	62.9	
	>15	14.7	13.7	72.0	

Table 8: Relationship between sociodemographic and perceptions on seriousness of COVID-19.

Sociodemographics		Think COVID-19 is serious		P value
		Yes	No	
Age	Less than 25	52.7	47.3	0.060
	26-45	45.6	54.4	
	46-65	46.5	53.5	
	66 or more	64.9	35.1	
Level of education	Primary school	35.0	65.0	0.010
	Middle school	40.0	60.0	
	High school	51.4	48.6	
	College degree	47.0	53.0	
	Non-educated	80.0	20.0	

Table 9: Reasons for visiting/no visiting during COVID-19.

		Frequency	Percent
Reason for visiting dentist during COVID-19	Routine checkup	86	8.6
	Emergency	72	7.2
	Didn't answer	842	84.2
Reason for not visiting dentist during COVID-19	Not needed	502	50.2
	Not urgent	199	19.9
	Urgent but phobia	108	10.8
	Home based	33	3.3
	Didn't answer	158	15.8

Table 10: Relationship between sociodemographic and knowledge about type of dental emergency treatments during COVID-19.

Do you know that emergency treatment being done in dental clinics during COVID-19 pandemic				
		Yes	No	P value
Age	Less than 25	42.4	57.6	0.013
	26-45	31.6	68.4	
	46-65	29.9	70.1	
	66 or more	29.7	70.3	

Continued.

Do you know that emergency treatment being done in dental clinics during COVID-19 pandemic			
Income (SR)	Less than 3000	37.1	62.9
	3K-6K	42.9	57.1
	>6K-9K	26.9	73.1
	>9K-12K	32.6	67.4
	>12K-15K	36.5	63.5
	>15	24.5	75.5
			0.007

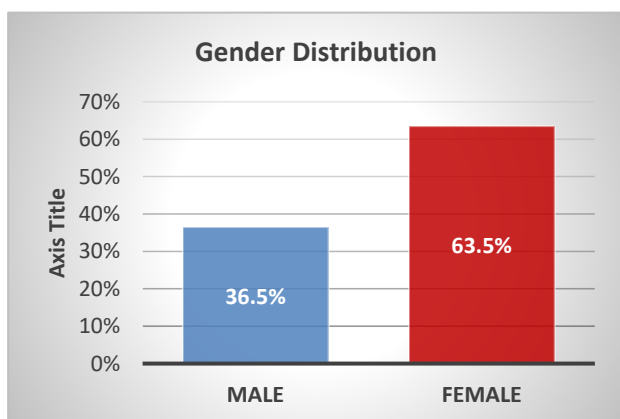


Figure 1: Gender distribution among the participants.

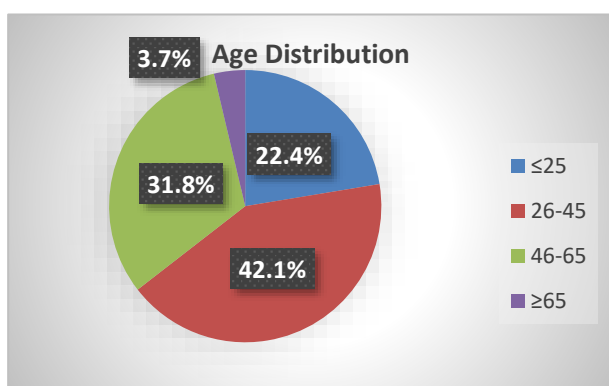


Figure 2: Age distribution among the participants.

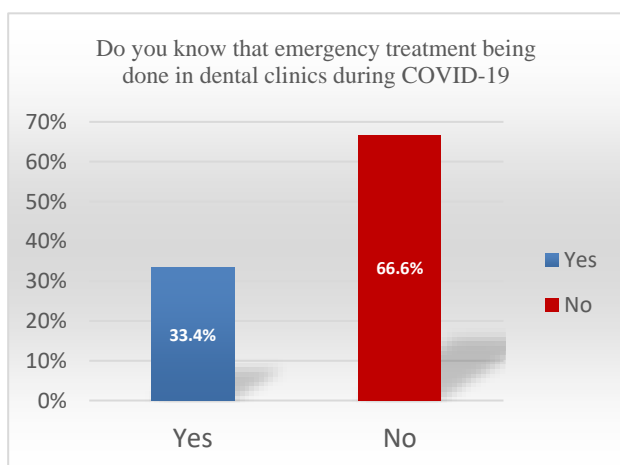


Figure 3 Emergency treatment being done in dental clinics during COVID-19.

DISCUSSION

At the time that this survey was conducted (from the 2 July 2020 to the 14 July 2020), there were about 237,000 cases in Saudi Arabia. At the time of writing these results, the 1st of August, that number has jumped to 275,905 cases.

The World Health Organization (WHO) has recognized oral health as an essential factor of overall health and well-being.¹⁶ Evidence has linked poor oral health to several chronic diseases, microbial infections and immune disorders, as well as to oral cancer and Alzheimer's.^{14,17-19} In this study, we explored the knowledge and behaviour of patients with systemic illness towards dental and oral health during the COVID-19 pandemic across multiple regions of Saudi Arabia.

It seems that the COVID-19 pandemic has had a damaging effect when it comes individuals' eating habits. More than half of our participants reported that their eating habits were negatively affected. Many factors could underlie such an outcome, including economic conditions and variation in how knowledgeable and aware people are about the pandemic. In our study, effects of both income and education level could be observed (Table 1 and 2).

Although more than 75% of participants stated that brushed their teeth at least once daily, this cohort mostly consisted of younger participants and those with advanced educational degrees. This can explain why most of the participants who reported having experienced tooth loss in the past were in the 46-and-older age group and had lower educational attainment (Table 1 and 4).

Among our participants, income also seems to play a vital role, having a major effect on both brushing habits and eating habits. Moreover, most of the respondents who reported degradation in the quality of their oral-care practices were amongst the lower-income groups (Table 2).

Our findings suggest that non-Saudi participants have shown a greater willingness to visit the dentist during the pandemic, if necessary, than Saudi participants (Table 5). Smoking is considered a risk factor for many systemic and oral diseases.^{20,21} Half of the smokers in the study reported that their smoking increased during the pandemic. This increase was more severe amongst male participants. We suggest that this tendency towards increased smoking could be related to the stressful conditions and economic pressures that participants are experiencing during this

pandemic. Much literature associates smoking with stress and anxiety.²⁰

In this study, participants who were more educated were more likely to consider the pandemic a serious threat to their health (Table 8). Severe cases of COVID-19 often occur in patients who are elderly and have secondary comorbidities.²² Chronic respiratory system diseases, diabetes, hypertension and cardiovascular diseases are considered risk factors for severe cases of COVID-19.²² As can be concluded from Table 6, more than 30% of patients suffering from bone and joint diseases, patients suffering from hypertension and patients with than one chronic disease are neglecting their oral hygiene. This negligence has its own consequences -in hypertensive patients, for example, poor oral hygiene may interfere with and worsen the regulation of blood pressure.²³ In individuals with osteoporosis, meanwhile, oral hygiene can play a major role in preventing the progression of the disease.²⁴

Interestingly enough, more than 90% of the respondents that are suffering from thyroid and blood disorders, despite seeming to have decent brushing habits before the onset of the pandemic, reported that their oral-health habits worsened during the pandemic. Bacteremia is associated with gingival bleeding and poor oral hygiene. By enhancing oral hygiene, the risk of developing infective endocarditis can be decreased.²⁵ That some participants' oral hygiene is deteriorating might be related to stress and anxiety. Both can be caused by the current conditions and are considered risk factors for pre-mature death; anxiety is a predictor of all-cause death, especially in elderly people.²⁶ Social distancing and isolation -despite being beneficial and widely recognized as the first line of defense against the transmission of COVID-19 -could actually increase individuals' burdens of existing emotional stresses. For elderly people with comorbidities, social distancing means isolation and loneliness. Loneliness itself can lead to disability, depression and cardiovascular diseases.²⁷

Early detection and treatment for oral disease are extremely important to minimize post-operative side effects and treatment failure, as well as to mitigate the risk of developing other diseases.²⁸ To provide safe dental treatment during the pandemic, an initial assessment of COVID-19 symptoms, conducted via tele-screening, is recommended, as is the collection of a complete history of the prospective patient's recent travel and contact others.²⁹ During the pandemic, only emergency procedures should be allowed, and elective dental treatments should be postponed for at least 2 weeks for patients with signs or symptoms of COVID-19. Some urgent cases can be treated remotely by prescribing medications to relieve acute pain.²⁹

In an effort to protect healthcare staff and patients from the transmission of SARS-CoV-2, healthcare providers across Saudi Arabia have postponed check-ups, elective surgeries and other non-urgent medical appointments that must be

conducted in person.³⁰ Emergency cases that involve swellings that interfere with airways should be addressed in airborne-isolation settings or negative-pressure rooms. Neglecting tooth abscesses, which can be painless, can put the patient into a ventilator, a piece of key equipment needed to care for patients critically ill with COVID-19. Ludwig's angina is one of the conditions that can arise as a result of a tooth abscess; it is life-threatening, rapidly expanding and causes airway obstruction that requires immediate hospitalization and intervention.

Consequently, the Saudi ministry of health and CDC both recommend that dental services be limited only to emergency care in order to prevent cross-contamination and expand available hospital capacity.⁴ Moreover, the Saudi ministry of health has encouraged dentists to sign up to join the virtual medical academy as an effort to prepare the healthcare delivery system to respond to a potential surge in COVID-19. Dental hygienists and dental assistants can also register to as part of this effort. Currently, many dentists acknowledge their part in supporting public health during this crisis.⁴ Future studies are required -especially after the pandemic ends -to understand the true extent to which the current pandemic is impacting oral and general health.

Elderly patients and individuals with chronic diseases such as hypertension, cardiovascular diseases, diabetes, blood disorders, asthma and respiratory diseases, malignancies and immunodeficiencies are considered to be in at high-risk of severe manifestations of COVID-19. Moreover, individuals with more than one chronic disease were more prone to exhibiting a stronger tendency towards negative behaviours.

Limitations

Cross-sectional studies do not give us the opportunity to see the cause-effect relationship. Furthermore, in such study designs, subjects tend to give socially acceptable answers. In addition, by conducting the study through an online questionnaire, we are sacrificing a group in the population that are not using internet. Thus, although it is a necessary sacrifice to reduce the risk of COVID-19 transmission, the findings in this study could not be generalized for the whole Saudi population.

CONCLUSION

Despite the enormous efforts that have been made around the world to provide guidelines for decreasing the risk of COVID-19 spread during dental procedures, focussing on measuring and enhancing patients' knowledge of and behaviour towards oral health can sometimes provide information that is useful in dental practice and contexts. Our results clearly show that a very alarming percentage of participants do not see COVID-19 as threatening to their health. At the same time, a number of people needed urgent treatment but preferred to stay home because of fear and anxiety connected to the pandemic. The lack of

information can lead to the exacerbation of such fear, which in turn causes individuals to neglect their oral health. This study present a baseline of information that helps to understand the level of knowledge and how the residents in Saudi Arabia will perceive, react and manage their health during this pandemic. However, there is a need to do more research in this area to build and enhance the baseline information that was established.

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REFERENCES

- Komies S, Aldhahir AM, Alghamdi SM, Alqarni A, Oyelade T, Alqahtani JSJ. COVID-19 Outcomes in Saudi Arabia and the UK: A Tale of Two Kingdoms. 2020.
- Zhang L-P, Wang M, Wang Y, Zhu J, Zhang NJFM. Focus on a 2019-novel coronavirus (SARS-CoV-2). Future Med. 2020;15(10).
- Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). Int J Surg. 2020;76:71-6.
- Control CfD, Prevention. CDC guidance for providing dental care during COVID-19. 2020.
- Algaissi AA, Alharbi NK, Hassanain M, Hashem AM, Health P. Preparedness and Response to COVID-19 in Saudi Arabia: Building on MERS Experience. 2020;13(6):834-8.
- Health TSmo. Available at: <https://www.moh.gov.sa/Ministry/MediaCenter/News/Pages/News-2020-05-24-001.aspx>. Accessed on: 25 July 2020.
- CDC COVID-19 Response Team. Severe outcomes among patients with coronavirus disease 2019 (COVID-19)—United States, February 12–March 16, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(12):343-6.
- Meyer U, Kleinheinz J, Handschel J, Kruse-Lösler B, Weingart D, Joos U, et al. Oral findings in three different groups of immunocompromised patients. J Oral Pathol Med. 2000;29(4):153-8.
- Kragt L, Dharmo B, Wolvius EB, Ongkosuwito EM. The impact of malocclusions on oral health-related quality of life in children—a systematic review and meta-analysis. Clin Oral Investig. 2016;20(8):1881-94.
- Huang DL, Chan KCG, Young BA. Poor oral health and quality of life in older US adults with diabetes mellitus. J Am Geriatr Soc. 2013;61(10):1782-8.
- CDC. Adult oral health | basics | division of oral health |. 2019. Available at: <https://www.cdc.gov/oralhealth/basics/adult-oral-health/index.html>. Accessed on: 25 July 2020.
- ADA. From the emergency room to the dental chair—Action for dental health. 2020. Available at: <https://www.ada.org/en/public-programs/action-for-dental-health/er-referral>. Accessed on: 25 July 2020.
- ADHA. Adha covid-19 updates for dental hygienists | adha—American dental hygienists association. 2020. Available at: <https://www.adha.org/covid19>. Accessed on: 25 July 2020.
- Griffin SO, Jones JA, Brunson D, Griffin PM, Bailey WD. Burden of oral disease among older adults and implications for public health priorities. Am J Public Health. 2012;102(3):411-8.
- Ghaffari M, Rakhshanderou S, Ramezankhani A, Noroozi M, Armoon BJ. Oral health education and promotion programmes: meta-analysis of 17-year intervention. Int J Dent Hyg. 2018;16(1):59-67.
- Petersen PE. World Health Organization global policy for improvement of oral health-World Health Assembly 2007. Int Dent J. 2008;58(3):115-21.
- Petersen PE, epidemiology o. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol. 2003;31:3-24.
- Kamer AR, Craig RG, Dasanayake AP, Brys M, Glodzik-Sobanska L, de Leon MJ, et al. Inflammation and Alzheimer's disease: possible role of periodontal diseases. Alzheimers Dement. 2008;4(4):242-50.
- Pritchard AB, Crean S, Olsen I, Singhrao SK. Periodontitis, microbiomes and their role in Alzheimer's disease. Front Aging Neurosci. 2017;9:336.
- Johnson JG, Cohen P, Pine DS, Klein DF, Kasen S, Brook JS. Association between cigarette smoking and anxiety disorders during adolescence and early adulthood. JAMA. 2000;284(18):2348-51.
- Kinane D, Chestnutt IG. Smoking and periodontal disease. Crit Rev Oral Biol Med. 2000;11(3):356-65.
- Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. Int J Infect Dis. 2020;94:91-5.
- Pietropaoli D, Del Pinto R, Ferri C, Wright JT, Giannoni M, Ortu E, et al. Poor oral health and blood pressure control among US hypertensive adults: results from the national health and nutrition examination survey 2009 to 2014. Hypertension. 2018;72(6):1365-73.
- Huang YF, Chang CT, Liu SP, Muo CH, Tsai CH, Hong HH, et al. The impact of oral hygiene maintenance on the association between periodontitis and osteoporosis: a nationwide population-based cross sectional study. Medicine (Baltimore). 2016;95(6):e2348.
- Lockhart PB, Brennan MT, Thornhill M, Michalowicz BS, Noll J, Bahrani-Mougeot FK, et al. Poor oral hygiene as a risk factor for infective endocarditis-related bacteremia. J Am Dent Assoc. 2009;140(10):1238-44.

26. Ostir GV, Goodwin JS. High anxiety is associated with an increased risk of death in an older tri-ethnic population. *J Clin Epidemiol*. 2006;59(5):534-40.
27. Berg-Weger M, Morley JE. Loneliness in old age: an unaddressed health problem. *J Nutr Health Aging*. 2020;24:243-5.
28. SEER. Cancer of the oral cavity and pharynx—Cancer stat facts. 2019. Available at: <https://seer.cancer.gov/statfacts/html/oralcav.html>. 2019. Accessed on 15 April 2020.
29. Ather A, Patel B, Ruparel NB, Diogenes A, Hargreaves KM. Coronavirus disease 19 (COVID-19): implications for clinical dental care. *J Endod*. 2020;46(5):584-95.
30. Klompas M, Morris CA, Sinclair J, Pearson M, Shenoy ES. Universal masking in hospitals in the Covid-19 era. *NEJM*. 2020;382(21):63.

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