

# Impact of COVID-19 on dental practice and anxiety among increased risk group dentists: A cross-sectional study

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## Abstract.

**BACKGROUND:** The likelihood of infection with SARS-COV-2 (COVID-19) in the dental office is considered high.

**OBJECTIVE:** Assessing the impact of the COVID-19 on dental practices and anxiety levels in risk group Brazilian dentists.

**METHODS:** A cross-sectional study was performed using an online questionnaire. The data obtained were analyzed using the IBM SPSS 25.0 software (Pearson's Chi-square association test, multivariate logistic regression, and Poisson multiple regression), with subsequent calculation of the odds ratio at a 95% confidence interval, with a significance level of 5%.

**RESULTS:** Responses of 578 dentists distributed in all regions of Brazil were collected. Most of the dentists were female, with an average age of 35. Of the participants, 23.4% were part of the increased risk group for COVID-19. The professionals who belonged to the increased risk group had a greater chance of not feeling prepared to perform consultations (OR = 1.67) and were not performing any procedures during the pandemic (OR = 2.03). Belonging to the increased risk group did not influence anxiety levels among the dentists. The factors associated with increased anxiety were being female, being younger, working in the southeastern region of the country, being afraid of contracting COVID-19 while working, and being concerned for one's professional future.

**CONCLUSIONS:** The pandemic has had a negative impact on the professional practice of individuals at risk, but the level of anxiety was like professionals who were not part of the increased risk group for COVID-19.

Keywords: Dentists, COVID-19, Dentist's practice patterns, anxiety

## 1. Introduction

In March 2020, the World Health Organization (WHO) declared a pandemic situation resulting from Coronavirus Disease 2019 (COVID-19) [1]. Patients with COVID-19 usually have symptoms similar flu, but some of them progress to seri-

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ous complications that can lead to death, such as severe acute respiratory syndrome and kidney failure. Individuals with advanced age and/or chronic comorbidities (obesity, diabetes, hypertension, respiratory diseases, cardiovascular diseases, kidney diseases and immunosuppression) are at increased risk and have a greater chance of presenting the worst prognosis for the disease [2, 3].

Transmission between humans occurs through inhalation of respiratory droplets loaded with viruses and contact with contaminated surfaces [4–6]. Dental offices are potential transmission routes for COVID-19, due to the production of aerosols and exposure to droplets during procedures. Therefore, it has been necessary to establish rigorous and effective biosafety protocols for dental care during the pandemic [7–9].

Dentists are the health professionals at greatest risk of contracting COVID-19 from their patients [10]. In view of this situation, it is common for dentists to become fearful of being infected by their patients. This creates a situation of constant anxiety [11, 12]. In a study conducted in 30 countries, it was seen that 78% of the evaluated dentists were anxious and were afraid of contracting COVID-19 in the workplace [13]. In Israel it has also been observed in professionals belonging to a dental team, that those who were included in the increased risk group for COVID-19 exhibited elevated psychological distress [14].

Changes in dental care in the face of the COVID-19 pandemic have resulted in the need for greater investment by dentists in biosafety measures as well as a reducing care. This has resulted in serious monetary implications for dental practices worldwide [15, 16]. In December 2020, Brazil had already presented 7,263,619 million COVID-19 cases [17]. It is important to note that Brazil has the largest number of active dentists in the world [18]. In view of this, it is likely that the pandemic has a strong negative impact on the Brazilian dental class, especially professionals who are part of the group at increased risk from the disease. To date, no research published in Brazil has addressed this hypothesis. The present study was therefore conducted with the objective of assessing the impact of the pandemic on Brazilian dental practice and on the level of anxiety among dentists who are at increased risk for COVID-19.

## 2. Method

The present work is characterized as cross-sectional study and was approved by the Research

Ethics Committee of the Health Sciences Center of the Federal University of Paraiba, Brazil (CAAE: 31757120.7.0000.5188). The research was conducted in full compliance with ethical principles of research involving human beings and in accordance with the Declaration of the Helsinki World Medical Association [19]. This study is in accordance with the STROBE guidelines for reporting observational studies (Appendix 1).

The sample calculation was performed using the online tool OpenEpi. For the calculation, the population size was 337,788 surgeons - dentists registered at the Federal Dentistry Council (FDC) of Brazil (<https://website.cfo.org.br/estatisticas/quantidade-geral-de-entidades-e-active-professionals/> Accessed: 06.05.2020). It was considered that 70% (anticipated frequency) of the participants would be aware of the FDC's recommendations. A 95% confidence interval (alpha error = 5%),  $\beta$  error of 20%, power of 80% ( $1 - \beta$ ) and a design effect (deff) of 1.5 were established [20]. From these parameters, a sample size of 484 dentists distributed throughout Brazil, (Northern: 27; Northeast: 80; Central-West: 43; Southeast: 255; and Southern: 79), was defined using the inclusion criteria of dental surgeons working in private clinics and in agreement with the research consent term. Participants who did not complete the questionnaire were excluded.

The instrument for collecting this research was a questionnaire developed by the researchers from consultations with studies assessing the impact of the pandemic on dental practice in other countries [9, 11, 13, 14, 21]. Before beginning the research, a pilot test was conducted, with the questionnaire being sent randomly to dentists of different age groups, (included or not in the increased risk group for COVID-19), who worked in a private clinic ( $n = 12$ ). The respondents' data were submitted to an internal consistency analysis, which yielded a Cronbach's alpha of 0.941.

The questionnaire presented 58 multiple-choice questions and was divided into four sections (Appendix 2): Socio-demographic profile; Knowledge and adherence of the professional to the new biosafety standards and care practices guided by WHO/FDC; Dental care and possible financial implications during the COVID-19 pandemic; and Self-assessment of the professionals' anxiety of becoming infected in their workplace. The professionals' anxiety level was assessed using the Generalized Anxiety Disorder Test-7 (GAD-7). The version of GAD-7 was validated for the Brazilian population [22].

The GAD-7 assess consists of a 7-item scale that measures the presence, frequency and severity of anxiety symptoms over a 2-week period. For each of the 7 items on the scale, scores of 0, 1, 2, and 3 were assigned to the response categories “None”, “Several days”, “More than half of the days” and “Almost every day”, respectively. The scores for each item were then added together to obtain a total score ranging from 0 to 21. Scores from 0 to 4, 5 to 9, 10 to 14 and 15 to 21 were respectively indicative of minimal, mild, moderate, and severe anxiety [22].

The questionnaire was added to Google Forms and its first page was the free and informed consent term, which guaranteed the confidentiality of the data and informed the participants concerning the objectives of the study and their voluntary participation. The dentists’ consent to participate in the study was implied when they clicked the “next” button to answer the survey. The questionnaire was released by the researchers from 06/20/2020 to 08/11/2020 in WhatsApp®, Facebook®, and Instagram® groups, and online forums (sample for convenience). Participants were asked to help by referring the questionnaire to other dentists so that it might be distributed throughout the country.

### 2.1. Statistical analyses

The data obtained from the online platform were exported and tabulated in an Excel spreadsheet, with subsequent analysis using the IBM SPSS® software (25.0, IBM Corporation, Armonk, NY, USA). The data were initially submitted to a descriptive and exploratory analysis to determine the absolute and relative frequencies. The statistically significant associations were then assessed using Pearson’s Chi-square test. The factors associated with dentist anxiety (GAD-7 score) were assessed by multiple Poisson regression. In the adjusted model, prevalence ratio (PR) values and a 95% confidence interval (95% CI) were obtained for the variables with  $p < 0.20$ . The factors associated with dental surgeon concerns about their professional future were assessed using multiple logistic regression. The adjusted model ( $p < 0.20$ ) presented an odds ratio (OR) and confidence intervals of 95% (95% CI). For all analyses, 5% significance ( $p < 0.05$ ) was adopted.

## 3. Results

The responses of 578 participants distributed across all regions of Brazil were evaluated. Of these participants, 23.4% were part of the increased risk

group for COVID-19. Most of the participants were female (73.9%), with an average age of 35, and minimum and maximum ages of 22 and 69 years old. A great part of these dentists had graduated within the last five years (31.1%). Table 1 presents the variables related to dentist characteristics, impact on dental practices, and study participant anxiety.

It was observed that 61.6% of the dentists were being regularly informed about the new biosafety standards for dental care during the pandemic through the official agencies. A total of 69.2% of dentists stated that they routinely follow all the recommended biosafety measures. The distributions of all responses to variables related to biosafety protocols recommended by WHO/FDC are shown in Table 2.

There was a negative impact on professional activity in 80.60% of study participants and 84% of dentists are concerned about their professional future. Fear of becoming infected with COVID-19 while working was seen in 85.9% of dentists. Table 3 evaluates the variable “Are you part of the increased risk group for COVID-19?” regarding impact on dental practice and anxiety levels during the pandemic. It was observed that professionals abstaining from care were 2.03 times more likely to be part of the increased risk group. It was also seen that, a response of “Not feeling prepared to assist patients during the COVID-19 outbreak” increased by 1.67 times the chance that the professional was in the increased risk group. Yet there was no association between reported anxiety level and the increased risk group variables.

Table 4 presents variables associated with the increased anxiety levels of the professionals during the pandemic. Multiple Poisson regression was performed, and the GAD-7 score was considered as the dependent variable. The factors associated with increased anxiety were female gender, relative youth, working in southeastern Brazil, fear of contracting COVID-19 while working, and concern for one’s professional future.

Table 5 presents the variables associated with increased concern for the dentist’s professional future. Multiple logistic regression was performed, and it was found that the most prevalent factors were female gender, working in northeastern and Southeastern Brazil, not having postgraduate degree and fear of contracting COVID-19.

## 4. Discussion

The possibility of dentists to become infected with COVID-19 during dental care is considered high [23].

Table 1  
 Characteristics, dental practice and anxiety levels of the study participants. *N* = 578

Variable	Categories	<i>N</i>	%
Gender	Male	151	26.1
	Female	427	73.9
Region	North	31	5.4
	Central-West	48	8.3
	South	83	14.4
	Northeast	147	25.4
	Southwest	269	46.5
Time from having graduated in dentistry	0 to 5 years	180	31.1
	6 to 10 years	116	20.1
	11 to 15 years	75	13.0
	16 to 20 years	57	9.9
	Over 20 years	150	26.0
Postgraduate studies	No	90	15.6
	Yes	488	84.4
Risk group	Yes	135	23.4
	No	443	76.6
Had COVID-19	Yes	28	4.8
	No	550	95.2
Intimate with COVID-19	No	188	32.6
	Yes	388	67.4
Suspension of elective care after declaration by WHO/FDC	Suspended calls	48	8.3
	Continued with calls	530	91.7
Impact on professional activity resulting from the COVID-19 pandemic	There was no negative impact	112	19.4
	There was a negative impact	466	80.6
Concern about professional future	No	91	16.0
	Yes	478	84.0
Reasons for concern about the professional future	Not knowing when this emergency will end	208	36.0
	Whether patients will be able to afford dental treatment after the end of the pandemic	191	33.0
	The need for new procedures and devices for safety and infection prevention	95	16.4
	Closing the office due to the monetary crisis after the end of the pandemic	65	11.3
	Prefer not to declare	19	3.3
Fear of COVID-19 infection while working	No	78	14.1
	Yes	474	85.9
Prepared to assist patients during the COVID-19 outbreak	No	88	15.20
	Yes	490	84.80
GAD-7 test	Minimal anxiety	137	23.70
	Mild anxiety	181	31.30
	Moderate anxiety	107	18.50
	Severe anxiety	153	26.50

*N* = Absolute Frequency. % = Percentage.

These impact both the professionals' dental practices and emotions [24]. It was found in the present study that 80.6% of the dentists already suffered a negative impact on their professional activity, and 31.3% of the participating dentists reported mild anxiety and 26.5% reported severe anxiety during the pandemic.

Mild anxiety is considered natural and promotes preventive behaviors, but in cases of severe anxiety it is common for the individual to panic, to become more likely to make mistakes and irrational decisions, and to exhibit irrational behaviors as well [25]. While the pandemic continues, several doubts afflict den-

tists, such as uncertainty as to when the pandemic will end, the potential effectiveness of treatments or proposed vaccines, the resumption of activities, and financial maintenance of the office as before. These and others generate anxiety for the dentist, and it can vary in intensity by individual. It is thus necessary to highlight the principal reasons associated with such increased levels of anxiety.

For dentists included in the COVID-19 risk group, it is possible that anxiety is due to the fear of contracting the disease while working, of fear for their professional future, or from a potential need to sus-

Table 2  
Variables related to the WHO/FDC recommended biosafety protocols. *N* = 578

Variable	Category	<i>N</i>	%
Is phone screening being done for patients?	No	108	18.70
	Yes	419	72.50
	I'm not attending during the pandemic	43	7.40
	I prefer not to declare	8	1.40
Are you postponing treatment in patients suspected or diagnosed with COVID-19?	No	68	11.80
	Yes	510	88.20
Are you making spaced appointments by appointment?	No	69	11.90
	Yes	509	88.10
Did you install a carpet with bactericidal disinfectant at the front door of the waiting room?	No	302	52.20
	Yes	226	39.10
	I'm not attending during the pandemic	43	7.40
	I prefer not to declare	7	1.20
Do you disinfect the chairs and surfaces touched by the patient, several times a day?	No	9	1.60
	Yes	520	90.00
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	5	0.90
Do you keep at least three feet of space between people?	No	29	5.00
	Yes	501	86.70
	I'm not attending during the pandemic	45	7.80
	I prefer not to declare	3	0.50
Do you keep the waiting room and office ventilated between patient intervals?	No	74	12.80
	Yes	455	78.70
	I'm not attending during the pandemic	45	7.80
	I prefer not to declare	4	0.70
Do you ask the patient to wash their hands with soap water and then rub with 70% alcohol when they arrive at the office?	No	85	14.70
	Yes	446	77.20
	I'm not attending during the pandemic	45	7.80
	I prefer not to declare	2	0.30
Do you offer a cap, mask, and shoe protection to the patient?	No	280	48.40
	Yes	242	41.90
	I'm not attending during the pandemic	45	7.80
	I prefer not to declare	11	1.90
Do you check the patient's current health status, as well as his body temperature, when he arrives at the office?	No	220	38.10
	Yes	305	52.80
	I'm not attending during the pandemic	45	7.80
	I prefer not to declare	8	1.40
Do you and your team wash hands and then rub them with 70% alcohol?	No	5	0.90
	Always – before and after each appointment	146	25.30
	Always – before and after office disinfection	19	3.30
	Always before and after each appointment and before and after office disinfection	362	62.60
	I'm not attending during the pandemic	42	7.30
	I prefer not to declare	4	0.70
	Do you remove and replace all mechanical barriers (new), and disinfect all dental equipment and surfaces with each new patient?	No	45
Do you disinfect surfaces with substances recommended by WHO/FDC?	Yes	483	83.60
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	6	1.00
	No	21	3.60
After each patient are all disposable PPE replaced and the dentist and his assistant's protective shield and face shield disinfected?	Yes	512	88.60
	I'm not attending during the pandemic	43	7.40
	I prefer not to declare	2	0.30
	I do not perform any of the recommendations mentioned above	13	2.20
	Yes. I only change the disposable PPE	62	10.70
Yes. I only disinfect the goggles and face shield	132	22.80	

(Continued)

Table 2  
(Continued)

Variable	Category	N	%
	Yes. I change the disposable PPE, disinfect the protective glasses, and face shield	323	55.90
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	4	0.70
Do you use the basic routine PPE (lab coat, hat, goggles, surgical mask and procedure gloves)?	No	11	1.90
	Yes	523	90.50
	I'm not attending during the pandemic	42	7.30
	I prefer not to declare	2	0.30
Do you use a waterproof disposable apron weighing over 30g/m <sup>2</sup> ?	No	135	23.40
	Yes	396	68.50
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	3	0.50
Do you use shoe protectors (Pro pé)?	No	260	45.00
	Yes	272	47.10
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	2	0.30
Do you use a face shield? ( <i>Face shield</i> )?	No	14	2.40
	Yes	517	89.40
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	3	0.50
Do you use Mask N95 or PFF2 (without expiratory valve)?	No	78	13.50
	Yes	454	78.50
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	2	0.30
Do you rinse with 1% hydrogen peroxide or 0.2% polyvidone before the dental procedure?	No	240	41.50
	Yes	290	50.20
	I'm not attending during the pandemic	43	7.40
	I prefer not to declare	5	0.90
Are you avoiding/minimizing aerosol production?	No	158	27.30
	Yes	366	63.30
	I'm not attending during the pandemic	44	7.60
	I prefer not to declare	10	1.70
Are you using absolute isolation in every service that involves tooth opening and produces aerosol?	No	345	59.70
	Yes	157	27.20
	I'm not attending during the pandemic	48	8.30
	I prefer not to declare	28	4.80
Are you using a vacuum pump during service?	No	229	39.60
	Yes	292	50.50
	I'm not attending during the pandemic	46	8.00
	I prefer not to declare	11	1.90
Are you performing four handed dentistry?	No	268	46.40
	Yes	260	45.00
	I'm not attending during the pandemic	45	7.80
	I prefer not to declare	5	0.90
Are you avoiding intraoral x-ray procedures?	No	257	44.50
	Yes	267	46.20
	I'm not attending during the pandemic	46	8.00
	I prefer not to declare	8	1.40
Which of the following sources of information do you use most to self-inform about COVID-19 and dental care during this period?	I do not access information	2	0.30
	Social Media/Internet	130	22.50
	Television	13	2.20
	Official sources (WHO /FDC)	356	61.60
	University websites, Research centers or Scientific literature	74	12.80
	I prefer not to declare	3	0.50
Do you routinely follow all measures recommended by the WHO /FDC for dental care during the COVID-19 pandemic?	No	178	30.80
	Yes	400	69.20

N = Absolute Frequency. % = Percentage.

Table 3  
Association between risk group x dental practice x level of anxiety. N= 578

Variable	Category	Are you part of the risk group for COVID-19?		p-value	OR (CI 95%)
		No	Yes		
Suspension of elective care after declaration by WHO/FDC	Not doing any kind of care	34 (61.80%)	21 (38.20%)	0.023	2.03 (1.10–3.74)
	Continued attending normally	195 (79.90%)	49 (20.10%)	0.375	–
	Making only emergency calls	214 (76.70%)	65 (23.30%)	–	1
Impact on professional activity resulting from the COVID-19 pandemic	There was no negative impact	93 (83.00%)	19 (17.00%)	0.082	–
	There was a negative impact	350 (75.10%)	116 (24.90%)		
Concern about professional future	No	78 (78.00%)	22 (22.00%)	0.796	–
	Yes	365 (76.40%)	113 (23.60%)		
Fear of COVID-19 infection while working	No	82 (78.80%)	22 (21.20%)	0.610	–
	Yes	361 (76.20%)	113 (23.80%)		
Prepared to assist patients during the COVID-19 outbreak	No	60 (68.20%)	28 (31.80%)	0.042	1.67 (1.01–2.74)
	Yes	383 (78.20%)	107 (21.80%)		
GAD-7 test	Minimal anxiety	103 (75.20%)	34 (24.80%)	0.974	–
	Mild anxiety	139 (76.80%)	42 (23.20%)		
	Moderate anxiety	83 (77.60%)	24 (22.40%)		
	Severe anxiety	118 (77.10%)	35 (22.90%)		

Pearson’s Chi-Square Test. OR = Odds Ratio. 95% CI = 95% Confidence Interval. Significance level = 5%.

Table 4  
Variables that are associated with an increased level of anxiety among dentists during a pandemic. N= 578

Independent variable	B	CI 95% (B)		p-value	PR	CI 95% (RP)	
		Inf.	Sup.			Inf.	Sup.
Female	0.144	0.024	0.265	0.019	1.155	1.024	1.303
Male					Ref.		
South region	0.241	–0.003	0.485	0.053	1.273	0.997	1.624
Southeast region	0.316	0.087	0.545	0.007	1.372	1.091	1.725
Midwest region	0.250	–0.016	0.516	0.066	1.284	0.984	1.675
Northeast Region	0.184	–0.053	0.421	0.129	1.202	0.948	1.524
North region					Ref.		
Graduate = Yes	–0.082	–0.205	0.041	0.193	0.921	0.815	1.042
Graduate = No					Ref.		
Risk Group = Yes	0.088	–0.028	0.205	0.136	1.092	0.973	1.227
Risk Group = No					Ref.		
Fear of COVID-19 infection = Yes	0.204	0.019	0.389	0.031	1.226	1.019	1.476
Fear of COVID-19 infection = No					Ref.		
Future professional concern = Yes	0.620	0.448	0.793	<0.001	1.860	1.565	2.210
Future professional concern = No					Ref.		
Age	–0.010	–0.016	–0.005	<0.001	0.990	0.985	0.995

B = Poisson’s Multiple Regression Coefficient; 95% CI (B) = 95% Confidence Interval for Multiple Poisson Regression; PR = Prevalence Ratio; 95% CI (PR) = 95% Confidence Interval of the Prevalence Ratio; Significance level = 5%.

Table 5  
Variables that are associated with increased concern for the professional future of dentists. N= 578

Independent variable	B	S.E.	p-value	OR	CI 95% (OR)	
					Inf.	Sup.
Gender – Female	0.466	0.263	0.076	1.593	0.952	2.666
Age	–0.015	0.012	0.196	0.985	0.962	1.008
Region (North)				Ref.		
Region (NE)	1.471	0.541	0.007	4.353	1.509	12.561
Region (Central-West)	0.871	0.616	0.157	2.390	0.715	7.990
Region (SE)	1.212	0.497	0.015	3.360	1.268	8.905
Region (S)	0.698	0.541	0.197	2.009	0.695	5.805
Graduate (Yes)	–1.889	0.638	0.003	0.151	0.043	0.528
Fear of COVID-19 infection (Yes)	1.071	0.292	<0.001	2.919	1.646	5.176

B = Multiple Logistic Regression Coefficient; S.E. = Standard Error; OR = Odds Ratio; 95% CI (OR) = 95% Confidence Interval of Odds Ratio; Significance level = 5%.

pend care during the pandemic. As predicted, we observed that dentists who are part of the increased risk group present a greater possibility of not attending at all (OR=2.03; CI 95%: 1.10–3.74) and feeling less prepared to attend (OR=1.67; 95% CI: 1.01–2.74) than dentists who are not at increased risk. Individuals with chronic diseases are more susceptible if infected by COVID-19, and face greater odds of hospitalization, of undergoing intensive treatment, and of suffering the worst prognosis of the disease [14, 26].

It was also expected that levels of anxiety would be higher in dentists who are at increased risk, but there was no relationship between these variables. This might be explained by the uncertainty and insecurity of the unknown that the pandemic has generated, being (for all) an unexpected event. The variables associated with increased anxiety in the present study were being female, being younger, working in southeastern Brazil, being afraid of contracting COVID-19 while working, and being concerned about one's professional future. The literature shows that a psychological reaction to epidemics and pandemics depends on one's individual vulnerability [27]. The extent of any psychological symptoms will thus be directly influenced by age, sex, type of professional activity, and the proximity of patients carrying COVID-19 [28].

Age is an important sociodemographic variable, younger individuals tend to develop symptoms more easily such as anxiety and depression [29, 30]. Older people end up building resilience due to exposure to multiple and different stresses over time, which yields better emotional management [29]. In this study, the age factor (younger dentists) was associated with the anxiety factor ( $p < 0.001$ ), corroborating previous studies [29, 30]. The average age of the participants was 35, and severe anxiety was observed in 26.5% of the participants. This percentage is high compared to a study by Consolo et al. [11], which applied the GAD-7 assess to Italian dentists. Most participants were between 35 and 55 years old, and only 8.7% of the respondents presented severe anxiety as per the GAD-7 scale [11].

In this study, the variable for female sex was a factor that triggered increases in both the level of anxiety and in concern for the professional's future. Previous studies have shown that anxiety disorders and depressive disorders occur more frequently in females [31], and it has already been observed that the psychiatric impact of the COVID-19 pandemic has been greater in women [32]. Anxiety disorders

can be found at levels three times higher in women than in men [33]. Studies show that with the closing of schools and daycare centers, and the need for social distance during the pandemic, many women have now been overwhelmed with domestic activities and with the education of their children [34], to suffer serious difficulties in reconciling and fulfilling their tasks and professional responsibilities in the face of this new reality [35]. Also, periods of hormonal variations in women (puberty, pregnancy and perimenopause) seem to be a major risk factor to develop diseases related to stress, such as anxiety and depression [36].

It was also verified in this study that working in southeastern Brazil was associated with an increase in anxiety levels, and with participant concerns for their professional futures. When assessing the distribution of dentists in Brazil, we noted a greater concentration in the Southeast, with approximately three times more dentists than recommended by WHO and saturating the labor market in the region [37]. It is also important to note that although all regions of the country present cases of COVID-19, the regions most affected are the North, Northeast, and Southeast [38]. In the state of São Paulo, the largest numbers of cases of the disease are concentrated, with a lethality rate of 6.8% [39].

In dental offices, the need to suspend all elective appointments and maintain only urgent and emergency appointments was reflected in dentists' increased concern with the economic implications that this could cause [13, 40, 41]. Concern with the professional's future was seen in 84% of the dentists who participated in the present study, with no difference between belonging or not to the increased risk group, since fear and financial insecurity occur in all professionals who work in a private clinic. The vast majority (80.60%) of dentists in this study claim to have suffered a negative impact on their professional activity. It was observed that 11.25% of dentists are not providing any type of care and 46.54% are only providing emergency care, which implies a significant monetary impact [40]. In addition, not knowing when the emergency will end (36%) and not knowing whether patients will be able to afford treatments after the end of the pandemic (33%), are the main factors of distress for dentists. The study by Schwendicke et al. [41] that assessed the economic impact of mitigation/suppression policies against COVID-19 on dental practices in Germany demonstrated a profound economic effect on dental practices, and that the longer these measures are extended, the more they affect the economic capacity of dental offices. Also,

Ferneini et al. [42] warns that the monetary impact caused by the pandemic on dental practices (in the short and long term), affects both experienced and novice professionals, it prevents them from continuing to see their patients, or even forces them to closing their office.

Dental offices are gradually resuming elective care and it is essential that all biosafety recommendations made by the WHO [43] and the FDC [44] be followed to guarantee a safe environment and with the minimum possible risk for cross-infection between dentists and patients [8]. In Jordan, it was observed that though most dentists were aware of the new protocols, few adhered to the new measures during dental care [21]. In the present study, 69.2% of dentists routinely followed the new biosafety measures and many (85.9%) continued afraid of being infected by COVID-19 while working. This result should be evaluated with caution, since only two answer options were offered to participants, yes or no, and including the increased risk group may have resulted in an increase in negative responses. And so, the fear of becoming infected is consistent with the lower adoption of biosafety measures. Yet, it is necessary to improve the rates of adherence to the new biosafety measures recommended by the WHO and the CFO by dentists, to protect themselves during visits and allow them to safely resume their activities.

Dentists' adherence to the new biosafety standards was best for routine personal protective equipment (PPE) and for office surface disinfection procedures. The neglect of important criteria was observed, such as an adequate verification of the patient's health status and minimizing the production of aerosol and the dispersion of droplets during the dental procedure. Khader et al. [21], warn in their work about the existence of divergences between dental clinics, where many lack even minimal infection control requirements and thus charge low dental fees to the patient. Cavalcanti et al. [16] report that changes in biosafety protocols result in a significant increase in the costs of dental consultations in Brazil, and lower financial returns to the clinic. Excessive increases in materials costs, of PPE, and disinfection products, together with the already existing inequalities between offices, may make it difficult for dentists to adhere to the new biosafety protocols.

The impact caused by the COVID-19 pandemic on general dental practice is related to the emotional upheaval felt by the dental surgeons and presented in this research. This, regardless of whether the professionals belonged to the increased risk group. The fear

and insecurity that dentists have of becoming infected while working can be minimized if they correctly follow all WHO and FDC recommendations. It is necessary that mechanisms and strategies are adopted to deal with the existing anxiety of the individual professional, restoring calm and safety to each person. This highlights the importance of mental health care in times of pandemics.

The exclusive use of GAD-7 scale can be pointed out as a limitation of the present study, as it does not consider other problems that may influence the dentist's anxiety levels. Further, the potential risk of self-selection and approaching the participants through social media, online forums, and messaging applications, may well be considered another limitation of this study, though considering the current pandemic situation, it has been an especially useful resource for research data collection. Further, when the pandemic is over, the impossibility of long-term participant monitoring limits assessment of emotional and financial impact on these dentists, and points to the need for further studies to address these variables.

#### 4. Conclusions

The present study demonstrated that professionals belonging to the increased risk group presented a greater chance of not feeling prepared to attend, and of not performing procedures during the pandemic. Increased anxiety levels for these professionals were influenced by being female, being younger, working in the southeastern region of the country, being afraid of contracting COVID-19 while working, and being concerned about one's professional future. However, anxiety levels had no significant effect on dentists in the increased risk group for COVID-19.

#### Conflict of interest

The authors declare that they have no conflict of interest.

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## Supplementary materials

The appendices are available from <https://dx.doi.org/10.3233/WOR-211035>.

## References

- [1] Mahase E. China coronavirus: WHO declares international emergency as death toll exceeds 200. *BMJ*. 2020;31:368:m408. <http://dx.doi.org/10.1136/bmj.m408>
- [2] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020;323(11):1061-9. <https://dx.doi.org/10.1001/jama.2020.1585>
- [3] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497-506. [https://dx.doi.org/10.1016/s0140-6736\(20\)30183-5](https://dx.doi.org/10.1016/s0140-6736(20)30183-5)
- [4] Chan JFM, Yuan S, Kok KH, Para KKW, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: A study of a family cluster. *Lancet*. 2020;395(10223):514-23. [https://doi.org/10.1016/S0140-6736\(20\)30154-9](https://doi.org/10.1016/S0140-6736(20)30154-9)
- [5] Liu T, Hu J, Kang M, Lin L, Zhong H, Xiao J, et al. Transmission dynamics of 2019 novel coronavirus (2019-nCoV). *Lancet*. 2020:51. <https://dx.doi.org/10.1101/2020.01.25.919787>
- [6] Meng L, Hua F, Bian Z. Coronavirus disease 2019 (COVID-19): Emerging and future challenges for dental and oral medicine. *J Dent Res*. 2020;99(5):481-7. <https://dx.doi.org/10.1177/0022034520914246>
- [7] Peng X, Xu X, Li Y, Cheng L, X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci*. 2020;12(1):1-6. <https://dx.doi.org/10.1038/s41368-020-0075-9>
- [8] Izzetti R, Nisi M, Gabriele M, Graziani F. COVID-19 transmission in dental practice: Brief review of preventive measures in Italy. *J Dent Res*. 2020;99(9):1030-8. <https://dx.doi.org/10.1177/0022034520920580>
- [9] Kamate SK, Sharma S, Thakar S, Srivastava D, Sengupta K, Hadi A, et al. Assessing knowledge, attitudes and practices of dental practitioners regarding the COVID-19 pandemic: A multinational study. *Dent Med Probl*. 2020;57 (1):11-7. <https://dx.doi.org/10.17219/dmp/119743>
- [10] Jamal M, Shah M, Almarzooqi Sh, Aber H, Khawaja S, El Abed R, Alkhatib Z, Samaranyake LP. Overview of transnational recommendations for COVID-19 transmission control in dental care settings. *Oral Dis*. 2021;27(3):655-64. <https://dx.doi.org/10.1111/odi.13431>
- [11] Consolo U, Bellini P, Bencivenni D, Iani C, Checchi V. Epidemiological aspects and psychological reactions to COVID-19 of dental practitioners in the northern Italy districts of Modena and Reggio Emilia. *Int J Env Res Public Health*. 2020;17(10):3459-76. <https://dx.doi.org/10.3390/ijerph17103459>
- [12] Ng K, Poon BH, Puar THK, Quah JLS, Loh WJ, Wong YJ, et al. COVID-19 and the risk to health care workers: A case report. *Ann Intern Med*. 2020;172(11):766-7. <https://dx.doi.org/10.7326/L20-0175>
- [13] 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 Env Res Public Health*. 2020;17(8):2821-32. <https://dx.doi.org/10.3390/ijerph17082821>
- [14] Shacham M, Hamama-Raz Y, Kolerman R, Mijiritsky O, Ben-Ezra M, Mijiritsky E. COVID-19 factors and psychological factors associated with elevated psychological distress among dentists and dental hygienists in Israel. *International Int J Env Res Public Health*. 2020;17(8):1-7. <https://dx.doi.org/10.3390/ijerph17082900>
- [15] Farooq I, Ali S. COVID-19 outbreak and its monetary implications for dental practices, hospitals and healthcare workers. *Postgrad Med J*. 2020;96:791-2. <https://dx.doi.org/10.1136/postgradmedj-2020-137781>
- [16] Cavalcanti YW, Silva RO, Ferreira LF, Lucena EHG, Souza AMLB, Cavalcante DFB, et al. Economic impact of new biosafety recommendations for dental clinical practice during COVID-19 pandemic. *Pesqui Bras Odontopediatria Clín Integr*. 2020;20:1-9. <https://doi.org/10.1590/pboci.2020.143>
- [17] World Health Organization, WHO Coronavirus Disease (COVID-19) Dashboard, World Health Organization. [Accessed 2020 Dez 23]. Available from: <https://covid19.who.int/table>
- [18] Morita MC, Haddad AE, Araújo ME. Perfil atual e tendências do cirurgião-dentista brasileiro. Maringá: Dental Press; 2010, p. 98.
- [19] World Medical Association. Ethical principles for medical research involving human subjects. 59th WMA General Assembly, Seoul, October 2008. [Accessed 2020 Oct 18]. Available from: <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/doh-oct2008/>
- [20] Luiz RR, Magnanini MMF. A lógica da determinação do tamanho da amostra em investigações epidemiológicas. *Cad Saúde Coletiva*. 2000;8(2):9-28.
- [21] Khader Y, Nsour MA, Al-Batayneh OB, Saadeh R, Bashier H, Alfagih M, et al. Dentists' awareness, perception, and attitude regarding COVID-19 and infection control: Cross-sectional study among Jordanian dentists. *JMIR Public Health Surveill*. 2020;6(2):e18798. <https://dx.doi.org/10.2196/18798>
- [22] Moreno AL, Desousa DA, Souza AMFLP, Manfro GG, Salum GA, Koller SH, et al. Factor structure, reliability, and item parameters of the Brazilian-Portuguese version of the GAD-7 questionnaire. *Trends Psychol*. 2016;24(1):367-76. <https://dx.doi.org/10.9788/tp2016.1-25>
- [23] Cagetti MG, Cairoli JL, Senna A, Campus G. COVID-19 outbreak in North Italy: An overview on dentistry. A questionnaire survey. *Int J Env Res Public Health*. 2020;17(11):3835-46. <https://dx.doi.org/10.3390/ijerph17113835>
- [24] Vergara-Buenaventura A, Chavez-Tuñon M, Castro-Ruiz C. The mental health consequences of coronavirus disease 2019 pandemic in dentistry. *Disaster Med Public Health Prep*. 2020:1-4. <https://dx.doi.org/10.1017/dmp.2020.190>
- [25] Fazel M, Hoagwood K, Stephan S, Ford T. Mental health interventions in schools in high-income countries. *Lancet Psychiat*. 2014;5(1):377-387. [https://dx.doi.org/10.1016/S2215-0366\(14\)70312-8](https://dx.doi.org/10.1016/S2215-0366(14)70312-8)
- [26] Ornell F, Halpern SC, Kessler FHP, N arvaez JCM. The impact of the COVID-19 pandemic on the mental health of

- healthcare professionals. *Cad Saúde Pública*. 2020;36(4):1-6. <https://dx.doi.org/10.1590/0102-311x00063520>
- [27] Taylor S. *The psychology of pandemics: Preparing for the next global outbreak of infectious disease*. Cambridge: Cambridge Scholars Publishing; 2019, p. 161.
- [28] Bohlken J, Schömig F, Lemke Mr, Pumberger M, Riedel-Heller SG. COVID-19 pandemic: Stress experience of healthcare workers - a short current review. *Psychiatr Prax*. 2020;47(4):190-7. <https://dx.doi.org/10.1055/a-1159-5551>
- [29] Solomou I, Constantinidou F. Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: Age and sex matter. *Int J Env Res Public Health*. 2020;17(14):4924. <https://dx.doi.org/10.3390/ijerph17144924>
- [30] Salehiniya H, Abbaszadeh H. Prevalence of corona-associated anxiety and mental health disorder among dentists during the COVID-19 pandemic. *Neuropsychopharmacol Rep*. 2021;41(2):223-9. <https://doi.org/10.1002/npr2.12179>
- [31] Alexander JL, Dennerstein L, Kotz K, Richardson G. Women, anxiety and mood: A review of nomenclature, comorbidity and epidemiology. *Expert Rev Neurother*. 2007;7(11):45-58. <https://doi.org/10.1586/14737175.7.11s.S45>
- [32] Özdin S, Özdin SB. Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: The importance of gender. *Int J Soc Psychiatry*. 2020;66(5):504-11. <https://doi.org/10.1177/0020764020927051>
- [33] Wang Y, Di Y, Ye J, Wei W. Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China. *Psychol Health Med*. 2020;26(1):13-22. <https://doi.org/10.1080/13548506.2020.1746817>
- [34] Alon TM, Doepke M, Olmstead-Rumsey J, Tertilt M. The impact of COVID-19 on gender equality. NBER: Working Paper Series. 2020;n 26947. <https://doi.org/10.3386/w26947>
- [35] Jones Y, Durand V, Morton K, Ottolini M, Shaughnessy E, Spector Nd, et al. Collateral damage: How COVID-19 is adversely impacting women physicians. *J Hosp Med*. 2020;8:507-9. <https://doi.org/10.12788/jhm.3470>
- [36] Hodes GE, Epperson CN. Sex differences in vulnerability and resilience to stress across the life span. *Biol Psychiatry*. 2019;86(6):421-32. <https://doi.org/10.1016/j.biopsych.2019.04.028>
- [37] Martin ASS, Chisini LA, Martelli S, Sartori LRM, Ramos EC; Demarco FF. Distribuição dos cursos de Odontologia e de cirurgões-dentistas no Brasil: Uma visão do mercado de trabalho. *Revista da Abeno*. 2018;18(1):63-73. <https://dx.doi.org/10.30979/rev.abeno.v18i1.399>
- [38] Lobo AP, Cardoso-Dos-Santos AC, Rocha MS, et al. COVID-19 epidemic in Brazil: Where are we? *Int J Infect Dis*. 2020;97:382-5. <https://dx.doi.org/10.1016/j.ijid.2020.06.044>
- [39] Marson FAL, Ortega MM. COVID-19 in Brazil. *Pulmonology*. 2020;26(4):241-4. <https://dx.doi.org/10.1016/j.pulmoe.2020.04.008>
- [40] Ali S, Farooq I, Abdelsalam M, AlHumaid J. Current clinical dental practice guidelines and the financial impact of COVID-19 on dental care providers. *Eur J Dent*. 2020;14(S 01):S140-5. <https://dx.doi.org/10.1055/s-0040-1716307>
- [41] Schwendicke F, Krois J, Gomez J. Impact of SARS-CoV2 (Covid-19) on dental practices: Economic analysis. *J Dent*. 2020;99:103387. <https://dx.doi.org/10.1016/j.jdent.2020.103387>
- [42] Ferneini EM. The financial impact of COVID-19 on our practice. *J Oral Maxillofac Surg*. 2020;78(7):1047-8. <https://dx.doi.org/10.1016/j.joms.2020.03.045>
- [43] World Health Organization (WHO). Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19). Interim guidance - 19 March 2020 [accessed 2020 Abr 30]. Available from: [https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPE\\_use-2020.2-eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPE_use-2020.2-eng.pdf)
- [44] Thomé G, Bernardes SR, Guandalini S, Guimarães es MCV. Manual de boas práticas em biossegurança para ambientes odontológicos. 2020; 41p. Available from: <https://website.cfo.org.br/wp-content/uploads/2020/04/cfo-lanc%CC%A7a-Manual-de-Boas-Pra%CC%8Iticas-em-Biosseguranc%CC%A7a-para-Ambientes-Odontologicos.pdf> (accessed 2020 Abr 30).