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RESEARCH ARTICLE

COVID-19 Pandemic Driven Knowledge, Attitude, Clinical Practice, Distress Reactions, and Post-Traumatic Growth of Dental Care Providers in Riyadh City, Saudi Arabia: A Cross-Sectional Study

Nawaf Labban[1,*], Afnan F. Alfouzan[1], Nouf Al-Shibani[2], Hanan N. Al-Otaibi[1], Sara Mohammad Al Taweel[1], Shahad Hamad Al Ghanem[3] and Stuart M. Schrader[4]

[1]*Department of Prosthetic Dental Sciences, College of Dentistry, King Saud University, Riyadh, Saudi Arabia*
[2]*Department of Periodontics and Community Dentistry, College of Dentistry, King Saud University, Riyadh, Saudi Arabia*
[3]*College of Dentistry, King Saud University, Riyadh, Saudi Arabia*
[4]*Behavioral Sciences, Indiana University School of Dentistry, Department of Biomedical Sciences and Comprehensive Care, Indianapolis, Indiana*

Abstract:

Objective:

The present study aimed to assess knowledge, attitude, clinical practices, distress reactions, and post-traumatic growth of dentists during the COVID-19 pandemic in Riyadh City.

Methodology:

An online questionnaire was developed to assess various dental professionals from both governmental and private sectors during the early COVID-19 outbreak in Riyadh City, Saudi Arabia. The questionnaire was framed to assess the demographic variables, knowledge, attitude, and clinical practices towards handling the COVID-19 pandemic. Furthermore, the general anxiety disorder-7 (GAD-7), worry questionnaire items, short form of post-traumatic growth inventory (PTGI-SF), and life satisfaction questionnaire items were developed to assess the anxiety, worries, post-traumatic growth, and life satisfaction of dental care providers following the traumatic events. Data were analysed using SPSS 22.0 and R environment ver.3.2.2. Continuous measurement results were presented as mean ± SD, and categorical measurements results were presented in number (%).

Results:

Our study's significant findings revealed that a majority of the dentists were in the age group of 21-30 and practiced general dentistry. The study participants in age groups 51–60 and 41–50 years old showed more liability in perceiving COVID-19 as an extremely dangerous disease than 31–40 and 21–30 age groups. The majority of respondents (63.4%) had an anxiety scale score of greater than 40, followed by 22.8% with scores 20-40 and 13.9% with scores less than 20, respectively. The mean scores for the GAD-7 and the worry items were 8.24 ± 3.21 and 13.92 ± 4.77, respectively. The data showed that most survey participants had adopted moderate post-traumatic changes during the pandemic, as evident by their mean score of 34.17 ± 3.40. The life satisfaction of the participants was neutral, as demonstrated by their mean score of 20.16 ± 4.03.

Conclusion:

This study's findings delineated that the COVID-19 pandemic situation has influenced dentists' mental health, with a moderate level of anxiety, and worries among other psychological symptoms. Furthermore, there was adequate knowledge regarding the COVID-19 among dentists; however, the pandemic affected the financial conditions of the respondents. There was a moderate level of post-traumatic growth and neutral life satisfaction of the dental providers.

Keywords: COVID-19, Pandemic, Dentists, Anxiety, Fear, Dental care.

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1. INTRODUCTION

The outbreak of pneumonia in late 2019 in Wuhan, China, reported by the Chinese Centre for Disease Control and Prevention, was caused by the Novel Coronavirus (2019-nCoV/SARS-CoV-2) [1, 2]. The coronavirus disease (COVID-19) compared to severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV) [1] was observed to be a highly contagious human-to-human transmission disease with

* Address correspondence to this author at the Department of Prosthetic Dental Sciences, College of Dentistry, King Saud University, P. O. Box 60169, Riyadh 11545, Saudi Arabia; Tel: +966114677325; E-mail: nalabban@ksu.edu.sa

significant numbers of deaths worldwide.

Initially, there were no approved antiviral medications or government-approved treatments available for COVID-19. Therefore, the only intervention for healthcare workers was to provide supportive care and promote and advocate for preventive measures to avoid the spread of the infection [3]. The guidelines outlining these preventive measures are a must during a pandemic to limit the nosocomial COVID-19 transmission [4, 5] and prevent the risk of further outbreaks from recurring [6]. The most widely distributed and followed preventive guidelines and precautions for the COVID-19 crisis are issued by the World Health Organization (WHO) and/or the US Centre for Disease Control and Prevention (CDC) [3].

On January 30th, 2020, the WHO reclassified COVID-19 from an epidemic to a pandemic due to its extensive global outbreak [7]. WHO also recorded 5,33,416 laboratory-confirmed cases, 24,110 deaths, and 1,23,268 retrievals by April 2020 [8], and as of November 2020, there had been approximately 46 million confirmed worldwide cases and 1.2 million deaths [9].

Like all other nations, Saudi Arabia was also engaged in the fight against this pandemic well before the first COVID-19 case was reported on March 2nd, 2020 [8]. Before the first reported case in February 2020, the Saudi Arabia Ministry of Health (MOH) issued general health guidelines for combating the COVID-19 pandemic [10]. Following the first confirmed case, the country went beyond recommending personal preventative health measures to also adopting workplace and school suspension measures and restricted outdoor activities.

Later in July 2002, the Eastern Mediterranean began to report its highest number of confirmed cases [11, 12]. By November 2020, the cumulative number of cases reported in Saudi Arabia was 347,282, with 5402 mortalities [8, 10]. COVID-19 is the second COVID virus outbreak in Saudi Arabia after the early MERS-CoV that affected the Middle East region in 2012 [13].

During the early days of the pandemic, recommendations were also made to restrict health and dental services. For example, on March 16th, 2020, the American Dental Association (ADA) recommended that dentists and dental schools only provide emergency dental treatment and suspend, at the time, all other regular and non-emergency dental treatments [14].

Also, during March 2020 in Saudi Arabia, medical and dental treatment were both confined to emergency care [15]. The MOH in June 2020 published practical guidelines for restricting dental care to include only emergency dental procedures [15]. These guidelines were then updated in October 2020 to provide guidelines for all dental procedures to highlight a variety of important infection control measures and recommendations for clinical practices during a pandemic [16].

Global dental staff, which includes dentists and dental auxiliaries, were crucial in increasing the public's awareness and understanding about COVID-19 (For *e.g.*, dental staff was involved in providing information regarding the importance of wearing a mask and handwashing, maintaining social distancing, and what patients should do if they have any signs and symptoms of COVID-19). Accordingly, in order to provide up-to-date, evidence-based, and scientifically accurate information regarding COVID-19, dental providers need to be well-informed or educated about the COVID-19 situations to provide it to their staff, colleagues, patients, and their families and throughout the community. Dental providers globally also more than likely required a constructive attitude concerning infection control measures in order to begin addressing the complex issues of how they would explain to staff and patients about what treatments were allowable and what new protocols were needed to enhance everyone's safety in relation to the severity of the disease. Although dental staff in Saudi Arabia have demonstrated a positive attitude during the earlier COVID outbreak, there continues to be a general lack of awareness and attitude among dental professionals about "transmission-based precautions," which necessitates additional training [17]. Hence, in part, the present study was designed to assess dentists' knowledge, attitudes, and clinical practices during the early onset of the COVID-19 pandemic. Furthermore, traumatic incidents related to COVID could have a lot of negative physical and psychological effects on the dental staff. The likelihood of positive growth following traumatic experiences needs evaluation [18]. Therefore, it is also important to explore the well-being of dental providers during this traumatic event which includes their levels of distress and possible positive traumatic growth to the pandemic situation. Therefore, this study deals with the knowledge, attitudes, dental practices, distress reactions, and post-traumatic growth of Saudi Arabia's dental health care providers during the COVID-19 pandemic.

2. MATERIALS AND METHODS

2.1. Study Design and Protocol

The present research was a cross-sectional study conducted during July-August 2020 using a non-probability sampling method. The institutional review board exempted the study from obtaining ethical approval since there was no treatment involved. An online link was created to conduct an anonymous Google form survey which included instructions for participation, a brief contextual introduction, and the study's aim. Participation was voluntary, non-name linked, and all appropriate levels of confidentiality were maintained. The online survey link was circulated to dentists in Saudi Arabia irrespective of their nationality or workplace (government or private) through an email address registered with the licensing authority of the Saudi Council for Health Specialties.

The following demographic and general details were obtained from all participants: consent to participate in the study, gender, age – four age groups were defined as follows: 21-30 years, 31-40years, 41-50 years, and 51-60 years, marital status (single, with a spouse but no children, with spouse and children, with children but no spouse, with a roommate, single), children less than 12 years, present illness related to cardiovascular diseases, respiratory conditions, immune-suppression conditions and age over 65 years, profession type (dentists, dental specialists, dental hygienist, dental assistants), number of years in practice, and current work situation.

2.2. Questionnaire Design and Development

The majority of the questionnaire was developed by the Tel Aviv University School of Dental Medicine and Dr.Nir Uziel, the Head, Unit of Medical Education and Behavioural Sciences, grounded in the literature related to KAP, distress, and PTG [19, 20]. The survey was then modified by Stuart Schrader at the Indiana University School of Dentistry to include various pre-validated sub-scales to examine the dental providers' well-being.

The questionnaire had knowledge, attitude, practice, distress, and PTG set of five sections in the English language as detailed below:

(1) The knowledge (K) section consisted of questions related to risk factors for contracting COVID-19 infection, knowledge regarding positive people, and how information was obtained through media and various governmental or other organizational authorities.

(2) Attitude (A) section comprised questions related to health providers' interest in volunteering in an organization related to helping those with COVID and dentist concerns about treating patients during the pandemic and its influence on dentist-patient relationships.

(3) Practice (P) section questions were related to the financial impact and COVID-19 related information from the professional organization and dentist-patient interactions during the coronavirus pandemic.

(4) The distress section had three subsets, namely anxiety level, general anxiety disorder (GAD), and participants' concerns and state of worry. Anxiety level was assessed on a scale of 0 (no anxiety) to 100 (high anxiety); GAD was evaluated using the seven questions (*e.g.*, feeling nervous, anxious, or on edge, not being able to stop or control worrying, worrying too much about different things, *etc*.,) measurement tool that measures the generalized anxiety (panic, social anxiety, and post-traumatic stress disorder), on a 5-point scale, from 0 (not at all) to 4 (several days) [21]. The total score can be 0 to 28, with a higher score interpreting the severity of anxiety. The participants' concerns and state of worry (*e.g.*, worried about finances, physical and mental health, relationship with family and friends, *etc*.) were assessed using a modified eight questions measurement tool rated on a 5-point Likert scale from 0 (A little worried) to 4 (Not at all worried) [22]. The total score can be 0 to 32, with a higher score interpreting the severity of worries.

(5) Post-traumatic growth (PTG) was assessed using a validated 10-item questionnaire to record the responses related to others, new possibilities, personal strength, spiritual change, and appreciation of life [23, 24]. This questionnaire was a shorter form (PTG-SF) of the original 21-item scale developed by Tedeschi and Calhoun (1996) [18]. Respondents were asked to rate their confidence about positive self-related changes relative to their distress during the height of the COVID-19 pandemic on a 7-point scale, from 0 (no change at all) to 6 (to a very great degree of change). The total scale ranges from 0 to 60. The life Satisfaction scale was evaluated using a modified version of Diener's 5-item questionnaire. Respondents were asked to rate their life satisfaction during the pandemic on an 8-point scale, from 0 (nil) to 7 (Strongly disagree). The total score is 0-35, with a score of 20 indicating a neutral point on the scale. Scores between 5-9 indicate that the participant is extremely dissatisfied with life, whereas scores between 31-35 indicate that the participant is extremely satisfied [25, 26].

2.3. Face Validity and Reliability of the Questionnaire

The modified questionnaire by Schrader was further adopted and translated individually into Arabic language version by three professors who were fluent in both English and Arabic languages at the Department of Community Dentistry, College of Dentistry, King Saud University. The three translations were compared and edited accordingly to obtain a final draft. Subsequently, the final draft was translated back into the Arabic language by a translator who was fluent in both Arabic and English language. The two translated versions were compared and evaluated by one professor, and a few minor changes were performed to the final Arabic version. The face validity of the questionnaires was calculated using Cohen's Kappa Index and a Kappa (κ) of > 0.8 material validity ratio (CVR) was found that indicated good agreement.

The questionnaires were pilot tested to assess the reliability of the final drafted questions. For the same purpose, the questionnaires were distributed to 25 dentists in different regions of Riyadh city to include a heterogeneous sample. The sample dentists had no problems with the questions, and the survey was completed on an average of 15-20 minutes. Reliability was assessed using inferential Cronbach Alpha analysis that showed a value of 0.8, indicating good reliability. Similarly, reliability was evaluated for the measurement tools (GAD, PTG, and Life satisfaction scale) (Cronbach's α coefficient 0.90, 0.85, and 0.89, respectively). The data obtained from the pilot study was not included in the final analysis.

2.4. Sample Size Calculation

A priori sample size calculation was applied to determine the minimum sample required for the survey. For the population size of 400, confidence interval of 95%, and error margin of 5%, a minimum of 197 participants were required. However, 202 participants obliged and participated in the study.

2.5. Statistical Analysis

The statistical software of SPSS 22.0 and R environment ver.3.2.2 was used for data analyses. Descriptive and inferential statistical analysis was conducted such that frequencies and means were calculated for all items. Continuous measurement results are presented as means ± SD, and categorical measurements results are presented as percentages (%).

3. RESULTS

3.1. Demographic Details and Other Information

The survey was sent to 400 dental providers but received a response from 202 participants. The majority of the participants were in the age group of 21-30 years (49.5%),

followed by 31-40 years (30.2%), 41-50 years (13.9%), and 51-60 years (6.4%). The difference in the number of participants from different age groups was found to be statistically significant (P<0.001). In this study, the response from the female providers (71.3%) was more compared to male participants (28.7%), and this difference between the gender was statistically significant (P=0.012). The majority of the participants were single (52.5%), followed by married (45.5%) and divorced (2%). Around 43.1% reported living with parents, 36.6% were living with spouse and children, 7.4% were living with a roommate or sharing housing with others, and 6.4% were living with spouses without children. Among the participants, 48% did not have children, 35.1% had 1-2 children, and 11.9% had more than two children. About 14.4% reported as being over 65 years or as having at least one of the following health risk factors: diabetes, cardiovascular diseases, respiratory problems, or immune-suppressive diseases. The majority of the participants (30.7%) were practising general dentistry, and most dentists (63.4%) had less than ten years of experience (Table **1**).

3.2. Knowledge

Table **2** presents the participants' responses regarding the pandemic information acquired from the professional organisation and other electronic sources. Most dentists (64.4% and 77.2%) felt that they received significantly useful information, advice, and recommendations from the Saudi Commission for Health Specialties (SCFHS) (64.4%) and other professional healthcare/dental organizations (77.2%) regarding how best to provide necessary dental treatment. Similarly, 60.4% of the participants felt that they received a lot of information significantly from TV, social media, radio, and internet sources regarding the COVID-19.

Table 1. Demographic details and other information.

Demographic Variables	(N=202)	*P*-Value
Age		<0.001*
• 21-30	100 (49.5%)	
• 31-40	61 (30.2%)	
• 41-50	28 (13.9%)	
• 51-60	13 (6.4%)	
Gender		0.012*
• Female	144 (71.3%)	
• Male	58 (28.7%)	
Marital status		0.004*
• Divorced	4 (2%)	
• Married	92 (45.5%)	
• Single	106 (52.5%)	
Who are you currently living with?		0.425
▪ Living with parents	87 (43.1%)	
• Living with spouse and children	74 (36.6%)	
• Living with a roommate	15 (7.4%)	
• Living with a spouse without children	13 (6.4%)	
• Living alone	7 (3.5%)	
• Living with children without a partner	6 (3%)	
How many children below the age of 12 years old are living with you?		0.032*
▪ 0	97 (48%)	
▪ 1-2	71 (35.1%)	
▪ > 2	24 (11.9%)	
Do you have diabetes, cardio-vascular disease, respiratory problems, immune-suppressive disease, or over the age of 65 years?		<0.001*
▪ No	173 (85.6%)	
▪ Yes	29 (14.4%)	
Indicate the number of years you have worked as a dental provider		<0.001*
▪ <10	128 (63.4%)	
▪ 10-20	57 (28.2%)	
▪ >20	17 (8.4%)	

*Significant difference between responses (P ≤ 0.05).

Table 2. Participants' responses regarding the information (knowledge) obtained during the pandemic.

Questionnaire Item	N=202
K1. Do you believe the MOH, Saudi Commission for Health Specialties (SCFHS) has provided you with sufficient information, advice, and recommendations so that you can provide necessary dental treatment?	
▪ No	72 (35.6%)
▪ Yes	130 (64.4%)
K2. Do you believe that professional healthcare/dental organizations has provided you with sufficient information, advice, and recommendations so that you can provide necessary dental treatment?	
▪ No	46 (22.8%)
▪ Yes	156 (77.2%)
K3. How much information through professional webinars helping you to handle this crisis?	
▪ A little	34 (16.8%)
▪ A lot	79 (39.1%)
▪ A whole lot	12 (5.9%)
▪ Somewhat	62 (30.7%)
▪ Not at all	15 (7.4%)
K4. To what extent do you receive news about the pandemic from sources such as TV, social media, radio, and internet?	
▪ A little	18 (8.9%)
▪ A lot	88 (43.6%)
▪ A whole lot	36 (17.8%)
▪ Somewhat	54 (26.7%)
▪ Not at all	6 (3%)

3.3. Attitude

Most of the study participants (54.5%) felt they were not at risk for getting coronavirus, while 45.5% felt they were at increased risk for getting the infection. The participants (37.1%) felt that some people with flu symptoms should be tested for coronavirus, whereas an equal number of participants (9.4%) felt that most and all patients, respectively, should be subjected to coronavirus testing if they had flu symptoms. Among the dental health providers, 29.2% of them had assisted COVID-19 positive patients. Around 39% of the dental providers considered volunteering in any organization that treats COVID-19 patients while 60% reported being wary or hesitant about volunteering. On the contrary, more than 50% of the participants were already involved in various volunteering organizations (Table **3**).

Table 3. Participants' attitudes during the pandemic.

Questionnaire Item	N=202
A1. Do you feel you are at an increased risk of getting coronavirus?	
▪ No	110 (54.5%)
▪ Yes	92 (44.5%)
A2. Should people without flu symptoms be tested for coronavirus?	
▪ None	54 (26.7%)
▪ A few	35 (17.3%)
▪ Some	75 (37.1%)
▪ Most	19 (9.4%)
▪ All	19 (9.4%)
A3. Have you helped or assisted in any way, anyone with a positive test?	
▪ No	143 (70.8%)
▪ Yes	59 (29.2%)
A4. Do you consider that you should, or would like to volunteer in an organization that treats COVID-19 patients?	
▪ A little	48 (23.8%)
▪ A lot	15 (7.4%)
▪ A whole lot	16 (7.9%)
▪ Somewhat	67 (33.2%)
▪ Not at all	56 (27.7%)
A5. How much are you currently involved in various volunteering organizations?	
▪ A little	42 (20.8%)

(Table 3) contd.....

Questionnaire Item	N=202
▪ A lot	15 (7.4%)
▪ A whole lot	4 (2%)
▪ Somewhat	43 (21.3%)
▪ Not at all	98 (48.5%)

It was evident that 61% of dental health providers were practicing as usual during the coronavirus pandemic. However, only 28.9% of the participants received their salary or monetary compensation during the pandemic from providing dental services. Additionally, finances were significantly impacted overall in that about 20% of participants' spouse/partner's employment was affected by a reduction in financial resources. Most of the participants (59%) trusted that the authorities handled the crisis properly (Table **4**).

Table **5** presents the dentist-patient interaction and participants' concern about treating patients (a subset of practice) during the pandemic. More than 50% of the participants have treated their patients since the beginning of the pandemic. Additionally, around 65% and 57% of dentists had provided patient care through messages and telephonic calls, respectively. The data also showed that providing dental care and support through video conferencing was practised by less than 20% of the dentist. The majority of dental providers were willing to treat patients (44.1%), and most of them were also reported being committed to taking care of their patients (47%). As to be expected, more than 50% also reported being afraid or reluctant to treat patients. Additionally, more than 50% of the dentists were concerned about not treating the patients in the personal way they did before. While more than 50% of the dentist still claimed they had personal contact with their patients.

Table 4. Participants' responses regarding their clinical practices during the pandemic.

Questionnaire Item	N=202
P1. What best describes your current work situation?	
▪ I do not practice at the moment	28 (13.9%)
▪ I provide only emergency treatment	51 (25.2%)
▪ I work almost as usual	123 (60.9%)
P2. During the pandemic, have you received a salary or financial compensation that does not involve dental care?	
▪ No	156 (77.2%)
▪ Yes	46 (22.8%)
P3. Was your spouse's \ partner's employment affected by the coronavirus pandemic?	
▪ No	161 (79.7%)
▪ Yes	41 (20.3%)
P4. How much do you trust the authorities to handle this crisis properly?	
▪ A little	17 (8.4%)
▪ A lot	80 (39.6%)
▪ A whole lot	40 (19.8%)
▪ Somewhat	59 (29.2%)
▪ Not at all	6 (3%)

Table 5. Dentist-patient interaction and participants' concerns for treating patients during the pandemic.

Questionnaire Item	N=202
P5. How many patients have you treated since the beginning of the coronavirus pandemic?	
▪ None	38(18.8%)
▪ Below 5	27(13.4%)
▪ 5 - 20	52(25.7%)
▪ 20 - 50	26(12.9%)
▪ More than 50	59(29.2%)
P7. How many patients have you provided help with using text messaging during the current pandemic?	
▪ None	69(34.2%)
▪ Below 5	58(28.7%)
▪ 5 - 20	50(24.8%)
▪ 20 - 50	15(7.4%)
▪ More than 50	10(5%)

(Table 5) contd.....

Questionnaire Item	N=202
▪ None	86(42.6%)
P8. How many patients have you provided help with using a phone during the current pandemic?	
▪ Below 5	53(26.2%)
▪ 5 - 20	37(18.3%)
▪ 20 - 50	15(7.4%)
▪ More than 50	11(5.4%)
▪ None	160(79.2%)
P9. How many patients have you provided help with using video conferencing during the current pandemic?	
▪ Below 5	18(8.9%)
▪ 5 - 20	17(8.4%)
▪ 20 - 50	3(1.5%)
▪ More than 50	4(2%)
P10. To what extent do you feel a commitment to taking care of your patients?	
▪ A little	7(3.5%)
▪ A lot	95(47%)
▪ A whole lot	50(24.8%)
▪ Somewhat	43(21.3%)
▪ Not at all	7(3.5%)
P11. How much are you currently willing to treat your patients?	
▪ A little	9(4.5%)
▪ A lot	89(44.1%)
▪ A whole lot	48(23.8%)
▪ Somewhat	50(24.8%)
▪ Not at all	6(3%)
P12. To what extent are you currently afraid or reluctant to treat your patients?	
▪ A little	55(27.2%)
▪ A lot	32(15.8%)
▪ A whole lot	9(4.5%)
▪ Somewhat	65(32.2%)
▪ Not at all	41(20.3%)
P13. How concerned are you about not being able to treat your patients in the personal way you did before?	
▪ A little	45(22.3%)
▪ A lot	44(21.8%)
▪ A whole lot	16(7.9%)
▪ Somewhat	67(33.2%)
▪ Not at all	30(14.9%)
P 14. How much do you currently feel that you have personal contact with your patients?	
▪ A little	47(23.3%)
▪ A lot	49(24.3%)
▪ A whole lot	10(5%)
▪ Somewhat	76(37.6%)
▪ Not at all	20(9.9%)

3.4. Distress Reactions

In order to measure dentists' levels of distress, they were asked about their anxiety level on a scale of 0 (no anxiety) to 100 (highest amount of anxiety). The majority (63.4%) had a score of greater than 40, followed by 22.8% with scores 20-40 and 13.9% with scores less than 20, respectively. This difference was statistically significant (p=0.130) (Table **6**), and it would suggest that they seem anxious or distressed based on this evaluative measure.

However, when asked about distress over the past several days, most reported (50.5%) being nervous, anxious, or on edge for several days, and 14.4% claimed they were felt the same more than half the days. Their further distress was illustrated in that 47.5% of the dentists could not stop or control worrying for several days, 47% were concerned too much about different things for several days, and 38.1% of the participants were restless for several days. Additionally, 40.6% were easily annoyed or irritable for many days in comparison to participants (30%) who were not irritable at all. About 46.5% of the dentists were also afraid and felt something awful might happen. The dentists' response to worries (evaluative of distress) about the pandemic showed that most of the dentists were worried about their physical well-being (90%), their

financial situations (80%), and mental health (75%). Similarly, a high number of participants responded that they were worried about their relationship with immediate family (80%), with friends (78%), extended family (75%), and with people in society, neighborhoods, or community (75%). Table (**7**) presents the mean scores for the GAD (8.24 ± 3.21) and the worry items (13.92 ± 4.77). This infers that the participants presented with moderate anxiety and worry.

Table 6. Anxiety scores of dental providers during the pandemic.

The Scale of 0 (No Anxiety) to 100 (High Anxiety)	Total
<20	28(13.9%)
20-40	46(22.8%)
>40	128(63.4%)
Total	202(100%)

P=0.130, Statistically significant.

Table 7. Mean scores of distress reactions scales.

	Number of items	Mean ± SD	Minimum	Maximum
General Anxiety Disorder (GAD)	7	8.24 ± 3.21†	0	28
Worry scale	8	13.92 ± 4.77‡	0	32

†-indicates moderate anxiety

‡- The total score ranges between 0 to 32, with a higher score interpreting the severity of worries.

3.5. Post-traumatic growth and life satisfaction

The participants were asked to rate their confidence about positive self-related changes brought about in their life during the coronavirus pandemic. The data showed that most survey participants had adopted moderate positive changes during the pandemic, as evident by their average mean score of 34.17 ± 3.40 (Table **8**). Around 1/4th(26.2%) of participants moderately accepted that they changed their priorities about what is essential in life, and a 1/5th (20.8%) showed a greater appreciation for the value of their life because of the crisis. Similarly, 20.8% had a better understanding of spiritual matters, 18.3% experienced moderate to greater faith in religion, and 22.8% experienced a greater sense of closeness with others. Furthermore, 18.3% felt stronger than they thought, 21.3% established a new path for their lives, and 29.2% knew they could better handle difficulties.

About 1/4th of all dentists also reported being presently satisfied with varying aspects of life. For example, 27.7% somewhat agreed that their current living conditions are excellent, 23.8% somewhat agreed that their lives are currently close to ideal in most ways, and 23.8% reported they are currently satisfied with life and decided that they had got the important things in life. In comparison, 19.3% neither agreed nor disagreed that if they could live their life over, they would change almost nothing, which was statistically significant. Overall, the life satisfaction of the participants was neutral, as demonstrated by their average mean score of 20.16 ± 4.03 (Table **8**).

Table 8. Mean scores of the PTG-SF and life satisfaction scale.

-	Number of Items	Mean ± SD
PTGI-SF		
Relating to others	2	6.69 ± 1.05
New possibilities	2	6.23 ± 1.21
Personal strength	2	7.07 ± 1.65
Spiritual change	2	7.21 ± 1.47
Appreciation of life	2	6.97 ± 1.38
Total	**10**	**34.17 ± 3.40**†
Life Satisfaction	7	20.16 ± 4.03‡

†-The total scale ranges from 0 to 60. The obtained scores indicate moderate positive self-related changes

‡- The total scale ranges from 0-35. The obtained scores indicate the neutral point.

4. DISCUSSION

The current cross-sectional online survey was carried out to assess the knowledge, attitude, clinical practices, perceived distress, and positive growth of dentists during the unfolding COVID-19 pandemic in Riyadh city, Saudi Arabia. Knowledge (K), Attitudes (A), and Practices (P) are co-influenced (bi-directionally) by an individual's perceived/reporting of distress (evaluated as anxiety, worry, and concern) and how they positively manage/grow in relation to such distress. This would be a major contribution to literature beyond just dentistry as most articles only focus on KAP or Distress or PTG but not on the proposed bi-directional co-influences.

Demographic details revealed that about 71% % of the study participants were females compared to males (29%). This is consistent with the findings of Al-Khalifa *et al*. [17], where the authors reported more female (52.8%) respondents compared to males (47.2%). However, in the study by Mustafa *et al*. [27], 61% of the respondents were males compared to 39% of female respondents. The majority of the participants were 21-30 years of age (49.5%) and practised general dentistry (55.4%).

4.1. Knowledge

In combatting the novel COVID-19 outbreak, it is always vital for the health care providers to assess their knowledge regarding the pandemic and be updated with the latest information from time to time [28]. This information is usually released from the WHO, government entities (*e.g*., MOH, SCFHS), or professional organisations. During this pandemic, the information obtained from the electronic and print media has been helpful for the dental providers to disseminate the same to the public or their patients.

The respondents in our study stated that they received significantly useful information, advice, and recommendations from the SCFHS and MOH (64.4%) and other professional healthcare/dental organizations (77.2%) regarding how best to provide necessary dental treatment. Similarly, 60.4% of the participants felt that they significantly received a lot of information from TV, social media, radio, and internet sources regarding the COVID-19. This is consistent with the findings of Pasiga *et al*. [29], where the author showed that 51% of the

respondents received the COVID-19 information through online resources. In comparison, Al-Khalifa and colleagues [17] reported that a significantly higher number of the respondents (82%) were updated about COVID-19 through online resources. Furthermore, 88% in the previous study reported being following the MOH guidelines regarding COVID-19.

4.2. Attitude

In our study, 51–59 years-old participants were more likely to perceive COVID-19 as a very dangerous illness than age groups of 31–40 and 41–50 years. These findings are similar to a study conducted in Saudi Arabia by Mustafa *et al*. [27], where they found that participants in age groups ≥60 and 50–59 years old were more likely to perceive COVID-19 as a very dangerous condition compared to 30–39 and 40–49 age groups. This may suggest that older dentists believed COVID-19 was dangerous because they found themselves in a higher risk category for contracting the virus with the possibility of greater severity of complication than younger people [30]. The findings revealed that about 45.5% of the participants felt that they were at higher risk of acquiring COVID-19 and about 14.4% of them were at higher risk of contracting COVID-19 from patients. The feeling of fear among the dental providers was associated with fear of being infected by a patient or coworker, and transmitting the infection to one's family [31 - 34]. In accordance with our study findings, studies have found that dentists had been touted to be at a high risk of exposure with risk of getting infected and in possibly further transmitting it to their patients, families, and colleagues [35, 36].

According to studies, enlisting volunteers to provide complementary services to professional treatment, such as counseling patients and overseeing supplies, is a cost-effective approach for improving patient satisfaction [37]. Furthermore, volunteering has been shown to improve people's views of themselves, enabling them to build trust and self-esteem while also gaining new skills. This can help to transform one's life by encouraging him to think more positively. Dental clinicians in Singapore had volunteered to conduct swab operations. Similarly, dentists and other dental support teams in the UK volunteered in NHS to provide maternal, critical, and emergency care in dental hospitals [38]. The data from the present study demonstrated that around 52% of the dental health providers in Riyadh were involved in various volunteering organizations providing supportive care to COVID-19 patients. On the contrary, 27% of the respondents felt that they would never volunteer in any organization.

In our study, 65.4% of respondents reported a willingness to refer suspicious patients to the hospital without providing dental treatment. Additionally, 85.1% would not allow their dental staff who demonstrate flu-like symptoms to work with patients. Such outcomes can be credited to various conditions. First, the inherent aspects of clinical dental environments lend themselves to droplets and aerosols being produced during dental procedures (*e.g*., from ultrasonic and sonic devices, high-speed headpieces, and air-water syringes), which leads to viral particles moving a long distance and, in turn, being under suspension for several hours in the air, infecting dental assistants and dentists, as well as contaminating surfaces in dental clinics [39]. Also, the close contact between patients and dental workers puts dentists at an exceptionally high risk of getting infected by contagious diseases [39]. Furthermore, it has been shown that strategies for standard infection control, which are regularly implemented during dental care, are not sufficient to prevent the transmission of COVID-19 infections [2]. Advanced precautionary measures have been suggested for treating suspected patients with COVID-19 [30], which are particularly important with asymptomatic or at a latent stage of disease when the virus sheds at a higher rate [40].

4.3. Practices

In the current study, most participants were committed to taking care of the patients, and more than 50% of the participant had treated patients since the beginning of the coronavirus pandemic. Additionally, as such, the majority of study respondents (81%) in the present study reported that they were working almost "as usual". It was significant that 81% of dental health providers were practicing as usual during the coronavirus pandemic even though certain global, US, and/or governmental agencies/organizations strongly recommended at times to suspend procedures other than emergency care. Their continuance may have been due to their feelings of responsibility and duty to their patients. On the contrary, Ahmadi *et al*. [41] reported that 46% of the dentists in Iran had temporarily suspended their work.

A significant number of respondents had financial difficulties caused by their reduced working hours, restricted procedures for dental care. Around 77.2% in our study reported that they did not receive their salary, and dentists had possibly relied on additional revenue as they reported that they received a salary or monetary compensation from non-dental resources. A limited number (22.8%) of them have, however, obtained financial support from public organizations. Consistent with our study findings, Schwendicke *et al*. [42] inferred that dental offices faced financial hardship and reduced revenue up to 20% due to the COVID-19 pandemic in Germany. In Iran, 97% of respondents stated that their financial income had decreased since the pandemic erupted and had spent their savings on their daily expenses [41]. These findings suggest that related dental organizations and policymakers must put more effort into funding dentists and their assistants during unprecedented times [41 - 43].

The Occupational Safety and Health Administration (OSHA) has indicated that for non-emergent cases during the pandemic, remote dental consultations should be considered. The respondents (57%) in our study had provided dental consultation through the phone calls; however, this was significantly low compared to Iranian dentists who had received 93% calls from their patients during the pandemic lockdown [41]. Besides, the creation of programs to provide economic support for professionals and encourage the use of applications or computer programs to facilitate communication via the internet with patients can help reduce the impact on these professionals' mental health, including dentists.

4.4. Distress Reactions

Amidst this tumultuous atmosphere worldwide, dentistry had 'gone into a shell,' and dentists were at times during the height of pandemic slightly to moderately worried and anxious about the ongoing problems [31, 35, 36, 44 - 46]. Feelings of fear, anxiety, and stress have been reported in most studies [2, 32, 34, 47, 48]. Furthermore, earlier studies have shown that dentists are hesitant to treat patients with communicable diseases and, as a result, suffer more psychological discomfort [31, 49, 50]. Previous studies evaluating the General Anxiety Disorder-7 (GAD-7) to assess the anxiety of the dental providers have identified mild to moderate anxiety levels [32, 51].

Consolo *et al*. [32], assessing the anxiety level of dental providers from 2 districts in Italy, reported a mean GAD score of 6.56, inferring mild anxiety. On the contrary, the anxiety level of the respondents in our study was moderate with a GAD-7 score of 8.24, and these findings were in agreement with the GAD-7 score of 8.15 in the study of Mahendran *et al*. [51], who evaluated the anxiety level of the staff at a dental teaching hospital in the UK. High GAD scores have been related to severe service impacts, such as functional disability, including decreased productivity at work and increased sick days, so the prevalence of generalized anxiety symptoms among workers is worrying. Furthermore, higher anxiety levels are shown to affect the body's inflammatory processes and, as a result, the immune response system [51].

The respondents in this study, when asked about distress over the past several days, most reported (50.5%) being nervous, anxious, or on edge for several days, and 14.4%, claimed they were felt the same more than half the days. This interestingly seems to illustrate a certain slight level of distress, but it may be due to the amount of distress at the time of taking the survey being relatively low. In the current study, we had a worry scale (evaluative of distress) score of 13.92, indicating that respondents had moderate worries relative to their physical well-being (90%), their financial situations (80%), and mental health (75%). In a study by Ammar *et al*. [52], it was found that dentists globally worried about professional responsibilities and restricted mobility. Thus, the outcome of this present finding suggests the importance of psychological attention to health professionals, including dentists, during pandemics.

4.5. Post-Traumatic Growth (PTG) and Life Satisfaction of the Dental Health Providers

Posttraumatic growth has been defined as "positive psychological change experienced as a result of a struggle with highly challenging life circumstances" and through establishing perspectives for a "new normal" when the old normal is no longer an option [18, 53]. Following traumatic events, it is a normal process for those affected to be relieved of the traumatic events. In this study, we assessed the post-traumatic growth using a shorter form (PTGI-SF) of the Post-traumatic growth inventory (PTGI), which has shown internal reliability of 0.9 [24]. The outcome of PTGI-SF showed that the respondents in this study had developed moderate positive self-related changes (PTGI-SF=34.17) following the traumatic events. On the contrary, life satisfaction showed neutral scores (20.16). A study by Tao *et al*. [54] evaluating the psychological aspects of emergency dental care providers showed that respondents presented with depression, anxiety, and posttraumatic stress disorder during COVID-19. Similarly, Sarapultseva *et al*. [55], evaluating the distress and post-traumatic symptoms of dental providers in Russia, demonstrated a high risk for psychological distress and posttraumatic stress disorder during the COVID-19 pandemic. Similarly, Uziel *et al*. [19] found that dental providers' PTG was significantly related to worries regarding their physical health. These previous results, along with our study outcomes, infer the importance of psychological care of dental providers during epidemic outbreaks.

The study is a snapshot of the respondents' perceptions within a very fast-moving set of local, national, and global events related to the COVID-19 pandemic. However, some limitations are worth mentioning, despite the positive outcomes of this research. Only correlations can be reported, with no cause-effect relationships, as this is a cross-sectional study. The nature of self-reporting and the participants' recall capacity should also be considered during the time of this survey completion. During the early phase of the outbreak in Saudi Arabia, this study survey was carried out online among dentists, with a short data collection duration. Also, around the same time, the impact of nationwide lockdown, rapid transmission of COVID-19 infection, and worldwide fatality news could have contributed to a small sample size restricting the results' generalizability. The outcomes of this study further limit its generalizability due to a conveyance sample and that some of the sub-scales (*e.g*., worry subscale) and other general content items were not previously validated as part of any psychometric studies. Furthermore, the data on distress reaction (worry scale), post-traumatic growth, and life satisfaction scales from our study could not be compared with previous studies due to the non-availability of baseline data at the time of submission of this study.

CONCLUSION

This study's findings delineated that the COVID-19 pandemic situation influenced dentists' mental health, with a moderate prevalence of fear, anxiety, and worries, among other psychological symptoms. Furthermore, adequate knowledge regarding COVID-19 was observed among dentists; however, the pandemic affected the financial conditions of the respondents. There was a moderate level of post-traumatic growth and neutral life satisfaction of the dental providers. Therefore, the support and monitoring of these professionals are vital to minimize traumatic episodes resulting from pandemic diseases, like COVID-19. In future continuous education, dental professionals should be provided activities to enhance their role in the COVID-19 like pandemic situation

ETHICALS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Written informed consent was obtained from each participant prior to the study.

STANDARDS OF REPORTING

STROBE guidelines methodologies were used for this study.

AVAILABILITY OF DATA AND MATERIALS

The datasets for the current study are not publicly available due to the confidentiality of study participants but can be made available upon reasonable request to the corresponding author.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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