Determinants of knowledge and prevention measures towards COVID-19 pandemic among Lebanese dentists: a cross sectional survey

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Abstract

Background: Coronavirus Disease 2019 (COVID-19) is a major global threat. Healthcare professionals including dentists are facing real challenges during this pandemic. This study aimed to evaluate knowledge, attitudes, and prevention measures of Lebanese dentists towards COVID-19 and determinants of high level of knowledge and prevention practices.

Methods: A cross-sectional study was conducted between May and August 2020 in Lebanon on a random sample of 323 Lebanese dentists. Data were collected through an online survey questionnaire. A multivariate linear regression model was used to evaluate factors associated with COVID-19 knowledge. A multivariate logistic regression was conducted to evaluate the factors associated with high level of prevention measures towards COVID-19.

Results: The mean COVID-19 knowledge index was 24.5 over 38 with only 15% achieving high knowledge level. The mean prevention measures index was 11.4 over 16 with only 35% achieving high prevention level. Higher knowledge index was associated with younger age, being employed, and considering dentist's role significant in teaching others about COVID-19. General dental practitioners, dentists living with family members and concerned about their family members to get infected because of their occupational exposure were more likely to report higher level of adopted prevention measures. Higher knowledge was associated with high level of prevention measures.

Conclusions: Given the rapid evolution of information related to COVID-19 pandemic, dentists should be regularly educated through trainings, workshops, and updates of national guidelines for dental healthcare.

Keywords: SARS-CoV-2, Health knowledge, Prevention, Dental practice, Pandemic

Introduction

The World Health Organization has declared Coronavirus Disease 2019 (COVID-19) a pandemic on March 11, 2020, considering it a worldwide public health emergency [1, 2]. COVID-19 is caused by a novel coronavirus, called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of February 2021, the worldwide global cumulative number of cases was estimated at 105.4 million with 2.3 million cases of deaths [3]. In Lebanon, as of February 15, 2021, and since the start of the pandemic, an estimated 340,861 SARS-CoV-2 cases and 4037 deaths were recorded with a fatality rate of 1.2% [4].

Until now, there is still no universal effective treatment acting specifically against COVID-19 [5]. For this,
adopting the appropriate preventive measures remains one of the best solutions to fight against the infection. Since the emergence of SARS-CoV-2, healthcare professionals have been facing critical challenges. Dental professionals who are in close contact with the patient, are at great risk of exposure to the virus, while performing procedures and surgical acts that produce a mixture of splatter, droplets, and aerosols. Thus, it is important to evaluate dentists’ knowledge and prevention measures towards COVID-19 as it is highly likely that the current pandemic will impact dental practice in general and will shape the training of the future generations of dentists. A contribution to the fight against the pandemic is expected from dentists through spreading awareness, screening for suspected cases, providing consultations and through updating dentistry curricula to include trainings about new methods of prevention control and about preparedness for future pandemics [6].

To control the spread of the virus in dental healthcare facilities, the Centers for Disease Control and Prevention [7, 8], and the American Dental Association [9] have published different guidelines for dental healthcare practice. In Lebanon, dental healthcare guidelines [10] had been released by the Lebanese Dental Association (LDA) at the time when data started to be collected for the study. Those guidelines highlighted the types of personal protective equipment (PPE) required and their appropriate use, the definition of a dental emergency, and included a protocol for dental care during COVID-19 pandemic.

COVID-19, which is a highly contagious disease, constitutes a major threat to the health of dentists, their assistants, and patients. Therefore, dentists should have information and should be aware of the most effective prevention measures to protect their own and patients’ health. Given their crucial role in combatting the outbreak of the disease, we aimed in this study to assess the knowledge, attitudes, prevention measures and clinical practices of Lebanese dentists regarding COVID-19 pandemic.

Methods

Study design and sampling

A cross-sectional survey was conducted from May to August 2020 using a web-based questionnaire. A stratified random sampling from the list of all Lebanese dentists registered in the LDA was conducted. For this study, 10% of dentists’ population was taken as sample size estimated at 320 dentists. The sample was proportionally distributed according to the Lebanese governorates (Beirut, Mount Lebanon, North Lebanon, South Lebanon and Bekaa). Assuming that the rate of completed questionnaires will be 20% [11], the total number of dentists to be selected and invited to participate were 1600 dentists.

Questionnaire and data collection

The questionnaire was designed in English and then translated to French and reviewed for consistency. The questions were developed based on the literature and international guidelines. The questionnaire included:

1. Sociodemographic characteristics and factors related to participants general practices and health.
2. Knowledge assessed by 7 questions including 38 answers on: clinical symptoms, incubation period, modes of transmission, molecules under investigation in clinical trials and mouthwash virucidal activity against the COVID-19 virus.
3. Prevention measures adopted in dental clinics and other practices.
4. Attitudes towards COVID-19 pandemic

Each participant was contacted by phone call where the survey objective was described. After obtaining an oral informed consent from the participant, a google form link was sent through phone message or whatsapp.

Statistical analysis

Descriptive analysis was used to describe participant characteristics using means and standard deviations (SD) for quantitative variables and frequencies and percentages for qualitative variables. For knowledge index, a correct answer was given one point and wrong or “I don’t know” was given zero point. The total knowledge index was calculated by summing all the answers and ranged between 0 and 38. The index was classified into 3 levels of knowledge, high (80–100%), moderate (60–79%) or low (≤ 59%) level [12]. The same method was used to calculate and categorize the prevention measures index which ranged between 0 and 16.

A multivariate linear regression model was performed to identify factors associated with the knowledge index. A multivariate logistic regression model was used to explore factors associated with high prevention measures level taking low and moderate index combined as the reference category. Independent variables associated with the dependent variables with a p-value ≤ 0.2 in the bivariate analyses were included in the multivariate models [13]. Data was analyzed using SPSS software.

Results

Characteristics of the study participants

A total of 323 dentists completed the questionnaire. The age of the participants ranged between 25 and 70 years
old, with more than half (57.3%) being males. Around a quarter of the participants were general dental practitioners, most of them had more than 10 years of experience, and only 17.6% had comorbidities. A detailed description of study participants characteristics is presented in Table 1.

Knowledge towards COVID-19
Almost all the respondents reported the main COVID-19 symptoms which included fever (99.1%), fatigue (91.3%), dry cough (92.6%) and headache (92.9%). However less than half reported the less common symptoms. Most of the dentists (73%) reported the correct average incubation period of the virus being 1–14 days and identified the modes of transmission of the virus. Regarding molecules under investigation in clinical trials, 90.7% of the respondents reported hydroxychloroquine, meanwhile, less than half of the respondents reported other molecules (Table 2). The mean knowledge index regarding COVID-19 was 64.5% and its Cronbach alpha for its internal consistency was 0.79. Low and moderate knowledge was observed in around 85% of the participants (Table 3).

Prevention measures towards COVID-19
Almost all the respondents reported adopting the right preventive measures in the dental clinics by applying hand hygiene (95.7%), disinfection for surfaces (90.4%) use of PPE (93.2%) and protective clothes for staff members (84.8%). More than half of the respondents reported that they use high-speed evacuation for dental procedures (65%), avoid operations that can produce droplets or aerosols (57.6%) and avoid moving patients out of their area unless necessary (54.8%). Only 30.7% of respondents reported placing patients with known or suspected COVID-19 infection in adequately ventilated single rooms (Table 4a).

Most dentists reported adopting the right prevention measures with the patients, by asking them to sit far from each others (77.1%), wearing masks (97.2%), applying hand hygiene (88.2%), screening patients (70.9%), taking their temperature (91%) and asking about recent travel (62.8%). Meanwhile, less than half of the respondents reported asking patients about recent contact with suspected or known infected people (42.7%) and the use of rubber dam for dental procedures (37.8%) (Table 4b).

Overall, the mean prevention measures index of the participants was 71.2% and the Cronbach alpha for its internal consistency was 0.67. While 21.1% of dentists reported adopting low prevention measures level, 34.7% reported adopting high level of prevention measures towards COVID-19 (Table 3).

### Table 1: Characteristics of study participants (n = 323)

| Characteristics                  | Mean ± SD | N (%) |
|----------------------------------|-----------|-------|
| Age (years)                      | 44.62 ± 10.8 |       |
| Gender                           |           |       |
| Male                             | 185 (57.3%) |       |
| Female                           | 138 (42.7%) |       |
| Work region                      |           |       |
| Beirut                           | 64 (19.8%)  |       |
| Mount Lebanon                    | 178 (55.1%) |       |
| Bekaa, South and North of Lebanon| 81 (25.1%)  |       |
| Graduation university            |           |       |
| Public: LU                       | 117 (36.2%) |       |
| Private: USJ or BAU              | 112 (34.7%) |       |
| Abroad                           | 94 (29.1%)  |       |
| Years of experience*             |           |       |
| ≤ 10                             | 88 (27.2%)  |       |
| > 10                             | 231 (71.5%) |       |
| Specialty (1)†                   |           |       |
| General practitioner             | 155 (48%)   |       |
| Oral surgeon                     | 64 (19.8%)  |       |
| Implant surgeon                  | 43 (13.3%)  |       |
| Orthodontist                     | 30 (9.3%)   |       |
| Endodontic                       | 29 (9%)     |       |
| Periodontic                      | 25 (7.7%)   |       |
| Prosthodontic                    | 22 (6.8%)   |       |
| Restorative Dentist              | 18 (5.6%)   |       |
| Other                            | 21 (6.5%)   |       |
| Specialty (2)                    |           |       |
| General practitioner only        | 84 (26%)    |       |
| Surgeon (oral, implant)          | 104 (32.2%) |       |
| Specialist dentist               | 135 (41.8%) |       |
| Employment status                |           |       |
| Self-employed                    | 221 (68.4%) |       |
| Employee                         | 95 (29.4%)  |       |
| Unemployed                       | 7 (2.2%)    |       |
| Living with family members       |           |       |
| Yes                              | 233 (72.1%) |       |
| No                               | 90 (27.9%)  |       |
| Comorbidities†                   |           |       |
| None                             | 268 (83%)   |       |
| Hypertension                     | 20 (6.2%)   |       |
| Diabetes                         | 18 (5.6%)   |       |
| Cardiovascular disease           | 9 (2.8%)    |       |
| Obesity                          | 10 (3.1%)   |       |
| Respiratory disease              | 5 (1.5%)    |       |
| Active cancer                    | 2 (0.6%)    |       |
| Immunodeficiency                 | 5 (1.5%)    |       |

* Years of experience: missing data = 4
† The sum of the percentages is greater than 100% because dentists can have several specialties and several comorbidities
LU Lebanese University, USJ Saint-Joseph University, BAU Beirut Arab University
Table 2  Responses to questions about Coronavirus Disease 2019 (COVID-19) knowledge by the participating dentists

|                          | Answers | N (%)          |
|--------------------------|---------|----------------|
| **Incubation period (days)** |         |                |
| 1–14                     | Correct | 238 (73.7)     |
| 2–7                      | Incorrect | 28 (8.7)   |
| 7–14                     | Incorrect | 25 (7.7)    |
| 7–21                     | Incorrect | 25 (7.7)    |
| I don't know             | Incorrect | 7 (2.2)     |
| **Symptoms**             |         |                |
| Fever                    | Correct | 320 (99.1)    |
| Fatigue                  | Correct | 295 (91.3)    |
| Dry cough                | Correct | 299 (92.6)    |
| Headache                 | Correct | 300 (92.6)    |
| Shortness of breath      | Correct | 296 (91.6)    |
| Diarrhea                 | Correct | 155 (48)      |
| Vomiting                 | Correct | 134 (41.5)    |
| Runny nose               | Correct | 161 (49.8)    |
| Sore throat              | Correct | 240 (74.3)    |
| Red eyes                 | Correct | 98 (30.3)     |
| Skin rash                | Correct | 137 (42.4)    |
| Joint or muscle pain     | Correct | 197 (61)      |
| Loss of smell and taste  | Correct | 263 (81.4)    |
| May present with no symptoms | Correct | 308 (95.4)  |
| I don't know             | Incorrect | 1 (0.3)    |
| **Mode of transmission** |         |                |
| Droplets                 | Correct | 310 (96)      |
| Coughing and sneezing    | Correct | 319 (98.8)    |
| Hand shaking             | Correct | 264 (81.7)    |
| Touching surfaces such as doorknobs and tables | Correct | 257 (79.6) |
| Contact with blood       | Incorrect | 169 (52.3) |
| Contact with stools      | Incorrect | 71 (22)     |
| I don't know             | Incorrect | 1 (0.3)     |
| **Transmission is possible when** |       |                |
| Symptomatic              | Correct | 300 (92.9)    |
| Asymptomatic             | Correct | 217 (67.2)    |
| Asymptomatic with positive PCR | Correct | 300 (92.9) |
| I don't know             | Incorrect | 7 (2.2)     |
| **Molecules under investigation in clinical trials** |       |                |
| Chloroquine              | Correct | 156 (48.3)    |
| Hydroxychloroquine       | Correct | 293 (90.7)    |
| Azithromycin             | Correct | 100 (31)      |
| Ivermectin               | Correct | 49 (15.2)     |
| Remdesivir               | Correct | 124 (38.4)    |
| Lopinavir                | Correct | 92 (28.5)     |
| Ritonavir                | Correct | 89 (27.6)     |
| Fluoroquinolones         | Incorrect | 12 (3.7)   |
| Methylprednisolone       | Correct | 9 (2.8)       |
| Penicillin               | Incorrect | 10 (3.1)   |
| Oseltamivir              | Incorrect | 11 (3.4)    |
| Thalidomide              | Correct | 6 (1.9)       |
| I don't know             | Incorrect | 14 (4.3)    |
Other practices and attitudes towards COVID-19

Around half of the respondents reported treating only dental emergency cases during lockdown (55.7%), accepting to treat patients with flu like symptoms (48.6%) and avoiding treating patients with known or suspected COVID-19 infection (51.7%). Dentists reported opening their clinics on average of 1.1 days (SD = 1.3) per week during lockdown. Almost all the respondents reported the prescription of paracetamol, 38% reported the prescription of nonsteroidal anti-inflammatory drugs and only 14% reported the prescription of corticosteroids for pain management during COVID-19 pandemic.

While 18.6% of the respondents reported perceiving COVID-19 as very dangerous, 46.4% and 35% reported perceiving it as moderately dangerous and not dangerous respectively. Approximately half of the respondents reported that their role in teaching others about COVID-19 is very significant and only 12.4% reported that their role is not significant at all. Lastly, most dentists reported being afraid of getting infected with COVID-19 (66.6%) and being afraid about family members to get infected due to their occupational exposure (79.3%).

Factors associated with knowledge towards COVID-19

The multivariate linear regression model showed that higher knowledge index was associated with working in Mount Lebanon and considering dentist’s role important in teaching others about COVID-19. Older age and being self-employed compared to being employed were associated with a lower knowledge index (Table 5a).

Factors associated with high level of prevention measures towards COVID-19

The multivariate logistic regression model showed that dental specialists excluding surgeons were less likely to have high prevention measures level comparing to general dental practitioners. Besides, participants working in Mount Lebanon were less likely to have high prevention measures level comparing to those working in Beirut. However, dentists living with family members (OR = 2.3) and those who considered dentist’s role important in teaching others about COVID-19 (OR = 2.76) were more likely to have high prevention measures level. Lastly, having a higher knowledge index was significantly associated with a higher likelihood of having high prevention measures level (OR = 1.15) (Table 5b).

Discussion

In this study, Lebanese dentists achieved an average knowledge index of 65% and an average prevention measures index of 71%. Scoring high level of prevention measures was associated with higher knowledge index, considering dentists role significant in teaching about COVID-19, living with family members, and being afraid about family members to get infected with the
virus. Dental specialists were less likely to achieve high prevention measures index compared to general dental practitioners.

Our multivariate linear model showed that being younger was associated with better knowledge. Findings from other studies showed no association with age [14–16]. First, this difference in results may be partly related to the difference in the questions used to assess dentists’ knowledge. Second, we think that Lebanese young dentists were more knowledgeable than older ones because given the lack of national guidelines for dental healthcare in Lebanon before the start of the study, younger dentists who are more familiar with online learning have consulted the international guidelines that have been published on the international health institutions websites earlier since the start of the pandemic. Our study also showed that dentists working in Mount Lebanon region had higher knowledge score than those working in Beirut. This might be related to the significantly younger age of the dentists working in Mount Lebanon comparing to those working in Beirut (mean = 43 and 48 years old respectively). Lastly, dentists who considered their role significant in teaching others about COVID-19 achieved higher level of knowledge. Although dentists and physicians deliver different type of medical services, their trainings and education share similarities. Therefore, with their knowledge, dental professionals can contribute alongside other healthcare professionals to the fight against COVID-19 pandemic that poses a real challenge to worldwide healthcare systems. For instance, dental professionals should help in patients screening, should develop online platform to spread awareness about COVID-19 and educate the public about oral hygiene especially during lockdown periods.

Our study showed that dentists adopt high level of prevention measures in dental clinics during the pandemic including hand hygiene, surface disinfection, use of PPE and taking patient’s temperature as part of the triage process. This practice was similar to previous studies [17–25] and conform with the international [7, 8] and LDA guidelines [10]. However Lebanese dentists’ prevention practices were suboptimal mainly regarding rubber dam use and patients triage including questions about patient’s recent travel and patient’s contact with a person with suspected or known COVID-19 infection. Patient triage is crucial in order to identify the patients with suspected or confirmed COVID-19 infection and to schedule the dental care according to the emergency of the patients dental problem and to assess the need in terms of protection equipment and disinfection [10, 26].

Our multivariate logistic regression model showed that better knowledge was associated with having high prevention measures index. To our knowledge, only two previous studies explored the factors associated with prevention practices of dental professionals and reported

### Table 4 Prevention Measures adopted by the participating dentists in the dental clinic to prevent the transmission of Coronavirus Disease 2019 (COVID-19)

| Prevention measures adopted in the dental clinic | N (%) |
|-------------------------------------------------|-------|
| Use high-speed evacuation (saliva evacuator) for dental procedures producing an droplets or aerosols | 210 (65%) |
| Avoid operations that can produce droplets or aerosols | 186 (57.6%) |
| Frequently clean hands by using alcohol-based hand rub or soap and water | 309 (95.7%) |
| Routinely clean and disinfect surfaces in contact with known or suspected patients | 292 (90.4%) |
| Use personal protective equipment (such as dental goggles, masks, and gloves) only with patients with known or suspected COVID-19 infection | 301 (93.2%) |
| Avoid moving and transporting patients out of their area unless necessary | 177 (54.8%) |
| All health staff members wear protective clothing | 274 (84.8%) |
| Place patients with known or suspected patients COVID-19 infection in adequately ventilated single rooms | 99 (30.7%) |

| Measures adopted with patients in the dental clinic | N (%) |
|---------------------------------------------------|-------|
| Ask patients to sit far from each other | 249 (77.1%) |
| Ask patients to wear masks while in the waiting room | 314 (97.2%) |
| Ask patients to wash hands before getting in the dental chair | 285 (88.2%) |
| Take patient’s temperature when they arrive at the clinic | 294 (91.1%) |
| Screen patients for signs and symptoms of COVID-19 infection | 229 (70.9%) |
| Ask patients about recent travel | 203 (62.8%) |
| Ask patients about recent contact with a person with known or suspected COVID-19 infection | 138 (42.7%) |
| Use a rubber dam | 122 (37.8%) |
similar association with knowledge [19, 23]. Unlike the previous study in Lebanon [23], the present study showed that specialists dentists were less likely to achieve high prevention measures index compared to general dental practitioners. We should note that the previous study was based on a snowball sampling technique and might have suffered from lack of representativeness for dental professionals in Lebanon. Working in Mount Lebanon was
also associated with lower prevention measures index compared to working in Beirut. This might be explained in part by the younger age of dentists in Mount Lebanon, who may, because of their high knowledge, be more confident when taking more risk regarding the precautionary measures while delivering dental care to their patients. On the other hand, high level of prevention measures practice was associated with considering that dentist’s role is significant in teaching about COVID-19, living with family members, and being afraid about family members to get infected with the virus. Like other healthcare professionals, dentists worry that they might carry the virus home to their families. And therefore, they tend to take the essential prevention measures and to adhere to infection control protocol to avoid the transmission of the virus to their families.

On one hand around half of Lebanese dentists in the present study provided emergency treatment for their patients. The percentage of dentists providing emergency interventions was low in India [17, 25] and high in Turkey [15, 21]. This discrepancy might be explained by the availability or the lack of local guidelines and recommendations for dentists regarding the delivery of emergency therapies. In addition, Lebanese dentists opened their clinics on average 1 day per week reflecting a compliance with the total lockdown imposed by the Lebanese authorities. On the other hand, around half of the participants accepted to treat patients with flu like symptoms and patients with known or suspected COVID-19 infection. Most of dentists from previous studies mainly conducted in the early period of the COVID-19 outbreak prefer not to treat patients with COVID-19 [18, 22, 27, 28]. This was expected as many guidelines stated that only emergency interventions to be performed, with rescheduling of the elective treatment procedures [7, 9]. These findings may be attributed to the high risk of contamination of different areas of dentist’s face during dental practices [29], the inefficacy of standard protective measures in daily clinical work to prevent the spread of COVID-19 [30], the time during which studies were conducted (early during the outbreak), if dental management and infection control guidelines for COVID-19 from dental associations were available and lastly the classification of dentistry as a very high-risk occupation for COVID-19 infection according to the Occupational Safety and Health Act Guidance [31].

More than half of the dentists considered COVID-19 as a dangerous infection and were afraid of getting infected with COVID-19 due to occupational exposure and most of them were afraid about transmitting the virus to their family members. On one hand, there was no effective treatment or vaccine against COVID-19 at the time of the study. On the other hand, the average age for dentists who considered COVID-19 very dangerous was 48 years old in our study compared to an average of 43 years old among those who considered COVID-19 as not dangerous or moderately dangerous. Thus, older dentists are.scarred from being infected because increased age was shown to be associated with high risk of severe disease and complications [32].

One strength of our study is that it is the first study conducted among dentists in Lebanon with a representative sample randomly selected from the list of dentists registered in the LDA. Besides, the survey collected an important number of variables to identify factors related to knowledge and prevention practices of dentists regarding COVID-19. This study was one of the few that explored the factors related to adherence to prevention measures in dental clinics.

One limitation of this study is the lack in the knowledge questionnaire of questions related to the type of masks used, the use of mouthwash before and/or during dental care delivery and the choice of disinfectant solutions. Other limitations included recall and information bias related to the use of an online self-administered questionnaire as survey instrument.

Conclusions
As information about COVID-19 continues to evolve rapidly, further improvement and update would be beneficial to optimally manage patients in this challenging situation. The knowledge on infection control in dental clinics should be strengthened through online educational trainings if physical meetings are not possible due to recurrent lockdowns. National guidelines for dental care should be regularly updated and shared with dentists particularly older ones.

Abbreviations
COVID-19: Coronavirus disease 2019; LDA: Lebanese Dental Association; PPE: Personal protective equipment; SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2; SD: Standard deviation.

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Authors’ contributions
M.H. and N.S. conceptualized and designed the study, C.H., N. H. and M. C. collected all the data and contributed to the analysis of the data, M.H. and N.S. interpreted the results, M.H., C.H., N. H. and M. C. prepared the first draft of the manuscript, M.H. and N.S. reviewed and edited the final draft of the manuscript, All authors read and approved the final manuscript.

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Availability of data and materials
The datasets generated and analyzed during the current study are not publicly available due to limitations of ethical approval involving the patient data and anonymity but are available from the corresponding author on reasonable request.
Declarations

Ethical approval and consent to participate

The survey was completely voluntary and anonymous. Confidentiality of the responses was guaranteed to the participants. Participant’s informed consent was obtained before the completion of the questionnaire. The study being observational and respecting participants’ anonymity and confidentiality, the institutional review board of the Lebanese university waived the need for an official approval.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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