

Scientific Research Report

Spanish Dentists' Awareness, Knowledge, and Practice Regarding COVID-19: A Multiple Regression Analysis



Yolanda Martínez-Beneyto^{a,1*}, Veronica Ausina-Márquez^b,
Antonio J. Expósito-Delgado^c, Antonio J. Ortiz-Ruiz^{d,2},
Francisco J. Ibañez-Lopez^e, Juan C. Llodra-Calvo^f, Manuel Bravo^{g,3}

^a Unit of Preventive & Community Dentistry, Department of Stomatology, Faculty of Medicine-Dentistry, University of Murcia, Murcia, Spain

^b Department of Pediatric and Preventive Dentistry, Faculty of Dentistry, European University of Valencia, Valencia, Spain

^c Area de Gestión Sanitaria Jaén Norte, Servicio Andaluz de Salud, Jaén, Spain

^d Unit of Integrated Pediatric Dentistry, Department of Stomatology, Faculty of Medicine-Dentistry, University of Murcia, Murcia, Spain

^e Scientific and Technical Research Area, Statistical Service, University of Murcia, Murcia, Spain

^f Department of Preventive & Community Dentistry, Faculty of Dentistry, University of Granada, Granada, Spain

^g Department of Preventive & Community Dentistry, Faculty of Dentistry, University of Granada, Granada, Spain

ARTICLE INFO

Article history:

Available online 28 January 2021

Key words:

COVID-19

Infection control

Dentist

Dental hygienist

Dental practice management

ABSTRACT

Introduction: During the first months of the coronavirus disease 2019 (COVID-19) pandemic, Spain had the highest mortality rate and the second-highest infection rate in the world.

Objective: To analyze the occupational situation of dentists, hygienists, and dental auxiliary staff during the peak of the pandemic, after the state of alarm was declared in Spain, and when the state of alarm was declared. In addition, a possible relationship between the geographical distribution of infected people and the availability of individual protection systems was investigated.

Material and Methods: A cross-sectional questionnaire was answered by 6470 dentists and dental staff via WhatsApp and social media.

Results: A total of 1 in 4 dental professionals ceased working completely. Of those that kept working, 25.28% of dentists and 19.61% of hygienist-auxiliary were equipped with filtering face piece (FFP) 2 masks ($P < .05$), and 61.8% complied with the official protection recommendations set by the General Council of Dentists of Spain. Nearly 59.4% of respondents had symptoms, but only 1.5% of dentists were tested, with 14% of dentists in isolation at the time of response. Overall, it is suggested that 10% of dental professionals may have been in direct contact with the coronavirus.

Conclusions: Direct contact of Spanish dental health professionals with severe acute respiratory syndrome coronavirus disease 2 (SARS CoV-2) has been high during the most active phase of the pandemic. Dental professionals did not have personal protective equipment (PPE) necessary to care for patients, a situation that justified the reduction in scheduled dental care and only emergencies being treated. The Spanish geographical regions with the highest number of contagions had the least amount of individual protective resources (FFP2 and FFP3 masks).

© 2021 The Authors. Published by Elsevier Inc. on behalf of FDI World Dental Federation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Disclaimer The results and opinions expressed in this paper are those of the authors and do not necessarily represent the official positions of either SESPO, the Spanish Dental Association, or Spanish dental hygienist societies.

* Corresponding author. Avda. Marqués de los Vélez, s/n. Clínica Odontológica Universitaria Morales Meseguer, 2ª planta (Murcia), Department of Stomatology, Faculty of Medicine/Dentistry, <https://doi.org/10.1016/j.identj.2021.01.012>

0020-6539/© 2021 The Authors. Published by Elsevier Inc. on behalf of FDI World Dental Federation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

University of Murcia, Murcia, Spain.

E-mail address:

¹ Yolanda Martínez-Beneyto: <https://orcid.org/0000-0002-1523-9415>

² Antonio J. Ortiz-Ruiz: <https://orcid.org/0000-0001-9113-8416>

³ Manuel Bravo: <http://orcid.org/0000-0001-5508-561X>

Introduction

Spain, with a population of 47.1 million, has 37,787 registered dentists, of whom approximately 1400 work in the Spanish national health system. Data from the latest National Health Survey¹ show 50.3% of Spaniards visited a dentist in the last year,² meaning that 23 million patients are treated annually in dental clinics. Of these, 10.6% went to public dentists and 89.4% to private dentists.

Since December 2019, the pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has affected almost every country in the world. In Wuhan, China, a pneumonia of unknown origin was reported on December 31, 2019, and was eventually named coronavirus disease 2019 (COVID-19). In Spain, a German patient who had visited Wuhan became the first recorded case of COVID-19 on January 3, 2020. Data published on August 23, 2020, indicated that there were 23,400,000 confirmed cases and 809,000 deaths worldwide³ and 386,000 confirmed cases and 28,838 deaths in Spain, the second-highest number of infections and the highest mortality rate in the world at that time.⁴

To date, the main transmission routes of COVID-19 have been shown to include direct transmission (coughing and sneezing due to respiratory droplets), transmission by contact through mucous membranes (nasal, oral, and ocular), and by fomites and aerosols.⁵ In Spain, as well as in Italy,⁶ 2 countries with similar weather, rapid viral transmission was possible due to coughing, sneezing, and the inhalation of droplets. The oral cavity is a primary entry route for the virus because epithelial cells of the tongue⁷ and minor salivary glands⁸ have more receptors for the enzyme angiotensin-converting enzyme II (ACE-2), a cell receptor for SARS-CoV-2, than the lungs. To et al⁹ found SARS-CoV-2 was detected in saliva before lung lesions appeared in 11 out of 12 patients. The minor salivary glands may be the origin of asymptomatic infections.¹⁰

Although patients with COVID-19 symptoms are the main source of transmission, asymptomatic patients and those in the incubation period are also carriers of the virus.^{10,11} Health care workers and patients treated in health facilities have a higher risk of transmission of the virus to healthy patients than the rest of the population. Among health care workers, dental professionals may be those at greatest risk of contagion and transmission of the virus. They work a few centimetres from patients' mouths, are continuously in contact with saliva, and use rotary or ultrasonic instruments that generate aerosols that can spread over long distances.^{12,13} Studies have suggested that SARS-CoV-2 may remain in the air for 2.7 hours due to aerosols generated during medical procedures.^{7,12,14}

In Spain, in the face of the public health emergency and international pandemic, the government issued a Royal Decree (463/2020, of March 14)¹⁵ declaring a state of alarm to combat the health crisis caused by SARS-CoV-2. The decree forced the shutdown of all nonessential activity. However, private dental clinics, such as health centres, could remain open but only for dental emergencies, following the recommendations of the General Council of Dentists.¹⁶ Dental professionals working in public health facilities treated patients

primarily via telephone or to screen people, with direct face-to-face care only when the dentist deemed it necessary.

Several international associations, such as the Centers for Disease Control and Prevention,¹⁷ the American Dental Association,¹⁸ the UK Coronavirus disease guide,¹⁹ and the World Health Organization,²⁰ recommended guidelines for dentists and dental staff for treating patients. Recently the Spanish General Council of Dentists published a Strategic Action Plan for the COVID-19 de-escalation period,²¹ which will serve as a guideline for all dental health professionals during the situation generated by the COVID-19 pandemic.

In Spain, the level of contagion among health care workers has been very high (approximately 34,000 as of May 11, 2020). However, the geographical distribution of the pandemic in Spain has been very uneven and has been principally centred on the large cities (Table 1).

To date, as far as we know, there are no published data on how the situation has affected Spanish dental professionals. Therefore, the aim of this study was to examine Spanish dentists, hygienists, and auxiliary staff's awareness, knowledge, and practice regarding COVID-19 during the peak week of the pandemic after the state of alarm was declared in Spain. In addition, the study investigated the relationship between geographical distribution of infected people and the availability of individual protection equipment.

Material and methods

Sample and procedure

The study was approved by the Bioethics Committee of Murcia University (Reference Number: 2842/2020).

The study population consisted of registered dentists, dental hygienists, and auxiliary staff from private practice and the Spanish National Health System. A retrospective questionnaire was administered between April 8, 2020 and April 14, 2020. The survey was designed using the Survey Platform of the University of Murcia (<https://encuestas.um.es/encuestas/inicio.publico.logincas.genParticipants>). The questionnaire was sent via WhatsApp, Facebook, and Instagram; it was anonymous and all participants were informed that completion implied consent to participate in the study. The survey was administered using the ENCUESTAS Platform (University of Murcia) (<https://encuestas.um.es/encuestas/covid19sespo.cc>).

A pilot questionnaire was tested on 85 dentists and hygienists from 12 Spanish autonomous communities (political and geographical regions) and 10 Spanish oral epidemiologists, most of whom were university professors, to ensure the questions had been correctly designed, were easily understandable, and did not require a prolonged response time or did not require a long time to answer.

Study instrument

The questionnaire was divided into 2 main sections (supplementary file 1, available online). The first section covered sociodemographic characteristics.

Table 1 – Geographical distribution of the sample (dentist and hygienist-auxiliary staff) by autonomous community and cumulative incidence (cases accumulated per 100,000 inhabitants).

Spanish autonomous communities*	DentistN (%)	Hygienist-auxiliaryN (%)	CI*	Total Population†	Number of deaths*
La Rioja	25 (0.6)	39 (1.8)	638.58	316,798	177
Castilla-La Mancha	131 (3.1)	122 (5.6)	443.12	2,032,863	1255
Madrid	532 (12.4)	217 (10)	418.00	6,663,394	5586
Navarra	118 (2.7)	38 (1.7)	346.98	654,214	206
Castilla Leon	210 (4.9)	81 (3.7)	296.64	2,399,548	1028
Basque Country	224 (5.21)	121 (5.6)	279.96	2,207,776	635
Cataluña	607 (14.1)	168 (7.7)	256.80	7,675,217	3041
Aragón	151 (3.5)	164 (7.5)	200.26	1,319,291	349
Cantabria	26 (0.6)	13 (0.6)	182.76	581,078	92
Galicia	201 (4.7)	213 (9.8)	180.96	2,699,499	213
Extremadura	61 (1.4)	48 (2.2)	135.06	1,067,710	271
Valencia	367 (8.5)	436 (20.1)	100.70	5,003,769	724
Asturias	77 (1.80)	34 (1.6)	90.54	1,022,800	102
Ceuta	9 (0.2)	0 (0)	88.47	84,777	4
Islas Baleares	96 (2.2)	62 (2.8)	73.95	1,149,460	89
Andalucía	923 (21.5)	217 (10)	71.15	8,414,240	605
Melilla	1 (0.1)	0 (0)	63.59	86,487	2
Murcia	319 (7.4)	95 (4.4)	56.83	1,493,898	85
Islas Canarias	220 (5.1)	104 (4.8)	51.31	2,153,389	91
Spain	4298 (100)	2172 (100)	210.69	47,026,208	14,555

CI = Cumulative incidence of confirmed cases/100,000 persons in the 14 days prior to 08/04/2020; INE = Instituto Nacional de Estadística.

* Data from the Ministry of Health, Update No. 69. Coronavirus disease (COVID-19) date 08/04/2020.

† INE population by autonomous community and autonomous city. Municipal census 1 January 2020

Variables studied:

- Sex: Male/Female.
- Age (mean age)
- Professional category
 - Dentist
 - Dental hygienist
 - Nursing assistant
- Years of work experience (mean age)
- The autonomous community where you work: 16 Spanish autonomous communities
- Environment of work
 - Rural area (<20,000 inhabitants).
 - Semi-urban area (20,000-100,000 inhabitants).
 - Urban area (>100,000 inhabitants).
- Field of work: public/private
 - Public
 - Private

The second section consisted of questions related to the occupational situation, symptoms related to COVID-19, biological protection and the use of approved personal protective equipment (PPE), the risk of contagion, and symptoms and the fear of COVID-19. Some questions used multiple-choice answers.

Variables studied:

- Dental care of patients:
 - I have been treating scheduled patients.
 - I am still working in my usual position, treating only dental emergencies.
 - I am still working but mainly on support functions related to COVID-19 (triage, case tracking, etc.).

- I am at home, in case I need to go to work.
- I am not working face-to-face, just telephone consultations.
- I have stopped working completely until further notice.
- If you have been working on patient clinical care, point out what type of masks you have MAINLY used since the start of the pandemic:
 - a Surgical.
 - b FFP2.
 - c FFP3.
 - d I have not been wearing a mask in my usual work.
- If you have been working on patient clinical care, indicate the protective equipment you have used routinely at work, in addition to a mask (multiple choice):
 - Facial screen.
 - Protective glasses.
 - Waterproof suit on top of regular work clothes.
 - None of the above.
- Do you have PPE for staff at the dental office?
 - Yes, for everyone.
 - Yes, but only for the dentist, not for the whole team.
 - We do not have PPE.
- Have you had to care for patients infected with COVID-19?
 - Yes
 - No
 - I do not know.
- The information concerning the protective measures necessary to prevent professional infection that you have implemented in your clinic has come from (multiple choice):
 - Health service management.

- Clinic management.
- The Council of Dentists/Professional Colleges.
- From my personal search on the web or social networks.
- I have not received any information.
- Have you complied with official recommendations to prevent infections?
 - Yes, always.
 - Almost always.
 - Sometimes.
 - Almost never.
 - Never.
- Symptoms compatible with COVID-19 infection during February, March, or April? (multiple choice):
 - Persistent cough.
 - Fever (more than 37.5 °C).
 - Vomiting.
 - Diarrhoea.
 - Sore throat.
 - Headache.
 - Muscle pain.
 - Unexplained tiredness.
 - Dyspnoea.
 - Alterations in smell and taste.
 - Serious lung problems.
 - I have not had any symptoms.
- Duration of the symptoms:
 - 1-3 days.
 - 4-7 days.
 - 8-13 days.
 - 14 days.
- Have you been in self-isolation for 2 weeks for COVID-19?
 - Yes, because of a confirmed case.
 - Yes, because of a suspected case.
 - Yes, because of a close contact.
 - I have not been in isolation.
- If you have been in isolation, have you been tested for COVID-19 after the quarantine period?
 - Yes, I am waiting for the results.
 - Yes, and it was positive.
 - Yes, and it was negative.
 - No, because there is no test available.
 - No, the protocols in force do not consider it necessary.
- Fear to leave home of getting infected
 - a Never.
 - b Almost never.
 - c Sometimes.
 - d Almost always.
 - e Always.

Level of contagion according to the Spanish geographical situation

The Spanish Ministry of Health publishes a weekly update on the COVID-19 situation.²² Based on this data, risk levels were

established according to autonomous communities. The cumulative incidence (contagious cases accumulated per 100,000 people, to refer to groups of human beings or humans in general) in the 14 days prior to the publication of the update (April 4, 2020) were the basis for this grouping (Table 1). The specific levels were:

Level 1: (Extreme risk): La Rioja (>600 cases/100,000 people)

Level 2: Madrid-Castilla la Mancha (418-443.12 cases/100,000 people)

Level 3: Navarra (346.92 cases/100,000 people)

Level 4: Cataluña, Basque Country (256.80-279.98 cases/100,000 people)

Level 5: Aragón, Cantabria, Galicia (180.96-200.26 cases/100,000 people)

Level 6: Extremadura, Valencia, Asturias (90.54-135.06 cases/100,000 people)

Level 7 (reference category): Islas Baleares/Balearic Islands, Andalusia, Murcia, Ceuta, Melilla, Islas/Canary Islands (51.31-88.47 cases/100,000 people)

Data analysis

Data were processed and analysed using the R statistical software. To identify the association level in the categorical variables regarding the sociodemographic variables, Pearson χ^2 test was used in contrasts where the required assumptions were met, and Fisher exact test when they were not (data independence and expected values of frequencies greater than 5). To identify statistically significant differences in ordinal variables regarding sociodemographic variables, the Kruskal-Wallis test was used (P value < .05 and level of significance .05) because this test is the most robust in this type of data.

A multiple logistic regression study was carried out. The dependent variable, "presence of FFP2 and FFP3 masks," (yes) acts as a proxy variable in terms of the need for this type of mask to comply with the official recommendation concerning PPE (dependent variable). It was then compared with sociodemographic variables. (independent variables) calculating the odds ratio (OR) and 95% CI. The regression model began with all the indicated variables and was then optimized for better results.

Description of independent variables used, previous improvement and adjustment of the variables that are influential in the logistic regression model:

- Age :
 - 31-40 years
 - 41-50 years
 - 51-60 years
 - >60 years
- Professional occupation: Dental hygienists
- Professional activity: Private
- Spanish geographic regions:

Level 2: Madrid-Castilla la Mancha (418-443.12 cases /100,000 people)

Level 3: Navarra (346.92 cases/100,000 people)

Level 4: Cataluña, Basque Country (256.80-279.98 cases/100,000 people)

Level 5: Aragón, Cantabria, Galicia (180.96-200.26 cases/100,000 people)

Level 6: Extremadura, Valencia, Asturias (90.54-135.06 cases/100,000 people)

Level 7 (reference category): Islas Baleares/Balearic Islands, Andalusia, Murcia,

- Have you been infected: Yes/I dont know
- Have you had fever (more than 37.3° C): Yes
- Have you had headache: Yes

To check the validity of the adjusted model of the multiple logistic regression, the Hosmer-Lemeshow test was performed, obtaining a nonsignificant *P* value (*P* value = 0.1514), which indicated that the model is a good fit on the predicted probabilities to those recorded in the observations.

A cross-sectional study was made which complied with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) norms on cross-sectional studies (<http://www.strobe-statement.org>).

Results

Descriptive analysis

A stratified sampling approach was not utilized in this study due to the methodology used, but in [Table 2](#) the similarity of the sample study group with the Spanish General Dental Council data according to mean age, years of professional experience, private practice (%), and geographical working area can be observed.

There were full responses from 6470 professionals, of whom 26% were male and 74% female with a mean age of 41.33 years; 65% (4298) were registered dentists, 26.6% (1722) dental hygienists, and 6.9% (450) auxiliary staff. The mean professional experience was 16.1 years. The distribution of the sample by communities is shown in [Table 1](#).

The autonomous communities with the highest responses were Madrid with 11.6% (749) of the sample, Cataluña with 12% (775), and Castilla la Mancha with 3.9% (253), which were also the most affected communities by COVID-19 ([Table 1](#)). Most respondents worked in urban areas (56.4%), followed by semi-urban (30.4%) and rural (13.2%). In terms of the type of activity, 87.6% (5667) of respondents worked in the private sector and 12.4% (803) in the public health system ([Table 3](#)).

Inferential analysis

During the week with the highest number of infections in Spain (April 6-12, 2020), 25.7% of dentists attended patients by telephone, while 25% stopped work completely (*P* < .001). Likewise, 57.3% of auxiliary staff and hygienists ceased work completely ([Table 3](#)). Of dentists who continued to treat patients, 25.3% stated they had filtering face piece (FFP2) masks (*P* < .001) and 7.3% FFP3, while fewer dental hygienists and auxiliary staff had the same protection (19.6% for FFP2; *P* < .001). A total of 36.3% of dentists used face screens, 43.6% glasses, and 15% waterproof suits (*P* < .001). Similar values were described by hygienists and auxiliary staff, although 11.7% (*n* = 118) were unprotected (*P* < .001). A total of 51 (1.2%)

Table 2 – Similarity of study group (data from the Spanish General Dental Council).

Variable	All dentists	Sample of dentists
Mean age	41	42.4
Professional experience (mean number of years)	17	17.5
women (%)	60.5%	63.2%
Private practice (%)	91%	88.9%
Geographical working area		
Northeast	21%	19.8%
East	13%	15.9%
South	21%	28%
Centre	29%	20.3%
Northwest	9%	11%
North	7%	5%

dentists and 22 (1%) hygienists and auxiliary staff claimed to have cared for patients diagnosed with COVID-19 ([Table 4](#)).

Half the dentists had received information from the General Dental Council and regional dental colleges, 37% of hygienists and auxiliary staff received information from their colleges, and 30.7% from clinic managers (*P* < .001). Approximately 61.8% of dentists and 70.5% of hygienists and auxiliary staff always or almost always complied with official occupational recommendations (*P* < .001) ([Table 4](#)).

Nearly 60% of respondents stated they had had symptoms related to COVID-19, including cough (7%) and fever >37.5 °C (5%). A total of 14% of dentists and 13.2% of dental hygienists self-isolated due to a confirmed, suspected, or close contact with an infected patient, and 1.5% of dentists and 1.1% of hygienists and auxiliary staff had a diagnostic test for COVID-19 ([Table 5](#)).

Multiple logistic regression analysis

Using the availability of type FFP2 and FFP3 masks as the dependent variable and the variables shown in [Table 5](#) as the independent variables, it was observed that private dentists had about half the probability (odds ratio = 0.536) of using protective masks than public sector dentists and hygienists (*P* <

Table 3 – Sociodemographic characteristics of Spanish dentists and dental staff.

	Dentist, n (%)	Dental staff, n (%)	Total, n (%)
Participants	4298 (66.4)	2172 (33.9)	6470 (100)
Sex			
- Male	1580 (36.8)	103 (4.7)	1683 (26)
- Female	2718 (63.2)	2069 (95.3)	6470 (74)
Environment of work			
- Rural	580 (13.5)	274 (12.6)	854 (13.2)
- Semi-urban	1239 (28.8)	725 (33.4)	1964 (30.4)
- Urban	2479 (57.7)	1173 (54)	3652 (56.4)
Field of work			
- Public	477 (11.1)	326 (15.0)	803(12.4)
- Private	3821 (88.9)	1846 (85)	5667 (87.6)
	Mean (SD)	Mean (SD)	Mean (SD)
Age	42.4 (±11.1)	38.2 (±9.6)	41 (±10.78)
Years of Practice	17.5 (±9)	13.4 (±11.4)	16.1 (±10.63)

SD = standard deviation.

Table 4 – Dental care and PPE used by dentists and dental staff.

Questions	Dentist,n (%)	Dental staff,n (%)	P value
Dental care on patients			
- I continue to work treating scheduled patients.	26 (0.5)	1 (1.7)	P < .001*
- I continue to work in my usual position, treating only dental emergencies.	819 (16.3)	322 (13)	P < .001*
- I am still working but mainly on support functions related to COVID-19.	177 (3.53)	132 (5.3)	P < .001*
- I am located at home in case I need to go to work.	1404 (28.2)	370 (15)	P < .001*
- I do not work on anything in person, only telephone consultation.	1288 (25.0)	189 (7.6)	P < .001*
- I have stopped working completely until further notice.	1296 (25.6)	1416 (57.3)	P < .001*
P < .001*			
If you have been working on patient clinical care, point out what type of masks you have used MAINLY since the onset of pandemic			
- Surgical	1595 (67.2)	609 (74.2)	P < .001*
- FFP2	600 (25.3)	161 (19.6)	P < .001*
- FFP3	174 (7.3)	46 (5.6)	P < .001*
- I do not use a mask in my usual work.	4 (0.16)	5 (0.6)	P = .171†
If you have been working in clinical patient care, state the protective measure(s) you have used, in addition to a mask, routinely at work (you can choose more than one option):			
- Facial screen.	1158 (36.3)	319 (31.6)	P < .001*
- Protective glasses.	1393 (43.6)	427 (42.4)	P < .001*
- Waterproof suit on top of regular work clothes.	487 (15.3)	144 (14.3)	P < .001*
- None of the above.	153 (4.8)	118 (11.7)	P < .001*
P < .001*			
Do you have PPE for all staff at the dental office?			
- Yes, for everyone.	526 (12.2)	558 (25.7)	
- Yes, but only for the dentist, not for all staff.	3399 (79.1)	1460 (67.2)	
- We do not have PPE.	373 (8.7)	154 (7.1)	
P < .001*			
Have you had to care for patients infected with COVID-19?			
- Yes	51 (1.2)	22 (1.0)	
- No	450 (10.5)	151 (7)	
- I do not know.	1623 (37.8)	561 (25.8)	
P = .651*			
The information on protective measures necessary to prevent professional infection that you have introduced in your clinic has come from:			
- Health service management.	441 (6.9)	379 (11.4)	P < .001*
- Clinic management.	840 (13.2)	1017 (30.7)	P < .001*
- The Council of Dentists/Professional Colleges.	3179 (50)	1228 (37.0)	P < .001*
- From my personal search on the web or social networks.	1647 (25.9)	496 (15)	P < .001*
- I have not received any information.	257 (4)	195 (5.9)	P < .001*
P < .001*			
Have you complied with official recommendations to prevent infections?			
Yes, always	2147 (49.9)	1269 (58.4)	
Almost always	512 (11.9)	263 (12.1)	
Sometimes	246 (5.7)	80 (3.7)	
Almost never	1176 (27.3)	467 (21.5)	
Never	217 (5.0)	93 (4.3)	
P < .001‡			
Are you afraid to leave home for fear of getting infected?			
Never	455 (10.6)	159 (7.3)	
Almost never	550 (12.8)	167 (7.7)	
Sometimes	764 (17.8)	347 (16)	
Almost always	1113 (25.9)	805 (37.1)	
Always	1416 (32.9)	694 (31.9)	
P < .001‡			

COVID-19 = coronavirus disease 2019; FFP = filtering face piece; PPE = personal protective equipment.

* χ^2 Pearson test.

† Fisher Test.

‡ Kruskal-Wallis Test.

.001). Older dentists ($P < .05$) and dental hygienists ($P < .001$) had less access to FFP2 or FFP3. There were differences in the availability of material and the risk of infection between autonomous communities: those at level 4 (Cataluña and Basque Country: 256.80-279.98 cases/100.000 persons) were 3 times more likely to have PPE available than those at level 1 ($P < .05$) (Table 6).

Discussion

The first positive case of a dentist with COVID-19 was a professor of preventive dentistry at Wuhan University Dental Hospital¹⁴ and was reported on January 23, 2020. To our knowledge, there are no published data for Spain, even though Spain had the highest number of deaths due to

Table 5 – Differences between dentists and dental hygienist in symptoms and professional isolation due to COVID-19.

Questions	Dentist, n (%)	Dental staff, n (%)	P value
Have you had symptoms compatible with the COVID-19 infection during the month of February, March, or April?			
Cough	514 (7.3)	276 (7.6)	P = .418*
Fever (>37.5 °C)	333 (4.8)	184 (5)	P = .334*
Vomiting	52 (0.7)	28 (0.8)	P = .878*
Diarrhoea	340 (4.9)	170 (4.7)	P = .945*
Sore throat	703 (10.1)	370 (10.2)	P = .511*
Headache	837 (12)	503 (13.8)	P < .001*
Muscle pain	487 (6.77)	289 (7.9)	P = .023*
Unexplained tiredness	466 (6.7)	256 (7.0)	P = .273*
Shortness of breath	146 (2.1)	63 (1.7)	P = .321*
Loss of taste and smell	193 (2.8)	93 (2.5)	P = .748*
Difficulty breathing	10 (0.1)	8 (0.21)	P = .327*
No symptoms	2906 (41.6)	1399 (38.4)	P = .011*
If you have had symptoms, please indicate the duration:			
- 1-3 days.	563 (13.1)	316 (14.5)	
- 4-7 days	417 (9.1)	230 (10.6)	
- 8-13 days	233 (5.4)	149 (6.9)	
- >14 days.	207 (4.8)	99 (4.5)	
P = .346			
Have you been in solitary isolation for 2 weeks because of COVID-19?			
- Yes, because of a confirmed case.	79 (1.8)	38 (1.7)	
- Yes, because of a suspected case.	314 (7.3)	142 (6.5)	
- Yes, because of close contact.	208 (4.8)	106 (4.9)	
- I have not been in solitary isolation	3697 (86)	1886 (86.8)	
P = .708*			
If you have been in solitary isolation, have you been tested for COVID-19 after the quarantine period?			
Yes, I am waiting for the results.	15 (0.3)	6 (0.3)	
Yes, and it was positive.	14 (0.3)	4 (0.2)	
Yes, and it was negative.	39 (0.9)	14 (0.6)	
No, because there are/were no tests available	221 (5.1)	92 (4.2)	
No, the protocols in force do not consider it necessary.	296 (6.8)	154 (7.1)	
P = .460*			

COVID-19 = coronavirus disease 2019.

* χ^2 Pearson test.

COVID-19 and the second-highest number of infections during the study period. The methodology of our study (via WhatsApp and social networks) allowed access to a large number of dentists and dental hygienists in the week that coincided with the peak of infection in Spain.

Not having access to all registered dentists and hygienists and auxiliary staff and not carrying out random sampling could, at first sight, seem to be a limitation of the study. However, we believe that the large sample size and wide geographical distribution for both male and female professionals minimised any possible bias in the resulting data. Indeed, extrapolating these results to the country as a whole is not advisable because stratified sampling has not been carried out due to the type of methodology used, "WhatsApp and social networking," and always respecting the user's data protection. However, the distribution of male dentists in the Spanish General Dental Council who were surveyed is slightly lower than that in Spain (43.2%).²

Our sample size is large enough to conclude a significant association ($P < .05$) when there is a minimal standardised difference (i.e., 0.2, according to Cohen's scale)²³ between 2 groups being compared (ie, dentists and assistants), with a 80% power. Thus, in these large studies one should look not

only at the P value, but also at the differences between the 2 groups being compared.

In Spain, especially during the peak of the pandemic, many patients (medical, dental, primary care, hospital, public, private) were unable to receive scheduled treatment because activity was restricted to emergency situations by government mandate. Private and public dentistry were no exception, and only dental emergencies were treated.¹⁵ Most care was remote, with 25.7% of dentists attending patients by telephone from their homes, 25% from health facilities, and 3%-5% fulfilling COVID-19 functions, such as telephone triage. Numerous countries recommended this patient triage system in the case of possible COVID-19 infection before emergency face-to-face treatment,^{6,12,14} thus avoiding the risk of infection. In Spain 1 in 4 dentists and 57% of hygienists and auxiliaries stopped work completely. This situation is specific to Spain, where around 90%-95% of care is in private practice,² unlike the situation in many countries, such as Jordan,²⁴ where most of dentists work in the public sector, university, and military sector and only 39.1% in the private sector. Our results have shown that private dentists are half as likely to use FFP2 and FFP3 masks as public dentists.

The PPE recommended for dental professionals includes protective surgical glasses (EN 166:2001) and shields, FFP2

Table 6 – Factors associated with availability of protective masks (FFP2 + FFP3) in dentists and dental staff (hygienist and auxiliary).

Sample (n = 6470)	Adjusted OR (95% CI)	P value
Demographics		
Age		
31-40 years	0.836 (-0.438/0.082)	.178
41-50 years	0.903 (-0.362/0.160)	.446
51-60 years	0.752 (-0.586/0.016)	.063
>60 years	0.583 (-0.941/-0.147)	.008*
Occupation		
Hygienist	0.619 (-0.688/-0.276)	<.001 [†]
Professional activity		
Private	0.534 (-0.831/-0.423)	<.001 [†]
Risk geographic regions		
Level 2	1.510 (-0.506/1.525)	.417
Level 3	1.755 (-0.470/1.752)	.313
Level 4	2.896 (0.145/2.176)	.036*
Level 5	2.096 (-0.179/1.854)	.145
Level 6	1.625 (-0.433/1.599)	.339
Level 7	1.537 (-0.475/1.534)	.392
Infected		
No	0.979 (-0.544/0.512)	.938
I do not know	0.700 (-0.856/0.153)	.165
Fever		
Yes	0.723 (-0.707/0.043)	.089
Headache		
Yes	0.835 (-0.402/0.039)	.109

CI = confidence interval; FFP = filtering face piece; OR = odds ratio.

* $P \leq .05$

[†] $P \leq .001$

masks (EN 149:2001), and nitrile or latex gloves (EN ISO 374-5). During the study week, 15% had protective outwear, and 31%-36% had shields to protect the eyes and oral and nasal mucosa. However, Khader et al²⁴ found that 92.9% of Jordanian dentists and 82.6% of all dental staff had PPE, a situation far better than that found in Spain (12.2%). This variable was chosen to determine the level of compliance of the study population as regards PPE, which, in Spain, has been the most difficult protective equipment to obtain. Public health professionals also had a greater percentage of masks, although older professionals (>60 years) were the least likely to follow this protective measure. The lack of protective equipment for dental professionals was conveyed to the health authorities by the General Council of Dentists, suggesting the need for dental treatment to be suspended due to the lack of protective equipment for professionals and patients, a situation caused by shortages in supply.

Despite the reduction in dental care in Spain, and the fact that only emergencies were treated, our results show there was a risk of dental professionals becoming infected, especially because 25%-37% did not know if any of their patients were or had been infected. The results showed that 51 dentists and 22 hygienists had treated patients with confirmed COVID-19 infection. Wuhan Dental School,¹⁴ the centre of the pandemic, reported 9 cases in the 169 dental professionals. This shows there is a risk of transmission of the virus in dental centres, especially after exposure to aerosols.

The Spanish Ministry of Health, Consumer and Social Welfare⁴ and the General Council of Dentists (<https://www.consejodentistas.es>) presented daily updates on the situation in Spain, while the General Dental Council also developed

protocols of action and guidelines to prevent infection in dental clinics.²¹ Approximately half the dentists who responded stated that they received information in this way, as did hygienists, although they also received information from practice managers. It was observed that approximately 74.7% of dentists and 80.4% of hygienists were unable to follow official recommendations to prevent infections in dental centres due to a lack of protective equipment (FFP2 masks), although 64.8% (n = 4190) of dental health professionals always or almost always claimed that they complied with official occupational recommendations. This situation highlights the initial lack of knowledge about the composition of PPE by dental professionals during the first days of the pandemic. This information relates to the peak by the pandemic, a situation which changed due to the efforts of public administrations to equip professionals and the population, in general, with the recommended PPE.

The clinical manifestations of COVID-19 disease include fever, cough, and shortness of breath in 80% of infected cases²⁶ and some less specific symptoms such as conjunctivitis, sore throat, diarrhoea, vomiting, fatigue, and muscle pain.^{27,28} In our study, with 6470 respondents, 10.1% of dentists claimed to have had a sore throat, 7.3% a cough, 4.76% a fever of >37.5 °C, and 12% a headache. These figures are lower than those described in the Jordanian study where, of 368 dentists surveyed, 98.6% claimed to have had a fever, 91% a cough, 39% diarrhoea, and 32% vomiting; the incubation period was also longer (7-14 days) compared with our results (1-7 days).²⁵

However, the finding that 59.4% of respondents stated they had had symptoms should be treated with caution because these are very high numbers considering that only 1.5% of the total sample of dentists and 1.1% of hygienists were tested and 14% self-isolated at home. Many symptoms may have erroneously been confused with COVID-19.

We found that 58.8% of dentists and 70% of hygienists and auxiliary staff had a fear of leaving home and becoming infected, compared with 71.7% of Jordanian dentists,²⁴ despite having personal protective material available for all dental workers and a much lower level of infection than Spain. Likewise, a high level of psychological stress among Israeli dentists due to the fear of being infected by patients was reported.²⁹

The geographical distribution of infections in Spain has not been uniform. Some areas had a cumulative 14-day incidence of >600 infections/100,000 people, while other regions had a much lower incidence, such as the Canary Islands (50 cases/100,000 people). The recent results of the national seroepidemiological study of COVID-19 infection in Spain suggested an estimated prevalence of immunoglobulin G (IgG) antibodies against SARS-CoV-2 in 5% of people tested (95% CI 4.7%-5.4%), with marked geographical differences. The prevalence was >10% in communities such as Madrid and Castilla la Mancha but <2% in Ceuta, Melilla, Murcia, Asturias, and the Canary Islands.²² In communities such as Catalonia and the Basque Country, with infection rates of around 250/100,000 people, dental professionals stated that they had 3 times more protective equipment (FFP2 + FFP3 masks) than communities with much higher infection rates (eg, La Rioja).

The conclusions of this study refer to the situation in Spanish dentistry from April 6, 2020, to April 14, 2020 (the first peak

of the Spanish pandemic). As it is a cross-sectional study, conclusions should be drawn with caution.

Conclusions

Direct contact of Spanish dental health professionals with SARS CoV2 has been high, and during the most active phase of the disease, they did not have the PPE necessary to care for patients, a situation that justified the reduction in scheduled dental care, with only emergencies being treated. Private dentists had about half the probability of using protective masks than public sector dentists. The Spanish geographical regions with the highest number of contagions had the least amount of individual protective resources (FFP2 and FF3 masks). In addition, there has been widespread concern and fear among dental health professionals about leaving home.

Acknowledgements

The authors thank the Spanish Society of Epidemiology and Oral Public Health (SESPO) for expert supervision of the questionnaire; the Spanish General Council of Dentists (GCD) and the Spanish societies of dental hygienists for their rapid dissemination of the survey to their members.

Author contributions

Conceptualization, Y. M-B., M. B.; Methodology, Y. M-B., M. B., and A. J. O-R.; Software, F. J. I-L.; Validation, V. A-M., A. E-D., Y. M-B., and J. C. L.-C.; Formal Analysis, F. J. I-L., M. B., and Y. M-B.; Investigation, Y. M-B.; Resources, Y. M-B.; Data Curation, F. J. I-L.; Writing – Original Draft Preparation, Y. M-B., A. J. O-R., and M. B.; Writing – Review & Editing, Y. M-B., A. J. O-R., M. B., V. A-M., and J. C. L.-C.; Visualization, Y. M-B.; Supervision, All the authors.; Project Administration, Y. M-B.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest

None disclosed.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.identj.2021.01.012](https://doi.org/10.1016/j.identj.2021.01.012).

REFERENCES

- Bravo-Pérez M, Almerich-Silla JM, Ausina-Márquez V, et al. Encuesta de salud oral en España 2015. RCOE 2016;21 (Supp.1):8–48.
- Instituto Nacional de Estadística. Asistencia sanitaria. Cifras absolutas. Visitas a dentistas, estomatología e higienista dental. Available from: <https://www.ine.es/jaxi/Tabla.htm?path=/t15/p419/a2017/p02/&file=02009.px>. Accessed 20 April 2020.
- World Health Organization. Rolling updates on coronavirus disease (COVID-19). Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus.2019/events-as-they-happen>. Accessed 14 April 2020.
- Ministerio de Sanidad, consumo y bienestar social. Situación actual de Covid-19. Available from: www.msbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov/situacionActual.htm. Accessed 2 April 2020.
- Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 2020;382(13):1199–207.
- Izzetti R, Nisi N, 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.
- Xu H, Zhong L, Deng J, et al. High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa. *Int J of Oral Sci* 2020;12(1):8.
- Xu J, Li Y, Gan F, Du Y, Yao Y. Salivary glands: potential reservoirs for COVID-19 asymptomatic infection. *J Dent Res* 2020;99(8):989.
- To KK, Tsang OT, Chik-Yan YC, et al. Consistent detection of 2019 novel coronavirus in saliva. *Clin Infect Dis* 2020;71(15):841–3.
- Chan JF, Yuan S, Kok KH, 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.
- Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *N Engl J Med* 2020;382(10):970–1.
- Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci* 2020;12(1):9.
- Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. *J Hosp Infect* 2020;104(3):246–51.
- 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.
- Spanish Government. Real Decreto 463/2020, de 14 de marzo, por el que se declara el estado de alarma para la gestión de la situación de crisis sanitaria ocasionada por el COVID-19. Available from: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-3692. Accessed 14 April 2020.
- Consejo General de Dentistas. Recomendaciones de buenas prácticas para la atención de urgencias. Available from: <https://www.consejodentistas.es/ciudadanos/coronavirus.html>. Accessed 14 April 2020.
- Centers for Disease Control and Prevention. Developing guidance regarding Responding to COVID-19 in dental settings. Available from: <https://www.cdc.gov/oralhealth/infection-control/statement-COVID.html>. Accessed 2 May 2020.
- American Dental Association. Coronavirus frequently asked questions. Available from: <https://success.ada.org/en/practice-management/patients>. Accessed 11 April 2020.
- Razai MS, Doerholt K, Ladhani S, Oakeshott P. Coronavirus disease 2019 (COVID-19): a guide for UK GPs. *BMJ* 2020;368:m800.
- World Health Organization. Clinical management of severe acute respiratory infection when novel coronavirus (nCoV) infection is suspected: interim guidance. Available from: <https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel>

- coronavirus-(nCov)-infection-is-suspected. Accessed 19 April 2020.
21. Consejo General de Dentistas. Plan estratégico de acción para el periodo posterior a la crisis creada por el COVID-19. Available from: <https://www.consejodentistas.es/comunicacion/actualidad-consejo/notas-de-prensa-consejo/item/1763-plan-estrategico-de-accion-para-el-periodo-posterior-a-la-crisis-creada-por-el-covid-19.html>. Accessed 15 April 2020.
 22. Ministerio de Sanidad, consumo y bienestar social. Estudio ENE-Covid 19: primera ronda. Estudio Nacional de Sero-Epidemiología de la infección por SARS-COV-2 en España. Información preliminar 13 Mayo 2020. Available from: <https://www.mscbs.gob.es>. Accessed 2 April 2020.
 23. Cohen J. *Statistical power analysis for the behavioral sciences*. Hillside, NJ: Lawrence Erlbaum Associates; 1988.
 24. Khader Y, Al Nsour M, Al-Bataumej OB, et al. Dentist's awareness, perception and attitude regarding COVID-19 and infection control: a cross-sectional study among Jordanian Dentist. *JMIR Public Health Surveill* 2020;6(2):E18798. 9.
 25. Ministerio de Industria, Comercio y Turismo. Resolución del 23 de Abril de 2020, de la Secretaria general de industria y de la pequeña y mediana empresa, referente a los equipos de protection individual en el contexto de la crisis sanitaria ocasionada por el COVID-19. Available from: <https://www.boe.es/buscar/doc.php?id=BOE-A-2020-4651>. Accessed 22 April 2020.
 26. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020;395(10223):507–13.
 27. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travelers from Wuhan, China, 20-28 January 2020. *Euro Surveill* 2020;25(5):2000062.
 28. Guan WJ, Ni ZY, Hu Y, et al. China Medical treatment expert group of COVID-19. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020;382(18):1708–20.
 29. Shacham M, Hamama-Raz Y, Kolerman R, Mijiritsky O, Ven-Erza M, Mijiritsky E. COVID-19 factors and psychological factors associated with elevated psychological distress among dentist and dental hygienist in Israel. *Int J Environ Res Public Health* 2020;17(8):2900.