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Dentists' Perceptions of Their SARS-CoV-2 Risk and Infection Control Needs



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ABSTRACT

Objective: Rapid worldwide dissemination of SARS-CoV-2 has prompted dental professionals to optimise their infection control procedures. To help identify areas of opportunity for protecting dentists and their patients, the aim of this investigation was to analyse Mexican dentists' early perceptions of their risk of exposure to SARS-CoV-2 and their need for comprehensive infection control education.

Methods: This cross-sectional survey was conducted from May 9 to June 3, 2020, during the social distancing phase in Mexico. The survey adhered to relevant guidelines for ethical research design. The questionnaire was designed with Google Surveys and applied online in Spanish. The questionnaire included items on demographics and clinical specialisation. To obtain time-sensitive perceptions, statements were preceded by "While SARS-CoV-2 circulates in the community and new COVID-19 cases are reported"; responses were collected in a 5-point Likert-type scale.

Results: The survey's link received 1524 "clicks." Over 25 days, 996 dentists participated (39% men; 89% working in Mexico and 11% in other Spanish-speaking Latin American countries). Most participants (73%) fully agreed that "Looking after patients will pose a risk for the dentist." Total agreement was more common ($P = .0001$) amongst dentists in Mexico (76%) than amongst those in other countries (53%). Knowing someone with COVID-19 was more common amongst Mexican dentists ($P = .0008$). The perceived need for enhanced infection control procedures increased with age ($P = .0001$). Forty-nine percent totally agreed that they sterilise dental handpieces between patients. One-third expressed total agreement that everyone in their clinic was trained in infection control.

Conclusions: Amongst this nonprobabilistic self-selected sample of dentists, age and country of work influenced their perceptions about occupational exposure to SARS-CoV-2 and infection control needs. This survey revealed areas of opportunity to improve infection control education and training for dental professionals.

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Introduction

On March 12, 2020, the World Health Organization posted a "global pandemic alert" on the novel severe acute

respiratory syndrome coronavirus-2 (SARS-CoV-2) and the coronavirus disease 2019 (COVID-19) that it causes.¹ This virus spread rapidly, mainly through global travel. To mitigate the spread of the novel coronavirus, health authorities worldwide set social distancing measures temporarily restricting activities to only those considered essential.

In Mexico, the first 3 cases of COVID-19 were reported on February 28, 2020.² By June 10, Mexico had reported 124,301

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cases and 14,649 deaths and was listed amongst the most affected countries.³

Health care workers are at risk of SARS-CoV-2 airborne transmission when performing aerosol-generating procedures.⁴⁻⁶ This has significant implications for the delivery of dental care, because the novel coronavirus is present in saliva,⁷ and common clinical procedures generate aerosols that disseminate microorganisms from the patient's mouth,⁸ placing dental health care workers at high risk of exposure.

The US Centers for Disease Control and Prevention (CDC) published updated guidance for infection control⁹ to advise the dental profession on how to minimise risks associated with the provision of dental care. Additionally, the FDI World Dental Federation¹⁰ and the *Consejo de Dentistas de España*¹¹ published protocols for dentistry's safe return to clinical activities. In Mexico, however, there are profound deficiencies in infection control education,^{12,13} posing challenges for a safe return to work.

This cross-sectional nonprobabilistic survey was conducted online during the social distancing phase in Mexico to collect dentists' time-sensitive perceptions and to test the hypothesis that, at the beginning of the pandemic, demographic variables influenced their perceived risk of occupational exposure to SARS-CoV-2 and their need for evidence-based infection control education and training.

Materials and Methods

Ethics and biosafety

This cross-sectional survey followed relevant guidelines for ethical research design and the standards to ensure the protection of human subjects, in accordance with the World Medical Association's Code of Ethics (Declaration of Helsinki). The protocol was reviewed and approved by the Research Ethics Committee at the School of Legal and Forensic Medicine, Universidad Complutense de Madrid, Spain (IRB 002/2020), and written informed consent was waived. The study took place online in Mexico during the social distancing phase. The online survey was anonymous, the individual's responses were confidential, and no identifying personal data were collected. The participants were not in a subordinate relationship with any of the researchers. No incentives were offered. Voluntarily responding to the online questionnaire did not represent any risk or cause harm to the participants.

Survey

During the social distancing phase, most dental offices were closed or received emergencies only. To obtain the participation of as many dentists as possible, the link to the questionnaire was placed on a dental distributor's web page. The survey was open from May 9 to June 3, 2020. In addition to those dentists who regularly purchase supplies from this distributor, anyone visiting the website had access to the link. Individuals could return to the web page more than once.

Questionnaire

The questionnaire was designed with Google Surveys to be answered online in Spanish. Items on demographics included sex (male or female), age in years, years in practice, and location of their dental practice. To identify qualified dentists, we asked "Which dental school did you graduate from?" and for their field of clinical specialisation. To provide context, the 24 statements on their perceptions were preceded by "While SARS-CoV-2 circulates in the community and new COVID-19 cases are reported." Responses were collected in a Likert-type scale as totally agree (TA), agree (A), neutral (N), disagree (D), or totally disagree (TD).

Statistical analysis

The participant's responses were captured in a database from which frequency tables were developed.

Continuous variables were age and years in practice. Independent variables were age, sex, practice's location, and field of clinical specialisation. Each perception response was a dependent variable.

For categorical measures, the Chi-square test was applied to compare response trends for each perception item (dependent variable) against each independent variable (age, sex, practice's location, and field of clinical specialisation). The Chi-square test determines whether the observed response distribution occurs randomly or is significantly associated with a demographic variable. Data were analysed using the JMP 9 statistical package (SAS Institute Inc.). A critical value of $P \leq .05$ was considered statistically significant. Results are presented as rounded percentages.

Results

Over 25 days, the web page received 16,987 views, 10,137 (66%) from Mexico, 4423 (29%) from the US, and 371 (3%) from diverse Spanish-speaking countries. Visitors could access the web page more than once. The survey's link received 1524 clicks (a click is a measurement of a user-initiated action on the link) of which 759 (50%) clicks were made in the first 24 hours. At its closing on June 3, the survey had obtained the participation of 996 qualified dentists who answered the questionnaire. Of 23,904 (996×24) possible responses, there were only 19 empty cells. The percentage of missing responses ranged from 0.1% to 1%.

For participating dentists, who indicated which university they graduated from, there were 392 (39%) men and 604 (61%) women, 23 to 75 years old (mean, 47 years $\pm$ 12 SD; 95% confidence interval [CI], 46.2-47.7), with 2 to 48 years in practice (mean, 22; 95% CI, 21.4-22.9). Dentists' age correlated with their years in practice ($r^2 = 0.954916$, $P < .0001$).

Amongst the 996 participating dentists, 891 (89%) had their dental office in Mexico. In addition to this target population, 105 (11%) worked in other Spanish-speaking Latin American countries, including 62 in Colombia. There were more men ($P = .0028$) amongst dentists from other Latin American countries (53%) than amongst Mexican dentists (39%). Age

Table 1 – Dentist's perceived risk of exposure to SARS-CoV-2.

	While SARS-CoV-2 circulates in the community and new COVID-19 cases are reported						P*			
	TA	A	N	D	TD					
	n (%)						AGE	SEX	CTR	SPE
Looking after patients will pose a risk for the dentist	732 (73)	158 (16)	78 (8)	15 (2)	15 (2)				.0001	
The risk of infection with SARS-CoV-2 is exaggerated	120 (12)	136 (13)	190 (19)	118 (12)	431 (43)				.0001	
I have a medical condition that puts me at a higher risk for COVID-19	276 (28)	99 (10)	82 (8)	73 (7)	463 (46)	.0001	.0001		.0030	
I personally know someone hospitalised with COVID-19	237 (24)	42 (4)	57 (6)	59 (6)	600 (60)				.0008	
My family worries about my possible occupational exposure to SARS-CoV-2	718 (72)	147 (15)	85 (8)	22 (2)	25 (3)	.0332			.0101	
I'll get the vaccine as soon as it becomes available	680 (68)	100 (10)	127 (13)	38 (4)	51 (5)				.0456	

* Using Chi-square test.

TA, total agreement; A, agreement; N, neutral; D, disagreement; TD, total disagreement; CTR, country where they work; SPE, field of clinical specialisation.

distribution was not different ($P = .4196$) between non-Mexican and Mexican participants.

Of the 996 dentists, clinical specialties were as follows: general practitioners, 358 (36%); orthodontists, 246 (25%); prosthodontists and implant dentistry, 106 (10%); endodontics, 89 (9%); children's dentistry, 82 (8%); periodontics, 45 (5%); oral and maxillofacial surgery, 35 (3.5%); and 35 (3.5%) "other" (oral pathology, forensics, public health).

Dentist's perceptions of exposure risk to SARS-CoV-2 are presented in Table 1. Most participants (73%) fully agreed that "Looking after patients will pose a risk for the dentist." Total agreement (TA) was more common ($P = .0001$) amongst dentists in Mexico (76%) than amongst those in other countries (53%).

One in four participants perceived that the risk of infection was exaggerated [12% TA and 13% agreement (A)]. TA with a perception of an exaggerated risk was higher (27%) amongst dentists working in other countries ($P = .0001$).

Amongst all the participants, 276 (28%) totally agreed that they had a medical condition that placed them at higher risk. As age increased, the percentage went from 4% to 54% ($P = .0001$). Men were more likely to agree that they had a preexisting medical condition ($P = .0001$). TA that they had a medical condition was 30% amongst dentists in Mexico and 11% amongst those working in other countries ($P = .0030$).

Amongst all participants, 237 (24%) totally agreed that they knew someone hospitalised with COVID-19. Dentists outside Mexico were less likely to know a patient with COVID-19 ($P = .0008$).

TA with the perception that their family worried about the dentist's occupational exposure was 72%. Dentists aged 60 years or older were more likely to totally agree (75%) that their family worried ($P = .0332$). This concern was more common ($P = .0101$) amongst dentists in Mexico (74%) than amongst dentists in other countries (57%).

TA with "I'll get the vaccine as soon as it becomes available" was 68%, higher ($P = .0456$) in Mexico (69%) than in other Latin American countries (60%).

Dentists' perceptions of logistics problems, cost increase, and patient's fear are shown in Table 2. Nearly half (49%) totally agreed that it would be expensive to update their

infection control procedures. No significant differences were observed by age, sex, country, or clinical specialisation.

Thirteen percent of participants expressed TA that enhanced infection control will slow down their delivery of services in the dental office. Amongst those aged 60 years or older, 21% shared this perception ($P = .0165$).

A minority (9%) indicated TA with conditioning appointments by "demanding that the patient presents a recent negative PCR test result". Female dentists were more likely to indicate "disagree" or "neutral" ($P = .0375$).

Sixty percent of the participants believed that patients were afraid of going to the dentist (37% TA and 23% A). This perception was more common amongst older dentists ($P = .0144$).

"My patients ask about the infection control that I will apply in my dental office" was answered in TA by 297 (30%) dentists. This perception increased to 40% amongst those aged 60 years and older ($P = .0001$). Men were more likely to agree ($P = .0012$). TA varied ($P = .0061$) across the clinical specialties: 43% (15/35) oral surgeons, 33% (28/86) prosthodontists, 31% (109/354) general dentists, and 23% (57/246) orthodontists.

Most participants (85%) perceived that their current patients will continue trusting the biosafety of their dental offices (58% TA and 27% A). No significant differences were observed by demographics.

Dentists' perceptions of infection control practice and training needs are shown in Table 3. In response to "Without exception, I steam sterilise dental handpieces in between patients," 49% of all participants totally agreed. TA was 56% amongst those 50 to 60 years old (0.0023). Combined TA+A were 65% in Mexico and 51% in other countries ($P = .0005$). More women remained neutral ($P = .0204$).

Sixty percent totally agreed that they generate aerosols. TA increased to 65% amongst older dentists ($P = .0128$). This perception differed by clinical specialisation ($P = .0001$).

The statement "In my clinic we are all trained to achieve infection control" was answered in TA by 329 (33%). Oral surgeons were more likely to perceive that in their clinics all were trained to achieve infection control ($P = .0204$).

Having evidence-based information on infection control was perceived in TA by 464 (47%). Dentists aged 50 years or older totally agreed (53%), compared with 40% of dentists

Table 2 – Dentists' perceptions of logistics problems, cost increase, and patient's fear.

	While SARS-CoV-2 circulates in the community and new COVID-19 cases are reported					P*			
	TA	A	N	D	TD				
	n (%)					AGE	SEX	CTR	SPE
It will be expensive to update the infection control procedures	492 (49)	237 (24)	187 (19)	45 (5)	35 (4)				
The new infection control procedures will slow the functioning of my dental office	126 (13)	157 (16)	273 (27)	148 (15)	291 (29)	.0165		.0116	
I'll demand from patients a recent negative PCR test result for SARS-CoV-2	88 (9)	75 (8)	290 (29)	177 (18)	365 (37)	.0002	.0375	.0209	
Patients are afraid of going to the dentist because of the risk of being exposed to SARS-CoV-2	371 (37)	227 (23)	284 (29)	77 (8)	37 (4)	.0144			
My patients ask about the infection control that I will apply in my dental office	297 (30)	175 (18)	252 (25)	132 (13)	138 (14)	.0001	.0012		.0061
My current patients will continue trusting the biosafety in my dental office	576 (58)	269 (27)	114 (12)	18 (2)	12 (1)				

* Using Chi-square test.

TA, total agreement; A, agreement; N, neutral; D, disagreement; TD, total disagreement; CTR, country where they work; SPE, field of clinical specialisation.

younger than 30 years old ($P = .0175$). TA was more common ($P = .0211$) amongst men (52%) than amongst women (43%). TA varied ($P = .0404$) across the clinical specialties: 39% (139/354) general practitioners, 46% (113/246) orthodontists, 55% (48/88) endodontists, and 69% (24/35) oral surgeons.

"I need to update my knowledge on infection control" elicited TA from 555 (56%) and agreement from 191 (19%). TA was 58% in Mexico vs 39% in other countries ($P = .0010$). Oral surgeons were more likely to perceive that they did not need to update their knowledge ($P = .0063$).

In response to "I need to enhance my infection control procedures," 668 (67%) indicated their TA. This perception increased with age to 77% ($P = .0001$) and was expressed by 68% of dentists in Mexico ($P = .0022$). Fifty-five percent of

respondents perceived (TA + A) that they did not need to change the way they work.

Most participants (75%) expressed TA with the need to use better personal protective equipment, and this perception increased to 83% at an older age ($P = .0329$). Thirty-nine percent totally agreed that "dentists need special technology to disinfect the air in the dental office," followed by the need for enhanced surface disinfection (TA 24%) and for controlling aerosols from the patient's mouth (TA 20%). Half of the participants disagreed [Total disagreement (TD) and disagreement (D)] that disinfecting surfaces or controlling aerosols was all they needed to do.

In response to "in my locality I find all necessary infection control materials," 259 (26%) indicated TA. TA was 33%

Table 3 – Dentists' perceptions of infection control practice and training needs.

	While SARS-CoV-2 circulates in the community and new COVID-19 cases are reported					P*			
	TA	A	N	D	TD				
	n (%)					AGE	SEX	CTR	SPE
Without exception, I steam sterilise dental handpieces in between patients	487 (49)	125 (13)	179 (18)	103 (10)	97 (10)	.0023	.0204	.0005	
In my clinical specialisation I do generate aerosols	598 (60)	102 (10)	165 (17)	62 (6)	67 (7)	.0128			.0001
In my clinic we are all trained to achieve infection control	329 (33)	253 (25)	243 (24)	105 (11)	65 (7)				.0204
I have updated evidence-based information on infection control	464 (47)	252 (25)	192 (19)	51 (5)	36 (4)	.0175	.0211		.0404
I need to update my knowledge on infection control	555 (56)	191 (19)	148 (15)	59 (6)	43 (4)			.0010	.0063
I need to enhance my infection control procedures	668 (67)	165 (17)	100 (10)	41 (4)	22 (2)	.0001		.0022	
I don't need to change the way I work	362 (36)	194 (19)	120 (12)	90 (9)	230 (23)				
Dentists need personal protective equipment better than the one they currently use	748 (75)	131 (13)	74 (7)	17 (2)	25 (3)	.0329		.0001	
Dentists need special technology to disinfect the air in the dental office	389 (39)	178 (18)	230 (23)	100 (10)	95 (10)			.0001	
I only need to thoroughly clean and disinfect clinical surfaces	235 (24)	103 (10)	148 (15)	154 (15)	355 (36)	.0214		.0048	
I only need to control aerosols from the patient's mouth	202 (20)	118 (14)	173 (17)	153 (15)	347 (35)	.0022		.0441	
In my locality I find all necessary infection control supplies	259 (26)	135 (14)	174 (17)	142 (14)	285 (29)	.0060	.0002	.0001	.0257

* Using Chi-square test.

TA, total agreement; A, agreement; N, neutral; D, disagreement; TD, total disagreement; CTR, country where they work; SPE, field of clinical specialisation.

amongst dentists aged 60 years or older ($P = .0060$). Women (32%) were more likely than men (24%) to totally disagree ($P = .0002$). The country where they worked was associated ($P = .0001$) with dentists' perceived access "in their locality"; TA was 29% amongst those not in Mexico and 26% amongst those in Mexico. Moreover, those outside Mexico City were more likely to totally disagree (36%) than those in Mexico City (15%). TA varied ($P = .0257$) across the clinical specialties: 27% (96/354) general practitioners, 26% (63/246) orthodontists, 33% (29/89) endodontists, and 17% (6/35) oral surgeons.

In addition to the results presented in [Tables 1 to 3](#), those dentists who had a medical condition placing them at a higher risk of severe COVID-19-associated illness perceived, more than their healthy colleagues, (a) the need to enhance their infection control procedures ($P = .0001$); (b) the need for technology to disinfect the air in their dental offices ($P = .0001$); (c) their family's concerns about possible occupational exposure to SARS-CoV-2 ($P = .0002$); and (d) that dental patients would fear being exposed to SARS-CoV-2 ($P = .0270$) and expressed a positive attitude about being immunised ($P = .0461$).

Discussion

The results of this investigation indicate that amongst this nonprobabilistic sample of dentists, age, sex, their workplace's location, and clinical specialty may have influenced their earliest perceptions of their risk of occupational exposure to SARS-CoV-2 and their perceived needs for infection control information, training, and supplies.

Recent publications reveal that, to identify areas of opportunity for protecting dentists and their patients, diverse multinational online surveys documented the dental profession's early reaction to the rapid dissemination of SARS-CoV-2.¹⁴⁻¹⁶ One year into the COVID-19 pandemic, these surveys provide a global panorama of dentists' concerns about their occupational safety and their standing needs for evidence-based infection control education and training.

In this cross-sectional survey, participant dentists expressed their perceived risk of exposure to SARS-CoV-2 in a scenario marked by many unknowns about the virus and uncertainty about the pandemic's long-term impact on the dental profession. At the time when the survey took place, it was unlikely that the participants had studied and implemented the enhanced infection control protocols recommended by the CDC,⁹ the FDI,¹⁰ or the Spanish Council of Dentists.¹¹ Most participants declared that they had updated infection control information but expressed also that they needed to update that knowledge and to enhance infection control procedures in their clinics.

In May through June 2020, most participants perceived that caring for patients will pose an occupational risk of exposure to SARS-CoV-2 and agreed that the risk was not exaggerated, which is consistent with results obtained in other regions,¹⁶⁻¹⁸ where a low level of comfort with infection control procedures has been reported,¹⁵ as well as fear, anxiety, and depression.^{14,16,19}

Their age and the country where they worked were the demographic variables most likely to influence participants'

perceptions. As age increased, medical conditions became more common. It is possible that preexisting medical conditions in a third of all participants may have influenced their perceptions of their family's concern and of the need to enhance their infection control procedures. Dentists in Mexico were more likely to personally know patients with COVID-19, to perceive themselves at risk, and to perceive their family's concern. In contrast, those dentists who worked in other Latin American countries were significantly less concerned.

Differences in perception were observed amongst the clinical specialties; their diverse clinical activities and patients' age group (children, adolescents, or adults) may have contributed to the participants' perceptions of risk and needs.

Early in the pandemic, international surveys found differences in dentists' perceived risk,^{15,16} which may be attributable to social, cultural, and environmental factors.¹⁶ The reported distribution of COVID-19 cases and deaths may have also led to differences in perceived risk. The World Health Organization's Situation Reports database shows that on May 10, 2020, the counts of cumulative cases/deaths were Colombia 10,051/428, Ecuador 28,818/1704, and Mexico 31,522/3160.²⁰ Mexico has remained amongst the 20 countries most affected and the one with the largest number of deaths per 100 confirmed cases.²¹ Moreover, the Pan-American Health Organization's Epidemiological update on February 9, 2021, shows that in the Americas, the largest number of reported deaths amongst health care workers were in Mexico (2996), the US (1347), Peru (589), and Brazil (480).²²

In contrast with their declared concerns of occupational exposure, only 68% of the participants expressed a positive interest in being immunised. Now that immunisation against SARS-CoV-2 is available, vaccine hesitancy and anti-vax perceptions may remain a challenge. The Mexican Ministry of Health prioritised immunisation against SARS-CoV-2 for frontline health care workers between December 2020 and February 2021. Thereafter, the immunisation roll-out for the general population is scheduled by age starting with adults older than 60 years.²³ No specific calendar was published for the immunisation of dentists. Therefore, non-hospital-based oral health care providers are included in the general population to be immunised according to their age group. By mid-May 2021, no record exists of how many dentists in Mexico have been immunised or declined immunisation.

In terms of limitations of the study, questionnaire responses may be subject to memory bias. In this survey, participants were looking for information on infection control and dental supplies on a dental trade web page. It is therefore possible that their search was motivated by infection control concerns and needs. No personal information was recorded, providing the confidentiality that may have reduced possible social desirability bias. This survey's main limitation is that it reached a nonprobabilistic sample of dentists who chose to participate. Therefore, no claim is made for this sample to be representative of Mexico or Latin America.

Social distancing, including the closure of universities and dental offices on short notice, hindered the structuring of a probabilistic sampling at dental trade shows or by contacting dental offices via telephone or the postal service. Moreover,

in Mexico there is no official roster of licensed and active dentists.²⁴

Education and training in infection prevention and control are associated with decreased risk of SARS-CoV-2 infection in health workers.²⁵ Low COVID-19 prevalence and positivity rates amongst US dentists suggest that current enhanced infection control procedures may be sufficient to prevent exposure to SARS-CoV-2 in dental settings.¹⁹ However, early in the pandemic gaps were observed between the perceived occupational risk and the implementation of enhanced infection control procedures.^{14,17}

In this survey, participants' responses revealed that the challenge for reopening dental offices is permeated by deficiencies in infection control education and practice. In many Latin American dental schools, infection control is not consistently taught as part of the academic programme.^{12,13} Amongst 207 recent graduates from 43 schools of dentistry, only 35% declared that they were trained to sterilise dental handpieces between patients.²⁶

No report exists on the transmission of SARS-CoV-2 during dental procedures, but the perception prevails that safe dental care requires enhanced infection control. However, in the absence of sound knowledge about infection control practices and policies, most dentists will be disoriented when facing the challenges of the new practice standards imposed by SARS-CoV-2.

This survey revealed opportunities to improve infection control education and training for dental professionals. Older dentists perceived the need to update their infection control knowledge. This can be remediated through continuing education. For the younger dentists who were less concerned about COVID-19 and for whom dental handpiece sterilisation was not routine, awareness and training could be enhanced through updated evidence-based courses in dental school. Collaboration amongst organised dentistry, academia, industry, and regulatory authorities would help develop and sustain a dental practice standard safer for patients and dental health care personnel.

Conclusions

Amongst this nonprobabilistic self-selected sample of dentists, age and country of work influenced their perceptions about occupational exposure to SARS-CoV-2 and infection control needs. This survey revealed areas of opportunity to improve infection control education and training for dental professionals.

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Conflict of interest

None disclosed.

Author contributions

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Bernardo Perea-Pérez, MD, PhD: Conceptualisation, revising the article critically, final approval of the version to be submitted.

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