Original Research

Perception of the COVID-19 Vaccination Process in Peruvian Dental Professionals: A Logistic Regression Analysis

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Abstract

Aim: Because of the situation regarding COVID-19, dentists are constantly exposed to being infected with the coronavirus, since they have direct contact with the patient. Therefore, agreeing to be vaccinated against COVID-19 seems to be a promising solution to reduce the risk of death in these professionals. Therefore, the present study aims to assess the perception of the vaccination process against COVID-19 in Peruvian dental professionals. **Materials and Methods:** An analytical, observational, and cross-sectional study was conducted in 360 Peruvian dentists between June and August 2021. An instrument that measured the perception of the COVID-19 vaccination process was developed and validated. A crude and adjusted logit model was used to assess the association of the following variables: age (X1), gender (X2), marital status (X3), number of children (X4), place of origin (X5), occupation (X6), years of experience (X7), academic degree (X8), specialization (X9), vulnerability (X10), COVID-19 history (X11), origin of vaccine (X12), dose received (X13), and professional association location (X14), with the perception of dentists toward the COVID-19 vaccination process, considering a P value < 0. 05. **Results:** Of the 360 Peruvian dentists surveyed, the prevalence of poor perception was 53.61% (95% confidence interval [CI] = 48.45%–58.75%). Of the variables analyzed, the only one that proved to have a significant influence on the development of poor perception, according to the logistic regression analysis (*logit* model), was the location of the professional association, with an odds ratio (OR = 0.37, CI = 0.22–0.62), whereas Sinopharm vaccine (OR = 1.70, CI = 0.35–8.25) or Pfizer/BioNTech (OR = 2.31, CI = 0.45–11.88) and the other variables were not considered as influential factors in the development of poor perception toward the COVID-19 vaccination process (P > 0.05). **Conclusions:** More than half of the Peruvian dentists surveyed had a poor perception of the COVID-19 vaccination process. However, those whose professional association was located in the capital city were 63% less likely to have a poor perception than those dentists from the provinces. In addition, the origin of the vaccine and other variables such as age, gender, marital status, number of children, origin, occupation, years of experience, academic degree, specialization, vulnerability, history of COVID-19 and dose received were not considered influential factors for developing poor perception.

Keywords: COVID-19, Dentistry, Dentists, Perception, Peru, Vaccination

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Introduction

On December 31, 2019, an increase in the number of cases of pneumonia with unknown etiology was identified in Wuhan (China), officially termed severe acute respiratory syndrome caused by coronavirus 2 (COVID-19). In January 2020, the World Health Organization announced that this outbreak constituted a public health emergency of international concern.[1-3] In Peru, because of this coronavirus, a total of 3,546,696 confirmed cases and 212,207 deaths have been reported to date (March 2022).[3] Therefore, because of the rapid spread of the virus and

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to reduce its contagion speed, the government decrees confinement, social distancing, hand washing, the use of masks,[4] and recently vaccines as health strategies, as they represent the most promising strategy to combat the COVID-19 pandemic through primary prevention.[5]

In dentistry, because of its care characteristics, the risk of crossinfection is high between dentists and patients, because the production of contaminated aerosols is evident and significant during dental procedures,[6,7] so the possible routes of transmission to which the dentist is exposed are the airborne spread of salivary droplets, contact with fluids, or contact with contaminated surfaces (fomites).[8] Scientific evidence has shown that this is possible, because SARS-CoV-2 can remain stable for 4 h on a copper surface, 24 h on a cardboard surface, 5–6 h on stainless steel, and 6–8 h on plastic.[4]

Vaccination is a simple and effective way to protect people against harmful diseases before they come into contact with the biological agent that triggers them, because vaccines activate the body's natural defenses and strengthen the immune system. Most vaccines are injected, but others are ingested (orally) or nasally nebulized.[3] It has been reported that factors that could determine acceptance of vaccination are age, gender, place of origin, educational level, among others.[9-12] It has also been reported that people are more willing to be vaccinated when government health authorities and health personnel recommend them through open communication channels and especially when their benefits are communicated through reliable media.[9-11]

In Peru, to date (March 2022), 66,378,815 doses of the vaccine against COVID-19 have been administered,[3] of which the general population has been immunized with Sinopharm (China) vaccines and the vulnerable population, such as adults the elderly, people with comorbidities, and pregnant women with the Pfizer/BioNTech (USA) vaccine.

Regarding the Chinese vaccine, it has been reported, according to the Beijing Institute of Biological Products, that clinical trials carried out in the United Arab Emirates in phase III resulted in 79.34% effectiveness of the Sinopharm vaccine.[13,14] Despite this information, there are still doubts toward the effectiveness of Chinese vaccines, because of some negative news related to the increase in infections and even some deaths in already vaccinated populations.[15,16] On the other hand, regarding the Pfizer/BioNTech vaccine, it has been reported that its efficacy is on average 95%.[13,17]

In order to carry out large-scale immunization in Peru, a National Vaccination Plan against COVID-19 was established in February 2021, free and voluntary,[5,18] with active participation of the professional associations together with the national health system to immunize mainly medical and dental personnel with the Sinopharm vaccine.[5] A vaccination strategy was implemented outside the health services, which included the communication of the date, schedule, and location of the health care post through the local media. In addition, the environments had to be spacious, ventilated, and illuminated, providing ideal conditions for the vaccines, vaccinators, and users. Preferably, these places should avoid crowding and waiting lines, and staff should be available to perform triage to detect comorbidities and answer questions about adverse effects and postvaccination care.[5,19]

In view of the above, this study was carried out with the aim of assessing the perception of the vaccination process against COVID-19 in Peruvian dental professionals. The null hypothesis considered in this study was the following: there is a poor perception of the vaccination process against COVID-19 in Peruvian dental professionals.

Materials and Methods

Type of the study

An analytical, observational, prospective, and cross-sectional study was performed. This article was written in accordance with the STROBE guidelines for observational studies.[20]

Population and selection of participants

The study was carried out between June and August 2021. The sample size was 360 dentists and was calculated using a formula to estimate a proportion in an estimated population of 49,860 registered dentists throughout Peru. This was done from a pilot study with 50 participants from different parts of the Peruvian territory, from which a proportion of perception, $P = 0.64$ and $q = 0.36$, was obtained, considering a significance level, $\alpha = 0.05$, and a margin of error of 5%. The sampling technique was by snowball, according to the eligibility criteria, until completing the 360 participants.

Inclusion criteria

The following are the inclusion criteria:

- Professionals with the title of Doctor of Dental Surgery
- Dentists working legally in Peru
- Dentists who had been administered the COVID-19 vaccine
- Dentists who gave virtual informed consent.

Exclusion criteria

The following are the exclusion criteria:

- Dentists who did not complete the virtual questionnaire
- Dentists not affiliated to a Peruvian professional association.

Variables

The outcome variable was the perception of the vaccination process to prevent COVID-19, whereas the

independent variables were age, gender, academic degree, place of origin, and origin of the vaccine,[9-12] and the confounding variables were marital status, number of children, occupation, years of experience, specialization, vulnerability to COVID-19, history of COVID-19, doses received, and location of the professional association.

Validation and application of instrument

A preliminary validated instrument was used.[21] However, the construct and reliability were revalidated, and the stability of the instrument was also evaluated. On the other hand, questions about sociodemographic factors (14 items) were included.

This scale consisted of 18 items that assessed the perception of the COVID-19 vaccination process in Peruvian dental professionals[21] divided into four dimensions: perception of the process organization (Q1–Q7), perception of the service (Q8–Q11), perception of the care procedure (Q12–Q14), and perception of the vaccine efficacy (Q15–Q18). Each item had five ordinal (Likert-type) response alternatives: "totally disagree," "disagree," "indifferent," "agree," and "totally agree" with a score from 1 to 5, respectively. When answering the instrument, the individual value of each item was noted and then added together to obtain a total score. The results of the perception of the COVID-19 vaccination process were dichotomized as poor perception (18–62 points) and good perception (63–90 points). This cut-off point was calculated based on a five-level scale with the following total score: poor perception (very low perception [18–32 points], low [33–47 points], regular [48–62 points]) and good perception (high [63–77 points] and very high [78–90 points]).

For the construct validation, the same items preliminarily validated by the same authors of the study were used,[21] and the variability of each item was evaluated, using a Pearson correlation matrix (item total) and inverting the scores of the Likert scale when the items were negative. As for the perception scale, it presented an acceptable determination coefficient (<0.001) and the Kaiser-Meier-Olkin measure (KMO = 0.886) and Bartlett's sphericity ($P < 0.05$), both acceptable. Therefore, it was decided to perform an exploratory factor analysis (EFA). The principal components analysis according to the EFA suggested four dimensions, unlike the preliminary validation that had three dimensions,[21] with an explained variance of 33.95%, 12.04%, 10.11%, and 6.59% with respect to the total variance. Then, to group the items (Q) according to the four dimensions, principal component analysis was used with the Varimax rotation method with Kaiser normalization, from which we obtained: dimension 1 (Q1–Q7), dimension 2 (Q8–Q11), dimension 3 (Q12–Q14), and dimension 4 (Q15–Q18). Reliability was then analyzed with Cronbach's alpha for each dimension, obtaining acceptable values: 0.872 (confidence interval [CI] = 0.850–0.891), 0.785 (CI = 0.747–0.819), 0.801 (CI = 0.763–0.834), and 0.792 (CI = 0.755–0.825), respectively. The reliability of the whole instrument was very good with an alpha value of 0.876 (CI = 0.856–0.894).

A test–retest analysis was performed, changing the order of the items, in 50 dental professionals. This was done at two different times with a time interval of 10 days.[22-24] These results were then evaluated with Cohen's kappa index, which significantly showed very good agreement (k = 0.822, CI = 0.656–0.988) ($P < 0.05$).

Procedure

The scale was developed on the Google Classroom virtual platform and was distributed virtually through social networks such as Facebook, WhatsApp, and personal and institutional e-mails, using the survey technique, from July 5 to August 31, 2021. The invitation was extended to dental professionals from the capital and three regions of Peru. The dentists who accepted the invitation were directed to the first page of the questionnaire that consisted of the objective of the study, the informed consent, and the data of the principal investigator. By giving their consent, they were just directed to the full scale. At no time was private information such as home address, telephone number, or full name requested. The instrument was made online to be answered only once. A total of 473 responses to the survey were received, of which 113 were incomplete. All responses were collected and stored in a Microsoft Excel 2019 spreadsheet and stored in a password-protected digital folder accessible only to researchers.

Statistical analysis

Data analysis was performed with the *Statistical Package for the Social Sciences* (SPSS), version 24.0. The data were imported from the Excel spreadsheet and descriptive statistics were applied to obtain the percentages of the categorical variables. Pearson's chi-square test was used for bivariate analysis. Risk factors were established with the logistic regression model (*logit model*) using *odds ratio* (OR). The outcome variable was the perception of the vaccination process to prevent COVID-19, dichotomized as poor and good perception. All analyses were performed, considering P value < 0.05 as significant.

Bioethical considerations

This research was reviewed and approved by the Institutional Research Ethics Committee with resolution No. 423-2021-VRI-UPSJB of July 1, 2021. All participants voluntarily gave their informed consent, respecting the Helsinki bioethical principles related to nonmaleficence, freedom, respect, and confidentiality.[25]

Results

The prevalence of poor perception among the 360 Peruvian dentists surveyed was 53.61% (95% CI = 48.45%–58.75%). The predominant categories among the 14 associated factors

were being between 41 and 65 years old (59.4%), female (58.1%), married (living with family) (48.1%), no children (36.7%), from capital city (66.9%), only private care (50.3%), with ≥10 years of experience (72. 5%), with master's degree (56.9%), no specialty (53.1%), no vulnerability to COVID-19 (75.3%), no history of COVID-19 (78.1%), vaccinated with Sinopharm (85.6%), with two doses received (87.8%), and from a professional association in the capital city (76.1%). In addition, in all the aforementioned categories, the highest frequency of cases with poor perception of the vaccination process was found, except in those who did not have a specialty, since those who did had a higher frequency of poor perception [Table 1].

Regarding the organizational process, most of the dentists surveyed considered that both the dissemination of those selected in the first instance by the professional association and the call for the COVID-19 vaccination process were fast and efficient, and they also considered that the schedule, geographic location, and facilities for the vaccination process were the most appropriate.

Table 1: Characterization of sociodemographic variables in Peruvian dentists and their perception of the vaccination process

Sociodemographic variable	Category	n	%	Vaccination process	
				Poor perception, f (%)	Good perception, f (%)
Age	<41 years old	135	37.5	77 (57.0)	58 (43.0)
	41–65 years old	214	59.4	109 (50.9)	105 (49.1)
	>65 years old	11	3.1	7 (63.6)	4 (36.4)
Gender	Female	209	58.1	114 (54.5)	95 (45.5)
	Male	151	41.9	79 (52.3)	72 (47.7)
Marital status	Single	124	34.4	70 (56.5)	54 (43.5)
	Married (living alone)	28	7.8	12 (42.9)	16 (57.1)
	Married (living with family)	173	48.1	95 (54.9)	78 (45.1)
	Widowed	8	2.2	3 (37.5)	5 (62.5)
	Divorced	27	7.5	13 (48.1)	14 (51.9)
Number of children	No children	132	36.7	78 (59.1)	54 (40.9)
	One child	96	26.7	50 (52.1)	46 (47.9)
	Two children	111	30.8	55 (49.5)	56 (50.5)
	Three or more children	21	5.8	10 (47.6)	11 (52.4)
Place of origin	Capital city	241	66.9	141 (58.5)	100 (41.5)
	Province	119	33.1	52 (43.7)	67 (56.3)
Occupation	Private care	181	50.3	104 (57.5)	77 (42.5)
	Public care	36	10.0	20 (55.6)	16 (44.4)
	University professor	38	10.6	19 (50.0)	19 (50.0)
	University professor and private care	81	22.5	39 (48.1)	42 (51.9)
	University professor and public care	24	6.7	11 (45.8)	13 (54.2)
Years of experience	Less than 10 years	99	27.5	57 (57.6)	42 (42.4)
	10 years or more	261	72.5	136 (52.1)	125 (47.9)
Academic degree	Bachelor's degree	123	34.2	66 (53.7)	57 (46.3)
	Master's degree	205	56.9	114 (55.6)	91 (44.4)
	Doctorate	32	8.9	13 (40.6)	19 (59.4)
Specialty	Yes	169	46.9	97 (57.4)	72 (42.6)
	No	191	53.1	96 (50.3)	95 (49.7)
Vulnerability to COVID-19	Yes	89	24.7	55 (61.8)	34 (38.2)
	No	271	75.3	138 (50.9)	133 (49.1)
History of COVID-19	Yes	79	21.9	41 (51.9)	38 (48.1)
	No	281	78.1	152 (54.1)	129 (45.9)
Origin of vaccine	Sinopharm	308	85.6	165 (53.6)	143 (46.4)
	Pfizer/BioNTech	42	11.7	21 (50.0)	21 (50.0)
	Other	10	2.8	7 (70.0)	3 (30.0)
Doses received	One dose	37	10.3	21 (56.8)	16 (43.2)
	Two doses	316	87.8	166 (52.5)	150 (47.5)
	More than two doses	7	1.9	6 (85.7)	1 (14.3)
Location of professional association	Capital city	274	76.1	163 (59.5)	111 (40.5)
	Province	86	23.9	30 (34.9)	56 (65.1)

Additionally, because of the benefit that the vaccine represents, 53.6% considered that the waiting period was justified and 56.7% considered that the elaboration of the list order for vaccination was impartial. However, opinions were divided regarding the management of the Ministry of Health in coordination with the professional association [Table 2].

Regarding the service provided in general, 86.9% of the dentists surveyed considered that the triage personnel treated them kindly. In addition, 78.9% were satisfied with the postvaccine information received, 53.1% considered that the information received regarding the possible postvaccine effects was sufficient and adequate, and 61.9% considered that the healthcare personnel treated them adequately at the time of receiving the vaccine [Table 2].

Regarding the care procedure, less than 30% perceived a lack of transparency and were concerned that the dose was manipulated. In addition, only 19.2% doubted the professional competence of healthcare personnel [Table 2].

Table 2: Perception frequency of the COVID-19 vaccination process in Peruvian dentists

Question (items)	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
	f (%)	f (%)	f (%)	f (%)	f (%)
Perception about the organization					
Q1. I consider that the dissemination of those selected in the first instance by the professional association and the call for the COVID-19 vaccination process were fast and efficient	38 (10.6)	94 (26.1)	23 (6.4)	145 (40.3)	60 (16.7)
Q2. I consider that the organization in relation to vaccination environment (adequate space, ventilation, signage) was the most adequate	17 (4.7)	35 (9.7)	16 (4.4)	208 (57.8)	84 (23.3)
Q3. I consider that the waiting period to start the vaccination process was justified for the benefit it represents	39 (10.8)	96 (26.7)	32 (8.9)	148 (41.1)	45 (12.5)
Q4. I consider that the process of data verification and elaboration of the list order for vaccination was adequate and impartial	45 (12.5)	75 (20.8)	36 (10.0)	141 (39.2)	63 (17.5)
Q5. I consider that the geographical location of the vaccination process was the most appropriate	17 (4.7)	65 (18.1)	35 (9.7)	180 (50.0)	63 (17.5)
Q6. I consider that the schedule chosen for the vaccination process was the most suitable one	19 (5.3)	49 (13.6)	35 (9.7)	190 (52.8)	67 (18.6)
Q7. I consider that the management of the Ministry of Health and the professional association to obtain vaccines was the best	57 (15.8)	101 (28.1)	37 (10.3)	122 (33.9)	43 (11.9)
Perception about the service					
Q8. I believe I would recommend the COVID-19 vaccination service to my colleagues	7 (1.9)	11 (3.1)	31 (8.6)	187 (51.9)	124 (34.4)
Q9. I consider that the triage staff treated me with kindness and respect	3 (0.8)	15 (4.2)	29 (8.1)	205 (56.9)	108 (30.0)
Q10. I consider that the information received regarding the possible postvaccine effects was sufficient and adequate	10 (2.8)	33 (9.2)	33 (9.2)	191 (53.1)	93 (25.8)
Q11. I consider that the treatment received by the healthcare personnel during the vaccination process was ideal	5 (1.4)	13 (3.6)	31 (8.6)	223 (61.9)	88 (24.4)
Perception about the care procedure					
Q12. I feel that at the time I was injected with the vaccine, the procedure was not transparent since I was not allowed to see what was being injected	58 (16.1)	155 (43.1)	48 (13.3)	79 (21.9)	20 (5.6)
Q13. I have constant concerns that my vaccine dose has been manipulated in some way	57 (15.8)	159 (44.2)	62 (17.2)	68 (18.9)	14 (3.9)
Q14. I am suspicious about the professional competence of the personnel involved in the care work of the COVID-19 vaccination process	51 (14.2)	183 (50.8)	57 (15.8)	59 (16.4)	10 (2.8)
Perception about vaccine efficacy					
Q15. I believe that the vaccine I received will prevent serious health complications if I become infected with the coronavirus	6 (1.7)	22 (6.1)	19 (5.3)	207 (57.5)	106 (29.4)
Q16. I am confident in the efficacy of the COVID-19 vaccine	13 (3.6)	46 (12.8)	36 (10.0)	191 (53.1)	74 (20.6)
Q17. I feel that being vaccinated against COVID-19 gives me the confidence to treat a larger number of patients	11 (3.1)	81 (22.5)	36 (10.0)	164 (45.6)	68 (18.9)
Q18. Now that I have been vaccinated against COVID-19 I am less afraid of getting infected with the coronavirus	16 (4.4)	87 (24.2)	40 (11.1)	156 (43.3)	61 (16.9)

f = absolute frequency

Regarding the efficacy of the vaccine against COVID-19, 86.9% of the dentists surveyed were confident that it would prevent them from developing serious complications if they were infected, and 73.7% were confident in its efficacy against contagion. As a result, 60.2% were less fearful of becoming infected and 64.5% felt more confident about treating a greater number of patients [Table 2].

According to the items about the perception of the COVID-19 vaccination process, the results showed a significant association of the number of children, origin, occupation, and location of professional association with Q1 ($P = 0.028$, $P = 0.029$, $P = 0.024$, and $P < 0.001$, respectively). In addition, origin, academic degree, specialty, and origin of vaccine were significantly associated with Q2 ($P = 0.042$, $P = 0.014$, $P = 0.041$, and $P = 0.007$, respectively). Item Q3 was significantly associated with origin, years of experience, and location of professional association ($P < 0.001$, $P = 0.022$, $P < 0.001$, respectively). Item Q4 was significantly associated with gender, origin, vulnerability to COVID-19, and location of professional association ($P = 0.035$, $P = 0.002$, $P = 0.006$, and $P < 0.001$, respectively). Likewise, item Q5 was significantly associated with marital status, number of children, origin, occupation, and history of COVID-19 ($P = 0.012$, $P = 0.013$, $P = 0.034$, $P = 0.037$, $P = 0.039$, respectively), whereas the item Q6 significantly associated with marital status, origin, occupation, origin of vaccine, and location of professional association ($P = 0.016$, $P = 0.010$, $P = 0.010$, $P = 0.034$, $P = 0.037$, $P = 0.003$). Finally, item Q7 was significantly associated with origin, vulnerability to COVID-19, and location of professional association ($P = 0.012$, $P = 0.002$, and $P < 0.001$, respectively) [Table 3].

Reactive Q8 was significantly associated with origin, occupation, origin of vaccine, doses received, and location of professional association ($P = 0.029$, $P = 0.003$, $P = 0.002$, $P = 0.019$, and $P = 0.027$, respectively), whereas item Q9 was only significantly associated with specialty ($P = 0.009$). Furthermore, item Q10 was significantly associated with marital status and origin ($P = 0.046$ and $P = 0.012$, respectively). Finally, item Q11 was not associated with any sociodemographic factor ($P = 0.046$ and $P = 0.012$, respectively) [Table 4].

Item Q12 was significantly associated with gender and number of children ($P = 0.028$ and $P = 0.040$, respectively). Item Q13 was significantly associated with gender, history of COVID-19, and origin of vaccine ($P = 0.048$, $P = 0.004$, $P = 0.028$, respectively), whereas item Q14 was significantly associated only with history of COVID-19 ($P = 0.041$) [Table 5].

On the other hand, item Q15 was significantly associated with origin of vaccine and doses received ($P = 0.001$ and $P = 0.002$). In addition, item Q16 was significantly associated with number of children, origin, doses received, and location of professional association ($P < 0.001$, $P = 0.021$, $P = 0.007$, and $P < 0.001$, respectively). Likewise, item Q17 was significantly associated with occupation, specialty, origin of vaccine, doses received, and location of professional association ($P = 0.043$, $P = 0.012$, $P = 0.036$, $P = 0.043$, $P = 0.004$, respectively). Finally, item Q18 was significantly associated with origin of vaccine, doses received, and location of professional association ($P = 0.002$, $P = 0.038$, $P = 0.007$, respectively) [Table 6].

In the crude regression model, it was observed that the apparently influential factors in poor perception of dentists regarding the vaccination process were specialty ($P = 0.038$), vulnerability to COVID-19 ($P = 0.024$), and location of professional association ($P = 0.004$). However, in the adjusted regression model, it was possible to demonstrate that the only influential factor in poor perception that Peruvian dentists had toward the COVID-19 vaccination process was the location of professional association (X14), so that those who belonged to a professional association in the capital showed 63% (OR = 0.37, CI = 0.22–0.62) less probability of developing poor perception of this vaccination process, in a very significant way ($P < 0.001$). On the other hand, the variable age (X1), gender (X2), marital status (X3), number of children (X4), origin (X5), dedication (X6), years of experience (X7), academic degree (X8), second specialty (X9), vulnerability (X10), history of COVID-19 (X11), origin of vaccine (X12), and doses received (X13) were not considered as significant influencing factors for developing poor perception of the COVID-19 vaccination process ($P > 0.05$) [Table 7].

Discussion

It is well known that COVID-19 has severely increased the morbidity and mortality rate worldwide, especially among health personnel, with dentists being a population at greater risk of contagion because of the fact that their work in health care necessarily obliges them to come into contact with the main biological vector of contagion, saliva.[26] In this sense, authorities, health personnel, and general population place their hopes in the COVID-19 vaccine as the main way to reduce the growing mortality rate. Therefore, it is important to evaluate the perception of the COVID-19 vaccination process in order to provide valuable information that the relevant authorities should consider, with the objective of improving receptivity and dispelling doubts that could arise in health professionals in relation to this process.[9-11] Furthermore, this contributes to a better reception of future booster dose application processes, taking into consideration that the effectiveness of vaccines depends on the speed and reach in the population, before new resistant variants emerge.[27] Although the threshold for vaccine-induced herd immunity is pathogen-specific, it is estimated that a value of 43%–67% is sufficient to achieve herd immunity against COVID-19.[28-30] Health professionals are responsible for

Table 3: Perception of the COVID-19 vaccination process organization associated with sociodemographic factors of dentists

Items	Age	Gender	Marital status	Number of children	Place of origin	Occupation	Years of experience	Academic degree	Specialty	Vulnerability to COVID-19	History of COVID-19	Origin of vaccine	Doses received	Location of professional association
	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P
Q1	0.782	0.747	0.082	0.028	0.029	0.024	0.889	0.735	1.000	0.161	0.897	0.024	0.499	<0.001
Q2	0.080	0.749	0.676	0.195	0.042	0.090	0.669	0.014	0.041	0.953	0.243	0.007	0.225	0.232
Q3	0.070	0.408	0.322	0.088	0.000	0.064	0.022	0.374	0.536	0.231	0.510	0.312	0.906	<0.001
Q4	0.137	0.035	0.143	0.151	0.002	0.101	0.189	0.701	0.567	0.006	0.764	0.323	0.610	<0.001
Q5	0.363	0.588	0.012	0.013	0.034	0.037	0.351	0.438	0.421	0.096	0.039	0.930	0.055	0.069
Q6	0.559	0.177	0.016	0.272	0.010	0.034	0.802	0.316	0.971	0.132	0.953	0.037	0.734	0.003
Q7	0.682	0.896	0.432	0.080	0.012	0.085	0.278	0.486	0.490	0.002	0.824	0.137	0.066	<0.001

*$P < 0.05$ (significant association according to Pearson's chi-square)

Table 4: Perception of COVID-19 vaccination service associated with sociodemographic factors of dentists

Items	Age	Gender	Marital status	Number of children	Place of origin	Occupation	Years of experience	Academic degree	Specialty	Vulnerability to COVID-19	History of COVID-19	Origin of vaccine	Doses received	Location of professional association
	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P
Q8	0.489	0.836	0.556	0.437	0.029	0.003	0.826	0.372	0.468	0.078	0.226	0.002	0.019	0.027
Q9	0.282	0.432	0.394	0.148	0.305	0.295	0.314	0.429	0.009	0.070	0.687	0.161	0.073	0.081
Q10	0.620	0.844	0.046	0.430	0.012	0.250	0.188	0.655	0.511	0.059	0.600	0.110	0.242	0.122
Q11	0.566	0.568	0.438	0.678	0.081	0.052	0.808	0.086	0.176	0.379	0.481	0.379	0.347	0.205

*$P < 0.05$ (significant association according to Pearson's chi-square)

Table 5: Perception of the COVID-19 vaccination care procedure associated with sociodemographic factors of dentists

Items	Age	Gender	Marital status	Number of children	Place of origin	Occupation	Years of experience	Academic degree	Specialty	Vulnerability to COVID-19	History of COVID-19	Origin of vaccine	Doses received	Location of professional association
	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P
Q12	0.850	0.028	0.178	0.040	0.314	0.051	0.065	0.073	0.286	0.746	0.097	0.663	0.308	0.289
Q13	0.778	0.048	0.341	0.135	0.203	0.354	0.570	0.437	0.811	0.592	0.004	0.028	0.098	0.938
Q14	0.078	0.109	0.284	0.146	0.904	0.389	0.222	0.162	0.797	0.701	0.041	0.703	0.104	0.961

*$P < 0.05$ (significant association according to Pearson's chi-square)

Table 6: Perception of the COVID-19 vaccine efficacy associated with sociodemographic factors of dentists

Items	Age	Gender	Marital status	Number of children	Place of origin	Occupation	Years of experience	Academic degree	Specialty	Vulnerability to COVID-19	History of COVID-19	Origin of vaccine	Doses received	Location of professional association
	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P	*P
Q15	0.614	0.795	0.180	0.223	0.273	0.285	0.809	0.702	0.859	0.122	0.566	0.001	0.002	0.435
Q16	0.437	0.094	0.055	0.000	0.021	0.385	0.688	0.631	0.567	0.453	0.178	0.055	0.007	<0.001
Q17	0.212	0.541	0.080	0.397	0.596	0.043	0.383	0.554	0.012	0.879	0.713	0.036	0.043	0.004
Q18	0.980	0.875	0.827	0.838	0.179	0.290	0.713	0.565	0.130	0.709	0.653	0.002	0.038	0.007

*$P < 0.05$ (significant association according to Pearson's chi-square)

Table 7: Logistic regression model for perception of dentists of the COVID-19 vaccination process, according to its associated factors

Variable	Category	Crude model				Adjusted model			
		P	OR	95% CI		P	OR	95% CI	
				LL	UL			LL	UL
X1: Age	<41 years old	-	1.00	-	-	-	-	-	-
	41–65 years old	0.712	1.33	0.29	6.05	-	-	-	-
	>65 years old	0.552	1.56	0.36	6.76	-	-	-	-
X2: Gender	Female	-	1.00	-	-	-	-	-	-
	Male	0.924	0.98	0.60	1.59	-	-	-	-
X3: Marital status	Single	-	1.00	-	-	-	-	-	-
	Married (living alone)	0.995	1.00	0.37	2.70	-	-	-	-
	Married (living with family)	0.694	1.26	0.40	4.03	-	-	-	-
	Widowed	0.188	0.55	0.22	1.34	-	-	-	-
	Divorced	0.413	0.46	0.07	2.96	-	-	-	-
X4: Number of children	No children	-	1.00	-	-	-	-	-	-
	One child	0.165	0.44	0.14	1.40	-	-	-	-
	Two children	0.799	0.87	0.31	2.49	-	-	-	-
	Three or more children	0.980	1.01	0.37	2.77	-	-	-	-
X5: Place of origin	Capital city	-	1.00	-	-	-	-	-	-
	Province	0.901	0.96	0.51	1.80	-	-	-	-
X6: Occupation	Private care	-	1.00	-	-	-	-	-	-
	Public care	0.551	0.74	0.27	2.00	-	-	-	-
	University professor	0.642	0.76	0.23	2.45	-	-	-	-
	University professor and private care	0.572	0.72	0.23	2.27	-	-	-	-
	University professor and public care	0.886	0.93	0.32	2.66	-	-	-	-
X7: Years of experience	Less than 10 years	-	1.00	-	-	-	-	-	-
	10 years or more	0.147	0.60	0.31	1.19	-	-	-	-

Table 7: Continued

Variable	Category	Crude model				Adjusted model			
		P	OR	95% CI		*P*	OR	95% CI	
				LL	UL			LL	UL
X8: Academic degree	Bachelor's degree	-	1.00	-	-	-	-	-	-
	Master's degree	0.433	0.66	0.23	1.87	-	-	-	-
	Doctorate	0.205	0.56	0.23	1.38	-	-	-	-
X9: Specialty	Yes	-	1.00	-	-	-	1.00	-	-
	No	0.038	0.57	0.34	0.97	0.266	0.78	0.51	1.20
X10: Vulnerability to COVID-19	Yes	-	1.00	-	-	-	1.00	-	-
	No	0.024	0.53	0.31	0.92	0.098	0.66	0.40	1.08
X11: History of COVID-19	Yes	-	1.00	-	-	-	-	-	-
	No	0.911	0.97	0.55	1.71	-	-	-	-
X12: Origin of vaccine	Sinopharm	-	1.00	-	-	-	-	-	-
	Pfizer/BioNTech	0.513	1.70	0.35	8.25	-	-	-	-
	Other	0.315	2.31	0.45	11.88	-	-	-	-
X13: Doses received	One dose	-	1.00	-	-	-	-	-	-
	Two doses	0.266	3.70	0.37	37.12	-	-	-	-
	More than two doses	0.229	3.96	0.42	37.26	-	-	-	-
X14: Location of professional association	Capital city	-	1.00	-	-	-	1.00	-	-
	Province	0.004	0.36	0.18	0.72	<0.001	0.37	0.22	0.62

LL = lower limit, UL = upper limit

Logit model = all variables were entered in the statistical analysis of the crude model and the model was accepted since a significance of $P = 0.012$ was obtained according to the omnibus test of the model coefficient. Subsequently, the adjusted logit model was also accepted since a significance of $P = 0.000$ was obtained

promoting best practices in health and their influence on the public because of their own experience during the vaccination process, being fundamental to generate awareness and avoid as much as possible the refusal of vaccination, causing a positive impact.[29]

The present study found that more than half of the Peruvian dentists surveyed had a poor perception of the COVID-19 vaccination process. Also, those whose professional association was located in the capital city were less likely to have a poor perception, which could be due to the fact that the vaccines took longer to arrive at the provinces, in addition to the fact that the conditions of the facilities at the beginning were not optimal. In addition, there were many people crowded together and social distancing was not respected.[31,32] Also, many government and health authorities in the capital had been vaccinated first, without respecting any principle of impartiality, causing some rejection by some health personnel in the provinces.[33,34] These findings differ from those published by Zawahrah *et al.*,[35] who reported that respondents living in rural areas were more likely to be willing to receive a vaccine for COVID-19. This could be due to the fact that the respondents by Zawahrah *et al.* included both professionals and nonprofessionals, in addition to the fact that this study was conducted in Palestine, a territory with numerous social and armed conflicts with an ongoing health crisis, which could influence its inhabitants' perception of vaccination.[36]

Regarding the sociodemographic factors assessed, it was found that women and those with a master's degree presented the highest frequency of cases with poor perception of the vaccination process. These findings are consistent with the findings of Malik *et al.*, whose research was carried out in the United States.[37]

Regarding the origin of vaccine, the present study did not show any association of poor perception if the vaccine was American or not. These results differ from those reported by Kreps *et al.*,[38] who indicated that the non-American origin of vaccine was associated with lower probability of choosing it. This difference may be due to the fact that Kreps *et al.* surveyed vaccinated and unvaccinated dentists, whereas the present study only surveyed vaccinated dentists, because it was important to know their perception of the whole process. However, it should be noted that the present study obtained a slight difference in favor of poor perception toward the vaccine of Chinese origin (Sinopharm), whereas the perception of the American vaccine was balanced. These findings are consistent with those reported by Alvarado-Socarras *et al.* in Colombia and by Jaramillo-Monge *et al.* in Ecuador, who reported that there is a poor perception toward the vaccine with lowest effectiveness.[39,40]

In the present study, 86.9% of the dentists were confident that the vaccine would prevent them from developing serious complications if the developed COVID-19 and 73.7% were confident in efficacy of the vaccine against contagion. These results are in agreement with those reported by Nasr *et al.*,[41] who found 86% acceptance of the vaccine among Lebanese dentists. However, it is worth mentioning that just under 30% of the dentists doubted that the dose was manipulated and only 19.2% doubted the professional suitability of the health care personnel. This is probably due to the fact that there was a lot of biased information against the vaccine of Chinese origin (Sinopharm) provided by some Peruvian open signal media and social networks[42,43]; this is revealed in the study by Di Gennaro *et al.*, who reported that contradictory information propagated by the media in 69% of the cases was the reason for doubt or hesitation toward the vaccine by health personnel.[44] A similar situation was evidenced in the study by Kabamba *et al.* in which they reported that 72% of Congolese health workers would not accept being vaccinated, because of the dissemination of bad information regarding the vaccine.[45] The news broadcast by the media stating that some members of the personnel in charge of applying the vaccine were manipulating the appropriate dose[46] could explain the distrust of some dentists regarding this immunization process.

Among the findings of the present study, in reference to the specialty, it was found that it is an associated factor, but not an influential one in the poor perception of the vaccination process against COVID-19. This is in agreement with what was obtained by Zigron *et al.*, in reference to the predisposition to be vaccinated, because they reported that dentists with a specialty in maxillofacial surgery had the lowest acceptance of immunization.[47]

The present study is important because dentists, being clinical specialists with a high risk of crossinfection by SARS-CoV-2, need to be promptly immunized against COVID-19 in a vaccination process that complies with health regulations in a satisfactory manner, without generating more concerns than those they already have as a result of their healthcare work in the context of the pandemic. Therefore, it is crucial to highlight the perception that many dentists have toward the vaccination process considering its different associated factors and in this way urge the health authorities to take part in the organization and continuous improvement of the vaccination process, because if a large part of the health personnel is vaccinated and recommend their good experience in the immunization process, it would probably achieve greater receptivity and security in the general public, considering that there will be calls to receive booster doses.

This study had some limitations, such as not being able to personally assess dentists, because at the time of the survey, the country was under mandatory social distancing measures due to the pandemic. It was also not possible to verify whether the dentists surveyed were practicing dentistry at the time of the survey. In addition, it should be considered that all public surveys under a cross-sectional design with snowball sampling present a potential selection bias considering that

the survey was conducted through social networks in a highly dynamic and changing social context, with possible variations in the perception toward the vaccination process and toward the COVID-19 vaccine itself.

It is recommended to evaluate the perception of the vaccination process in health professionals who have direct contact with potentially infected patients, in different social contexts worldwide and under different working conditions. In addition, crosscultural validation and application of the scale used in the present study is recommended in order to evaluate its metric properties in another social context.

Conclusions

In summary, recognizing the limitations of the present study, it can be concluded that more than half of the Peruvian dentists surveyed had a poor perception of the COVID-19 vaccination process. However, those whose professional association was located in the capital city were 63% less likely to have a poor perception than those dentists who were in the provinces. In addition, the origin of vaccine and other variables such as age, gender, marital status, number of children, origin, occupation, years of experience, academic degree, specialty, vulnerability to COVID-19, history of COVID-19, and doses received were not considered influential factors for developing poor perception. It is important that government and health authorities take into account the implementation of plans and strategies to improve the information, organization, and development of the vaccination process. Some recommendations would be to improve the dissemination channels through digital platforms and media to have greater reach, explaining in detail all the stages involved in the COVID-19 immunization process, using infographics and flowcharts that are easy to understand. Likewise, the location of the vaccination site should be easily accessible, with ideal conditions such as a spacious, ventilated, and well-lit environment. Finally, suitable dates and times for the professionals should be taken into consideration, taking into account the weather conditions at the time.

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Conflicts of interest

There are no conflicts of interest.

Authors' contributions

CFCR conceived the research idea; CFCR, GBV, and NECL elaborated the article; GBV, MLC, and CLG collected and tabulated the information; ACP and MLC carried out the bibliographic search; CFCR and ACP interpreted the statistical results; CFCR, NECL, and GBV helped in the development from the discussion; CFCR, ACP, CLG, MLC, and LACG performed the critical revision of the manuscript. All authors approved the final version of the article.

Ethical policy and institutional review board statement

The present study respected the bioethical principles for medical research on human beings of the Declaration of Helsinki, related to confidentiality, freedom, respect, and nonmaleficence. It was also approved by the Institutional Research Ethics Committee of the Universidad Privada San Juan Bautista with resolution no. 423-2021-VRI-UPSJB dated July 1, 2021.

Patient declaration of consent

All participants understood and signed an informed consent form.

Data availability statement

The data that support the study results are available from the author (Dr. César Félix Cayo-Rojas, e-mail: cesar.cayo@upsjb.edu.pe) on request.

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