



Attitude towards COVID-19 Vaccination in the Peruvian population

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ABSTRACT

The objective of this study was to determine the differences in attitudes towards vaccination according to sex, age group, educational level, and occupation in a Peruvian sample. This research study is empirical with an associative strategy using a comparative design. In total there were 786 participants, 337 (43%) males and 449 (53%) females, between 18 and 70 years of age. The results were described with favorable attitude towards vaccination, those who had a higher attitude were males, as well as people in the age groups called adult and elderly, who reported favorably towards vaccination, also, statistically significant differences were observed in terms of educational level, where high values were recorded for those participants who have higher education (graduates, teachers and doctors), regarding occupation it was observed that health professionals lead the most favorable approach to vaccination. In addition, the psychometric properties of the instruments used in this research were favorably evaluated. In conclusion, it was possible to know the attitude towards vaccination with a higher percentage of acceptance towards the vaccine against covid-19, as well as a higher acceptance by adult males and in people with a higher university education level and, finally, it was reported that health professionals, educators and higher education students showed a greater openness and favorable attitude towards vaccination.

Key words: Attitude, Vaccine, Covid-19, Vulnerable population

HOW TO CITE THIS ARTICLE: Antonio Serpa Barrientos, Pedro Leonardo Tito Huamani, Juan Jesús Soria Qui jaite, Betty Giovanna Pena Tomas, Luis Alberto Geraldo Campos, Attitude towards COVID -19 vaccination in the Peruvian population, J Res Med Dent Sci, 2021, 9 (7):01-10.

INTRODUCTION

Humanity around the world is being seriously affected by the effects of SARS-CoV-2 and the subsequent coronavirus disease 2019 (COVID-19) with fatal consequences, not only by the 3.805.657 deaths worldwide as reported as of Jun 14, 2021 [1], but also because of the economic consequences, which according to preliminary World Bank projections, the global economic deficit increased by 4.3% in 2020, making it the fourth deepest recession in the last 150 years [2]. In addition, the world has experienced major social repercussions, such as loss of jobs, forced migrations and an increase of psychosomatic diseases in the population [3]. The latter is closely related to the behavior that has been shown not only by infected people, but also by society due to social psychosis.

Faced with this global problem, the scientific community, including universities, research institutes, laboratories and biotechnology

companies, military researchers, pharmaceuticals, among others [4], have been making strenuous efforts to alleviate the ravages of the pandemic [5,6]. One of these strategies was to generate effective and safe vaccines in the shortest possible time to rapidly immunize the population and control the spread of the virus [4] such as the vaccines developed by Oxford-AstraZeneca, Pfizer, BioNTech, Fosun Pharma, Rentschler Biopharma, among others [7,8].

The vaccine is the ideal means to immunize the population, therefore, different perceptions arise regarding its chemical composition, its applicability, the results, and effects it may cause, as well as the cultural and religious connotations of wanting or not wanting to be vaccinated. Given that vaccination is a necessity, it is up to health policy makers in each country or state to persuade and implement effective vaccination strategies against COVID-19 [9,10].

Attitude is the predisposition that people must evaluate objects, subjects, situations, or other

people in a favorable or unfavourable way, being considered a mediating variable of behavioural change [11]. Furthermore, he mentions that the metacognitive model of attitudes suggests that attitude objects are associated not only with positive and/or negative evaluative labels of objects, situations, or persons, but also with validity labels [12]. Accordingly, the model proposes that an attitude can be described as univalent when positive or negative relations exist, explicitly ambivalent when positive and negative relations exist and are endorsed, or implicitly ambivalent when an evaluative association is endorsed and the opposite exists but is rejected; i.e. implicit ambivalence is the evaluative conflict of which the person is not aware as a result of changing from one attitude to another or having discrepancies; these cases of implicit ambivalence are an example of how both positive and negative evaluative associations can influence people's judgments despite being explicitly rejected by them.

The attitudes of the population regarding their willingness to be vaccinated or not are diverse. The United States and the United Kingdom were the first to implement mass vaccination in their population through the Pfizer vaccine, whose preliminary results reached 95% efficacy [7,13,14], so it is estimated that 60% of the population must be vaccinated to achieve herd immunity [7,9,13].

However, there are diverse attitudes that the population has been showing about their predisposition to be vaccinated or not. In one study, it was found that 80% of the population generally accepts vaccination because they perceive that they will be protected against COVID-19; this indicator is higher (91%) in the case of people over 70 years of age [4]. Re-search conducted at the country level shows that the highest rates of acceptance to be vaccinated are led by Ecuador (97.0%) [15], Malaysia (94.3%), Indonesia (93.3%) and China (91.3%) [10].

Other studies show resistance to getting vaccinated against COVID-19. A study by [9] showed that only 57.7% said they were willing to be vaccinated, a trend that was corroborated in November 2020 when 56% of respondents said they were willing to be vaccinated and only 31% said the opposite [16]. In Australia, the perception of the population willing to be

vaccinated decreased by 2% between April and August 2020 [7]. However, research by [17] showed that more than 80% of respondents were unsure or unwilling to be vaccinated because of the side effects of vaccines. Also, according to country-level studies, the lowest vaccine acceptance rates were found in Kuwait (23.6%), Jordan (28.4%), Italy (53.7%), Russia (54.9%), Poland (56.3%), the United States (56.9%), and France (58.9%) [10]. However, a more specific study developed in France showed that 75% of healthcare workers intend to be vaccinated, according to occupational categories [18].

Several authors mention that the unfavorable perceptions of a sector of the population are related to general distrust of vaccines, concerns about side effects [19], distrust of vaccine safety [20], the speed of vaccine development and the speed of approval by government agencies [21]. The positive perceptions of the population according to recent studies are related to confidence and safety, which is the determining factor for vaccination [20]. Governmental awareness of the benefits of vaccination depends on developing sustainable strategies of communication and organized participation for the population [4,6,9] and campaigns to address all their concerns [21]. Thus, education of healthcare workers is imperative for an effective vaccination campaign [17], requiring a transparent evidence-based policy from all stakeholders [22].

Evidence on the perception against COVID-19 vaccine in American countries such as Ecuador, Mexico, Brazil and the USA shows generally favorable results [10,15]. However, in the Peruvian context, there are still no published scientific studies that reveal the attitude towards COVID-19 vaccines, therefore this study aims to better understand the attitudes towards the COVID-19 vaccine in the Peruvian population, as well as to identify the differences in attitudes considering demographic variables such as sex, age group, education level and occupation.

MATERIALS AND METHODS

Design

This research study is empirical with an associative strategy using a comparative design [23], since the objective is to better understand the existing differences in the pro-posed groups with respect to the attitude towards vaccination.

Participants

An intentional sample of 838 participants was collected nationwide through the Google Forms platform, from which 56 of those evaluated were withdrawn due to the extreme scores presented and verified through the Z scores, which registered outside the range -3 to +3 [24]. Thus, the final sample was 786 evaluated for statistical analysis. 337 (43%) participants were male and 53%, female, the latter had greater participation; with ages ranging from 18 to more than 70 years of age, although the predominant group was of those between the ages of 18 to 49 years old; with educational level of graduates amounting to 35.5% of the total sample. Finally, the occupation that most characterizes the study sample is represented by educators and health professionals (Table 1).

Instrument

To collect the information, the domains of the 5C scale developed by [25] were considered. This

scale is composed of three dimensions: trust and collective responsibility, complacency and constraints and calculation; the latter refers to the active interest of an individual to seek information. Among the three dimensions it contemplates 13 Likert scale items with four options, "1=strongly disagree", "2=Disagree", "3=Agree" and "4=Strongly agree". Regarding the psychometric properties of the scale, the previous study reported reliability co-efficient values (>0.78) with good internal consistency; to verify the sources of evidence of validity, the content and internal structure were used, showing favorable results.

With respect to vaccination attitude, the Attitudes towards vaccination against COVID-19 scale [26] was used, which consists of 9 items and is grouped into a single dimension, with four-option Likert-type options labeled as: "1=Strongly disagree", "2=Disagree", "3=Agree" and "4=Strongly agree".

Table 1: Description of demographic variables (n=786).

	f1 (Observed frequency)	%
Age group		
18 - 29 years old	257	32.7
30 - 49 years old	273	34.73
50 - 69 years old	216	27.48
70 years old or older	40	5.09
Sex		
Men	337	42.88
Women	449	57.13
Education		
Bachelor's Degree	279	35.5
Master's Degree	186	23.66
Secondary (High School) Completed	123	15.65
Doctoral Degree	82	10.43
Technical/Trade School Degree	76	9.67
Did not finish Secondary (High School)	40	5.09
Occupation		
Educator/Professor	180	22.9
Student	139	17.68
Engineer	49	6.23
Other	107	13.61
Administrative personnel	84	10.69
Health care professional	171	21.76
Independent worker	56	7.12
Has received COVID vaccine		
No	706	89.82
Yes	80	10.18
Do you belong to a vulnerable population for COVID-19?		
No	453	57.63
Yes	242	30.79
I don't know	91	11.58
Have you lost a family member to COVID-19?		
No	437	55.6
Yes	349	44.4

Procedure and data analysis

Initially, this research study was reviewed and approved by the ethics committee of the Universidad Peruana Unión (N° 2021-CEUPeU-0031); likewise, permission was requested from the authors of the instruments used for their linguistic adaptation to the Peruvian con-text, obtaining a favorable response. Once the items had been translated and back-translated [27], the initial Peruvian Spanish version was sent to a group of experts to evaluate the clarity, pertinence and relevance of the items (evidence of content-based validity), after which a focus group study in a group equivalent to the sample was used in order to evaluate the clarity and understanding of the items (evidence of validity based on the response process), as well as the structure of the response alternatives. Finally, a pilot study was conducted through the dissemination of a Google Forms link. It should be noted that in the collection of the empirical evidence, always we strictly complied with informing the objectives of the research study and requesting their voluntary participation in answering the questionnaires through the Google Form; in this way we complied with the informed consent. The verification of the psychometric properties of the instruments was performed using the confirmatory factor analysis technique (evidence of validity based on internal structure), with global goodness-of-fit indices such as the $B\chi^2/df$ with accept values of 2 to 3 [28,29], as well as comparative fit index (CFI) and the Tucker-Lewis index (TLI) where values above .95 were considered optimal [30]. As for obtaining the reliability for the internal consistency method, the α and ω coefficients $\geq .70$ were used [31].

For the evaluation of the psychometric properties of the instruments, the R studio software was used, especially the lavann package [32], considering the ordinality of the data and its application of the robust estimator (WLSMV). As for the verification of the hypotheses, the Jamovi 1.6 software [33] was used, employing non-parametric inferential statistics with correction of homogeneity of variance through Welch's test, to verify the difference between two groups and more than two groups through ANOVA - Welch, with acceptance of the working hypothesis at the level of statistical significance, $p < 0.05$.

RESULTS

For this research study, the evidence of validity and reliability of the domains of the 5C and the Attitudes towards vaccination against COVID-19 instrument was evaluated. We began with the adaptation of the scale to the Peruvian context, following the guidelines dictated by the International Test Commission [CIT] [27], that is, the items were translated from English to Spanish by two translators related to the social sciences, culminating the process with the back-translation by two other professionals (from Spanish to English), verifying the translation without further observations. Once the translation was completed, expert judges were called on to evaluate the instrument, where their observations were minimal, therefore, content-based validity is evidenced. Subsequently, a study was conducted in a group equivalent to the final sample, made up of 10 participants; the technique used was the focus group, asking the participants: were the items quite clear, did any item or items require more than two readings for their understanding, and were the characteristics of the answers in accordance with the form of the questions? All these questions were answered satisfactorily, where the participants stated that they did not observe any difficulty in understanding the meaning of the items. The answers to these questions are within the framework of the evidence of validity based on the response process. Finally, the validity evidence of the internal structure of the domains of the 5C was evaluated through confirmatory factor analysis (CFA), obtaining appropriate fit index values ($\chi^2/df=1.778$, CFI=.972, TLI=.963, SRMR=.062) for three oblique factors. As for the estimates obtained for the Attitudes towards vaccination against COVID-19 scale, the goodness-of-fit index values were adequate ($\chi^2/df=3.469$, CFI=.992, TLI=.988, SRMR=.013).

Regarding the reliability of the domains of the 5C was contrasted through the internal consistency method with the ordinal alpha and omega coefficient, obtaining appropriate values: for the dimension trust and collective responsibility ($\alpha=.884$ and $\omega=.786$), complacency and restrictions ($\alpha=.865$ and $\omega=.779$) and calculation ($\alpha=.835$ and $\omega=.739$). For the Attitudes toward COVID-19 vaccination scale, reliability reports

by the internal consistency method were also adequate ($\alpha=.841$ and $\omega=.885$).

Descriptive analysis

Out of the whole sample, 54.71% agreed to be vaccinated against COVID-19, while 45.29% disagreed to be vaccinated against COVID-19 (Figure 1).

Differences between males and females with respect to attitudes toward vaccination

Regarding the differences that exist between men and women, with respect to their attitude towards vaccines, the results indicate that there is a statistically significant difference ($t=2.759$, $df=742.138$ and $p<.01$), with a small effect size $d=.20$; [34], that is, the phenomenon of interest is evident for the study sample in 20%. This difference considers a greater favor-able attitude of men towards vaccines with respect to women (Table 2 and Figure 2).

Differences between age ranges with respect to attitude toward vaccination.

However, with respect to the attitude towards

vaccines, it was not possible to establish any significant difference between age groups ($F=1.288$, $df=3$, $p>.05$ (Table 3); that said, the statistical trend indicates differences between groups, which is important to describe; in this sense, the younger participants, under 50 years of age, would be reporting lower attitudes towards vaccines (Figure 3), with respect to participants over 50 years of age.

Differences between educational level groups with respect to attitude toward vaccination

In relation to the differences obtained according to educational level, the attitude towards the vaccine reports a statistically significant difference ($F=12.631$, $gl=5$, $p<.000$) (Table 4).

One of the first differences observed corresponds to the group with incomplete secondary school/ no studies and with a master’s degree, where the statistical significance estimation reported adequate values ($t=-3.543$, $p<0.006$); this difference favored the group with a mas-ter’s degree as having a better attitude towards

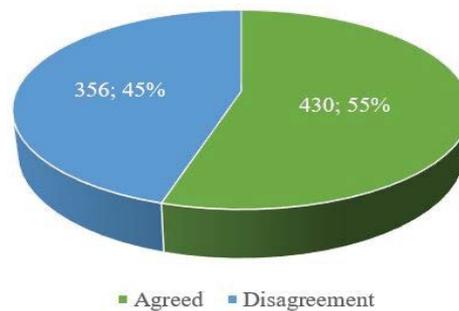


Figure 1: Percentage of agreement and disagreement with the Covid-19 vaccine: The figure shows the frequencies and percentages of agreement and disagreement with receiving the COVID-19 vaccine.

Table 2: Differences in attitudes toward vaccines according to sex.

	t1	df	p	Mean Difference	SE Difference	95% CI for Mean Difference		d*
						Lower	Upper	
Attitude to vaccines	2.759	742.138	0.006	0.783	0.284	0.226	1.339	0.2

1Welch's t-test. *Cohen's d

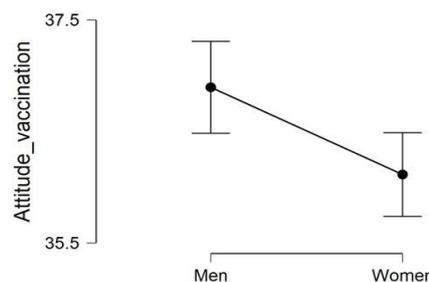


Figure 2: Attitude towards the vaccine (n=786): Difference in averages, attitude towards vaccines.

the vaccine in comparison to the incomplete secondary school/no studies group. As for the comparison between the complete secondary school group with those with a trade or vocational degree, the complete secondary school group showed a more favorable attitude toward the vaccine ($t=5.796, p<0.001$).

On the other hand, the difference between the group with a trade or vocational degree differed statistically significantly with bachelors, master's, and doctoral degree holders; the lowest mean was found in the group with a trade or vocational degree ($t=-4.574, p<0.001; t=-7.038,$

$p<0.001; t=-5.563, p<0.001$; respectively) (Table 5 and Figure 4).

Regarding occupation in contrast to the favorable or unfavorable attitude towards the vaccine, it is observed that teachers or educators, health professionals and undergraduate and graduate university students reported favorable values towards the vaccine (93 [52%], 71 [51%] and 97 [57%]; respectively); however, engineering professionals, administrative personnel and in-dependent workers reported unfavorable opinions towards the vaccine (31 [63%], 52 [62%] and 29 [52%]; respectively) (Table 6).

Table 3: ANOVA for attitude toward vaccination.

Homogeneity Correction	Cases	Sum of Squares	df	Mean Square	F	p	$\eta^2 p$
Welch	Age	64.16	3	21.387	1.288	0.28	0.005
	Residuals	12370.305	172.103	71.878			

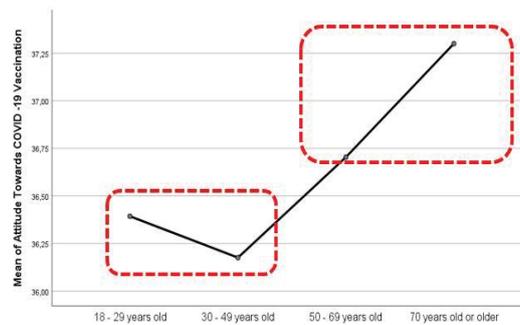


Figure 3: Comparison of means according to age range. Attitude towards the vaccine.

Table 4: Comparison of means of the variable education towards vaccines.

	Sum of square	gl	Root mean square	F	Sig.
Between Groups	931,377	5	186,275	12,631	0
Within groups	11,503,087	780	14,748		
Total	12,434,464	785			

Table 5: Post Hoc comparisons-Education.

		Mean Difference	SE	t	p tukey
Secondary incomplete/no studies	Secondary, Complete	-1.939	0.699	-2.775	0.063
	Trade/Vocational	1.308	0.75	1.743	0.503
	Bachelor's	-0.965	0.649	-1.486	0.674
	Master's	-2.372	0.669	-3.543	0.006**
	Doctorate	-2.094	0.741	-2.827	0.054
Secondary, Complete	Trade/Vocational	3.247	0.56	5.796	< .001***
	Bachelor's	0.975	0.416	2.345	0.177
	Master's	-0.432	0.446	-0.968	0.928
	Doctorate	-0.154	0.547	-0.282	1
Trade/Vocational	Bachelor's	-2.273	0.497	-4.574	< .001***
	Master's	-3.679	0.523	-7.038	< .001***
	Doctorate	-3.402	0.611	-5.563	< .001***
Bachelor's	Master's	-1.407	0.364	-3.87	0.002**
	Doctorate	-1.129	0.482	-2.341	0.179
Master's	Doctorate	0.278	0.509	0.545	0.994

* $p < .05$, ** $p < .01$, *** $p < .001$.

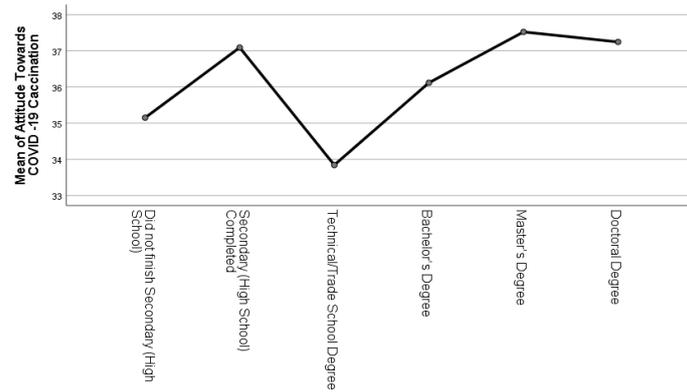


Figure 4: Comparison of means according to education.

Table 6: Comparison of occupation vs. attitude towards vaccines.

	Attitude towards the vaccine		Total
	Disagree	Agree	
Educator/Professor	87 (48%)	93 (52%)	180
Student	68 (49%)	71 (51%)	139
Engineer	31 (63%)	18 (37%)	49
Others	58 (54%)	49 (46%)	107
Administrative Personnel	52 (62%)	32 (38%)	84
Health Care Professional	74 (43%)	97 (57%)	171
Independent Worker	29 (52%)	27 (48%)	56
Total			786

DISCUSSION

The objective of this research study was to better understand the intention to be vaccinated against COVID-19 and to evaluate the existing differences with respect to sex, age group, educational level, and occupation; it was also important to analyze the psychometric properties of the instrument: The domains of the 5C and Attitudes towards vaccination against COVID-19 scales. The results provide valuable information and initial validation for two instruments that could be used for future studies that could improve the understanding of the vaccination system and the inclusion of mental health professionals in the process itself, since attitudinal (behavioral) aspects become more relevant in decision making, which is a distinctive feature of the human being. In addition, this can help improve communication channels (Government-Population) regarding the main objectives of mass immunization and its effect on prevention and health care.

According to the results, it is evident that the intention to vaccinate is supported mostly by men as opposed to women (55% and 45%, respectively), this difference is statistically significant and can be interpreted

as the magnitude of the observed phenomenon (attitude to-wards vaccination in men and women) in the study sample, amounting to 20% effect size. These results can be contrasted with what was found by (16), where they assessed the willingness of Australian adults to receive the COVID-19 vaccine, finding that 65% were willing to be vaccinated, and 27% were in the "maybe" category; for their part [4] evidenced that the acceptance in general is positive in 80% to be vaccinated, because they perceive that it will protect them against COVID-19, this indicator is higher (91%) when it comes to people over 70 years of age. In addition, they found that when the disease appeared to be less serious, people had less confidence in the science, with women being the least willing to be vaccinated, due to insecurity about its effectiveness, side effects and the availability of vaccines. There are also a wide range of factors that foster vaccine reluctance, including efficacy, ad-verse effects, unfamiliarity with vaccine-preven diseases, and distrust of governments. Vaccine reluctance is an extremely important problem for the effective control of vac-cine-preven diseases [35].

However, there is evidence describing that the unfavorable perceptions of a sector of the population are related to general distrust in

vaccines, concerns about side effects [19], and distrust in vaccine safety [20], the speed of vaccine development, the side effects that vaccines can produce, and the speed of approval by government agencies [21].

With respect to the analysis of the age groups and the degree of acceptance or rejection of the vaccine, it was found that people belonging to the adult and older adult group are more willing to be vaccinated than young people; these results are similar to those described by [22], who investigated in 19 countries comprising about 55% of the world population, 71.5% of the group of adults responded that they would get the vaccine if it was shown to be safe and effective. It is worth mentioning that a person's willingness to be vaccinated may not necessarily be a good predictor of receiving the vaccine, as vaccine decisions are multifactorial and may change over time.

Regarding educational level, the results described in this study report that there is a favorable tendency towards vaccination in those people who have a higher level of study (bachelor's, master's or doctorate); however, people with a trade or vocational degree showed an unfavorable attitude towards the vaccine, which could be associated with job opportunity, socio-economic level and other contextual and psychosocial factors that could be interfering in the acceptance of the vaccine by this group, despite the impact in different areas of life that they are facing. Given this, [17] noted that individuals planning to receive a COVID-19 vaccine were more likely to be older, male, more educated, Asian, or white, with completed vaccinations, no direct patient contact, and have had COVID-19 testing.

With respect to the occupation variable, it was found that the health care professionals present more favorable attitudes towards the vaccine than the rest of the groups considered in this study, with 57% acceptance, followed by educators and students who also manifest themselves favorably (52% and 51%, respectively). These results coincide with those described by [20], which show that most health professionals have the intention to receive the vaccine, but it is important to analyze the factors that are interfering in the acceptance of the vaccine and to work against this, providing information that is transmitted with clarity, coherence, and confidence, including the benefits, efficacy, and

value of the COVID-19 vaccine. It should be noted that being in the front line makes immunization awareness the alternative that gains more strength compared to other alternatives such as confinement or quarantine.

The limitations of this research study are the sample size, which was 786 valid evaluations, which could limit the capacity to discover important information in other contexts and with a larger sample; as well as the limitations due to the multi and pluricultural nature of the Peruvian population, considering that the observation in urban and rural communities requires the analysis of the sociodemographic particularities of interest, where future studies, whether by groups or regions, would be better adapted. In sum, the limitations are indicators of greater commitment and opportunities for future research. However, the described results are important findings, which will be part of the first evidence in better understanding the attitudes of the population towards vaccines against COVID-19, allowing governmental institutions to improve their communicational strategies, to deploy a responsible immunization plan in the Peruvian population.

CONCLUSIONS

In conclusion, it was possible to describe the attitudes towards vaccination, reporting greater acceptance among adult males, people with higher university education, who expressed their agreement with the vaccine. Finally, it was reported that health care professionals, educators and higher education students showed greater openness and favorable attitudes towards vaccines.

Future studies should be conducted on the methods and communication strategies used by public agencies to express the benefits of vaccines, which will allow for making the necessary contributions to improve their impact. The level of health literacy should be considered, identifying, and deepening the understanding of the beliefs, values and removing the uncertainty of the population, considering the sociodemographic and psychosocial variables present, as well as including the participation of opinion leaders from different sociocultural levels. This will contribute to the generation of trust and acceptance in the population.

FUNDING

This research received no external funding.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of PERUVIAN UNION UNIVERSITY (protocol code N° 2021-CEUPeU-0031 and date of approval).

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

DATA AVAILABILITY STATEMENT

<http://bit.ly/DATA-COVID-19>

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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