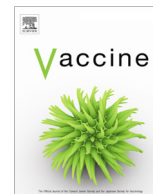




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## Factors associated with the intention to participate in COVID-19 vaccine clinical trials: A cross-sectional study in Peru



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### ABSTRACT

**Objective:** To evaluate the factors associated with the intention to participate in COVID-19 vaccine clinical trials in the Peruvian population.

**Methods:** Cross-sectional study and secondary analysis of a database that involved Peruvian population during September 2020. The Poisson regression model was used to estimate the associated factors.

**Results:** Data from 3231 individuals were analyzed, 44.1% of whom intended to participate in COVID-19 vaccine clinical trials. Factors associated with the outcome were being male (RPa: 1.25; 95% CI: 1.15–1.35), being from the highlands region (RPa: 1.18; 95% CI: 1.09–1.28) or jungle (RPa: 1.30; 95% CI: 1.15–1.47), having a relative that is a healthcare professional (PRa: 1.16; 95% CI: 1.06–1.28), using a medical source of information (PRa: 1.28; 95% CI: 1.17–1.41), and trusting in the possible effectiveness of vaccines (PRa: 1.40; 95% CI: 1.29–1.51). The main reason for not participating in the trial was the possibility of developing side effects (69.80%).

**Conclusion:** There is an urgent need to generate a perception of safety in COVID-19 vaccine clinical trials, to increase the population's intention to participate in these studies, and to provide evidence-based information about the vaccine.

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## 1. Background

Since the beginning of the Coronavirus Disease 2019 (COVID-19) pandemic, approximately 430 million confirmed cases and about 6 million deaths have been reported worldwide, conducting a

sanitary, political, and economic crisis around the world [1–3], which has required the scientific community to develop preventive measures and possible treatments [4]. Among them, the accelerated development of vaccine candidates has represented one of the most promising measures for the early control of the pandemic [5].

In January 2020, the genetic sequence of Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) was published, encouraging the world to develop a potential vaccine [6]. Since then, more than 190 vaccines have been developed in the preclinical phase and more than 130 candidates have reached the clinical

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evaluation phase [7]. In the case of Peru, the clinical trials started between September to December 2020 for the evaluation of the vaccines of Sinopharm, AstraZeneca, Johnson & Johnson, and CureVac [8–10]. Of this, only one vaccine (Sinopharm) was approved based on national data, the other three vaccines (Pfizer, Johnson & Johnson, and AstraZeneca) were introduced in the country considering the results of international studies [11]. Due to the high demand for vaccines worldwide, the scarce resources of middle and low-income countries, like Peru, and the uncertainty on the efficacy of vaccines against coronavirus variants more prevalent, there is still a need to continue developing more vaccine candidates and conducting national trials to explore the efficacy and safety in a specific population [12,13]. Therefore, it will become very relevant to promote the participation of the population in clinical trials.

However, the rapid development of potential vaccines has led to mistrust and concern about their quality and safety in the population [14,15], creating barriers to participation in vaccine clinical trials. Previous studies show that the factors associated with participate in a clinical trial of the COVID-19 vaccine are older age, male gender, being a health care worker, and perceived individual risk [16,17], which can change considering the culture and idiosyncrasy of the population.

In the Peruvian context, some studies postulated that intention to vaccinate could be low for concern about safety [18], despite that is often that phases two and three reported a prevalence of serious adverse effect less than 1% [19], and the potential benefits outweigh the harm. Knowing this, the Peruvian government implements some strategies for people to participate in COVID-19 vaccine trials, like providing quality information through official media and use the prestige of quality institutions to host the clinical trial [20,21]. However, there are no evaluations of the characteristics to contribute the participation and the trends in the Peruvian population. This study evaluate the factors associated with the intention to participate in COVID-19 vaccine clinical trials in the Peruvian population during the year 2020.

## 2. Materials and methods

### 2.1. Study design, space, and participants

A cross-sectional analytical study was conducted, based on a previously collected database with the intention of knowing the frequency of prevention and control practices against COVID-19 in the population  $\geq 18$  years of age in Peru. The primary study was conducted during the first wave of the pandemic for a period of 14 days (starting on September 7, 2020) prior to the approval of any of the vaccines against COVID-19 and during the full state of emergency and focused quarantine, the methodology of the primary study has been previously reported [22]. For the present study, persons older than 18 years of residence and Peruvian nationality were included, and those with a history of COVID-19 were excluded, because the variable of interest was not considered in the questionnaire for this group.

### 2.2. Survey

The survey consisted of the following sections: 1) sociodemographic characteristics (sex, age, comorbidities), 2) preventive practices and perspectives on the COVID-19 for persons without a history of COVID-19 (including intention to vaccinate), 3) practices and perspectives on the COVID-19 in persons with a history of COVID-19, only sections 1 and 2 were used for this study (Supplementary file 1). This survey was constructed considering previous studies [23]. The validity of the questionnaire was

reviewed by a group of clinicians and/or researchers. The Cronbach's Alpha showed good survey reliability (0.70).

The questionnaire used was disseminated through social networks (Facebook, WhatsApp, Instagram and Telegram) using the personal accounts of the authors and collaborators. In addition, the survey was published every 3 days in digital groups representative of universities, localities, among others. Convenience sampling was used, reaching adults in the 24 departments of Peru.

### 2.3. Outcome: Intention to participate in a COVID-19 vaccine clinical trial

The intention to participate in vaccine clinical trials was defined as an individual's desire to participate in an experimental study related to the evaluation of potential vaccines against COVID-19, in which he or she may receive a candidate vaccine or a placebo, taking into account that the intervention being evaluated may or may not have health benefits for the participant. We assessed participants' self-reported intention to participate using the following question: "Would you volunteer to have the new vaccine tested with you?", with a two-choice response possibility of "no" and "yes". Such a question was previously evaluated in a previous study in France [16]. In addition, the answer to this question was contrasted through the participants' opinion about the vaccine candidates (I am not informed, it is not effective, it is effective) and for the reasons for not participating in a clinical trial (because it may cause other evils, because it would be of foreign origin, because I do not believe in the efficacy of vaccines, because it would have microchips to track people, among others).

### 2.4. Other variables

Other evaluated variables were: sex (female, male), age (young, adult or older adult), marital status (single, married or cohabiting), educational level (higher education, secondary education or a lower level), region (coast, highlands, jungle), area of residence (urban and rural), employment status (no, yes), social class (low, medium-high), healthcare professional within the family (no, student of health sciences, healthcare professional), source where the information about COVID-19 was obtained (social networks, press media, medical information, friends and family), comorbidities for COVID-19 (no, yes), family member diagnosed with COVID-19 (no, yes), family member died of COVID-19 (no, yes), and perspectives about the disease (none or little and a lot).

### 2.5. Data entry, processing, and analysis

Data processing and statistical analysis were performed in Stata v16.0 (StataCorp, TX, USA). Absolute and relative frequencies of categorical variables were estimated, and the chi-square test was used to compare the proportions between groups. To assess the factors associated with the intention to participate in vaccine clinical trials, Poisson regression models were used to calculate the crude (RPc), and the adjusted (RPa) prevalence ratios with their respective 95% confidence intervals. For the adjusted analysis, an epidemiological model was followed, including all the variables evaluated in the crude analysis.

### 2.6. Ethics approval

The primary study was evaluated and approved by the Institutional Ethics Committee of the Universidad Peruana Unión (Code: 2020-CEUPeU-00020). The initial survey was anonymous, and had extended consent for the use of respondents' data for future research.

### 3. Results

#### 3.1. General characteristics of the study sample

The primary study evaluated a total of 3,630 individuals, of whom 399 were excluded because they did not respond to the outcome of interest, leaving 3,231 participants included in the present study. A total of 62.7% were female, the mean age was  $25.07 \pm 9.23$ , 87.6% were single, 76% had a higher education level, 48.9% belonged to the coast region, 84.8% were from the urban areas, and 85.3% had no comorbidity for COVID-19 (Table 1).

#### 3.2. Prevalence of intention to participate in COVID-19 vaccine clinical trials

The prevalence of intention to participate in COVID-19 vaccine clinical trials was 44.1%. Regarding the reasons for not participating in a clinical trial, 70.42% of participants thought that the biologic could cause side effects, while 8.81% was doubtful of its efficacy, 2.6% considered that the vaccine could contain tracking microchips, 2.27% stated that the main reason was the foreign origin of the biologic, and finally 3.93% gave other reasons.

#### 3.3. Factors associated with the intention to participate in COVID-19 vaccine clinical trials

Factors associated with the intention to participate in COVID-19 vaccine clinical trials were being male (PRa: 1.25; 95% CI: 1.15–1.35), being from the highlands (PRa: 1.18; 95% CI: 1.09–1.28) or jungle (PRa: 1.30; 95% CI: 1.15–1.47), having a healthcare professional in your family (PRa: 1.16; 95% CI: 1.06–1.28), using a medical source for information about COVID-19 (RPa: 1.28; 95% CI: 1.17–1.41), and trusting in the possible effectiveness of vaccines (RPa: 1.40; 95% CI: 1.29–1.51) (Table 2).

### 4. Discussion

#### 4.1. Main findings

Around the world, clinical trials are the cornerstone for the development of COVID-19 vaccines. In Latin America, implementation of multisite clinical trials had face challenges, such as to limited facilities, fake news about vaccines and insufficient number of participants [24]. Additionally, political scandals could have affected the credibility of COVID-19 vaccines clinical trials [25] and generated less participation of the population in these studies [26].

Our study revealed that 44% of respondents intended to participate in COVID-19 vaccine clinical trials. Detoc M et al. reported 47% in France [16] and Abu-Farha RK et al. found 36% of intention in Jordan, not very different from the present study [27]. The variation among different reports could be explained by cultural and religious factors [28], and by the COVID-19 pandemic impact on these countries. Under these circumstances, countries with higher morbidity and mortality from COVID-19 [4] such as Peru and France, could have a population with higher intention to participate in clinical trials, given the urgency for a faster development of COVID-19 vaccines [16]. Interestingly, these studies [16,27] included recovered COVID-19 cases; therefore, the intention to participate in clinical trials may be overestimated [29].

Before the COVID-19 pandemic, only a minority of clinical trials had been conducted in Peru [30]. For this reason, the knowledge and confidence level to participate in clinical trials among Peruvian population could be lower than those reported in other region countries of South America. On another hand, in the context of

COVID 19 pandemic, the participation in vaccines clinical trials may be considered a potential therapeutic intervention and an opportunity to collaborate with the community [31]. It is worth mentioning that the Peruvian government has had a crucial role in the pandemic to fight misinformation and to increase the acceptance of clinical trials by providing correct information [32], emphasizing the contribution of clinical trials in people's health and highlighting that trials are regulated by local and international ethics committees [30].

In 2020, approximately 29 COVID-19 clinical trials were conducted in Peru, 5 of them about COVID-19 vaccines [33]. Frequently, younger population are enrolled in these trials, which was also noted in previous studies and the current one [34]. The higher intention to participate of this age group is probably due to altruism and the adequate information received by public health personnel [34]. Another potential explanation for this finding may be that the majority of young people were on an education system [35], therefore they may have an acceptable knowledge about COVID-19 vaccines. In addition, comorbidities are lower in this age group; thus, risk of potential side effects could be perceived as low by the participants. However, the massive enrollment of young population in COVID-19 vaccine clinical trials could provoke potential bias of representative sample sizes, making very difficult to extrapolate the results to the elderly and population with comorbidities [36].

Interestingly, more than half of the respondents did not intend to participate due the possible development of side effects from the vaccine candidate. Some studies attribute this finding to the poor access of information about study processes, and lack of knowledge of ethical and legal aspects of COVID-19 vaccine clinical trials [37]. In order to improve this aspect, we believe that the Peruvian Ministry of Health should take the lead in educating the population about COVID 19 clinical trials through social media, newscasts, social networks, personalized messages to telephone numbers and others [38].

Another interesting finding of the present study was the small proportion of population that believed COVID-19 vaccines contained tracking microchips. This conspiracy theory originated from internet forums where it was mentioned that the Microsoft founder contributed with vaccine development to spread microchips around the world and control human population [39]. This theory spread through internet, especially by social networks that do not have regulations against fake news [40]. There are some strategies that have been implemented worldwide to control this problem, such as public health campaigns for social networks users, autoregulation of social network companies [40], spreading official information by government channels [32] and imprisonment for fake news promoters [41]. However, such efforts have not been sufficient [42].

In previous studies, low education level, coming from rural areas, and low socioeconomic level were associated with a decreased intention to participate in COVID-19 vaccine clinical trial [23,43]. In Peru, these findings were found in the highlands and jungle [44]. However, in our study, coming from the highlands or jungle were associated with a higher intention to participate in COVID-19 vaccine clinical trials, which is surprising given the disproportionate higher incidence of COVID-19 infection in the coast of Peru that could make us think that this population would be more interested in participating in clinical trials. A possible explanation could be that the population from coast of Peru has more access to conspiracy theories by the media, leading to a lower intention to participate [44,45].

Also, we found the male gender was independently associated to intention to participate in COVID-19 vaccine clinical trial. Similar results were reported in France [16]; however, in China the intention in female population was significantly higher [31]. We

**Table 1**  
Bivariate analysis of factors associated with the intention to participate in the clinical trial for COVID-19 vaccine (N = 3,231).

Variables		N (%)	Intention to participate in a clinical trial for the COVID-19 vaccine		p*
			No (N = 1.805) N (%)	Yes (N = 1.426) N (%)	
Gender	Female	2027 (62.74)	1199 (66.43)	828 (58.06)	
	Male	1204 (37.26)	606 (33.57)	598 (41.94)	<b>&lt;0.001</b>
Age**	25.07 ± 9.23	25.94 ± 10.15	23.98 ± 7.78		
	18 to 25 years old	2462 (76.20)	1318 (73.02)	1144 (80.22)	
	26 to 29 years old	271 (8.39)	155 (8.59)	116 (8.13)	
	30 to 49 years old	352 (10.89)	226 (12.52)	126 (8.84)	
	50 to 64 years old	127 (3.93)	92 (5.10)	35 (2.45)	
	65 to 100 years old	19 (0.59)	14 (0.78)	5 (0.35)	<b>&lt;0.001***</b>
Marital status	Single	2832 (87.65)	1535 (85.04)	1297 (90.95)	
	Married or cohabiting	399 (12.35)	270 (14.96)	129 (9.05)	<b>&lt;0.001</b>
Grade of education	High school or less	773 (23.92)	408 (22.60)	365 (25.60)	
	Higher (technical or university)	2458 (76.08)	1397 (77.40)	1061 (74.40)	<b>0.048</b>
Region	Coast	1581 (48.93)	938 (51.97)	643 (45.09)	
	Highlands	1369 (42.37)	732 (40.55)	637 (44.67)	
	Jungle	281 (8.7)	135 (7.48)	146 (10.24)	<b>&lt;0.001</b>
Area of residence	Urban	2741 (84.83)	1529 (84.71)	1212 (84.99)	
	Rural	490 (15.17)	276 (15.29)	214 (15.01)	0.823
Work relationship	No	2509 (77.65)	1343 (74.40)	1166 (81.77)	
	Yes	722 (22.35)	462 (25.60)	260 (18.23)	<b>&lt;0.001</b>
Socioeconomic level	Low	851 (26.34)	507 (28.09)	344 (24.12)	
	Medium High	2380 (73.66)	1298 (71.91)	1082 (75.88)	<b>&lt;0.001</b>
Health professionals within the family	No	1257 (38.9)	780 (43.21)	477 (33.45)	
	Health science student	518 (16.03)	297 (16.45)	221 (15.50)	
	Health professional	1456 (45.06)	728 (40.33)	728 (51.05)	<b>&lt;0.001</b>
Source where you acquire information about COVID-19	Social networks	1098 (33.98)	639 (35.40)	459 (32.19)	
	Press media	1173 (36.3)	720 (39.83)	453 (31.77)	
	Medical information	847 (26.21)	371 (20.55)	476 (33.38)	
	Friends and family	113 (3.5)	75 (4.16)	38 (2.66)	<b>&lt;0.001</b>
Comorbidities for COVID-19	No	2757 (85.33)	1534 (84.99)	1223 (85.76)	
	Yes	474 (14.67)	271 (15.01)	203 (14.24)	0.535
Family member with COVID-19 diagnosis	No	2397 (74.19)	1339 (74.18)	1058 (74.19)	
	Yes	834 (25.81)	466 (25.82)	368 (28.81)	0.994
Do you consider COVID-19 to be a dangerous and deadly disease?	Not at all or a little	750 (23.21)	423 (23.43)	327 (22.93)	
	A lot	2481 (76.79)	1382 (76.57)	1099 (77.07)	0.736
Do you consider that you are at increased risk of contracting COVID-19?	Not at all or a little	2419 (74.87)	1358 (75.24)	1061 (74.40)	
	A lot	812 (25.13)	447 (24.76)	365 (25.60)	0.588
Do you think there are many cases of COVID-19 in your community?	Not at all or a little	1788 (55.34)	1037 (57.45)	751 (52.66)	
	A lot	1443 (44.66)	768 (42.55)	675 (47.34)	<b>0.007</b>
Opinion on COVID-19 vaccine	I am not informed	1568 (48.53)	988 (54.74)	580 (40.67)	
	Not effective	222 (6.87)	146 (8.09)	76 (5.33)	
	It is effective	1441 (44.60)	671 (37.17)	770 (54.00)	<b>&lt;0.001</b>

\* Chi2 test.

\*\* Mean ± standard deviation.

\*\*\* Mann-Whitney U test.

believe that specific communication strategies are needed in Peru to decrease the gender difference. This finding may be secondary to the traditional education in Peru, where men feel responsible for protecting the members of their family [46].

Given the low intention to participate in clinical trials found in this study, strategies are needed to address this issue. To achieve this objective, it should be taken into account that there are modifiable factors (misinformation) and non-modifiable factors (sex)



**Table 2**  
Multivariate analysis of factors associated with intention to participate in a clinical trial for COVID-19 vaccine (N = 3,231).

Variables		Outcome: Intention to participate in a clinical trial for the COVID-19 vaccine			
		RPc* (CI 95%)	p	RPa* (CI 95%)	p
Gender	Female	Ref.		Ref.	
	Male	1.22 (1.13–1.31)	<0.001	<b>1.25 (1.15–1.35)</b>	<b>&lt;0.001</b>
Age	18 to 25 years old	Ref.		Ref.	
	26 to 29 years old	0.92 (0.80–1.06)	0.264	0.95 (0.81–1.1)	0.488
	30 to 49 years old	0.77 (0.67–0.89)	<0.001	0.9 (0.75–1.09)	0.287
	50 to 64 years old	0.59 (0.45–0.79)	<0.001	<b>0.72 (0.52–0.98)</b>	<b>0.038</b>
	65 to 100 years old	0.57 (0.27–1.20)	0.139	0.68 (0.3–1.49)	0.335
Marital status	Single	Ref.		Ref.	
	Married or cohabiting	0.71 (0.6–0.82)	<0.001	0.89 (0.74–1.07)	0.215
Grade of education	High school or less	Ref.		Ref.	
	Higher (technical or university)	0.91 (0.84–1)	0.044	0.96 (0.88–1.05)	0.395
Region	Coast	Ref.		Ref.	
	Highlands	1.14 (1.05–1.24)	0.001	<b>1.18 (1.09–1.28)</b>	<b>&lt;0.001</b>
	Jungle	1.28 (1.12–1.45)	<0.001	<b>1.3 (1.15–1.47)</b>	<b>&lt;0.001</b>
Area of residence	Urban	Ref.		Ref.	
	Rural	0.99 (0.89–1.1)	0.824	1.04 (0.93–1.16)	0.510
Work relationship	No	Ref.		Ref.	
	Yes	0.77 (0.7–0.86)	<0.001	0.89 (0.79–1.03)	0.113
Socioeconomic level	Low	Ref.		Ref.	
	Medium High	1.12 (1.03–1.23)	0.013	1.08 (0.98–1.18)	0.129
Health professionals within the family unit	No	Ref.		Ref.	
	Health science student	1.12 (0.99–1.27)	0.061	1.1 (0.98–1.25)	0.143
	Health professional	1.32 (1.21–1.44)	<0.001	<b>1.16 (1.06–1.28)</b>	<b>0.002</b>
Source where you acquire information about COVID-19	Social networks	Ref.		Ref.	
	Press media	0.92 (0.84–1.02)	0.122	1 (0.9–1.1)	0.963
	Medical information	1.34 (1.23–1.47)	<0.001	<b>1.28 (1.17–1.41)</b>	<b>&lt;0.001</b>
	Friends and family	0.8 (0.62–1.05)	0.112	0.84 (0.65–1.09)	0.184
Comorbidities for COVID-19	No	Ref.		Ref.	
	Yes	0.97 (0.86–1.08)	0.539	1.02 (0.92–1.14)	0.672
Family member with COVID-19 diagnosis	No	Ref.		Ref.	
	Yes	1 (0.91–1.09)	0.994	1 (0.91–1.09)	0.927
Do you consider COVID-19 to be a dangerous and deadly disease?	Not at all or a little	Ref.		Ref.	
	A lot	1.02 (0.93–1.11)	0.737	1.07 (0.98–1.18)	0.134
Do you consider that you are at increased risk of contracting COVID-19?	Not at all or a little	Ref.		Ref.	
	A lot	1.02 (0.94–1.12)	0.587	1.05 (0.96–1.15)	0.249
Do you think there are many cases of COVID-19 in your community?	Not at all or a little	Ref.		Ref.	
	A lot	1.11 (1.03–1.2)	0.006	1.07 (0.99–1.16)	0.076
Opinion on COVID-19 vaccine	I am not informed	Ref.		Ref.	
	Not effective	0.93 (0.76–1.12)	0.433	0.91 (0.75–1.1)	0.322
	It is effective	1.45 (1.33–0.157)	<0.001	<b>1.4 (1.29–1.51)</b>	<b>&lt;0.001</b>

that can modify the intention to participate. Concerning modifiable factors, there is a need for strategies to decrease the amount of false news and increase the promotion of evidence-based medical information. This problem was also seen in developing countries, such as the US, where it has been recommended that there be a responsibility of the government to regulate health information [47]. In this case, the use of artificial intelligence for screening fake

news and the incorporation of laws about health information regulation could be a solution [48].

For non-modifiable factors, strategies such as promoting participation by community leaders or influencers, or using economic and non-economic incentives could be used [49]. Taking in consideration that female participant could be more likely to ask for partners or family' advices before providing consent, previous

**Table 3**  
Reasons for not participating in a clinical trial for the COVID-19 vaccine N = 1805.

Reasons	N (%)
Because it can cause other ailments (side effects)	1271 (70.42%)
Because it would be of foreign origin	41 (2.27%)
Because I do not believe in the efficacy of vaccines	159 (8.81%)
Because it would have microchips for tracking people	47 (2.60%)
Because I have a comorbidity	20 (1.11%)
Because I don't want them to test the vaccine in my body	30 (1.66%)
Because clinical trials are being done in a very short time and I do not trust them	27 (1.50%)
Because I don't have time and I'm not interested	20 (1.11%)
Because I don't know about clinical trials and I am not informed	19 (1.05%)
Because I did not catch Covid-19	19 (1.05%)
Because I consider myself a person at risk (age, gestation)	19 (1.05%)
Because I prefer to wait for an approved vaccine	27 (1.50%)
Because I don't want to risk it out of fear	35 (1.94%)
Other	71 (3.93%)

educational interventions and other strategies should be useful [50]. Likewise, the Peruvian government should increase trust towards vaccines and clinical trials, which requires measures taken by other governments, such as identifying minorities and disadvantaged groups, as they are the most exposed to COVID-19 and have the least access to health care [51], maintaining close communication with the population through call-centers as in the case of Slovenia [52] or websites that allow the population to express their views, as in the case of France [53]. In addition, the state could contact influential people to provide verified information in the case of younger people, as reported in Finland and Korea [54].

In fact, a key determinant for the trust of the population is equity [54], however it has been cracked by corruption scandals and lack of ethics on the part of the Peruvian government and universities, such as the Vacuna-gate case [55], in which political elites were the first to benefit. It should be noted that measures to increase confidence would eliminate the barrier of lack of participation in clinical trials and subsequent vaccination in the Peruvian population (see Table 3).

#### 4.2. Strengths and limitations

The study had some limitations. First, our sample is not completely representative of the Peruvian general population. Second, the use of social networks to recruit surveys depends on the accessibility of participants' internet services, and their willingness to participate in online surveys. Third, the phase of the clinical trial was not specified, and the intention to participate may vary between the different phases of the clinical trials. Despite these limitations, this is the first study in the Peruvian population to evaluate the factors associated with the intention to participate in the COVID-19 vaccine trial. This study involved a large sample size of 3,231 Peruvian participants from different regions of the country.

#### 5. Conclusion

In conclusion, less than half of the participants had the intention to participate in COVID-19 vaccine clinical trials. The main reasons for not participating were the possible side effects of the vaccine candidates, distrust in its efficacy, and the belief that the vaccine candidate would contain microchips. Likewise, almost half of the participants were not informed about the preventive nature of a vaccine.

Among the factors associated with a higher intention to participate, we found that being informed from medical sources, having a healthcare professional in the family, being from the highlands or jungle region and being male increased the intention among individuals. These findings should alert the Peruvian government of the need to implement public policies to increase the awareness on vaccine clinical trials. We recommend targeting population with characteristics associated with high acceptance in vaccine trials to ensure an adequate enrollment in clinical studies.

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All authors attest they meet the ICMJE criteria for authorship.

#### CRedit authorship contribution statement

**Abraham De-Los-Rios-Pinto:** Conceptualization, Investigation, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Daniel Fernandez-Guzman:** Conceptualization, Investigation, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **David R. Soriano-Moreno:** Conceptualization, Investigation, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Lucero Sangster-Carrasco:** Conceptualization, Investigation, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Noelia Morocho-Alburquerque:** Investigation, Data curation, Writing – original draft. **Antony Pinedo-Soria:** Investigation, Data curation, Writing – original draft. **Valentina Murrieta-Ruiz:** Investigation, Data curation, Writing – original draft. **Angelica Diaz-Corrales:** Investigation, Data curation, Writing – original draft. **Jorge Alave:** Supervision, Writing – original draft, Writing – review & editing. **Wendy Nieto-Gutierrez:** Project administration, Methodology, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. **Jose Armando Gonzales-Zamora:** Supervision, Writing – original draft, Writing – review & editing.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2022.04.003>.

#### References

- [1] Alokaily F. COVID-19 Global health crisis. Saudi Med J 2021;42:3–4. <https://doi.org/10.15537/smi.2021.1.25663>.
- [2] Patterson A, Clark MA. COVID-19 and Power in Global Health. Int J Health Policy Manag 2020;9:429–31. <https://doi.org/10.34172/ijhpm.2020.72>.
- [3] Nicola Maria, Alsafi Zaid, Sohrabi Catrin, Kerwan Ahmed, Al-Jabir Ahmed, Iosifidis Christos, et al. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. Int J Surg Lond Engl 2020;78:185–93.
- [4] World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard. [cited 21 Nov 2021]. Available: <https://covid19.who.int>; 2021.
- [5] Koirala A, Joo YJ, Khatami A, Chiu C, Britton PN. Vaccines for COVID-19: The current state of play. Paediatr Respir Rev 2020;35:43–9. <https://doi.org/10.1016/j.prrv.2020.06.010>.
- [6] Thanh Le Tung, Andreadakis Zacharias, Kumar Arun, Gómez Román Raúl, Tollefsen Stig, Saville Melanie, et al. The COVID-19 vaccine development landscape. Nat Rev Drug Discov 2020;19(5):305–6.

- [7] World Health Organization. COVID-19 vaccine tracker and landscape. [cited 21 Nov 2021]. Available: <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>; 2021.
- [8] Ministerio de Salud. Ministerio de Salud otorgó autorización a la vacuna de Sinopharm que llegará al país en los próximos días. [cited 30 Jan 2022]. Available: <https://www.gob.pe/institucion/minsa/noticias/326706-ministerio-de-salud-otorgo-autorizacion-a-la-vacuna-de-sinopharm-que-llegara-al-pais-en-los-proximos-dias>.
- [9] Ministerio de Salud. Llegó el primer lote de vacunas contra la COVID-19 a nuestro país. [cited 30 Jan 2022]. Available: <https://www.minisa.gob.pe/newsletter/2021/edicion-54/nota1/index.html>.
- [10] Ministerio de Salud. Cuatro nuevos laboratorios internacionales realizarán ensayos clínicos de la vacuna contra la COVID-19 en el Perú. [cited 27 Feb 2022]. Available: <https://www.gob.pe/institucion/minsa/noticias/304315-minisa-cuatro-nuevos-laboratorios-internacionales-realizaran-ensayos-clinicos-de-la-vacuna-contra-la-covid-19-en-el-peru>.
- [11] VIPER Group COVID19 Vaccine Tracker Team. Peru – COVID19 Vaccine Tracker. [cited 30 Jan 2022]. Available: <https://covid19.trackvaccines.org/country/peru/>.
- [12] The Organization for Economic Co-operation and Development. Access to COVID-19 vaccines: Global approaches in a global crisis. [cited 21 Nov 2021]. Available: <https://www.oecd.org/coronavirus/policy-responses/access-to-covid-19-vaccines-global-approaches-in-a-global-crisis-c6a18370/>; 2021.
- [13] World Health Organization. Viral variants and their effects on COVID-19 vaccines. [cited 21 Nov 2021]. Available: <https://www.who.int/es/news-room/feature-stories/detail/the-effects-of-virus-variants-on-covid-19-vaccines>; 2021.
- [14] Torreele E. The rush to create a covid-19 vaccine may do more harm than good. *BMJ* 2020;370:. <https://doi.org/10.1136/bmj.m3209>.
- [15] Determann Domino, de Bekker-Grob Esther W, French Jeff, Voeten Helene A, Richardus Jan Hendrik, Das Enny, et al. Future pandemics and vaccination: Public opinion and attitudes across three European countries. *Vaccine* 2016;34(6):803–8.
- [16] Detoc M, Bruel S, Frappe P, Tardy B, Botelho-Nevers E, Gagneux-Brunon A. Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. *Vaccine* 2020;38:7002–6. <https://doi.org/10.1016/j.vaccine.2020.09.041>.
- [17] Luo Chuxuan, Yang Yuan, Liu Yueming, Zheng Danna, Shao Lina, Jin Juan, et al. Intention to COVID-19 vaccination and associated factors among health care workers: A systematic review and meta-analysis of cross-sectional studies. *Am J Infect Control* 2021;49(10):1295–304.
- [18] Herrera-Añazco Percy, Uyen-Cateriano Ángela, Urrunaga-Pastor Diego, Bendezu-Quispe Guido, Toro-Huamanchumo Carlos J, Rodríguez-Morales Alfonso J, et al. Prevalencia y factores asociados a la intención de vacunarse contra la COVID-19 en el Perú. *Rev Peru Med Exp Salud Publica* 2021;38(3):381–90.
- [19] Kaur RJ, Dutta S, Bhardwaj P, Charan J, Dhingra S, Mitra P, et al. Adverse Events Reported From COVID-19 Vaccine Trials: A Systematic Review. *Indian J Clin Biochem* 2021;36:427–39. <https://doi.org/10.1007/s12291-021-00968-z>.
- [20] Ministerio de Salud. Minsa pone al alcance de la ciudadanía información sobre ensayos clínicos de vacunas contra la COVID-19. [cited 5 Mar 2022]. Available: <https://www.gob.pe/institucion/minsa/noticias/324417-minsa-pone-al-alcance-de-la-ciudadania-informacion-sobre-ensayos-clinicos-de-vacunas-contra-la-covid-19>.
- [21] Vaccine COVID-19 Peru. Phase III Trial Study. [cited 21 Nov 2021]. Available: <https://vacnacovid.pe/>; 2021.
- [22] Fernandez-Guzman Daniel, Soriano-Moreno David, Ccami-Bernal Fabricio, Rojas-Miliano Cristhian, Sangster-Carrasco Lucero, Hernández-Bustamante Enrique A, et al. Prácticas de prevención y control frente a la infección por Sars-Cov2 en la población peruana. *Revista Del Cuerpo Médico Hospital Nacional Almanzor Aguinaga Asenjo* 2021;14(Sup1.1149):13–21.
- [23] Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes Toward a Potential SARS-CoV-2 Vaccine. *Ann Intern Med* 2020;173:964–73. <https://doi.org/10.7326/M20-3569>.
- [24] Carracedo S, Palmero A, Neil M, Hasan-Graniér A, Saenz C, Reveiz L. The landscape of COVID-19 clinical trials in Latin America and the Caribbean: assessment and challenges\*. *Rev Panam Salud Pública* 2021;45:. <https://doi.org/10.26633/RPSP.2021.33e33>.
- [25] Taylor L. Scandal over COVID vaccine trial at Peruvian universities prompts outrage. *Nature* 2021;592:174–5. <https://doi.org/10.1038/d41586-021-00576-0>.
- [26] Chauvin L. Peruvian COVID-19 vaccine scandal spreads. *Lancet Lond Engl* 2021;397:783. [https://doi.org/10.1016/S0140-6736\(21\)00508-0](https://doi.org/10.1016/S0140-6736(21)00508-0).
- [27] Abu-Farha RK, Alzoubi KH, Khabour OF. Public Willingness to Participate in COVID-19 Vaccine Clinical Trials: A Study from Jordan. *Patient Prefer Adherence* 2020;14:2451–8. <https://doi.org/10.2147/PPA.S284385>.
- [28] Malik AA, McFadden SM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. *EclinicalMedicine* 2020;26:. <https://doi.org/10.1016/j.eclim.2020.100495>;100495.
- [29] Felemban Rania M, Tashkandi Emad M, Mohorjy Doaa K. The willingness of the Saudi Arabian population to participate in the COVID-19 vaccine trial: A case-control study. *J Taibah Univ Med Sci* 2021;16(4):612–8.
- [30] El Comercio. How to increase the number of clinical trials in Peru? [cited 16 May 2021]. Available: <https://elcomercio.pe/tecnologia/ciencias/lograr-incremento-numero-ensayos-clinicos-peru-ecpm-noticia-638418-noticia/>; 2019.
- [31] Sun S, Lin D, Operario D. Interest in COVID-19 vaccine trials participation among young adults in China: Willingness, reasons for hesitancy, and demographic and psychosocial determinants. *Prev Med Rep* 2021;22:. <https://doi.org/10.1016/j.pmedr.2021.101350>;101350.
- [32] Government of Peru. Press release on false information. [cited 16 May 2021]. Available: <https://www.gob.pe/institucion/mtc/noticias/208626-comunicado-sobre-informacion-falsa>; 2020
- [33] Lope PC, Carracedo S, Romani F. Regulation of clinical trials for COVID-19 in Peru. *Rev Peru Med Exp Salud Publica* 2021;38:171–7. <https://doi.org/10.17843/rpmpesp.2021.381.6627>.
- [34] Detoc M, Launay O, Dualé C, Mutter C, Le Huec J-C, Lenzi N, et al. Barriers and motivations for participation in preventive vaccine clinical trials: Experience of 5 clinical research sites. *Vaccine* 2019;37(44):6633–9.
- [35] National Institute of Statistics and Informatics. 27% of the Peruvian population are young people. [cited 14 Apr 2021]. Available: <https://www.inei.gob.pe/prensa/noticias/el-27-de-la-poblacion-peruana-son-jovenes-8547/>; 2015.
- [36] Walsh Edward E, Frenck Robert W, Falsey Ann R, Kitchin Nicholas, Absalon Judith, Gurtman Alejandra, et al. Safety and Immunogenicity of Two RNA-Based Covid-19 Vaccine Candidates. *N Engl J Med* 2020;383(25):2439–50.
- [37] Málaga G, Zúñiga-Rivera A. Do clinical trials contribute to the development of research in Peru: how can this be achieved? *Rev Peru Med Exp Salud Publica* 2012;29:529–34.
- [38] Blastland M, Freeman ALJ, van der Linden S, Marteau TM, Spiegelhalter D. Five rules for evidence communication. *Nature* 2020;587:362–4. <https://doi.org/10.1038/d41586-020-03189-1>.
- [39] Ball P, Maxmen A. The epic battle against coronavirus misinformation and conspiracy theories. *Nature* 2020;581:371–4. <https://doi.org/10.1038/d41586-020-01452-z>.
- [40] Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Hum Vaccines Immunother* 2020;16:2586–93. <https://doi.org/10.1080/21645515.2020.1780846>.
- [41] Ministry of Justice and Human Rights of Peru. In: Twitter. [cited 21 Nov 2021]. Available: [https://twitter.com/MinjusDH\\_Peru/status/1247871817815150592](https://twitter.com/MinjusDH_Peru/status/1247871817815150592); 2020.
- [42] Fajardo-Trigueros C, Rivas-de-Roca R. EU action in Spain in the face of the disinformation “infodemic” by COVID-19. *Rev Estilos Aprendiz* 2020;13:19–32.
- [43] Ruiz JB, Bell RA. Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey. *Vaccine* 2021;39:1080–6. <https://doi.org/10.1016/j.vaccine.2021.01.010>.
- [44] Santillán CH. Cultural identity in Peru: background, differences between regions and influence of modernism. *Educ Comun Rev Investig Fac Humanidades* 2016;4:62–7. <https://doi.org/10.35383/educare.v1i6.93>.
- [45] World Health Organization. Episode #24 - Vaccine myths vs science. . [cited 21 Nov 2021]. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/science-in-5/episode-24-vaccine-myths-vs-science>; 2021.
- [46] Salguero VA. Identity, family responsibility and the exercise of paternity in men in the State of Mexico. *Papeles Poblac* 2006;12:155–79.
- [47] Terry N. Regulating health information: a US perspective. *BMJ* 2002;324:602–6.
- [48] Kaliyar RK, Goswami A, Narang P, Sinha S. FNDNet – A deep convolutional neural network for fake news detection. *Cogn Syst Res* 2020;61:32–44. <https://doi.org/10.1016/j.cogsys.2019.12.005>.
- [49] A rapid review of evidence on the determinants of and strategies for COVID-19 vaccine acceptance in low- and middle-income countries. In: JOGH [Internet]. 20 Nov 2021 [cited 3 Feb 2022]. Available: <https://jogh.org/2021/jogh-11-05027/>.
- [50] Lobato L, Bethony JM, Pereira FB, Grahek SL, Diemert D, Gazzinelli MF. Impact of gender on the decision to participate in a clinical trial: a cross-sectional study. *BMC Public Health* 2014;14:1156. <https://doi.org/10.1186/1471-2458-14-1156>.
- [51] Robertson Elaine, Reeve Kelly S, Niedzwiedz Claire L, Moore Jamie, Blake Margaret, Green Michael, et al. Predictors of COVID-19 vaccine hesitancy in the UK household longitudinal study. *Brain Behav Immun* 2021;94:41–50.
- [52] Nacionalni inštitut za javno zdravje. Cepimo se. In: Cepimo se [Internet]. [cited 27 Feb 2022]. Available: <https://www.cepimose.si/>.
- [53] Le CESE vous donne la parole. In: Le CESE vous donne la parole [Internet]. [cited 27 Feb 2022]. Available: <https://participez.lecese.fr/>.
- [54] OECD Policy Responses to Coronavirus. Enhancing public trust in COVID-19 vaccination: The role of governments. [cited 27 Feb 2022]. Available: <https://www.oecd.org/coronavirus/policy-responses/enhancing-public-trust-in-covid-19-vaccination-the-role-of-governments-eae0ec5a/#endnotea0z39>.
- [55] Kenyon G. Vacuna-gate escalates in Peru. *Lancet Infect Dis* 2021;21:463. [https://doi.org/10.1016/S1473-3099\(21\)00157-2](https://doi.org/10.1016/S1473-3099(21)00157-2).