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Prevalence of negative attitude towards COVID-19 vaccines and its association with institutional trust and infodemic in the adult population of the department of Magdalena*

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Abstract

Objective: To determine the prevalence of negative attitudes toward COVID-19 vaccines and explore their association with institutional trust and exposure to infodemic information among the adult population of the department of Magdalena, Colombia.

Methodology: A cross-sectional observational study was conducted with a sample of 1,600 participants, including students, professors, and administrative staff from two higher education institutions in the department of Magdalena. Probabilistic sampling was applied based on participants' roles. Between May and August 2022, participants completed the Vaccine Attitude Scale, the Institutional Trust Scale during the outbreak, and an Infodemic Questionnaire.

Results: A total of 1,441, one thousand four hundred forty-one participants aged 18 to 74 years ($M = 22.28$, $SD = 6.65$). 55.93% were female and 66.97% had a university education, and 68.49% reported low income. The prevalence of resistance to the covid-19 vaccine was 63.98%. Negative attitude toward the vaccine was associated with low trust in institutions during outbreaks ($aOR = 1.80$, 95%CI 1.45-2.25), and an infodemic evidenced in the misinformation that getting vaccinated for COVID-19 can have side effects ($aOR = 1.50$, 95%CI 1.12-2.09) and implant a microchip ($aOR = 1.52$, 95%CI 1.20-1.94). The variables "18 to 25 years old", "wage income", and "vaccine limitation of civil rights" were not linked to negative attitude toward the vaccine.

Conclusions: The negative attitude towards COVID-19 vaccines was 63.98%, which was linked to low trust in institutions during the outbreak and the infodemic. Longitudinal studies on attitudes towards vaccines in the post-pandemic are suggested.

-----**Keywords:** Attitude towards the vaccine, distrust of institutions, infodemic, vaccination

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Prevalencia de la actitud negativa hacia las vacunas contra COVID-19 y su asociación con la confianza institucional y la infodemia en población adulta del departamento del Magdalena

Resumen

Objetivo: Estimar la prevalencia de actitudes negativas hacia las vacunas contra la COVID-19 y explorar su asociación con la confianza institucional y la exposición a la infodemia entre la población adulta del departamento del Magdalena, Colombia.

Metodología: Se realizó un estudio observacional transversal con una muestra de 1.600 participantes, entre estudiantes, profesores y personal administrativo de dos instituciones de educación superior del departamento del Magdalena. Se aplicó un muestreo probabilístico basado en los roles de los participantes. Entre mayo y agosto de 2022, los participantes completaron la escala de actitud ante las vacunas, la escala de confianza institucional durante el brote y un cuestionario de infodemia.

Resultados: Participaron 1441 personas, en edades entre los 18 y los 74 años. El 55,93 % eran del género femenino, el 66,97 % tenían estudios universitarios y el 68,49 % informó ingreso económico bajo. La prevalencia de la resistencia hacia las vacunas contra COVID-19 fue del 63,98 %. La actitud negativa hacia la vacunación se asoció a la escasa confianza en las instituciones durante el brote de la enfermedad (RDa = 1,80; IC 95 % = 1,45-2,25) y a la infodemia, evidenciada en la desinformación de que vacunarse por covid-19 puede tener efectos secundarios (RDa = 1,50; IC 95 % = 1,12-2,09) y que implantarían un microchip (RDa = 1,52 IC 95 % 1,20-1,94). Las variables “edad 18-25 años”, “ingreso salarial” y “la vacuna limita los derechos civiles” no se vincularon con la actitud negativa hacia las vacunas.

Conclusión: La actitud negativa hacia las vacunas contra COVID-19 fue del 63,98 %, lo que se vinculó a la baja confianza en las instituciones durante el brote y a la infodemia. Se sugiere realizar estudios longitudinales sobre la actitud hacia las vacunas en la pospandemia.

-----**Palabras clave:** desconfianza hacia las instituciones, infodemia, negativa a la vacunación, vacunas contra la COVID-19

Prevalência de atitude negativa em relação às vacinas contra COVID-19 e sua associação com a confiança institucional e a infodemia na população adulta do departamento de Magdalena

Resumo

Objetivo: Conhecer a prevalência de atitudes negativas em relação às vacinas contra a COVID-19 e explorar sua associação com a confiança institucional e a exposição à infodemia entre a população adulta do departamento de Magdalena, Colômbia.

Metodologia: Foi realizado um estudo observacional transversal com uma amostra de 1.600 participantes, entre estudantes, professores e pessoal administrativo de duas instituições de ensino superior do departamento de Magdalena. Foi aplicado uma amostragem probabilística com base nos papéis dos participantes. Entre maio e agosto de 2022, os participantes preencheram a escala de atitude em relação às vacinas, a escala de confiança institucional durante o surto e um questionário sobre infodemia.

Resultados: Um total de 1.441 participantes com idades entre 18 e 74 anos (M = 22,28; DP = 6,65). 55,93% eram do sexo feminino e 66,97% tinham ensino superior, e 68,49% referiram baixa renda. A prevalência de resistência à vacina contra a covid-19 foi de 63,98%. Resistência à vacina foi associado à baixa confiança nas instituições durante os surtos (RCa = 1,80; IC 95 % 1,45-2,25), e uma infodemia evidenciada na desinformação de que se vacinar para COVID-19 pode ter efeitos colaterais (RCa = 1,50; IC 95 % 1,12-2,09) e implantar um microchip (RCa = 1,52; IC 95 % 1,20-1,94). As variáveis “idade de 18 a 25 anos”, “renda salarial” e “limitação dos direitos civis da vacina” não estavam ligadas à atitude negativa em relação à vacina.

Conclusão: A atitude negativa em relação às vacinas contra a covid-19 foi de 63,98%, ligada à baixa confiança nas instituições durante o surto e à infodemia. Pesquisas futuras requerem estudos longitudinais de atitudes durante a era pós-pandemia.

-----**Palavras-chave:** Atitude em relação à vacina, desconfiança nas instituições, infodemia, vacinação

Introduction

The COVID-19 pandemic highlighted the importance of vaccination plans in protecting public health [1]. The rapid spread of the virus, coupled with high morbidity and mortality rates in the general population, contributed to the development of effective vaccines, which was critical to achieving herd immunity and reducing the burden of disease [2,3]. However, the successful implementation of vaccination programs was hampered by resistance and negative attitudes towards vaccines [4]. In 2020, globally, 70.6% of the population received at least one dose of the COVID-19 vaccine, and 64.9% completed the vaccine [5]. However, adherence to the vaccination schedule varies considerably between countries, with only 33.0% of people in low-income countries receiving at least one dose [5].

A negative attitude or resistance towards vaccines is a delay in directly accepting or refusing vaccines despite service availability [6]. This refusal to follow vaccination programs increased the spread and exposure of people to various outbreaks and, consequently, generated health threats by delaying herd immunity [4]. Favorable attitudes toward vaccines play a determining role in predicting protective behaviors and preventing the increase in outbreaks of infectious diseases under control [7].

Vaccine resistance is a growing problem in global health [7]. At this level, during the COVID-19 pandemic, in the general population, negative attitudes toward COVID-19 vaccines ranged from 7 to 54 percent [8-10, 12]. In the UK, in 32,361 people, 16% of participants reported negative attitudes towards COVID-19 vaccines, quantified using the Vaccination Attitudes Examination Scale [13]. In Ethiopia, among 415 participants, 54.5% expressed a low disposition towards it, explored through a structured questionnaire [14]. In the same country, out of 1160 people, 53.5% were unsure or unwilling to be vaccinated, assessed through an online survey [15]. In the United Kingdom, of 5114 participants, 11.7% showed hesitancy towards this vaccine, assessed with the Oxford COVID-19 Vaccine Hesitancy Scale [11]. In 19 countries around the world, out of 13,426 participants, through a survey on the likelihood of vaccine acceptance, 38.8% reported having a negative attitude towards COVID-19 vaccines [9]. Likewise, in Germany, Denmark, France, Italy, the Netherlands, Portugal, and the United Kingdom, in 7664 participants, it was found that 18.9% of respondents were unsure about getting vaccinated and 7.2% did not want to be vaccinated, quantified with an online survey [10]. In Colombia, of 1136 university students, it was found that 79% had a negative attitude towards COVID-19 vaccines, measured with the scale of resistance or attitudes towards COVID-19 vaccines [8]. In another study on 11,721 older Colombians who

responded to a telephone survey, 39% reported rejection or hesitancy towards vaccines [16].

The negative attitude towards COVID-19 vaccines is a multifactorial phenomenon. The available research points to differences based on contextual, social, and individual determinants [4,14,17-19]. The link of contextual factors such as age, income level, and gender to negative attitudes toward vaccines is inconsistent. For example, among 492 participants in Ethiopia, the population over 45 had a more favorable attitude towards vaccines than those under 18 and 25 (aPR = 2.36; 95% CI = 1.09-5.39) [17]. In 5114 adults in the United Kingdom, the negative attitude was associated with younger age, 18 to 24 years ($\beta = -0.031$; $p = 0.01$) [12]. In Ethiopia, with 450 participants, men were more likely to resist COVID-19 vaccines than women (aPR = 2.15; 95% CI = 1.29 - 3.56) [14]. Regarding educational attainment, in Ethiopia, 492 participants with secondary and higher education (aPR = 2.59; 95% CI 1.52 - 4.39) reported greater acceptance of vaccination [17]. In another study, 450 participants with a university degree or higher education had a higher favorable attitude towards vaccines (aPR = 3.09; 95% CI 1.50 - 6.37) [14]. Lower-income people showed more favorable attitudes towards them (aPR = 1.38; 95% CI 1.09 - 1.74) [9]. In the UK, in 2025 participants, those with lower income levels were more likely to resist vaccines (aPR = 2.48; 95% CI 1.11 - 5.54) [11].

Social determinants such as distrust of institutions during epidemics and the infodemic affected attitudes towards COVID-19 vaccines [8]. Institutional distrust during outbreaks is defined as an individual or group's lack of trust in systems, whether governmental, public health, or medical [18]. Institutional distrust stems from several factors, including perceived corruption, poor perceived legitimacy of institutions, poor healthcare practices, legal permissiveness, and political extremism [18]. This distrust can fuel the perception that vaccines are promoted for political or economic reasons rather than genuine public health reasons [10]. In 13,426 participants from 19 European countries, those who distrusted the Government showed less favorable attitudes towards vaccines than those who expressed greater confidence (aPR = 1.67; 95% CI 1.54-1.80) [7]. In Israel, in 484 participants, institutional distrust was linked to a negative attitude toward vaccination ($\beta = 0.11$; $p = 0.03$) [19].

The infodemic is another factor that helped mitigate confidence in vaccines. The infodemic is understood as the overabundance of information and disinformation provided by the media and social media platforms, through which conspiracy theories are spread, beliefs that vaccines against COVID-19 limit civil rights and generate side effects [4]. The infodemic can produce confusion and fear among the population, leading to increased distrust and skepticism towards vaccination

[20]. In Poland, in 1971, medical students experienced side effects from COVID-19 vaccines, which were associated with a lower probability of getting vaccinated (OR = 0.62; 95% CI 0.56-0.68) [20]. In Spain, in 2120 participants, it was found that conspiracy beliefs about SARS-CoV-2 were associated with hesitancy against this vaccine ($\beta = -0.11$; $p = 0.01$) [21].

In the context of the immunization program against COVID-19, in Colombia, the Government implemented the National Vaccination Strategy as of February 17, 2021. Although the start was gradual, by February 2022, the program managed to vaccinate 65% of the population, including Venezuelan immigrants [22,23]. This progress of the vaccination plan was significant, considering the fragility of the Colombian health system and the socio-political context that deepens social inequality [23]. The vaccination plan began when the country was undergoing fiscal reform and a social crisis that affected the immunization coverage of the population, especially in dispersed regions [22]. This situation highlighted the additional challenges regions, particularly the Caribbean region, face in effectively implementing the vaccination plan [23]. This panorama was accentuated by distrust of institutions and by the infodemic. Understanding and addressing these variables is critical for the Government and the media to promote vaccine-friendly attitudes. Ensuring trust in health and scientific institutions could help mitigate the impact of future health crises on global public health [4]. In the Caribbean region of Colombia, some studies were designed to address social and cultural determinants that could influence attitudes towards vaccination against COVID-19, such as institutional distrust and the infodemic [8,16].

The present study estimated the prevalence of negative attitudes towards COVID-19 vaccines. It explored their association with institutional trust and exposure to the infodemic among adults in the Department of Magdalena, Colombia.

Methods

A cross-sectional observational study was designed.

Population and sample

The population comprised students, professors, and administrators of two higher education institutions in Magdalena. Probability sampling and stratification were carried out according to the participants' roles. It was estimated to reach a sample of at least 1600 subjects, for a prevalence of 23% of negative attitudes towards vaccines against COVID-19, with a margin of error of 5 and a confidence level of 95%. The final sample was 1441 participants.

Inclusion criteria were over 18 years of age and resided in the Caribbean region. Living with an apparent intellectual or physical disability condition was determined as an exclusion criterion, which would limit the completion of the web form (see Figure 1).

Instruments

A booklet that compiled the following questionnaires was prepared:

- *Questionnaire on sociodemographic factors.* This questionnaire explored age, gender, education level, socioeconomic status, and urban or rural residence.
- *Scale of attitude towards vaccines against COVID-19.* This scale consists of eight items and five response options ranging from zero to four, from strongly disagree to strongly agree [24]. The scale has a scPre from 0 to 32. A cut-off point equal to or less than 24 was classified as a negative attitude towards COVID-19 vaccines [8]. This scale showed adequate reliability in the Colombian context, with Cronbach's alpha of 0.79 [23].
- *Trust in the Institutional Response to the Outbreak.*
- This instrument brings together four items, with four response options, from strongly disagree to agree, graded from zero to three strongly. The higher the rating, the higher the trust. The cut-off point is established according to the average response of the participants. The scale showed adequate internal consistency in a previous study, with Cronbach's alpha of 0.75 [25].
- *Questionnaire for infodemic.* This questionnaire measured misinformation about COVID-19 vaccines. Three questions that explored conspiracy beliefs spread by the media were included [1]: "Do vaccination programs limit civil rights?", "Will getting vaccinated against COVID-19 implant a microchip?" and "Can getting vaccinated against COVID-19 have side effects?". The questions comprised four answer options, ranging from strongly disagree to agree, with scPres ranging from zero to four strongly. The present study showed an internal consistency with Cronbach's alpha of 0.64.

Procedure

The data were collected between May and August 2022 through the application of an online questionnaire sent in a group to professors, administrative staff, and students from two higher education institutions who agreed to participate in the study, with prior authorization from the directives to enter the courses and offices. The questionnaire in Google Forms was shared with participants via a link, or a handheld device was provided to people without a cell phone.

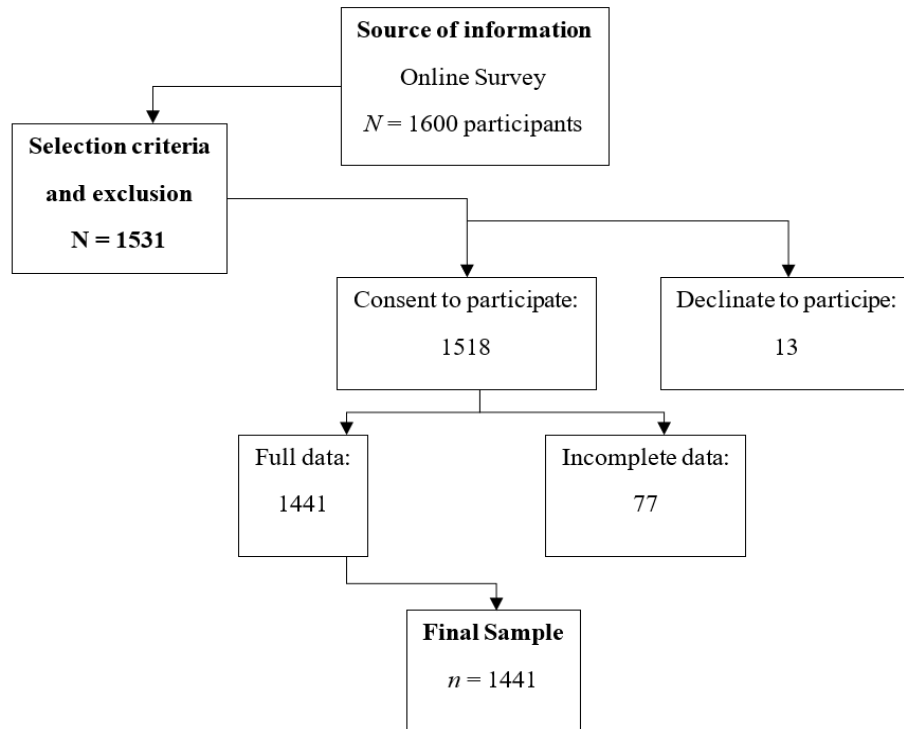


Figure 1. Participant flow diagram

Data analysis

Initially, frequencies and percentages of each of the variables were estimated. Then, in the bivariate analysis, resistance to vaccines was taken as a dependent variable, and confidence in the institutional response to outbreaks and infodemics was classified as independent or explanatory, and demographic variables as covariates. *Odds Ratios* (OR) were calculated with 95% CI. Finally, a multivariate analysis was carried out using binary logistic regression, in which variables with probability values of less than 25% observed in the bivariate analysis were included. When executing the different models, Greenland's recommendations were considered. The goodness of fit was estimated for the best model with the Hosmer-Lemeshow test. Those with a 95% CI that did not include unity (1.0) were accepted as significant associations [11]. This data analysis was carried out using the IBM-SPSS® program, version 22.0, licensed by the institution.

Ethical aspects

The project was approved by the Research Ethics Committee of the University of Magdalena, located in the Colombian Caribbean region, through Minute 010 of September 30, 2021. The research considered the frameworks of Resolution 8430 of 1993 [26] and the Declaration of Helsinki [27].

During the study, integrity, security, privacy, and willingness to participate were respected. An online informed consent form was designed, which specified the research's objectives and importance and stated that no personal information, such as phone number or email, would be recorded. After signing the informed consent with one click, participants had access to a tab to complete the research questionnaire. Permanent communication was maintained between the team of researchers and the participants to resolve doubts about the study.

Results

A total of 1441 people aged 18 to 74 years participated ($M = 22.28$; standard deviation = 6.65). 55.93% were female, 66.97% had university studies, and 68.49% reported low income. In addition, 92.23% were in the age range between 18 and 29 years, and 92.23% lived in a residential area (see Table 1). The prevalence of resistance to COVID-19 vaccines was 63.98% (see Table 2).

An association was observed between negative attitudes towards vaccines, low trust in institutions during outbreaks, and the infodemic, evidenced in the information that getting vaccinated for COVID-19 can have side effects and will implant a microchip, age between 18 and 29 years, and low wage income. Table 3 shows the crude and adjusted ORs included in the final model.

In the multivariate model for vaccine resistance, low trust in institutions during outbreaks was associated ($aPR = 1.80$; 95% CI 1.45 - 2.25), and the infodemic was

evidenced by misinformation that getting vaccinated for COVID-19 can have side effects (aPR = 1.53; 95% CI 1.12 - 2.09) and that they will implant a microchip (aPR = 1.52; 95% CI 1.20 - 1.94).

The variables “age between 18 and 29 years,” “wage income,” and “the vaccine limits civil rights” were not linked to negative attitudes toward vaccines. Adjusting the model by excluding these variables did not modify the PR by more than 10%.

Table 1. Description of socioeconomic variables

Variable		Frequency	Percentage
Age between 18 and 29 years	Yes	1329	92.23
	No	112	7.77
Gender	Female	806	55.93
	Male	635	44.07
Schooling (high school or less)	Yes	476	33.03
	No	965	66.97
Low income	Yes	987	68.49
	No	454	31.51
Urban or municipal/rural seat	Urban	1218	84.52
	Rural	223	15.48
Marital status (singleness, separation, or widowhood)	Yes	1269	88.06
	No	172	11.94
Just study	Yes	1015	70.44
	No	426	29.56
Total		1441	100

Table 2. Description of the study variables

Variable		Frequency	Percentage
When you get vaccinated against COVID-19, you will have a microchip implanted	Yes	940	65.23
	No	501	34.77
Vaccine limits civil rights	Yes	755	52.39
	No	686	47.61
Getting vaccinated for COVID-19 can have side effects	Yes	1248	86.61
	No	193	13.39
Low trust in institutions during outbreaks	Yes	793	55.03
	No	648	44.97
Negative attitude towards COVID-19 vaccines	Yes	922	63.98
	No	519	36.02
Total		1441	100

Table 3. Crude and Adjusted Bivariate Model for COVID-19 Vaccine Resistance

Variable	cPR	CI95 %	aPR	CI 95 %
Age 18-29 year	1.48	1.00-2.18		
Male	1.09	0.87-1.35		
Schooling (high school or less)	0.97	0.77-1.21		
Low income	1.46	1.16-1.83		
Marital status (singleness, separation, or widowhood)	1.00	0.72-1.40		
Just study	1.12	0.88-1.41		
Vaccine limits civil rights	1.29	1.15-1.20		
Low trust in institutions during outbreaks	1.85	1.49-2.30	1.80	1.45-2.25
Getting vaccinated for COVID-19 can have side effects	1.55	1.14-2.11	1.53	1.12-2.09
When you get vaccinated against COVID-19, you will have a microchip implanted	1.55	1.14-2.11	1.52	1.20-1.94

Hosmer-Lemeshow goodness-of-fit test $\chi^2 = 2.87$; $df = 5$; $p = 0.72$.

Nagelkerke $R^2 = 0.49$. gl: degree of freedom; 95% CI: Confidence interval; cPR: crude Probability Ratio; aOR: Adjusted Probability Ratio; p -value > 0.05

Discussion

In the present study, the prevalence of negative attitudes towards COVID-19 vaccines was 63.98% and was associated with low trust in institutions during outbreaks and the infodemic, evidenced by misinformation and concern about the side effects of the vaccines and the implantation of a microchip when vaccinated.

The prevalence observed in the reported research is greater than 53% of being unsafe or unwilling to be vaccinated against COVID-19 in two studies from Ethiopia, with 1160 adults [15] and 415 participants [14]. It is also higher than the 38.8% resistance to COVID-19 vaccines in 13,426 participants from 19 countries [9] and the 18.9% insecurity of vaccination in 7664 subjects from different European countries [10].

In the Colombian context, unfavorable attitudes towards COVID-19 vaccines observed in this study were higher than the 39.6% documented in 11,721 people over 80 years in 2021 [16]. However, it is similar to 79% of 1136 university students during 2021 [8].

The variability of the results can be explained by differences in research methods, measurement questionnaires used, and access to vaccines from different countries [19]. Another perspective of analysis is the multicausal nature of the negative attitude towards vaccines against COVID-19. The complexity of the different studies' social, political, ideological, and cultural contexts may account for the divergences of the findings in the different studies [19,26]. In addition, the prevalence of unfavorable attitudes may change over time due to the ability of education and persuasion strategies used by

governments to mitigate unfavorable attitudes towards vaccination [19].

Theoretically, attitudes toward vaccines are mediated by susceptibility and perceived severity. Therefore, increased susceptibility to contracting the virus and a greater perception of the severity of disease complications may affect individuals' attitudes toward vaccines [9].

In the research presented, distrust of institutions during outbreaks was significantly related to a negative attitude towards COVID-19 vaccines. This finding is consistent with what was reported in two studies of 13,426 participants from 19 European countries [9] and 484 participants from Israel [19], which observed that trust in the Government is strongly associated with vaccine acceptance and can contribute to compliance with the actions recommended by the authorities [9,19].

Attitudes toward vaccines and trust towards institutions are intrinsic and potentially modifiable components for adopting vaccination programs and ensuring the prevention of outbreaks of COVID-19 and other controlled infectious and emerging public health diseases [9]. From this perspective, trust in government organizations, medical associations, and health professionals increases knowledge and awareness of the benefits of vaccines; therefore, it makes it easier for the population to have a favorable attitude toward vaccines [19,26,27]. Trust in science and scientists drives a favorable attitude toward adopting preventive measures [27,28].

In the present research, the infodemic, evidenced by misinformation and concern about the side effects of vaccines and the fact that they will implement a microchip when getting vaccinated, was related to

resistance to vaccines against COVID-19. However, information about the Government's mandatory vaccination limits civil rights is independent of the negative attitude towards COVID-19 vaccines. These findings are consistent with previous research highlighting the role of misinformation and concerns about side effects from COVID-19 vaccines and hesitant conspiracy beliefs against COVID-19 vaccines in 1971 medical students in Poland [20] and 2120 participants in Spain [21]. Misinformation related to concerns about the safety, efficacy, and side effects of vaccines has had an impact on the negative attitude of the population [6].

The media have disseminated the infodemic for a long time [4]. However, during the COVID-19 pandemic, it spread widely and uncontrollably through traditional media, especially social media, which could negatively affect attitudes towards COVID-19 vaccines [19].

The viral nature of online information facilitated the spread of conspiracy theories and fake news related to COVID-19 vaccines [4]. These messages can increase existing fears, sow doubts about the efficacy and safety of vaccines, and erode trust in public health authorities and science in general [1,29]. In addition, the rapid evolution of the pandemic generated uncertainty and anxiety, which may have made people more susceptible to misinformation about COVID-19 vaccines [23].

Vaccination plans were affected due to the rapid mutation of the SARS-CoV-2 virus. From the emergence of the virus to November 2023, 21 mutations were identified in circulation globally [30]. New variants could exceed the protection offered by current vaccines [31]. This situation raises the possibility that the development of adaptations or new vaccines targeting emerging variants may be required [4]. As a result, booster doses may need to be administered or new vaccines implemented [1]. In this context, vaccination plans are affected by institutional distrust, and biased information provided by the media poses significant challenges to achieving high immunization coverage rates for most immunopreventable diseases and, ultimately, to effectively control the transmission of any viral infection [28]. It is crucial to address these barriers to promote a favorable attitude towards vaccination and strengthen trust in public health institutions during future pandemics [10,11-29].

On the other hand, the present study offers some suggestions and preventive actions for the health system from a public health perspective, in order to increase the favorable attitude towards vaccines against covid-19: 1) health communication strategies need to focus on the key predictive factors promoted by vaccination and trust based on scientific evidence [21]; 2) governments need to strengthen governance for the management of vaccination plans based on equity and the reduction of barriers to access to the health system [19]; 3) permanently

promote e-literacy strategies in digital health, through actions towards vaccines, cultivate relationships of trust between the population and government entities and effectively communicate the risks and benefits of vaccines [32]; and 4) using social media to monitor public opinions in real time, which can help adjust communication strategies dynamically and effectively, in order to counter the spread of false, misleading, or unreliable information about vaccines against communicable diseases or emerging outbreaks in the post-pandemic [33].

The results of this research contribute to the understanding of social and cultural factors in attitude

towards vaccines, from a conceptual framework of the role of the population's trust in government agencies and health unions and the power of the information disseminated by the media during the pandemic. The quality and accuracy of information can contribute to mitigating the negative effect of the infodemic circulating on technological platforms and social networks on users' willingness to be vaccinated and to promote evidence-based health practices [33]. In addition, the study uses a representative probabilistic sample, which ensures that the data collected reflects the characteristics of the population studied. This finding allows epidemiological models to be applied to understand the interaction between the study variables.

The present study has some limitations that must be overcome in future research: the barriers to access to the vaccination plan, previous experience with vaccines, and the cultural aspects of this region of Colombia were not considered. In addition, it is important to include vulnerable and minority population groups, such as Indigenous people, Afro-descendants, LGTBI, and people in chronic conditions due to medical and mental health diseases. Finally, cross sectional studies do not allow us to establish the direction of causal association of variables.

The prevalence of negative attitudes towards COVID-19 vaccines was 63.98% and was associated with low trust in institutions during outbreaks and the infodemic, evidenced by misinformation and concerns about the side effects of the vaccines and the implantation of a microchip when vaccinated. Future research could conduct longitudinal studies on vaccine attitudes during the post-pandemic era.

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Conflict of Interest Statement

The authors have not no conflict of interest.

Disclaimer

The authors take responsibility for all aspects of the work and guarantee the accuracy and integrity of the manuscript.

Authors' Contribution Statement

The authors contributed significantly to the development of this study. Carmen Cecilia Caballero Domínguez designed the research, supervised data collection, performed statistical analysis, and contributed to the interpretation and final approval of the manuscript. Edwin Herazo oversaw the literature review and contributed to critically analyzing the findings and the manuscript's writing. In addition, authors approved the final version of the manuscript.

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