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AderVax: Factors related to the acceptance or rejection of the COVID-19 vaccine in 8 cities in Colombia for the development of an intervention

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ABSTRACT

Since the pandemic began, the COVID-19 vaccination has faced various challenges, including population hesitancy; these can be explained due to multiple factors that require further exploration. This study analyzes factors associated with either the acceptance or rejection of the COVID-19 vaccine as well as the intention to initiate or to complete vaccination schedules in individuals over the age of 18; individuals from eight cities in Colombia. The study encompasses both urban and rural areas, seeking to develop an intervention strategy. A total of 3384 individuals participated in a mixed-methods study which applied the DESVAAC scale and involved focus groups. Results show that only 11.3% of participants were highly motivated, intending to start or to continue vaccination. The health factor was significantly associated with greater intention ($p < 0.01$) as compared to social or vaccine-related factors. Greater likelihood of vaccination was also associated with higher education ($p < 0.01$), greater age ($p < 0.02$), living with people with chronic conditions ($p < 0.05$), or cohabiting with individuals over 50 years of age ($p < 0.028$). Family support (82.9%) and observing others vaccinate (74.1%) were key motivators. Paucity of knowledge regarding vaccines was identified as an important factor, while decisions were also influenced by social, family, and health factors. Also, within the context of a pandemic, there were certain mandatory requirements. The study highlights that community leaders, media and cultural aspects significantly influenced the decision to get vaccinated. It is considered essential to strengthen coordinated efforts between government entities, social leaders, and the community; promoting increased training and education in order to support informed decision-making regarding vaccination within the context of social responsibility. Finally, the psychoeducational intervention strategy VACtívate was designed and implemented; targeting healthcare personnel, social leaders, and health authorities in order to better promote informed vaccination.

1. Overview

From the beginning of the COVID-19 pandemic, vaccination faced various challenges, including population hesitancy. This hesitancy can be explained due to multiple factors which require further exploration. In order to develop an intervention strategy, this study aims to analyze those factors associated with either the acceptance or rejection of the COVID-19 vaccine as well as the intention to either initiate or to complete vaccination schedules. Individuals over 18 years of age come from eight cities in Colombia (Yopal, Pasto, Bogotá, San Andrés, Mocoa, Mitú, Quibdó, and Riohacha). These municipalities encompass both urban and rural areas. A total of 3384 individuals participated in a mixed-methods study, utilizing the DESVAAC scale and focus groups. Results show that only 11.3% of participants definitely intended to either start or continue vaccination. The health factor was significantly associated with a greater intention ($p < 0.01$) as compared to social or vaccine-related factors. A greater likelihood of vaccination was also associated with higher education ($p < 0.01$), older age ($p < 0.02$), living with people with chronic conditions ($p < 0.05$), or cohabiting with individuals over 50 years of age ($p < 0.028$). Family support (82.9%) and observation of others being vaccinated (74.1%) were key motivators. Limited knowledge regarding vaccines was identified: decisions were influenced by social, family, and health factors, and, within the pandemic context, by mandatory requirements. The study highlights the significant influence of community

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leaders and media, as well as cultural aspects, on the decision to get vaccinated. It is considered essential to strengthen coordinated efforts between government entities, social leaders, and the community, promoting increased training and education to support informed decision-making regarding vaccination within the context of social responsibility. Finally, the psychoeducational intervention strategy VACtívate was designed and implemented, targeting healthcare personnel, social leaders, and health authorities in order to promote informed vaccination.

2. Introduction

The COVID-19 pandemic had a profound impact on humanity, not only because of its morbidity and mortality but also due to its disruption of social, economic, and cultural life worldwide. Vaccination rapidly emerged as a key public health measure in order to mitigate the burden of disease and facilitate the gradual return to daily activities. Globally, vaccination coverage has advanced substantially; by June 2024, the World Health Organization (WHO) [1] reported that 64% of the world's population had completed the primary COVID-19 vaccination series. However, significant disparities persisted in low-income countries, only 21% of the population had been fully vaccinated, highlighting inequities in global vaccine access [2–4].

Importantly, the global experience has demonstrated that vaccine uptake extends beyond the mere availability of the biological product. A broad range of contextual, social, and individual determinants influence the decision to vaccinate [5–9].

The WHO has urged countries to consolidate the lessons learned from the pandemic, particularly after reclassifying COVID-19 as a persistent and established health condition. This recognition underscores the need to sustain preventive behaviors in order to limit viral transmission and reduce disease severity [1]. The urgency of these recommendations lies in the ongoing risks posed by emerging SARS-CoV-2 variants, whose capacity to mutate may alter transmissibility and undermine the effectiveness of preventive measures, including vaccines [10]. Consequently, continuous surveillance and promotion of vaccination are essential to maintain high levels of population immunity [11–14].

A substantial body of literature has examined the factors that shape the decision to vaccinate. Internal or individual-level determinants include beliefs, risk perception, attitudes, trust in vaccines and science, perceived barriers, and diverse psychological states [15–17]. In addition to the rational evaluation of vaccine benefits, motivational and emotional factors—such as fear of infecting family members or contracting the disease—play an important role [18].

External determinants and social factors are also critical. Greater age, educational attainment and income level alongside gender and ethnic origin have consistently been associated with a greater intention to vaccinate [19,20]. Moreover, easier vaccine access, urban residence, and information received from trusted health personnel are strong enablers of vaccine acceptance [21–24].

Conversely, multiple studies, predominantly cross-sectional quantitative investigations, have demonstrated that conspiracy beliefs, perceived risks of vaccination, misinformation, and the negative influence of social media correlate with reduced vaccine uptake [25,26].

Given these challenges, various strategies have been proposed in order to foster vaccination. Evidence highlights the value of accurate and accessible information, community engagement, and tailored interventions that address specific population needs [27]. In this regard, designing interventions rooted in both scientific evidence and local community insights is essential [28,29].

The post-pandemic context presents unique challenges and opportunities. The novelty of the disease and vaccines, combined with the circulation of misinformation and the variable implementation of government measures, has shaped a distinctive environment for decision-making. This situation has stimulated the development of new taxonomies to better understand the determinants of vaccine hesitancy [30].

Within this framework, the present study analyzed perceptions held toward COVID-19 vaccination and the factors associated with vaccination intention across both urban and rural populations in eight Colombian cities. The research was designed not only to generate empirical evidence but also to inform practical responses. Its ultimate goal was to design and implement a psychoeducational intervention strategy, informed by local diagnostics, and directed at influential community stakeholders. In parallel, a communication strategy was developed to reach the broader community, promoting informed decision-making, strengthening trust in vaccination, and fostering sustainable health behaviors.

3. Methodology

3.1. Study design

This study employed a mixed-methods approach [31] with a concurrent triangulation design [32], allowing for the simultaneous and independent collection and analysis of qualitative and quantitative data. The quantitative component utilized a non-experimental, descriptive, and correlational design, while the qualitative component followed a phenomenological design.

3.2. Sampling

For this mixed-methods study, a concurrent sampling strategy was employed. For the quantitative component, stratified random sampling by city was conducted, categorizing cities into subgroups with higher and lower COVID-19 vaccination coverage, while also considering rural and urban areas. Vaccination coverage data were obtained from the National Vaccination Plan of the Colombian Ministry of Health, with a reference date of September 20, 2022.

Sample size was calculated using a 5% margin of error, a 95% confidence level, and an assumed 10% non-response rate. The proportion of individuals fully vaccinated against COVID-19 in each city, as of October 5, 2022, was used as the basis for estimation, resulting in a total quantitative sample of 2913 participants.

For the qualitative component, purposive sampling was applied. Each focus group included a minimum of eight participants, yielding an estimated 48 individuals per city and a total of 284 participants. Inclusion criteria required participants to be Colombian nationals, aged 18 years or older, vaccinated or unvaccinated against COVID-19, and residing in either rural or urban areas of the selected cities. Individuals with neurocognitive deficits or with medical or psychiatric conditions that could hinder participation were excluded.

3.3. Measurement

In the quantitative component, factors associated with COVID-19 vaccine acceptance and intention were assessed using the DESVAAC scale (Descriptive Scale of COVID-19 Vaccine Acceptance) (annex 1). Based on the Theory of Planned Behavior, the scale was created through a multi-phase process, beginning with the generation of 301 items. After expert review by specialists in infectious diseases, public health, and psychology, and subsequent pilot testing, the scale was refined to 36 items and finally reduced to 19. These items cover domains such as vaccine safety and efficacy perception, trust in health authorities, quality of information received, social influence, and willingness to complete vaccination schedules. The DESVAAC was validated in a Colombian sample of 501 adults from eight cities, recruited through snowball sampling and direct outreach.

Psychometric validation of the DESVAAC involved exploratory and confirmatory factor analyses (EFA and CFA), using both polychoric correlations and robust estimation methods to ensure model fit. Reliability was confirmed through multiple indices, including McDonald's omega ($\omega = 0.96$), Cronbach's alpha ($\alpha = 0.90$), and ordinal alpha,

demonstrating excellent internal consistency. Criterion validity was assessed using ROC curve analysis to determine optimal cut-off points. Additionally, sociodemographic comparisons of DESVAAC scores were conducted using non-parametric statistical tests.

3.4. Participants

The eight cities with the highest coverage (Yopal, Pasto, Bogotá, and San Andrés) and the eight with the lowest COVID-19 vaccination coverage (Mocoa, Mitú, Quibdó, and Riohacha) in Colombia in 2022 were selected [33]. A total of 3384 people participated, with 2968 completing the DESVAAC Scale and 416 participating in focus groups. The inclusion criteria required participants to be over 18 years of age, to hold Colombian nationality, to reside in one of the eight selected cities, to be either vaccinated or unvaccinated against COVID-19, and to voluntarily agree to participate in the study by providing a signed informed consent. Information was collected equitably from urban and rural areas. As part of the psychoeducational intervention strategy, the VACtívate course was carefully designed and implemented, engaging a total of 286 participants across the eight selected cities.

3.5. Data analysis

The quantitative analysis employed descriptive and correlational methods. One-way ANOVA was used to compare means across more than two groups, while Bonferroni post hoc tests were applied when significant differences were detected. For comparisons between two independent groups (e.g., gender, city coverage, or cohabitation with at-risk populations), independent-samples *t*-tests were conducted following the verification of normality and homogeneity of variance assumptions. Pearson's correlations were applied to normally distributed variables, while Spearman's rho was used for non-normally distributed variables to examine associations between the number of vaccine doses received, vaccination intent, and related factors. Categorical associations (e.g., vaccination intent by age groups or sociodemographic variables) were assessed using Pearson's Chi-square test. Statistical significance was set at $p < 0.05$. All quantitative analyses were performed using SPSS® software (version 28).

Qualitative data were analyzed with ATLAS.ti using axial coding and the Consensual Qualitative Research (CQR) methodology. To enhance interpretive rigor, findings from both approaches were compared through concurrent triangulation, enabling the identification of convergences, divergences, and the emergence of novel variables or datasets. Meta-inferences were derived using an information juxtaposition

Table 1
Sociodemographic Variables: Total, DESVAAC, and Focus Group.

Variable	Total Population ($N = 3384$)	% Total Population	DESVAAC ($N = 2968$)	% DESVAAC	Focal Group ($N = 416$)	% Focal Group
Life Cycle						
Early Adulthood	1979	58.48	1764	59.43	215	51.68
Middle Adulthood	1098	32.45	953	32.11	145	34.86
Late Adulthood	307	9.07	251	8.46	56	13.46
Health System						
Contributory	1431	42.29	1278	43.06	153	36.78
Subsidized	1852	54.74	1600	53.91	252	60.58
Special Regime	82	2.42	75	2.53	7	1.68
No Response / Don't Know	14	0.41	10	0.34	4	0.96
Education Level						
None	104	3.07	80	2.7	24	5.77
Primary Education	507	14.99	423	14.25	84	20.19
Junior High School	319	9.43	268	9.03	51	12.26
High School	1076	31.8	958	32.29	118	28.37
Technical/Technological	646	19.09	577	19.44	69	16.59
University	583	17.23	537	18.09	46	11.06
Postgraduate	149	4.4	125	4.21	24	5.77
Income Level						
Low	3021	89.29	2661	89.65	360	86.54
Medium	350	10.34	296	9.97	54	12.98
High	13	0.39	11	0.37	2	0.48
Marital Status						
Married	638	18.86	546	18.39	92	22.12
Separated	82	2.42	67	2.26	15	3.61
Single	1524	45.04	134	46.28	150	36.06
Cohabiting / Common-law Union	1056	31.2	915	30.82	141	33.89
Widowed	84	2.48	66	2.22	18	4.33
Occupation						
Unemployed	478	14.13	403	13.58	75	18.03
Employed	1103	32.6	101	34.4	82	19.71
Student	558	16.49	502	16.91	56	13.46
Self-employed	893	26.39	779	26.24	114	27.4
Retired	79	2.33	65	2.19	14	3.37
Other	63	1.86	39	1.31	24	5.77
Unpaid domestic worker	209	6.18	159	5.36	50	12.02
Lives with						
Risk Groups	1613	47.68	1444	48.63	169	40.63
People >50 years old	1376	40.67	1243	41.89	133	31.97
Pregnant individuals	79	2.33	72	2.43	7	1.68
Chronic diseases	661	19.53	574	19.34	87	20.91
Immunocompromised individuals	586	17.32	574	19.34	12	2.88
Area of Residence						
Rural	1709	50.51	1495	50.37	214	51.44
Urbana	1675	49.49	1473	49.63	202	48.56

Source: Own elaboration.

approach [34], integrating complementary evidence from qualitative and quantitative results. This strategy strengthened the robustness of the conclusions and provided a multidimensional understanding of the determinants of COVID-19 vaccination acceptance and intent.

4. Results

4.1. Sociodemographic characterization

The study included a total of 3384 participants from eight cities in Colombia: Yopal, Mocoa, Bogotá, Pasto, Riohacha, San Andrés, Quibdó, and Mitú. Of these, 61.5% were women and 38.5% were men, with an average age of 38.9 years (SD = 16.2, range: 18–97 years). Participants reported living with an average of three household members.

Within the total sample, 2968 individuals completed the DESVAAC Scale, of whom 60.1% were women with a mean age of 38.5 years. Additionally, 416 participants took part in focus groups, 71.9% of whom were women with a mean age of 41.79 years. Both subsets of participants fulfilled the criterion of residing in either rural or urban areas.

Detailed sociodemographic variables are presented in Table 1, while Table 2 outlines the vaccination status of the sample.

4.2. The decision to vaccinate: Facilitating and hindering factors

The decision to vaccinate against COVID-19 was influenced by a range of factors, including personal, family, social, labor-economic, educational, political, health-related, and healthcare system elements. Vaccine-specific and pharmaceutical industry-related considerations were also significant. Furthermore, the pivotal role of information sources emerged as a critical category.

On the DESVAAC scale and in order to measure vaccination intention, the exploratory factor analysis yielded the categories "social," "health," and "vaccine-related". Table 3 shows that the social factor includes reasons such as peer pressure or trust in institutions; it shows that the health factor includes reasons such as pre-existing conditions or perceived risk; and it shows that the vaccine factor encompasses reasons directly related to the vaccine, such as safety, efficacy, or mistrust of vaccines. The *p*-values presented in Table 3 reflect the existence of statistically significant associations as evidenced between sociodemographic variables and the three factors evaluated by the DESVAAC scale (social factor, health factor, and vaccine-related factor).

4.3. Personal factors

Analysis revealed that only 11.3% of the population exhibited a strong intention to vaccinate (whether for the initial dose or to complete the vaccination schedule). A majority of cities displayed medium levels of vaccination intent (71.8%); thereby indicating a potential risk due to the lack of firm stances on vaccination decisions. Older adults showed a significantly higher willingness to vaccinate compared to younger adults ($p = 0.002$). Moreover, there were clear disparities in the average number of vaccine doses received: older adults received an average of 2.4 doses, compared to 2.1 for younger adults and 2.0 for middle-aged individuals ($p < 0.001$).

Formal education also played a crucial role, individuals holding higher education degrees demonstrated a greater vaccination intent ($p = 0.001$). While no significant differences were observed in vaccination intent between genders, women received, on average, more doses than men (2.11 vs. 2.03, $p = 0.025$).

The pandemic period brought about widespread emotional and psychological challenges, including excessive fear of infection, social isolation, and family separation due to living arrangements or preventive measures. Depression was reported both at individual and collective levels. Despite these challenges, there has been increased awareness of preventive behaviors such as mask-wearing, handwashing, and self-care.

> *"Today, the aftereffects remain, but people don't always connect depression to having gone through such a difficult time. Levels of violence and sexual abuse increased during that period, but because these are not directly associated with the COVID-19 diagnosis, they were not addressed accordingly. Mental health issues were mishandled from the beginning and continue to be mishandled today."* – Focus Group, San Andrés, Urban.

4.4. Family and social factors

Family and social considerations emerged as powerful motivators. According to the DESVAAC scale, 82.9% of respondents cited family protection as a reason for vaccination, particularly in households with at-risk individuals. Living with someone over 50 years old significantly increased vaccination intent (75.8% vs. 73.3%, $p = 0.028$), as did living with someone with a chronic illness ($p = 0.019$).

Participants shared:

> *"And another reason was family responsibility. For example, young people who didn't like it or didn't believe in it would do it when you mentioned their grandparents, and they usually complied."* – Focus Group, Pasto, Urban.

> *"There were people who eventually agreed to vaccinate because they saw it as a way to protect themselves and their families."* – Focus Group, Riohacha, Rural.

Social factors also played a critical role in shaping vaccination behavior. The DESVAAC scale showed significant differences (t (2965) = −6.724, $p = 0.001$) among cities with lower vaccination coverage (Riohacha, Quibdó, Mocoa, and Mitú), which scored higher (M = 24.3), and cities with higher vaccination coverage (Bogotá, San Andrés, Yopal, and Pasto), which scored lower (M = 23.0). Encouragingly, 74.2% of

Table 2
Vaccination conditions and variables: Totals, DESVAAC, and Focus Group.

Variable	Total Population (N = 3384)	% of Total Population	DESVAAC (N = 2968)	% DESVAAC	Focal Group (N = 416)	% Focal Group
Number of doses						
0 dose	264	7.8	218	7.35	46	11.06
1 dose	633	18.71	551	18.56	82	19.71
2 doses	1229	36.32	1094	36.86	135	32.45
3 doses	1057	31.24	934	31.47	123	29.57
> 3 doses	201	5.94	171	5.76	30	7.21
Vaccine conditions						
Got vaccinated	3120	92.2	2750	92.65	370	88.94
Didn't get vaccinated	264	7.8	218	7.35	46	11.06
Vaccination schedule						
Homologous	725	21.43	453	15.26	272	65.38
Heterologous	1989	58.76	1911	64.39	78	18.75
Doesn't remember	452	13.36	386	13.01	66	15.87

Table 3
Sociodemographic variables (DESVAAC) and associated factors.*

	Variable	Quantitative component (Total number of participants n = 2968)%	Social Factor (*p* value)	Health Factor (p value)	Factor associated with the vaccine (p value)
Life Cycle	Early Adulthood	59.43	**0.001**	**0.001**	0.124
	Intermediate Adulthood	32.11			
	Late Adulthood	8.46			
Health Regimen	Contributory	43.06	0.676	0.060	**0.033**
	Subsidized	53.91			
	Special scheme	2.53			
	No response / no answer	0.34			
Educational level	None	0.7	**0.014**	0.150	**0.001**
	Primary Education	14.25			
	Secondary Education	9.03			
	High School Diploma	32.29			
	Technical/Technological Education	19.44			
	University Education	18.09			
	Postgraduate Education	4.21			
They live with	Groups at risk	48.63			
	People over 50	41.89	**0.012**	0.088	0.561
	Pregnant people	2.43	0.271	0.761	0.691
	Chronic illnesses	19.34	**0.049**	0.097	0.463
	Immunocompromised people	19.34	0.420	0.942	0.191

* Pearson's chi-square statistic.

participants viewed vaccination as important in order to motivate others to follow suit, while 74.1% were influenced by observing others get vaccinated. Additionally, 76.6% highlighted the solidarity of vaccination as a means to reduce mortality rates. However, focus groups revealed that social beliefs often undermined trust in vaccines. Distrust was perpetuated within communities by religious leaders, social influencers, and other prominent community agents. This highlights the need for targeted communication and education strategies to address these challenges.

> *"You didn't know who to believe—half the town said it was good, and the other half said it was bad. So, you were just lost, feeling completely undecided. I kept thinking, 'My God, what should I do?' In the end, I avoided it altogether."* – Focus Group, Yopal, Rural.

> *"Despite being in constant contact with people, I never got vaccinated. I was told that if you protected yourself properly, the vaccine wasn't necessary. So, I didn't get vaccinated, and to this day, I haven't considered it. Over time, I learned what the elders always said: 'The cure is right here.' The thing is you need to know the remedies well. I would always encourage people to take a lot of mataratón (a local medicinal plant)."* – Focus Group, Mocoa, Rural.

Regarding the health-related factors assessed using the DESVAAC scale, statistically significant differences were observed based on city coverage (t (2965) = −6.271, $p = 0.001$), making this the only factor with a significant distinction (see Table 4).

Table 4
Percentages of health factor items.

item	Percentage of agreement and strong agreement
I agree to be vaccinated against COVID-19 in order to protect my own health.	83.4%
I will be vaccinated because I am afraid of getting infected with COVID-19.	73.9%
It is important to get vaccinated against COVID-19 in order to avoid being hospitalized.	75.2%
I think COVID-19 symptoms can be more severe if vaccination is not done.	76.2%
I believe it is important to be vaccinated because COVID-19 is real.	80.4%
I will be vaccinated against COVID-19 in order to avoid health complications.	81.3%

Among the facilitating factors, 83.4% of participants expressed a desire to protect their health, while 81.3% aimed to avoid complications. Within the healthcare system, key positive influences included efforts by some health insurance providers (EPS) to contact users and encourage vaccination, the commitment of healthcare personnel in vaccination campaigns, and, in certain regions, the presence of translators in Indigenous communities to facilitate the vaccination process.

However, focus groups identified several barriers, including distrust in the vaccination process, limited availability of preferred vaccine brands, inadequate or minimal information provided regarding the vaccine and healthcare services, and a lack of proper explanation regarding informed consent.

> *"The issue isn't a real obstacle—it's the poor logistical organization, the misinformation, and the contradictions in the information being provided. Because if I tell you to isolate yourself, but then I ask you to come here among all these people, what exactly am I doing?"* – Focus Group, San Andrés, Rural.

Additionally, across all eight cities, self-medication and traditional health practices were commonly mentioned as alternative means of treatment, protection, and prevention. Home remedies, rituals, and ancestral medicinal practices, such as herbal drinks and medicinal baths, were frequently used.

> *"There was ivermectin, and people recommended matarratón or ginger. And there was a product called Perón—it was really expensive… Pharmacies had signs advertising it, one said 'Perón' and right next to it another said 'matarratón.'"* – Focus Group, Pasto, Urban.

When evaluating vaccine-related factors, 59.6% of DESVAAC survey respondents agreed or strongly agreed that the vaccine was ineffective. Focus groups frequently expressed concerns about potential health effects, including sterility, cardiac and respiratory issues, body pain, worsening of pre-existing conditions, or even death.

A significant lack of understanding about vaccines was also evident. Many participants held misconceptions, believing the vaccine to be an antibody, a medication, or a substance designed to counteract the disease—or even the virus itself in small quantities. Misinformation regarding the vaccine containing microchips or causing genetic

alterations further discouraged vaccination. Distrust also stemmed from skepticism regarding how quickly the vaccines were developed and a perception that government and pharmaceutical industries were financially motivated.

> *"At first, we thought it was just an antibody, a kind of defense. But later, the information we received suggested the vaccine was just an experiment they were conducting. So yes, as the nurse said, there was a lot of misinformation. Honestly, I got vaccinated only because it was required."* – Focus Group, Mocoa, Rural.

Vaccination intent also varied based on the type of immunization schedule. Individuals with heterologous vaccination schedules exhibited the highest intent to continue vaccination (79.3%), followed by those with homologous schedules (76.9%) and those who did not recall their schedule (76.6%, $p = 0.001$).

Despite concerns, vaccines were widely recognized as instrumental in restoring normalcy, instilling hope during a devastating time, and reducing mortality rates. The credibility of the vaccine manufacturer also played a role, with 80.4% of participants feeling more confident when the vaccine was authorized or from a well-known laboratory. Additionally, 74.9% considered home-based vaccination services a positive factor.

Several factors within the pharmaceutical industry influenced vaccination decisions. Single-dose vaccines and the perceived effectiveness of certain brands based on their country of origin were facilitators. However, barriers included the mode of administration, distrust in pharmaceutical companies, and fears of potential side effects.

> *"My concern was about the long-term effects. There were reports that after getting vaccinated, many athletes, especially football players, were collapsing… That uncertainty about the possible effects really made me hesitant."* – Focus Group, Mocoa, Urban.

Among political factors, mandatory vaccination had the greatest influence on COVID-19 vaccination uptake:

> *"Either you get the shot, or you can't study; either you get the shot, or you can't enter; either you get the shot, or you can't do anything. So, you're always left with the idea that you did it because you had to, not because you wanted to."* – Focus Group, Bogotá, Urban.

In contrast, a facilitating political factor was belonging to a government or healthcare institution or working as a healthcare professional, which influenced vaccine acceptance—whether due to obligation or personal conviction.

A key factor associated with vaccination decisions was the role of information sources. The overwhelming amount of information available led to uncertainty, fear, and confusion, fueling myths about vaccination. This, in turn, contributed to misinformation and unfavorable attitudes toward the vaccine:

> *"At times, I had so many doubts. But then I thought, that's impossible, how could a company or multinational create a virus just to profit from it? It sounded unbelievable."* – Focus Group, Mocoa, Urban.

No statistically significant differences were found between urban and rural areas; however, qualitative data revealed some distinctions. In urban areas, there was a stronger focus on healthcare access during the pandemic, social beliefs about the vaccine, protection measures against infection, and sources of information. Media coverage, particularly news reports, played a crucial role in shaping public perception, with many people feeling that the information provided was unclear or misleading. Urban respondents were also more likely to associate vaccination with political positions and noted religion as a negative influence on vaccination decisions.

> *"We started to worry because people didn't trust the vaccines. They were developed so quickly, with rushed studies just to see what they could find... Normally, vaccines take years to develop to ensure they are effective, but this was done so fast due to the global emergency. We didn't believe in it."* – Focus Group, Mocoa, Urban.

Mistrust regarding potential long-term effects was more pronounced in urban areas, along with concerns about economic or social control:

"People say that after the vaccine, new illnesses emerged... and many claimed they haven't felt well since getting vaccinated." – Focus Group, Bogotá, Urban.

In contrast, rural participants expressed greater fear of vaccination due to reports of vaccine-related deaths, concerns about the vaccine's rapid development, and doubts about its efficacy. As a result, they prioritized traditional health practices and spiritual beliefs over vaccination:

> *"I started praying and declaring that the virus wouldn't affect me, declaring and declaring that it wouldn't reach me. As a Christian, that strengthened my faith."* – Focus Group, San Andrés, Rural.

Across the surveyed population, support networks played a crucial role, with family, friends, neighbors, churches, and various institutions offering assistance:

> *"There were people we helped with basic necessities—a small food packages, hygiene supplies—whatever we could provide with the resources each church had. We would delegate someone to deliver the supplies, for example, 'Leave it outside, he lives across the street,' and that's how we organized the distribution."* – Focus Group, Bogotá, Rural.

Based on the findings, this project developed and implemented a psychoeducational intervention strategy called VACtívate across eight cities. This short course was designed for health authorities, medical personnel, community leaders, and social communicators, aiming to promote knowledge and actions that foster a comprehensive approach to vaccination in Colombia.

The course consisted of four modules:

1. Vaccination Education – Addressing misinformation and knowledge gaps about vaccines.
2. Decision-Making in Vaccination – Encouraging reflection on the reasons people choose to get vaccinated.
3. Influence as a Vaccination Advocate – Highlighting the role of leadership in shaping community perceptions and spreading information.
4. Public Health Proposals – Creating an interdisciplinary and transdisciplinary space for collaboration among key stakeholders.

VACtívate was supported by the Colombian Association of Infectiology (ACIN) – Asociación Colombiana de Infectología - and led by a physician and psychologist from the AderVax research team. Additionally, a community-focused communication strategy was developed and implemented in each city to promote vaccine education, with the collaboration of local journalists and communicators.

5. Discussion

In the post-pandemic context, this study examined populations from eight Colombian cities to identify factors associated with COVID-19 vaccine acceptance and rejection, which informed the design and implementation of an intervention strategy. Despite the relatively high national vaccination coverage reported in official indicators, the population evaluated largely expressed low-to-moderate vaccination intention. This finding underscores prevailing indecision regarding vaccination and highlights that, for many individuals, the primary motivation to receive the vaccine during the pandemic was compliance

with mandates required to continue daily activities, a phenomenon similarly documented in global studies [35–39]. Such dynamics reduce the degree of conscious decision-making and collective responsibility, instead of reinforcing short-term behaviors shaped by immediate social pressures.

Consistent with international evidence; health concerns, family-related considerations, and sociodemographic variables emerged as significant determinants of vaccine intention. However, this study also revealed widespread gaps in knowledge regarding the nature of vaccines and expectations of their function. Many participants demonstrated limited understanding of vaccine development processes, and misconceptions remained prevalent. In addition, cultural and contextual influences—including religious beliefs, community perspectives, and political narratives—played a prominent role in shaping attitudes toward vaccination. These findings call not only for improved information dissemination but also for comprehensive education on vaccination. Such education should transcend the health sector to include active community engagement and the empowerment of local leaders who can serve as trusted messengers across diverse social sectors [28,40]. Conversely, poorly coordinated messaging or the dissemination of non-evidence-based content fosters public confusion and distrust [41].

Within this framework, the media emerge as critical stakeholders in strengthening public education on vaccines. Their leadership and accountability are essential to building sustained trust, while community voices must also be integrated to ensure that strategies are contextually tailored. Academic institutions, the health sector, the education system, and industry partners must articulate their efforts to design participatory strategies responsive to community needs, as emphasized in recent scholarship [42,43]. Pharmaceutical companies, in particular, share responsibility for rebuilding public confidence. Persistent doubts regarding vaccine development, efficacy, and safety were evident in this study, echoing concerns documented elsewhere. Participants frequently expressed skepticism about perceived links between the pharmaceutical industry, politics, and economic interests, a perception that further eroded trust. As previous studies demonstrate, these beliefs amplify fear and vaccine hesitancy [44]. Addressing such skepticism requires greater transparency in vaccine development, broader dissemination of safety data, and opportunities for the public to engage in debates regarding Adverse Events Following Immunization (AEFI).

Participants also suggested exploring alternative vaccine administration methods to address needle-related fears, which became more pronounced during the pandemic. Intranasal administration, for example, was highlighted as a promising option to reduce anxiety associated with injections [45]. Incorporating such innovations could foster greater community-level acceptance of vaccines [46].

Mental health emerged as another critical dimension associated with vaccine decision-making. During and after the pandemic, many individuals experienced heightened anxiety, stress, and depression linked to fear of illness, lockdown measures, and bereavement. These psychological stressors contributed to vaccine hesitancy, in some cases extending beyond COVID-19 to other immunizations—a trend observed in prior studies [47]. Addressing mental health alongside vaccine education is therefore essential for reducing fear-driven resistance and promoting informed acceptance.

The study further identified persistent challenges within Colombia's primary health care system. Strengthening trust and education in vaccination requires reduction of barriers to health care access and fostering more humanized approaches to service delivery [48,49]. In parallel, ensuring greater stability in vaccination workforce contracts and securing the resources necessary for consistent service provision are crucial [50]. Such systemic improvements would not only enhance immunization coverage but also build long-term resilience in public health.

Taken together, the diagnostic evaluation and intervention findings from this project led to the proposal of a model to promote conscious vaccination in Colombia (Fig. 1). This model emphasizes the integration of intercultural education, intersectoral collaboration, transparent communication, and the inclusion of mental health perspectives. It also

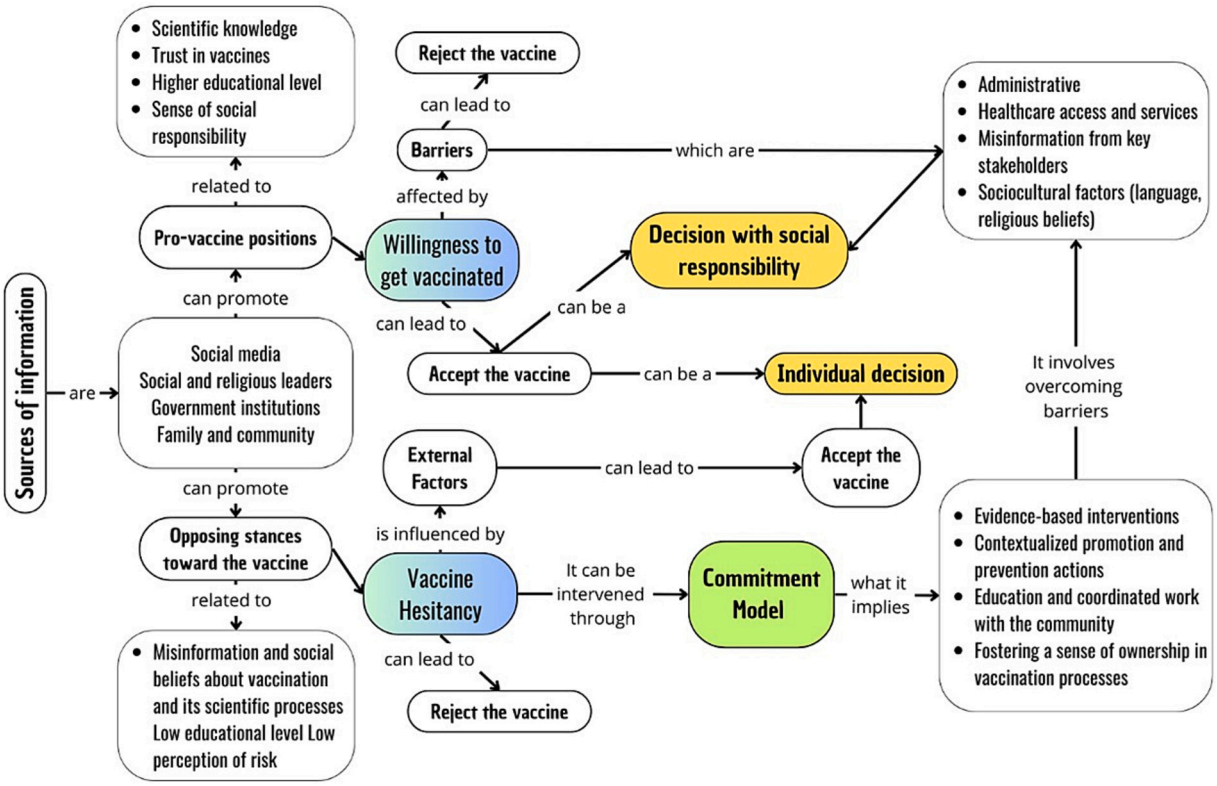

Fig. 1. Immunization Commitment Model.

underscores the role of community leaders, media, academia, and industry as active partners in restoring and sustaining trust in vaccines.

By situating vaccine hesitancy within a broader sociocultural, political, and psychological framework, this study highlights the limitations of strategies focused solely on coverage targets. Instead, it advocates for approaches that build informed, voluntary, and collective engagement with immunization. The lessons learned extend beyond COVID-19, providing a foundation for addressing hesitancy toward other vaccines and for strengthening preparedness against future public health emergencies.

CRediT authorship contribution statement

Laura Juliana Valderrama Orbegozo: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Laura Julieth Ramírez Lasprilla:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Diana Estefanny Arce Leonel:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Investigation, Data curation, Conceptualization. **Michell Rezene Tesfamariam Ortega:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **David Javier Fortich Pérez:** Writing – review & editing, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization.

Ethics approval and consent to participate

This project was reviewed and approved by the Ethics and Biomedical Research Committee of the Pediatric Scientific Corporation (multisite approval number: CEI-057-2023). All study participants gave informed written consent which was thus obtained from study participants after the purpose of the study and their involvement was explained to them. All transcripts were de-identified, and participants were referred to by code numbers rather than names to ensure confidentiality. The methods employed by this study are in accordance with the principles and standards in the Declaration of Helsinki.

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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.jvacx.2025.100767.

Data availability

Data will be made available on request.

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