Attitude towards COVID-19 vaccines in Colombian university students: Frequency and associated variables

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Abstract. *Background and aim of the work:* The attitude towards the COVID-19 vaccine varies widely depending on the context, way of measurement, and pandemic stage. However, little information is available about Colombian populations. The study aimed to know the frequency and variables associated with COVID-19 vaccine attitude in students of a Colombian university. *Methods:* A cross-sectional study was carried out which participated emerging adult students of a Colombian university. *Results:* A total of 1,136 students between 18 and 29 years (M= 22.0, SD = 3.0); most of participants were female (66.0%), non-health students (82.8%), low-income (79.0%), and residents of urban areas (84.9%). The percentage of low institutional trust was 74.8%; low cognitive social capital, 27.9%; low fear of COVID-19, 49.5%; low perceived stress related to COVID-19, 83.5%; and negative attitude towards COVID-19 vaccines, 78.9%. Non-health carrier (Adjusted OR = 3.63, 95% CI 2.58-5.10), rural residence (AOR = 1.85, 95% CI 1.13-3.04), low income (AOR = 1.84, 95% CI 1.31-2.57), and perceived stress related to COVID-19 (AOR = 1.74, 95% CI 1.20-2.54) were related to unfavorable attitude towards COVID-19 vaccines. *Conclusions:* The negative attitude towards COVID-19 vaccines is high among emerging adult Colombian university students. The negative attitude towards COVID-19 vaccines is related to non-health science carriers, rural residents, low-income, and low-perceived stress related to COVID-19. The COVID-19 related health literacy should be improved in students of this university considering socio-cultural background. (www.actabiomedica.it)

Key words: Coronavirus disease, Vaccination refusal, Students, Universities, Cross-sectional studies.

Introduction

Colombia is a middle-income country located north of South America, with more than 50 million inhabitants. The first case of coronavirus disease (COVID-19) in Colombia was identified on March 6th, 2020. More than 2.7 million cases have been reported and more than 70 thousand deaths from COVID-19 have been confirmed; data indicate a death toll of 1,373 per million inhabitants, by April 23rd, 2022 (1). However, national news and social networks vaccines have been evidenced a high frequency of a negative towards COVID-19 (2), as activism against some vaccines or national vaccination plans has increased (3, 4).

According to the World Health Organization, the spectrum of vaccination intentions to receive a

COVID-19 vaccine follows a non-linear pattern, including activism, rejecting, hesitance, accepting, demanding, and advocating (5). Activism implies a negative position towards vaccine and active participation in events such as protests. Rejection is based on the safety of COVID-19 vaccines, experiences, perceptions, and values. Furthermore, hesitation is the presence of doubts in accepting the COVID-19 vaccine due to the novelty of the disease, ignorance of the vaccination program, use of new vaccination platforms and uncertainty surrounding the vaccine's safety (3-5). Given the overlap in these definitions, aversion, distrust, hesitance, mistrust, refusal, rejection and resistance are used as synonymous (3, 4).

The attitude towards COVID-19 vaccines varies widely depending on the context, way of measurement,

and pandemic stage (6-8). For instance, Sallam, among adults representing the general public, found prevalences between 23.6% in Kuwait and of vaccine acceptance 97% in Ecuador; 28.4% in Jordan, 53.7% in Italy, 54.9% in Russia, 56.3% in Poland, 56.9% in the United States, 58.9% in France, 91.3% in China, 93.3% in Indonesia, and 94.3% in Malaysia (9).

Similar findings have been observed in samples of college or university students. For instance, Barello et al. (10), among 735 Italian students, 86.1% reported the intention to get vaccinated, and 13.9% reported not being sure (low intention to vaccinate). In Malta, Grech et al. (11) found that in 852 students, 30.5% reported unlikely, and 25.3% undecided to receive the COVID-19 vaccine. No previous studies reported the prevalence of acceptance or rejection of vaccines for COVID-19 in Colombia.

The variables associated with a negative attitude towards COVID-19 vaccines follow the same pattern as the markedly different frequencies in the available studies; it highlights the importance of cultural and social determinants of health literacy (12). Barello et al. (10) found no demographic differences between university students who accept vaccination and those who have low intention. Grech et al. (11) reported that a negative attitude towards COVID-19 vaccines was higher in dentistry than medical students and university administrative personnel than academic and students. However, among the general population, Fisher et al. (13) observed a negative attitude towards COVID-19 vaccines was associated with younger age, Afro-American, lower educational achievement, and not receiving the influenza vaccine the last year. Paul et al. (14), in a large sample from the general population, found that COVID-19 vaccine uncertainty and refusal were associated with female gender, low income, not receiving a flu vaccine prior year, poor adherence to COVID-19 government guidelines, and living with children.

Few studies have quantified the attitude towards COVID-19 vaccines using construct measurement scales, none in a low- or middle-income country (9). Careful consideration should be given to the need for specific public health actions according to university students' characteristics since health knowledge can have a lasting positive impact on the life course (15). Besides, university students adequately instructed in scientific information on the COVID-19 pandemic

can be disseminators, promoters, or influencers of vaccination among peers and relatives with less access to truthful information (16).

The study's objective was to evaluate the frequency and variables associated with attitude towards COVID-19 vaccines in students of a Colombian university.

Methods

Participants

An analytical cross-sectional study was implemented. A non-probability sample of participants was taken. At least 384 participants were expected; this sample size is adequate for prevalence from 3% (more or less 1) to 50% (more or less 5) for any variable, a confidence level of 95% (17). This sample is indicated to explore associations between variables with sufficiently narrow confidence intervals.

The authors expected to have a sample of active pre-graduate students of a state university in Santa Marta, a city on the Caribbean coast, with approximately 500,000 inhabitants. The university admits students from all over the Colombian territory; however, most students come from Santa Marta and the surrounding Caribbean region. Students of emerging age were invited to participate. According to Arnett, emerging adults are people between 18 and 30 years. Emerging age is distinct demographically and subjectively in terms of identity explorations and coping methods (18).

Measurements

COVID-19 Vaccine Attitude Scale

The Spanish version of the COVID-19 Vaccine Attitude Scale (COVID-19 VAS) followed a translation process from the original version in Danish to English and English to Spanish. The back-translation process was satisfactory because the sentences' simplicity quickly reached the linguistic equivalence. The COVID-19 VAS is an eight-item tool that offers five response options: "totally disagree", "disagree", "unsure", "agree", and "totally in agreement". These responses are scored directly from 0 to 4, except for item 7, which is scored in

reverse. The possible total scores are between 0 and 32. The scale presents high internal consistency, Cronbach's alpha of 0.95 (19). The cores of 24 or less were classified as a negative attitude towards COVID-19 vaccines, based on the upper limit of the interquartile range. In the present sample, the COVID-19 VAS presented an internal consistency of 0.95.

Institutional trust

The institutional trust was measured with an instrument adapted for the COVID-19 outbreak, the Institutional Trust Scale (ITS) (20). The ITS is an instrument made up of four items that ask for trust in the national government and the municipality (mayors). Each item offers four response options: "strongly disagree," "disagree," "agree," and "strongly agree," which are scored from 0 to 3. The ITS was used in a previous study for exploitative purposes without reporting reliability or validity indicators; however, it showed acceptable face validity (19). In the present study, the scores between 0 and 5 were classified with low institutional trust, based on the lower limit of the interquartile range. The internal consistency of the ITS was 0.68 (McDonald's omega) in the current sample.

Cognitive capital social

The cognitive social capital scale (CSCS) measures global social capital. It explores social cohesion and trust in the neighbourhood and nearby community. The CSCS presents five questions with Likert response options: "very disagree," "disagree," "agree," and "very agree," that rated from 0 to 3. The original study of the CSCS did not report internal consistency (21). The CSCS showed Cronbach's alpha value of 0.79 in a Colombia sample (22). For the current study, scores less than or equal to five were categorized as low CSC, the same cut-off point in previous Colombian research (22). The CSCS presented internal consistency of 0.81 in the current sample.

COVID-5 Fear Scale (Fear of COVID-5)

The Fear of COVID-5 is a five-item tool that quantifies attitude toward COVID-19. The scale offers four response options: "never," "seldom," "often," and "always," which are rated from zero to three. Total scores are between 0 and 15; the scores lower than four were classified as low fear of COVID-19. The Fear of COVID-5 showed an internal consistency of 0.75 in Colombian adults who participated in an online investigation (23). The Fear of COVID-5 presented a Cronbach's alpha of 0.82 in the current sample.

COVID-19 Pandemic–Related Perceived Stress Scale (PSS-10-C)

The PSS-10-C is a ten-item instrument that quantifies perceived stress during the last month related to the COVID-19 epidemic. The tool offers five response options: "never," "seldom," "occasionally," "often," and "always," which are rated from zero to four. The total scores can be observed between 0 and 40; the scores below 25 were categorized as low perceived stress. The PSS-10-C showed an internal consistency of 0.85 in a previous online study of Colombian adults (24). The PSS-10-C reached an internal consistency of 0.85.

Procedure

An email invitation was sent to all student's registered emails in the university's admission system. The email explained the study's objectives and reported the participants' anonymity and the confidential handling of information. Besides, informed consent was required to implement a questionnaire designed by Google Form[(c)]. All responses were mandatory to avoid missing values. Two emails were sent with an interval of one week. The second email aimed to recall participate. A second email after a week can improve the response rate (25). The questionnaire link was available from January 18th to February 5th, 2021.

Data analysis

For qualitative variables, frequencies (n) and percentages (%) were established, and for quantitative variables, mean (M), standard deviation (SD), median, and interquartile range (IQR). Variables were dichotomized for bivariate analysis to avoid the excess of categories. Many categories increase the risk of making a type II error. The negative attitude towards COVID-19 vaccines was the dependent or outcome variable. Demographic features, institutional trust,

cognitive social capital, fear of COVID-19, and stress-related to COVID-19 were the independent variables. Crude and adjusted odds ratios (OR) were established with 95% confidence intervals (CI).

The associations were adjusted according to Greenland's recommendations for logistic regression. The first recommendation is that all variables that show significant association or probability values less than 0.20 be considered for the adjustment. The second recommendation is that only the variables that show significant probability values are left in the final model. Moreover, those variables that induce a modification higher than 10% on the most robust association. The variable first included in the process must show the higher value of OR (26). Those non-significant variables that produce a variation of 10% or more indicate a significant confounding effect; then, those variables should always be considered. The Hosmer-Lemeshow goodness-of-fit test was computed for each adjustment (27). Statistical analysis was performed with IBM-SPSS version 23.0 (28).

Ethical issues

The project respected the ethical principles promulgated in Resolution 008430 of 1993 of the Colombian Ministry of Health and Declaration of Helsinki of the World Medical Association. An institutional research ethics board approved the project (Act 002 of the ordinary meeting of March 26th, 2020). Students signed an online informed consent.

Results

A total of 1,409 (6.7%) out of 21,144 pre-graduate students responded to the email. Two hundred seventy-three questionnaires were excluded because responders were younger than 18 years or older than 29 years; 67 students under 18 and 206 over 29 years. Then, 1,136 questionnaires of emerging adult students (M=22.0, DE=3.0) were analyzed. The highest proportion of responders were women, single, non-health students, low-income, and residents of urban areas. The characteristics of the participants are presented in Table 1.

The ITS scores were between 0 and 12 (Mean = 4.3, SD = 2.1, Median = 4, IQR = 3-6); CSCS scores

were between 0 and 15 (Mean = 7.2, SD = 3.0, Median = 7, IQR = 5-9); fear of COVID-19 scores were between 0 and 15 (Mean = 5.0, SD = 4.0, Median = 3, IQR = 2-5), PSS-10-C scores were between 0 and 40 (Mean = 18.2, SD = 4.4, Median = 19, IQR = 14-22), and COVID-19 VAS scores were found between 0 and 32 (Mean = 18.7, SD = 7.2, Median = 19, IQR = 14-24). The findings in frequencies and percentages are reported in Table 1.

Table 1. Frequencies and percentage of evaluated variables.

Variable	n	%
Gender		
Female	750	66.0
Male	386	34.0
Marital status		
Single, separated or widowed	986	85.3
Married or civil partnership	167	14.7
Faculty		
Health science	195	17.2
Other	941	82.8
Low income		
Yes	897	79.0
No	239	21.0
Working students		
Yes	180	15.8
No	956	84.2
Rural residence		
Yes	172	15.1
No	964	84.9
COVID-19 infection history		
Yes	96	8.5
No	1,040	91.5
Institutional trust		
Low	850	74.8
High	286	25.2
Cognitive social capital		
Low	317	27.9
High	819	72.1
Fear of COVID-19		
Low	562	49.5
High	574	50.5
Perceived stress related to COVID-19		
High	187	16.5
Low	949	83.5
Attitude towards COVID-19 vaccines		
Negative	896	78.9
Favourable	240	21.1

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Crude associations were observed between the carrier (OR = 3.50, 95% CI 2.51-4.87), residence place (OR = 2.11, CI 95% 1.31-3.42), income (OR = 1.97, CI 95% 1.43-2.73), marital status (OR = 1.62, CI 95% 1.03-2.54), perceived stress related to COVID-19 (OR = 1.51, CI 95% 1.05-2.16) and negative attitude towards COVID-19 vaccines. Other associations are presented in Table 2.

After adjusting, carriers (OR = 3.63, 95% CI 2.58-5.10), residence place (OR = 1.85, CI 95% 1.13-3.04), income (OR = 1.84, CI 95% 1.31-2.57), and perceived stress related to COVID-19 (OR = 1.74, CI 95% 1.20-2.54) kept on significant level. Nevertheless, marital status was not associated with a negative attitude towards COVID-19 vaccines after adjusting for the other variables; it was excluded from the model. It did not affect the final model that showed adequate goodness-of-fit (Hosmer-Lemeshow's test, X^2=1.98, df=5, p = 0.85). See details in Table 3.

Discussion

In the current study, the frequency of negative attitude towards COVID-19 vaccines is 78.9%. It is related to non-health science carrier, rural residence, low income, low perceived stress related to COVID-19 in a sample of students at a Colombian university. The observed frequency of negative attitude towards COVID-19 vaccines in the present research is significantly high than in university students in Italy, in whom 13.9% reported a low intention to vaccinate (10), and in Malta, where 55.8% of participants reported that it was unlikely or undecided about being vaccinated against COVID-19 (11). These marked differences in attitude towards COVID-19 vaccines have also been documented in the general population (6-9).

The findings are a strong wake-up call for educational and public health authorities to better understand the student health education, particularly related to COVID-19, given the high safety and positive effects of the vaccination (29). Health literacy is higher in the younger cohorts and people with more formal education years (13, 14, 30). University students can develop discernment above the average; this ability should be a protective factor against the infodemic associated with COVID-19 (30, 31).

Furthermore, in the present study, it was observed that low income and rural residence were related to a negative attitude towards COVID-19 vaccines. These findings are consistent with other studies that show that these characteristics predict a negative attitude

Table 2. Crude associations for the negative attitude towards COVID-19 vaccines.

Variable	OR	95%CI
Female gender	1.16	0.86-1.56
Married or civil partnership	1.62	1.03-2.54
Non-health science student	3.50	2.51-4.87
Low income	1.97	1.43-2.73
Working student	1.23	0.82-1.85
Rural residence	2.11	1.31-3.42
Non-history of COVID-19	0.85	0.50-1.45
Institutional distrust	0.99	0.71-1.37
Low cognitive social capital	1.00	0.73-1.37
Low fear of COVID-19[1]	1.01	0.76-1.34
Low perceived stress related to COVID-19	1.51	1.05-2.16

Table 3. Adjusted associations for the negative attitude towards COVID-19 vaccines.

Variable	OR	95%CI
Non-health science student	3.63	2.58-5.10
Rural residence	1.85	1.13-3.04
Low income	1.84	1.31-2.57
Low perceived stress related to COVID-19	1.74	1.20-2.54

towards COVID-19 vaccines (13, 14). However, another investigation found independence between income and scores for attitude toward COVID-19 vaccines (32). However, it should be considered that the attitude towards vaccines, in general, is related to cultural and social factors that can be little affected by professional training (12). For instance, the current report failed to show an association between institutional trust, social capital, and a negative attitude towards COVID-19 vaccines. This finding is striking because Colombia is an upper-middle-income country with a low Gini inequality index of 0.54 in 2018 (33) and a high corruption index of 39 in 2020 (34). In Italy, Prati (35) found that institutional trust was related to COVID-19 vaccine trust. Public vaccination trust in programs depends on the work institutions do for the community regarding individual, family, cultural, social, and political issues (36).

This preliminary finding suggests that the student's university carrier can modify the attitude towards COVID-19 vaccines. In Malta, it was found that medical students reported higher COVID-19 vaccine trust than dentistry students and administrative workers (11). Similarly, psychological states such as perceived stress can anticipate the attitude towards vaccines. Previously, it was reported that worries were correlated to COVID-19 vaccine trust (35). Nevertheless, fear of COVID-19 may have less importance; Paul et al. (14) reported no correlation between Coronavirus Anxiety Scale and mistrust of vaccine benefits scores. These associations require further study to get strong evidence and variables such as gender that have shown inconsistent associations (10, 13, 14).

Nowadays, strengthening health literacy is very important to prepare individuals and societies for future emergencies that require urgent actions and rapid inter-and cross-sectoral containment. Educational institutions, social media, work environments, healthcare systems, political sectors, and economic groups play a crucial role to reduce the negative impact of emerging diseases. High education institutions may build individual, family, community, and society health literacy; possibly, healthy collectives require more and better health education (12). The COVID-19 pandemic is more of a syndemic due to the complex interaction of negative individual, social and cultural events, processes,

and situations. In financial or multidimensional poverty, converge several disadvantages; consequently, people living in poverty are at greater risk of fall ill or die from the convergence of acute and chronic adversities (37, 38).

This study provides relevant information on COVID vaccines' attitude, measured with a structured instrument, and the importance of psychological distress in emerging-age university students from a middle-income country. Nevertheless, the study has several limitations that invite one to take the findings with caution. The sample does not represent Colombian university students (17), the response rate was relatively low (25), and the reliability of the institutional trust measurement showed a value lower than 0.70 (39). Although, depending on the development of the instrument, values greater than 0.60 may be allowed (40).

In conclusion, the frequency of negative attitude towards COVID-19 vaccines is high among emerging adult pre-graduate students at a Colombian university. The negative attitude towards COVID-19 vaccines is associated with non-health science carriers, rural residents, low-income and low-perceived stress related to COVID-19. COVID-19 related health literacy should be improved in this group of students. All training actions must consider the social and cultural context of the students.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Ethics approval: The Research Ethics Board approved the project of the University of Magdalena, Colombia (Act 002 of the ordinary meeting of March 26th, 2020).

Consent to participate: The participants signed an online informed consent.

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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