INTERAÇÃO EM PSICOLOGIA

Is vaccine hesitation related to sociodemographic variables and personality factors?

Wanderson Arão do Nascimento Pereira

Adriana de Andrade Novais

Lucas Guimarães Cardoso de Sá

ABSTRACT

The objective of this study was to investigate the relationships between vaccine hesitancy and sociodemographic variables and personality factors. The sample consisted of 340 people aged between 18 and 72 years (*M* = 29.79, *SD* = 11.19), 65.19% of whom were women. First, a scale was developed to measure vaccine hesitancy; this scale included three factors: *confidence in the efficacy of vaccines, fear of negative vaccine reactions and influence of information on vaccine hesitancy*. Vaccine hesitancy was compared between different groups, and the influences of sociodemographic variables and five major personality factors on vaccine hesitancy were verified. The results indicated greater vaccine hesitancy in men, people with less education, people with more conservative beliefs and people with a less left-leaning political alignment. Among the personality factors, greater *agreeableness*, *conscientiousness* and *neuroticism* were associated with greater confidence in vaccines. In conclusion, vaccine hesitancy is related to specific sociodemographic variables and personality factors. Promoting the dissemination of correct information about vaccines is necessary to reduce the level of vaccine refusal in people with more characteristics of hesitancy.

Keywords: Effectiveness of vacines; Politics; Neuroticism; Five major factors; political-ideological orientation.

RESUMO

Hesitação vacinal está relacionada a variáveis sociodemográficas e fatores de personalidade?

O objetivo deste trabalho foi investigar a relação da hesitação vacinal com variáveis sociodemográficas e fatores de personalidade. A amostra foi composta por 340 pessoas entre 18 e 72 anos (*M* = 29,79, *DP* = 11,19), 65,19% mulheres. Inicialmente, foi desenvolvida uma escala capaz de medir a hesitação vacinal, composta por três fatores: *confiança na eficácia das vacinas, temor das reações negativas da vacina e influência das informações sobre a hesitação vacinal*. A hesitação vacinal foi comparada entre diferentes grupos e foi verificada a influência de variáveis sociodemográficas e dos cinco grandes fatores de personalidade sobre ela. Os resultados apontaram para maior hesitação vacinal em homens e em pessoas com menor escolaridade. Também indicaram que maior conservadorismo e menor alinhamento político à esquerda influenciam na maior hesitação vacinal. Quanto a personalidade, maior *amabilidade*, *conscienciosidade* e *neuroticismo* influenciam em maior confiança nas vacinas. Portanto, a hesitação vacinal está relacionada a variáveis sociodemográficas e fatores de personalidade. Conclui-se que há necessidade de promover a divulgação de informações corretas acerca das vacinas, com o intuito de diminuir os níveis de recusa vacinal nas pessoas com características mais hesitantes.

Palavras-chave: Eficácia das vacinas; Política; Neuroticismo; Cinco grandes fatores; Orientação político-ideológica.

Sobre os Autores

W. A. N. P.
orcid.org/0000-0003-3913-5407
Universidade Federal do Maranhão (UFMA) – São Luiz, MA
wanderson.arao@discente.ufma.br

A. A. N.
orcid.org/0000-0001-9497-0136
Universidade Federal do Maranhão (UFMA) – São Luiz, MA
adriana.andrade@discente.ufma.br

L. G. C. S.
orcid.org/0000-0003-1656-0136
Universidade Federal do Maranhão – São Luiz, MA
lucas.gcs@ufma.br

In recent years, even before the pandemic period, historical, political and social contexts resulted in an increase of antivaccination groups in Brazil, jeopardizing the integrity of information disseminated about vaccinations and increasing hesitancy in the search for immunization (Castro, 2021; Saraiva & De Faria, 2019). People who are considered vaccine hesitant are those who, despite being able to receive vaccinations and protect themselves against diseases, choose not to do so.

Vaccine hesitancy is defined as the refusal or delayed acceptance of available vaccines offered by health services (Salmon et al., 2015). Vaccine hesitancy is not dichotomous (or, with two options of total acceptance or refusal), but rather a continuum that varies between the two extremes. Vaccine-hesitant individuals can be classified along this continuum depending on the degree of intensity of their hesitancy.

Vaccine hesitancy involves three factors known as the 3 Cs: (1) *confidence*, which refers to the relationship between an individual's belief in the efficacy and safety of the vaccine, their level of trust in the health system and the relevant health authorities; (2) *complacency*, which refers to a low risk perception of contracting the disease, causing an individual to believe the vaccine is unnecessary, and (3) *convenience*, which refers to vaccines' physical availability and an individual's access to them, along with relevant information regarding them (MacDonald & the SAGE Working Group on Vaccine Hesitancy, 2015; Sato, 2018). Robinson et al. (2022) proposed subdivisions for each of these 3 Cs. Confidence has three dimensions: trust, information, and fear of vaccines/their side effects. Complacency has two dimensions: the importance of individual choices and the role of large companies/government in health-related decisions. Convenience has three dimensions: access, availability, and both media and/or school influence.

More recently, another proposal suggested the 7 Cs, as follows: (1) *confidence*; (2) *complacency*; (3) *constraints*, structural and psychological obstacles that make vaccination more difficult or costly; (4) *calculation*, weighing the costs and benefits of vaccination at a personal level; (5) *collective responsibility*, the will to protect others and eliminate infectious diseases; (6) *compliance*, the support of social sanctions for those who are not vaccinated; and (7) *conspiracy*, the influence of conspiracy theories on vaccination (Geiger et al., 2022).

Vaccine hesitancy has been associated with individual characteristics such as sex, education, age and income, both in Brazil (Gonçalves et al., 2022; Gontijo et al., 2022; Moore et al., 2021; Oliveira et al., 2021; Paschoalotto et al., 2021; Rezende et al., 2021) and in other parts of the world, such as Qatar (Alabdulla et al., 2021), New Zealand (Lee et al., 2017), Japan (Lahav et al., 2022) and the United Kingdom (Halstead et al., 2022). Vaccine hesitancy has also been associated with beliefs, the influence of family or other groups, media, social and cultural contexts, and economic, political, geographic and demographic factors (Dubé et al., 2013; Gonçalves et al., 2023; Lazarus et al., 2020; MacDonald & the SAGE Working Group on Vaccine Hesitancy, 2015; Moore et al., 2021).

Psychological constructs are considered important for understanding vaccine hesitancy (Nazlı et al., 2022). One of these constructs is personality, which is defined as the patterns of the cognitive, behavioral and emotional functioning of each individual (Carvalho et al., 2017). One of the most accepted and modern personality theories is the Big Five Personality Factor Theory (BFF; Pires et al., 2019). Various studies have sought to understand how personality, as described by the BFF, may be related to decision-making and vaccination-related behaviors (Baker and Merkley, 2023; Halstead et al., 2022; Gonçalves et al., 2022; Gupta et al., 2023; Lin & Wang, 2020; Murphy et al., 2021; Panish et al., 2023; Reagu et al., 2023). In general, the results of these studies tend to indicate that lower levels of agreeableness, conscientiousness, openness and neuroticism result in greater vaccine hesitancy.

Therefore, although low adherence to vaccination recommendations may occur due to health system-related factors, such as a lack of supplies or limitations of application centers, a broad analysis of this low adherence rate from the perspective of vaccine hesitancy is necessary (MacDonald & the SAGE Working Group on Vaccine Hesitancy, 2015). In the same direction, information on vaccine hesitancy in Brazil is scarce, especially in adults (Gonçalves et al., 2023).

Searches in Scielo Brasil, Web of Science and PsycINFO using the keywords "vaccine hesitancy", "scale", "test", and "Brazil" did not produce any results regarding an instrument for assessing vaccine hesitancy in adults. We found, however, a scale for parental vaccine hesitancy (Campos et al., 2022), by which parents are evaluated according to their degree of acceptance of vaccination in their children. Although the use of this instrument provides important information on vaccine hesitancy in adults, it does not directly indicate their degree of vaccination acceptance for themselves. Adult evaluations are generally performed with instruments that evaluate constructs related to vaccine hesitancy, such as vaccination adherence (Gonçalves et al., 2022); other instruments take a dichotomous single-item format, in which the individual is asked whether they would take the vaccine (Araújo et al., 2021; Gontijo et al., 2022; Macinko et al., 2021; Oliveira et al., 2021), contradicting the definition of hesitancy as a continuum between the extremes of acceptance and refusal.

Therefore, the research gap extends from a lack of measurement instruments to a lack of data on vaccine hesitancy in the Brazilian adult population. As reported by Gonçalves et al. (2023), vaccine hesitancy in countries in the Global South (such as Brazil) has cultural, social, ethnic and

regional aspects that are different from those in other parts of the world.

Therefore, some of the many questions in this field include the following: What factors are related to vaccine hesitancy among adults in Brazil? More specifically, what is the relationship between vaccine hesitancy and sociodemographic variables and personality factors? Answers to these questions may help delineate more precisely some of the reasons for vaccine refusal in Brazil. These data can aid in the planning of more targeted actions concerning the importance of the vaccine, increasing the awareness of the population in general.

The aim of this study was to determine how vaccine hesitancy might be related to sociodemographic variables and personality factors. Given the absence of a Brazilian instrument capable of measuring vaccine hesitancy in adults, the first specific objective was (1) to develop an instrument capable of assessing vaccine hesitancy in adults. The hypothesis was that the instrument would reproduce the structure of the 3 Cs (confidence, complacency and convenience). The other objectives were (2) to verify differences in the level of vaccination hesitation according to gender, education and income; (3) to determine the degree to which sociodemographic variables (age, religiosity and political position) influence vaccine hesitancy; and (4) to determine how much the personality factors of the BFF model influence vaccine hesitancy. The hypothesis was that women, people who were older, more religious, poorer, more conservative, less educated, more right-leaning in their political alignment, and people who had lower levels of agreeableness, openness, conscientiousness and neuroticism would have greater vaccine hesitancy.

METHOD

PARTICIPANTS

The sample consisted of 340 people. The only inclusion criterion was age greater than 18 years. No exclusion criteria were established. The ages of the participants ranged between 18 and 72 years (M = 29.79, SD = 11.19). From the total sample size, 65.19% identified themselves as female, 33.92% as male, and 0.88% as another gender or preferred not to respond. Education-related ditribuitions were 1.47% of the sample with only an elementary school education, 24.48% with complet high school, 68.73% with undergraduation-level education, and 5.3% with a post-graduation degree. Regarding income level, 17.4% of the sample reported an income up to BRL 1,200, 51.62% between BRL 1,200 and BRL 5,000, 21.53% between BRL 5,000 and BRL 10,000, 7.37% between BRL 10,000 and BRL 20,000, and 2.06% greater than BRL 20,000. On a scale ranging from zero to 10, the mean score of how religious people considered themselves to be was 5.85 (SD = 3.28). The mean score of how conservative people considered themselves (on a moral-related level) 3.94 (SD = 3.28); the mean score of how left-wing people considered their political stances was 5.57 (SD = 3.72).

INSTRUMENTS

A sociodemographic questionnaire was developed for this study, including questions about personal characteristics, such as gender, age and income. In addition, three questions were asked in the standard single-item format, according to the European Social Survey (2020) model: (1) “From 0-not at all to 10-completely, how strongly do you consider yourself a religious person who believes, follows and practices a certain religion?” (2) “In politics, people often use the words left and right to define their position. On a scale with values closer to 0 indicating a more right-leaning position and values closer to 10 indicating a more left-leaning position, where are you?” (3) “In terms of morals, beliefs about how people should behave, people often use the words conservative and liberal. On a scale with values closer to 0 indicating more liberal beliefs and values closer to 10 indicating more conservative beliefs, where are you?”

The Reduced Markers for Personality (Marcadores Reduzidos de Personalidade – MR-25; Hauck et al., 2012), was used to evaluate the BFF. IT consistos of a 25-item instrument for measuring BFF factors with five items each: openness to new experiences, conscientiousness, extraversion, agreeableness and neuroticism. Internal structure validity studies were conducted, and reliability was verified by internal consistency, with Cronbach's alpha values ranging between 0.78 and 0.88.

The vaccination hesitation scale for adults (VHSA) was developed for this study. Detailed information on the construction, structure and psychometric properties of this instrument is presented in the Results section.

PROCEDURES

This study had an analytical, observational, cross-sectional design (Hochman et al., 2005). To achieve the first specific objective, the items of the VHSA were prepared, based on a literature review, and other instruments for the evaluation of parental vaccine hesitancy. Participants were subsequently recruited for the study. The study was promoted through applications such as *WhatsApp* and *Instagram*. Individuals who showed interest in taking part of the study received a *Google Forms* platform link for a free and informed consent form (FICF), which explained the study’s procedures. According to the terms presented in the FICF, participants were asked to complete the VHSA, the sociodemographic characteristics questionnaire and the MR-25, in this order. The data were collected via convenience sampling, between February and May, 2022.

This study followed the norms of Resolutions 466/12 and 510/16 of the Brazilian National Health Council (NHC), which regulate research ethics in the humanities and social sciences. The study was submitted to and approved by the Research Ethics Committee of the Federal University of Maranhão (Inscription number 54978021.4.0000.5086; Approval report number 5.253.082).

DATA ANALYSIS

The data were analyzed using JASP, software version 0.15 (Jasp Team, 2021). First, an exploratory factor analysis (EFA) of the items of the VHSA was performed. The Kaiser-Meyer-Olkin (KMO) index was used as the general measure of sampling adequacy. Polychoric correlations were calculated with the ordinary least squares (OLS) estimation and Oblimin rotation methods. The number of factors was determined via parallel analysis and observation of the sedimentation graph. Items with a factor loading below 0.40 (Field, 2006) or two factors with loadings above 0.40 were discarded. At least three items were necessary to include the factors in the instrument.

Next, the mean values of the correlations between items and the correlations between factors were obtained. The reliability according to internal consistency was determined via McDonald's Omega values (ω). The item discrimination index scores were also calculated via the corrected item-total correlation.

For group comparisons, Welch's t test was performed for independent samples, with verification of the effect size by Cohen's d. The compared groups were sex (male × female), education (basic education [primary and secondary education] × higher education [undergraduate and graduate]) and income (up to BRL 5000 × over BRL 5000).

For evaluating the influence of sociodemographic and personality variables on vaccine hesitancy, multiple regression analyses were performed via the enter method. The F values and the model significance were calculated, as were the percentage of variance explained by the adjusted R^2 and the weights of each variable within the model, as well as their respective significance. In all analyses, the significance level adopted was 5%.

RESULTS

Initially, 33 items were constructed for the VHSA that encompassed attitudes and opinions about the use of vaccines. Ten items were adapted from the *vaccine hesitation scale*, an instrument developed by the World Health Organization that measures parental vaccine hesitancy, defined as the choice made by parents not to vaccinate their children, mainly due to complacency, difficult access to the vaccine and lack of confidence. The other 23 items were prepared on the basis of the literature review conducted by Larson et al. (2015). The participants were asked to indicate, on a scale of 0 (*none*) to 10 (*completely*), how much they agreed with each statement presented.

First, the KMO index for the VHSA was calculated; the index value was 0.93, which is considered optimal, indicating that the level of inter-correlation between the variables was sufficient for EFA. The dimensionality analysis indicated the existence of up to five factors. After the exclusion of items with a factor loading below 0.40, items with a factor loading above 0.40 in more than one factor simultaneously and factors with fewer than three items, a theoretically plausible scale containing three factors, which explain 58% of the total variance, was constructed.

The first factor (confidence in the vaccine efficacy) included 14 items. The second factor (fear of negative reactions to vaccines) included 5 items. The third factor, (information influence on vaccination hesitation) included 4 items. Table 1 shows the structure of the scale, the value of the factor loadings and the discrimination index of each item.

All factor loadings were significant and above 0.40. The mean correlation coefficient between the items of the first factor was 0.62 (95% confidence interval CI [0.57, 0.67]), while the second factor's value was 0.43 (95% *CI* [0.37, 0.49]), and the third factor's, 0.43 (95% *CI* [0.37, 0.49]). The correlation coefficient between the first and second factors was -0.47 (95% *CI* [-0.38, -0.55], with $p < 0.001$). The correlation coefficient between the first and third factors was 0.06 (95% *CI* [-0.04, 0.17], with $p = 0.23$). Finally, the correlation coefficient between the second and third factors was 0.12 (95% CI [0.02, 0.23], with $p = 0.02$).

Reliability, as determined by internal consistency via McDonald's omega coefficient (ω), was 0.95 (95% CI [0.94, 0.96]) for factor 1, 0.79 (95% *CI* [0.75, 0.83]) for factor 2, and 0.79 (95% *CI* [0.75, 0.83]) for factor 3. Values close to or above 0.80 indicate very good reliability. The discrimination index of the items of the first factor ranged between 0.52 and 0.88, that of the second factor ranged between 0.51 and 0.61, and that of the third factor ranged between 0.36 and 0.67. All values were greater than 0.30, indicating a good ability of the items to differentiate between people with high and low vaccine hesitancy.

A comparison of the levels of vaccine hesitancy according to sex (presented in Table 2) revealed a statistically significant difference in the fear of negative reactions to vaccines between men and women, with men being more afraid of negative reactions to vaccines than women were. However, the effect size of this difference was small. Table 2 also shows the comparison of vaccine hesitancy between the educational categories of basic education (elementary and secondary education) and higher education (undergraduate and graduate).

Table 1. ***Internal Structure of the Vaccination Hesitation Scale for Adults***

Items	Exploratory factor analysis (EFA)			
	F1	F2	F3	DI
Factor 1 - confidence in the efficacy of vaccines				
24. Vaccines are important to preserve people's health	**0.975**	0.147	-0.057	0.86
25. Vaccines work.	0.952	0.082	-0.025	
26. When I get a vaccine, I help preserve the health of the people I meet outside my home.	0.942	0.056	-0.033	0.88
30. When I get a vaccine, I help protect my family.	0.892	0.090	-0.053	0.81
1. I believe in the immunization power of the vaccine.	0.860	-0.095	0.036	0.88
14. People should get all the vaccines recommended by health professionals.	0.847	-0.055	0.056	0.85
13. Vaccines protect against disease complications.	0.784	-0.011	0.026	0.77
27. All government-provided vaccines have benefits.	0.770	-0.205	-0.002	0.84
4. I believe in the ability of health professionals to correctly administer vaccines.	0.683	-0.023	0.064	0.69
2. I believe what the health authorities say about vaccines.	0.666	-0.230	0.047	0.76
5. Health professionals are knowledgeable about vaccines.	0.655	-0.157	0.084	0.73
3. I trust the pharmaceutical companies that produce vaccines.	0.648	-0.299	0.061	0.78
31. I obey my doctors and follow their instructions regarding vaccines.	0.583	0.107	0.049	0.52
23. Important people in my life (for example, religious leaders, teachers, health professionals) recommend getting immunized.	0.515	-0.014	0.059	0.52
Factor 2 - fear of negative reactions to vaccines				
32. I am concerned about the negative reactions that vaccines cause in the body.	0.079	0.737	-0.005	0.61
10. The negative reactions caused by vaccines are worrisome.	0.011	0.700	0.070	0.61
28. New vaccines carry more risk than old vaccines.	-0.063	0.565	0.043	0.51
6. The effectiveness of vaccines is low, so they are not worth getting.	-0.318	0.511	0.052	0.57
15. I was already doubtful about whether I should really get the vaccines recommended by the government.	-0.226	0.506	0.103	0.55
Factor 3 - influence of information on vaccination hesitation				
7. The information I receive on social media helps me decide whether to get vaccines	-0.023	0.057	0.797	0.67
9. The information I receive from other people helps me decide whether to get vaccines.	-0.000	0.107	0.729	0.63

Items	Exploratory factor analysis (EFA)			
	F1	F2	F3	DI
8. The information I receive on television helps me decide whether to get vaccines.	0.074	-0.107	0.706	0.59
12. My friends influence my decision to get vaccinated.	-0.098	0.033	0.409	0.35
Explained variance	39%	11%	8%	
Minimum score obtained	4	0	0	
Maximum score obtained	56	20	16	
Mean score (Standard deviation)	46.20 (10.78)	4.89 (4.35)	4.28 (3.47)	

Note: DI= discrimination index

Table 2. ***Comparison of Vaccine Hesitancy Between Sexes and Educational Levels***

Levels of vaccines hesitancy	Men		Women		*t*	*p*	*d*
	M	*DP*	*M*	*DP*			
Confidence in the efficacy of vaccines	44.90	11.74	46.78	10.26	-1.45	0.14	-0.17
Fear of negative reactions to vaccines	5.93	4.88	4.39	3.98	2.91	0.004	0.34
Influence of information on vaccination hesitation	4.13	3.22	4.35	3.60	-0.55	0.58	-0.06
	Basic education		Higher education				
Confidence in the efficacy of vaccines	44.05	11.64	46.94	10.38	-2.17	0.030	-0.26
Fear of negative reactions to vaccines	5.69	4.51	4.60	4.27	2.02	0.004	0.25
Influence of information on vaccination hesitation	4.19	3.47	4.30	3.48	-0.26	0.792	-0.03

People with basic education had significantly less confidence in the efficacy of vaccines and greater fear of negative reactions to vaccines than more educated people did, but the effect size of this difference was small. There were no statistically significant differences in the comparison of vaccine hesitancy according to income.

Multiple linear regression analysis revealed a significant influence of the sociodemographic variables age, religiosity, conservatism and political position on confidence in the efficacy of vaccines (F = 26.02, p < 0.001, adjusted R^2 = 0.24) and fear of negative reactions to vaccines (F = 26.19, p < 0.001, adjusted R^2 = 0.23), but not on the influence of information (F = 2.27, p = 0.06, adjusted R^2 = 0.02). The results presented in Table 3 show that religiosity had no influence on vaccine hesitancy; however, vaccine hesitancy was affected by degree of conservatism and political positioning, as well as by age for confidence in vaccine efficacy.

Personality factors significantly impacted confidence in the efficacy of vaccines (F = 19.6, p < 0.001, adjusted R^2 = 0.23), especially neuroticism, conscientiousness and agreeableness. In terms of the information influence, the impact of personality factors is significant but negligible (F = 2.67, p = 0.02, adjusted R^2 = 0.04). Finally, the impact of personality factors on fear of negative reactions to vaccines was not significant (F = 0.87, p = 0.50, adjusted R^2 = 0.01). Openness to new experiences and extraversion did not significantly affect vaccine hesitancy.

DISCUSSION

In a sample of Brazilian adults self-assessing their vaccine hesitancy, the results were divided into three factors. The first factor, confidence in vaccine efficacy, measures the level of conviction that people have regarding the positive characteristics of vaccines, addressing their importance both as individual and collective protection factors. The lower the score for this factor is, the stronger the vaccine hesitancy. Other psychometric studies have also reported factors such as a lack of confidence and risk (Shapiro et al., 2018); confidence and compliance/risks (Domek et al., 2018); safety and efficacy of vaccines (Huang et al., 2022); and the benefits, efficacy and reliability of the vaccine and the perception of risk or concerns about reactions (Campos et al., 2022).

Considering the importance of the confidence factor in vaccine hesitancy, this factor was expected to be the most complex, with the largest number of items and the highest percentage of explained variance in vaccine hesitancy.

The second factor, fear of negative reactions to vaccines, includes items that assess the level of fear of the possible risks that vaccines may cause in people. This factor addresses the level of concern about the losses and negative effects that vaccines can cause. The proposal by Robinson et al. (2022) represents the fear of vaccine safety and side effects. In this case, the higher the score is, the greater the degree of vaccine hesitancy. Fear of an adverse event after vaccination (Araújo et al., 2021), fear of adverse effects (Rezende et al., 2021), reactions after taking a dose of the vaccine and fear of reactions (Araújo et al., 2023), concern regarding side effects (Paschoalotto et al., 2021) and fear regarding side effects (Machingaidze & Wiysonge, 2021) frequently appear in the literature as reasons for vaccine hesitancy.

Tabela 3. ***Sociodemographic Variables as Predictors of Vaccine Hesitancy***

Sociodemographic variables	Confidence in the efficacy of vaccines			Fear of negative reactions to vaccines			Influence of information on vaccination hesitation		
	β	*t*	*p*	*β*	*t*	*p*	*β*	*T*	*p*
Age	-0.21	-4.09	< 0.001	-0.10	-1.95	0.05	0.04	0.76	0.45
Religiosity	-0.02	-0.42	0.67	0.07	1.37	0.17	-0.02	-0.32	0.75
Conservatism	-0.22	-3.50	< 0.001	0.28	4.51	<0.001	0.16	2.34	0.02
Political positioning	0.22	3.92	<0.001	-0.26	-4.81	< 0.001	0.14	2.30	0.02

Table 4. ***Personality Factors as Predictors of Vaccine Hesitancy***

Personality factors	Confidence in the efficacy of vaccines			Fear of negative reactions to vaccines			Influence of information on vaccination hesitation		
	β	*t*	*p*	*β*	*t*	*p*	*β*	*T*	*p*
Openness	0.02	0.38	0.70	-0.01	-0.14	0.89	0.07	1.19	0.23
Conscientiousness	0.19	2.73	0.007	0.03	0.40	0.69	0.07	0.99	0.32
Agreeableness	0.19	2.73	0.007	0.05	0.67	0.50	0.01	0.11	0.91
Neuroticism	0.28	4.97	<0.001	-0.10	-1.66	0.10	0.13	2.03	0.04

The third factor (information influence on vaccination hesitancy) included items related to passively receiving information from external sources (such as television and social media), rather than actively seeking and checking the information on their own through reliable sources. A higher score on this factor is related to greater hesitancy, as the person does not make the decision whether to vaccinate based on their own search, but rather on information from various sources (which is subject to greater biases). The quality of information to which people have access is an important characteristic of this factor. The active search for information is related to an increase in interest in receiving the vaccine (Araújo et al., 2021). On the other hand, passivity in receiving information may be a factor that increases hesitancy, as the dissemination of false information has led to risky behaviors, which are a barrier to vaccine acceptance (Araújo et al., 2023; Campos et al., 2022).

These results did not confirm the hypothesis that this instrument would be divided according to the 3 Cs (confidence, compliance and convenience). Instead, the instrument was divided into a structure that corresponds more closely to the one proposed by Robinson et al. (2022). These authors proposed that the confidence dimension of the 3 Cs is subdivided into (a) confidence itself, (b) fear of the vaccine safety and side effects and (c) information and need for resources, which corresponds precisely to factors one, two and three obtained in this study. Different studies have indicated that trust is the main factor affecting individuals' hesitancy (Araújo et al., 2021; Araújo et al., 2023; Larson et al., 2015; MacDonald & the SAGE Working Group on Vaccine Hesitancy, 2015; Moore et al., 2021; Sato 2018).

In this study, men feared negative consequences caused by vaccines more than women did, as observed by Moore et al. (2021). This result was contrary to the hypothesis

previously raised by other studies (Mahamid & Veronese, 2022; Oliveira et al., 2021; Pachoalotto et al., 2021; Rezende et al., 2021), which reported that women have a greater prevalence of hesitation. A possible explanation for this difference is that, in evaluating vaccination's pros and cons, men seem to believe that the risks resulting from taking the vaccine would be greater than those of the disease itself. Then, men would rather face the disease than protect themselves from it. In this direction, men commonly seek fewer health, treatment and prevention services than women do (Costa-Junior & Maia, 2009).

The sample's lowest education level was significantly associated with lower confidence in vaccine efficacy and greater fear of negative reactions to vaccines. This result is similar to others who reported a greater likelihood of vaccine hesitancy in people with fewer years of education (Moore et al., 2021; Pachoalotto et al. 2021; Rezende et al., 2021). This result can be explained by the fact that less access to formal knowledge can result in information being misunderstood or more distorted, increasing the likelihood that unscientific knowledge may be propagated, resulting in less confidence and greater fear regarding vaccines.

Another relevant finding that corroborates other studies was that increasing age was associated with lower confidence in vaccines. Various studies have shown that older people have greater vaccine hesitancy (Lee et al., 2017, Macinko et al., 2021, Moore et al., 2021, Oliveira et al., 2021). One hypothesis is that younger people may be better able to verify information they receive via technology, whereas older people are more likely to believe the veracity of information received from unreliable sources. Another hypothesis is the resistance of older people to health care (Areosa et al., 2014), which makes them more hesitant and/or resistant to vaccination. Another possibility is that older people end up receiving little or inadequate information about how a vaccine works, leading them to give less importance to its immunizing effect, in addition to being afraid of adverse effects (Monteles et al., 2017).

Political variables were also relevant for understanding vaccine hesitancy. There was a tendency for people who described themselves as more conservative to trust less in vaccination and have more fear of its adverse effects. Likewise, political position also seems to be an important variable for understanding this phenomenon. In this study, a more left-leaning political stance was associated with greater confidence and lower fear of vaccination. Studies conducted by Dubé et al. (2013) and MacDonald & the SAGE Working Group on Vaccine Hesitancy (2015) corroborated the strong influence of variables such as political ideology on the phenomenon of vaccine hesitancy.

In the Brazilian historical, social and political context at the time this study was conducted, discussions about vaccination, especially related to COVID-19, acquired ideological biases (Seara-Morais et al., 2023). Ineffective treatments such as ivermectin and hydroxychloroquine were consistently supported by far-right politicians. In contrast, politicians on the left consistently spoke in favor of the vaccine, focusing on scientific evidence of vaccines as a means of preventing diseases (Ardnt et al., 2021). Gontijo et al. (2022) reported that people who had more liberal economic values and greater trust in the Brazilian federal government in office in 2020 were less willing to be vaccinated. Paschoalotto et al. (2021) reported greater vaccine hesitancy in people with a right-wing political stance than in those with a left-wing political stance. Seara-Morais et al. (2023) reported that cities with a higher percentage of votes for right-wing politicians had lower vaccination adherence.

Regarding personality variables, higher indices of agreeableness, conscientiousness and neuroticism were associated with greater confidence in vaccine efficacy. Higher levels of agreeableness (such as seen in people described as kind) tend to associate with more altruistic and wanting to protect others; therefore, people with high agreeableness believe that receiving the vaccine is a collective decision and not merely an individual one. In the proposal of the 7 Cs (Geiger et al., 2022), the collective responsibility component seems to be associated with confidence.

Conscientious individuals are more focused on responsibility and problem solving, which makes these individuals more practical and less hesitant to get the available vaccines to solve the problem immediately. Finally, people with greater neuroticism are more concerned with danger and wanting to protect themselves and are therefore less hesitant to get the vaccine, which can offer protection. In the 7 CS, this factor would be linked to the calculation component, in which individuals weigh the costs and benefits that vaccination can bring at a personal level. In this case, for someone with high levels of neuroticism, the cost of getting vaccinated would be lower than that of becoming sick.

Previous studies corroborated the association between higher levels of agreeableness (Gonçalves et al., 2022; Gupta et al., 2023; Lin & Wang, 2020; Murphy et al., 2021) and conscientiousness (Lin & Wang, 2020; Murphy et al., 2021; Panish et al., 2023) and the lowest degree of vaccine hesitancy. On the other hand, previous study results on neuroticism are contradictory; some studies have reported the opposite trend to that of our study, showing that the greater neuroticism is, the greater the degree of vaccine hesitancy (Halstead et al., 2022; Murphy et al., 2021).

The results presented here may contribute to intervention strategies aimed at the most hesitant groups. Notably, although the items of the scale and the data collection protocol did not specifically assess hesitancy regarding the COVID-19 vaccine, the responses were likely strongly influenced by this discussion since the study was conducted

during the COVID-19 pandemic period, when vaccination was widely debated in various sectors of society. Future studies may replicate this research at a time when discussions about COVID-19 vaccines are waning. Future studies may also focus on people who choose not to receive vaccines to obtain a more accurate portrait of this group and investigate the prevalent demographic and personality factors. Finally, considering that vaccine hesitancy is contextual, it is recommended that research on this subject be conducted often to capture precise information and identify possible changes in the scenario over time.

AUTHOR'S CONTRIBUTIONS

We certify that all authors contributed sufficiently for writing this paper, so that their responsability for its contest may be publicized. All authors contributed with managing the Research Project, data tabulation and analysis, researching and writing, as well as reviewing the manuscript.

CONFLICT OF INTERESTS' DECLARATION

The authors declare that they do not have any conflict of interest regarding this paper's content.

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