

Do gender and educational level predict vaccination? The mediating role of attitudes towards vaccines and fear of COVID-19

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Abstract

Given that the relationship between educational level, gender, and the fact of getting vaccinated does not seem to be clear, the aim of this research has been to verify if the beliefs towards vaccines and the fear of COVID-19 are mediating this relationship in a general Spanish sample of 761 participants. A logistic regression with latent variables was estimated using Mplus. The results showed that there is no direct effect of gender or educational level on vaccination but both, fear of COVID-19 and attitudes towards vaccines, act as mediators. Specifically, people with university studies show higher scores in trust of vaccine benefits, which in turn is a good predictor of getting vaccinated or not. So that having university studies and confidence in vaccines better predict getting vaccinated. Furthermore, being a woman with high levels of fear of COVID-19, as well as having up to higher education and showing high levels of fear of COVID-19, better predict getting vaccinated. However, this is a non-probabilistic sample, and similar studies should be carried out with a representative sample of the Spanish population and of another countries, in which the rate of people vaccinated against other viruses is declining. This study reports the importance of a model including mediating variables when analyzing the influence of sociodemographic

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variables on deciding to get vaccinated or not, because this kind of model allow the detection of specific groups with low probability of vaccination, which would allow the design of specific strategies.

KEYWORDS

attitudes towards vaccines, coronavirus, educational level, gender, logistic regression, structural equation modeling, vaccine hesitancy

1 | INTRODUCTION

Although the efficacy of vaccines in reducing mortality from various vaccine-preventable diseases has been proven, vaccination rates have been declining in many areas of the world in recent years. These data were already known before the COVID-19 pandemic (Kennedy, 2020). This situation has given rise to the reappearance of diseases that had been controlled, and even eradicated, such as pertussis and measles (Atwell & Salmon, 2014; Jansen et al., 2003). In Spain, until January 2023, the percentage of people who have received the full schedule of the COVID-19 vaccine is 92.6% (Health Ministry of Spain, 2023). However, hesitancy before vaccination against various diseases is an emerging public health problem in Spain. This problem has slowed the elimination process of measles and other diseases, and outbreaks are starting to appear (Masa-Calles & López-Perea, 2019; Moraga-Llop, 2020; Siciliani et al., 2020).

The decision to be vaccinated is influenced by the sociocultural context of the country where the vaccination is carried out (Dubé et al., 2014). A systematic review of different investigations found that people with higher educational level showed more vaccine hesitancy (Larson et al., 2014). However, in another study conducted with data from 24 countries, this relationship between educational level and vaccine hesitancy was not found (de Figueiredo et al., 2020). In another studies it was observed that both women and people with a low educational level had more doubts regarding the vaccine against COVID-19 (Morales et al., 2022; Sypsa et al., 2022). In the same way, in another study conducted with a representative sample in Italy, a lower level of education and lower income were predictors of vaccine hesitancy (Reno et al., 2021). Also in a study carried out with a sample from Malta, it was found that women showed more reluctance to get vaccinated (Cordina et al., 2021). However, in a study carried out with a Colombian sample (Espejo, Martín-Carbonell, et al., 2022) it was observed that there were no differences between men and women in their attitudes towards vaccination. That is, the evidence about the influence of gender and educational level on vaccine hesitancy is not clear. And this information is different depending on the country.

On the other hand, it has also been observed in different studies that women suffered a greater fear of COVID-19 when the coronavirus appeared, since they showed higher levels of stress and anxiety (Broche-Pérez et al., 2022; Espejo & Checa, 2021; Rossi et al., 2020), and this stress and anxiety influence their decision to get vaccinated. Furthermore, in a meta-analysis carried out to analyze the relationship of gender with fear and anxiety in the face of COVID-19, the results revealed that women showed higher levels of fear and anxiety towards COVID-19 (Cerdeira & García, 2022; Metin et al., 2022). Likewise, people with a higher educational level and more information about the coronavirus showed less fear of COVID-19 (Cerdeira & García, 2022). Similarly, another study found that fear of COVID-19 played a small and significant role in the intention of Slovenian post-secondary students to get vaccinated against COVID-19 (Šorgo et al., 2022).

Thus, the relationship between educational level, gender, and the fact of getting vaccinated does not seem to be clear. However, these studies have evaluated the direct effect of these variables, and perhaps the effect of certain demographic variables on hesitancy regarding vaccination is not a direct effect. And maybe this is the reason why the results are mixed and inconclusive, although the direct effect of the fear of COVID-19 is clearly understandable and expected. For this reason, the aim of this research is to assess whether the beliefs towards vaccines and the fear of COVID-19 are mediating the relationship between the sociodemographic variables and the fact of being vaccinated.

2 | METHOD

2.1 | Procedure

Data was collected online with the LimeSurvey software in two phases: between 15 November 2021 and 7 March 2022 ($n = 572$), and between 1 December 2022 and 6 February 2023 ($n = 189$). The survey was anonymous and voluntary. The link was sent via email to personal contacts and distributed on social networks, following the snowball process. Before starting the survey, participants had to accept informed consent to begin responding. The study was conducted in compliance with Spanish legislation (Ley Orgánica 3/2018, 5 December) and the code of ethics for research involving human subjects, as outlined by the Universitat de València Human Research Ethics Committee (ACGUV194/2006).

2.2 | Participants

The sample is composed of 761 participants. The average age is 31.34 years ($SD = 13.28$), ranging from 18 to 76 years, 68.3% were women and 30.6% men. In addition, five people identified themselves with another gender (0.7%), and three preferred not to answer (0.4%). Half of the participants were full-time students, or students with temporary or part-time jobs (50.1%), 39.3% were full-time workers, 5.1% were unemployed people looking for a job, and 2.4% were unemployed without looking for a job and 3.2% were retired. Half of the participants were single (52.8%), 42.6% were married or living with a partner, 3.4% were divorced, and 1.2% were widowed. Regarding the educational level, 6.4% have only primary studies or less, 4.6% have compulsory secondary studies, 47.4% have completed high school level, 32.2% have completed a university degree and 9.3% have a postgraduate or doctorate degree. Regarding the vaccination process against Covid-19, 89% of the sample declared having received the coronavirus vaccine, 3.4% did not receive the vaccine, and 7.6% did not answer. The dataset analyzed during the current study is available in the Zenodo repository (Espejo & Checa, 2023).

2.3 | Variables and instruments

Vaccination Attitudes Examination (VAX) Scale (Martin & Petrie, 2017). It is a 12-item questionnaire created to better understand general vaccination attitudes, which are answered using a 5-point Likert-type scale, ranging from 1-Strongly disagree to 5-Strongly agree. This scale evaluates four factors: trust of vaccine benefit (items 1–3), worries about unforeseen future effects (items 4–6), concerns about commercial profiteering (items 7–9), and preference for natural immunity (items 10–12). The advantage of this scale is that it does not assess attitudes towards a specific vaccine, although in this study it has been used in the context of vaccination against COVID-19. The Spanish version has been used (Espejo, Checa, & Martín-Carbonell, 2022).

Fear of COVID-19 Scale (Ahorsu et al., 2020). This is a one-factor scale composed of 7 items used to measure people's fear of COVID-19. The items are answered using a 7-point Likert-type scale, ranging from 1-Totally disagree to 5-Totally agree. The Spanish version has been used (Espejo & Checa, 2021).

2.4 | Data analysis

A logistic regression has been calculated to predict whether the participants had been vaccinated or not using a structural equation model. The reason is that we have used the latent variables to predict the dichotomous outcome variable (Vaccination yes or no).

Given the small number of non-binary individuals in the sample, only two categories have been considered for the variable Gender (male/female). Regarding the educational level, since most of the sample was concentrated in two categories, two groups were established to include it in the analysis (up to higher education/with university studies). In the model (see Figure 1) gender (male/female) and educational level (up to higher education/with university studies), have been considered as direct predictors of the outcome variable. In addition, five latent mediating variables have been considered between the sociodemographic variables and the outcome variable: fear of COVID-19 and the four factors that assess attitudes toward vaccines.

In addition to the estimation of the regression parameters, all the odds ratio were also obtained. Furthermore, this logistic regression model with latent variables offers the estimation of the location parameter for the outcome variable (the b parameter for the Rasch model), which reports the minimum level of the trait above which a person is most likely to be vaccinated. The logistic regression was estimated with Mplus 8.8 (Muthén & Muthén, 2017) using the Maximum Likelihood Robust estimator (MLR), and for the description of the sociodemographic variables IBM SPSS 28. The Mplus input for the logistic regression is available as Supplementary Material (see Supporting information Data S1).

3 | RESULTS

In Figure 1 is shown the standardized solution for the estimated model. Item factor loadings on each of the VAX factors and on the Fear of COVID-19 questionnaire factor were all statistically significant ($p < 0.001$). As can be seen in Figure 1, there are not direct statistically significant effects of educational level or gender on getting vaccinated or not (odds ratio 0.862, $SE = 0.515$, and 0.573, $SE = 0.330$, respectively). On the other hand, the educational level

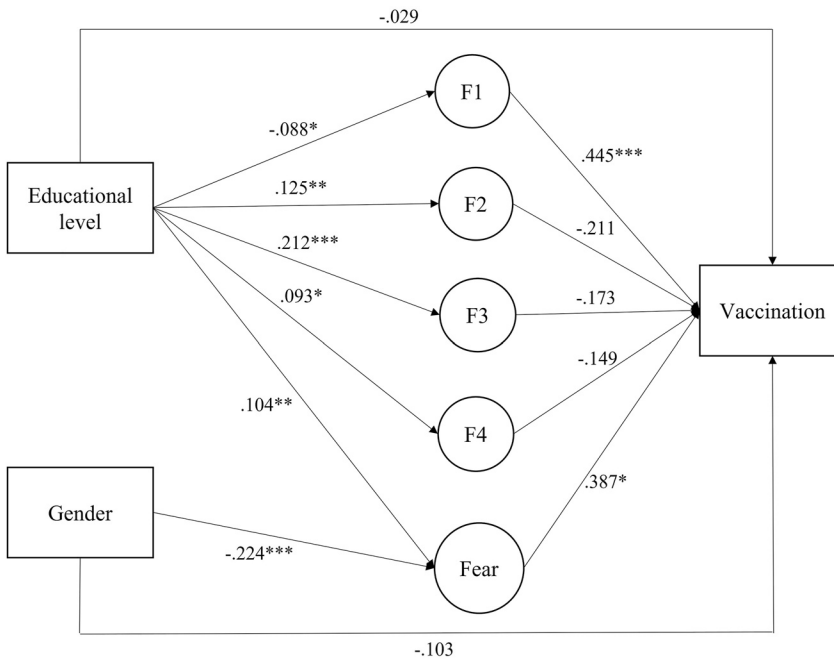


FIGURE 1 Standardized coefficients for the model. Reference group for Vaccine: Yes. Reference group for Gender: Male. Reference group for Educational level: Up to higher education. F1 = Trust of vaccine benefit; F2 = Worries over unforeseen future effects; F3 = Concerns about commercial profiteering; F4 = Preference for natural immunity; Fear = Fear of COVID-19. For clarity, the items of the questionnaires have been removed from the figure and only the latent variables are shown * $p < 0.05$; ** $p < 0.009$; *** $p < 0.001$.

significantly influences the four factors related to beliefs towards vaccines. Specifically, people with university studies show higher scores in Factor 1 (trust of vaccine benefits), while people with up to higher education show higher scores in the other three factors. However, only the first factor is a good predictor of getting vaccinated or not, so that having university studies and greater confidence in vaccines better predict getting vaccinated. Likewise, fear of COVID-19 acts as a mediator variable between both sociodemographic variables and getting vaccinated or not. Therefore, being a woman with high levels of fear of COVID-19, as well as having up to higher education and showing high levels of fear of COVID-19, better predict getting vaccinated. On the other hand, people with a higher educational level (university studies) and higher confidence in vaccines, are more likely to get vaccinated.

The odds ratio for the four factors of the VAX are 3.682 ($SE = 1.049$), 0.386 ($SE = 0.271$), 0.562 ($SE = 0.248$), and 0.563 ($SE = 0.282$), respectively, and for Fear of COVID-19 is 3.637 ($SE = 2.277$). On the other hand, the estimated value of b for the Vaccination variable is -2.352 ($p < 0.001$). This means that only people below this very low level of the trait decide not to get vaccinated in this sample, and above this level on the trait, people are more likely to be vaccinated.

4 | DISCUSSION

The aim of this study has been to verify if attitudes towards vaccines and fear of COVID-19 acted as mediators between two sociodemographic variables (gender and educational level) and getting vaccinated against COVID-19 or not. A logistic regression with latent variables has been carried out to predict vaccination in order to study not only the direct effects of gender and educational level on vaccination against the COVID-19, but the mediating effects of the attitudes towards vaccines and the fear of coronavirus.

The results show that neither gender (as expected) nor educational level are direct predictors of getting vaccinated, as has been seen in some previous studies. Regarding gender, these results are similar to the results obtained in other studies (Cordina et al., 2021; Espejo, Martín-Carbonell, et al., 2022) in which there were no differences between men and women in their attitudes towards vaccination. Regarding educational level, in some studies it seems that educational level is not a direct predictor of getting vaccinated or not (de Figueiredo et al., 2020), but in some studies low educational levels are direct predictors of vaccine hesitancy (Cordina et al., 2021; Morales et al., 2022; Reno et al., 2021; Sypsa et al., 2022).

However, the most interesting results of this study, and that provide more information, are the paths related to the mediating variables that predict getting vaccinated or not. On the one hand, being a woman with high levels of fear of COVID-19 better predicts getting vaccinated. On the other hand, having up to higher education and high levels of fear of COVID-19, better predict getting vaccinated. Therefore, if in this sample women with high scores on fear of coronavirus are more likely to get vaccinated, it is women with low fear of coronavirus and men who would be less likely to get vaccinated.

Regarding the attitudes towards vaccines, people with a higher educational level (university studies) and higher confidence in vaccines, are more likely to get vaccinated. On the other hand, although a lower educational level (up to higher education) is a predictor of having high scores in the other factors related to attitudes towards vaccines (worries about unforeseen future effects, concerns about commercial profiteering, and preference for natural immunity), these factors are not determinants to predict vaccination.

Following these results, people with a lower educational level (up to higher education), and who show little confidence in vaccines, are the people who are less likely to get vaccinated, and to whom specific campaigns should be directed. It is true that this result may be due to the characteristics of this sample, in which more than 90% of the participants have been vaccinated. Possibly, although among the sample participants there are doubts about vaccines or fear of side effects, confidence in vaccines is a better predictor of vaccination.

Therefore, this study reports the importance of taking into account the influence of certain mediating variables (i.e., attitudes towards vaccines) when analyzing the influence of sociodemographic variables on deciding to get

vaccinated or not. Considering the mediating effect of attitudes towards vaccines may allow the detection of specific groups with a low probability of vaccination, which would allow the design of specific strategies for those groups.

However, some limitations must be considered with this study. It must be remembered that this sample is not probabilistic. So, causal inferences are difficult to conclude with these data. On the other hand, the high vaccination rate in Spain (and in this sample) could have affected the ability to explain variation in the outcome, as it was mentioned before. In addition, it is important to consider the moment in which the biggest part of the data was collected (since the pandemic situation has caused significant fear of the coronavirus), and this fear has been a clear predictor of getting vaccinated, as has been observed in other studies. Perhaps attitudes towards vaccines, once the pandemic is over, can change in some people, who perhaps only got vaccinated against COVID-19 because of the fear they felt towards the coronavirus. However, these same people could show unfavorable attitudes towards vaccines if they already had them before, since other diseases are now practically invisible in Western society, so the perceived risk is lower. This perceived low risk could influence the decision not to be vaccinated against other viruses, or it could influence the decision to vaccinate their sons and daughters, as is currently happening in some countries. Therefore, similar studies should be conducted in other countries with different vaccination rates against COVID-19, and against another virus.

Maybe the effects of certain demographic variables as predictors of vaccination should be considered not as direct effects but, in any case, mediated by other variables, especially attitudes towards vaccines, since the state of alarm for the coronavirus pandemic has ended. Attitudes towards vaccines in general are probably what determine vaccination. There are countries in which vaccination against other viruses is decreasing, so certain diseases considered extinct are reappearing (also slightly in Spain). For this reason, it would be convenient to carry out studies of this type in the future, so that the attitudes towards vaccines that are most relevant for predicting vaccination among the population could be determined in each country. In addition, models of this type would also make it possible to determine if these attitudes are the same in different groups of people, depending on gender, educational level, or some other demographic variables considered of interest, and that could be different depending on the country or the characteristics of the population. Knowing the characteristics of the groups that are most reluctant to vaccination would allow governments to carry out specific campaigns aimed at these specific population groups, and therefore a higher success rate on vaccination could be expected.

AUTHORS CONTRIBUTIONS

Begoña Espejo and Irene Checa: conceptualization, methodology, formal analysis, data curation, writing—original draft, writing—review and editing. Both authors read and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

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 manuscript.

DATA AVAILABILITY STATEMENT

The datasets analyzed during the current study are available in the Zenodo repository (<https://doi.org/10.5281/zenodo.7639235>).

ETHICS STATEMENT

The study was approved by the ethics committee of the Universitat de València Human Research Ethics Committee (ACGUV194/2006) and was conducted in compliance with recognized international standards, including the

principles of the Declaration of Helsinki. All the participants provided informed consent. All procedures were performed in accordance with relevant guidelines.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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