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Attitudes towards COVID-19 vaccine in Spain: correlational and configurational analyses

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ABSTRACT

This study explains attitude towards vaccination against COVID-19. It evaluates four cognitive, affective and normative (CAN) factors: fear of COVID-19 (FCOVID), fear of the vaccine (FVACC), efficacy (EFFICACY), and social influence (SOCINF) and three sociodemographic variables: gender, age, and income level. Ordered logistic regression showed a significant positive influence of FCOVID, EFFICACY and SOCINF and a negative impact of FVACC and income level (INCOME). Configurational analysis allowed observing that all evaluated factors are relevant for explaining the attitude towards vaccination and that the sign of the relationship in configurations between CAN factors and attitude is positive for FCOVID, EFFICACY and SOCINF and negative for FVACC. These variables symmetrically impact on willingness and unwillingness to use the vaccine. INCOME and regarding gender (GENDER) impact asymmetrically to induce acceptance and resistance to vaccination. The results in our paper have clear practical implications. Correlational analysis discovers the average strength of assessed factors on vaccine acceptation and so identifying the most relevant variables. On the other hand, configurational analysis identifies how factors combine to shape profiles of persons with willingness and unwillingness to get vaccinated. These last profiles are of special concern for health policy-makers since their resistance diminishes the effectivity of collective vaccination.

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1. INTRODUCTION

Given the relevance of vaccines in controlling the consequences of COVID-19, identifying the variables that determine vaccine acceptance and quantifying their impact is important for developing an effective health policy [1]. This explains the wide literature on this topic since 2019 [2]. The first group of variables usually addressed in the literature is linked to vaccine perception, perception of the severity of COVID-19, and social influence on vaccination [2]. This type of variable is modelled in our paper by using the analytical ground in [3], which has been applied in the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) vaccination context [4]. Moreover, we assessed sociodemographic factors that are commonly assessed [4].

Despite the wide literature on the acceptance of COVID-19 vaccines (and, in general, any vaccine), to the best of our knowledge, quantitative analysis is usually performed using conventional statistical methodologies, like regression. Therefore, these studies report the strength and significance of assessed factors to explain willingness to be vaccinated, but neither provide information about how factors interact to

produce acceptance and resistance nor inform about consistent profiles of accepters and rejecters. Notice that the decision about getting or not getting the vaccine is made by different persons by combining not in the same manner as input factors.

To solve this gap, this study proposes using of fuzzy set qualitative comparative analysis (fsQCA) [5] to give a complementary perspective to conclusions from ordered logistic regression (OLR). It should be noted that the use of fsQCA for medical prediction and explanation is not new [6]. For example, fsQCA has been applied to determine distinctive taxonomy of equally effective configurations of urban actions in blocking COVID-19 [7]. OLR and fsQCA are complementary rather than competitive. Whereas regression methods quantify the mean influence of explanatory factors on the explained variable, fsQCA discovers combinations of independent variables (in our study, factors linked to willingness to be vaccinated) that may produce a given output in such a way that allows stating profiles of people with a tendency to accept and reject the output variable [7], that in this case is being vaccinated. Thus, fsQCA does not estimates a coefficient measuring the effect of the input factors over the outcome, but displays several modes in which explanatory factors interact to produce a response [5]. Moreover, fsQCA does not suppose symmetrical relations between factors [8].

2. COMPREHENSIVE THEORETICAL BACKGROUND

The theoretical ground [3] allows the identification of three types of factors to explain the attitude towards the SARS-COV-2 vaccine: cognitive, affective, and normative (CAN) variables [4]. Affective variables are fear of COVID-19 disease (FCOVID) and fear of vaccine (FVACC); cognitive factors are perceived efficacy (EFFICACY) and normative variables are social influence (SOCINF). The use of this group of variables is based on a meta-analysis [4] that outlines as relevant to explaining attitude towards vaccination those linked with vaccine perception, beliefs towards COVID-19, and informants about the illness and the vaccines.

Several studies have shown that perceiving COVID-19 as a potentially serious illness stimulates willingness and reduces hesitancy [4], [9]–[12]. Therefore, FCOVID is a relevant factor in explaining vaccine acceptance. However, many people perceive that any vaccine could be risky due to its potential side effects. Consequently, fear stimulates hesitancy in receiving it. Therefore, FCOVID is usually reported as a significant variable to explain unwillingness in COVID-19 vaccination setting [4], [12]–[16]. Similarly, the efficacy of any vaccine is an important factor that motivates its acceptance [2]. In the SARS-CoV-2 setting, the relevance of EFFICACY has been proven in different collectives and countries [4], [12], [14]–[18].

As long as people belong to social groups, the opinions of other members of the group about a product can encourage or discourage its consumption [3]. It can also be extended to any vaccine [19] and vaccines against SARS-CoV-2 [4], [18]–[20]. The opinion by health professionals and authorities may have a great positive influence on people's willingness to get vaccinated, which can also be extended to SARS-COV-2 [4]. A positive attitude towards vaccination is also linked to trust in the government [18]–[21]. However, misinformation [22] and the spread of conspiracy theories [15] have a relevant negative effect on the attitude towards the vaccine.

Along with CAN variables, we consider three control factors that are sociodemographic variables and very common in studies, such as ours: gender, age, and income level [2]. Regarding gender (GENDER), mainstream findings show that being female (male) could be significantly linked with hesitancy (acceptance) [10], [13], [14], [23], [24]. However, it must be noted that there are a significant number of reports that do not find a significant link between gender and attitude towards vaccination and even a positive relationship between acceptance and being female [2], [9], [16], especially in the case of pregnant females [25]. Age (AGE) is usually a relevant variable for explaining attitudes towards COVID-19 vaccines [2]. However, no clear patterns were observed in these reports. Several studies reported a positive linkage of age and intention to be vaccinated [9], [23], [24]. It is reasonable to argue that the risk of severe disease and death increases with age. However, there are also papers outlining that age is negatively linked with the intention to be vaccinated [10], [13], [16]. Likewise, there also exists a set of findings showing that middle-aged people are reluctant to get vaccinated is placed in medium-aged persons [14], [21]. Moreover, some studies have tested the influence of income level (INCOME) on intention to get vaccinated vaccination. Many reports have found a positive link between INCOME and the intention to be vaccinated [9], [10], [14], [21], [23].

3. RESEARCH METHOD

3.1. Materials

This study analysed an online self-administered survey implemented using Google Forms. Initially, 2,148 residents in Spain were contacted by e-mail between September 9th and September 16th, 2020. The sample was stratified as follows. First, we established quotes by age (33% of answers from people between 18 and 30 years old, 33% of respondents between 31 and 50 years old, and 34% over 50 years old). After

accomplishing age quotes, we considered as secondary objectives parity between males and females and balancing the responses from people whose income is above and under €2,500€. The minimum number of observations to conduct the study was established for 150 responses.

All questions were responded within an 11-point Likert scale (0 to 10) and are shown in Table 1. Regarding the output, intention to be vaccinated (IVAC), the questions were focused on the vaccine developed by AstraZeneca that, in accordance with news in September 2020, was the most advanced in time. Therefore, the survey was introduced in the following manner: "*Imagine that the COVID-19 vaccine that is currently being developed by the University of Oxford and AstraZeneca is the first vaccine to be approved by European Union health authority after the adverse effects have been addressed. Please, answer the following questions…*". The question for the output was "*I will intend to use the Oxford-AstraZeneca vaccine against COVID-19*". The scales used to measure perceived efficacy, fear of being infected by COVID-19, FVACC, and SOCINF are described in Table 1.

Table 1. Output and input questions of CAN model

Construct	Items
Input variable	
IVAC	IVAC1. I intend to get vaccinated (with AstraZeneca vaccine)
Output (CAN) variables	
Fear to COVID-19 [6]	FCOVID1. I am concerned about getting COVID-19
	FCOVID2. I am concerned about spreading COVID-19
Fear to vaccines [6]	FVACC1. I am concerned of the temporary secondary reaction by AstraZeneca vaccine
	FVACC2. I am concerned of the permanent secondary effect by AstraZeneca vaccine
Perceived efficacy [6]	EFFICACY1. I am sure about the efficacy of AstraZeneca vaccine
	EFFICACY2. AstraZeneca protects against COVID-19
	EFFICACY3. With AstraZeneca vaccine, reduces chances of being infected with COVID-19
	EFFICACY4. AstraZeneca vaccine prevents the need for other treatments against COVID-19
Social influence [5]	SOCINF1. People important for me believe that I have to be vaccinated with AstraZeneca vaccine
	SOCINF2. People who influence me believe that I have to use the AstraZeneca vaccine
	SOCINF3. Persons whose opinions are value feel that AstraZeneca vaccine must be used

3.2. Ethical statement

All participants provided detailed written information about the study and its procedures. No data directly or indirectly related to the subjects' health were collected; thus, the Declaration of Helsinki was not mentioned when the subjects were informed. Anonymity of the collected data was ensured at all times. No permission was obtained from a board or committee ethics approval; it was not required as per the applicable institutional and national guidelines and regulations. Voluntary completion of the questionnaire was considered as consent for the data to be used in the research, and informed consent of the participants was obtained through survey completion.

3.3. Quantitative methods

To implement OLR we follow the following steps. Firstly, we measured the reliability of the EFFICACY, FCOVID, FVACC, and SOCINF scales employing usual measures such a as Cronbach's alpha or convergent reliability. We run also factor analysis. Subsequently we define input variables in such a way that for CAN variables, we considered their standardized loadings from factor analysis and for GENDER, we take a dummy variable that took 1 when the observation comes from a female and 0 if it comes from a male. To measure AGE, we put into [0.1] the years of respondents:

$$AGE(x) = \begin{cases} 0 & x \leq 40\ years \\ \frac{x-40}{25} & 40 < x \leq 65\ years \\ 1 & otherwise \end{cases} \quad (1)$$

where x is the age (in years). Finally, to measure income level (INCOME), we transform the income categories in (1) into a value within [0,1] as follows:

$$INCOME(y) = \begin{cases} 1 & y \geq €3000 \\ 0.8 & €2500 \geq y > €3000 \\ 0.5 & €1750 \geq y > €2500 \\ 0.2 & €1000 \geq y > €1750 \\ 0 & otherwise \end{cases} \quad (2)$$

being y is the monthly income. We finally fitted with OLR the output question to the input variables.

To apply fuzzy set comparative qualitative analysis (fsQCA) we follow the steps in [8]. We firstly validate psychometric scales. Notice that it was already done when implementing correlational analysis. Subsequently we built membership functions for all variables. For GENDER, AGE, and INCOME, we consider their definitions to fit IVAC with OLR. In the other cases, as usual, we used the function "calibrate" in fsQCA 3.1 software [26]. For the explained variable, which was evaluated on an 11-level Likert scale, we fixed the required thresholds at 2, 5, and 8. In the case of EFFICACY, FCOVID, FVACC, and SOCINF, we state these thresholds at the 5, 50, and 95% percentiles of the factor loadings.

After defining all variables as membership functions, we apply fsQCA with fsQCA 3.1 program. If we symbolize the negation of a variable as "~", we independently adjust the Boolean functions:

$$IVAC = f(FCOVID, FVACC, EFFICACY, SOCINF, GENDER, AGE, INCOME) \quad (3)$$

$$\sim IVAC = f(FCOVID, FVACC, EFFICACY, SOCINF, GENDER, AGE, INCOME) \quad (4)$$

Notice that IVAC fits the intention of being vaccinated and ~IVAC resistance. It is done with Quine-McCluskey algorithm that finds so-called configurations/recipes/prime implicates and whose union is known as complex solution (CS). This solution is often hard to understand because it is adjusted without any assumption apart to data. In fsQCA setting beside CS we have the parsimonious solution (PS) which is fitted also by using Quine-McCluskey algorithm and any hypothesis on non-observed combination of variables that will allow to estimating the simplest solution. Minimization process finishes after fitting the intermediate solution (IS). It is fitted by supposing for non-observed configurations if an input variable contributes to output exclusively when it is present, absent, or does not matter with the help of theoretical-founded statements [5], [8].

Measures of consistency (cons) and coverage (cov) quantifies explanatory capability of prime implicates. Consistency indicates the membership degree of a prime implicate in the output set and is equivalent to a measure of significance in econometrics [27]. It is widely accepted that a recipe with cons >0.75 could be considered a sufficient condition. Coverage quantifies the part of outcome set covered by a configuration. So, it can be interpreted in a similar manner to R^2. Finally, to assess the impact of explanatory factors and their combinations on the willingness and non-willingness to be vaccinated we must interpret the solutions of fsQCA. In this regard, the most common procedure mixes IS and PS to state core and peripheral conditions [8].

4. RESULTS

The number of collected responses that fulfilled all items was 672 (i.e., we attained a success rate of 31.28%); however, after taking into account age quotes, we used only 600 observations. Attaining age quotes was the main criterion for stratifying the sample. Nevertheless, we were clearly above the minimum required sample size. The mean age of respondents was 41.97 years, with a standard deviation 15.52 years. Similarly, 45% of the respondents were men (53%). Income quotes were also approximately met since 48.6% of surveyed persons reported a monthly income under €2,500 (i.e., 51.4% declared an income ≥ €2,500). Table 2 presents answers descriptive statistics. Similarly, Table 2 also shows that all constructs have a Cronbach's alpha and composite reliability >0.7, and an average variance extracted >0.5. Factor analysis loaded a significant proportion of the variance (loadings >0.7). Thus, FCOVID, FVACC, EFFICACY, and SOCINF have internal consistency.

Table 2. Descriptive statistics of output and CAN variables and scale validation of CAN variables

	Mean	SD	Factor loading	Cronbach alpha	Composite reliability	Average variance extracted
IVAC	5.07	3.48				
FCOVID1	6.60	2.72	0.889	0.734	0.883	0.799
FCOVID2	7.86	2.74	0.889			
FVACC1	6.75	3.02	0.962	0.92	0.961	0.926
FVACC2	7.23	3.04	0.962			
EFFICACY1	4.93	2.81	0.920	0.933	0.953	0.836
EFFICACY2	5.31	2.80	0.950			
EFFICACY3	5.95	2.97	0.935			
EFFICACY4	4.89	2.94	0.849			
SOCINF1	4.85	2.95	0.964	0.971	0.981	0.945
SOCINF 2	4.64	2.95	0.979			
SOCINF 3	4.68	3.03	0.974			

Note: SD represents the standard deviation

Table 3 presents estimates by OLR. It was significant (pseudo R^2=25.80%, LR statistic=709.24, p<0.001). We adjusted for a significant odds ratio (OR) of >1 for EFFICACY (OR=3.013, p<0.001), FCOVID (OR=1.276, p<0.001), and SOCINF (OR=1.992, p<0.001). We also fit a negative link between IVAC and both FVACC (OR=0.725, p<0.001) and INCOME (OR=0.709, p=0.005). Finally, we have found that AGE (OR=0.988, p=0.9337) and GENDER (OR=0.971, p=0.7608) were not relevant.

Table 3. Results of ordered logit regression

Variable	Marginal effect	Odd ratio	p-value
FCOVID	0.243	1.276	<0.001
FVACC	-0.321	0.725	<0.001
EFFICACY	1.103	3.013	<0.001
SOCINF	0.689	1.992	<0.001
GENDER	-0.029	0.971	0.7608
AGE	-0.012	0.988	0.9337
INCOME	-0.344	0.709	0.005

Note: Pseudo R^2 = 25.80%, LR statistic = 709.24 (p<0.001)

Table 4 displays the results of the configuration assessment for vaccine acceptance (IVAC). Thus, consistency and coverage measures suggest that the combination of the proposed explanatory variables works fairly well to explain IVAC (cons>0.85 and cov>0.70). Likewise, all the factors are core conditions in several prime implications. However, recipes with a greater cov (>0.5) were built exclusively by CAN constructs. We can verify that the more relevant variables to explain IVAC are SOCINF (which is present as a core condition in seven recipes) and EFFICACY (they belong to six recipes). Note that the presence of CAN variables in the recipes explaining IVAC reveals a consistent positive (negative) relationship between IVAC and FCOVID, EFFICACY, and SOCINF (FVACC). Similarly, INCOME has a consistently negative relationship with IVAC. It is negated in three recipes where it is a core condition. We can also confirm that the effect of gender and age on IVAC induction is not univocal.

Table 4. fsQCA I of IVAC and ~IVAC

	Recipe	1	2	3	4	5	6	7	8	9
~IVAC=f (FCOVID, FVACC, EFFICACY, SOCINF, GENDER, AGE, INCOME)	FCOVID		•	•	•				•	•
	FVACC	⊗		⊗	⊗		⊗	⊗		
	EFFICACY	•		•		•	•	•	•	
	SOCINF	•	•		•	•	•		•	•
	GENDER			•		⊗	⊗	•	•	⊗
	AGE				⊗		•	⊗	⊗	•
	INCOME					⊗		⊗	⊗	⊗
	cons	0.902	0.880	0.886	0.877	0.878	0.879	0.872	0.865	0.865
	cov	0.517	0.591	0.225	0.375	0.184	0.182	0.181	0.209	0.082
	Cons of IS	0.720								
	Cov of IS	0.854								

	Recipe	1	2	3	4	5	6
~IVAC=f (FCOVID, FVACC, EFFICACY, SOCINF, GENDER, AGE, INCOME)	FCOVID	⊗		⊗	⊗	⊗	⊗
	FVACC	•	•	•			
	EFFICACY	⊗	⊗		⊗	⊗	⊗
	SOCINF	⊗	⊗	⊗	⊗	⊗	⊗
	GENDER		•	•	•	•	⊗
	AGE			⊗	•		⊗
	INCOME					•	⊗
	cons	0.867	0.874	0.858	0.898	0.865	0.838
	cov	0.430	0.367	0.219	0.112	0.173	0.124
	Cons of IS	0.847					
	Cov of IS	0.619					

Note: A large circle (•) indicates the presence of a condition and circles with x (⊗) indicate their absence. Large circles indicate core conditions, small circles indicate peripheral conditions, and blank spaces indicate the "don't care" condition

The results of the configuration analysis of unwillingness to receive vaccination are displayed in Table 4. Consistency and coverage measures indicate that the combination of the assessed factors provides a good explanation of ~IVAC (cons=0.85 and cov>0.6). All recipes present great cons (>0.85), but there is no prime implication with cov>0.5. Two greater coverages come from the first and second recipes (=0.43 and =0.367, respectively). The variables with greater explanatory power are SOCINF, EFFICACY, and FCOVID

(they are absent in six, five, and five of the six recipes, respectively), and GENDER (which is a core condition in five prime implicates). Similarly, the presence of CAN factors in the recipes explaining ~IVAC revealed a consistent positive (negative) influence of FCOVID, EFFICACY, and SOCINF (FVACC) on IVAC. It can also be seen that being female seems to be an enabler of resistance to vaccination since it is a core condition in 4 over 5 configurations in Table 4.

5. DISCUSSION

The ordered logistic regression (OLR) model provided a good adjustment for the intention to get vaccinated with the AstraZeneca vaccine (IVAC) (pseudo R^2>25%). All Cognitive-Affective-Normative (CAN) variables, fear of SARS-COV-2 (FCOVID), fear of the vaccine (FVACC), perceived efficacy (EFFICACY), and social influence (SOCINF), were significant in explaining IVAC. Likewise, the sign of their relationship with IVAC was as expected. On the other hand, among sociodemographic variables, only income level (INCOME) presents a significant relationship with IVAC, but not with the expected sign.

The significant positive relationship between FCOVID and IVAC is in accordance with previous studies [4], [9]–[12]. The significant and negative relationship between FVACC and IVAC is supported by [4], [14], [16], who found similar results for the influence of fear and perceived risk on the COVID-19 vaccine. Our results, like those in [4], [12], [14]–[18], display a positive and significant influence of EFFICACY on IVAC. The positive significant relation of SOCINF with IVACC confirms the findings in [4], [18]–[20]. Likewise, we found that gender had a negative nonsignificant relationship with the intention to get vaccinated. Surprisingly, we obtained a significant negative relationship between INCOME and IVAC, despite the fact that mainstream reports outline a positive linkage between those variables [14], [21], [23].

By employing so-called fuzzy set qualitative comparative analysis (fsQCA) we had not an excluding but a complementary perspective on the relation of CAN and sociodemographic variables with IVAC. We checked that the obtained models to fit acceptance and rejection attitudes toward vaccination presented great consistency (>0.8) and acceptable coverage. However, we obtained slightly better results for IVAC than for ~IVAC, particularly for the coverage measure.

We can verify that the incidence of CAN variables on IVAC and ~IVAC is essentially symmetrical and according to the sign observed in the OLR. FCOVID, EFFICACY, and SOCINF (FVACC) were consistently affirmed (negated) in the configurations that induced IVAC. Likewise, FCOVID, EFFICACY, and SOCINF (FVACC) are always negated (affirmed) in recipes where they appear to produce ~IVAC. The configurations in Table 4 suggest that the most relevant CAN variables to produce IVAC are, by this order, SOCINF (it appears in 7/9 recipes), EFFICACY (it is present in 6/9 configurations), FCOVID (it is present in 5/9 recipes) and FVACC (its absence is a core condition in 4/9 configurations). Regarding ~IVAC, SOCINF appears negated in 6/5 recipes, EFFICACY and FCOVID are negated in 5/6 configurations, and FVACC is affirmed in 3/6 configurations.

We observed that all sociodemographic variables are core conditions in recipes that produce both IVAC and ~IVAC. However, the sign of their relationship with the intention to get vaccinated is less consistent than that of CAN variables. Likewise, we also observed that the incidence of INCOME and GENDER in vaccine acceptance and rejection was not symmetrical. The results in Table 4 suggest that lower income levels may be an enabler of vaccine acceptance, since negation of INCOME is a core (peripheral) condition in three recipes (one recipe) that produce IVAC. This is consistent with the negative link between INCOME and IVAC detected using MLP. However, the incidence of INCOME in vaccination resistance has not been defined. Although gender is a core condition in 6/9 prime implicates vaccine acceptance, the sign of its incidence is contradictory. GENDER is affirmed, but is also absent in the three recipes. On the other hand, we have also observed that being female can be a factor generating rejection of the COVID-19 vaccine since GENDER is present as a core condition in 4/6 configurations for ~IVAC. This fact is consistent with the negative but non-significant relationship of GENDER with IVAC in OLR and also with the great amount of literature reporting an inverse relationship between being a woman and attitude towards the vaccine [10], [13], [14], [23], [24].

Despite OLR does not displays a significant relationship between age and IVAC, the fsQCA results suggest that it is a significant variable to explain acceptance and resistance to the SARS-COV-2 vaccine. However, these two findings are not contradictory but complementary. AGE is affirmed and negated in two and three recipes generating IVAC. Likewise, it is affirmed and negated in some recipes for ~IVAC. Therefore, depending on the combination of variables that produce the output, the sign of AGE impact on acceptance and rejection to get vaccinated may change, and therefore, the "average" effect detected by OLR remains neutral.

In our opinion findings of this work have clear potential consequences for managerial and health policies. Odd-ratios of OLR measure the average strength of evaluated variables on the intention to get

vaccinated. These ratios allow ordering of assessed factors by their average influence on acceptance, for example, to state what variables need to be prioritized in vaccination measures by policymakers. On the other hand, fsQCA makes possible stating how factors interact to induce vaccination acceptance and rejection and consistent profiles of potential users and non-users of these vaccines. These last profiles are of special concern for health authorities because their unwillingness to be vaccinated decreases the success of vaccination measures at a collective level.

While CAN variables seem to be the key factors to understand the attitude towards getting vaccinated and impact acceptance and resistance symmetrically, being female may explain a great portion of profiles liked to rejection in being vaccinated. Women's resistance to vaccines is in accordance with mainstream literature [10], [13], [14], [23], [24]. This could be because females have a lower probability of severe illness and even because of SARS-COV-2; therefore, fear of SARS-COV-2 is lower [28], and also because of a plausible link between menstrual perturbations and vaccination [29]. Likewise, having a low income seems to be an enabler of a positive attitude towards the vaccine for COVID-19. Although this finding seems contradictory to [9], [10], [14], [21], [23], it is usually assumed that vaccination may be financed individually. In our opinion, the reason could be that in Spain, there is a public health system with great coverage, and vaccination will have a negligible price for individuals. Likewise, the consequences of being infected with SARS-COV-2 may be perceived harder by people with lower income. For example, mandatory quarantines may be performed in worse conditions (smaller homes), or their employment contracts could have less coverage for illness.

We are conscious of the limitations of this study. It has been done in a concrete country, Spain, and it collects a low number of responses (600) at a specific date (September 2020). In this regard, it must be noted that the pandemic and the development of vaccines have changed continuously. For example, in 2022, vaccines against COVID-19 used in 2021 have become obsolete because they do not protect against dominant Omicron lineages [30]. Therefore, we must be careful to extrapolate the empirical results of this study to regions with different cultural strata since attitudes towards vaccination present great fluctuations between countries [31]. Thus, in [28], whereas in Nepal, practically 100% of the population manifested intention to use the vaccine, in Russia, the proportion was approximately 30%. These fluctuations may even rise in countries with the same geographical area. For example, at year 2022, within the European Union, the vaccination rate was close 90% in Spain and Portugal and but under 60% in Romania [32].

6. CONCLUSION

To the best of our knowledge, the study with fsQCA of variables that explain willingness and resistance to be shot with the COVID-19 vaccine has not been developed. This study displays that fsQCA not only allows capturing the way CAN and sociodemographic factors induce acceptance and resistance to vaccination, but also that CAN factors influence acceptance and non-acceptance sociodemographic factors symmetrically. Therefore, while correlational methods quantify the means effect of factors on the willingness be vaccinated, fsQCA identifies profiles of people that are potentially accepter/rejecters of the COVID-19 vaccine.

In our opinion, further research on the acceptance of COVID-19 vaccines with a mixed correlational-configurational focus could be of interest. Cultural differences are a key factor in understanding the divergence in attitudes towards vaccination between territories. Therefore, it may be relevant to identify the differences in the profiles of people for and against COVID-19 vaccines. Likewise, longitudinal studies on attitudes towards SARS-COV-2 vaccines are needed since not only the disease but also the available drugs and vaccines evolve over time. While COVID-19 is transforming from a pandemic to an endemic illness such as the flu, vaccines are to be adapted to new variants and lineages of SARS-COV-2. Likewise, citizens to vaccinate will go from the entire population to members of risk groups (e.g., aged persons) and health professionals such as doctors and nurses. In any case, the use of mixed methods (correlational and configurational) may provide a more complete picture of the perceived attitude towards vaccination. By using these methodologies, we could assess not only how the average impact of every variable on attitudes towards vaccination changes over time but also how consistent profiles of accepters and rejecters do so.

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