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Vaccine Refusal and Hesitancy in Spain: An Online Cross-Sectional Questionnaire

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Abstract: Vaccine refusal and hesitancy pose a critical challenge to public health, leading to delays in vaccination and compromising herd immunity. To address this issue, we conducted a comprehensive observational study on the adult Spanish population in 2021. Through an online questionnaire, we explored the sociodemographic and sociocultural factors, beliefs, and opinions of those refusing or holding hesitancy about vaccines, and their vaccination behaviours by vaccine type and sex. Our findings revealed that vaccine refusal rates were relatively low (16.8%), and mainly associated with influenza vaccination (10.3%). Greater refusal of vaccination was observed in over 60 years old, in those expressing hesitancy due to vaccine components and opposing free and compulsory vaccination, unaware that vaccination protects the community and being against consuming cow's milk and the use of infant formulas for breastfeeding. Vaccine hesitancy was greatest in individuals under 31 years old, women, parents of children under 15 years old, against compulsory vaccination, unaware that vaccination protects the community, with hesitancy due to vaccine costs, and in favour of alternative and complementary treatments. These insights underscore the need for strategies to improve education about vaccination and dispel misconceptions are crucial for effectively reducing vaccine refusal and hesitancy across the population.

Keywords: anti-vaccination movement; anti-vaccine; vaccination refusal; vaccine hesitancy

1. Introduction

Vaccination is a cost-effective public health measure that can prevent the spread of diseases and reduce the morbidity burden [1]. High vaccine uptake leads to a decline in the prevalence of vaccine-

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preventable diseases (VPDs) [2]. Vaccines are safe and effective and, although like medication they can cause adverse effects, these adverse effects are outweighed by individual and collective benefits [1,3].

The Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy concluded that vaccination hesitancy refers to delay or refusal of vaccination despite the availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence [4]. Declines in vaccination present threats to herd immunity [5].

According to the World Health Organization (WHO), 1.5 million child deaths from VPDs occur every year worldwide This is partly due to problems of access to vaccines for socio-economic reasons, and partly to vaccination hesitancy generated by the rise of anti-vaccine movements [6,7]. Vaccination hesitancy is considered a priority line of action for the WHO and a challenge for those countries working to close the immunisation gap [8,9].

The SAGE Group noted that the Vaccine Hesitancy Determinants Matrix displays the factors influencing the behavioural decision to accept, delay or reject some or all vaccines under three categories: contextual, individual and group, and vaccine/vaccination-specific influences [4]. A publication analysing the psychological factors that might motivate people in 25 countries to refuse vaccination showed that the best predictors of refusal were the following: high levels of conspiracy beliefs, low tolerance of perceived infringement of personal freedom, aversion to needles or blood, and religious beliefs [10]. Another review highlighted the complexity of factors related to acceptance or refusal of vaccines including demographic factors (ethnicity, age, sex, pregnancy, education, and employment), accessibility and cost of vaccines, personal responsibility and risk perceptions, trust in healthcare authorities and vaccines, safety and efficacy of new vaccines, and lack of information or misinformation [11].

In Spain, vaccination coverage is high, but varies depending on the vaccine. Data published by the Spanish Ministry of Health in 2022 showed a slight increase from the previous year in primary vaccination coverage (Polio, DTaP, Hib, Hepatitis B, Meningococcus C, Pneumococcus), as evidenced by the percentage of the population receiving the second dose of the hexavalent vaccine (DTaP, Hib, Hepatitis B) increasing from 96.8% in 2021 to 97.6% in 2022. However, coverage of two doses of the Measles, Mumps, and Rubella (MMR) vaccine in 2022 was 92.6% which did not meet the target coverage of ≥95% needed to keep measles' elimination status, even if coverage was achieved considering only one dose. After the positive effect of the COVID-19 pandemic on influenza vaccine coverage, there was a decreasing trend in in influenza vaccine coverage all population groups, while still remaining higher than pre-pandemic levels [12].

Vaccine hesitancy had been previously studied in Spain in specific groups such as HCPs and epidemiologists, so we consider it interesting to study it in the general population. [13,14]. Our study aimed to characterise the profile of the Spanish population with vaccination refusal specifically and hesitancy in general, to help HCPs conduct targeted vaccination campaigns to improve vaccination coverage. With this objective, we used an online questionnaire to describe the socio-demographic and sociocultural characteristics, beliefs and opinions of those refusing to have vaccine and those with hesitancy about vaccination, and their vaccination behaviours by vaccine type and sex.

2. Materials and Methods

2.1. Study Design

We performed an observational study in the Spanish population aged 18 years or older who had access to the online survey in 2021 and the faculty to decide on their own or others' vaccination.

We obtained the information through an online, self-administered questionnaire designed by the project research team. A pilot test was performed before the definitive questionnaire was obtained. Both were registered on a Research Electronic Data Capture (REDCap) web platform stored on a centralized server where the data remain securely in the custody of the Institut Català de la Salut [Catalan Institute of Health]. Anonymous information was exported to the statistical packages used

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for later analysis. The REDCap platform generated a link [15] for participation in the survey that was disseminated through scientific societies, social networks, research institutes, paediatricians, and nurses in primary care.

2.2. Variables

The main variables of the questionnaire were: sociodemographic factors (sex, age, having children under 15 years old, level of education); sociocultural factors (religious beliefs, culture, family); vaccine information variables (whether they have refused any vaccines and, in that case, the type of vaccine refused; who the refused vaccine was for; hesitancy due to vaccine components, associated diseases or to the payment of vaccines; whether they know that personal vaccination protects other people whether they would be in favour of free and compulsory vaccination; opinion about vaccines), variables of trust in the health system (sources of information about vaccines, whether HCPs can understand anti-vaccine arguments, whether HCPs have enough information to satisfy anti-vaccine people, whether when in doubt about vaccines they will consult the HCP); habits (type of diet, consumption of cow's milk, opinion on breastfeeding or artificial breastfeeding, opinion on alternative treatments or complementary treatments).

2.3. Statistical Analysis

The data were gathered in an anonymized database using the REDCap platform. We conducted a descriptive analysis of the findings, categorizing qualitative or ordinal data using absolute and relative frequencies. We evaluated the relative frequency of the categorical variables using the Chi square test or Fisher's exact test and identified the variables that were both statistically significant and clinically relevant. In selected subgroups of interest, we identified the factors independently associated with these results. The relationship between the variables is quantified using Odds Ratios (ORs), with 95% confidence interval (CI) estimates, as a measure of association for risk. We used logistic regression to identify which factors are independently linked to vaccination refusal or to hesitancy due to vaccine components or diseases that have been associated to being vaccinated. We employed a stepwise conditional variable recall model that retains variables at an adjusted p-value of <0.05 and excludes variables with a value >0.10. This included factors that were statistically significant in our initial comparisons of two variables at a time. We report the likelihood of these factors as ORs and their statistical significance (as adjusted p-values), using a cut-off of $p<0.05$ to define statistical significance. All analysis was conducted using SPSS software version 26.0.

2.4. Ethical Considerations

This study was approved by the ethics and clinical Research Committee of the Fundació Institut Universitari per a la Recerca a l'Atenció Primària de Salut Jordi Gol i Gurina (IDIAPJGol), with code 20/221-P. The study was conducted following the principles of the Declaration of Helsinki. The variables collected were treated anonymously to guarantee the confidentiality of the data, as established in Regulation (EU) 2016/679 of the European Parliament and the Council of April 27 on Data Protection (RGPD) and the Spanish Organic Law 3/2018, of the 5th December 2018, regarding the protection of personal data and guarantees of digital rights. The database is kept by the principal investigator and the research team in an Excel format, protected by password access. An anonymized database was used for the analysis. Before conducting the survey, online informed consent was completed, accepted, and signed.

3. Results

3.1. Description of the Study Population and Percentages of Vaccine Refusal and Hesitancy (Table 1)

There was a total of 1312 respondents to the survey: 74.5% were females and 25.5% males; 14.0% were under 31 years old, 73.7% between 31-59, and 12.4% over 59. Out of all the respondents, 1294

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responded to the question of whether they had ever refused a vaccine, with 16.8% (218/1294) of these claiming to have indeed refused vaccines.

Of the 218 respondents who had refused vaccines, the most commonly refused vaccine was for influenza (61.9%) followed by tetanus (18.3%) and papilloma (HPV) (16.1%). Other vaccines refused included the following: chicken pox (14.2%); hepatitis B (12.8%); MMR (10.1%); hepatitis A (8.3%); and diphtheria, pneumococcus, and polio (each 6.9%). A small proportion declined the vaccine for pertussis (6.4%), meningococcus C (5.5%), and haemophilus influenzae type B (3.7%). A percentage of 17.0% of respondents who had refused vaccines could not remember which vaccine they refused and 5.5% did not specify. Among the vaccines not funded by Spanish Health System in 2019, refusal rates were 11.0% for rotavirus, 8.3% for Meningococcus B, and 6.9% for Meningococcus ACWY. Of those who had refused vaccines, the majority (66%) had refused just one vaccine, while 34% had refused two or more. Most (73.4%) had refused vaccines for themselves, while some (34.4%) for their children, and just a few (3.7%) for their parents or others.

Hesitancy due to vaccine components was cited by 28.1% of respondents, associations with disease that have been linked to vaccines by 30.9%, and the fact that some vaccines must be paid for by 29.0%.

When looking at the overall support respondents showed for vaccines, a significant majority (76.1%) expressed strong support for vaccines, 16.7% showed slight agreement, and only a small fraction expressed indifference, or a slight or strong disagreement to vaccines (2.4%, 3.4%, and 1.3% respectively).

Table 1. Description of the study population.

Sociodemographic Data	**Total N=1312**	*** Responders to Q25 n=1294**	**Refusers n=218**
Gender (binary):			
Men	326 (25.5%)	325 (25.5%)	53 (24.5%)
Women	954 (74.5%)	952 (74.5%)	163 (75.5%)
Age (recodified):			
30 years old or less	180 (14.0%)	180 (14.0%)	25 (11.6%)
31-59 years old	948 (73.7%)	947 (73.8%)	151 (69.9%)
60 years old or more	159 (12.4%)	157 (12.2%)	40 (18.5%)
University studies:			
No	374 (29.0%)	372 (28.9%)	58 (26.7%)
Yes	915 (71.0%)	914 (71.1%)	159 (73.3%)
Do you have sons or daughters under 15 years old?			
Yes	604 (46.9%)	603 (46.9%)	106 (48.6%)
No	685 (53.1%)	683 (53.1%)	112 (51.4%)
Your religious beliefs are:			
In favour of vaccination	467 (35.6%)	466 (36.0%)	51 (23.4%)
Against vaccination	6 (0.5%)	6 (0.5%)	2 (0.9%)
I have no opinion	237 (18.1%)	220 (17.0%)	61 (28.0%)
I am not a believer	494 (37.7%)	494 (38.2%)	92 (42.2%)
I do not know	108 (8.2%)	108 (8.3%)	12 (5.5%)
Your culture is:			
In favour of vaccination	1111 (84.7%)	1109 (85.7%)	161 (73.9%)

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Against vaccination	14 (1.07%)	14 (1.08%)	9 (4.13%)
I have no opinion	128 (9.76%)	112 (8.66%)	36 (16.5%)
I do not know	59 (4.50%)	59 (4.56%)	12 (5.50%)
Your family is:			
In favour of vaccination	1165 (88.8%)	1163 (89.9%)	164 (75.2%)
Against vaccination	32 (2.44%)	32 (2.47%)	14 (6.42%)
Has no opinion	90 (6.86%)	74 (5.72%)	31 (14.2%)
I do not know	25 (1.91%)	25 (1.93%)	9 (4.13%)

Opinion about vaccinations	**Total N=1312**		***Responders to Q25 n=1294**		**Refusers n=218**	
Have you ever refused a vaccine?	218 (16.8%)	1294	218 (16.8%)	1294	218 (100%)	218
Which vaccine have you refused? (choice=Diptheria)	15 (1.14%)	1312	15 (1.16%)	1294	15 (6.88%)	218
Which vaccine have you refused? (choice=Influenza)	135 (10.3%)	1312	135 (10.4%)	1294	135 (61.9%)	218
Which vaccine have you refused? (choice=Haemophilus influenzae type B)	8 (0.61%)	1312	8 (0.62%)	1294	8 (3.67%)	218
Which vaccine have you refused? (choice=Hepatitis A)	18 (1.37%)	1312	18 (1.39%)	1294	18 (8.26%)	218
Which vaccine have you refused? (choice=Hepatitis B)	28 (2.13%)	1312	28 (2.16%)	1294	28 (12.8%)	218
Which vaccine have you refused? (choice=Meningococcus ACWY(Nimenrix®, Menveo®))	15 (1.14%)	1312	15 (1.16%)	1294	15 (6.88%)	218
Which vaccine have you refused? (choice=Meningococcus B (Bexero®, Trumemba®))	18 (1.37%)	1312	18 (1.39%)	1294	18 (8.26%)	218
Which vaccine have you refused? (choice=Meningococcus C)	12 (0.91%)	1312	12 (0.93%)	1294	12 (5.50%)	218
Which vaccine have you refused? (choice=Pneumococcus)	15 (1.14%)	1312	15 (1.16%)	1294	15 (6.88%)	218
Which vaccine have you refused? (choice=Polio)	15 (1.14%)	1312	15 (1.16%)	1294	15 (6.88%)	218
Which vaccine have you refused?	24 (1.83%)	1312	24 (1.85%)	1294	24 (11.0%)	218

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(choice=Rotavirus (Rotarix ®, Rotateq®))						
Which vaccine have you refused? (choice=Tetanus)	40 (3.05%)	1312	40 (3.09%)	1294	40 (18.3%)	218
Which vaccine have you refused? (choice=Whooping cough)	14 (1.07%)	1312	14 (1.08%)	1294	14 (6.42%)	218
Which vaccine have you refused? (choice=Triple vírica (MMR))	22 (1.68%)	1312	22 (1.70%)	1294	22 (10.1%)	218
Which vaccine have you refused? (choice=Papiloma virus HPV)	35 (2.67%)	1312	35 (2.70%)	1294	35 (16.1%)	218
Which vaccine have you refused? (choice=Varicella)	31 (2.36%)	1312	31 (2.40%)	1294	31 (14.2%)	218
Which vaccine have you refused? (choice=I do not remember)	37 (2.82%)	1312	37 (2.86%)	1294	37 (17.0%)	218
Number of vaccines refused	0.37 (1.54)	1312	0.37 (1.55)	1294	2.21 (3.19)	218
Who was the vaccine for? (choice=My sons and/or daughters)	75 (5.72%)	1312	75 (5.80%)	1294	75 (34.4%)	218
Who was the vaccine for? (choice=My mum or dad)	8 (0.61%)	1312	8 (0.62%)	1294	8 (3.67%)	218
Who was the vaccine for? (choice=Me)	160 (12.2%)	1312	160 (12.4%)	1294	160 (73.4%)	218
Who was the vaccine for? (choice=Others (open))	8 (0.61%)	1312	8 (0.62%)	1294	8 (3.67%)	218
Has the fact that vaccines contain components like thiomersal, aluminium, mercury or formaldehyde caused you any doubts about vaccines?	362 (28.1%)	1287	359 (28.0%)	1284	99 (45.4%)	218
Has the fact that vaccines have been linked to diseases such as cancer, allergies, autism, sudden infant death syndrome, multiple sclerosis,	399 (30.9%)	1290	398 (30.9%)	1288	101 (46.3%)	218

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asthma, and alterations of the immune system caused you any doubts about vaccines?						
Has the fact that you have to pay for any of the vaccines caused you any doubts about vaccination?	374 (29.0%)	1288	373 (29.0%)	1286	68 (31.8%)	214
Do you agree with vaccines:		1291		1288		214
Totally agree	982 (76.1%)		982 (76.2%)		112 (52.3%)	
Slightly agree	216 (16.7%)		215 (16.7%)		60 (28.0%)	
Indifferent	32 (2.48%)		32 (2.48%)		13 (6.07%)	
Slightly disagree	44 (3.41%)		43 (3.34%)		18 (8.41%)	
Totally disagree	17 (1.32%)		16 (1.24%)		11 (5.14%)	

[1]Responded to the question of whether they had ever refused a vaccine.

Sum of percentages might be slightly different from 100 because of roundings.

3.2. Socio-Demographic and Sociocultural Characteristics, Beliefs, and Opinions of the Population Who Refused Vaccines

We observed a significant positive association between vaccination refusal, being 60 years old or older, and with anti-vaccination culture and family (Table S1). There was also an association between refusing vaccination and hesitancy due to the vaccine components or associated diseases, a lack of understanding of the community-wide protection benefits of individual vaccination, and a reluctance to support compulsory vaccination even if it was free. Respondents who had refused vaccination were less inclined to view HCPs and healthcare websites as reliable sources of vaccine information than those who had not refused vaccination, and they trusted more friends. Moreover, respondents who had refused vaccination felt that HCPs lacked the information to address anti-vaccine hesitancy and would not consult HCPs, if they had a vaccine question. Finally, vaccination refusal, apart from being strongly related to total disagreement with vaccines, was also strongly related to opposition to the use of infant formula, or consumption of cow's milk, and support of alternative medicine. (Table S2).

In our multivariate logistic regression analysis, we found a statistically significant independent association between refusal of vaccination with the following variables: being 60 years and older; having hesitancy due to vaccine components; being against mandatory and free vaccination; not knowing that vaccination protects the community; and being against consuming cow's milk and the use of infant formulas for breastfeeding (Table 2).

Table 2. Dependent variable: Refusal of vaccination.

Significant Independent Variable	p-Value	OR	95% CI OR inf	95% CI OR sup
Age group				
30 years old or less	0.004	0.403	0.219	0.742
31-59 years old	0,001	0.491		
60 years old or more	Ref	Ref		
Knowledge of protecting more people	0.005	0.390	0.202	0.754
Desire for free and compulsory vaccination	0.000	0.278	0.200	0.386

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Hesitancy due to vaccine components	0.003	1.676	1.195	2.352
Opinion on use of infant formula	0.069	0.684	0.454	1.030
Opinion on consumption of cow's milk	0.021	0.607	0.397	0.929
Constant	0.005	3.521		

3.3. Socio-Demographic and Sociocultural Characteristics, Beliefs and Opinions of the Population with Hesitancy Due to Vaccine Components, Associated Diseases, or Payment

Women, parents with children under 15 years old and individuals with a culture or family against vaccination were more likely to express hesitancy due to vaccine components. Also, a heightened frequency of hesitancy due to the diseases associated with vaccines was seen among certain groups. In particular, individuals under 30 years old, women, those without a university education, those with children under 15 years old, and those aligned with a culture or family against vaccination (Table S1).

Individuals expressing hesitancy due to vaccine components (Table S3) or associated diseases (Table S4) were more hesitant about the payment for vaccines, were more likely unaware that individual vaccination protects the community and less likely to be in favour of free and compulsory vaccination. As for their information sources, they were more likely to report that social networks, family, and friends were reliable sources of information about vaccines. Conversely, they expressed more distrust in HCPs, and believed that HCPs are not a reliable source of information to satisfy anti-vaccine sentiments and would not consult an HCP if they had a question. There was greater hesitancy due to vaccine components or associated diseases among respondents who disagreed with vaccines, infant formula milks, cow's milk consumption or who had diets other than the Mediterranean diet and favoured alternative and complementary treatments (Table S3 and S4).

In our multivariate logistic regression analysis, we found a statistically significant independent association between hesitancy due to vaccine components or associated diseases with individuals under 30 years old, women, those with children under 15 years old, individuals against free and compulsory vaccination, those unaware of the community protection aspect of vaccination, individuals with hesitancy about vaccine payment or with anti-vaccine attitudes, and in favour of alternative and complementary treatments (Table 3).

Table 3. Dependent variable: Hesitancy due to vaccine components or associated diseases.

Significant Independent Variables	p-Value	OR	95%CI OR Inf	95% CI OR Sup
Age group				
30 years old or less	0.190	1,384	0.851	2.253
31-59 years old	0.093	0.695	0.454	1.062
60 years old or more	Ref	Ref		
Sex	0.009	1.494	1.104	2.023
Children under 15 years old	0.006	0.669	0.502	0.891
Knowledge of protecting more people	0.019	0.418	0.202	0.864
Desire for free and compulsory vaccination	0.000	0.436	0.331	0.573
Hesitancy due to payment for a vaccine	0.000	0.459	0.351	0.600
Opinion on vaccination	0.002	0.307	0.148	0.637
Use of alternative treatments	0.000	0.488	0.350	0.680
Use of complementary treatments	0.001	1.549	1.183	2.029
Constant	0.000	41.261		

There was more hesitancy due to the payment of vaccines among people younger than 30 years old, people without a university degree, and parents with children younger than 15 years old (Table S1). Those who were not in favour of free and compulsory vaccination, who were more likely to consider friends as reliable sources of information on vaccines, were also more likely to have hesitancy due to the payment of vaccines. People with hesitancy about vaccine payment reported

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that HCPs did not have enough information to satisfy people with anti-vaccine concerns. They also reported that they disagreed more with vaccines, the use of infant formula, and the consumption of cow's milk, and more of them were in favour of alternative treatments (Table S5)

3.4. Vaccination Behaviours by Vaccine Type and Sex

The socio-demographic features associated with various vaccines types mirrored the overall profile of vaccine refusal, albeit with some nuanced distinctions. Notably, individuals aged 60 years or older exhibited a higher refusal of influenza and tetanus vaccines. Men displayed a greater tendency to refuse tetanus vaccines, while university students showed a higher refusal to rotavirus vaccines but a lower refusal to tetanus vaccines. Parents with children under 15 years old display a higher refusal of vaccines for Haemophilus influenzae type B, Meningococcal B, and Rotavirus (Table S6).

Men showed a higher refusal rate for tetanus vaccination, whereas women demonstrated a greater inclination to refuse vaccines for their children (Table S7). Additionally, women, particularly those without children under 15 years old showed more hesitancy due to vaccine components or associated diseases (Table S8).

Regarding vaccine information sources, there were no discernible sex differences in the perceived reliability of HCPs, family or friends. However, women tended to view health websites as more reliable, while men leaned towards social networks, television and radio. Moreover, a larger proportion of men strongly disagreed with vaccines, in comparison with women. Finally, women showed a stronger preference for complementary treatments, although no sex differences were seen regarding alternative treatments (Table S7).

4. Discussion

In our study, we found that respondents generally favoured vaccination, with a refusal prevalence of 16.8%. This rate aligns with published data on the intention to refuse the COVID vaccine in the Catalan population in the same year of the study [16].

The SAGE Vaccine Hesitancy Working Group categorize vaccine hesitancy using a matrix of contextual influences, individual/social influences, and vaccine and vaccination specific issues [4,17].

Our study delved into several contextual influences, particularly focusing on the sociodemographic and sociocultural characteristics of the population. Analysis of respondent age revealed higher rates of vaccine refusal among those over 60 years old. This does not coincide with previous findings from other studies, where a greater likelihood of vaccination was detected in older people because of increased health concerns and susceptibility to illness [11,18–21]. We believe that the reason for this finding may stem from the significant rejection in our older population of the influenza vaccination, which is primarily targeted at people over 65 years old or with underlying pathologies in Spain, and from the difficulties already described in previous publications to achieve satisfactory vaccination coverage against influenza [21–24]. We also detected greater hesitancy due to the diseases associated with vaccines or to the payment for vaccines in people under 30 years old, and this matches previously published studies [11,18–21].

When considering sex, our study revealed that women and parents with children under 15 years old, showed greater hesitancy due to the components of vaccines or diseases that have been associated with vaccines. Greater doubts were detected in women without children under 15 years old than in men. Moreover, women were more likely to refuse vaccines for their children, aligning with previous studies, which show a greater predisposition to vaccination in men than in women, and less acceptance and greater hesitancy in parents [11,18,25,26]. Concretely, women with young children are more concerned about vaccinating their children, necessitating targeted strategies to bolster the trust and confidence, as previously proposed [11,18,26,27].

Regarding education level, individuals without a university education exhibited greater hesitancy due to associated diseases or vaccine payment. This aligns with published studies that show that the higher the level of education, the greater the acceptance of vaccines [11,18,20,23,28].

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Cultural, religious, and family beliefs emerged as influential factors associated with hesitancy and decision about vaccination, with a greater predisposition to get vaccinated if the sociocultural environment is provaccine. These results echo findings from prior studies [3,10,18].

In terms of political and policy-related contextual influences, most respondents favoured free and compulsory vaccination, except those who refused vaccines or expressed hesitation because of components, associated diseases, or payment for vaccines. Although in recent years there has been growing traction for anti-vaccine movements, most of the population seems to be in favour of compulsory vaccination policies, as evidenced in a 2019 review. Moreover, it seems that support towards mandatory policies increases after their implementation [29]. Nonetheless, efforts to improve vaccine acceptance, such as enhancing education and providing proof of the efficacy, benefits and safety of vaccines, remain crucial [30].

We observed greater vaccine refusal and hesitancy among individuals who deemed health professionals or websites unreliable sources of vaccine information, while considering friends, family, or social networks as reliable sources. These results reinforce previous publications which stated that the crisis in the vaccination system and the resurgence of anti-vaccine movements are due to the increased accessibility of information and the reduced credibility of HCPs [5,31]. Exposure to anti-vaccine content on social media was associated with refusal and hesitancy to vaccinate [32–36], highlighting the critical need to combat misinformation to mitigate its effects [34,35].

Our study also suggests that a lack of trust in HCPs is associated with greater vaccine refusal and hesitancy. This aligns with existing reviews and published studies that conclude that vaccine safety and trust in health authorities are the main factors in promoting vaccine acceptance [11,37]. According to the WHO's "3Cs" model (confidence, compliance, convenience), confidence in vaccines and in the healthcare system constitute one of the three main determinants of vaccine hesitancy [4,7,17].

We detected a greater refusal of the vaccines for influenza, tetanus, papilloma, and varicella (chicken pox). Mostly individuals refused vaccines for themselves and, to a lesser extent, their children. These findings mirror other international studies which highlight the difficulties in achieving satisfactory vaccination coverage for influenza and papillomavirus [30,35,38]. Data published by the Spanish Ministry of Health also corroborate these difficulties in vaccination coverage for influenza, papilloma, and varicella in 2021-2022. In Spain, the recommendation to maintain vaccination coverage ≥95% for MMR vaccination in 2021-2022 was not achieved [12] and the goal of maintaining measles and rubella elimination status was not met [39]. Again, although there are high coverage rates for tetanus in primary vaccination with the hexavalent vaccine, vaccination coverage with Td decreases in adolescents [12]. In our study, we found a greater refusal of tetanus vaccine than the diphtheria vaccine, although tetanus and diphtheria vaccines are usually administered together. We attribute this difference and other similar ones to a possible lack of knowledge of the vaccination schedule in our reference population or to a greater popular knowledge of tetanus vaccine because of its indication for administration in certain wounds.

Our study revealed a relationship between having hesitancy due to vaccine components and refusing a vaccine. It also showed that having hesitancy due to vaccine components or associated diseases were associated with hesitancy due to vaccine payment. Earlier research has found that accessibility and cost, along with safety and efficacy were reasons for hesitancy [11,17,40]. In most Spanish autonomous communities, the Meningococcal ACWY and Meningococcal B vaccines are now part of the public vaccination schedule and thus should no longer be a reason for hesitancy because of costs in these cases [41].

Collective responsibility was assessed and greater refusal and hesitancy was detected in respondents who were unaware that individual vaccination protects the community. The concept of collective responsibility was one of five factors that affect people's perception of vaccines, along with confidence (trust in vaccine efficacy and safety), complacency (perception about the risk of the disease), calculation (weighing the risks and benefits of vaccines) and constraint (accessibility of information about the vaccine). These are part of the 5Cs model [38], which extends from the 3C model introduced by the WHO SAGE Working group [4].

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We intended to study the profile of the local population with vaccine hesitancy and we observed heightened hesitancy among people who disagreed with cow's milk consumption or the use of infant milk formulas, and those who adhered to a non-Mediterranean diet or favoured alternative or complementary treatments for healthcare. This profile of population with a preference for natural therapies, with scepticism towards established scientific positions, and greater reticence towards healthcare systems and HCPs, seems to be the profile of vaccine hesitancy detected in primary care. To address vaccine hesitancy, we urge institutions and governmental bodies to seek strategies to enhance trust in HCPs, public health systems, authorities, and health policies. Encouraging shared participation in the formulation of vaccine recommendations is paramount [37]. Additionally, as previously suggested by some authors, novel approaches such as analysing population opinions on vaccination through social networks using artificial intelligence to complement traditional survey methods, can provide a more comprehensive understanding of vaccine refusal and hesitancy dynamics and allow targeted interventions. Such initiatives can facilitate effective engagement with diverse communities and foster informed decision-making regarding vaccination [33,42–45].

One of the limitations of this study is the inherent recruitment bias associated with the online survey method, which restricted participation to individuals with internet access. However, given that 96.1% of Spanish households have internet access, and 85% of Spaniards are users of social networks [46,47], the reach of our survey remains substantial. While most respondents were Catalan, we believe that vaccination behaviour is fairly homogenous across Spain. Another possible limitation is potential respondent repetition, although, we anticipate minimal impact on the final results because of expected low rate of repetition. Additionally, our sample skewed towards women and people with a university education, this could limit the interpretation and generalization of our study to the broader population. Finally, reaching the anti-vaccine population posed challenges, as interactions with these groups is difficult. To mitigate eventual bias deriving from this, in our sample size calculation, we considered that the proportion of antivaccine responses would be much lower than the proportion of pro-vaccine responses. Despite these limitations, our study provides valuable insights into vaccine refusal and hesitancy, but caution is warranted in extrapolating findings to the entire population.

5. Conclusions

Vaccination refusal in our surveyed population was low and mainly related to refusal of influenza vaccination, although hesitancy arguments related to vaccine safety were detected, which could compromise vaccination coverage.

Vaccine refusal was mainly associated with individuals over 60 years old, characterized by hesitancy towards vaccine components, a resistance to compulsory vaccination, and a lack of awareness regarding vaccination's community-wide protection benefits. Furthermore, resistance extended to dietary choices, notably being against cow's milk and the use of infant formulas for breastfeeding.

Vaccine hesitancy, on the other hand, was mainly associated with a younger demographic of people under 30 years old, typically women, parents of young children under 15 years old, and against compulsory vaccination. They were generally also unaware that vaccination protects the community, with hesitancy about vaccine payment or with anti-vaccine attitudes, and in favour of alternative and complementary treatments.

In general, greater hesitancy to vaccination was detected in women and they reported a greater refusal to vaccinate their children than men.

Addressing these complexities requires proactive health policies aimed at strengthening trust in scientific positions and HCPs. Additionally, strategies must be tailored to enhance community engagement and ensure sufficient education regarding vaccination, especially among populations with lingering doubts. Multifaceted approaches are indispensable for navigating the intricacies of vaccine acceptance and safeguarding public health in the face of evolving challenges and threats to established progress made at reducing vaccine refusal and hesitancy.

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Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org., Table S1: Socialdemographic and sociocultural characteristics of the populations refusing or showing hesitancy about vaccination; Table S2: Characteristics of the population of the populations refusing vaccination; Table S3: Characteristics of the population with hesitancy due to vaccine components; Table S4: Characteristics of the population with hesitancy due to diseases attributed to vaccines, Table S5: Charactersitics of the population with hesitancy due to the payment of vaccines; Table S6: Refusal by type of vaccine, Table S7: Vaccination behaviours by sex; Table S8. Results by sex and children.

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Data Availability Statement: The data are hosted on the research team's internal servers and will be provided under reasonable request.

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