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Original Article

Characteristics of adults who reported not having had COVID-19 in Spain after the first two years of the pandemic and associated factors

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ABSTRACT

Background: There is little evidence regarding the characteristics of adults who self-reported not having had COVID-19 after two years of the pandemic. This study aimed to analyse the characteristics of no-COVID-19 respondents and the associated factors to better understand which may have conditioned not having had the disease as guidance to help in the design of better public health strategies.
Methods: This cross-sectional, observational study was conducted in the Spanish general population in a representative sample of 1051 adults who completed an online survey in September 2022. Multivariable logistic regression was performed to assess which factors were related to reporting not having had COVID-19.
Results: Almost half of the respondents (47.8%) reported not having ever had COVID-19. Significant differences were found between people who reported having had and not having had COVID-19 according to sex, age, education level, employment and living with children. No-COVID-19 respondents had greater concern and less fear of the disease and were more worried about the new variants. After the multivariable analysis, factors associated with no-COVID-19 respondents were male sex (OR)=1.40; 95% (CI=1.07–1.82), older age (OR=1.01; 95% CI=1.01–1.03), having a greater perception of disease severity if infected (OR=4.71; 95% CI=2.97–7.47), greater adherence to preventive measures (OR=1.02; 95% CI=1.01–1.03), and having received a complete vaccination schedule and booster dose (OR=1.56; 95% CI=1.03–2.36).
Conclusions: Analysing the characteristics of people reporting not having had COVID-19 can support public health decision-makers in designing better interventions and facilitating the implementation of effective prevention and control measures to prepare for and respond to a possible future pandemic.

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1. Introduction

The incidence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has increased dramatically worldwide since December 2019, when the first case was detected in humans in Wuhan, Hubei Province, China [1]. Since then, more than 600 million people have been infected with SARS-CoV-2 worldwide, and 6.5 million deaths have been reported [2]. Apart from genetic factors, age and sex appear to be associated with coronavirus disease 2019 (COVID-19). According to the World Health Organization (WHO), since the start of the pandemic, there have been more COVID-19 cases among women (53.2%) than among men (46.8%) [3], with the 30–39 age group being the most affected [4].

Spain confirmed its first COVID-19 case in March 2020, and by September 30, 2022, it had registered 13,422,984 confirmed COVID-19 cases and 114,179 deaths [5]. In accordance with WHO data, more than half of the cases in Spain were female (54.1% vs 45.9%) [3], with the most affected age group being the 40–49 age group (18.2%), followed by the 30–39 age group (15.5%). These numbers are based on data available until the end of March 2022, when the national surveillance system started to report only cases among individuals aged 60 years and older [6]. In addition to personal protective measures, vaccination became available at the end of 2020 and has since been one of the most effective strategies for reducing transmission. More than 39 million people, 92.8% of the Spanish population over 12 years of age, had received the full regimen of two doses, and more than 26 million people (54.9%) had received a booster dose at the time of the study [7].

According to national COVID-19 data on confirmed cases, at least 28.3% of the Spanish population had been infected by the end of September 2022 [5]. However, in some Spanish regions, the cumulative incidence of SARS-CoV-2 had reached 47.4% [8].

While several studies have examined the clinical characteristics of different diseases in patients with and without COVID-19 [9–12], little is known about the sociodemographic characteristics, concerns, risk perceptions, knowledge, and preventive practices of adults who reported not having had COVID-19.

This study aimed to evaluate the sociodemographic characteristics and factors associated with adults who reported not having contracted COVID-19 during the first two years of the pandemic, to gain a deeper understanding of what contextual, personal, and behavioural factors may have influenced the avoidance of the disease and the importance of developing control measures for this and possibly future pandemics.

2. Materials and methods

2.1. Study design and population

A cross-sectional survey was conducted with data collected between 21 and 29 September 2022; a sample of 1051 adults was selected through a panel using a consumer research company. The inclusion criteria were being 18 years or older and living in Spain. The sample was matched with the general Spanish population in terms of age, education, sex, and area of residence. The detailed methodology has been previously published [13–15].

2.2. Survey questionnaire

The survey questionnaire collected quantitative data about participants' sociodemographic characteristics, COVID-19 experience, adherence to recommended preventive measures, perceived health, vaccination compliance, fears and concerns about COVID-19, risk perceptions, and knowledge about the disease. The COVID-19 Snapshot Monitoring (COSMO-Spain) was adapted from the WHO Behavioural Knowledge Questionnaire [16].

2.3. Variables

The dependent variable was the dichotomous variable "having had or not having had coronavirus/COVID-19", with "yes" or "no" answers.

Compliance with preventive measures was assessed using the question "During the last 7 days, indicate how often you have taken the following measures to prevent infection from coronavirus/COVID-19", with a response scale from 1 (never) to 5 (always). An index of preventive measures was obtained by adding the responses to 13 preventive measure questions.

Participants were also asked about their COVID-19 **vaccination status**, having as answer options not having been vaccinated or having received an incomplete, having received a full vaccination schedule without a booster dose, or a full schedule with a booster dose.

Concern about COVID-19 was assessed with the question "How much do you worry about coronavirus/COVID-19?", answered from 1 (not at all) to 5 (very much). Other specific concerns related to the disease were assessed with the question "Regarding the coronavirus/COVID-19, using a scale from 1 to 5, how much do you worry about new variants of coronavirus, people who do not wear a mask outdoors or overcrowding of health services?", ranging from 1 (not at all) to 5 (very much). An index was generated with the 14 concerns. The level of fear was assessed with the question "Coronavirus/COVID-19 scares me…" rated on a response scale from 1 (not at all) to 5 (very much).

The respondents' perceived health was assessed with the question "How would you assess your health before the coronavirus/COVID-19?" from 1 (poor) to 5 (very good). Physical and mental health were also assessed with the following questions: "My physical/ mental health is now", with answers "worse than before the pandemic" or "the same as or better than before the pandemic".

Severity and risk perceptions about COVID-19 were evaluated with several questions, such as "How severe do you think the disease would be if you contracted COVID-19?", ranging from 1 (very mild) to 5 (very severe); "What risk do you think you would have of getting the disease when…?", answered from 1 (very unlikely) to 5 (very likely); "I feel that the coronavirus/COVID-19 is spreading…" (response scale from 1 "very slow" to 5 "very fast"; and "Do you believe the worst of the pandemic…?", with options "has passed", "we are living the worst" or "is yet to come".

Knowledge of COVID-19 was assessed with the question "Do you think the following statements about the coronavirus are correct?", with options 1 (yes) or 0 (no). To assess the participants' level of knowledge related to COVID-19, an index was generated accounting for the sum of the correct answers to 12 statements related to symptoms, transmission routes, diagnosis and preventive measures asked about in the survey.

2.4. Data analyses

Descriptive statistics were used to summarize the characteristics of the study participants. Categorical variables are presented as frequencies and percentages, while continuous variables are presented as medians and interquartile ranges (IQRs). Differences in sociodemographic characteristics, knowledge, preventive measures, fear and concerns, health, risk, and disease severity perceptions between respondents who reported having had COVID-19 and those who reported not having had COVID-19 were assessed using the chi-square test and the Mann−Whitney U test for categorical and continuous variables, respectively. Odds ratios (ORs) and confidence intervals (CIs) were estimated via logistic regression.

Variables with a p value ≤ 0.05 in the bivariate analysis were included in backward stepwise logistic regression to identify factors associated with not having reported COVID-19. Adjusted ORs and

95% CIs were calculated. All the statistical analyses were performed using IBM SPSS Statistics version 27.

2.5. Ethics statement

This study was approved by the Ethics Committee of the Spanish National Health Institute, Carlos III (CEI PI 59_2020-v2). Informed consent was obtained from all participants.

3. Results

3.1. Sample characteristics

A total of 1051 participants completed the survey, 502 (47.8%) of whom reported not having had COVID-19 during the first two years of the pandemic. More than half of these no-COVID-19 respondents were men (56%), and the median age was older than that of the respondents who reported having had COVID-19 (52 vs 42 years). Respondents who reported not having had COVID-19 had significantly lower education levels and higher rates of unemployment (50.8% vs 39.2%) than did those who reported having had COVID-19, and fewer had family members who had died from COVID-19 (25.7% vs 35.2%) (Table 1).

3.2. Compliance with preventive measures and COVID-19 status

Respondents who reported not having had COVID-19 during the first two years of the pandemic had significantly higher median value of compliance with preventive measures than respondents who reported having had COVID-19 (46 vs 43) (Table 2). They washed their hands more often (61.5% vs 54%), used hydroalcoholic gel more often (53.6% vs 45.4%), practiced social distancing more often (39.3% vs 29.8%), wore a mask more often when in closed spaces (48% vs 36.6%) and in open spaces when there were crowds (40.5% vs 27.6%). At a significant level, no-COVID-19 respondents more frequently reported being fully vaccinated against COVID-19 and having received a booster dose than those who reported having had COVID-19 (57.5% vs 45.8%).

3.3. Fear, concerns, severity and risk perceptions related to COVID-19

Respondents who reported not having had COVID-19 were significantly more worried about the disease (18.6% vs 13.1%), more concerned about the new variants of coronavirus (50% vs 43.1%), and were more concerned about people who did not wear a mask outdoors (23.3% vs 14.2%) than participants who reported having had COVID-19 (Table 3).

No-COVID-19 respondents also reported more frequently that the COVID-19 would be severe/very severe for them (20.4% vs 5.6%), that they had a high risk of contracting the disease when going to crowded open spaces (32.8% vs 26.6%), that they felt that the COVID-19 was spreading very slowly (81% vs 74.9%), and that they thought the worst of the pandemic was yet to come (p = 0.036) (Table 4).

3.4. Knowledge about COVID-19

Compared with respondents who reported having had COVID-19, no-COVID-19 respondents reported more frequently that symptoms appeared as soon as someone was infected (13.6% vs 9.5%, p = 0.039) but less frequently that symptomless individuals could be contagious (81.8% vs 87.4%, p = 0.011), that coronavirus was airborne (67.6% vs 75.4%, p = 0.005), or that if the PCR or test result was negative, they could be incubating the disease and be positive the next day (80.4% vs 88.2%, p = 0.001) (Table 5).

3.5. Factors associated with not having COVID-19

According to the multivariable logistic regression analysis, not having reported to have had COVID-19 was associated with male sex (OR: 1.40), older age (OR: 1.01), lower education level (OR: 0.69),

Table 1
Participants' sociodemographic characteristics and COVID-19 experiences.

Sociodemographic characteristics	No. (%) or Median (IQR)						P value	OR (95% CI)
	Total		COVID-19		No-COVID-19			
Total	N = 1051		n 549	% 52.2	n 502	% 47.8		
Sex								
Women	526	50	305	55.6	221	44.0	< 0.001	(Ref)
Men	525	50	244	44.4	281	56.0		1.59 (1.25-2.03)
Age								
Median (IQR)	47	25	42	24	52	23	< 0.001	1.03 (1.02-1.03)
18-29	183	17.4	117	21.3	66	13.1		(Ref)
30-44	288	27.4	174	31.7	114	22.7		1.17 (0.80-1.72)
45-60	356	33.9	162	29.5	194	38.6		2.14 (1.48-3.09)
61 +	224	21.3	96	17.5	128	25.5		2.38 (1.59-3.56)
Education level								
Primary studies	176	16.7	80	14.6	96	19.1	< 0.001	(Ref)
Secondary studies	274	26.1	115	21.0	159	31.6		1.16 (0.79-1.69)
High school	260	24.7	141	25.7	119	23.7		0.70 (0.48-1.03)
Higher vocational training, university degree/diploma/graduate degree or doctorate	341	32.4	212	38.7	129	25.6		0.51 (0.35-0.73)
Job status								
Not working	470	44.8	215	39.2	255	50.8	< 0.001	(Ref)
Working	581	55.2	333	60.8	247	49.2		0.63 (0.49-0.80)
Children under 12 years								
No	845	80.4	423	77.0	422	84.1	0.004	(Ref)
Yes	206	19.6	126	23.0	80	15.9		0.64 (0.47-0.88)
Family members or relatives who have or have had persistent COVID-19								
No	555	52.8	329	59.9	226	44.9	< 0.001	(Ref)
Yes	496	47.2	220	40.1	277	55.1		1.83 (1.44-2.34)
Family members or relatives who died from COVID-19								
No	729	69.3	355	64.8	373	74.3	0.001	(Ref)
Yes	322	30.7	193	35.2	129	25.7		0.64 (0.49-0.83)

Chi-squared test .050.

Table 2
Compliance with preventive measures and COVID-19 status.

Preventive measures for COVID-19		Total (N = 1051)		COVID-19 (n = 557)		No-COVID-19 (n = 494)		P value	OR (95% CI)
		n	(%)	n	(%)	n	(%)		
Washing my hands often with water and soap for at least 20 s	Never/almost never	446	42.4	256	46.0	190	38.5	0.014	(Ref)
	Always/nearly always	605	57.6	301	54.0	304	61.5		1.36 (1.06-1.74)
Using hydroalcoholic gel or any other disinfectants for my hands	Never/almost never	533	50.7	304	54.6	229	46.4	0.008	(Ref)
	Always/nearly always	518	49.3	253	45.4	265	53.6		1.39 (1.09-1.77)
Practicing social distancing (2 m minimum)	Never/almost never	691	65.7	391	70.2	300	60.7	0.001	(Ref)
	Always/nearly always	360	34.3	166	29.8	194	39.3		1.52 (1.18-1.97)
Wearing a mask in closed spaces	Never/almost never	610	58.0	353	63.4	257	52.0	< 0.001	(Ref)
	Always/nearly always	441	42.0	204	36.6	237	48.0		1.60 (1.25-2.04)
Wearing a mask in open spaces when there are crowds	Never/almost never	697	66.3	403	72.4	294	59.5	< 0.001	(Ref)
	Always/nearly always	354	33.7	154	27.6	200	40.5		1.78 (1.38-2.31)
Using a mask following the recommendations in health centres, nursing homes and pharmacies	Never/almost never	215	20.5	115	20.6	100	20.2	0.871	(Ref)
	Always/nearly always	836	79.5	442	79.4	394	79.8		1.02 (0.76-1.38)
Using a mask following the recommendations on public transport	Never/almost never	215	20.5	110	19.7	105	21.3	0.546	(Ref)
	Always/nearly always	836	79.5	447	80.3	389	78.7		0.91 (0.67-1.23)
Avoiding public transport	Never/almost never	658	62.6	365	65.5	293	59.3	0.038	(Ref)
	Always/nearly always	393	37.4	192	34.5	201	40.7		1.30 (1.01-1.67)
Ventilating enclosed spaces	Never/almost never	321	30.5	186	33.4	135	27.3	0.033	(Ref)
	Always/nearly always	730	69.5	371	66.6	359	72.7		1.33 (1.02-1.74)
Not going to social/family gatherings	Never/almost never	851	81.0	470	84.4	381	77.1	0.003	(Ref)
	Always/nearly always	200	19.0	87	15.6	113	22.9		1.60 (1.17-2.19)
Not going to crowded places	Never/almost never	670	63.7	380	68.2	290	58.7	0.001	(Ref)
	Always/nearly always	381	36.3	177	31.8	204	41.3		1.51 (1.17-1.94)
Not going to visit family or friends in quarantine	Never/almost never	432	41.1	225	40.4	207	41.9	0.620	(Ref)
	Always/nearly always	619	58.9	332	59.6	287	58.1		0.94 (0.73-1.20)
Avoiding kissing and hugging people I do not live with	Never/almost never	661	62.9	380	68.2	281	56.9	< 0.001	(Ref)
	Always/nearly always	390	37.1	177	31.8	213	43.1		1.63 (1.26-2.09)
How many doses of the vaccine have you received?	Not vaccinated or incomplete vaccination schedule	149	14.2	84	15.1	65	13.2	0.001	(Ref)
	Full vaccination schedule without booster	363	34.5	218	39.1	145	29.4		0.86 (0.58-18.26)
	Full vaccination schedule with booster	539	51.3	255	45.8	284	57.5		1.44 (0.99-2.07)
Preventive measures index	Median (IQR)	44 (16)	43 (15)	46 (18)	< 0.001	1.02 (1.01-1.03)			
	Min	13	13	13					
	Max	65	65	65					

Table 3
Fear and concerns about COVID-19.

Fear and concerns about COVID-19		Total (N = 1051)		COVID-19 (n = 557)		No-COVID-19 (n = 494)		P value
		n	(%)	n	(%)	n	(%)	
How much do you worry about coronavirus/COVID-19?	Not at all/a little	886	84.3	484	86.9	402	81.4	0.014
	Much/very much	165	15.7	73	13.1	92	18.6	
Coronavirus/COVID-19 scares me	Not at all/a little	622	59.2	312	56.0	310	62.8	0.027
	Much/very much	429	40.8	245	44.0	184	37.2	
Concern about losing a loved one	Not at all/a little	246	23.4	135	24.2	111	22.5	0.499
	Much/very much	805	76.6	422	75.8	383	77.5	
Concern about overwhelmed health services	Not at all/a little	322	30.6	157	28.2	165	33.4	0.067
	Much/very much	729	69.4	400	71.8	329	66.6	
Concern about my physical or mental health	Not at all/a little	497	47.3	253	45.4	244	49.4	0.198
	Much/very much	554	52.7	304	54.6	250	50.6	
Concern about going out	Not at all/a little	918	87.3	494	88.7	424	85.8	0.164
	Much/very much	133	12.7	63	11.3	70	14.2	
Concern about people who do not use a mask indoors	Not at all/a little	631	60.0	343	61.6	288	58.3	0.279
	Much/very much	420	40.0	214	38.4	206	41.7	
Concern about a new lockdown	Not at all/a little	491	46.7	271	48.7	220	44.5	0.182
	Much/very much	560	53.3	286	51,3	274	55.5	
Concern about late and/or unknown effects of vaccination	Not at all/a little	512	48.7	279	50.1	233	47.2	0.344
	Much/very much	539	51.3	278	49.9	261	52.8	
Concern about losing my job	Not at all/a little	662	63.0	351	63.0	311	63.0	0.984
	Much/very much	389	37.0	206	37.0	183	37.0	
Concern about new variants of coronavirus	Not at all/a little	564	53.7	317	56.9	247	50.0	0.025
	Much/very much	487	46.3	240	43.1	247	50.0	
Concern about infecting my family	Not at all/a little	340	32.4	179	32.1	161	32.6	0.875
	Much/very much	711	67.6	378	67.9	333	67.4	
Concern about having persistent COVID-19	Not at all/a little	426	40.5	223	40.0	203	41.1	0.728
	Much/very much	625	59.5	334	60.0	291	58.9	
Concern about COVID-19 measures being lowered soon	Not at all/a little	653	62.1	360	64.6	293	59.3	0.076
	Much/very much	398	37.9	197	35.4	201	40.7	
Concern about people who do not wear a mask outdoors	Not at all/a little	857	81.5	478	85.8	379	76.7	< 0.001
	Much/very much	194	18.5	79	14.2	115	23.3	
Concern about a severe new wave of COVID-19	Not at all/a little	434	41.3	228	40.9	206	41.7	0.801
	Much/very much	617	58.7	329	59.1	288	58.3	
Concerns index	Median (IQR)	47 (16)	47 (16)	48 (16)	0.100			
	Min	14	14	14				
	Max	70	70	70				

feeling that one's physical health was the same or better than before the pandemic (OR: 1.85), a greater perception of the severity of the illness in case of infection (OR: 4.71), greater adherence to preventive measures (OR: 1.02), and receiving a full vaccination schedule with a booster dose (OR: 1.56). No-COVID-19 respondents had fewer family members who had died from COVID-19 (OR: 0.67) than did those who reported COVID-19; additionally, no-COVID respondents felt less often that COVID-19 was spreading quickly (OR: 0.60) and had a lower disease knowledge index (OR: 0.91) (Table 6).

4. Discussion

This study provides insights into the sociodemographic characteristics, adherence to preventive measures, fear, concerns, health, severity, and risk perceptions, and disease-related knowledge of adults who reported not having had COVID-19 during the first two years of the pandemic. The findings highlighted that age, educational level, perceived severity, vaccination status and adherence to preventive measures were associated with not having had the disease.

Table 4
Health, severity, and risk perceptions about COVID-19.

Health, risk, and severity perceptions about COVID-19		Total (N = 1051)		COVID-19 (n = 557)		No-COVID-19 (n = 494)		P value
		n	(%)	n	(%)	n	(%)	
How would you assess your health before the coronavirus/COVID-19?	Bad/very bad	502	47.8	248	44.5	254	51.4	0.026
	Good/very good	549	52.2	309	55.5	240	48.6	
My physical health is now	Worse than before the pandemic	296	28.2	178	32.0	118	23.9	0.004
	The same as or better than before the pandemic	755	71.8	379	68.0	376	76.1	
My mental health is now	Worse than before the pandemic	333	31.7	198	35.5	135	27.3	0.004
	The same as or better than before the pandemic	718	68.3	359	64.5	359	72.7	
How severe do you think the disease would be if you contracted COVID-19?	Mild/very mild	919	87.4	526	94.4	393	79.6	< 0.001
	Severe/very severe	132	12.6	31	5.6	101	20.4	
What risk do you think you would have of contracting the disease when going to crowded places in open spaces (terraces, parties.)?	None/unlikely	741	70.5	409	73.4	332	67.2	0.027
	Likely/very likely	310	29.5	148	26.6	162	32.8	
What risk do you think you would have of contracting the disease by going to the cinema?	None/unlikely	662	63.0	370	66.4	292	59.1	0.014
	Likely/very likely	389	37.0	187	33.6	202	40.9	
I feel that coronavirus / COVID-19 is spreading	Slowly/very slowly	817	77.7	417	74.9	400	81.0	0.018
	Fast/very fast	234	22.3	140	25.1	94	19.0	
Do you believe the worst of the pandemic	Has passed	901	85.7	492	88.3	409	82.8	0.036
	We are living the worst	65	6.2	29	5.2	36	7.3	
	Is yet to come	85	8.1	36	6.5	49	9.9	

Table 5
Knowledge about COVID-19.

Knowledge about COVID-19		Total (N = 1051)		COVID-19 (n = 557)		No-COVID-19 (n = 494)		P value
		n	(%)	n	(%)	n	(%)	
COVID-19 is spread by droplets when coughing/talking	No	143	13.6	67	12.0	76	15.4	0.113
	Yes	908	86.4	490	88.0	418	84.6	
If I have symptoms I should stay home as much as possible	No	181	17.2	97	17.4	84	17.0	0.860
	Yes	870	82.8	460	82.6	410	83.0	
Symptoms appear as soon as you are infected	No	931	88.6	504	90.5	427	86.4	0.039
	Yes	120	11.4	53	9.5	67	13.6	
Cases without symptoms may be contagious	No	160	15.2	70	12.6	90	18.2	0.011
	Yes	891	84.8	487	87.4	404	81.8	
Keeping a safe distance is an effective measure to prevent contagion	No	142	13.5	80	14.4	62	81.8	0.391
	Yes	909	86.5	477	85.6	432	87.4	
The coronavirus is transmitted through the air	No	297	28.3	137	24.6	160	32.4	0.005
	Yes	754	71.7	420	75.4	334	67.6	
If the PCR or test result is negative, you could be incubating the disease and be positive the next day	No	163	15.5	66	11.8	97	19.6	0.001
	Yes	888	84.5	491	88.2	397	80.4	
If the result of the PCR or the antigen test is negative, I can meet with friends and family, including people at risk, without having to worry about security measures	No	748	71.2	400	71.8	348	70.4	0.625
	Yes	303	28.8	157	28.2	146	29.6	
Vaccinated people can also get coronavirus	No	60	5.7	27	4.8	33	6.7	0.201
	Yes	991	94.3	530	95.2	461	93.3	
I must continue to wear a mask indoors if I am with vulnerable people	No	205	19.5	104	18.7	101	20.4	0.469
	Yes	846	80.5	453	81.3	393	79.6	
I must keep wearing a mask outdoors if there are crowds	No	364	34.6	203	36.4	161	32.6	0.190
	Yes	687	65.4	354	63.6	333	67.4	
Wearing a mask is an effective measure to prevent transmission and contagion	No	167	15.9	93	16.7	74	15.0	0.447
	Yes	884	84.1	464	83.3	420	85.0	
Knowledge index	Median (IQR)	9 (2)	9 (2)	9 (2)	0.989			
	Min	0	0	0				
	Max	12	12	12				

Table 6
Factors associated with not having had COVID-19.

Variables	Adjusted OR (95% CI)
Sex (men)	1.40 (1.07-1.82)**
Age	1.01 (1.01-1.03)**
Education level (secondary studies and above)	0.69 (0.52-0.92)**
My physical health is now the same as or better than before the pandemic	1.85 (1.36-2.51)*
If I am infected with coronavirus/COVID-19 it would be severe/very severe	4.71 (2.97-7.47)*
Preventive Measures index	1.02 (1.01-1.03)**
How many doses of vaccine have you received?	
Full vaccine schedule without booster dose	0.98 (0.64-1.51)
Full vaccine schedule and booster dose	1.56 (1.03-2.36)**
Family members or relatives deceased from COVID-19 (Yes)	0.67 (0.50-0.89)**
I have a feeling that the coronavirus/COVID-19 is spreading fast	0.60 (0.43-0.83)**
Knowledge index	0.91 (0.86-0.98)*

* p ≤ .001.
** p ≤ .050.

Although our study showed more percentage of self-reported infected adults than officially confirmed cases at the national level [8], official records are considered underestimated, since COVID-19 tests have become available in pharmacies and most people with mild cases have stopped arriving at health facilities for diagnosis or treatment, as shown by other studies [9].

This study revealed a greater percentage of men than women who reported not having had the disease. This finding is consistent with findings from the WHO worldwide reports, Spanish data and other studies that have shown a higher percentage of women infected with COVID-19 [3, 17, 18]. While this finding contrasts with the beginning of the pandemic, when men showed a greater risk than women of COVID-19 [19], women were more hesitant to be vaccinated throughout the pandemic [20], and it is well known that they usually bear the burden of family care, which could have put them at greater risk of contagion [21]. Compared with men, women also used to consult with their general practitioners more frequently and are more likely to undergo screening [17,22].

Although COVID-19 has shown greater severity among older adults [23], according to WHO worldwide data, the most affected age group during the period of our study was the 30–39 age group, with decreasing prevalence in the 60–80 age group and increasing prevalence in the over 80 age group [3]. In Spain, the most affected age group was the 40–49 age group, followed by the 30–39 age group, with rates decreasing between 60 and 80 years and increasing in individuals older than 80 years [4]. These data are consistent with our results, where the 30–44 age group was the group that was most affected by COVID-19, followed by the 45–60 age group. Different studies have also shown an association between older age and greater adherence to preventive measures, which could have protected people from the disease [14, 24, 25].

In this study, a lower level of education, higher perceived severity of the disease, lower disease knowledge index and greater adherence to preventive measures were associated with no-COVID-19 respondents. They often had less knowledge about the disease than people who reported having had COVID-19 [26]. Previous research has shown an association between lower education levels and greater perceived severity of disease [27], which has been related to a lower level of knowledge of the disease [28] and greater adherence to preventive measures [29]. The association between not having had the disease and higher compliance with preventive measures is known to reduce the probability of infection [14], although this association is not put into practice continuously and may fluctuate depending on the perception of risk. Several studies have shown the relationship between high-risk perceptions of COVID-19 and greater compliance with preventive behaviours [14, 30, 31] that protect against COVID-19 [32]. However, this study showed that the index of knowledge did not influence whether someone had reported having had COVID-19, but guaranteeing compliance with preventive measures did. It is essential to reinforce this message with clear public health and communication strategies. The use of preventive measures should still be encouraged to reduce the transmission of the virus, especially considering health environments and vulnerable people and if an increase in cases is detected.

In this study, people who have reported not having had COVID-19 perceived their physical health as being the same as or better than during the pandemic, which could be explained by the fact that these people had not suffered directly from the disease or its physical or mental consequences [33,34]. In addition, successful compliance with protective measures may have influenced individuals' positive perceptions of their own health [35].

The strong association between being fully vaccinated and not having reported COVID-19 aligns with the effectiveness of vaccination campaigns. Participants who reported not having had COVID-19 during the first two years of the pandemic were more likely to receive a full schedule of the vaccine and booster dose. The protection against infection and severity of the disease provided by COVID-19 vaccination with the booster dose has also been demonstrated [36,37]. Vaccination campaigns have been a key strategy for reducing the severity of the disease and preventing transmission and increasing vaccination coverage among those who had not contracted COVID-19, confirming that vaccination has played a crucial role in protecting individuals from infection.

4.1. Limitations

This was a cross-sectional study, and it has several limitations. Surveys of this type involve successive snapshots taken at a given point in time, so the results may not be generalizable. This sample was representative at the national level, but the sample size did not permit any assessment of regional differences. In addition, the results were drawn from self-reported data, so there may have been reporting bias.

The survey was administered only online, so groups of people with problems accessing the internet (older people, people with disabilities, or people with a lower education level) may have been underrepresented in the sample. However, this study used a nationally representative sample in terms of age, sex, education, and area of residence.

5. Conclusions

This study provides valuable insights into the characteristics and behaviours of individuals who reported not having had COVID-19. These results are consistent with those of other studies adding information on the social characteristics of people who reported not having suffered from COVID-19, which could help governments and public health decision-makers better understand what factors may have conditioned not having contracted the disease. Age, educational level, perceived severity, vaccination status and adherence to preventive measures were related to not having had COVID-19, while no association was found with disease knowledge. These results highlight that people who were more likely to follow recommended preventive behaviours, including vaccination and booster doses, were less likely to report having been infected. There is a need to reinforce compliance with preventive measures as a proven way to avoid contracting the disease, especially when the decline in compliance continues despite the many peaks in the number of cases. Knowing these factors could be highly relevant for designing public health strategies and interventions aimed at preventing the spread of COVID-19 and other infectious diseases and for addressing possible future pandemics of communicable diseases with similar characteristics. Efforts should focus on targeting vulnerable and high-risk populations to increase awareness and compliance with protective behaviours.

Further research is needed to explore additional factors that may contribute to the risk of COVID-19. Continued monitoring and evaluation of public health interventions will be crucial for managing the ongoing pandemic and future infectious disease outbreaks.

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Declaration of Competing Interest

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 paper.

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