

# Consumption of information and citizen's perception of the sources consulted during the Covid-19 pandemic: A study of the situation based on opinion polls

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Recommended citation:

**Quian, Alberto; Elías, Carlos; Soengas-Pérez, Xosé** (2023). "Consumption of information and citizen's perception of the sources consulted during the Covid-19 pandemic: A study of the situation based on opinion polls". *Profesional de la información*, v. 32, n. 4, e320413.

<https://doi.org/10.3145/epi.2023.jul.13>

Artículo recibido el 08-03-2023  
Aceptación definitiva: 21-06-2023



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## Abstract

The aim of this cross-sectional study is to analyze the consumption of information about coronavirus disease 2019 (COVID-19) in Spain and to ascertain the public's perception of the role of journalists, the media, the scientific community, and governmental and health authorities. The methodology involved taking a descriptive survey of a sample of 1,800 people who were representative of the Spanish population, were of legal age, and were residents of the 17 autonomous communities, between June 6 and 22, 2022. Age, political leaning, attitude toward vaccines, and level of education were determining variables. The results show that ideology and age are the factors that most condition the use of different types of information sources. Centrists consume more traditional media than those on the political left or right, who are the least likely to obtain their information from traditional media. And left-wingers rely more on official sources, such as health authorities, in contrast to centrists or right-wingers. Anti-vaccinationists (anti-vaxxers) prefer alternative sources. Meanwhile, the use of sources does not differ between men and women. Their consumption behavior is similar, which shows that gender is not a variable that significantly influences information consumption, neither in the selection of sources nor in the perception of the role of science and journalism. In general, the main sources of information consulted during the COVID-19 pandemic were the traditional media and the health authorities. In the context of the pandemic, young people consumed the least information and expressed the greatest distrust in journalism and science.

## Keywords

COVID-19; Coronavirus; Epidemics; Journalism; Media; Social networks; Social media; Disinformation; Fake news; Infodemic; Disinfodemic; Information sources; News sources; Science; Health; Surveys; Public opinion.



## Funding

This article is a result of the projects:

1. R&D&I project “Digital native media in Spain: strategies, competencies, social involvement and (re)definition of journalistic production and dissemination practices” (PID2021-122534OB-C21), financed by *Ministerio de Ciencia e Innovación (MCIN)* and *Agencia Estatal de Investigación (AEI)*, Spain, (10.13039/501100011033), and the *European Regional Development Fund (ERDF)*. *A way to make Europe*.
2. Project “Multi-source and multi-method prediction to support Covid-19 policy decision making” (*React-EU/ERDF, CAM*), and project “Pseudoscience, conspiracy theories, fake news, and media literacy in health communication” (Spanish Government: PID2022-142755OB-I00).

## 1. Introduction

### 1.1. Theoretical and contextual framework

Health is fertile ground for creators of disinformation, especially on the Internet (**Daraz et al.**, 2019) and particularly on social networks (**Naeem; Bhatti; Khan**, 2020), which can generate individual or collective pseudo-knowledge (**Introne et al.**, 2018). The coronavirus disease 2019 (COVID-19) pandemic created a situation conducive to the spread of hoaxes, manipulated content, conspiracy theories, and disinformation, and posed one of the greatest global threats to public security and well-being in recent decades (**Quian**, 2023). The mass spread of false, manipulated, or erroneous information, in the form of a disinformation pandemic, or disinfodemic, put the scientific community on alert, as it was concerned about the negative societal impacts that this disinfodemic would cause (**Gallotti et al.**, 2020; **Jolley; Lamberty**, 2020; **Patel; Kute; Agarwal**, 2020; **Solomon et al.**, 2020; **Zarocostas**, 2020). Additionally, this alert was issued by the *World Health Organization (WHO)*, by its Director-General, Tedros Adhanom Ghebreyesus, who acknowledged that

“we’re not just fighting an epidemic; we’re fighting an infodemic. Fake news spreads faster and more easily than this virus” (*The United Nations Department of Global Communications*, 2020).

The *WHO* thus recognized for the first time the dangers and threats of health-related viral disinformation phenomena (disinfodemics) and the importance of infodemiology as a scientific field, more than two decades after the genesis of infodemiological studies, which **Eysenbach** (2020) places in 1996. Recognizing the global threat posed by the disinfodemic in the context of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic prompted the *WHO* to create a website with information fact-checked by the scientific and health community, which has acted as a means to debunk disinformation about COVID-19 (**Zarocostas**, 2020).

**Eysenbach** (2002) coined the term “infodemiology” to conceptualize the epidemiology of (dis)information, but 18 years passed before this concept gained scientific relevance with the COVID-19 pandemic. In this context, two phenomena –infodemics and disinfodemics– coexist. Infodemics (information + epidemic) are described as information epidemics, in which huge volumes of information circulating on the Web overstrain people’s ability to discern whether the sources are reliable or not and whether the information received is true or false. In addition, information saturation impacts social dynamics during a health crisis and may even increase the spread of the natural epidemic (**Gallotti et al.**, 2020; **Tangcharoensathien et al.**, 2020; **Tomes**, 2020). The newer concept of a disinfodemic (disinformation + epidemic) limits the focus exclusively to the virality (on an epidemic or pandemic scale) of fake news, manipulated content, conspiracy theories, and any disinformation strategy or product aimed at generating confusion about medical science, and can be more toxic and more lethal than disinformation on other topics (**Posetti; Bontcheva**, 2020a,b). Therefore, the term “disinfodemic” seems appropriate when discussing viral disinformation phenomena related to human health and the scientific health field (**Quian**, 2023).

In the scenario of a global pandemic, there are warnings regarding conspiratorial, denialist, and populist disinformation strategies used to discredit the scientific health authorities, to undermine confidence in health institutions and programs (*The lancet infectious diseases*, 2020), and to

“create fear, rumours, and prejudice that jeopardise our global collaboration in the fight against this virus” (**Calisher et al.** 2020, p. e42).

**Mian and Khan** (2020) warn of a progressive “disconnect between scientific consensus and members of the public,” fostered by the populist movements of the 21<sup>st</sup> century, political and social polarization, and attacks on science from extremist sectors –a trend that worsened in the context of the COVID-19 pandemic with the spread of disinformation on a global scale, “drowning out credible sources of information” (**Mian; Khan**, 2020, p. 1).

According to several studies from before the COVID-19 pandemic, there is a correlation between belief in conspiracies, rejection of science, and support for pseudosciences (**Lewandowsky; Gignac; Oberauer**, 2013; **Lewandowsky; Oberauer; Gignac**, 2013; **Lobato et al.**, 2014; **Van-der-Linden**, 2015; **Hartman et al.**, 2017; **Lobato; Zimmerman**, 2019). In the context of the COVID-19 pandemic, **Mian and Khan** (2020) also indicate that the media contributed to public disinformation and confusion because their concern was to “increase viewership” rather than to provide truthful and verified information –they were

“creating dramatic headlines but are instead inciting panic amongst the public” (**Mian and Khan**, 2020, p. 1).

The scientific sectors' criticism of the media was very harsh during the pandemic; in fact, they were accused of being "guilty of favouring quick, sensationalist reporting rather than carefully worded scientific messages with a balanced interpretation" (*The lancet infectious diseases*, 2020).

Opposing some media outlets' recurrent use of inexpert and pseudoscientific sources (Elias, 2020; Quian, 2023), authors such as Hauer and Sood (2020, p. 3) speak of how

"amplifying the voices of experts increases the number of people that receive accurate and up to date information about COVID-19."

These expert voices (the scientific health authorities) must serve as bastions of truth against the fabricators of lies and conspiracies, but they also must

"resist attempts to sway their messaging to reflect institutional or political interests." (Garrett, 2020, p. 942).

The scientific health community has also warned of the dangers of politicizing and ideologizing the global public health crisis –polarizing the public– to profit by gaining votes (Fraser *et al.*, 2021; Legido-Quigley *et al.*, 2020; Mian; Khan, 2020; Nogrady, 2021).

## 1.2. The state of affairs

In Spain, at various times throughout the pandemic, surveys similar to the one presented herein were conducted to learn about the means of information consumption that were related to COVID-19 and shaped by the pandemic environment. Bernal-Triviño (2020) conducted research using 830 surveys to identify changes in media access routines after one month of lockdown in Spain. The results of this work show that there was a high level of interest in the news at the beginning of the pandemic period, with the following of the media, social networks, and journalists becoming increasingly selective, and criticism of disinformation and sensationalism and their lack of ethics among media outlets. Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz (2023) conducted another national survey, in July 2021, with a sample of 682 people, to learn about the perceptions of Spanish citizens regarding disinformation in the COVID-19 period; the results indicated a distrust of the media and politicians. An experimental study carried out in Germany also found a distrust of scientists (König; Breves, 2021), although less than that of politicians. This distrust has led, in some cases, to harassment of and attacks on scientists (Nogrady, 2021; O'Grady, 2022).

Other studies focusing on educational aspects show that scientific literacy and political ideology are determining variables for trusting science and solutions provided by it, such as vaccines (Allum *et al.*, 2008; Gauchat, 2012; Hamilton, 2015, Hartman *et al.*, 2017), but the work of Egelhofer (2023) shows that populist politicians' anti-science discourse has little impact on citizens' perceptions of scientists.

Several surveys conducted in Spain and other countries also demonstrate the devastating health impacts that believing in conspiracies about COVID-19 (Freeman *et al.*, 2022) and the acceptance of disinformation or false information (Rozenbeek *et al.*, 2020) can have. For example, Islam *et al.* (2020, p. 1624) documented that, during the first quarter of 2020 in Iran, 800 people died, 5,876 were hospitalized, and 60 were blinded by consuming methanol as a purported antidote to SARS-CoV-2. The people concerned were persuaded by false information circulating on the Internet and disregarded the advice of the scientific and health authorities. There is also evidence that science and health content played a prominent role in shaping the spread of deception during the pandemic (León *et al.*, 2022).

In contrast to what happens on social networks, journalists from media outlets that are considered "benchmark" media outlets, especially in the press, use credible sources or, at least, those with *auctoritas*. Catalán-Matamoros and Elías (2020) explored the main sources used by the Spanish press to report on COVID-19 vaccines, and governmental sources stood out.

## 1.3. Objectives

The general objective of this research is to determine what the public's perception of the sources of information consulted during the COVID-19 health crisis is and to find out how the pandemic affected public opinion and social dynamics. To this end, we conducted a survey of 1,800 citizens of legal age residing in the 17 autonomous communities of Spain. The following are established as specific objectives:

- O1: To understand to what level information on COVID-19 was followed.
- O2: To identify the main sources that citizens used to learn about the pandemic.
- O3: To identify sociodemographic variables that can determine information consumption and opinion-forming behaviors.
- O4: To identify sociodemographic variables that may determine citizens' trust or distrust in official sources, scientific and health authorities, and the media.
- O5: To find out the degree of trust or distrust in science and journalism during the pandemic.

In addition, we posed several research questions, related to the objectives, which we considered necessary to pursue the topic under study:

- Q1: How have Spanish citizens obtained information about the COVID-19 pandemic?
- Q2: To citizens, which sources have the most credibility or trustworthiness?
- Q3: Are there generational and gender differences in the ways to access and consume information, and in the perception of science and journalism?
- Q4: Are education and political ideology determinant when it comes to the means of accessing information and trust in science and journalism?
- Q5: Does being pro- or anti-vaccine condition how people obtain information and their perception of science and journalism?

## 2. Methodology

This cross-sectional study uses a descriptive survey, conducted between June 6 and 22, 2022, of 1,800 citizens who reside in the 17 autonomous communities of Spain and who have an age range between 18 and 80 years old. The representativeness criteria took into account the variables of sex, age, and geographic area. Quotas were set for each, and a weighting was applied to adjust them. In addition, the level of education, field of studies, and political leaning of the respondents were identified.

To set the sample representation, the data of the population were obtained from the Spanish *National Institute of Statistics (INE)*. The 1,800 surveys that were integrated for quantitative analysis in this study were collected by random sampling, adjusting their composition according to the Spanish population at the national level and the distribution according to the autonomous communities, with a confidence level of 95.5%, a variability of  $p = q = 50%$ , and a margin of sampling error of  $\pm 2.34%$ .

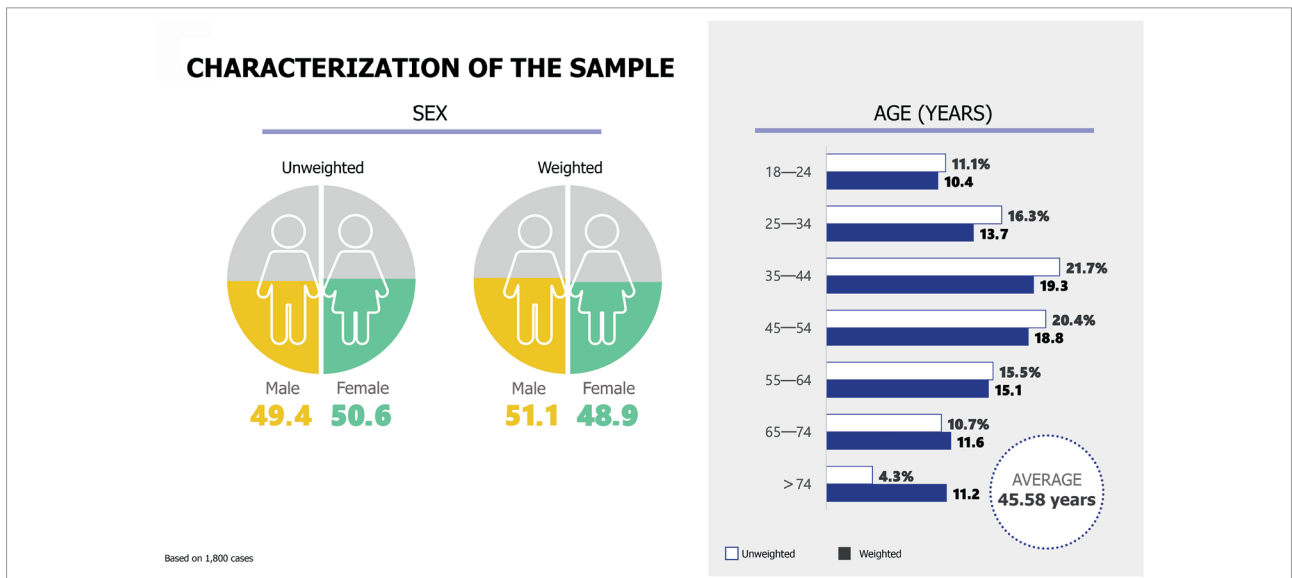


Figure 1. Characterization of the sample according to sex and age

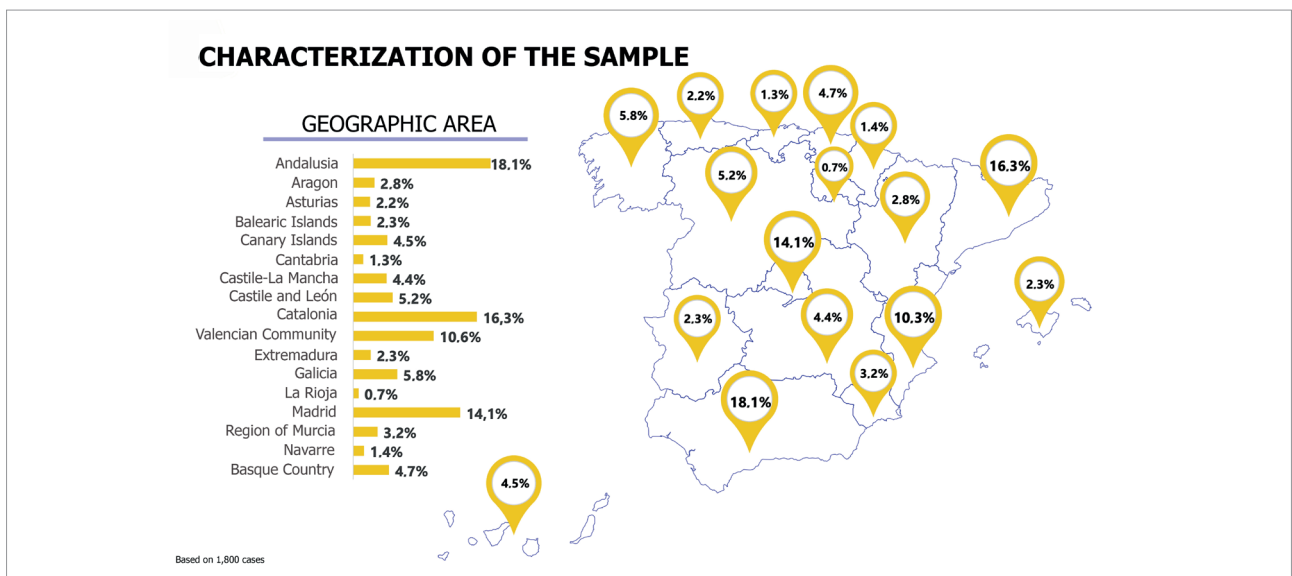


Figure 2. Characterization of the sample according to autonomous community

Data collection was carried out through an online survey, following the *Computer assisted web interviewing (CAWI)* method, through a consumer panel. This computer-assisted model allowed individuals to self-administer a structured questionnaire with closed-ended questions.

Respondents were guaranteed that their answers would stay anonymous, and the *ISO 20252* standard and the *CCI/ESOMAR Code of Conduct* were applied to maintain the rigor and quality of the research.

Descriptive surveys are useful for obtaining, in the early stages of research, information about specific phenomena affecting large populations (Malhotra; Grover, 1998; Rea; Parker, 2014; Rossi et al., 2013), and they provide an appropriate level of clarification about respondents' characteristics, opinions, attitudes, and preferences (McMurray et al., 2004). And although this method does not draw correlations or causal relationships, it does effectively portray the phenomenon being researched and allows evidence to be obtained through data collection on particular issues, which can be used for future decision-making (Oppenheim, 1992).

## 2.1. Characterization of the sample

The survey data presented below (Figures 1, 2, 3, and 4) describe the research sample according to the variables of gender, age, autonomous communities, level of education, and political leaning.

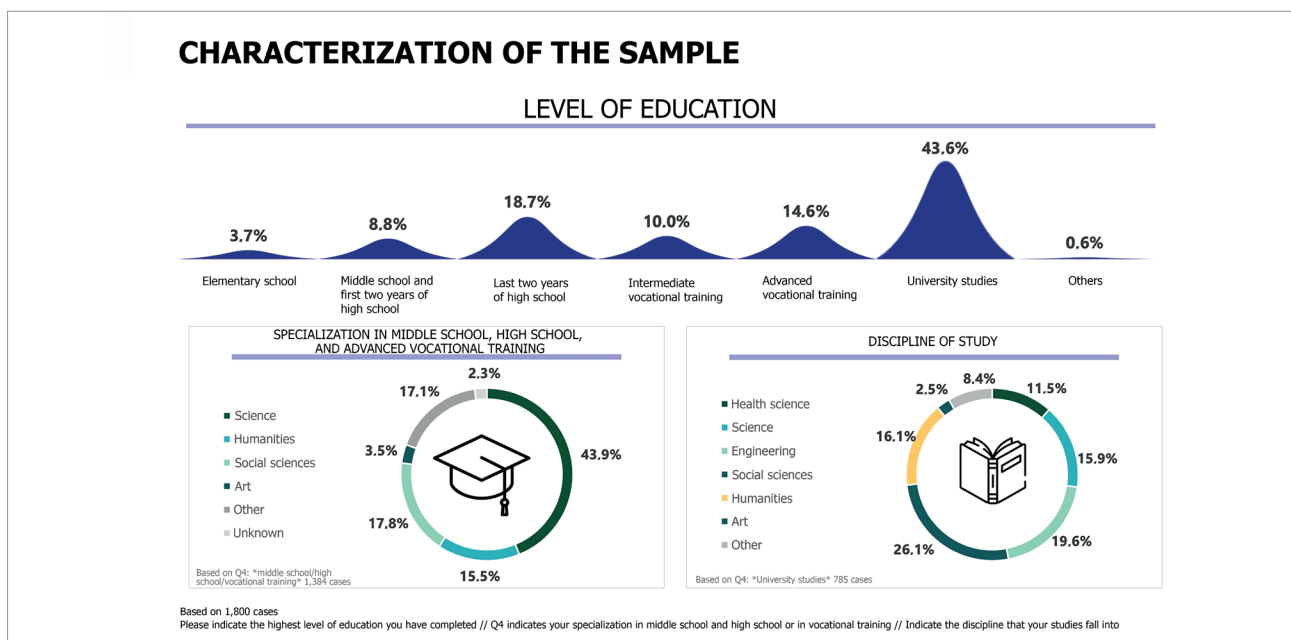


Figure 3. Characterization of the sample according to level of education

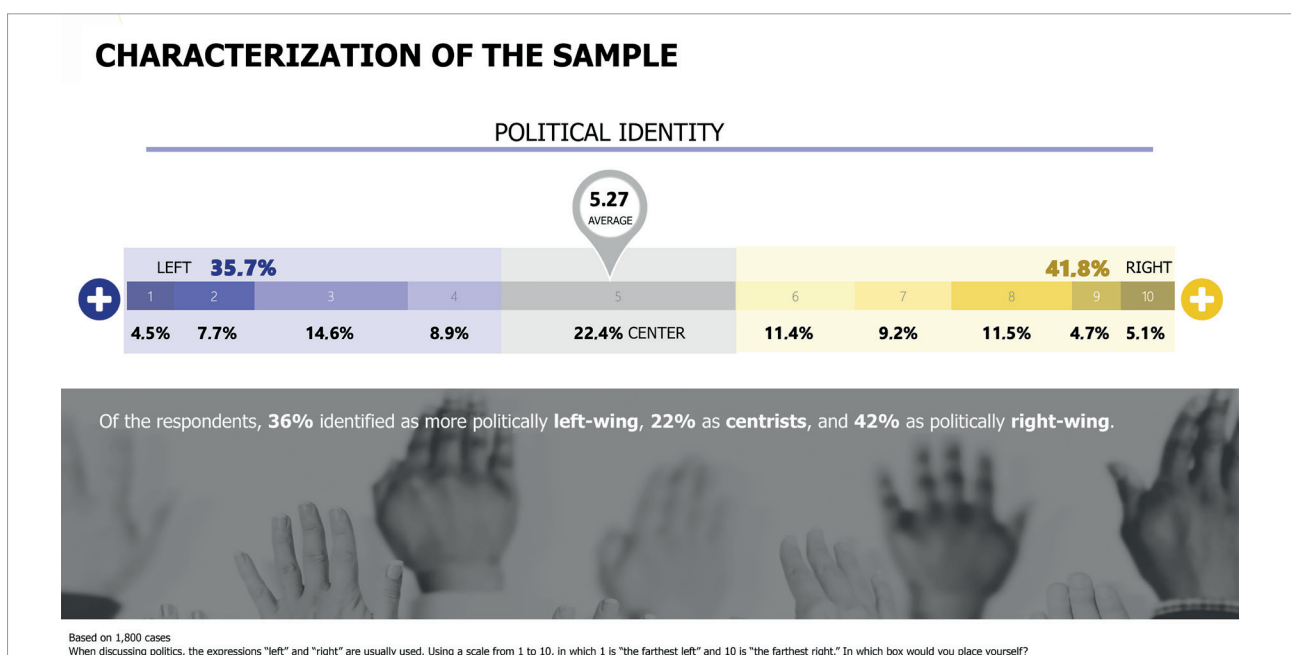


Figure 4. Characterization of the sample according to political identity



This is a representative sample based on *INE* data, in which women outnumber men (51.1% versus 48.9%), the average age of the respondents was 45.58 years, and the autonomous communities with the highest population weight were Andalusia (18.1%), Catalonia (16.3%), and Madrid (14.1%).

Data on level of education showed that 43.6% had a university education and only 3.7% had not gone beyond elementary school.

The political characterization of the surveyed population showed that, on a scale of 1 to 10, where 1 is “far left” and 10 is “far right,” the average was ideologically centrist (5.7 out of 10), although there were more people on the right (41.8%) than on the left (35.7%).

Once the sample had been defined according to sex, age, autonomous community, level of education, and political leaning, the variable “vaccination” (Figure 5) was considered to determine the percentage who were vaccinated and the respondents’ attitudes toward COVID-19 vaccines, so as to relate it to the use of information sources. In the period analyzed, only 6.4% of the respondents had not been vaccinated, and 1% did not want to reveal whether they had been vaccinated or not. Some 80.4% had already received the full regimen.

### 2.2. Following of news, sources, and degree of trust/distrust

To obtain data on respondents’ attitudes and information-seeking behaviors, the following questions were asked (Table 1), the answers to which were subsequently disaggregated according to the sociodemographic variables:

## 3. Results

### 3.1. Following of news and sources of information

Of the respondents, 85.1% had followed news related to COVID-19 very closely. Only 3.6% said they had not done so. The main sources of information were the traditional media (press, radio, and TV; +26.5%) and the health authorities (+26.4%). Regarding respondents’ second choices for sources of information, central, regional, and local governments (15.8%); research organizations (11.4%); and family and friends on social networks (9.2%) stood out. Regarding the respondents’ first choice of source, 4.8% acknowledged having consulted alternative sources and the pharmaceutical sector (3.3%), and universities (1.9%) also appeared as minority sources.

According to gender, differences, with respect to the total, were only found between women (>11.4%) and men (<6.9%) when it came to accessing information from friends and family on social networks. And, according to age, differences, with respect to the total, were identified for young people aged 18-24 years, who showed less interest in following news about COVID-19 (<71.3%) and in the health authorities (<18.1%), for which confidence seemed to be greater in the age group 65-74 years (>33.4%).

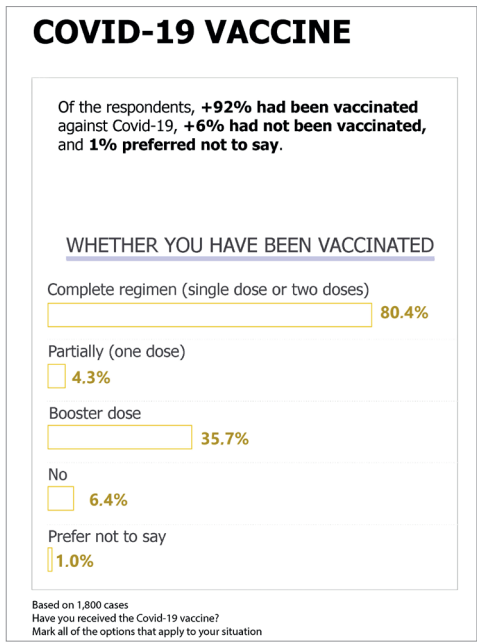


Figure 5. Characterization of the sample according to COVID-19 vaccination

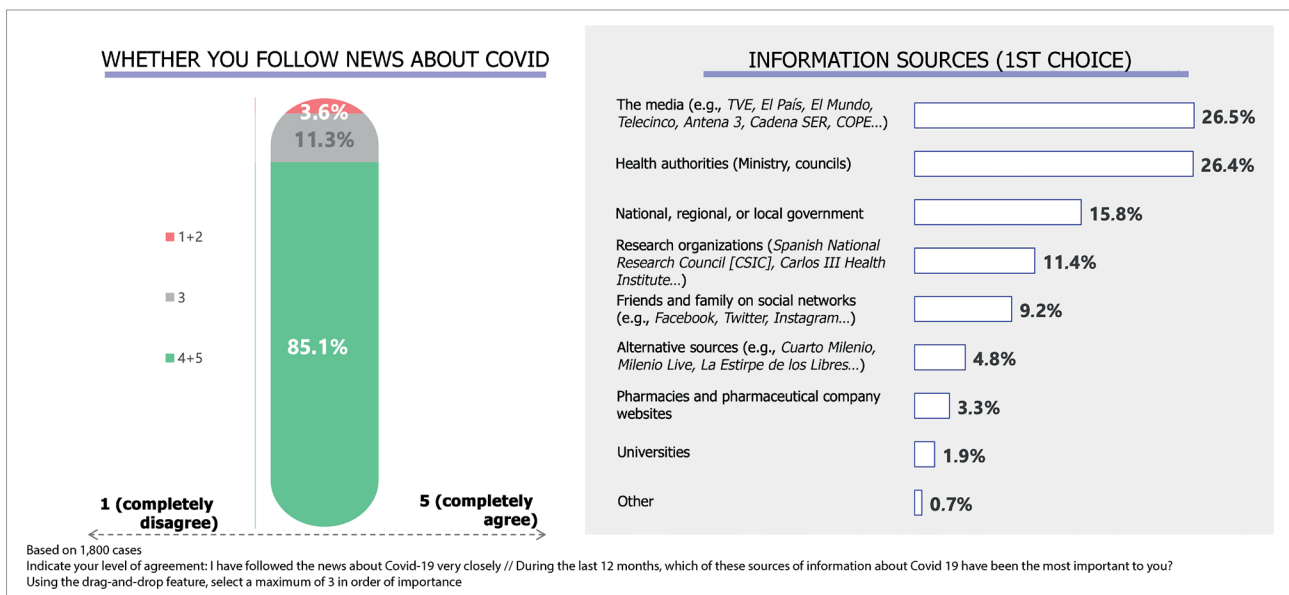


Figure 6. Monitoring of COVID-19 news and key sources of information

Table 1. Design of the questions and objectives to be achieved

Questions	Type	Responses	Objectives
You have followed news about COVID-19.	Likert scale 1-5	1 = strongly disagree 2 = disagree 3 = neither agree nor disagree 4 = agree 5 = strongly agree	O1, O3
Sources of information used.	Multiple choice: - Friends and family on social networks - Health authorities - Pharmacies and pharmaceutical company websites - Alternative sources - National, regional, or local government - The media - Research organizations - Other	Each subject's first choice was used for the calculations.	O2, O3
Statements - Science aims to seek the truth and make it public. - The existence of news or information about the COVID-19 pandemic that distorts reality is a problem in our country. - It is advisable to have external oversight over journalism to monitor the quality of the content disseminated by the media when it comes to health matters. - Journalism aims to seek the truth and make it public. - It is easy for me to identify news or information about the COVID-19 pandemic that distorts reality or is even false. - When faced with news or information that I question, I turn to webpages, online resources, or fact-checking tools on the computer to verify information about COVID-19 ( <i>Maldita.es</i> , <i>Newtral</i> , <i>VerificaEfe</i> , etc.). - The management of the pandemic (vaccination, closures of hospitality services, etc.) in your autonomous community will matter when it comes to your voting decision in the next elections. - Media coverage during the COVID-19 pandemic has created or increased stigma and discrimination against certain groups (obese people, older people, immigrants, smokers). - During the pandemic, journalists have covered COVID-19 in accordance with the ethical principles of truthfulness and impartiality. - The terminology used by the media to refer to the COVID-19 virus and vaccines has been too technical and difficult to understand. - Scientists routinely endanger humanity.	Likert scale 1-5	1 = strongly disagree 2 = disagree 3 = neither agree nor disagree 4 = agree 5 = strongly agree  The 11 statements were grouped into three categories according to the degree of agreement or disagreement that they received: - TOP (more than 70% of respondents agreed) - MED (about 50% agreed/disagreed) - BOTTOM (less than 50% agreed)	O4, O5

The younger segment, aged 18-24 years, also showed less interest in alternative sources (<1.5%), as opposed to the populations aged 25-34 years (7.2%) and 35-44 years (>7.2%). The two youngest segments were also the ones that stood out most in terms of the use of family and friends as sources on social networks (>18.0% and >14.6%, respectively), data that contrasted with a minimal use of these sources by the oldest (<2.7% in the segment aged 65-74 years and <2.6% from that aged 75 years and older). The population aged 18-24 years paid the most attention to the information provided by universities (>4.3%), and a progressive drop in the use of academic institutions was observed as age increased.

In terms of the information provided by the central, regional, and local governments, differences were found between the attention paid to it by the age group 35-44 years, which had the least confidence in these sources (<12.3%), and those over 74 years of age (>20.9%). The older segment also demonstrated the greatest confidence in pharmaceutical sources (>7.8%), with a difference of with respect to the overall sample.

Scientific research organizations had similar values in all segments, except in the 65-74-year-old segment, where confidence was higher (>15.5%).

“ Of the respondents, 85.1% followed news related to the COVID-19 pandemic very closely. Only 3.6% said they had not done so ”

	SEX		AGE (YEARS)						
	Female	Male	18–24	25–34	35–44	45–54	55–64	65–74	>74
	920	880	187	247	347	338	271	208	202
YOU HAVE FOLLOWED NEWS (4 + 5)	83.8	86.5	<71.3	86.6	86.4	86.4	87	86.9	87.1
YOU HAVE FOLLOWED NEWS (1 + 2)	4.1	3	5.5	2.8	3.6	3.9	2.4	3.7	3.8
<b>INFORMATION SOURCES (1st choice)</b>									
The media (e.g., TVE, El País, El Mundo, Telecinco, Antena 3, Cadena SER, COPE...)	26.1	26.9	30.3	22.9	24.5	27.8	30.1	22.9	27.6
Health authorities (Ministry, councils)	25.9	27	<18.1	24.8	25.5	25.2	28.7	>33.4	29.4
National, regional, or local government	15.6	15.9	12.8	14.4	<12.3	16.2	17.3	17.9	>20.9
Research organizations (Spanish National Research Council [CSIC], Carlos III Health Institute...)	10.2	12.6	12.4	8.8	12.2	12.4	10.2	>15.5	7.6
Friends and family on social networks (e.g., Facebook, Twitter, Instagram...)	>11.4	<6.9	>18.0	>14.6	11.4	8.0	6.7	<2.7	<2.6
Alternative sources (e.g., Cuarto Milenio, Milenio Live, La Estirpe de los Libres...)	5.3	4.4	<1.5	7.2	>7.2	5.5	4.1	3.1	2.7
Pharmacies and pharmaceutical company websites	3.2	3.4	2.5	3.6	2.9	3.3	1.4	2.4	>7.8
Universities	1,7	2,2	>4,3	3,4	>3,5	1,1	0,7	0,5	<0,0
Other	0,7	0,7	0	0,3	0,5	0,5	0,8	1,6	1,3

Based on 1,800 cases  
 Indicate your level of agreement: I have followed the news about Covid-19 very closely // During the last 12 months, which of these sources of information about Covid 19 have been the most important to you?  
 Using the drag-and-drop feature, select a maximum of 3 in order of importance

Figure 7. Main sources of information about COVID-19 according to gender and age group

In terms of political leaning, no differences were observed in following news about COVID-19 among the different groups, but ideology did condition the use of different types of information sources. People who considered themselves in the center of the political spectrum showed a significant positive difference, with respect to the total, in information consumption through traditional media (>34.4%), compared with those who declared themselves to be right-wing, who had a substantial negative difference, with respect to the total (<23.2%). Left-wingers were the ones who turned the most to health authorities as sources (>33.8%), whereas lower values in comparison with the other groups sample were observed for those in the center (<21.5%) and on the right (<22.8%). Among right-wingers, there were also differences when it came to consulting information offered by the central, regional, and local governments, as they had values lower than the other groups (<13.5%). However, right-wingers as a political profiles had higher values when it came to consulting information provided by research organizations (>15.2%), compared with left-wingers, who had lower values (<8.1%). The same was true for pharmaceutical sources, which were consulted more by those on the right (>5.0%) and

	POLITICAL IDENTITY			VACCINATION		
	Left	Center	Right	Yes	Unsure	No
	643	404	753	1072	409	186
YOU HAVE FOLLOWED NEWS	86.5	82.3	85.4	>90.1	83.4	<77.8
YOU HAVE FOLLOWED NEWS	3.1	4.1	3.8	<1.8	3.5	3.7
<b>INFORMATION SOURCES (1st choice)</b>						
The media (e.g., TVE, El País, El Mundo, Telecinco, Antena 3, Cadena SER, COPE...)	25.9	>33.4	<23.2	27.3	28.6	<20.3
Health authorities (Ministry, councils)	>33.8	<21.5	<22.8	27.5	26.4	27.6
National, regional, or local government	17.7	16.9	<13.5	16.8	15.2	14.3
Research organizations (Spanish National Research Council [CSIC], Carlos III Health Institute...)	<8.1	9.3	>15.2	11.7	10.1	11.6
Friends and family on social networks (e.g., Facebook, Twitter, Instagram...)	<7.3	10.3	10.2	8.7	9.2	11
Alternative sources (e.g., Cuarto Milenio, Milenio Live, La Estirpe de los Libres...)	3.5	4.9	5.9	<2.0	6.6	>9.1
Pharmacies and pharmaceutical company websites	<2.2	1.9	>5.0	3.7	1.8	3.3
Universities	1.4	1.2	>2.8	2	1.5	1.9
Other	<0.0	0.5	>1.4	<0.2	0.6	1

Based on 1,800 cases  
 Indicate your level of agreement: I have followed the news about Covid-19 very closely // During the last 12 months, which of these sources of information about Covid 19 have been the most important to you? Using the drag-and-drop feature, select a maximum of 3 in order of importance

Figure 8. Main sources of information about COVID-19 according to political identity and attitude toward vaccines



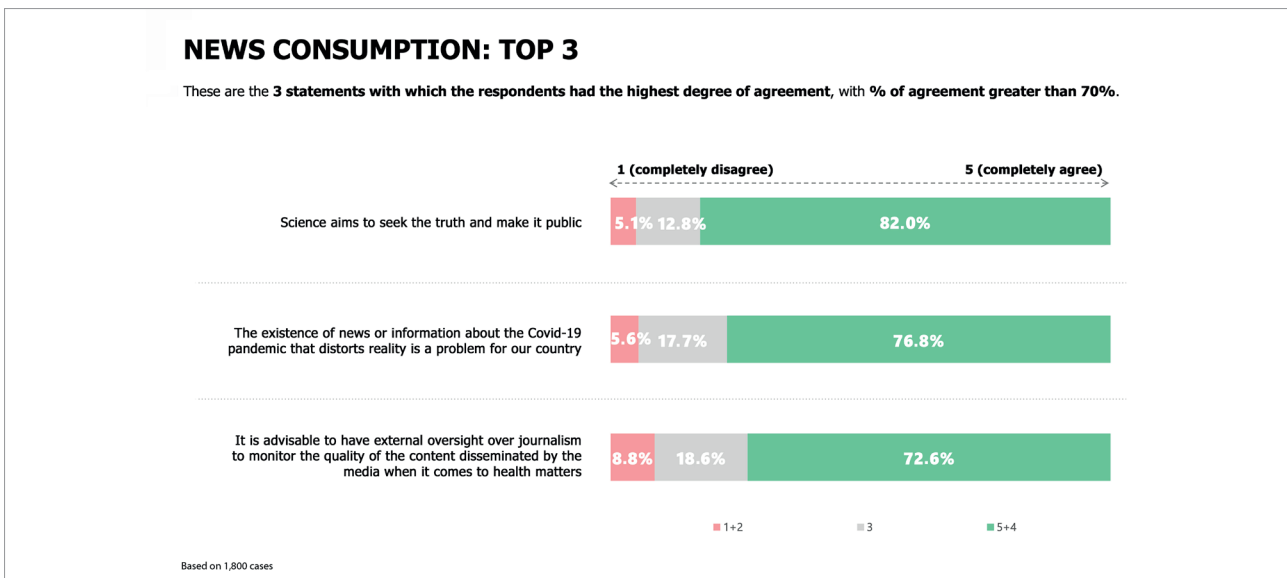


Figure 9. Degree of agreement/disagreement with TOP statements

less by those on the left (<2.2%). The latter also had the lowest values for accessing information from friends and family on social networks (<7.3%), while more conservative individuals had higher values for accessing information from university sources (>2.8%).

There were no substantial differences in the use of alternative sources according to political ideology.

Attitude toward vaccines was not, in general, a variable that revealed important differences in the use of sources, but those reluctant to receive the vaccine did have lower values when it came to consulting traditional media (<20.3%) and had a greater difference than the average when it came to the use of alternative sources (>9.1%), where those on the left also showed a lower percentage than the total (<2.0%).

### 3.2. Degree of trust/distrust in science and journalism

The 11 statements (S1-S11) presented to the respondents were grouped into three categories according to the degree to which respondents agreed or disagreed with them: TOP (more than 70% of respondents agreed), MED (about 50% agreed/disagreed), and BOTTOM (less than 50% agreed).

The highest degree of agreement (TOP) out of the entire sample was with these three statements:

- S1: "Science aims to seek the truth and make it public" (82.0%).
- S2: "The existence of news or information about the COVID-19 pandemic that distorts reality is a problem for our country" (76.8%).

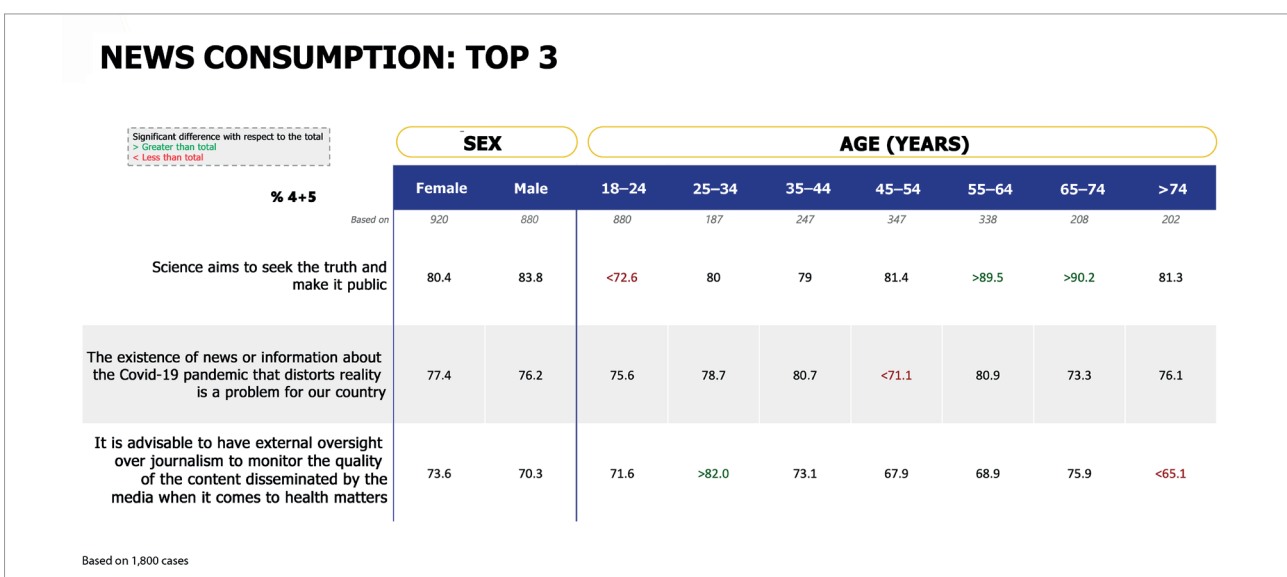


Figure 10. Degree of agreement/disagreement by gender and age for top 3 statements

% 4+5	POLITICAL IDENTITY			VACCINATION		
	Left	Center	Right	Yes	Unsure	No
Based on	643	404	753	1072	409	186
Science aims to seek the truth and make it public	>87.3	<75.9	80.9	>87.6	81.8	<65.0
The existence of news or information about the Covid-19 pandemic that distorts reality is a problem for our country	>81.2	<72.0	75.6	78.2	76.5	<69.8
It is advisable to have external oversight over journalism to monitor the quality of the content disseminated by the media when it comes to health matters	73.4	70.7	71.5	72.1	>77.8	<65.7

Based on 1,800 cases

Figure 11. Degree of agreement/disagreement according to political identity and attitude toward vaccination in TOP 3 statements

- S3: “It is advisable to have external oversight over journalism to monitor the quality of the content disseminated by the media when it comes to health matters” (72.6%).

According to gender, no notable differences were found for S1, S2, and S3.

According to age, in S1 there were differences, with respect to the total, in the youngest segment, 18-24 years of age, which had the lowest degree of agreement with this statement (<72.6%), and in the groups 55-64 years (>89.5%) and 65-74 years of age (>90.2%), which had the highest degree of agreement with S1. In S2, significant differences, in respect to the total, were found only in the intermediate age segment, 45-54 years, which showed the lowest degree of agreement (<71.1%). And in S3, differences were observed in the age group 25-34 year (>82.0%) and in the age group over 74 years (<65.1%), with the highest and lowest degrees of agreement and disagreement, respectively.

According to political leaning, there were differences in S1 and S2, with respect to the total, between those who identified as left-leaning and centrist, with left-wingers showing the highest degree of agreement with S1 (>87.3%) and S2 (>81.2%), and centrists the lowest (<75.9% and <72.0%, respectively).

In the section on attitudes toward vaccination, significant differences were identified in the degree of agreement with S1 in the pro-vaccine (>87.6%) and anti-vaccine (<65.0%) groups –the degree of agreement with S2 was lower, with respect to the total, in those who rejected vaccination (<69.8%), and for S3 the degree of agreement was higher in the group that had doubts about the vaccine (>77.8%) and lower in those who rejected it (<65.7%).

% 4+5	EDUCATION			ESP. INTERMEDIATE EDUCATION			ESP. UNIVERSITY STUDIES		
	BASIC	INTERMEDIATE	UNIVERSITY	SCIENCE	HUMANITIES	OTHER	HEALTH SCIENCE	SCIENCE	HUMANITIES
Based on	224	780	785	608	508	236	90	278	350
Science aims to seek the truth and make it public	<76.2	<79.7	>85.9	>86.4	83.3	80.7	88.9	>87.7	84.2
The existence of news or information about the Covid-19 pandemic that distorts reality is a problem for our country	72.9	78	76.7	78.1	77.8	77.2	84.3	74	76.7
It is advisable to have external oversight over journalism to monitor the quality of the content disseminated by the media when it comes to health matters	76.4	72.4	70.4	<67.2	>77.6	73.8	67.5	68.4	73.8

Based on 1,800 cases

Figure 12. Degree of agreement/disagreement according to educational level and study discipline on TOP 3 statements

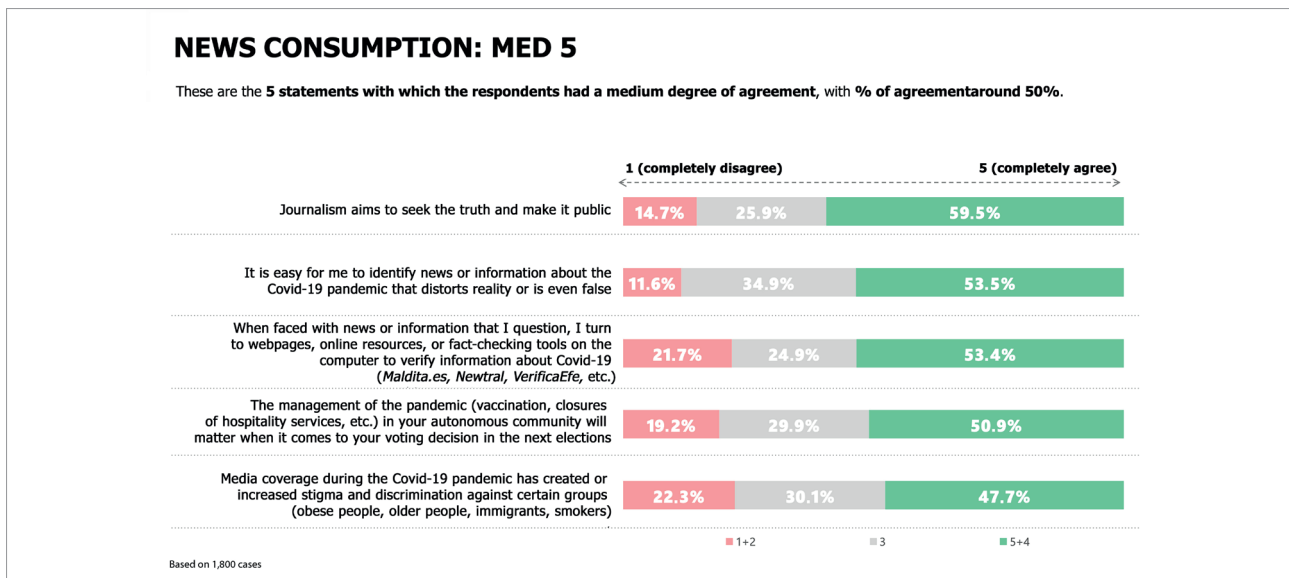


Figure 13. Degree of agreement/disagreement when it came to MED 5 statements

According to level of education, the degree of agreement with S1 was different in all groups –lower in those with basic education (<76.2%) and higher in those with university education (>85.9%)– and there were no significant differences for S2 and S3.

According to specialization, differences, with respect to the total, were found in S1 in those who specialized in science, in both intermediate (>86.4%) and higher education (>87.7%). For S2 there were no notable differences in any group, and for S3 there was a higher degree of agreement for the group with an intermediate level of education in the arts (>77.6%) and a lower degree of agreement for the group with a science specialization at the same educational level (<67.2%).

The statements with medium agreement (MED) were the following:

- S4: “Journalism aims to seek the truth and make it public” (59.5%).
- S5: “It is easy for me to identify news or information about the COVID-19 pandemic that distorts reality or is even false” (53.5%).
- S6: “When faced with news or information that I question, I turn to webpages, online resources, or fact-checking tools on the computer to verify information about COVID-19 (Maldita.es, Newtral, VerificaEfe, etc.)” (53.4%).
- S7: “The management of the pandemic (vaccination, closures of hospitality services, etc.) in your autonomous community will matter when it comes to your voting decision in the next elections” (50.9%).
- S8: “Media coverage during the COVID-19 pandemic has created or increased stigma and discrimination against certain groups (obese people, older people, immigrants, smokers)” (47.7%).

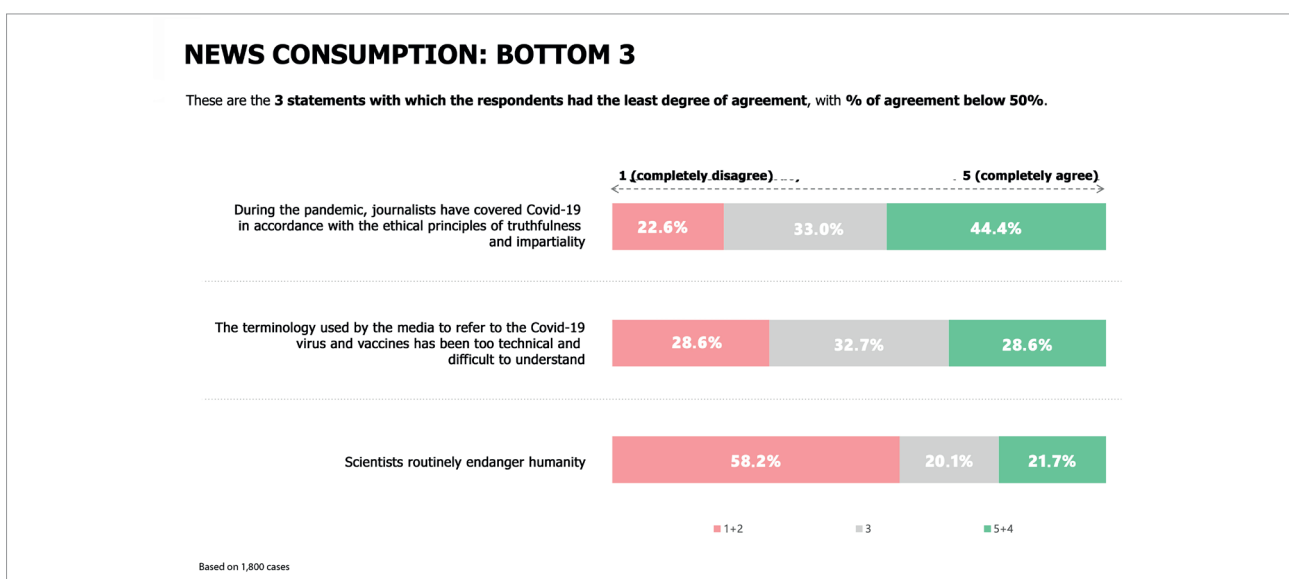


Figure 14. Degree of agreement/disagreement with BOTTOM 3 statements

% 4+5	SEX		AGE (YEARS)						
	Female	Male	18-24	25-34	35-44	45-54	55-64	65-74	>74
Based on	920	880	187	247	347	338	271	208	202
During the pandemic, journalists have covered Covid-19 in accordance with the ethical principles of truthfulness and impartiality	43.5	45.4	39.4	>51.1	42	44.1	47.4	48.3	<37.8
The terminology used by the media to refer to the Covid-19 virus and vaccines has been too technical and difficult to understand	27.2	30.2	33.3	>37.4	>33.5	25.3	<23.3	27.7	<19.0
Scientists routinely endanger humanity	22.3	21.1	>29.2	>33.9	25.4	20.2	<12.9	<11.5	18.6

Based on 1,800 cases

Figure 15. Degree of agreement/disagreement according to gender and age with BOTTOM 3 statements

The lowest degree of agreement (BOTTOM) from the entire sample was with the following statements:

- S9: “During the pandemic, journalists have covered COVID-19 in accordance with the ethical principles of truthfulness and impartiality” (44.4%).
- S10: “The terminology used by the media to refer to the COVID-19 virus and vaccines has been too technical and difficult to understand” (28.6%).
- S11: “Scientists routinely endanger humanity” (21.7%).

According to gender, there were no notable differences, with respect to the total, in S9, S10, and S11.

According to age, the degree of agreement for S9 was higher, with respect to the total, in the age group 25-34 years (>51.1%) and lower in the age group over 74 years (<37.8%); for S10 it was also higher in the age group 25-34 years (>37.4%) and lower in the age group over 74 years (<19.0%); and for S11 it was higher again for the age group 25-34 years (>33.9%) and age group 18-24 years (>29.2%), and lower in the age group 65-74 years (<11.5%) and age group 55-64 years (<12.9%).

Political leaning made clear differences. Here the degree of agreement with the three statements was higher among people who defined themselves as right-wing (S9: >47.7%; S10: >39.1%; S11: >33.0%).

% 4+5	POLITICAL IDENTITY			VACCINATION		
	Left	Center	Right	Yes	Unsure	No
Based on	643	404	753	1072	409	186
During the pandemic, journalists have covered Covid-19 in accordance with the ethical principles of truthfulness and impartiality	46.4	<35.3	>47.7	>54.3	<36.6	<22.5
The terminology used by the media to refer to the Covid-19 virus and vaccines has been too technical and difficult to understand	<20.2	<22.5	>39.1	>31.2	<23.0	27.5
Scientists routinely endanger humanity	<11.5	<17.1	>33.0	20.7	18.4	26.7

Based on 1,800 cases

Figure 16. Degree of agreement/disagreement according to political identity and attitude toward vaccines with BOTTOM 3 statements

	EDUCATION			ESP. INTERMEDIATE EDUCATION			ESP. UNIVERSITY STUDIES		
	BASIC	INTERMEDIATE	UNIVERSITY	SCIENCE	HUMANITIES	OTHER	HEALTH SCIENCE	SCIENCE	HUMANITIES
<b>% 4+5</b>									
Based on	224	780	785	608	508	236	90	278	350
During the pandemic, journalists have covered Covid-19 in accordance with the ethical principles of truthfulness and impartiality	41.2	44.8	45	45.6	46.6	45.6	46.5	46.2	44.7
The terminology used by the media to refer to the Covid-19 virus and vaccines has been too technical and difficult to understand	28.2	30.1	27.6	<25.1	31.5	29.4	25.7	31.3	26.7
Scientists routinely endanger humanity	25.3	22.1	20.5	<18.2	23.5	21.7	23.3	19	21.8

Based on 1,800 cases

Figure 17. Degree of agreement/disagreement according to educational level and study discipline for BOTTOM 3 statements

With respect to attitude toward vaccination, there were notable differences in the degree of agreement with S9 –higher among pro-vaccinationists (>54.3%) and lower among anti-vaccinationists (anti-vaxxers; <22.5%) and those on the fence (<36.6%)– and with S10, also higher among those who accepted vaccination (>31.2%) and lower in those who were not certain about receiving it (<23.0%), whereas with S11 there was greater agreement among those who rejected vaccines (26.7%).

According to educational specialty, only the segment with intermediate studies in science had a different degree of agreement with respect to the total: lower for S10 (<25.1%) and S11 (<18.2%).

#### 4. Discussion

This research is based on a survey of a sample of 1,800 adults residing in the 17 autonomous communities of Spain, designed to describe how information about COVID-19 has been consumed and what the public opinions on the role of journalists, the media, the scientific community, and health and governmental authorities are, and to understand consumption and opinions according to sociodemographic variables.

The results indicate that a high percentage of the sample population (85.1%) has closely followed the news related to the SARS-CoV-2 coronavirus pandemic, but the information consumption by young people (18-24 years old) in this context is much lower (13.8 percentage points below the sample mean and with a percentage difference of 16.21%).

The main sources of information were the traditional media (press, radio, and TV) and health authorities, which far surpassed other sources; in fact, both accounted for more than half of the respondents' first choices of sources. The second-choice sources of information were government authorities, research agencies, and, to a lesser extent, social network landscape. Among the other categories of sources, the limited role played by alternative sources, through which the scientific health and governmental authorities' versions of information about COVID-19 have been cast into doubt, stood out, albeit the differences between the 18-24 and 25-44-year-old segments were important. Those aged 18-24 years had lower values in comparison with the sample mean, and those aged 25-44 years had higher values, with a difference between the two groups of 5.7 points and a percentage difference of 68.75% and 50%, respectively, compared with the mean. In addition, the percentage difference between the two groups is 380% for the use of alternative sources. Also of note was the low percentage of first choices that were pharmaceutical and universities sources in general; in fact, they were practically negligible as sources of information.

According to the survey, the use of sources did not differ between women and men. We found coincident consumption behavior, which showed that gender is not a determining and differential variable, except in the case of social network use, where women went to their friends and family more to get information about the pandemic (+4.5 points, with a difference of 39.47% with respect to men).

Consumption of information about COVID-19 on social networks may pose a health risk. Gallotti *et al.* (2020) analyzed 100 million messages posted on *Twitter* between January 22 and March 10, 2020; their findings demonstrated that surges in potentially unreliable information preceded the increase in infections, showing that

“in a highly digital society, the epidemic and the infodemic dimensions of COVID-19 co-evolve” (Gallotti *et al.*, 2020, p. 1289).

Political identity conditioned information-seeking behaviors. Respondents who identified as centrists trusted the traditional media more than those on the left and the right



The risk of exposure to disinformation on social networks—where fake news is ubiquitous—is higher, as **Naeem, Bhatti and Khan** (2020) observed after analyzing 1,225 pieces of fake news about COVID-19, replete with false claims about, conspiracy theories regarding, and pseudoscientific therapies involving the diagnosis, treatment, prevention, origin, and spread of this disease. In a citizen survey conducted between March 17 and 24, 2020, among people aged 18-65 years living in Spain during the lockdown period (two years prior to the survey used for this research), **Bernal-Triviño** (2020, p. 175) found that most of the fake news identified by respondents came from *WhatsApp* (90.5%) and social networks (87.9%), followed distantly by television (18.2%).

“The main sources of information during the pandemic were the traditional media and health authorities. Respondents’ second-choice sources included government authorities, research organizations, and the social network environment”

In Spain, in the first months of the pandemic, “social networks, including both private messaging applications and open networks, provided the primary setting for the spread of hoaxes (82.9%), way ahead of the traditional media and other interpersonal communication channels” (**León et al.**, 2022, p. 11). If the use of social platforms exposes citizens to more false information, the survey conducted for this work shows that a significant part of the sample was not at a high risk of exposure owing to these networks’ use as second-choice options for information-seeking, although there were segments of the population that were more vulnerable, mainly women and young people. In an online survey conducted in July 2021 with a sample of 682 subjects, also residents in Spain and of legal age, that was similar to the survey conducted for this research, **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz** (2023, p. 9) found that

“women perceive the impact of disinformation with less intensity”,

although according to the data from the survey conducted for this study, they turn more often to social networks.

**Bernal-Triviño** (2020) found that the majority of respondents preferred to obtain information from the online press (50.4%), whereas 33.3% opted for social networks and 31% for television. In addition, 35% preferred to seek information from targeted and official sources, such as the *Official State Gazette (BOE)*, the *World Health Organization (WHO)*, and scientific articles on COVID-19. Radio and the press were considered the “most credible and reliable” media (**Bernal-Triviño**, 2020, p. 175). These results were similar in some aspects to those obtained in the survey conducted for this research, where conventional media and health authorities were the respondents’ preferred options, but they differ in the use of social networks as sources of information, which is lower in the study conducted for this research than in that of **Bernal-Triviño** (2020).

The results of the survey conducted for this research did not depart much from those obtained by **König and Breves** (2021) in a social network experiment on public perception of political and scientific authorities during the COVID-19 crisis, with a sample of 424 participants. Their results only partially support the hypothesis that the public considers the recommendations of scientists to be more reliable. Furthermore, according to data from **König and Breves** (2021), scientists possess more expertise than politicians, but politicians convey more integrity and benevolence than scientists. This could explain why, in the survey conducted for this study, the health authorities (Ministry/councils) and governments ranked higher than research organizations and universities as first-choice sources of information. However, according to **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz** (2023), a primary effect of disinformation is increased distrust toward traditional media and politicians, which contrasts with the results obtained from the survey from this research. Another study focused on the sources used by the Spanish press to provide information to address doubts that surfaced in response to vaccine use says that the press’s main source was governmental institutions (**Catalán-Matamoros; Elías**, 2020).

The data obtained in the survey from this study showed that age was a determining and differential variable in the use of some sources. Younger profiles (aged 18-34 years) used their social network contacts for monitoring COVID-19 more than other groups did, whereas older profiles (+65 years) preferred to obtain information from authorities (ministries/councils, governments, research bodies, and pharmacies). The percentage difference with respect to the average in the use of social networks was 95.65% higher in the youngest group and 71.74% lower in the oldest (+74 years), with a percentage difference between the youngest and oldest groups of 592.31%. These results can be related to those of **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz** (2023), where they observed that the higher the age, the lower the perception of the intensity of disinformation’s effect, which is related to the type of sources used. However, there is a discrepancy, since in their study they state that, in those over 65 years of age,

“of note is their trust, both toward traditional media and toward social networks and information sources” (**Casero-Ripollés; Doménech-Fabregat; Alonso-Muñoz**, 2023, p. 10),

whereas in the research carried out for this work, the use of social networks was higher among younger people and lowered as age increased.

Political identity conditioned information-seeking behaviors. Respondents who defined themselves as centrists trusted the traditional media more than those on the left and right. Left-wingers preferred health authorities (ministries/councils) as sources, and those on the right preferred research organizations, pharmacies, and universities. The survey

results showed that right-wingers were the least likely to rely on traditional media, government authorities, and governments as sources of information. And left-wingers turned less frequently to research organizations and the pharmaceutical sector; thus, it follows that they are more distrustful of these sources but also of the environment on social networks.

“ The use of sources did not differ between women and men, except in the use of social networks, where women turned more to their friends and family for information about the pandemic ”

**Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz (2023)** also analyzed behaviors taking ideology as a reference and found that people on the extreme right

“perceive a higher incidence of disinformation, both in terms of changing an opinion and voting decision and of their distrust of traditional media and social networks as sources of information”,

whereas citizens who consider themselves on the extreme left and on the left

“perceive there to be fewer ramifications from disinformation and exhibit a more favorable view of traditional and digital media as reliable sources of information”.

On the other hand,

“those in the center and on the extreme right are the most critical in this aspect and show a greater degree of distrust toward the media” (**Casero-Ripollés; Doménech-Fabregat; Alonso-Muñoz, 2023, pp. 11-12**).

Attitude toward vaccines, according to the survey results, was not a variable that made substantial differences in use of sources, in general. The results showed that anti-vaccinationists consumed less information from traditional media and more from alternative sources that disseminate discourse, for example, denialist and conspiracy discourse, that runs contrary to what the scientific health and governmental authorities say. **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz (2023, p. 1)** show that, in Spain, untruths

“have had an impact on the rise of conspiracy theories among citizens”.

Other research by **Elías and Catalán-Matamoros (2020)** found that, during the coronavirus pandemic, there was an increase in the consumption of alternative television programs that began to address health issues in the manner as mystery and esotericism. And data from **León et al. (2022, p. 11)** indicated that

“hoaxes with scientific and health-related content accounted for a considerable percentage (35.08%) of all false information spread during the first three months of the pandemic”.

In a survey of 2,501 adults in England between May 4 and May 11, 2020, **Freeman et al. (2022)** found that people who believe in conspiracies are less likely to follow social distancing guidelines, wear a facemask, take a test, or accept the COVID-19 vaccine. And in another series of national surveys conducted between mid-April and early May 2020 in Ireland ( $n = 700$ ), the United States ( $n = 700$ ), Spain ( $n = 700$ ), and Mexico ( $n = 700$ ), and two separate ones in the United Kingdom ( $n = 1,050$  and  $n = 1,150$ ), **Roosenbeek et al. (2020)** found that there is a clear link between accepting erroneous or false information and having doubts about vaccines and a lower probability of complying with health measures imposed or recommended by the authorities.

When analyzing the level of trust/distrust in science, the data showed that there was a social consensus on its role as a bastion of truth and the importance of its public function (82.0%), but a lower degree of trust in science was observed in the youngest subgroup (18-24 years) and higher degree in the older segments. The percentage difference between the youngest group and the average was 15.3% lower, and the percentage difference between this segment and the age group 65-74 years (the one with the highest degree of confidence) was 24.3%. Left-wingers were also more confident in science, and centrists less so; in fact, the former trusted science 15.02% more than the latter.

Differences in the perception of science were substantial depending on attitude toward vaccines. It was higher in the pro-vaccine group and lower in the anti-vaccine group, with a difference of 22.6 points between the two subgroups and a percentage difference of 34.77%. This also depended on the level of education. Thus, those with a university education expressed a higher level of confidence in science, especially those who had pursued a science degree. **Hamilton (2015)** found that, in the United States, trust in scientists when it came to vaccines, in general, was also higher the higher the respondent's educational level, but it was lower among people who were ideologically conservative.

The overall positive view of science in the research carried out for this study was rounded out by the fact that only 2 out of 10 respondents believed that scientists habitually endanger humanity, although the percentage of agreement with this statement was higher among those who defined themselves as ideologically right-wing and among the two younger subgroups. This statement corresponds to conspiratorial thinking, being that

“people motivated to reject an overwhelming scientific consensus, one way in which they may explain this consensus is via the ideation of a conspiracy among researchers” (**Lewandowsky; Oberauer, 2016, p. 219**).

In addition, conspiratorial thinking has been shown to be linked to the denial of vaccines' benefits (**Briones et al. 2012**).

One of the questions that researchers have asked most often is whether level of education, scientific knowledge, and scientific literacy can predict public attitudes toward science and trust in science. **Allum et al.** (2008) found a positive correlation between general attitudes toward science and general knowledge of scientific facts in 40 countries.

Consumption of information about COVID-19 on social networks may pose a health risk

Using their *Science credibility scale*, **Hartman et al.** (2017, p. 365) demonstrated that

“people with higher levels of education reported more positive evaluations of science, although this effect accounted for only 3% of the variance in *CoSS* [*Credibility of science scale*] scores,”

and additionally a positive association between evaluations of science and scientific literacy was found. Thus, as in the results of the survey conducted for this research, not only does confidence increase with higher level of education, but also it is increased among those who belong to the science field. However, while **Hartman et al.** (2017, p. 365) note that age and gender each accounted for less than 1% of the variation in their scores, in the survey conducted for this research, there were in fact significant differences between the youngest and oldest, with those aged 18-34 years having a less positive view of science. The results of the survey also agreed with **Hartman et al.** (2017) and **Gauchat** (2012) as to the influence of political ideology, as it was shown that more conservatives viewed science less positively than progressives or liberals.

Public confidence in science contrasted with the views and experiences of some scientists. A survey conducted by *Nature* of 321 scientists from various countries who reported and commented on the COVID-19 pandemic in the media and on social networks shows that 81% of respondents suffered personal attacks or attacks from trolls, 59% received attacks on their credibility on social networks, 22% received threats of physical or sexual violence, 15% received death threats, and 6 of the respondents suffered physical attacks (**Nogrady**, 2021). A *Science* survey of 510 scientists who have published papers on COVID-19 says that 38.2% suffered some form of harassment or abuse, ranging from insults to death threats via social networks, email, or telephone, and sometimes even in person (**O’Grady**, 2022).

The high degree of confidence in science expressed by respondents contrasted with their distrust of journalism and the media during the public health crisis—a distrust that was indicated by three-quarters of the sample agreeing that the existence of news or information about the COVID-19 pandemic that distorted reality was a problem for the country and indicating that there should be external control over journalism to oversee the quality of the content disseminated by the media when it comes to health issues. The latter statement was more marked in the 25-34-year-old segment and less so in the 74+-year-old segment. In addition, respondents who defined themselves as ideologically left-wing were more aware of the negative impacts of disinformation, whereas anti-vaxxer respondents were less concerned about it and also demanded external monitoring of health information less. The results of the survey conducted for this research differed from those of **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz** (2023, p. 7), which state that the data

“reveal that Spanish citizens perceive the effects of disinformation at a medium-low intensity”.

The survey by **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz** (2023) also maintains that the mechanisms for combating disinformation that citizens view to be the most effective are, firstly, the work carried out by agencies that fact-check fake news and, secondly, criminal legislation to punish the dissemination of this type of content. Other mechanisms identified as factors that helped were media literacy and the promotion of governmental plans, and respondents considered consuming news from traditional media to be the least useful resource (**Casero-Ripollés; Doménech-Fabregat; Alonso-Muñoz**, 2023, p. 12).

Citizens’ opinions on these issues, both in the survey from this research and in that of **Casero-Ripollés, Doménech-Fabregat and Alonso-Muñoz** (2023), can be tied to the low level of agreement on the statement that said during the pandemic journalists followed the ethical principles of truthfulness and impartiality when covering COVID-19, a statement with which only 4 out of 10 of those surveyed for this research agreed. Those over 74 years of age, centrists, anti-vaxxers, and vaccine skeptics had the least confidence in journalism, and those aged 25-34 years and people who were pro-vaccine had the most confidence in the veracity and impartiality of journalistic information. These results coincided in many respects with those of **Bernal-Triviño** (2020), for example, when she states that respondents

“expressed feelings of exhaustion or impatience with the lack of new developments and repetitive content, confrontations based on controversies and media exclusives, sensationalism and ‘macabre’ use of more personal stories about patients and their families, doubts regarding data and their different interpretations depending on the media outlet, and the creation of ‘alarm or hysteria’” (**Bernal-Triviño**, 2020, p. 176)

In **Bernal-Triviño’s** research (2020, p. 176), respondents also pointed out the “lack of ethics in some television programmes” and doubted the expertise of the studio guests to talk about COVID-19. Specifically,

“a total of 41.5% stated that the media did not use quality sources or invite sufficiently well-informed studio guests [...] The result was the media were becoming ‘news sellers,’ where authority and knowledge were no longer basic requirements as long as audience ratings were high” (**Bernal-Triviño**, 2020, p. 178).

And

“the way in which they have done so is clearly sensationalist because in many cases it has followed in the footsteps of the worst crime journalism programs” (Francés-Lecumberri, 2020, p. 105).

In addition, **Costa-Sánchez** and **López-García** (2020) found examples of fearmongering and sensationalism in news reporting during the first months of the pandemic.

However, the distrust of journalists and the media reflected in the results of the survey conducted for this research contrasted with the low levels of perceived difficulty in understanding the terminology used by the media to refer to COVID-19 and vaccines. Thus, it can be deduced that, in general, the quality of the information offered, in terms of readability and comprehension, was interpreted as good, mainly by the older segments, pro-vaccinationists, and centrists and left-wingers. However, this differs from the findings of **Bernal-Triviño** (2020), where interviewees

“expressed their concern over lack of scientific rigour in such a delicate public health situation and the sensationalism with regard to the number of deaths, while they rejected the language of war used to describe the crisis. They also expressed the feeling that the media prioritized speed over depth, leading to ‘contradictions or misunderstandings that have to be corrected later on, but without acknowledging making such corrections’” (Bernal-Triviño, 2020, p. 176).

With respect to level of education, in general, there were no major differences in the degree of trust in journalistic work, according to the results of the survey conducted for this research. However, according to the survey by **Casero-Ripollés**, **Doménech-Fabregat** and **Alonso-Muñoz** (2023), the most educated people

“are the most critical of the media, both traditional and digital, considering them to be unreliable as a source of information”.

Their results also indicate that

“the level of education has differing consequences on Spanish citizens’ perception of misinformation” (Casero-Ripollés; Doménech-Fabregat; Alonso-Muñoz., 2023, p. 10).

The view of science and journalism was also recently studied in Austria so as to understand the possible impacts of the populist anti-elite and anti-science rhetoric of certain political actors. In this case, it was observed that populist attacks on science and journalism have limited effects on the perceptions of citizens, whose

“attitudes towards scientific issues are rather stable and not easily influenced by anti-science communication on social media” (Egelhofer, 2023, p. 370).

Could this happen in Spain? Although the level of trust in science shown by the respondents in this research was high and stable, it was not shown to be sufficient to face the emerging populist discourse of some Spanish parties and politicians; it also must be ascertained whether they contribute to the erosion of journalistic credibility. This is a line of research that should be explored.

## 5. Conclusions

Ideology conditions the use of different types of information sources. Centrists consume more traditional media than those on the political left or right, who are the least likely to turn to them for information. And left-wingers rely more on official sources, such as health authorities, in contrast to centrists or right-wingers.

The percentage of respondents who consider universities –which do not have political ties in Spain– to be reliable sources when it comes to scientific topics such as COVID-19 was very low (1.9%). However, the percentage of respondents who obtained information from political sources (ministries or councils) reached 26.4%, and those who preferred scientific sources that had political ties, because their heads are appointed by the government, as with the *CSIC* or the *Carlos III Health Institute*, accounted for 11.4%.

Antivaxxers obtained information less from traditional media and preferred alternative sources (programs such as *Cuarto Milenio* or *La Estirpe de los Libres*, for example). This is explained by the fact that traditional media supported vaccines (Catalán-Matamoros; Elías, 2020).

The consensus that science aims to seek the truth and make it public (82.0%) showed that there was great confidence in science, but the youngest –in theory the most well-educated– agreed the least with this statement: Only 72.6% of respondents aged 18-24 years agreed, compared with 90.2% of those aged 65-74 years. These data suggest that distrust in science is increasing among young people, which explains, for example, the shortage of people in this segment pursuing scientific careers (Elías, 2019).

In contrast to the confidence in science that respondents had nearly across the board, they expressed a great distrust about the media. The statement “the existence of news or information about the COVID-19 pandemic that distorts reality is a major problem in our country” was supported by 76.8%, and 72.6% considered it advisable to have external oversight over journalism to monitor the

“Differences in the perception of science were substantial depending on attitude toward vaccines”



quality of media content when it comes to health matters. This statement was supported by another idea that very few agreed with: Only 44% believed that, during the pandemic, journalists covered COVID-19 in accordance with the ethical principles of truthfulness and impartiality. These data showed that there was trust in science and distrust in journalism.

The distrust of journalists and the media in a global public health crisis such as COVID-19 demonstrates that the defense of truth and access to verified, reliable, and accurate information have become a “matter of life and death” (Posetti; Bontcheva, 2020a; Pennycook *et al.*, 2020). And the role that journalism must play is fundamental.

For citizens, even those who have scientific backgrounds, it can be complicated to identify what is science; science is about following the scientific method; it is not about using scientific jargon, and it is not simply what a scientist or a health authority with political ties says (Elías, 2020). This nuance is important, as many health hoaxes use scientific jargon so that they sound like science, but obviously they are not. This cocktail that was observed in the results of the survey conducted for this research is very conducive to fake news and hoaxes –alternative sources that disseminate false information, but garnished with scientific jargon, and, at the same time, having great distrust in traditional journalistic media and watching alternative programs such as those of esoterists and conspiracy theorists.

The study population recognized that information from health authorities appointed by political appointment or from research organizations, which also had political ties (CSIC and Carlos III Health Institute), was science, but hardly any of them did when it came to universities, which are independent. This shows that the communication offices of institutions with political ties are mobilized when there is an information crisis involving science. In contrast, those of universities stand alone and do not participate in the public debate.

This research analyzed the consumption of information and the shaping of public opinion regarding COVID-19 and the role of science and journalism in this public health crisis, using one of the largest surveys ever conducted in Spain using this approach.

The limitations of this research were determined by the application of descriptive statistics, which were adequate to characterize the sample and the subgroups that compose it, but make it difficult to establish correlations between the variables analyzed that could be obtained with inferential statistics. Moreover, being a national survey, the results cannot be extrapolated to the international level, but the characteristics of the survey and the size of the sample allow us to provide a useful and valid outline for other research that seeks to expand lines of study on how information about COVID-19 has been consumed and the shaping of public opinion on the role of science and journalism in this health crisis in Spain.

We believe that these results can serve as a basis for further research to figure out and explain variables that may have influenced the behaviors of the Spanish public in response to the pandemic. They can also enable comparative studies to be carried out in other geographical areas. In addition, they can be useful for governmental, administrative, and scientific health authorities in making strategic communication decisions, and for journalists and the media to better understand the behaviors of their target audiences and improve their information strategies regarding health and well-being.

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