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Communication, information, and knowledge in the pandemic by COVID-19 in Brazil

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Abstract

As coronavirus disease 2019 (COVID-19) is asserting itself as a health crisis, it is necessary to assess the knowledge and perceptions of people about the disease. The aim of this study is to assess the knowledge of the general population about COVID-19 and how the media influence this knowledge.

This is a cross-sectional study with 5066 participants who answered an online questionnaire between April and May 2020. Data analysis was performed using descriptive statistics and logistic regression models.

Over 75% have obtained a high degree of knowledge regarding signs, symptoms, and transmission, 95% stated to check the veracity of the information received, and also showed that the total knowledge about COVID-19 was associated with the level of instruction, with the perception of the quality of information disseminated by the media, and with the risk perception.

Despite the high level of knowledge of participants, the results pointed to the need to reinforce information for individuals with less education and the importance of avoiding denialism that reduces the risk perception about COVID-19.

Abbreviations: CBO = Brazilian Classification of Occupations, COVID-19 = coronavirus disease 2019, EIQ-BR = EIQ COVID-19 BRASIL (name of the instrument).

Keywords: coronavirus, COVID-19, epidemiology, health communication, information dissemination, knowledge, risk perception

1. Introduction

On March 11, 2020, the World Health Organization declared that COVID-19, the name given to the new infection caused by a newly discovered coronavirus strain, had become the first pandemic of the 21st century.[1] Brazil declared coronavirus disease 2019 (COVID-19) a national public health emergency on February 3, 2020; the country reported the first confirmed COVID-19 case on February 25, 2020, and during this research data collection period (from April to May 2020), Brazil had one of the fastest-growing COVID-19 epidemics in the world, with more populated and better-connected municipalities being affected earlier, and those less populated being later.[2] On May 22, Brazil was already the second in the worldwide number of confirmed COVID-19 cases, and on June 12, it was also the second in the number of confirmed deaths.[3] The second wave of COVID-19 started to take hold in Brazil at the end of 2020, and in the first semester of 2021, the nation became the epicenter of the global pandemic, with crowded intensive care units and breaking daily death records in a row. In March 2021, 23.5% of all global COVID-19 deaths took place in Brazil; and in 2 days in early April, there were >4000 deaths in the country.[4–6] As of October 05, 2021, while we write this article, Brazil has accumulated 21,499,074 cases and 598,829 confirmed deaths.[7] It should be noted that due to the absence of mass testing, the relative lack of medical human and material resources in less populated cities, and the relevant presence of asymptomatic cases, data regarding the COVID-19 pandemic in Brazil are believed to be largely underreported regarding not only the number of cases but also of deaths.[8–11]

Among the several differences that the COVID-19 pandemic presents in relation to the ones in the past, it is worth highlighting the technological evolution of the ways to communicate and inform. As an example, during the Spanish flu, the information circulated mainly in printed newspapers, as well as in radios and telephones, which were not accessible to the entire population. With the current reach and speed of information dissemination among the population and health authorities, it is possible to have access (to information) both through traditional and digital media (media and/or social networks), almost instantaneously.[1]

The digital media has the potential to promote a wider and faster circulation of information, including instructions on how to deal with the new disease.[12] However, their expansion resulted, at the same time, in the dissemination of distorted

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versions of concepts and scientific facts, the well-known fake news,[13] due to the autonomy they allow as they are self-managed. When related to health issues, such distortions can generate knowledge and behaviors that are not in line with the medical and health indications based on the best scientific evidence. This can result in health problems or deaths that could be avoided[14]; therefore, it represents a clear and direct danger not only to the individual, but also to the collective and public health.

Among the means of defense against the pandemic caused by severe acute respiratory syndrome coronavirus 2, combating fake news is crucial. For this reason, scientists, in addition to producing and disseminating knowledge, must defend and validate new discoveries and provide a correct interpretation of the continuous production of new researches.[15] However, the fight against fake news is not only a responsibility of the scientific community and health professionals, but social media providers, like Facebook, Twitter, Instagram, YouTube, or Weibo, should be responsible for filtering the incorrect information in a more incisive way as information checking mechanisms are available, as the World Health Organization Information Network for Epidemics.[16]

Both the impact of information and misinformation are crucial for society, and the future direction of the pandemic control depends on this[17] to a large extent. In this sense, the media has a key role to play in health promotion, capable of influencing public attitudes.[18]

It is true that, in some cases, both in the media and on social networks, there has been an excess of information on the pandemic during a large part of it, coining the term "infoendemic" in this respect. An accumulation of information constantly evolving with scientific advances, which in other cases lacks scientific evidence, can negatively impact a population in need of information. This type of problem occurs especially on social networks where information that lacks scientific rigor is frequently published and where the individual may have problems in discerning between truthful information and opinions.[19]

This type of phenomenon can increase the level of anxiety among the population,[18] so providing clear, concise, and correct information allows the population to make decisions more efficiently and reduce uncertainty about the disease, especially in health crises such as the one caused by COVID-19.[20]

Thus, as COVID-19 consolidates as an unprecedented health crisis and one of the most important global threats in the age of digital information, it is necessary to carry out rapid evaluations of people's knowledge and perceptions about the disease[13] in order to find more effective mechanisms to communicate and inform the population.[21] In this context, this research aims to assess the knowledge of the general population regarding COVID-19 and whether or not the media influences this knowledge as it is a source of information related to COVID-19.

2. Material and Methods

The present investigation was carried out following a cross-sectional study design. The study base population included all Brazilians >18 years of age living in Brazilian territory. The sample was selected according to the nonprobabilistic technique of snowball sampling; and the final sample was composed of 5066 participants.

For data collection, an ad hoc internet-based instrument was developed to assess the impact of the COVID-19 pandemic on emotional well-being and psychological adjustment of health professionals and the general population, called EIQ COVID-19 BRASIL (EIQ-BR). It was designed by an international consortium of researchers, translated, and adapted into Brazilian Portuguese. Due to the need for social distancing to reduce the transmission of COVID-19, participants were recruited via emails and social media networking sites (WhatsApp, Facebook, Instagram, Twitter, and LinkedIn) and the questionnaire was available online at the following link: https://cutt.ly/IMPACT_COVID-19_BRASIL. The research was also publicized through articles in local and regional newspapers, television, and radio programs. At the end of the data collection period (from April 23 to May 30, 2020), 6918 individuals answered the questionnaire, of which 1852 were not included due to not having completed the questionnaire, thus totaling 5066 complete respondents.

Regarding the questions that covered the knowledge about COVID-19, the EIQ-BR presents 15 questions, which were divided into advanced knowledge, specific for health professionals (10 questions), and basic knowledge (5 questions). As this study considered the entire population responding to the instrument, only the 5 basic knowledge questions were analyzed, namely: the incubation period of COVID-19, between infection and symptoms, is 2 to 14 days; the most common and easy-to-observe symptoms of COVID-19 are fever, dry cough, diarrhea, and breathing difficulties; people who tested positive for COVID-19 should remain isolated; the main form of transmission is by air, through droplets from persons carrying the virus, even if it is also transmitted by touching the eyes, nose, or mouth after touching contaminated surfaces; and COVID-19 is transmitted after symptoms are present. Each question had a possible answer of "yes," "no," or "I don't know."

The platforms through which participants sought information about COVID-19 were considered the independent variable, being: social networks, friends and family, online or printed newspapers, radio and television; websites of official institutions or scientific societies; Google; and other search engines, applications, scientific articles, and other sources of information. Since participants could choose >1 option, the answers were categorized into: social networks, friends and family; traditional platforms (online and/or printed newspapers, radio, and television); official platforms (websites of official institutions or scientific societies); other platforms (Google and/or other search engines, applications, scientific articles, and other information sources); 2 platforms; 3 platforms; 4 platforms; all platforms, or Do not search for information.

The covariates evaluated were sex (dichotomous variable: man and woman), age (continuous variable), age categories (categorical variable divided into: youth, 18–25 years; adults, 26–59 years; seniors, ≥60 years), marital status (categorical variable divided into: single; married or living with a partner; separated/divorced and widowed), children (dichotomous variable: yes and no, this variable includes not only babies and infants but also grown-up children), level of education (categorical variable divided into the following categories: elementary school, high school, higher education, specialization, master's degree, and doctorate), region of the country where the person (he) resides (categorical variable separated into: north, northeast, center-west, southeast, and south), profession (categorical variable divided according to the large groups of the Brazilian Classification of Occupations and Students: members of the armed forces, police and military firefighters; senior members of the public authority; heads of public interest organizations and companies, managers; science and arts professionals; middle-level technicians; administrative service workers; service workers, sellers of trade in shops and markets; agricultural, forestry and fisheries workers; workers in the production of industrial goods and services; workers in repair and maintenance services, student; other option not previously considered), health professional (dichotomous variable: yes and no), work situation (categorical variable divided into: retired, working partially from home, working partially away from home, working from home, working away from home, combining work from and away from home, unemployed, on sick leave, others, and student), perception about the accessibility of information on COVID-19 (categorical variable divided into categories: very low, low, medium, high, and very high), perception about the amount of information on COVID-19 (categorical variable divided into categories: very low, low, medium, high, and very

high), perception about the quality of information on COVID-19 (categorical variable divided into categories: very low, low, medium, high, and very high), perception of the usefulness of information on COVID-19 (categorical variable divided into categories: very low, low, medium, high, and very high), specific information for prevention of COVID-19 infection received by the employer (dichotomous variable: yes and no), clarity and accuracy of information from the employer (variable with minimum value of 0 and maximum of 10), number of hours that is reported on COVID-19 (categorical variable divided into: up to 1 hour, from 1 to 4 hours, from 4 to 8 hours, >8 hours), checks the veracity of the information received comparing with other sources (dichotomous variable: yes and no), and risk perception (discrete variable with a minimum of 9 and a maximum value of 90).

Finally, the dependent variable was knowledge about COVID-19, which was evaluated by the 5 questions on COVID-19 that are described above, and which were aimed at the general population. From the answers to these questions, a final result was calculated by summing the scores for each question. The correct answers were scored as being worth a point and the incorrect answers and "I don't know" as 0. Therefore, the highest possible result was 5 points. Then, a dichotomous variable was constructed in which knowledge was divided into "below average" and "above average," according to a cutoff point, based on the average of the percentage of rights,[22–24] which was 94.6%.

Regarding data analyses, the evaluation of participants' knowledge about COVID-19, we used proportions, measures of central tendency, and dispersion. To identify whether the means of communication used by the individuals to obtain information influenced their knowledge about the disease, simple logistic regression analyses were performed followed by the adjustment of a multiple logistic regression model. The independent variables that were included in the multiple logistic regression model should have reached a P value of ≤.25 (2-tailed) in the simple models. In the multiple model, variables that obtained a P value of <.05 (2-tailed) were considered statistically significant. The dependent, independent, and covariable variables included in this analysis were identified and described previously. Statistical analyses were performed using the IBM/SPSS Statistics v.26.0 statistical package.

Regarding ethical concerns, this research was authorized by the National Commission of Ethics in Research of Brazil (CAAE 30437120.4.0000.5411, 23/04/2020). The participants signed an informed consent about the conditions, and their participation was voluntary. The information was recorded anonymously and confidentially.

3. Results

Table 1 presents the sociodemographic, occupational, and related characteristics of the process of acquiring and analyzing the information about COVID-19 among the study participants. It should be noted that among the 5066 research participants included in the analysis, 1417 (28.0%) used 4 platforms to obtain information on COVID-19 and 4765 (94.1%) stated that they checked the veracity of the information received.

Table 2 provides information on the correct answers to the basic knowledge questions about COVID-19 present in the EIQ-BR (N = 5066); of the total participants, the mean percentage of correct answers was 94.6%, and 24% of the participants reached a percentage of correct answers below this. It should be noted that there was no difference statistically significant obtained by the chi-square test between the knowledge of the general population and that of health professionals (P = .106) as there was no difference statistically significant when using the same test in relation to the different information platforms (P = .191).

According to the simple logistic regression model results (Table 3), the following variables presented P value <.05: age, marital status, level of education, risk perception, clarity and

Table 1

Sociodemographic, occupational, and related characteristics obtained from the process of acquiring and analyzing the information on COVID-19 that the participants had (N = 5066)

	N (%)	Median (IQR)
Sex		
Male	1367 (27.0)	
Female	3699 (73.0)	
Age		32.0 (20.0)
Age categories, yr		
Youth (18–25)	1598 (31.5)	
Adults (26–59)	3148 (62.1)	
Seniors (≥60)	320 (6.3)	
Marital status		
Single	2614 (51.6)	
Married/living with a partner	2037 (40.2)	
Separated/divorced	360 (7.1)	
Widowed	55 (1.1)	
Children		
Yes	1734 (34.2)	
No	3332 (65.8)	
Highest level of education		
Elementary school	24 (0.5)	
High school	1384 (27.3)	
Higher education	1284 (25.3)	
Specialization	981 (19.4)	
Master's degree	838 (16.5)	
Doctorate	555 (11.0)	
Region of Brazil		
North	41 (0.8)	
Northeast	248 (4.9)	
Center-west	321 (6.4)	
Southeast	3957 (78.1)	
South	499 (9.8)	
Risk perception		60.0 (13.0)
Profession (n = 4324)*		
CBO group* 0	25 (0.6)	
CBO group 1	226 (5.2)	
CBO group 2	1509 (34.9)	
CBO group 3	209 (4.8)	
CBO group 4	143 (3.3)	
CBO group 5	99 (2.3)	
CBO group 6	5 (0.1)	
CBO group 7	29 (0.7)	
CBO group 8	30 (0.7)	
CBO group 9	11 (0.3)	
Student	1631 (37.7)	
Other option not previously considered	407 (9.4)	
Health worker		
Yes	1389 (27.4)	
No	3677 (72.6)	
Work situation		
Working partially from home	450 (8.9)	
Working partially away from home	350 (6.9)	
Working from home	1148 (22.7)	
Working away from home	604 (11.9)	
Combining working from and away from home	180 (3.6)	
Unemployed	463 (9.1)	
On sick leave	39 (0.8)	
Retired	179 (3.5)	
Others	339 (6.7)	
Student	1314 (25.9)	
Platforms		
Social networks, friends and family	142 (2.8)	
Traditional platforms	137 (2.7)	
Official platforms	80 (1.6)	
Others	69 (1.4)	
Combined		
Two platforms	774 (15.2)	
Three platforms	1229 (24.2)	
Four platforms	1417 (28.0)	
All of them	1217 (24.0)	

(*Continued*)

Table 1

(*Continued*)

	N (%)	Median (IQR)
Do not search for information	1 (0.1)	
Received information on COVID-19 from employer (n = 4688)		
Yes	2108 (45.0)	
No	2580 (55.0)	
Clarity and information of the employer's information		3.0 (8.0)
Hours per day spent on obtaining information on COVID-19 (n = 4688)		
Up to 1	1213 (23.9)	
1–4	2429 (47.9)	
4–8	865 (17.2)	
>8	559 (11.0)	
Verify the truthfulness of the information		
Yes	4765 (9.1)	
No	301 (5.9)	
Accessibility of media information		
Very low	103 (2.0)	
Low	276 (5.4)	
Average	1155 (22.8)	
High	2082 (41.2)	
Very high	1450 (28.6)	
Quantity of media information		
Very low	40 (0.8)	
Low	98 (1.9)	
Average	538 (10.6)	
High	1877 (37.1)	
Very high	2513 (49.6)	
Quality of media information		
Very low	253 (5.0)	
Low	750 (14.8)	
Average	2517 (49.7)	
High	1265 (25.0)	
Very high	281 (5.5)	
Utility of media information		
Very low	127 (2.5)	
Low	556 (11.0)	
Average	2187 (43.2)	
High	1659 (32.7)	
Very high	537 (10.6)	

CBO = Brazilian Classification of Occupations, COVID-19 = coronavirus disease 2019.
*CBO group 0: Members of the armed forces, police and military firefighters; 1: senior members of the government, leaders of public interest organizations and companies, managers; 2: professionals in the sciences and arts; 3: medium level technicians; 4: administrative service workers; 5: service workers, shop sellers in stores and markets; 6: agricultural, forestry and fisheries workers; 7: workers in the production of industrial goods and services; 8: workers in the production of industrial goods and services; 9: workers in repair and maintenance services.

Table 2

Correct answers to basic knowledge questions about COVID-19 of the EIQ-BR (N = 5066).

	N (%)
The incubation period of COVID-19 (between infection and symptoms) is 2–14 d	4803 (94.8)
The most common and easy-to-observe symptoms of COVID-19 are fevers, dry coughing, diarrhea, and breathing difficulties	4655 (91.9)
People who tested positive for COVID-19 should remain isolated	5032 (99.3)
The main form of transmission is by air (by means of droplets from people carrying the virus), although it is also transmitted by touching the eyes, nose or mouth after touching contaminated surfaces	4963 (98.0)
COVID-19 begins to transmit after symptoms	4502 (88.9)

COVID-19 = coronavirus disease 2019, EIQ-BR = EIQ COVID-19 BRASIL (name of the instrument).

information of the employer's information, hours per day spent on obtaining information on COVID-19, verify the truthfulness of the information, perception of media information accessibility, and perception of media information quality. However, since the effect of each independent variable is not adjusted for each other in simple logistic regression models, these results should be seen with caution and, most important, must not be interpreted as if they were associated with the outcome. Thus, to determine the unique contributions of each factor while controlling for these potential unknown sources of confounding, all variables presenting P value <.25 were included together in the subsequent analysis, this is why the results from the multiple logistic regression model are the ones that really should be interpreted as being associated with the outcome.

The result of the multiple logistic regression model (Table 4) shows that the total knowledge about COVID-19 was positively associated with the level of education, perception about the quality of information in the media, and risk perception.

4. Discussion

This study sought to evaluate communication, information, and knowledge about COVID-19. The results showed that >75% of the interviewees had good knowledge about signs, symptoms, and transmission. A study conducted in the United States of America and United Kingdom[25] presented similar data, in which most participants were able to recognize the symptoms and cite the means of transmission of the disease. Furthermore, our results are on par with those of Sari et al,[26] Zhong et al,[27] and with the findings of a systematic review and meta-analysis of 48 studies (most from Asia and Africa) encompassing 76,848 participants, which has shown that >80% of the participants had good knowledge regarding COVID-19 causes, symptoms, ways of transmission, and ways of prevention.[28] Another systematic review and meta-analysis of 84 studies from 45 countries or territories, that comprised a total of 215,731 participants, has found that knowledge scores ranged from 72% for low-income countries to 79% for upper-middle-income countries and reported a pooled knowledge score of 75%.[29] On the other hand, similar studies from Malaysia,[30] India,[31] Lebanon,[32] and China[33] have found somewhat lower knowledge levels about COVID-19, but not as low as that observed in a study conducted in Bangladesh, which showed that only 33% of the participants had a good level of knowledge about COVID-19.[34]

The fact that during this study's data collection period, Brazil had one of the fastest-growing COVID-19 epidemics in the world,[2] which resulted in it being the country with most cases and deaths in Latin America,[35] and the intense coverage of the pandemic by Brazilian mainstream media, with high-quality content due to the participation of well-known researchers and health professionals,[36] might explain the high level of knowledge found in this study.

One could argue that since public's knowledge about a disease affects people's attitudes and practices,[28,31] and thus is considered to vastly help in the control of epidemics at the community level,[31,37,38] our results indicate that Brazil should not have had such a difficult time to combat COVID-19. However, even if the public knowledge, attitudes, and practices are important, they are not a silver bullet; controlling a pandemic is highly dependent on coordinated and science-based government response, and the Brazilian federal government's response to COVID-19 is an example of what should not be done. Brazil had 3 ministers of health in 4 weeks during the initial stage of the pandemic, there was no federal policy enforcing physical distancing and isolation (or even guidelines to the states), testing rates were far below the world average, contact tracing was, at best, limited, there were gaps and lack of transparency regarding epidemiologic data, and useless drugs were promoted not only by Brazil's President but also by the Ministry of Health.[39–41]

It is also important to emphasize that even though Brazil is the ninth-largest world economy, it is one of the world's most unequal country; in 2018, 25.3% of the population was living

Table 3

OR, (95% CI, and *P* values obtained through univariate logistic regression models).

	OR	95% CI	*P* value
Sex (ref.: male)			
Female	1.111	0.962–1.282	.152
Age	1.005	1.001–1.010	.028
Age categories (ref.: seniors)			
Youth	0.908	0.689–1.197	.495
Adults	1.147	0.878–1.497	.314
Marital status (ref.: single)			
Married/living with a partner	1.271	1.108–1.458	.001
Separated/divorced	1.044	0.810–1.347	.738
Widowed	0.928	0.510–1.691	.808
Children (ref.: yes)			
No	0.908	0.792–1.041	.168
Highest level of education (ref.: elementary school)			
High school	2.180	0.968–4.907	.060
Higher education	2.614	1.159–5.893	.021
Specialization	3.477	1.534–7.881	.003
Master's degree	2.753	1.214–6.243	.015
Doctorate	3.168	1.383–7.253	.006
Region of Brazil (ref.: North)			
Northeast	0.465	0.174–1.241	.127
Center-west	0.456	0.173–1.202	.112
Southeast	0.422	0.165–1.080	.072
South	0.541	0.207–1.412	.209
Risk perception	1.009	1.002–1.015	.008
Profession (ref.: CBO group* 0)			
CBO group 1	2.404	0.966–5.979	.059
CBO group 2	1.624	0.695–3.796	.263
CBO group 3	1.351	0.552–3.308	.511
CBO group 4	1.171	0.469–2.924	.736
CBO group 5	1.393	0.536–3.619	.496
CBO group 6	1.882	0.180–9.677	.597
CBO group 7	1.479	0.447–4.889	.521
CBO group 8	1.546	0.469–5.095	.474
CBO group 9	2.118	0.369–2.156	.400
Student	1.302	0.558–3.039	.542
Other option not previously considered	1.287	0.540–3.066	.570
Health worker (ref.: yes)			
No	0.886	0.765–1.026	.106
Work situation (ref.: retired)			
Working partially from home	0.786	0.517–1.197	.262
Working partially away from home	0.838	0.541–1.298	.429
Working from home	0.881	0.598–1.298	.522
Working away from home	0.832	0.554–1.251	.377
Combining working from and away from home	1.007	0.604–1.679	.979
Unemployed	0.675	0.446–1.022	.063
On sick leave	1.772	0.648–4.846	.265
Others	1.164	0.739–1.834	.512
Student	0.726	0.496–1.064	.101
Platforms (ref.: social networks, friends and family)			
Traditional platforms	0.829	0.497–1.383	.473
Official platforms	1.849	0.934–3.660	.078
Others	0.896	0.477–1.683	.733
Two platforms	1.240	0.830–1.851	.294
Three platforms	1.323	0.897–1.952	.159
Four platforms	1.214	0.826–1.784	.324
All of them	1.277	0.865–1.883	.218
Received information on COVID-19 from employer (ref.: yes)			
No	0.885	0.773–1.012	.074
Clarity and information of the employer's information	1.026	1.008–1.045	.004
Hours per day spent on obtaining information on COVID-19 (ref. up to 1)			
From 1–4	1.162	0.991–1.362	.064
From 4–8	1.248	1.017–1.533	.034
>8	1.029	0.818–1.294	.805
Verify the truthfulness of the information (ref.: yes)			
No	0.752	0.582–0.973	.030
Accessibility of media information (ref.: very low)			
Low	1.321	0.810–2.153	.265
Average	1.355	0.881–2.085	.167
High	1.699	1.113–2.595	.014

(*Continued*)

Table 3

(*Continued*)

	OR	95% CI	*P* value
Very high	1.653	1.077–2.537	.022
Quantity of media information (ref.: very low)			
Low	0.726	0.307–1.718	.466
Average	0.850	0.395–1.830	.677
High	0.934	0.441–1.977	.859
Very high	0.928	0.439–1.960	.844
Quality of media information (ref.: very low)			
Low	1.084	0.792–1.485	.614
Average	1.356	1.019–1.806	.037
High	1.461	1.080–1.976	.014
Very high	1.246	0.850–1.827	.260
Utility of media information (ref.: very low)			
Low	1.073	0.701–1.642	.745
Average	1.254	0.845–1.861	.261
High	1.478	0.991–2.205	.056
Very high	1.341	0.871–2.065	.183

CBO = Brazilian Classification of Occupations, CI = confidence interval, COVID-19 = coronavirus disease 2019, OR = odds ratio.

*CBO group 0: members of the armed forces, police and military firefighters; 1: senior members of the government, leaders of public interest organizations and companies, managers; 2: professionals in the sciences and arts; 3: medium level technicians; 4: administrative service workers; 5: service workers, shop sellers in stores and markets; 6: agricultural, forestry and fisheries workers; 7: workers in the production of industrial goods and services; 8: workers in the production of industrial goods and services; 9: workers in repair and maintenance services.

Table 4

OR, 95% CI, and *P* values obtained through the multiple logistic regression model.

	OR	95% CI	*P* value
Highest level of education (ref.: elementary school)			
High school	2.579	1.060–6.277	0.037
Higher education	3.141	1.289–7.656	0.012
Specialization	4.328	1.765–10.608	0.001
Master's degree	3.416	1.393–8.378	0.007
Doctorate	3.985	1.610–9.860	0.003
Quality of media information (ref.: very low)			
Low	1.468	1.092–1.973	0.011
Average	1.638	1.199–2.239	0.002
Risk perception	1.009	1.002–1.016	0.009

CI = confidence interval, OR = odds ratio.

below the poverty line.[3,42,43] Even if people living in poverty know the recommendations for prevention, they might not be able to follow them.[3] It is not possible to wash hands, clean, and disinfect highly touched surfaces properly if one lives without piped water and proper sanitation. Living in multigenerational overcrowded households limits social distancing. Being unable to work from home, something that was more common among low-income workers,[44] exposes these workers to crowded public transportation means, where keeping a safe distance from others is not practicable.

Regarding associations with knowledge about COVID-19, this study showed that the high level of knowledge could be directly related to the high level of education of the participants (25.3% higher education, 19.4% specialization, 16.5% master's degree, and 11% doctorate). Several studies from all around the world have already shown that people with a higher level of education would be better informed about the pandemic.[27–29,31–33,45–47] Therefore, those with lower education levels should be the focus of intensive education interventions using target group-specific educational approaches. It should be noted, however, that, unlike the participants of this research, <50% and 10% of the Brazilian population complete their medium and higher education, respectively.[48]

Another fact that could explain the high level of knowledge is that more than three-quarters of the participants sought information about COVID-19 for >1 hour per day (one-third for >4 hours per day), and approximately 95% of the participants claimed to check the veracity of the information they consumed.

Currently, scientific information circulates freely in digital media, but it is necessary to know how to interpret it correctly as a way to validate the veracity of the information before spreading it. In this sense, the State Department of the United States of America reported how the dissemination of false information caused panic in the media.[49] It pointed out one of the most widely read articles in Brazil (about 13 million views) as a disseminator of unfounded fears about COVID-19 and thus undermining the fight against the pandemic, a situation that illustrates the importance and need for verification of information and the urgent need for interventions.

The spread of fake news at health events is not a new phenomenon with the COVID-19 pandemic. In 2008, during the yellow fever outbreak, several theories of natural prescriptions to cure the disease were published and the record of the occurrence was a farce to promote the sale of vaccination.[50] Already at that time, the Brazilian population was polarized for or against science,[51] even with the available evidence. A survey identified that, in Brazil, 86% of respondents used the internet to obtain information on health and disease,[52] a percentage higher than those who sought information from doctors or specialists (74%). These results seem to corroborate that self-managed ideas give space to the building of knowledge not based on scientific evidence and methods, but on common experiences,[53] often incorrect, which are spread by ignorance or maybe deliberately.

This study also identified that the platforms for obtaining information on COVID-19 did not relate to the basic knowledge score, which can be partially explained by the diversity of platforms used by the participants since 91.5% of these used >1 source of information, and 24% made use of all the sources that were asked. In addition, almost all participants (94%) stated that they checked the veracity of the facts, regardless of the means they received. The findings suggest that participants viewed journalism as a way to check information but also created their own methods of legitimizing information that is conveyed by websites/social networks not linked to large communications companies.[51] One report pointed out that 85% of

the Brazilian population is concerned about what is real and false in the media[54]; however, another study showed that most of the population tends to distrust the information it receives but still relies on the content conveyed without analyzing facts.[52] Knowing how to select the means of communication to obtain information could establish positive factors associated with knowledge since almost half (49.6%) of the respondents used traditional and official ways of communication.

Contrary to what happened in other countries, such as Peru[55] and Spain,[56] where information from official channels was perceived as being of higher quality, the low rate of access to official sources (20%), such as the Brazilian Ministry of Health, can be explained by the current lack of transparency of the federal agency, historically recognized as a source of good and scientific information. As an example, a post of the same Ministry, on Facebook, where the slogan "Life score" made a metaphor to football and featured the number of recovered people (an epidemiologically irrelevant aspect of the pandemic) in a month (July 2020) during which the country had daily records of deaths and new cases.[57] The disclosure of data on recovered people, amid the growing curve of cases and deaths in Brazil, was an incentive to denialism, creating a feeling that the health situation was improving.[24]

On the other hand, traditional media have been working to minimize the impact of misinformation, carrying out public checks and clarifications of the veracity of facts[24]; for example, the "Fact or Fake" platform developed by the G1 digital news portal of Globo Television.[58] These actions favor digital literacy, aiming to educate the population to verify the information before disseminating it.[59]

Another point to be discussed is the association between risk perception and knowledge. In the present study, with each increase of 1 point in the perception of risk, the chance of having knowledge above the average increased by about 1%, contradicting the results of previous Brazilian[60] and Chinese[61] studies, in which the association between these variables was negative. Nevertheless, it should be noted that studies on Middle East Respiratory Syndrome had already indicated a positive association between knowledge and risk perception[62,63]; and also that it is predicted that the greater the risk perception that the individual has of the pandemic, the more information is sought on how to avoid the disease.[64,65]

Therefore, it is necessary to avoid actions aimed at reducing the perception of risk of the population, especially those that originate from government sources, since the current Federal management is incompetent and irresponsible in dealing with the pandemic.[66] The denialism promoted by the high political level reflects on the high rates of cases and deaths by COVID-19 by encouraging ineffective treatments, agglomerations, and noncompliance with restrictive measures,[57] supported by globally validated evidence, being counterproductive to scientific knowledge and pandemic control.

Although it brings important information to reflect on important and pertinent issues for the current Brazilian sanitary situation, it is important to highlight the limitations of this study. First, individuals with greater interest in COVID-19 may have participated, in a larger proportion, possibly resulting in self-selection bias. In addition, the participants definitely do not represent the general population of the country, as can be observed when analyzing the level of education of the participants, which is quite high compared to the national reality. In addition, some participants may have consulted information sources when presenting doubts since it was a questionnaire of self-responsibility, available online, without time control or simultaneous access to other sites. Thus, it is possible that the results presented represent an overestimation of reality. Another limitation would be the absence of a standardized and validated tool that evaluates the knowledge on COVID-19, which makes it difficult to compare with other studies. However, this limitation may be mitigated when the results are compared between other countries that are members of this international consortium.

5. Conclusions

Considering the objectives of the present study to evaluate the knowledge of COVID-19 of the general population, the participants of this research had a high degree of knowledge regarding the basic questions on COVID-19, in agreement with the literature. Thus, it is possible to attribute this finding to the fact that the access to the information was made by several platforms and verifying the veracity.

However, despite the high level of knowledge found, the results also point to the need to reinforce information for individuals with lower level of education, in order to make scientific explanations accessible to all. The results also reinforce the importance of avoiding negationist measures that reduce the perception of risk in this pandemic and serve as a lesson for those that may occur in the future.

Author contributions

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