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COVID-19 Misinformation in Portuguese-Speaking Countries: Agreement with Content and Associated Factors

Álvaro Francisco Lopes de Sousa [1,2,*], Guilherme Schneider [2], Herica Emilia Félix de Carvalho [2], Layze Braz de Oliveira [2], Shirley Verônica Melo Almeida Lima [3], Anderson Reis de Sousa [4], Telma Maria Evangelista de Araújo [5], Emerson Lucas Silva Camargo [2], Mônica Oliveira Batista Oriá [6], Carmen Viana Ramos [7], Rodrigo Mota de Oliveira [2], Camila Aparecida Pinheiro Landim Almeida [8], Andrêa Jacqueline Fortes Ferreira [9], Jules Ramon Brito Teixeira [10], Iracema Lua [11], Fernanda de Oliveira Souza [12], Tânia Maria de Araújo [10], Inês Fronteira [1] and Isabel Amélia Costa Mendes [2]

1 Global Health and Tropical Medicine (GHTM), Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, 1349-008 Lisbon, Portugal; ifronteira@ihmt.unl.pt
2 Human Exposome and Infectious Diseases Network (HEID), Ribeirão Preto College of Nursing, University of São Paulo, Ribeirao Preto 14040-902, Brazil; guilherme.schneider@usp.br (G.S.); hericacarvalho@usp.br (H.E.F.d.C.); layzebraz@usp.br (L.B.d.O.); lucmrg0@gmail.com (E.L.S.C.); rodrigoo@usp.br (R.M.d.O.); iamendes@eerp.usp.br (I.A.C.M.)
3 Center for Research in Collective Health, Federal University of Sergipe, Sao Cristovao 49100-000, Brazil; shirleymelo.lima@gmail.com
4 College of Nursing, Federal University of Bahia (UFBA), Salvador 40110-909, Brazil; anderson.sousa@ufba.br
5 Nursing Department, Federal University of Piauí, Teresina 64049-550, Brazil; telmaevangelista@gmail.com
6 Nursing Department, Federal University of Ceará, Fortaleza 60020-181, Brazil; profmonicaoria@gmail.com
7 Nursing Department, Centro Universitário UNINOVAFAPI/AFYA, Teresina 64073-505, Brazil; carmen.ramos@uninovafapi.edu.br
8 Institute of Health Sciences, Universidade Católica Portuguesa, 4099-002 Porto, Portugal; clalmeida@porto.ucp.pt
9 Data and Knowledge Integration Center for Health—CIDACS (Fiocruz-Bahia), Salvador 41745-715, Brazil; andreaferreiracv@gmail.com
10 Epidemiology Center, Feira de Santana State University, Feira de Santana 44036-900, Brazil; julesramon@gmail.com (J.R.B.T.); araujo.tania@uefs.br (T.M.d.A.)
11 Institute of Collective Health, Federal University of Bahia, Salvador 40170-110, Brazil; iracemalua.enfermeira@gmail.com
12 Health, Education and Work Department, Federal University of Recôncavo da Bahia, Santo Antonio de Jesus 44380-000, Brazil; fernandasouza@ufrb.edu.br
* Correspondence: sousa.alvaromd@gmail.com

Abstract: In the wake of the COVID-19 pandemic, a complex phenomenon called the "infodemic" has emerged, compromising coping with the pandemic. This study aims to estimate the prevalence of agreement with misinformation about COVID-19 and to identify associated factors. A web survey was carried out in Portuguese-speaking countries in two stages: 1. the identification of misinformation circulating in the included countries; 2. a multicentric online survey with residents of the included countries. The outcome of the study was agreement or disagreement with misinformation about COVID-19. Multivariate analyzes were conducted using the Poisson regression model with robust variance, a logarithmic link function, and 95% confidence intervals. The prevalence of agreement with misinformation about COVID-19 was 63.9%. The following factors increased the prevalence of this outcome: having a religious affiliation (aPR: 1.454, 95% CI: 1.393–1.517), having restrictions on leisure (aPR: 1.230, 95% CI: 1.127–1.342), practicing social isolation (aPR: 1.073, 95% CI: 1.030–1.118), not avoiding agglomeration (aPR: 1.060, 95% CI: 1.005–1.117), not seeking/receiving news from scientific sources (aPR: 1.153, 95% CI: 1.068–1.245), seeking/receiving news from three or more non-scientific sources (aPR: 1.114, 95% CI: 1.049–1.182), and giving credibility to news carried by people from social networks (aPR: 1.175, 95% CI: 1.104–1.251). There was a high prevalence of agreement with misinformation about COVID-19. The quality, similarity, uniformity, and acceptance of the contents indicate a concentration of themes that reflect "homemade", simple, and easy methods to avoid infection by SARS-CoV-2, compromising decision-making and ability to cope with the disease.

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1. Introduction

Coronavirus disease 2019 (COVID-19), a respiratory disease caused by the etiologic agent SARS-CoV-2, which is registered in 178 countries, has produced, or intensified what the WHO has called the "infodemic" [1], a term used to characterize the uncontrolled volume of information disseminated on a subject, including real and fake news. Excessive information makes it difficult to discern reliable sources and obtain safe guidelines for actions [2]. The convenience provided by the digital age, enhanced by social networks, caused a dispersion of content with a speed and unprecedented reach unseen previously in history. The rapid circulation of information without any type of prior checking or filtering allows the appearance of rumors, fake information, misinformation, and even false manipulated information with dubious intent (disinformation) [3–6]. Similar to an epidemic, false information and news are spreading with the capacity to produce diverse forms of damage, as observed with the spread of the virus, which justifies the adopted term [7].

The massive spread of information can be illustrated by almost 20,000 scientific articles on the COVID-19 topic published on Google Scholar since the beginning of the pandemic, as well as by more than 360 million videos uploaded to YouTube® in a single month using the terms "COVID-19" and "COVID 19", and more than 500 million monthly tweets related to the terms "coronavirus", "corona virus", "covid19", "covid-19", "covid_19", and "pandemic" on Twitter® [1].

The emergence of an immense amount of information compromises the strict control of the quality of posted and published content, leading to misinformation [3]. In the pandemic context, the uncertainties of the scenarios experienced and the fear of being affected, intensify the search for immediate guidance, comfort, or relief. Thus, due to this urgency, information is often accepted without the necessary dedication of people to an analysis of its contents, the careful evaluation of available evidence, and whether the information comes from a reliable source. Disinformation acquires the potential to be easily consumed, accepted, and propagated by significant sections of the population, according to personal or collective interests [8,9].

With globalization and the rise of the digital age, misinformation started to break territorial boundaries and, when benefited by characteristics such as shared language between culturally different countries, it has its propagation maximized, potentiating the adoption of behaviors and attitudes that expand individual and collective risks, resulting in a harmful scenario during the pandemic. The dissemination of misinformation on social networks and other means of communication impacts confidence in institutions (government, industry, and science), and consequently reduces confidence in health systems [10].

Based on the need and importance of public health actions supported by solid scientific knowledge of the control of health crises, and considering the potential adverse impacts of disinformation on the global control of diseases, it is necessary to identify the magnitude of the agreement with misinformation about COVID-19 and to analyze the factors that can influence beliefs and operate acceptance or rejection of false information between people, countries, and cultures. This study aims to estimate the prevalence of agreement with misinformation about COVID-19 and to identify associated factors.

2. Materials and Methods

A multicentric online survey (web survey) was carried out with populations from seven countries whose official language is Portuguese: Portugal, Brazil, Angola, Cape Verde, Guinea-Bissau, Mozambique, and São Tomé and Príncipe.

The research was developed in two stages:

2.1. Step 1. Identification of the Main Fake News Digitally Transmitted in Portuguese

In this step, a data mining technique was used. The social network used was Twitter, due to its privacy policy [11] that makes all tweets registered by its users public, allowing anyone to view and search through the application programming interfaces (APIs) supported by tools for monitoring and analyzing published content. Thus, an application was developed in NodeJS (https://nodejs.org/ accessed on 7 December 2021) that interacts with the Twitter API to collect all messages published through the search filters and the base criteria defined for the study. The search was done on messages published only in Portuguese. In April and May 2020, around 10,000 Twitter messages (tweets) were collected and selected for analysis which contained at least one of the following hashtags: #COVID-19, #Coronavirus, and #SARSCov-2. The terms should be mentioned in the same post, using uppercase or lowercase letters, and spelled without accentuation. Posts in other languages and retweets were excluded.

After selecting the sample, a pre-processing of data was carried out to improve the quality of the findings and increase the efficiency of the data mining process. The R software [12] was used due to its robust tools that make it possible to manipulate and organize the findings. We searched for the words most associated with the posts (for example, "garlic" and "COVID-19") and later, what was the most publicized news related to that word on the social network (for example: "garlic recipe with boiled water kills COVID-19"). As a result, a list of 21 false information (Supplementary Table S1) was identified and placed on a data collection form. In order to avoid mistrust on the part of the participants, and measurement bias, a real post was inserted for every seven examples of fake news.

2.2. Step 2. Populational Online Survey

The data collection was carried out between June and August 2020, when countries were already experiencing restrictive sanitary measures, social distancing, and quarantine to prevent the spread of SARS-CoV-2.

The participants were recruited using the snowball method adapted to the virtual environment. In this method, the participant himself is responsible for recruiting other participants with a similar profile through his social networks. Initially, to meet the requirements of this method, we randomly selected 30 people from Portugal and Brazil from a database of a previous studies about the COVID-19 pandemic. These people were the first participants and were called "seeds". To increase the generalizability of the study, this group included people from diverse locations in the countries (divided according to regions), with differing origins (native and immigrants), ethnicities (white and non-white), ages (young, adult, and older adults), and levels of education (elementary/high school, university education, and postgraduate). Concomitantly, to disseminate the study, we have used e-mail lists from universities that maintained interchange and partnership relations with each other (Institute of Hygiene and Tropical Medicine, University of São Paulo; Higher Institute of Health Sciences of Angola; and Higher Institute of Science and Technology of Mozambique). Information about the research was also published on the social network Facebook, aiming to enhance responses to the questionnaire.

2.3. Population, Sample, and Eligibility Criteria

The sample size necessary for conducting the study was calculated using the calculation for finite samples ($n = [EDFF \times Np(1 - p)]/[(d^2/Z^2_{1-\alpha/2} \times (N - 1) + p \times (1 - p)]$) and the following parameters: total number of residents of the seven countries (N = 286,165,991), incidence of 50% due to the lack of previous studies, accuracy of 3%, correction for sampling design of 2, confidence level of 95%, and 20% additional subjects due to possible losses and withdrawals, resulting in 2562 participants.

In total, 7083 people answered the questionnaire, of which 240 were excluded for not living in the selected countries, not speaking Portuguese, being aged under 18 years, or due to the presence of invalid answers in more than 50% of the questions. The final sample

consisted of 6843 residents of the seven countries, which is a population greater than the estimated minimum, increasing the power of this study.

2.4. Data Collection Instrument

A structured questionnaire was developed by the authors based on the literature [13–17] and evaluated by a group of experts through successive Delphi rounds. The expert analysis covered the questionnaire's construct validity and its cultural and linguistic properties. The online questionnaire was hosted on a specific website that allowed for quick data collection in Brazilian and European Portuguese and only allowed one response via Internet Protocol (IP), that is, one response per electronic device, thus avoiding multiple entries by the same user and, consequently, selection biases [18,19].

The questionnaire was divided into four sections:

1. Sociodemographic data (place of birth; country, region/district, state and city where the subjects were currently living; time living in the country; number of people living with each subject; number of rooms in the subject's house; family income; age; gender identity; schooling; religion; and marital status);
2. Perception about the COVID-19 pandemic (fear, impact, and limitations experienced during the pandemic, and agreement with preventive measures and strategies to mitigate the virus), practices to prevent contact and spread of the virus, and COVID-19 testing and test results;
3. Search and consumption of information/news about COVID-19, impact of information/news about COVID-19, actions taken based on information/news received about COVID-19;
4. Agreement with misinformation about COVID-19, assessed through a Likert scale with responses of strongly agree, agree, neutral, disagree, and strongly disagree.

Scientific sources were defined as those resulting from recommendations issued by scientific societies or the representatives of these societies. Official bodies were considered those linked to governments (such as the country's Ministry of Health) or internationally recognized organizations (such as the World Health Organization). Finally, high-circulation newspapers were defined as those that have existed for a long time in each country and are edited by large publishing groups. Low- or limited-circulation newspapers were defined as those that are relatively new and are considered as a "free press". The definitions mentioned above were made available to the respondents.

2.5. Outcome

The outcome of this study was agreement (strongly agree or agree) or disagreement (strongly disagree, disagree, or neutral) with at least one of the statements characterized by misinformation about COVID-19.

2.6. Data Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPPS) version 24.0 (SPSS Inc., Chicago, IL, USA).

The descriptive analysis included absolute and relative frequencies. Prevalence ratios were used to evaluate crude associations (bivariate analysis), and their statistical significance was tested using Pearson's Chi-square test and the Monte Carlo method, considering $p \leq 0.05$ the minimum significance value. Ninety-five percent confidence intervals were also established. Monte Carlo permutations were used to calculate p values of independent variables presenting more than two categories of analysis to obtain a better statistical adjustment of the data.

All variables were previously analyzed to assess whether multicollinearity existed or not, following tolerance coefficients and VIF (variance inflation factor) parameters. Considering the high frequency of the reference outcome (agreement with misinformation about COVID-19 greater than 10%), the measure of association from traditional logistic regression analyzes (odds ratio, OR) overestimates associations. Thus, we opted for the

Poisson regression model with a robust variance estimation using a covariance matrix (generalized linear model) to estimate the prevalence ratio (PR), which, in turn, is the most appropriate measure for cross-sectional studies. A logarithmic link function and 95% CI were also used [20,21].

The selection of variables for the multivariate model was made based on the results of the bivariate analyzes, based on statistical significance (p-value ≤ 0.05), theoretical relevance, or better adjustment conditions. The parameters observed for the best performance adopted the Akaike information criterion (AIC), log-likelihood, the omnibus test, and effect tests (type III) as references.

2.7. Ethical and Legal Aspects

The Institutional Review Boards of the countries in which the study was conducted approved the research project. All the participants signed a free and informed consent form before taking part in the study.

3. Results

From the 6843 participants considered eligible for the online survey, 4291 (62.7%) resided in Brazil, 1299 (19.0%) in Portugal, 414 (6.0%) in Angola, 348 (5.1%) in Mozambique, 268 (3.9%) in Cape Verde, 155 (2.3%) in São Tomé and Príncipe, and 68 (1%) in Guinea-Bissau (results not shown in tables).

The prevalence of agreement with COVID-19 misinformation was 63.9% (Supplementary Table S1). The multivariate regression identified important aspects that can influence agreement with COVID-19 misinformation in an integrated manner. Some factors increased the prevalence of agreement with COVID-19 misinformation: having a religious affiliation (45%), having restrictions on leisure (23%), practicing social isolation (7%), and number of rooms in their residence (5%). Not avoiding agglomerations by performing activities such as going to a bar/restaurant or to social events increased the acceptance of COVID-19 misinformation by 6%.

The source of information influenced the acceptance of content with dubious information about COVID-19 in general. The lack of search for reliable sources increased the prevalence of agreement with misinformation about COVID-19 by 15%, while the act of searching for unreliable sources or questionable sources increased the outcome by 6% (considering access to one to two sources) and by 14% (access to three or more sources). Besides this, giving credibility to news carried by people from social networks or by unofficial bodies, to the detriment of official bodies, increased the outcome of agreement with misinformation by 18% and 13%, respectively (Table 1).

Table 1. Sociodemographic characteristics, variables related to the pandemic period, and bivariate and multivariate analysis of factors associated with the agreement with COVID-19 misinformation, 2020.

Associated Factors	Agreement with COVID-19 Misinformation	*p* (%)	*p*-Value	Bivariate Analysis PR (CI 95%)	Multivariate Analysis aPR (CI 95%)
Sociodemographic characteristics					
Country of residence			<0.001		
Angola	276	66.7		1.312 (1.203–1.431)	-
Brazil	2951	68.8		1.354 (1.278–1.433)	
Cape Green	151	56.3		1.109 (0.985–1.248)	
Guinea Bissau	35	51.5		1.013 (0.799–1.284)	
Mozambique	215	61.8		1.216 (1.102–1.342)	
São Tomé and Príncipe	82	52.9		1.041 (0.889–1.219)	
Portugal	660	50.8		1.00	
Immigrant			<0.001		

Table 1. *Cont.*

Associated Factors	Agreement with COVID-19 Misinformation	*p* (%)	*p*-Value	Bivariate Analysis PR (CI 95%)	Multivariate Analysis aPR (CI 95%)
Yes	443	53.0		1.00	-
No	3297	65.4		1.234 (1.154–1.318)	
Marital status			0.749		
In a relationship	2860	64.0		1.00	-
Single	1510	63.6		0.994 (0.957–1.032)	
Age group			0.228		
18 to 29 years	1.507	64.6		0.990 (0.941–1.041)	-
30 to 49 years	2071	62.9		0.963 (0.918–1.012)	
50 years and older	792	65.2		1.00	
Number of rooms in the residence			<0.001		
Less than or equal to 3	862	57.7		1.00	1.00
Greater than 3	3.508	65.6		1.138 (1.085–1.193)	1.052 (1.001–1.106)
Number of people in the residence			0.058		
Less than or equal to 3	2982	63.1		1.00	-
Greater than 3	1388	65.5		1.038 (0.999–1.078)	
Education			<0.001		
Elementary/High School	844	59.9		0.909 (0.865–0.955)	-
University education	1452	63.4		0.963 (0.925–1.002)	
Postgraduate level	2037	65.9		1.00	
Religious affiliation			<0.001		
Yes	2732	75.5		1.488 (1.431–1.546)	1.454 (1.393–1.517)
No	1638	50.8		1.00	1.00
Coping strategies					
Social isolation time			<0.001		
Not in isolation	873	57.8		0.904 (0.856–0.955)	0.973 (0.922–1.027)
Less than 90 days	921	68.7		1.095 (1.049–1.142)	1.073 (1.030–1.118)
More than 90 days	537	70.5		1.00	1.00
Agglomeration avoidance (bars, restaurants, and social events)			0.003		
Yes	3781	63.2		1.00	1.00
No	589	68.5		1.084 (1.032–1.139)	1.060 (1.005–1.117)
Environments/objects sanitization			0.037		
Yes	3137	63.1		1.00	-
No	1233	65.8		1.043 (1.003–1.084)	
Postponement of travels			0.385		
Yes	2.972	63.5		1.00	-
No	1398	64.6		1.017 (0.979–1.056)	
Use of masks for individual protection			0.004		
Yes	4.275	64.1		1.00	-
No	95	53.7		1.013 (0.908–1.129)	
Agreement with the need for social distancing			0.020		
Yes	4216	63.7		1.00	-
No	75	75.0		1.177 (1.049–1.320)	

Table 1. *Cont.*

Associated Factors	Agreement with COVID-19 Misinformation	*p* (%)	*p*-Value	Bivariate Analysis PR (CI 95%)	Multivariate Analysis aPR (CI 95%)
Agreement with the strategies adopted by the Government to fight COVID-19			0.032		
Yes	913	66.5		1.00	-
No	2662	63.4		0.952 (0.911–0.995)	
Consumption, confidence, and attitudes towards COVID-19 news					
Searched or received news from scientific sources			0.002		
No	201	73.9		1.170 (1.083–1.264)	1.153 (1.068–1.245)
Yes, from 1 to 2 sources	2654	63.6		1.007 (0.970–1.047)	1.050 (1.008–1.095)
Yes, from 3 or more sources	1.515	63.2		1.00	1.00
Searched or received news from non-scientific sources			<0.001		
No	1562	61.0		1.00	1.00
Yes, from 1 to 2 sources	1878	64.6		1.133 (1.069–1.200)	1.064 (1.022–1.109)
Yes, from 3 or more sources	493	69.1		1.058 (1.016–1.103)	1.114 (1.049–1.182)
Gave credit to news published by:			<0.001		
Official bodies	3516	62.0		1.00	1.00
People from social networks (family, friends, and acquaintances)	340	77.3		1.247 (1.181–1.317)	1.175 (1.104–1.251)
Unofficial bodies	216	66.7		1.076 (0.994–1.165)	1.134 (1.047–1.229)
Frequency in which you receive or search for news about COVID-19			0.033		
Daily	2440	63.3		0.924 (0.873–0.978)	-
Weekly	1476	63.5		0.928 (0.874–0.985)	
Rarely/never	454	68.5		1.00	
Impact of news on preventive attitudes			<0.001		
None/low impact	705	68.1		1.078 (1.030–1.129)	-
Medium/high impact	3665	63.1		1.00	
Frequency in which you have made decisions based on news from low-circulation sources			<0.001		
Never	3518	62.7		1.00	
1 or more times	852	68.9		1.192 (1.099–1.198)	-
Repercussions of the pandemic on the daily life					
Do you fear the repercussions of the pandemic in your future life?			0.019		
Yes	3870	64.4		1.00	-
No	427	60.0		0.931 (0.874–1.991)	
Do you feel unmotivated/stressed during the pandemic?			0.006		
Yes	3.795	64.5		1.077 (1.019–1.138)	-
No	575	59.9		1.00	
Do you know someone who has had COVID-19 or died from the disease?			0.087		
Yes	2333	64.8		1.00	-
No	2037	62.8		0.969 (0.935–1.005)	
Restrictions on leisure			0.015		

Table 1. *Cont.*

Associated Factors	Agreement with COVID-19 Misinformation	*p* (%)	*p*-Value	Bivariate Analysis PR (CI 95%)	Multivariate Analysis aPR (CI 95%)
Yes	142	71.2		1.133 (1.037–1.238)	1.230 (1.127–1.342)
No	4228	63.6		1.00	1.00
Restriction on access to family/friends			0.220		
Yes	3638	64.2		1.030 (0.981–1.082)	-
No	732	62.3		1.00	
Restriction on access to essential goods			0.251		
Yes	585	65.6		1.031 (0.980–1.085)	-
No	3.785	63.6		1.00	
Restriction on access to professional activities			0.021		
Yes	1694	65.6		1.044 (1.007–1.083)	-
No	2676	62.8		1.00	
Restriction on access to protection measures			0.008		
Yes	657	60.3		0.935 (0.888–0.985)	-
No	3.713	64.5		1.00	

p-value (Pearson's Chi-square test); *p*: prevalence; PR: prevalence ratio; CI 95%: confidence interval. aPR: adjusted prevalence ratio/omnibus test ($p < 0.001$)/ROC curve: 0.700 (0.682–0.705); $p < 0.001$. Best Akaike and likelihood criteria were evaluated.

4. Discussion

Countries historically close in geography, culture, religion, and language may share content, reinforcing misinformation about COVID-19 in their territories. Since the countries in which the study was undertaken have different populations but share a common language (Portuguese), the content characterized as misinformation about COVID-19 consumed in these territories was strongly similar and accepted in a uniform manner. Given the above, the diffusion of misinformation about COVID-19 probably can overcome terrestrial and cultural barriers and can cross countries and continents, negatively affecting the fight against COVID-19 in a global health perspective. A uniformity of the content consumed by the participants was found, and focused on homemade, simple, and easy methods to avoid infection by SARS-CoV-2. Consequently, people start to face the virus using the fallacy of easy protection, which justifies the abandonment of other protections and mitigation measures that require higher levels of effort or commitment.

Among the variables related with agreement with misinformation about COVID-19 (presented by approximately two-thirds of the participants) were social characteristics (religion affiliation and housing), attitudes and perceptions concerning social distancing (practice of isolation, not avoiding agglomerations, and leisure restrictions), source of information (traditional/high-circulation newspapers versus non-traditional/low-circulation newspapers), and the emitter of the content (scientific or non-scientific sources, and people from social networks).

Among the factors mentioned above, religious affiliation stood out. The deaths and disruptions caused by the COVID-19 pandemic may make people turn to religious groups. In times of crisis, faith can be a source of personal comfort and resilience, uniting communities searching for strength to go through these challenging times. On the other hand, as COVID-19 advances worldwide, the misinformation role of religious leaders also has advanced, especially in countries in Africa and Latin America [22–24]. A study [25] shows that disinformation about the new coronavirus is significant in Latin-American Christian communities. Due to their reliable and hegemonic position, some religious leaders legitimize potentially dangerous ideas for the general public through cults, independent newspapers, and social media, undermining virus mitigation actions, fostering skeptical positions regarding restrictive measures and the establishment of prevention strategies.

This scenario benefits from healthism, a belief system in which individuals see themselves as mainly or solely responsible for their health. While on one hand these individuals may become rational and informed, on the other hand they can present a strong distrust towards medical authorities and conventional medicine, making people more likely to resort to "alternative truths" and explanations that lack theoretical or empirical support [26]. In general, they come to defend negative positions that endorse a set of actions that, at best, are innocuous, but when amplified by influence groups, have dangerous collective impacts.

The COVID-19 pandemic is a milestone for humanity, and, historically, changes have been the target of resistance, especially when they affect our beliefs and lifestyles. For this reason, limitations related to measures of social distancing (isolation, experiencing restrictions, access to leisure, and agglomeration avoidance) have impacted the prevalence of agreement with misinformation. Studies [27,28] indicate that as the pandemic state is extended, the population's willingness to adhere to non-pharmacological measures decreases. On the other hand, there is an increase in the willingness to use alternative treatments that lack scientific support, as they can be less painful and cause fewer complications than traditional ones, which may explain the popularity of misinformation about "magic solutions".

The search for information in the face of imminent danger can reflect an adaptive behavior, which allows us to make informed decisions about how to stay safe. Regarding this, data [25–30] point out that the very context of COVID-19, with restrictions, lockdowns, and social distancing, enhances the sharing of information through social media, regardless of the quality of that information [30–35]. When such news has a tone of "novelty" or brings a "simple and magical solution", people tend to be more receptive and sharing increases. For this reason, a study [36] estimates that fake news spreads 70% faster than real news and reaches more audiences in less time.

In this sense, the COVID-19 pandemic reinforces the contemporary behavioral tendency to seek information that confirms some beliefs in a convenient manner, a phenomenon known as confirmatory bias. This effect is particularly strong in matters of intense emotional charge and deeply held beliefs, as in the present moment.

On this aspect, it is evident that not only the information itself is decisive for misinformation, but also the origin of the source and who propagates it. Information sources are related to the reader's need for information and also their perception of trust, which is why the type of the information source (non-traditional) and the increased consumption of non-scientific sources (news transmitted by unreliable sources and people from social networks) have raised the prevalence of agreement with misinformation in the present study. False information tends to present a unilateral narrative with a simple rumor from a theoretically "reliable" source to foster the "facts", opinions, and points of view presented in the news. Factors such as lack of time to consume and analyze the origin of the news have interfered with the authentication of fake news, with subsequent sharing [37,38].

Among the biggest social media platforms, WhatsApp is a tool that allows the sharing of a great volume of disinformation. Twitter and Facebook have guidelines and rules that restrict the spread of fake news, such as warnings or causing the publication to be deleted [38,39]. According to Agência Brasil [40], in April 2020, the beginning of the coronavirus pandemic in Brazil, 73.7% of fake news circulated through the WhatsApp application. The excess of information and fake information disseminated on social media can make people experience two types of decision-making: one involves the indiscriminate use of so-called preventive measures without scientific scrutiny, and the other involves the refusal of scientifically proven information [41,42].

Combating the spread of misinformation is extremely necessary, requires multidisciplinary approaches, and increasingly sophisticated initiatives. Global internet and social media companies such as Google [43], Whatsapp [42], Facebook [44], and Twitter [45] have launched initiatives that allow users to ask questions and check the veracity of some information, and even machine learning algorithms to detect fake-news advertising and other misinformation has been used. The scientific community has also been working to

fight against misinformation related to COVID-19, using surveillance systems to track the infodemic, analyzing false news, alternative, or invalid treatments and the dissemination of unfounded rumors in online media and social networks. Governments and organized civil society must partner with scientists, internet companies, and the media so that global initiatives are locally adapted and can bring messages accessible to the populations of their territories.

This research has some limitations. The sample was recruited by convenience sampling, which may not have been the best method for recruiting a representative sample of the countries' populations. Although we used a large sample size and strategies to increase the generalization of the data, such as the use of "seeds" and methods to increase the diversity of the sample, we have observed a concentration of young people and young adults in the sample. Thus, the data cannot be generalized for the general Portuguese-speaking populations. In addition, although nine countries officially speak Portuguese, we only managed responses from seven of them.

We included in this research countries with very different levels of socioeconomic development from each other, especially with regard to access to the technological resources necessary to participate in the study. This may have strongly affected our study and may have worked as a criterion for selecting specific groups. This is an important problem in web surveys and must be considered.

Despite these limitations, this study has many positive points. The first point to be highlighted is its scope, involving a large sample of seven Portuguese-speaking countries. Although the largest proportion of the participants consisted of Brazilians, it included an important contingent of residents from other countries. The high level of agreement with misinformation found characterizes a problem that has already crossed national barriers and, thus, needs to be tackled globally. Another strong point is the wide set of factors analyzed that allowed for a scan of variables potentially related to the problem under investigation. The results pointed out factors that need special attention in the fight against misinformation.

5. Conclusions

Our findings showed that in Portuguese-speaking countries, in the context of the COVID-19 pandemic, the infodemic is accelerating and perpetuating misinformation, seemingly expanding at the same pace as content production. The large amount of content available is affecting decision-making processes for dealing with the pandemic, as people expect immediate responses and do not seem to spend enough time to carefully analyze the scientific evidence. It is essential and urgent that governments create efficient and accessible institutional mechanisms capable of interrupting this dangerous cycle. In addition, they must create bold, intelligent, and safe strategies to map the content of fake news that is produced and disseminated, making it possible to recognize the intentions and targets of misinformation, and with that, prepare populations to fight fake news and get involved in collective counter-disinformation actions.

We cannot ignore the impact that misinformation has on the current panorama of the COVID-19 pandemic, especially in Latin America and Africa, where conflicting information also comes from institutional offices. In this sense, it is necessary to think about digital and informational health literacy, empowering populations to recognize fake information and providing helpful tools for that purpose.

It is necessary to increase communication efforts for groups more vulnerable to disinformation. To do so, there must be a review of communication strategies through health education and communication actions that approach the reality experienced by individuals, (re)building the link between scientific knowledge and popular knowledge, allowing the construction of shared knowledge that is meaningful for the population.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/su14010235/s1, Table S1: misinformation identified from twitter.

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