

COVID-19 vaccination challenges: from fake news to vaccine hesitancy

Gabriela Martins Silva (<https://orcid.org/0000-0001-8895-4471>)¹
Antonia Aline Rocha de Sousa (<https://orcid.org/0000-0001-9106-0188>)²
Sabrina Maria Carreiro Almeida (<https://orcid.org/0000-0002-4571-4467>)³
Itamara Carvalho de Sá (<https://orcid.org/0000-0002-0765-0888>)³
Fátima Rosane Barros (<https://orcid.org/0000-0003-1383-076X>)⁴
José Edson Santana Sousa Filho (<https://orcid.org/0000-0002-9457-5600>)⁵
José Mateus Bezerra da Graça (<https://orcid.org/0000-0002-0401-2987>)⁶
Nathanael de Souza Maciel (<https://orcid.org/0000-0002-5088-011X>)⁷
Alex Silva de Araujo (<https://orcid.org/0000-0002-6033-370X>)⁸
Cidianna Emanuely Melo do Nascimento (<https://orcid.org/0000-0001-5477-4413>)⁷

Abstract *This article aims to synthesize articles addressing fake news and COVID-19 vaccine hesitancy in the context of public health. We conducted an integrative review of articles published in any language between 2019 and 2022 in journals indexed in the following databases: Latin American and the Caribbean Literature on Health Sciences, Medical Literature Analysis and Retrieval System Online, Scopus, Web of Science, and Embase. A critical analysis was performed, guided by the research question and objective of the review. Eleven articles were selected, the overwhelming majority of which were cross-sectional studies. The main factors related to vaccine take-up highlighted by the studies were gender, age, education level, political leanings, religion, trust in health authorities, and perceptions of side-effects and vaccine efficacy. The main obstacles to attaining optimal vaccination coverage were vaccine hesitancy and disinformation. All studies addressed the relationship between low vaccination intention and the use of social media as a source of information about SARS-CoV-2. It is necessary to build public trust in vaccine safety and efficacy. Promoting a better understanding of the benefits of COVID-19 vaccination is essential to combat vaccine hesitancy and improve vaccine take-up.*

Key words COVID-19, Health education, Disinformation, Public health, Vaccination

¹ Universidade Potiguar. Av. Senador Salgado Filho 1610, Lagoa Nova. 59056-000 Natal RN Brasil. gabrielamartinsmed@outlook.com

² Christus Faculdade do Piauí. Piri-piri PI Brasil.

³ Centro Universitário UNINTA. Sobral CE Brasil.

⁴ Universidade Federal do Piauí. Teresina PI Brasil.

⁵ Universidade Católica de Quixadá. Quixadá CE Brasil.

⁶ Centro Universitário de Patos. Patos PB Brasil.

⁷ Universidade Estadual do Ceará. Fortaleza CE Brasil.

⁸ Universidade Estadual do Maranhão. São Luís MA Brasil.

Introduction

The first human cases of COVID-19 emerged in Wuhan, China, in December 2019. Initially diagnosed as severe pneumonia of unknown etiology, an analysis of respiratory samples from the patients revealed a novel coronavirus named SARS-CoV-2. COVID-19 is a viral infection transmitted through respiratory droplets or aerosols from infected people¹.

In response to the rapid global spread of the disease, the World Health Organization (WHO)¹ declared the outbreak a pandemic on 11 March 2020. Since then, various recommendations aimed at addressing this problem have emerged along with proposals to accelerate the production of vaccines, diagnosis, and treatment².

In 2020, the United States and some European countries received emergency use authorization for the first COVID-19 vaccines. In Brazil, emergency use authorization was issued by the National Health Surveillance Agency (ANVISA) in January 2021 and vaccination began in February of the same year³.

The country's national COVID-19 vaccination plan defined the following high-risk groups: people with pre-existing comorbidities, people with Down's syndrome, people aged over 60, and people who are immunosuppressed⁴. Currently, the focus of vaccination is children.

According to epidemiological data on vaccination coverage, by 22 March 2022, 57.8% of the world population had received the second dose of the vaccine. In Brazil, 74.9% of the population are fully vaccinated and 35% have received the booster⁵. Despite scientific evidence supporting vaccination, the dissemination of fake news has promoted vaccine resistance and mistrust about the efficacy and safety of immunization, resulting in low vaccine take-up.

The rapid spread of fake news has contributed to widespread disinformation. Published mainly on the internet, fake news is the creation and spread of false or misleading information aimed at distorting reality, misleading people, damaging or enhancing a reputation, and manipulating public opinion^{6,7}.

Fakes news is now considered a major public health problem⁸. The spread of health-related fake news results in the misrepresentation of science, promoting doubt and mistrust about inventions and findings and changing public opinion of disease prevention and protection measures, considerably influencing the health of individuals⁹.

Fakes news about COVID-19 circulating on the internet includes content supporting the use of medicines and home remedies with no scientific basis and contempt for prevention measures. More recently, the spread of misleading and disinformation about vaccines has generated anxiety and had a significant influence on vaccine acceptance, with many people opting not to get vaccinated or using unproven treatments that can pose a threat to individual and collective health⁸⁻¹⁰.

It is therefore important to explore the impact of fake news on vaccine take-up, given that people who refuse the vaccine due to the influence of false information are more likely to develop the severe form of the disease. Given the virus' high degree of transmissibility, vaccine resistance also hampers disease control by undermining containment measures, compromising public health. The present study takes a detailed look at this topical issue by undertaking an integrative review of current literature on COVID-19 vaccine take-up and highlighting fake news about vaccine testing and approval with aim of raising public awareness about this topic.

Given the influence of fake news on public perceptions of COVID-19 vaccines and vaccine take-up, the aim of this study was to synthesize articles addressing fake news and COVID-19 vaccine hesitancy in the context of public health.

Methods

We carried out an integrative review in six stages: 1) development of the research question; 2) definition of databases and study inclusion and exclusion criteria; 3) definition of the information to be extracted from the selected studies; 4) appraisal of the studies included in the review; 5) interpretation of the results; and 6) presentation of the review/synthesis of knowledge¹¹.

The research question was structured using the PICo (Problem, phenomenon of Interest, Context) strategy as follows: P – fake news; I – COVID-19 vaccine take-up; Co – public health. This gave rise to the following question: How did the process of COVID-19 vaccine take-up take place in the context of public health?

A search of the following databases was performed in March 2022: Latin American and the Caribbean Literature on Health Sciences (LI-LACS), using the Virtual Health Library (BVS); Medical Literature Analysis and Retrieval System Online (MEDLINE), accessed via the PubMed

platform; Scopus (Elsevier); Web of Science; and Embase (Elsevier).

The following inclusion criteria were used: full-text primary articles addressing themes related to vaccination against COVID-19, fake news about the vaccine process and its influence on vaccine take-up in the context of public health published in any language between 2019 and 2022. The exclusion criteria were duplicate articles and studies that did not address the research question.

We used controlled descriptors found in the Health Sciences Descriptors (DeCS) and their English equivalents in the Medical Subject Headings (MeSH), as well as non-controlled descriptors, using synonyms of the controlled descriptor found in the relevant literature on the topic. The sample selection process was systematized using an advanced search form modified according to the specific characteristics of each database. The search terms were connected using the Boolean operator OR between each word in the set of terms of each PICO component, and AND between each component, as shown in Figure 1. The search strategies followed the guidelines of the Peer Review of Electronic Search Strategies¹².

The searches were performed simultaneously by two researchers using the same order of descriptors for each database and the results from each search were compared. The services of a librarian were not used in this process. To ensure the widest possible search, the databases were accessed using the CAPES (Coordination for the Improvement of Higher Education Personnel) periodical platform.

The articles were sorted using the bibliographic citation management software Endnote, which imports studies into folders and allows the researcher to identify and remove duplicate references.

A total of 128 publications were identified, 11 of which were selected for the present integrative review after applying the inclusion and exclusion criteria. Figure 2 below illustrates the search strategy and study selection process.

The data were collected using a table designed by the authors with the following variables: title, year of publication, author(s), country, journal, study design, and abstract.

A critical analysis and qualitative synthesis of the selected studies was performed, guided by the research question and review objective and prioritizing the following aspects: the relationship between fake news, disinformation, and COVID-19 vaccine take-up; vaccine hesitancy;

main variables; and impact on overcoming the pandemic as a public health emergency.

Results

Eleven articles were selected: two from MEDLINE/PubMed, four from SCOPUS, three from Web of Science, and two from Embase. Nine of the articles were published in health journals, one in an interdisciplinary journal, and one in a journal covering the area of social media and society.

All the included articles were written in English. Ten of the studies used an analytical cross-sectional design and one was quantitative. Chart 1 shows the authors of the selected studies, country, year of publication, and main conclusions of each study.

Below we describe the results of the studies focusing on COVID-19 vaccine take-up and the impact of vaccine hesitancy and non-adherence to preventive measures on public health.

Three studies found a relationship between likelihood of intention to vaccinate and being male¹³⁻¹⁵. One study found that greater vaccine hesitancy was associated with being male¹⁷, while another found the same association with being female¹³. The other studies did not find any association between vaccine hesitancy and gender.

With regard to political leanings, two studies suggested that left-wing voting could increase the likelihood of accepting the COVID-19 vaccine^{13,14}. Furthermore, religious and political leaders and the government had a positive long-term influence on the decision to take the vaccine¹⁷ and trust in health authorities and seeking information on COVID-19 in public media or websites of health authorities also positively influenced vaccination intention^{13,18}.

Only one author found an association between age, marital status, profession, level of education, and pre-existing comorbidities (except cancer) and greater likelihood of accepting the COVID-19 vaccine¹⁵. In contrast, another author reported that participants with paid work, a religion other than Catholicism, and lower educational level were more likely to be hesitant¹⁹. Another study suggested that being Christian was a factor that positively influenced vaccine take-up and reported that being Hausa and living in the north of Nigeria were associated with greater acceptance¹⁴.

Vaccine hesitancy and disinformation are the main barriers to attaining optimal vaccination

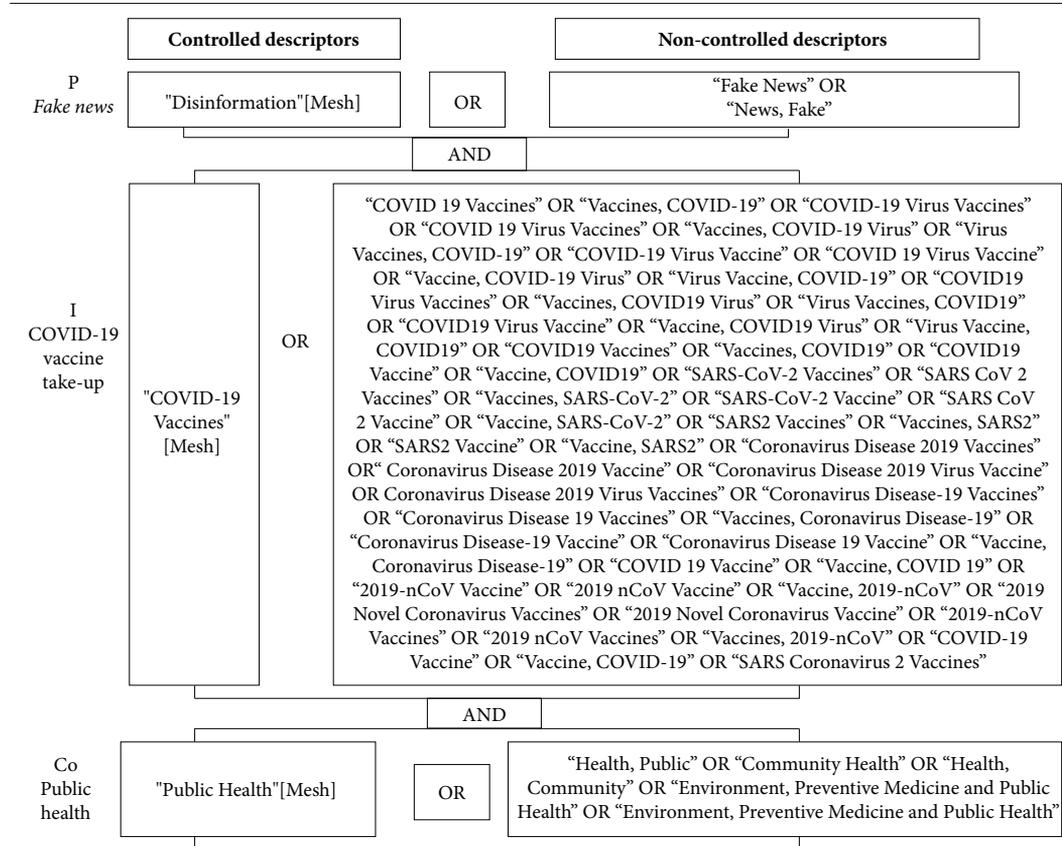


Figure 1. Controlled and non-controlled descriptors used in the problem, intervention, and context search strategy.

Source: Authors.

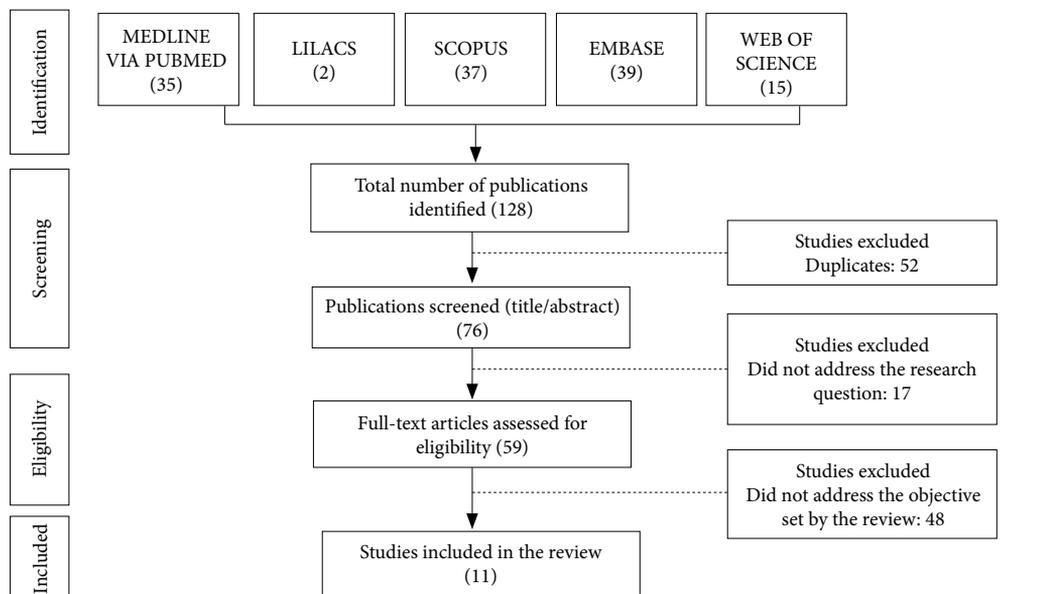


Figure 2. Flowchart showing the search strategy and study selection process.

Source: Authors.

Chart 1. Synthesis of the articles included in the integrative review showing the main study conclusions.

Authors/year	Country	Conclusions
Arkther T, Nur T, 2022 ²⁰	Bangladesh	Disinformation and belief in conspiracy theories hamper COVID-19 vaccination programs. Awareness, perceived usefulness, and ease of use of vaccines have a positive impact on individual attitudes toward vaccination and acceptance of immunization. Authorities should focus on campaigns that could reduce misinformation surrounding COVID-19 vaccination.
Baccolini V <i>et al.</i> , 2021 ¹⁶	Italy	Vaccine hesitancy changed throughout the pandemic in relation to confidence in vaccine safety and effectiveness, perceived risk of COVID-19, and education level. University students are a good target for intervention campaigns as they may be open to a change in behavior and additional efforts to increase their awareness and engagement, restore confidence in health authorities, and limit disinformation regarding the vaccines should be made.
Vries E <i>et al.</i> , 2022 ¹⁹	Holland	Vaccine hesitant respondents used messaging services like WhatsApp more frequently than non-hesitant respondents. Higher education level was associated with lower vaccine hesitancy. Hesitant respondents had less knowledge about vaccines and lower perception of the risks of COVID-19. Tailored communication strategies may be needed reach hesitant groups.
Ahorsu DK <i>et al.</i> , 2022 ²²	Iran	There was no direct association between problematic social media use and intention to get a COVID-19 vaccine. However, there were several indirect associations with cyberchondria, where fear of COVID-19 and COVID-19 risk perception were mediators. The term 'cyberchondria' should be approached with caution and viewed as a preliminary diagnostic proposal needing further empirical exploration.
Eze UA <i>et al.</i> , 2021 ¹⁴	Nigeria	Greater vaccine uptake was related to recommendations from health professionals. There was a positive association between being male, Muslim, from the Hausa tribe, and living in the north of Nigeria and vaccine acceptance. Awareness raising needs to target women and religious leaders should be involved in this process. Vaccine shortages and vaccine hesitancy are major limiting factors hampering the attainment of optimal vaccination coverage.
Aida El Far Cardo <i>et al.</i> , 2021 ¹³	Germany	High risk perceptions and vaccination intention were associated with left-wing voting. Trust in health authorities, seeking information about the virus from public media or websites of health authorities, and hesitation were associated with being female.
Neely S <i>et al.</i> , 2021 ¹⁸	United States	The findings suggest that health professionals will need to be both strategic and proactive when engaging with health consumers on social media if they hope to counteract the deleterious effects of misinformation and disinformation. Effective training, institutional support, and proactive collaboration can help health professionals adapt to the evolving patterns of health information seeking.
Chadwick A <i>et al.</i> , 2021 ²³	United Kingdom	The findings show conspiracy mentality and use of social media and personal messaging apps to discourage vaccination. This suggests that an affinity between conspiracy mentality, social media use, and negative online social endorsement will undermine the vaccination program, to some extent. The public health implications of this finding are not straightforward. Social media companies are becoming more assertive in their removal of vaccine disinformation and anti-vax accounts, which increases vaccine acceptance].
Marcau FC <i>et al.</i> , 2022 ²¹	Romania	The study highlights that the level of confidence in fake news is a matter of serious concern when it comes to vaccination against COVID-19. Respondents showed a high degree of susceptibility to conspiracy theories and lack of trust in doctors led to the decision not to accept COVID-19 vaccines.
Tolia V <i>et al.</i> , 2022 ¹⁷	India	The study sheds light on factors that influence vaccine adoption, especially issues relating to lower uptake of vaccines, one of the long-standing problems in the vaccination process. Furthermore, emerging themes can help develop strategies for social marketers, researchers, and policymakers to promote vaccine acceptance.
Rodriguez B <i>et al.</i> , 2021 ¹⁵	Spain	Disinformation and the lack of political consensus are the main doubts of the Spanish population associated with the new vaccines against SARS-CoV-2 in an extraordinary scientific-health context. Trust in institutions is fundamental to guarantee levels of vaccination that lead to herd immunity.

Source: Authors.

coverage and immunization of the population in many countries. Awareness raising can have a positive impact on vaccine acceptance^{14,20}.

Raising awareness about vaccination is a strategy that can motivate people to take the vaccine²⁰. Another study reported that trust in the national vaccine program and doctors contribute to vaccine acceptance²¹. The use of the internet and social media to increase vaccine acceptance in India, focusing on children and specific groups, was associated with increased vaccine take-up due to the spread of truthful information¹⁷.

The use of social media as a source of information on SARS-CoV-2 was negatively associated with low vaccination intention, with all studies citing or describing this association. Five studies did not specify the type of social media^{14-16,21,22}, while six associated digital platforms such as Google, Facebook, Twitter, Instagram, WhatsApp, and TikTok with the spread of fake news using audio-visual resources containing false information, religious content, popular beliefs, and conspiracy theories^{13,17-19,20,23}.

Only one study showed that there was no statistically significant association between problematic social media use and intention to get a COVID-19 vaccine. In contrast, the same study reported the indirect effects of cyberchondria and the problematic use of digital platforms. The studies highlighted several factors that undermine trust in COVID-19 vaccines and fear and anxiety linked to perceptions of severe side-effects, duration of protection, and vaccine efficacy were commonly reported factors contributing to low vaccination intention^{16,17,19,22}. A study in Italy showed that less importance was given to the country of vaccine production (less than 5% of respondents)¹⁶.

High levels of vaccine hesitancy and conspiracy theory mentality were associated with a greater likelihood of discouraging others from vaccination via social media and personal messaging apps²³. In the same vein, another study highlighted the spread of fake news and belief in conspiracy theories, such as false claims that vaccines contained infertility agents or spread infectious pathogens like the human immunodeficiency virus (HIV)²⁰. Another study highlighted fake news claiming that the pandemic was not real and that there is a global secret society who wants to control the world and reduce the population through infertility and killing the elderly²¹.

Finally, one of the articles found that while higher perceived COVID-19 severity was negatively associated with vaccine hesitancy, higher

susceptibility to COVID-19 did not show any relationship. The lowest odds of vaccine hesitancy were found for a 1-unit increase in confidence in vaccine safety¹⁶.

Discussion

Vaccine hesitancy poses a challenge for efforts to control the novel coronavirus pandemic and has been a cause for concern around the globe, mainly due to the negative connotation that COVID-19 vaccines have received, especially on social media. Recognizing the barriers to vaccine take-up/acceptance is crucial to understanding how to tackle this problem.

The present literature review shows that intention to vaccinate was generally higher in men¹³⁻¹⁵. However, a study in Romania showed that both sexes gave roughly similar reasons for deciding not to vaccinate²¹. The relationship between gender and vaccine take-up was addressed superficially by studies, resulting in gaps in understanding of the factors that lead men to have higher vaccine acceptance. Further research into this association is therefore warranted, especially bearing in mind that women typically show greater adherence to health measures²⁴.

The findings also show that political leanings also play an important role in attitudes to vaccines, with left-voting individuals being more likely to accept vaccines^{13,15}. Non-voters and voters from other ends of the political spectrum reported a perception of risk and significantly lower intention to vaccinate, suggesting lack of trust in policy. This assumption is reinforced by the fact that non-voters distrusted federal institutions and health authorities. Some of the studies addressed the relationship between trust in policy, science, and health authorities and perception of risk and management of the pandemic¹⁵.

A study with Italian university students observed that students who opted not to disclose their political position were more likely to refuse the vaccine. These students may not have had a clear opinion or may not have wished to voluntarily disclose their position¹⁶. The ongoing political debate about COVID-19 vaccination remains intense and the association between political leanings and vaccination intention was reported by only three studies. Further research is therefore warranted to obtain a more in-depth understanding of this association.

Religiously-motivated disinformation can also pose a barrier to vaccine acceptance. A study in

Gujarat¹⁷, India, reported that religious leaders have an influence on vaccine acceptance. According to study participants, religious leaders have the power to influence people in their daily lives, irrespective of lifestyle or educational background.

In contrast to the study in Gujarat¹⁵, another study showed that although religion was not a factor influencing the decision to accept or refuse the vaccine, non-religious people were less hesitant than Christians. However, further research is needed to determine the relationship between religiousness and COVID-19 vaccine take-up²².

Almost all studies show that social media are a source of (dis)information about the issue. Having access to smartphones or computers was reported to be a factor determining vaccine hesitancy, as through these devices the population is able to access digital platforms like Facebook and WhatsApp, encountering fake news or disinformation about vaccine safety¹⁷. While other communication channels such as radio and the press were also cited, the main source of fake news and unreliable claims was social media¹⁵.

The findings show that disinformation is strongly associated with COVID-19 vaccine take-up. Safety concerns, fear of medium- and long-term side-effects, and conspiracy theories claiming that vaccines are a huge experiment on the world population, doctors are paid to inoculate biological preparations capable of reducing the world population, and people who take the vaccine are condemned to death in the coming years were cited^{15-17,20,21}.

Education level was also shown to affect vaccine acceptance, with low levels of education being significantly associated with vaccine hesitancy¹⁴. University students showed higher levels of vaccine acceptance, while groups with low education levels were more likely to be hesitant^{15,16}. Easy access to huge amounts of information on the internet and social media means that anybody with a smartphone is susceptible to the spread of fake news. The sharing of disinformation between laypeople is a dangerous tool, meaning that social media like Facebook and

WhatsApp can have a potentially major influence on vaccination campaigns.

Health education plays a vital role in this context. Both people with high and low levels of education, including health professionals, are susceptible to fake news, meaning that the latter has a direct impact on vaccine hesitancy. In addition, as some studies show, the motivation to get vaccinated may be related to the fact that vaccination will enable a return to work and normal everyday activities rather than the effect of the vaccine on the immunological system or reduction in the chances of dying from COVID-19. Sharing of fake news is a key factor in vaccine hesitancy.

Study limitations include the fact that the selected studies only encompassed the adult population, meaning that it is not possible to draw meaningful conclusions regarding children. Second, few articles directly addressed the association between fake news and vaccine take-up.

Final considerations

The present study synthesized articles addressing fake news and COVID-19 vaccine hesitancy in the context of public health. The main issues addressed were gender differences, policy, education level, health education, the internet, social media, and trust in vaccines.

The spread of disinformation is a serious threat to public health. It is therefore necessary to build public trust in vaccine safety and efficacy, especially among groups with a high degree of skepticism about vaccination. Our findings provide valuable inputs to inform the discussion of interventions to improve vaccine take-up, especially those focusing on health education. Promoting a better understanding of the benefits of vaccination is essential to combat vaccine hesitancy and improve take-up in the general population. It is important to highlight that this task should not involve only health professionals, but also religious and political leaders, schools, and the entire community.

Collaborations

GM Silva: methodology, articles selection and analysis, interpretation of results; AAR Sousa: introduction, articles selection and analysis, compliance with the journal's standards; SMC Almeida: introduction, articles selection and analysis, discussion of research data; IC Sá: articles selection and analysis, interpretation of the results, final considerations; FR Barros: methodology, articles selection and analysis; JES Sousa Filho: articles selection and analysis, discussion of research data; JMB Graça: planning of the study and final review; NS Maciel: planning of the study and review of the article; AS Araujo: research adequacy; CEM Nascimento: research adequacy and final revision of the article.

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