

Factors influencing childhood vaccination against COVID-19: a scoping review

Fatores que influenciam a vacinação infantil contra a Covid-19: revisão de escopo

Factores que influyen en la vacunación infantil contra el Covid-19: revisión de alcance

Bianca Cristina Galatti¹ ; Ana Cristina Ribeiro La Scaléa¹ ; Silvia Carla da Silva André Uehara¹ 

¹Universidade Federal de São Carlos. São Carlos, SP, Brazil

ABSTRACT

Objective: to map the scientific literature on the factors that influence parents' or guardians' adherence to childhood vaccination against COVID-19. **Method:** this is a scoping review, conducted based on the question, "Which factors influence parents' or guardians' adherence to childhood vaccination against COVID-19?", using the PubMed, Web of Science, Virtual Health Library, and Scopus databases. **Results:** thirteen studies were selected regarding the non-adherence of parents or guardians to childhood vaccination against COVID-19, which sought to identify the causes of vaccine hesitancy and its drivers, such as political and religious aspects and trust in vaccination. The main factors influencing adherence to vaccination were doubts about the safety and effectiveness of immunobiologicals, in addition to side effects. **Conclusion:** mapping the scientific literature on the factors influencing childhood vaccination against COVID-19 reveals a complexity of elements, with emphasis on trust in the efficacy and safety of vaccines.

Descriptors: COVID-19; SARS-CoV-2; Vaccination; Child; Parents.

RESUMO

Objetivo: mapear a literatura científica sobre os fatores que influenciam a adesão de pais ou responsáveis à vacinação infantil contra a Covid-19. **Método:** trata-se de uma revisão de escopo, realizada a partir do questionamento "Quais fatores influenciam a adesão de pais ou responsáveis à vacinação infantil contra a Covid-19?", nas bases de dados PubMed, Web of Science, Biblioteca Virtual em Saúde e Scopus. **Resultados:** selecionados 13 estudos sobre a não adesão à vacinação infantil contra a Covid-19 por pais ou responsáveis, que buscaram identificar as causas da hesitação vacinal e seus motivadores, como aspectos políticos, religiosos e a confiabilidade da vacinação. Os principais fatores que influenciaram a adesão à vacinação foram dúvidas sobre a segurança e a eficácia dos imunobiológicos, além de efeitos colaterais. **Conclusão:** o mapeamento da literatura científica sobre os fatores que influenciam a vacinação infantil contra a Covid-19 revela uma complexidade de elementos, destacando-se a confiança na eficácia e na segurança das vacinas.

Descritores: COVID-19; SARS-CoV-2; Vacinação; Criança; Pais.

RESUMEN

Objetivo: identificar la literatura científica sobre los factores que influyen en la adherencia de los padre y/o responsables a la vacunación infantil contra el Covid-19. **Método:** revisión de alcance, realizada con base en la pregunta "¿Qué factores influyen en la adherencia de los padres y/o responsables a la vacunación infantil contra el Covid-19?", utilizando las bases de datos PubMed, Web of Science, Biblioteca Virtual de Salud y Scopus. **Resultados:** se seleccionaron trece estudios sobre la no adherencia de los padres o responsables a la vacunación infantil contra el Covid-19. Estos estudios buscaron identificar las causas de la reticencia a la vacunación y sus motivadores, como factores políticos y religiosos y la confiabilidad de la vacunación. Los principales factores que influyeron en la adherencia a la vacunación fueron las dudas sobre la seguridad y eficacia de los inmunobiológicos, así como los efectos colaterales. **Conclusión:** la identificación en la literatura científica de los factores que influyen en la vacunación infantil contra el Covid-19 revela elementos complejos, en los que cabe destacar la confianza en la eficacia y seguridad de las vacunas.

Descriptores: COVID-19; SARS-CoV-2; Vacunación; Niño; Padres.

INTRODUCTION

COVID-19 affects all age groups; however, the lowest incidence and mortality rates are observed in the pediatric population. Most children are asymptomatic during viral infection; however, when symptoms are present, they may range from mild to severe, resembling those observed in adults and older adults¹.

As in adults and older adults, underlying conditions in children may constitute risk factors for the development of the severe form of the disease. In this regard, an analysis conducted in Vietnam found that children with pre-existing conditions were 2.08 times more likely to develop COVID-19-related pneumonia complications compared to those without comorbidities, which may contribute to the need for hospitalization².

This study was supported in part by the *Fundação de Amparo à Pesquisa do Estado de São Paulo – Brazil (FAPESP)*, Grant No. 2023/03629-9 and by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil (CAPES)* – Funding Code 001.

Corresponding author: Bianca Cristina Galatti. E-mail: bgalatti@estudante.ufscar.br

Editor in Chief: Cristiane Helena Gallasch; Associate Editor: Mercedes Neto

At the beginning of the pandemic, a low incidence rate of COVID-19 and hospitalization due to infection was observed in children. However, this scenario changed from 2021 onward, with a marked increase in the incidence of the disease as well as rising hospitalization rates among the pediatric population in several countries. In Italy and Poland, these indicators were associated with the emergence of more transmissible variants and with the delayed vaccination of children, which consequently led to low parental adherence to childhood COVID-19 vaccination³.

In this context, vaccination stands out as one of the most effective public health strategies in combating infectious diseases. An analysis conducted in the United States indicated that the implementation of childhood vaccination against COVID-19 prevented more than 350,000 cases and 273,000 hospitalizations among children aged 6 months to 15 years during the 4 to 7 months following the initiation of vaccination, representing a 26% reduction in the number of cases that would have been observed in this population without the vaccine⁴.

Scientific evidence points to the effectiveness of COVID-19 vaccination across all age groups, including the pediatric population⁵. Although vaccination is highly effective in preventing severe forms of COVID-19, low adherence rates to childhood vaccination have been observed among parents and guardians. In countries such as Japan, Saudi Arabia, and Greece, most parents reported being undecided about vaccinating their children⁶.

Childhood vaccination against COVID-19 is one of the most effective measures for reducing incidence, hospitalizations, and deaths due to the disease in the pediatric population, as well as for controlling viral transmission to the general population⁷. Thus, conducting studies that address the factors associated with low parental or guardian adherence to childhood vaccination against COVID-19 is essential. In this regard, understanding the reasons behind COVID-19 vaccine hesitancy may contribute to the development and implementation of public health strategies aimed at strengthening actions that encourage vaccination.

Therefore, this study aimed to map the scientific literature on the factors that influence parents' or guardians' adherence to childhood vaccination against COVID-19.

METHOD

This is a scoping review, conducted according to the six methodological steps described by the Joanna Briggs Institute (JBI): (1) identification of the research question; (2) identification of relevant studies; (3) study selection; (4) data extraction; (5) charting, summarizing, and reporting the results; and (6) dissemination of the results⁸. For reporting this review, the recommendations of the PRISMA Extension for Scoping Reviews tool were followed⁹.

Using the PCC acronym (Population: pediatric population; Concept: factors influencing adherence to vaccination; and Context: Covid-19), the following research question was structured: "Which factors influence parents' or guardians' adherence to childhood vaccination against COVID-19?"

The search strategies were developed using controlled vocabularies corresponding to the topics of the PCC mnemonic, available in the Health Sciences Descriptors (DeCS) and in Medical Subject Headings (MeSH), as shown in Figure 1.

DATABASE	SEARCH STRATEGY
PubMed	"(COVID-19) AND (Child) AND (SARS-CoV-2) AND (Vaccination) AND (Acceptance) AND (Parents)"
Web of Science	"(COVID-19) AND (Child) AND (SARS-CoV-2) AND (Vaccination) AND (Acceptance) AND (Parents)"
Scopus	"(COVID-19) AND (Child) AND (SARS-CoV-2) AND (Vaccination) AND (Acceptance) AND (Parents)"
Virtual Health Library (Biblioteca Virtual em Saúde, BVS)	"(COVID-19 OR Covid-19) AND (Crianças) AND (SARS-CoV-2) AND (Vacinação) AND (Aceitação) AND (Pais)"

Figure 1: Search strategies used in the databases. São Carlos, SP, Brazil, 2024

After selecting the descriptors, the search strategies were applied on January 5, 2024, in the following databases: PubMed, Web of Science, Virtual Health Library (VHL), and Scopus, accessed through the CAPES Journal Portal (Coordination for the Improvement of Higher Education Personnel) using authentication via the Federated Academic Community (CAFe), in order to standardize data collection across these databases.

Empirical primary studies addressing factors related to adherence to COVID-19 vaccination in the pediatric population were included, considering the three elements of the PCC mnemonic; studies published in Portuguese, English, and Spanish, and within the period from January 2021 to December 2023. Publications whose titles and abstracts were not aligned with the objective of the investigation were excluded, as well as studies addressing

vaccination in other age groups, in addition to opinion articles, editorials, and reviews. Reviews, protocols, institutional documents, and manuals were not included, since the focus was to map original knowledge production on the subject.

The study selection process took place between January and April 2024, based on the predefined criteria. The publications identified were imported into the software State of the Art through Systematic Review (StArt)¹⁰, which enabled blinding in the collaboration between the two reviewers. At this stage, duplicates were removed and titles and abstracts were screened, identifying those relevant; divergences were discussed with a third researcher and resolved by consensus. The final sample was defined based on full-text reading. Finally, a snowballing technique was also used, through manual searching (backward citation) in the reference lists of the included studies, in order to identify relevant publications not retrieved from the database searches.

The study selection is shown in a flow diagram, and the main results are summarized in a descriptive chart, highlighting bibliometric aspects related to the central question that guided this scoping review. No methodological quality assessment of the included studies was conducted, as this was not part of the inclusion criteria and is considered optional in scoping reviews.

RESULTS

A total of 518 articles were identified in the databases, of which 247 were duplicates. Thus, 271 articles were selected for title, abstract, and keyword screening. After this stage, 217 were excluded for being opinion articles, editorials, or studies whose titles, abstracts, and keywords did not address the objective of the investigation. Fifty-four articles were selected for full-text reading; subsequently, 41 studies were excluded for being literature reviews, not presenting primary data analysis, or not addressing the review question, resulting in a final sample of 13 studies included (Figure 1).

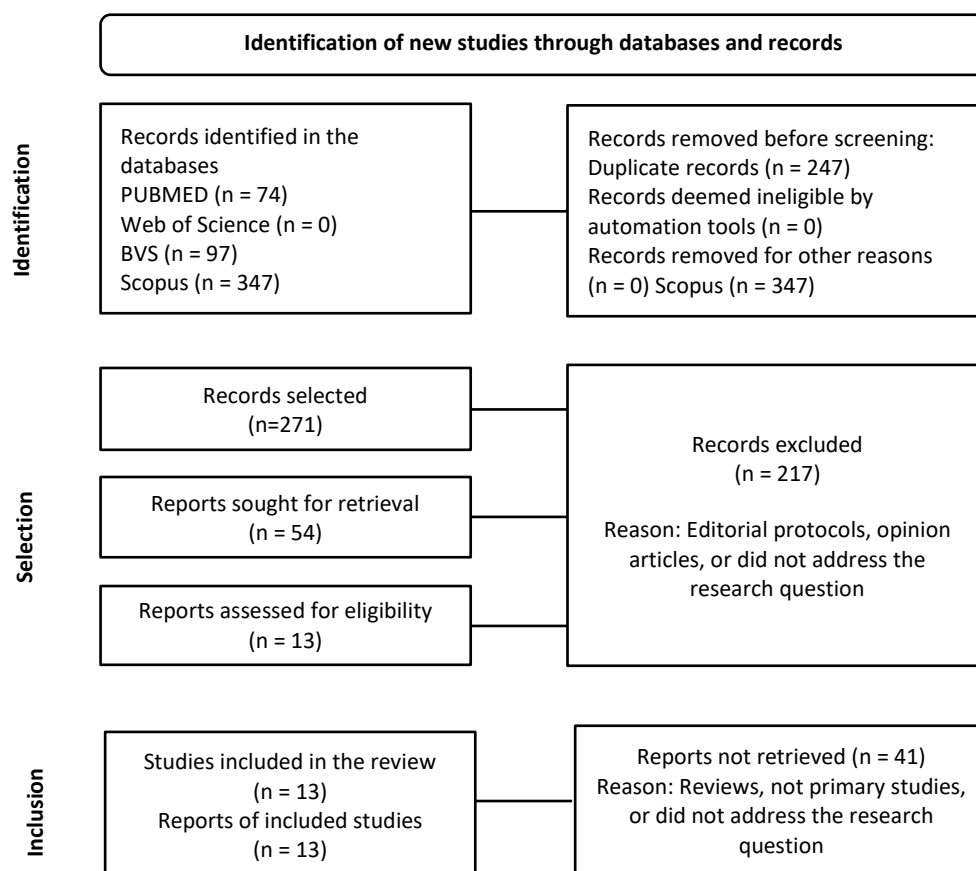


Figure 2: Flow diagram of the study selection process for the scoping review, in accordance with PRISMA-ScR guidelines. São Carlos, SP, Brazil, 2024.

The 13 selected studies were published in English. It is noteworthy that eight were published in the United States (61%) and one in each of the following countries (7.69%): Turkey, Asia, Ireland, Poland, and China. Regarding the countries of origin of the studies, six were conducted in the United States (46%), two in China (15.4%), and one in each of the following countries (7.7%): Turkey, Iran, the Middle East, Ireland, and Malaysia. Concerning the type of study, seven were cross-sectional and analytical (53.8%), as presented in Figure 3.

Authors/Year of publication/Country of origin	Objective	Type of Study and Sample	Factors Influencing Childhood Vaccination Against COVID-19
Wan et al., 2021, China ¹¹	To understand the factors influencing parents' willingness to vaccinate their children against COVID-19.	A cross-sectional study. N = 468	Parents who paid attention to information related to the COVID-19 vaccine were more likely to vaccinate their children.
Hammershaimb et al., 2022, United States ¹²	To assess parents' attitudes and beliefs regarding SARS-CoV-2-related disease and COVID-19 vaccines, and to evaluate parents' acceptance of COVID-19 vaccines.	Cross-sectional and analytical study. N = 3,230	Belief in the benefits of COVID-19 vaccination.
YÄ±lmaz et al., 2022, Turkey ¹³	To evaluate parents' willingness and attitudes toward the COVID-19 vaccine.	Cross-sectional and analytical study. N = 1,035	Parents or guardians being health professionals.
Ellithorpe et al., 2022, United States ¹⁴	To examine whether constructs of the Health Belief Model mediated the relationships between demographics, childhood vaccination behavior, and COVID-19 experience with intentions to vaccinate against COVID-19.	Cross-sectional and analytical study. N = 682	Parents whose children had recently received the influenza vaccine, as well as those with previous experience with COVID-19.
Fisher et al., 2022, United States ¹⁵	To assess the extent to which attitudinal and demographic factors previously identified as predictors of parents' decisions regarding COVID-19 vaccination for their children aged 5–11 years were related to the intention to vaccinate children under 5 years old.	Descriptive Study. N = 3,230	Higher parental educational level, middle/high income, mothers' vaccination history, and health beliefs about COVID-19.
Mohammed et al., 2022, Middle East ¹⁶	To assess Arab parents' health beliefs and their intention to vaccinate their children against COVID-19.	Cohort study. N = 1,154	Medical recommendation, adequate information provided, and general public acceptance of the vaccine.
Mangat et al., 2022, United States ¹⁷	To estimate parental acceptance of the vaccine for children aged 6 months to 4 years and to assess the factors influencing vaccine hesitancy.	Cross-sectional and analytical study. N = 1,000	Adherence to the vaccination schedule, perception of the severity of COVID-19 in children, and vaccine safety and effectiveness were associated with greater vaccine acceptance.
Marron et al., 2022, Ireland ¹⁸	To determine parents' attitudes toward COVID-19 vaccination among parents of children aged 0 to 48 months living in Ireland, and to examine the factors associated with parents' intention to vaccinate.	Cross-sectional and analytical study. N = 855	Parents' perception that COVID-19 is a serious disease, and those who agreed that vaccines are generally safe, were more likely to intend to vaccinate.
Ng et al., 2022, Malawi ¹⁹	To assess parents' willingness to vaccinate their children under 12 years of age against COVID-19.	Cross-sectional and analytical study. N = 3,528	Parents' COVID-19 vaccination history was a strong predictor of their willingness to vaccinate their children.
Baumann et al., 2022, United States ²⁰	To identify parental characteristics and beliefs that may be associated with COVID-19 vaccine acceptance.	A cross-sectional study. N = 1,298.	Trust in scientists showed the strongest association with parents' acceptance of the COVID-19 vaccine.
Li et al., 2022, China ²¹	To explore COVID-19 vaccine hesitancy and its predictors among Chinese parents of children aged 3 to 17 years, along with their willingness to vaccinate them.	A cross-sectional study. N = 3,484	Lower educational level and parental occupation may predict hesitancy toward the COVID-19 vaccine.
Santos et al., 2023, Brazil ²²	To identify factors associated with permission for childhood vaccination in the context of the COVID-19 pandemic.	A cross-sectional study. N = 94	Permission for vaccination was associated with higher educational level of parents or guardians, as well as permission for vaccines included in the national childhood vaccination schedule.
Sarbakhsh et al., 2023, Iran ²³	To evaluate the association of children's demographic and clinical characteristics, as well as parents' socioeconomic status, with the uptake of COVID-19 vaccination among children aged 5 to 12 years.	Case-control study. N = 913	Children without underlying conditions, a history of COVID-19 infection, and children of parents with higher educational levels were more likely to accept the vaccine.

Figure 3: Description of the articles, according to author, year and study location, objective, type of study, and main results. São Carlos, SP, 2024.

The analysis of this study highlights that 11 of the selected studies showed that more than 50% of parents or guardians reported adherence to childhood vaccination against COVID-19^{11,13,15-17}. However, two studies indicated that less than 50% of parents or guardians reported that adherence to vaccination would occur only in the event of an increase in infections^{12,14}. Factors discouraging parents or guardians from vaccinating their children were also analyzed, such as concerns regarding vaccine safety and effectiveness and adverse effects²¹.

It is worth noting that all the studies sought to identify the causes of vaccine hesitancy and its drivers, such as political and religious aspects and trust in vaccination.

The studies analyzed showed that, although parents or guardians of children demonstrated awareness of the importance of COVID-19 vaccination, many tended not to adhere to vaccination. Most of the studies that examined the reasons for vaccine refusal revealed that the main reasons were fear of side effects and distrust of vaccine safety^{13,16-18,20,22,23}. Furthermore, it was identified that the main sources of information reported by parents or guardians regarding vaccines were health professionals, the media, and social networks.

DISCUSSION

In light of the findings of this study, it is evident that parents' or guardians' hesitancy toward vaccination can be considered a significant challenge in addressing COVID-19. In the scenario of disease endemization, which entails the false perception that the problem has been resolved, people interpret that vaccination is no longer necessary. Although most children and adolescents infected are asymptomatic or have mild symptoms, recent data show the emergence of a severe late-onset inflammatory syndrome temporally associated with SARS-CoV-2^{24,25}.

In the United Kingdom, in April 2020, hospitalizations of usually healthy children and adolescents were reported, presenting with fever and multisystem inflammation, including severe cases with shock and multiple organ failure. Thus, a rare and severe syndrome, temporally associated with COVID-19, was identified and named Pediatric Multisystem Inflammatory Syndrome (PIMS); this condition primarily affects unvaccinated children^{24,25}.

In this context, vaccination against COVID-19, especially with mRNA-based vaccines such as Pfizer-BioNTech®, plays a role not only in preventing COVID-19 but also in reducing the incidence of severe complications such as PIMS. It is noteworthy that two doses of the Pfizer-BioNTech® vaccine are associated with a high level of protection against PIMS in people aged 12 to 18 years old, underscoring the importance of vaccination among all eligible children²⁶.

Nevertheless, in Brazil, 2024 data from the Ministry of Health show vaccination coverage of 23% for two doses and only 7% for the complete three-dose schedule among children aged 3 to 4 years²⁵. However, vaccine hesitancy is not exclusive to Brazil^{26,32,33}. In Canada, it was observed that factors such as risk perception, previous experiences with vaccines, misinformation and misconceptions, side effects, vaccine effectiveness, and political ideology also influenced parents' or guardians' adherence to childhood vaccination against COVID-19²⁷.

In addition, in the United States it was found that parents hesitant about childhood vaccination against COVID-19 had less knowledge about vaccines, were more accepting of vaccine-related conspiracies, and were less concerned about the risks of COVID-19 to their children's health compared to parents who accepted vaccination²⁸.

In this context, it is important to highlight the existence of the anti-science movement, which became more prominent during the critical phase of the pandemic, particularly regarding childhood vaccination against COVID-19²⁹. In Brazil, historical periods portray the relentless struggle against misinformation, such as the Vaccine Revolt, which occurred at the end of the 19th century in the city of Rio de Janeiro, fueled by conspiracy theories, misinformation, and moments of tension, leading to popular resistance against compulsory vaccination³⁰.

Currently, it is evident that the arguments and beliefs of anti-vaccine groups have not undergone substantial changes over the past century, as they continue to spread false claims such as vaccine ineffectiveness and the development of diseases resulting from vaccination. However, their ability to disseminate negative information has grown in both speed and effectiveness in the last decade^{24,31,32}.

In the digital era, with the advent of the internet, this movement gained greater strength and visibility. The development of mobile technologies such as smartphones, tablets, and laptops has contributed to the rapid and mass dissemination of information³². With these tools, organized groups promote narratives filled with various fallacies about vaccination, using emotional and pseudoscientific strategies to spread misinformation virtually.

In this context of information overload, distrust toward COVID-19 vaccine manufacturers and concerns about their safety were reinforced by the shortened time in which these immunobiologicals were developed. Consequently, lack of confidence in vaccines and immunization programs may lead to decreased vaccination coverage³³.

However, vaccine development is a complex scientific process; therefore, it is a misconception to assume that the work on producing COVID-19 vaccines began only at the start of the pandemic. The genetic sequence of SARS-CoV-2 was published on January 11, 2020, providing the scientific information necessary to initiate studies aimed at developing technological platforms for vaccine production against COVID-19 infection²⁹.

Thus, when SARS-CoV-2 emerged, the technology for developing COVID-19 vaccines already existed, requiring only adaptation for record-time development³⁴; since prior knowledge of SARS-CoV and MERS-CoV, which caused previous epidemics, involved genetic material similar to the novel coronavirus. In this way, development was accelerated so that vaccine production could occur swiftly and effectively, following protocols, given that the genomic composition was more easily achieved³⁵.

In Europe, several countries approved vaccination against COVID-19 in the pediatric population aged 5 to 11 years old in November 2021, and since then, the European Union has recommended vaccination for children from six months of age³⁰. In the United States, by February 2022, more than 16 million doses of the BNT-162b2[®] vaccine had been administered to children aged 5 to 11 years old, under the guidance of the Centers for Disease Control and Prevention (CDC). For children aged six months to four years old, vaccination began in the first half of 2023³⁶.

In Brazil, the federal government had adopted a skeptical stance regarding COVID-19 vaccines, generating controversy and concern among the general population. In a scenario of political and even ideological polarization, such manifestations intensified barriers to parents' or guardians' adherence to vaccinating children, since many did not evaluate sources, ignoring the quality and accuracy of information³⁷. In this context, childhood vaccination of children aged 5 to 11 years old against COVID-19 in the country began in January 2022, later being gradually expanded to younger age groups³⁹.

In September 2022, the Ministry of Health began recommending vaccination for children from six months of age, prioritizing those with comorbidities, and in November of the same year, immunization was made broadly available for all children aged six months to four years old. Immunization for children aged six months to under five years old was included in the national vaccination schedule as of January 2024³⁸. It should be noted that, in the first year of the vaccination campaign, low adherence was observed among children and adolescents aged 5 to 11 years old, resulting in a coverage rate of 69.5% for the first dose and 46.1% for the second dose in December 2022³⁹.

Religious and cultural issues also represent factors that interfere with acceptance of the COVID-19 vaccine, as religious groups follow doctrines established culturally, with characteristics specific to each religion, and in some cases, oppose vaccination. In Venezuela, it was observed that non-religious individuals were more willing to receive the COVID-19 vaccine than Catholic and Protestant participants, with Pentecostals being the most hesitant religious group regarding vaccines⁴⁰.

Thus, in different cultures, fear and vaccine hesitancy against COVID-19 are observed in the pediatric population, even in the face of a disease that has caused thousands of deaths worldwide. Immunization has contributed significantly to reducing deaths and severe cases of the disease; therefore, the greatest challenge remains adherence to childhood vaccination against COVID-19, since misinformation and the widespread dissemination of false news strongly influence parents' or guardians' decision-making⁴¹.

Given that parents' or guardians' decisions to vaccinate their children against COVID-19 are strongly influenced by the sources of information to which they have access, it is important to emphasize that health professionals must serve as reliable and essential mediators. This is particularly true for nursing professionals, due to their direct role in Primary Health Care services, where they play a strategic part in building rapport and trust with this population⁴¹. Therefore, whether in reception, home visits, outpatient procedures, or in the vaccination room, nursing professionals must provide qualified listening, a humanized approach, and evidence-based information, factors that contribute significantly to vaccine adherence^{42,43}.

Study limitations

The limitations of this review include the fact that only studies published in Portuguese, English, and Spanish were included, as well as the restriction to articles available in full text, and the exclusion of indexing databases not covered in this research.

FINAL CONSIDERATIONS

It is considered that false news and misinformation about vaccination are factors that directly impact parents' or guardians' non-adherence to childhood COVID-19 vaccination. In addition, vaccine hesitancy among parents or guardians of children is a global phenomenon that undermines the immunization of the pediatric population.

This study identified persistent gaps in the literature, such as analyses of different approaches to combating misinformation and increasing adherence to childhood COVID-19 vaccination. Moreover, there are few studies analyzing

vaccination adherence among minority groups, Indigenous communities, and socioeconomically disadvantaged populations. More detailed studies could reveal specific barriers faced by these groups in order to map similarities and differences in the factors that affect the effectiveness of childhood vaccination.

Based on the findings of this review, further studies are also suggested on adverse effects in children after COVID-19 vaccination and the evaluation of long-term outcomes of vaccination, including any potential impacts on overall health, development, and immune response.

REFERENCES

1. Rajapakse N, Dixit D. Human and novel coronavirus infections in children: a review. *Paediatr Int Child Health*. 2021 [cited 2016 Sep 20]; 41(1):36-55. DOI: <https://doi.org/10.1080/20469047.2020.1781356>.
2. Nguyen SN, Vu LT, Nguyen HT, Dao GH, Nguyen ANT. clinical epidemiological characteristics and risk factors for severity of SARS-CoV-2 pneumonia in pediatric patients: a hospital-based study in Vietnam. *Cureus*. 2024 [cited 2024 Jun 07]; 16(4):e58371. DOI: <https://doi.org/10.7759/cureus.58371>.
3. Esposito S, Giordano R, Painsi G, Puntoni M, Principi N, Caminiti C. Can we get out of the COVID pandemic without adequate vaccination coverage in the pediatric population? *Ital J Pediatr*. 2022 [cited 2024 Jun 07]; 48(1):150. DOI: <https://doi.org/10.1186/s13052-022-01339-x>.
4. Head JR, Collender PA, León TM, White LA, Sud SR, Camponuri SK, et al. COVID-19 vaccination and incidence of pediatric SARS-CoV-2 infection and hospitalization. *JAMA Netw Open*. 2024 [cited 2024 Jun 10]; 7(4):e247822. DOI: <https://doi.org/10.1001/jamanetworkopen.2024.7822>.
5. Fonseca Lima EJ, Leite RD. COVID-19 vaccination in children: a public health priority. *J Pediatr (Rio J)*. 2023 [cited 2024 Jun 11]; 99(1):S28-S36. DOI: <https://doi.org/10.1016/j.jped.2022.11.006>.
6. Souto EP, Fernandez MV, Rosário CA, Petra PC, Matta GC. Hesitação vacinal infantil e COVID-19: uma análise a partir da percepção dos profissionais de saúde. *Cad. Saúde Pública*. 2024 [cited 2024 Mar 07]; 40(3):e00061523. DOI: <http://dx.doi.org/10.1590/0102-311xpt061523>.
7. Rajapakse N, Dixit D. Human and novel coronavirus infections in children: a review. *Paediatr Int Child Health*. 2021 [cited 2024 Sep 20]; 41(1):36-55. DOI: <https://doi.org/10.1080/20469047.2020.1781356>.
8. Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil H. Scoping Reviews (2020). In: Aromataris E, Lockwood C, Porritt K, Pilla B, Jordan Z, editors. *JBIM Manual for Evidence Synthesis*. JBI; 2024 [cited 2025 Jan 10]. DOI: <https://doi.org/10.46658/JBIMES-24-09>.
9. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018 [cited 2025 Jan 10]; 169(7):467-73. DOI: <https://doi.org/10.7326/M18-0850>.
10. Laboratório de Pesquisa em Engenharia de Software UFSCar. State of the art through systematic review. Version 2.3.4.2 [Internet]. 2024 [cited 2025 Jan 10]. Available from: <https://www.lapes.ufscar.br/resources/tools-1/start-1>.
11. Wan X, Huang H, Shang J, Xie Z, Jia R, Lu G, et al. Willingness and influential factors of parents of 3-6-year-old children to vaccinate their children with the COVID-19 vaccine in China. *Hum Vaccin Immunother*. 2021 [cited 2024 Mar 07]; 17(11):3969-74. DOI: <https://doi.org/10.1080/21645515.2021.1955606>.
12. Hammershaimb EA, Cole LD, Liang Y, Hendrich MA, Das D, Petrin R, et al. COVID-19 vaccine acceptance among US parents: a nationally representative survey. *J Pediatric Infect Dis Soc*. 2022 [cited 2024 Mar 07]; 11(8):361-70. DOI: <https://doi.org/10.1093/jpids/piac049>.
13. Yilmaz M, Sahin MK. Parents' willingness and attitudes concerning the COVID-19 vaccine: A cross-sectional study. *Int J Clin Pract*. 2021 [cited 2025 Jan 10]; 75(9):e14364. DOI: <https://doi.org/10.1111/ijcp.14364>.
14. Ellithorpe ME, Aladé F, Adams RB, Nowak GJ. Looking ahead: Caregivers' COVID-19 vaccination intention for children 5 years old and younger using the health belief model. *Vaccine*. 2022 [cited 2025 Jan 10]; 40(10):1404-12. DOI: <https://doi.org/10.1016/j.vaccine.2022.01.052>.
15. Fisher CB, Bragard E, Jaber R, Gray A. COVID-19 Vaccine hesitancy among parents of children under five years in the United States. *Vaccines (Basel)*. 2022 [cited 2025 Jan 10]; 10(8):1313. DOI: <https://doi.org/10.3390/vaccines10081313>.
16. Mohammed AH, Hassan BAR, Wayyes AM, Gadhban AQ, Blebil A, Alhija SA, et al. Parental health beliefs, intention, and strategies about covid-19 vaccine for their children: a cross-sectional analysis from five Arab countries in the Middle East. *Vaccine*. 2022 [cited 2025 Jan 10]; 40(45):6549-57. DOI: <https://doi.org/10.1016/j.vaccine.2022.09.052>.
17. Mangat C, Rich J, Sanghavi D, Schmidt R, Milosavljevic N, Linh T, et al. Parents' perspective on COVID-19 vaccine in children 6 months through 4 years: a cross-sectional study from Northwest Wisconsin. *BMJ Open*. 2022 [cited 2025 Jan 10]; 12(9):e065453. DOI: <https://doi.org/10.1136/bmjopen-2022-065453>.
18. Marron L, Ferenczi A, O'Brien K, Cotter S, Jessop L, Morrissey Y, et al. 2022. Views on COVID-19 vaccination of young children in Ireland, results from a cross-sectional survey of parents. *Vaccine* 2022 [cited 2024 Jun 11]; 40(39):5716-25. DOI: <https://doi.org/10.1016/j.vaccine.2022.08.030>.
19. Ng DLC, Gan GG, Chai CS. The willingness of parents to vaccinate their children younger than 12 years against COVID-19: a cross-sectional study in Malaysia. *BMC Public Health*. 2022 [cited 2025 Jan 10]; 22:1265. <https://doi.org/10.1186/s12889-022-13682-z>.
20. Baumann B, Rodriguez R, DeLaroche A, Rayburn D, Eucker S, Nadeau N, et al. Factors associated with parental acceptance of covid-19 vaccination: a multicenter pediatric emergency department cross-sectional analysis. *Ann Emerg Med*. 2022 [cited 2024 Jun 11]; 80(2):130-42. DOI: <http://dx.doi.org/10.1016/j.annemergmed.2022.01.040>.

21. Li T, Qiu X, Gong X, Zhan R, Zheng X. The cross-sectional survey on COVID-19 vaccine hesitancy and its predictors among Chinese parents of 3-17 years aged children in Shenzhen City. *Ann Agric Environ Med*. 2022 [cited 2024 Jun 11]; 29(1):120-5. DOI: <https://doi.org/10.26444/aaem/146263>.
22. Santos DFD, Oliveira JO, Vieira ACS, Santos RCS, Silva AMOAD, Costa CRB. Factors associated with the permission for child vaccination in the context of the COVID-19 pandemic. *Rev Gaucha Enferm*. 2023 [cited 2024 Jun 11]; 44:e20220362. DOI: <https://doi.org/10.1590/1983-1447.2023.20220362.en>.
23. Sarbakhsh P, Jafari N, Salemi S, Akbarnejad R. Predictors of Pediatric COVID-19 vaccination: a case-control study in Tabriz, Iran. *BMC Pediatr*. 2023 [cited 2024 Jun 11]; 23(1):379. <https://doi.org/10.1186/s12887-023-04202-y>.
24. Galhardi CP, Feire NP, Fagundes MC, Minayo MC, Cunha IC. Fake news e hesitação vacinal no contexto da pandemia da COVID-19 no Brasil. *Ciênc. saúde colet*. 2022 [cited 2024 Jun 11]; 27(5):1849-58. DOI: <http://dx.doi.org/10.1590/1413-8123202275.24092021>.
25. Fundação Osvaldo Cruz. Boletim Observa Infância. Brasília (DF): Fiocruz; 2024 [cited 2024 Jun 11]; Available from: https://www.icit.fiocruz.br/sites/www.icit.fiocruz.br/files/boletim_oi_covid-19_em_crianças_e_adolescentes.pdf
26. Zambrano LD, Newhams MM, Olson SM, et al. Eficácia da vacinação com mRNA BNT162b2 (Pfizer-BioNTech) contra a síndrome inflamatória multissistêmica em crianças entre pessoas de 12 a 18 anos — Estados Unidos, julho a dezembro de 2021. *MMWR Morb Mortal Wkly Rep*. 2022 [cited 2024 Jul 14]; 71:52-8. DOI: <http://dx.doi.org/10.15585/mmwr.mm7102e1.27>.
27. Majid U, Ahmad M, Zain S, Akande A, Ikhlaf F. COVID-19 vaccine hesitancy and acceptance: a comprehensive scoping review of global literature. *Health Promot Inte*. 2022 [cited 2024 Jul 14]; 37(3):daac078. DOI: <https://doi.org/10.1093/heapro/daac078>.
28. Ruiz, JB, Bell RA. Parental COVID-19 Vaccine Hesitancy in the United States. *Public Health Rep*. 2022 [cited 2024 Jul 14]; 137(6):1162-9. <https://doi.org/10.1177/00333549221114346>.
29. Couto M, Thereza B, Carolina LA, Matos C. Considerations on COVID-19 impact on the individual-society relationship: from vaccine hesitancy to the clamor for a vaccine. *Saúde soc*. 2021 [cited 2024 Jul 14]; 30(1):e200450. DOI: <http://dx.doi.org/10.1590/s0104-12902021200450>.
30. Santos B, Barros RJ, Holanda JR, Monteiro DB, Morais LE, Almeida J, et al. A revolta da vacina e seus impactos: Cientific@. 2021 [cited 2024 Jul 14]; 8(2):1–10. <https://doi.org/10.37951/2358-260X.2021v8i2.5914>.
31. Sá EPP, Leão LMACA, Araújo ASS, Borges MS. Influência das fake news na adesão à vacinação infantil contra a Covid-19. *Rev Bras Revisão Saúde*. 2023 [cited 2024 Jul 14]; 3:10709-23. <https://doi.org/10.34119/bjhrv6n3-181>.
32. Ramos AC, Pacheco B, Sousa J, Petrilli JD, Costa G. Cobertura vacinal e o movimento antivacina: o impacto na saúde pública no Brasil. *Revista Baiana de Saúde Pública*. 2023 [cited 2024 Jul 14]; 47(1):210-26. DOI: <https://doi.org/10.22278/2318-2660.2023.v47.n1.a3831>.
33. Mendonça SB, Soares T, Pereira G, Burla R, Amorim C. Tecnologias globais na produção de vacinas contra o covid-19. *Rev. Cient. Fac. Med Campos*. 2020 [cited 2024 Jul 14]; 15(2):100-9. DOI: <https://doi.org/10.29184/1980-7813.rcfmc.373.vol.15.n2.2020>.
34. Souto EP, Fernandez MV, Rosário CA, Petra PC, Matta GC. Hesitação vacinal infantil e COVID-19: uma análise a partir da percepção dos profissionais de saúde. *Cad. Saúde Pública*. 2024 [cited 2024 Mar 07]; 40(3):e00061523. DOI: <http://dx.doi.org/10.1590/0102-311xpt061523>.
35. Hause A, Shay D, Klein N, Abara W, Baggs J, Cortese M, et al. Safety of COVID-19 Vaccination in United States Children Ages 5 to 11 Years. *Pediatrics*. 2022 [cited 2022 Jul 14]; 150(2):e2022057313. DOI: <http://dx.doi.org/10.1542/peds.2022-057313>.
36. Guilherme L. Necropolítica e Governo Bolsonaro: Plano da pandemia de vacinação da Covid-19 [Tese de Doutorado]. São Paul: Universidade Presbiteriana Mackenzie; 2023 [cited 2024 Aug 01]. Available from: <https://adelfa-api.mackenzie.br/server/api/core/bitstreams/1901c3e1-c40d-463b-bcab-40c6a0daff36/content>.
37. Ministério da Saúde (Br). Secretaria de Vigilância em Saúde. Departamento do Programa Nacional de Imunizações. Estratégia de Vacinação contra a Covid-19. Brasília (DF): Ministério da Saúde; 2024 [cited 2024 Jun 11]. Available from: <https://www.gov.br/saude/pt-br/assuntos/saude-de-a-a-z/c/covid-19/publicacoes-tecnicas/guias-e-planos/estrategia-de-vacinacao-contra-a-covid-19-2024-2a-edicao/view>.
38. Boing AC, Boing AF, Borges ME, Rodrigues DO, Barberia L, Subramanian SV. Spatial clusters and social inequities in COVID-19 vaccine coverage among children in Brazil. *Cien Saude Colet*. 2024 [cited 2024 Jun 11]; 29(8):e03952023. DOI: <https://doi.org/10.1590/1413-81232024298.03952023>.
39. Gonçalves BA, Matos C, Ferreira J, Itagyba R, Moço VR, Couto M. COVID-19 vaccine hesitancy in Latin America and Africa: a scoping review. *Cad. Saúde Pública*. 2023 [cited 2024 Jun 11]; 39(8):e00041423. DOI: <http://dx.doi.org/10.1590/0102-311xpt041423>.
40. Kato Y, Shinozaki T, Sugiyama D, Taguchi A, Nagata S. Potential motivators affecting parental intention in COVID-19 vaccination for children aged 6 months to 4 years: Implications for targeted vaccine interventions in Japan. *Hum Vaccin Immunother*. 2023 [cited 2024 Jun 20]; 19(3):2296737. DOI: <https://doi.org/10.1080/21645515.2023.2296737>.
41. Nunes LRJS. A Importância do Enfermeiro nas Campanhas de Vacinação Infantil. *Saude Coletiv (Barueri)*. 2025 [cited 2024 Jun 20]; 15(92):14158-71. DOI: <https://doi.org/10.36489/saudecoletiva.2024v14i92p14158-1417142>.
42. Souto EP, Fernandez MV, Rosário CA, Petra PC, Matta GC. Childhood vaccine hesitancy and COVID-19: an analysis based on the perception of health professionals. *Cad Saude Publica*. 2024 [cited 2024 Jun 11]; 40(3):e00061523. DOI: <https://doi.org/10.1590/0102-311XPT061523>.

Authors' contributions

Conceptualization, B.C.G. and S.C.S.A.U.; methodology, B.C.G. and S.C.S.A.U.; validation, B.C.G., A.C.R.L.S. and S.C.S.A.U.; análise formal, B.C.G. and S.C.S.A.U.; investigation, B.C.G. and S.C.S.A.U.; data curation, B.C.G., A.C.R.L.S. and S.C.S.A.U.; manuscript



writing, B.C.G., A.C.R.L.S. and S.C.S.A.U.; review and editing, B.C.G. and S.C.S.A.U.; visualization, B.C.G., A.C.R.L.S. and S.C.S.A.U.; supervision, B.C.G. and S.C.S.A.U.; project administration, B.C.G. and S.C.S.A.U. All authors read and agreed with the published version of the manuscript.

Use of artificial intelligence tools

The authors declare that no artificial intelligence tools were used in the composition of the manuscript *“Completeness of tuberculosis data in the Notifiable Diseases Information System: a cross-sectional study”*.