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Review Article

Influence of socioeconomic factors on COVID-19 mortality in children: a scoping review

Influência dos fatores socioeconômicos na mortalidade por COVID-19 na população infantil: revisão de escopo

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ABSTRACT

Objective: to identify the scientific evidence on the relationship between socioeconomic factors and mortality in children due to COVID-19. **Methods:** this is a scoping review. Searches were carried out in the following databases: US National Library of Medicine - National Institutes of Health; Scientific Electronic Library Online; Institute for Scientific Information; Cumulative Index to Nursing and Allied Health Literature; and SciVerse Scopus. **Results:** 15 articles were selected that showed the influence of socioeconomic factors on infant mortality from Severe Acute Respiratory Syndrome Coronavirus 2. **Conclusion:** it was shown that socioeconomic factors are related to increased mortality from COVID-19 in the infant population, low income and residence in locations considered to be of greater socioeconomic vulnerability, which were presented as important variables to be considered in the COVID-19 pandemic. **Contributions to practice:** several factors are related to increased susceptibility to Severe Acute Respiratory Syndrome Coronavirus infection and worsening of the disease in children. However, understanding that socioeconomic factors can be a determinant of COVID-19 incidence and mortality in children highlights the need to invest in actions aimed at reducing socioeconomic inequalities, to reduce preventable deaths.

Descriptors: COVID-19; Socioeconomic Factors; Child; Mortality.

RESUMO

Objetivo: identificar as evidências científicas sobre a relação entre os fatores socioeconômicos e a mortalidade em crianças por COVID-19. **Métodos:** trata-se de uma revisão de escopo. As buscas foram realizadas nas seguintes bases de dados: *US National Library of Medicine – National Institutes of Health*; *Scientific Electronic Library Online*; *Institute for Scientific Information*; *Cumulative Index to Nursing and Allied Health Literature;* e *SciVerse Scopus.* **Resultados:** foram selecionados 15 artigos que evidenciaram a influência dos fatores socioeconômicos na mortalidade infantil pelo *Severe Acute Respiratory Syndrome Coronavirus 2*. **Conclusão:** evidenciou-se que os fatores socioeconômicos estão relacionados ao aumento da mortalidade por COVID-19 na população infantil, baixa renda e à residência em localidades consideradas de maior vulnerabilidade socioeconômica, as quais se apresentaram como importantes variáveis a serem consideradas na pandemia de COVID-19. **Contribuições para a prática:** diversos fatores estão relacionados ao aumento da suscetibilidade à infecção do *Severe Acute Respiratory Syndrome Coronavirus* e agravamento da doença em crianças. No entanto, compreender que os fatores socioeconômicos podem se apresentar como um determinante na incidência e mortalidade por COVID-19 na população infantil ressalta a necessidade de investimentos em ações direcionadas à redução das desigualdades socioeconômicas, para assim reduzir as mortes evitáveis.

Descritores: COVID-19; Fatores Socioeconômicos; Criança; Mortalidade.

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Introduction

At the beginning of the pandemic caused by the novel coronavirus (COVID-19), it was observed that the highest incidence of cases and mortality from the disease were concentrated mainly in the elderly and adults. However, over the course of the pandemic, there has been a growing trend of cases in children in many countries[1-2].

The child population is just as likely to be infected by the virus known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) as adults; however, in contrast to adults, specifically the elderly, who are at greater risk of developing COVID-19 in its severe form and negative outcome, children generally present asymptomatic infection or mild, transient, and non-specific illness when infected[3].

With the evolution of the pandemic, there has been an increase in the number of COVID-19 cases in the child population, which may be related to the increase in testing, as well as the emergence of new variants of SARS-CoV-2 with greater potential for transmissibility. The different variants and the late immunization of children, as well as the low adherence of parents and guardians to vaccination, may be associated with the increase in infection and hospitalization rates[4-5].

However, socio-economic factors may also be related to COVID-19 mortality in children. In Brazil, it was found that municipalities with a low rate of outpatient clinics per 100,000 inhabitants and a low percentage of family health teams had greater social vulnerability in relation to infrastructure, such as difficulty in accessing piped water; inadequate garbage and sewage collection; and the highest mortality rates in the 0-4 and 15-19 age groups due to COVID-19[6].

Although studies indicate that the child population has a better prognosis and a lower death rate, the impact of COVID-19 on this specific population can vary considerably between countries and within the same territory[4-5,7]. Infant mortality from COVID-19 in developed countries is low; however, the disease is emerging as a new cause of death among children living, especially, in poorer countries[7].

In this context, the relationship between socio-economic factors and the unfavorable outcomes of COVID-19 in children is of paramount importance for public health, making studies that characterize the factors related to infant mortality resulting from SARS-CoV-2 infection essential. The aim of this article was to identify the scientific evidence on the relationship between socioeconomic factors and mortality in children due to COVID-19.

Methods

This is a scoping review based on the principles outlined by the JBI, namely: (1) identification of the research question; (2) identification of relevant studies; (3) selection of studies; (4) data extraction; (5) separation, summarization, and reporting of results; and (6) dissemination of results[8].

For the search criteria of the review, the JBI proposal was applied, represented by the acronym "PCC", which stands for "P" Population, "C" Concept and "C" Context. The guiding question for the study was developed in line with the PCC method, with "P" (children who died from COVID-19), "C" (socioeconomic factors) and "C" (COVID-19 pandemic) being defined as: What is the relationship between socioeconomic factors and child mortality from COVID-19?

The searches, carried out on the databases US National Library of Medicine - National Institutes of Health (PubMed), Institute for Scientific Information (Web of Science), Scientific Electronic Library Online (SCIELO), Cumulative Index to Nursing and Allied Health Literature (CINAHL), were carried out without restriction, and a filter was applied to the title, abstract and keywords of the journals in one of the SciVerse Scopus strategies. These searches were carried out between November and December 2022 and were conducted using descriptors and their synonyms found in the Health Sciences Descriptor (DeCS) and

Medical Subject Headings (MeSH), in the different languages, namely: COVID-19; SARS-CoV-2; pandemic; coronavirus; socioeconomic factors; death; lethality; mortality; preschool and child (Figure 1).

Database	Search strategy
CINAHL	(COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus) AND (("socia* indicato*" OR "socioeconomic facto*") AND (death OR mortality) AND (children OR preschool OR infant OR "infant mortality") (COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus) AND ("economic indicato*" OR "socioeconomic facto*"))) AND (death OR mortality) AND (children OR preschool OR infant OR "infant mortality")
PUBMED	(((COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus) AND ("social indicato*" OR "socioeconomic facto*")) AND (death OR mortality)) AND (children OR preschool OR infant OR "infant mortality") (((COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus) AND ("economic indicators" OR "socioeconomic factors")) AND (death OR mortality)) AND (children OR preschool OR infant OR "infant mortality")
SCIELO	(ab:((((COVID-19 OR coronavírus OR coronavirus) AND (*"indicadores sociais" OR "indicador social" OR "indicadores sociales" OR "indicadores económicos" OR* "social indicators") AND *("mortalidade infantil" OR "mortalidad infantil" OR "mortalidad del lactante" OR* "infant mortality"))))) (COVID-19 OR (SARS-CoV-2) OR (pandemia COVID-19) OR (epidemia de la COVID-19)) AND ((indicadores sociais) OR (indicador social) OR (fatores socioeconômicos) OR (indicadores sociales) OR (indicadores económicos) OR (factores socioeconómicos)) AND (óbito OR letalidade OR mortalidade OR muerte OR letalidade OR mortalidade) AND ((pré-escolar) OR infantil OR (mortalidade infantil) OR preescolar OR infantil OR lactante OR (mortalidade infantil) OR (mortalidade del lactante))
SCOPUS	(COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus) AND ("social indicators" OR "socioeconomic factors") AND (death OR mortality) AND (children OR preschool OR infant OR "infant mortality")) (TITLE-ABS-KEY (COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus) AND TITLE-ABS-KEY ("economic indicators" OR "socioeconomic factors") AND TITLE-ABS-KEY (death OR mortality) AND TITLE-ABS-KEY (children OR preschool OR infant OR "infant mortality"))
Web of Science	(((ALL=(COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus)) AND ALL=("social indicators" OR "socioeconomic factors)) AND ALL=(death OR mortality)) AND ALL=(children OR preschool OR infant OR "infant mortality))) (((ALL=(COVID-19 OR "SARS-CoV-2" OR "COVID-19 pandemic" OR coronavirus)) AND ALL=("economic indicators" OR "socioeconomic factors")) AND ALL=(death OR mortality)) AND ALL=(children OR preschool OR infant OR "infant mortality")

Figure 1 – Search strategies used in the databases. São Carlos, SP, Brazil, 2023

The following inclusion criteria were used: primary studies, studies published in Portuguese, English and Spanish, listed in the aforementioned databases and published between January 1 and October 31, 2022. Editorials, protocols, systematic reviews and studies whose title and abstract did not answer the problem question, as well as information from websites and the media, were not eligible. The reference lists of all the studies found were also examined.

After implementing the search strategy in each database, the references identified were imported into the State of the Art through Systematic Review (StArt) web application, where a two-stage selection of studies was carried out. The first selection phase was based on an analysis of titles and abstracts, followed by a full reading of the articles. The StArt tool used in the review was developed by the Software Engineering Research Laboratory at the Federal University of São Carlos[9]. The eligible studies were retrieved in full and assessed by three researchers. In both phases, discrepancies were debated until a consensus was reached, followed by the final selection.

The preparation of this review also adhered to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews (PRISMA-ScR)[10]. Relevant information was extracted from each selected article, including authors, journal name, country where the study took place, country of publication, study design and main results. The selection of studies is presented in a flow diagram and the results analyzed are shown in figure 3, in descriptive format, highlighting bibliometric aspects that address the central question that guided this scoping review.

Results

A total of 473 articles were found in the databases. Of these, 226 were removed for being duplicates, which led to the analysis of titles and abstracts of 247 articles. Of these, 206 studies were excluded for being duplicates, protocols, editorials, letters, systematic reviews and studies whose title and abstract did not answer the problem question. In addition, information from websites and the media was also rejected. At the end of the eligibility stage, 41 articles were selected for a full evaluation.

After a thorough analysis, 15 articles were identified that met the inclusion criteria and addressed the relationship between socioeconomic factors and infant mortality related to COVID-19. As for the analysis carried out on the reference lists of the studies found, no additional articles were identified that answered the research question of this review (Figure 2).

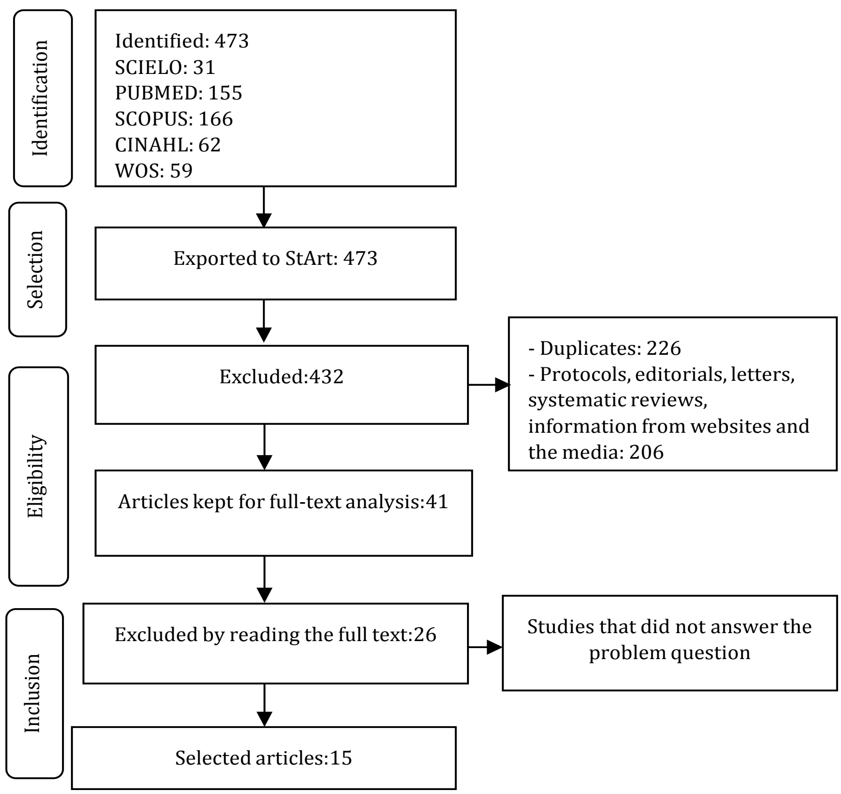

Figure 2 – Reference flowchart: inclusion and exclusion of articles. São Carlos, SP, Brazil, 2023

Of the studies included, 9 (60%) were carried out in Brazil; 2 (13.3%) in the United States; 1 (6.7%) in England, Norway, and South Africa respectively, as well as 1 (6.7%) multinational study that analyzed data from Germany, South Korea, Spain and France; it should be noted that all the studies were published in English.

Of the 15 studies selected for analysis, 6 (40%) were observational, 5 (33.3%) cohort studies, 2 (13.3%) ecological studies, 1 (6.67%) retrospective study and 1 (6.67%) descriptive study (Figure 3).

Author, year/place	Type of study and sample	Main results
Sanhueza-Sanzanaitalo et al. 2020, Brazil[11]	Ecological n= 22,830	Of the 22,830 confirmed cases, 2,333 died, with an apparent lethality rate of around 12%. Regarding the <1 year age group, 19 cases were reported, of which 3 died. In the 1-9 age group, 194 cases were reported, with 3 deaths. There were fewer deaths in the under-19 age group, representing 0.5% of the total.
Souza et al. 2020, Brazil[12]	Retrospective n= 67,180	The study revealed a low proportion of confirmed infections in younger age groups (≤ 20 years). Thus, 116 newborns (≤ 1 month), 381 babies (≥ 1 - 12 months), 518 children (≥ 1 - 12 years) and 258 adolescents (≥ 12 - 17 years) were diagnosed with COVID-19. A positive relationship was found between higher for everyone for each person income and COVID-19 diagnosis. In addition, there was an association between low for each person income and severe cases of acute respiratory infection of unknown origin.
Baggio et al. 2021, Brazil[13]	Cross-sectional observational n= 59,695	In the population aged ≤18 years, of the 3,362 cases, 17 died. There is a concentration of deaths in the older age groups and in males. On the other hand, survivors are concentrated in the younger age groups and in the female population. Epidemiological indicators also varied according to age and gender. Although the incidence rate was higher in the female population in all the age groups analyzed, the mortality rate and the fatality rate were higher in the male population. The highest incidence rates were observed in municipalities with better human development, education, income and greater social vulnerability.
Duarte-Salles et al. 2021, France, Germany, Spain, South Korea, and USA[14]	International cohort n= 242,158	Comorbidities, including neurodevelopmental disorders, heart disease and cancer, were more common among those hospitalized versus diagnosed with COVID-19. Hospitalization was observed in 0.3% to 1.3% of the cohort diagnosed with COVID-19, with undetectable (n< 5 per database) 30-day case fatality.
Martins-Filho et al. 2021, Brazil[7]	Based on records n= 3,998,055	Eight hundred deaths among children were recorded, representing around 0.7% of COVID-19-related deaths in the country. There were important differences in incidence and mortality rates between Brazilian regions, and a correlation between mortality rates and social and economic rates was found.
Oliveira et al. 2021, Brazil[15]	Observational n= 82,055	The estimated mortality rate stands at 4.8% in the first 10 days after hospital admission, rising to 6.7% in the first 20 days and reaching 8.1% at the end of follow-up. A survival analysis revealed that the risk of death increased in infants under the age of 2 and in adolescents aged 12 - 19 (compared to children aged 2, as well as in relation to individuals of white descent). This highlights that mortality associated with COVID-19 was correlated with factors such as age, indigenous ethnic origin, belonging to geopolitically disadvantaged regions and the presence of pre-existing medical conditions.
Oliveira et al., 2021, Brazil[16]	Cross-sectional n= 243,509	In the age group comprising children aged 0-9, 5,105 cases were recorded, with 60 deaths, with an incidence of 229.47 and mortality of 2.70 per 100,000 inhabitants, and lethality of 1.18. Mortality and lethality increased with age, except in children under the age of 10. Older black individuals with heart disease or diabetes who presented with dyspnea or fever were more likely to die.
Phaswana-Mafuva et al. 2021, South Africa[17]	Descriptive epidemiology n= 31,498	The highest hospitalization rate was among people aged 50-59 and the lowest among those aged 0-9. The proportion of hospitalizations in the 0-9 age group was 1.85%. The cumulative number of deaths in the 0-9 age group due to COVID-19 was highest among black children (95), followed by mixed race (6), Indian (2), white (1) and 15 children were not classified by ethnicity. Also, within this age group, females had more deaths than males. The proportion of deaths to hospitalizations by race and sex increased with increasing age. In each age group, this proportion was higher among black Africans and lower among whites.
Poulson et al. 2021, USA[18]	Observational n= 124.780	Black patients had more hospital admissions, intensive care unit admissions and need for ventilator support compared to their white counterparts. Regarding the population aged 0-9, 415 children were white and 198 were black. Black patients had a 1.42 times higher risk of hospitalization for COVID-19 compared to white patients. Black-white disparities in COVID-19 hospitalization persist across all age groups. There was no observed difference in mortality between black and white patients under the age of 19, but the difference between black and white deaths increases with increasing age.
Saatci et al. 2021, England[19]	Cohort n= 2,576,353	Black, Asian, or mixed-race children had lower proportions of SARS-CoV-2 tests and had higher positive results and hospitalizations for COVID-19 compared to white children. Older children (16-18 years) were also more likely to test positive for SARS-CoV-2 compared to infants.
Souza et al. 2021, Brazil[20]	Cross-sectional observational n= 5,857	Most of the comorbidities considered were risk factors for mortality. The presence of multiple comorbidities increased the likelihood of death almost tenfold. In addition to the association with comorbidities, influences linked to ethnic, geographic, and socioeconomic factors were identified that had an impact on the mortality rate in children hospitalized with COVID-19 in Brazil.

(the Figure 3 continue in the next page...)

Author, year/place	Type of study and sample	Main results
Bocong et al. 2022, USA[21]	Observational	Socio-economic disadvantage, single-parent families, low birth weight and severe housing problems positively affect confirmed cases of new coronavirus disease. Similar results are also found in the aspect of cases of death, where the association between social disadvantage and cases of death may be more prominent than between social disadvantage and confirmed cases.
Nogueira et al. 2022, Brazil[22]	Ecological n= 30,071	In the 0-9 age group, there were 188 confirmed cases, with only one death. Looking at the data comprehensively in the second quarter of the epidemic, compared to the urban regions of low vulnerability, the urban regions of high vulnerability had a lower risk of confirmed cases and a higher risk of hospitalizations and deaths.
Oliveira et al. 2022, Brazil[23]	Observational retrospective cohort n= 21,591	Among 21,591 pediatric patients hospitalized with COVID-19, 379 had diabetes. Overall, children and adolescents with diabetes had a higher prevalence of intensive care unit admission, invasive ventilation, and death. Children with diabetes had double the risk of death compared to pediatric patients without diabetes. Among children with diabetes, four covariates were independently associated with the primary outcome, living in the poorest regions of the country, northeast and north, oxygen saturation <95% on admission, presence of renal disorders and presence of obesity. The higher risk of death was associated with clinical and socioeconomic factors.
Stordal et al. 2022, Norway[24]	Cohort n= 1,219,184	The incidence increased by age category, but did not differ by gender. After adjustments, the risk of infection remained higher in age groups > 5 years compared to the reference category ≤ 5 years. Among those infected with SARS-CoV-2, the risk of hospitalization was lower in the 6 - 11 age group. Admission to intensive care (n=19) and death (n=2) were rare events, and these outcomes were not studied further. Low income, crowded housing, family size, age, non-Nordic country of origin and living area were independent risk factors for infection. Risk estimates were highest for residents with a family background from Africa, Asia and the Middle East/North Africa, while estimates for North America/Oceania were similar to that observed in the Nordic Countries Chronic comorbidity was associated with hospitalization.

Figure 3 – Description of articles according to author, year, location, type of study, sample and main results. São Carlos, SP, Brazil, 2023

Of the 15 studies analyzed, regarding socioeconomic disadvantages, three showed that social and economic relations affected the incidence and mortality of children from the virus[7,13,21], eight demonstrated social vulnerability with emphasis on low income and poverty[7,11-13,20-22,24], six highlighted ethnic/racial factors[15-20], and three economic inequalities[7,20-21], which had an impact on mortality. They also indicated variables related to family size and crowded housing[24], single-parent families[21], country of origin and serious housing problems[21], health conditions[11] and geographical conditions[20], and geopolitically disadvantaged regions[15,23].

Regarding race/ethnicity, black children not only had a higher risk of hospitalization and prolonged stays, but also a higher chance of mortality when compared to white children[17-19]. It is worth noting the differences found in some studies regarding the association between death and gender. From this perspective, one study found an association between the lethality rate and mortality in male children[13]; however, another study contradicts this result, showing that the female child population had more deaths than the male population[17]. However, one study found no association between mortality and sex in the child population[24].

Discussion

Based on the analysis of the studies selected in this review, it stands out that the relationship between the mortality of the child population due to COVID-19, in addition to the presence of comorbidities, is associated with socioeconomic factors that influence the prognosis of the severe form of the disease, as well as corroborating unfavorable outcomes, including death.

Although children are just as likely as adults to contract SARS-CoV-2 infection, they are generally less likely to present the severe and symptomatic form of the disease[25-26]. However, it should be noted that the symptomatology of the disease may be related to the influence of the different variants in circulation during the evolution of the pandemic, as well as the positivity rate, impacting on the health factors of the child population[4,27].

From this perspective, in Poland, there was a difference in the assessment of the clinical course of COVID-19 between 2020 and 2021. While the proportion of babies hospitalized for the disease in 2020 was 26%, in 2021 it was 37%[28]. In Ukraine, the proportion of COVID-19 cases among infants and children aged one to five increased significantly during the subsequent waves of the pandemic from June 2020 to February 2022[29].

The incidence and mortality of COVID-19 in children are also related to the new variants that have emerged during the pandemic. Thus, it was pointed out that the Alpha and Delta strains of SARS-CoV-2 showed a more severe course of the disease in the child population and higher mortality rates, compared to infection with the original strain, inferring that the clinical picture of COVID-19 may vary depending on the circulating strain[28,30]. Thus, the emergence of new variants with greater potential for transmissibility and pathogenicity may be one of the potential explanations for the differences in incidence and mortality observed in the child population throughout the pandemic since the symptomatic manifestation of the disease may contribute to the diagnosis of the disease.

In addition, the clinical manifestation of symptoms has contributed to an increase in testing in this population[25-26]. In this way, symptomatic presentation in children, especially at the very beginning of the disease, can be considered a positive factor, contributing to greater testing and, consequently, enabling early diagnosis and treatment, as well as reducing the chances of the disease progressing to more severe forms or even death. Additionally, testing positive for COVID-19 can help with adherence to disease prevention measures among people living in the same household as the infected child, helping to minimize the spread of the virus at home, as well as in school environments.

In relation to the development of the mild form of the disease in children, among the possible explanations may be hormonal differences, pre-pubertal children may have a low expression of Transmembrane Serine Protease Type II (TMPRSS2), which could limit the entry of the virus into the cells[31-32].

In addition, children have high numbers of lymphocytes, especially Natural Killer (NK) cells; lower Angiotensin Converting Enzyme II (ACE-2) binding capacity compared to adults; and the simultaneous presence of other viruses in the respiratory mucosa of children could compete with SARS-CoV-2. These factors can influence viral replication and coping with the virus[33-34].

In the same way that certain ages can confer protective factors, influencing the incidence of COVID-19, differences between the female and male sexes have also been associated with the mortality rate. For some studies, males had a higher risk of developing the severe form of infection, as well as a higher risk of hospitalization in the Intensive Care Unit and death when compared to females[35-36].

In this review, divergences were found in relation to the association between gender and mortality in the child population[13,17,24]. However, these divergences may be related to the heterogeneity that comprises each of the countries where the studies were carried out, as well as the size and characteristics of the samples analyzed.

The presence of pre-existing medical conditions also increased the risk of serious complications and death from the novel coronavirus in all age groups. Children with pre-existing medical conditions had a higher prevalence of hospitalization and death[23-24]. In addition, severe COVID-19 was present in around 5% of children with comorbidities, compared to those without, who accounted for 0.2%, showing that children with some diseases are at greater risk of severe manifestations of the disease and mortality when compared to previously healthy children[37]. These findings were to be expected, given that the presence of pre-existing illnesses, as observed in other age groups, directly influences the body's ability to defend itself against SARS-CoV-2 infection, often resulting in death.

This review shows that race/ethnicity influenced the incidence and mortality of SARS-CoV-2 infection in children, indicating that black, brown, Asian, and indigenous people had a higher risk of death compared to white individuals(17,19-20). In addition, testing varied between different ethnic groups, showing that white children had more access to testing when compared to children of other races/ethnicities(19).

The relationship between race/ethnicity and coronavirus disease is complex and multifaceted. However, the explanation for ethnic issues may lie beyond biological factors. Thus, the relationship between infant mortality from COVID-19 and socioeconomic factors, such as living in poorer regions with high vulnerability and poor housing conditions, has been associated with a negative outcome(7,12,15,21,23).

In this context, the pediatric population living in more developed cities had a 75% lower chance of death compared to those living in less developed cities(38). In addition, it has been reported that among the more than three thousand pediatric deaths from COVID-19 recorded in 2020, 91.5% belonged to low- and middle-income countries(39).

Thus, several hypotheses could explain the discrepancies in child mortality due to COVID-19 in different countries and according to race/ethnicity, and it is necessary to consider the social and economic context in which the children's families live. Vulnerable locations often have less coverage or even no basic sanitation, access to schools and health services, variables that are directly related to the health-disease process in the population.

In this context, it is understood that although all individuals are susceptible to the virus, the pandemic has had a greater impact on more vulnerable socio-economic groups and minorities(40-41). In this context, family income plays an essential role in access to basic resources and health services. Social inequalities have widened disparities in the health and well-being of families during the pandemic, with low levels of family income being associated with health problems in children. In addition, the socio-economic level of parents and family composition indicated that low levels of family income were related to worse health conditions in the 5-10 age group or in the 11-15 age group(42).

The pandemic has led to a global crisis, affecting people all over the world; however, lower-income families have faced additional challenges. An analysis of financial vulnerability, carried out in seven European Union countries, showed that of the 243 million individuals, 47 million were vulnerable to an income shock for three months, the average time during the first wave of COVID-19 lockdown(43). In addition, reports from family caregivers have shown that annual family income has decreased, in addition to the loss of work and resources, due to the pandemic(44).

Therefore, the impact on family income during the health emergency phase of the pandemic was something to be expected, while the type of occupation and working conditions also influenced the degree of exposure to the virus, especially during periods of greater transmissibility of the disease. However, many occupations do not allow the home office modality, such as workers in services considered essential and also workers in informal occupations, exposing these workers and their families to a greater risk of exposure to COVID-19.

Thus, during the health emergency phase caused by COVID-19, it has become crucial to implement government actions quickly, so that workers, especially those in informal occupations and non-essential services, can minimize the impact on family income caused by the pandemic, due to physical isolation measures, and at least guarantee food for these people.

Thus, social inequalities and their determinants arise from structural factors that affect unequal exposure to health-related factors. This exposure is mainly influenced by social status, constructed because of variables such as gender, educational level, and socioeconomic status. Thus, the unequal impact on the different spheres of society is the result of structural characteristics of the economic and political system. As a result, families with lower levels of education face worse working conditions and consequently lower incomes, which, together with other factors, directly influence health conditions[45].

In addition, the issue of housing, also listed as one of the factors presents in the social determinants of child health, showed an unequal distribution during the pandemic. Thus, children from more disadvantaged families who lived in homes with precarious structural housing conditions did less physical activity, had a poorer diet, were more exposed to noise or tobacco, had longer screen time and less social contact[46].

Socio-economic factors also seem to influence low childhood vaccination coverage against COVID-19. In the United States, 11 weeks after the launch of the program to maximize vaccination in the child population, although 54% of vaccine providers were in areas of high social vulnerability, the vaccination completion rate in children was approximately 33% lower in these areas when compared to those of low social vulnerability[47].

The disparities present in the different regions analyzed influence incidence and mortality rates, whether due to the availability and quality of health services, or the level of poverty, social inequalities, population density, average age of the population, and the level of public policies adopted in the face of health emergencies. Vaccination may also have contributed to the differences observed, since the development of vaccines for children became a priority as the other age groups were being vaccinated, and approval in different countries occurred at different times[9].

Despite evidence of the effectiveness of vaccination, prior to the COVID-19 pandemic, a reduction in childhood vaccination has been observed. In this scenario, the low rates of vaccination coverage in children are related to various factors such as the hesitation of parents and caregivers regarding the reliability, safety, and effectiveness of immunization against this disease; in addition to political, ideological aspects and the spread of fake news[2,48].

The results of this scoping review provide an overview of how socioeconomic factors are related to the incidence and mortality of children infected with COVID-19. Although the increase in mortality from SARS-CoV-2 is observed among children with some comorbidity, it is necessary to understand that many diseases can have their progression attributed to the socioeconomic vulnerabilities to which people are exposed throughout their lives. In addition, in many countries, especially developing countries, regions of high social vulnerability are a factor that hinders access to educational and health facilities, impacting on individual measures to deal with health emergencies.

Study limitations

The limitations of this review include the existence of indexing databases that were not included in this research. However, it was possible to identify persistent gaps in the literature, and future studies should address issues such as adherence to vaccination in children, differences in access to public health services in different countries, and the level of education of families. These can have a direct influence on health care for children, not just during a health crisis.

Contributions to practice

It is essential to implement public health strategies aimed at minimizing and preventing mortality in this age group, with adherence to vaccination being the most effective measure for preventing the development of the severe form of COVID-19. In addition, understanding that socioeconomic factors can be a determinant of COVID-19 incidence and mortality in children highlights the need to invest in actions aimed at reducing socioeconomic inequalities, to reduce preventable deaths.

Conclusion

This review showed that socio-economic factors are related to the increase in mortality from COVID-19 in the child population, in addition to low-income families, living in places considered to be more socio-economically vulnerable have been shown to be important variables to be considered in the context of the disease pandemic.

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Authors' contribution

Conception, analysis, interpretation of data, drafting of the manuscript, final approval of the version to be published and responsibility for all aspects of the manuscript: Silva BC, Uehara SCSA.
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