Epidemiological profile of children and adolescents with COVID-19: a scoping review

Perfil epidemiológico de crianças e adolescentes com COVID-19: uma revisão de escopo
Perífil epidemiológico de niños y adolescentes con COVID-19: revisión del alcance

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Objective: to map the epidemiological profile of children and adolescents with COVID-19 in the world literature. Methods: a scoping review systematized by the Joanna Briggs Institute protocol in the PubMed/MEDLINE, CINAHL, Web of Science, Scopus, Science direct and Google Scholar databases. Articles with children and/or adolescents with laboratory diagnosis of COVID-19 were used. Results: thirty-two articles were included in the review. Most children and adolescents were male, with contamination by family transmission. The most frequent clinical manifestations were fever, cough and diarrhea. Ten studies cited pre-existing condition/disease, and hospital length ranged from one to twenty days. Three deaths were reported and no study presented race/color, education and socioeconomic conditions. Conclusion: it was possible to screen the epidemiological profile with information about age group, sex, probable contamination of the disease, clinical manifestations, presence of pre-existing disease/condition, hospitalization and deaths among children and adolescents with COVID-19. Descriptors: COVID-19; Health Profile; Child; Adolescent; Epidemiology.

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In December 2019, the World Health Organization (WHO) was triggered due to a significant and abrupt increase in cases of pneumonia in the city of Wuhan, China\(^1\), whose cause referred to a new coronavirus strain, named, in January 2020, as 2019-nCoV, which spread rapidly around the world, generating high rates of morbidity and mortality in the population. Altogether, seven coronaviruses have been recognized in humans: HCoV-229E, HCoV-OC43, HCoV-NL63, HCoV-HKU1, SARS-COV (which causes severe acute respiratory syndrome), MERS-COV (which causes Middle East Respiratory Syndrome) and the most current - SARS-CoV-2, which causes COVID-19, a new coronavirus disease\(^2\)\(^3\).

SARS-CoV-2 is considered a highly contagious virus, and infected people can remain asymptomatic or with clinical symptoms, ranging from mild or moderate to most severe, with a variable incubation period of up to fourteen days, being the more frequent symptoms appear between the fourth and eighth day\(^4\). In a study conducted between January and February 2020, the following clinical symptoms of COVID-19 were identified in decreasing order of occurrence: fever (82%), cough with or without sputum (61%), muscle pain and/or fatigue (36%), dyspnea (26%), headache (12%), sore throat (10%) and gastrointestinal symptoms (9%)\(^5\).

According to the Pan American Health Organization (PAHO), 14% of people affected by COVID-19 appear to develop the most severe form and 5% evolve to the most critical situation\(^6\). Although the mortality rate may fluctuate according to different countries and territories, in general, it is associated with factors such as age and presence of comorbidities\(^1\)\(^3\). Research shows that the infection affected the population aged between 3 months and 99 years. Of this group, the most severe cases correlated with older age and presence of comorbidities, such as hypertension, diabetes, smoking, chronic and cardiovascular liver diseases\(^1\)\(^3\).

In March 2020, COVID-19 was configured as a pandemic, and although it has a mortality rate of 2 to 4%, it has a greater infection capacity than other viral infections\(^7\). According to WHO and PAHO, contagion occurs mainly through the respiratory droplets of the infected person, which can be from person to person (through sneezing, coughing or speaking) or through contact with contaminated objects, when respiratory droplets from contaminated people sneezing, coughing or speaking) or through contact with contaminated people, which can be from person to person (through sneezing, coughing or speaking) or through contact with contaminated objects, when respiratory droplets from contaminated people.

In December 2019 until the end of April 2020, when the search was limited to the PubMed/MEDLINE database, followed by an analysis of the most used words in the titles and abstracts of the articles. The search strategy included three stages: in the first, the search was limited to the PubMed/MEDLINE database, followed by an analysis of the most used words in the titles and abstracts of the articles. The second stage, searches were carried out in all databases using the keywords identified in the previous stage. In the third stage, the reference list of the articles collected was consulted in order to identify additional studies that had not been mapped in the previous stages. Throughout the system, the three stages were undertaken independently by two reviewers. It should be noted that any disagreements between the reviewers were resolved through a critical discussion with a third reviewer.

The keywords and terms in English were synthesized, respecting PCC strategy, and are described in Chart 1.

To survey the studies, scientific articles were selected, available in full, in Portuguese, English and Spanish, published from December 2019 until the end of April 2020, when the search was carried out. Additionally, studies whose participants were children or adolescents aged up to 19 years and the diagnosis of COVID-19 confirmed by laboratory examination were used as inclusion criteria. Publications that did not answer the research question and duplicates were excluded.

INTRODUCTION

OBJECTIVE

METHODS

The on-screen study is configured as a scoping review based on the protocol proposed by the Joanna Briggs Institute\(^8\), organized by the Preferred Reporting Items for Systematic Review and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), whose objective is to map concepts fundamental knowledge of a given area of knowledge, through a comprehensive coverage of the literature, to identify existing research gaps. The research question was constructed using PCC strategy, which recommends the mnemonic as fundamental elements: P - Population, C - Concept and C - Context. The elements were defined: P (children and adolescents with COVID-19); C (epidemiological profile) and C (world context). From this, the following research question was elaborated: what is the epidemiological profile of children and adolescents with COVID-19 in the global context?

After formulating the research question, the stage of identifying relevant studies was carried out in the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, Scopus, Science direct databases, accessed through the CAPES journals portal through of Café and Google Scholar access. The search strategy included three stages: in the first, the search was limited to the PubMed/MEDLINE database, followed by an analysis of the most used words in the titles and abstracts of the articles. In the second stage, searches were carried out in all databases using the keywords identified in the previous stage. In the third stage, the reference list of the articles collected was consulted in order to identify additional studies that had not been mapped in the previous stages. Throughout the system, the three stages were undertaken independently by two reviewers. It should be noted that any disagreements between the reviewers were resolved through a critical discussion with a third reviewer.

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The data extracted from the documents included specific details about the authors, year of publication, country, type of study, number of research participants, laboratory diagnosis and epidemiological profile, which was characterized by the age group of participants, probable contamination of the disease, manifestations clinics, presence of pre-existing disease or condition, hospitalization and mortality. Finally, the results were grouped and synthesized, with the main objective of presenting an overview of all the material.

Furthermore, as this is a systematic scope review, according to the methodology adopted, it is not necessary to assess the methodological quality of the included studies.

As for the ethical aspect, the reliability and fidelity of the information contained in the selected publications were guaranteed. These aspects were ensured through adequate referencing and rigor in data treatment and presentation.

**RESULTS**

All articles were published in the year 2020, and most of them in China (n=26). As for the type of study, most were cross-sectional (n=14) or not specified (n=9) and the number of participants ranged from 1 to 2,135 child (s) and/or adolescent(s) (Chart 2).

In the studies analyzed, the laboratory diagnosis of COVID-19 in children and adolescents was obtained by serological test(11) and by RT-PCR(12,13,42).

With regard to information on the epidemiological profile of children and adolescents with COVID-19, it is highlighted that the studies did not expose sociodemographic particularities (race/color, education and/or socioeconomic conditions). The age group of those involved ranged from newborn and one-year-old children to adolescents aged 18. There was a greater participation in the studies analyzed of men (n=1,399). With regards to the form of contamination of children and adolescents, studies have shown the predominance of family transmission (n=15), followed by community transmission (n=12). When mentioning presence of a pre-existing disease or condition, most did not specify whether participants had any previous morbidity (n=15); in 10 studies, children and adolescents did not have pre-existing illnesses or poor health conditions (12,16-19,22,24,32,36); in the other studies, heart failure(11), prematurity (13), previous infection by Streptococcus(12,23), hydro nephrosis and leukemia(18) and liver diseases or changes(33,40) were highlighted. As for the need for hospitalization, most studies (n=24) reported that children and/or adolescents were hospitalized for a period of 1 to 20 days (Chart 3).

The studies recorded three deaths of children and/or adolescents with COVID-19, and in two, presence of pre-existing disease/condition due to altered liver function was reported, without specifying age(40) and hydro nephrosis with leukemia(18) in a 10-month-old child; the other study did not mention whether there was any pre-existing morbidity or the victim's age(38).

When analyzing the clinical manifestations cited by the studies included in the scoping review, more than one symptom or clinical sign was reported, the most frequent being fever, cough, and diarrhea (Figure 2).

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**Chart 1** - Search strategy and article numbers identified in different databases

| Database            | Search strategy                                                                 | Total |
|---------------------|--------------------------------------------------------------------------------|-------|
| PubMed/ MEDLINE     | “Infant, newborn” OR “Infant” OR “Children, preschool” OR “Child” OR “Adolescent” AND “Health profile” AND “Risk factors” AND “Mortality” AND “morbidity” AND “COVID-19 virus” OR “SARS-CoV-2” OR “2019-nCoV” OR “coronavirus disease 2019” | 868   |
| CINAHL              | “Infant, newborn” AND “Infant” AND “Children, preschool” AND “Child” AND “Adolescent” AND “Health profile” AND “Risk factors” AND “Mortality” AND “morbidity” AND “COVID-19 virus” OR “SARS-CoV-2” OR “2019-nCoV” OR “coronavirus disease 2019” | 43    |
| Web of Science      | “Infant, newborn” AND “Infant” AND “Children, preschool” AND “Child” AND “Adolescent” AND “Health profile” AND “Risk factors” AND “Mortality” AND “morbidity” AND “COVID-19 virus” OR “SARS-CoV-2” OR “2019-nCoV” OR “coronavirus disease 2019” | 481   |
| Scopus              | “Infant, newborn” OR “Children, preschool” AND “Adolescent” AND “Mortality” OR “morbidity” AND “COVID-19 virus” OR “SARS-CoV-2” OR “2019-nCoV” OR “coronavirus disease 2019” | 4     |
| Science direct      | “Infant, newborn” OR “Child” AND “Adolescent” AND “Mortality” AND “morbidity” AND “COVID-19 virus” OR “SARS-CoV-2” OR “2019-nCoV” OR “coronavirus disease 2019” | 446   |
| Google Scholar      | “Child” OR “Adolescent” AND “Mortality” AND “morbidity” AND “COVID-19 virus” | 59    |

**Figure 1** - Search and selection process flowchart for the review articles, Brazil, 2020

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Search description and article selection was based on the Preferred Reporting Items for Systematic Review and Meta-Analyzes (PRISMA)(10). Thus, 26 articles were mapped (Figure 1). After analyzing their references, six more studies were added, totaling 32 scientific articles included in the final analysis of the scoping review.
Chart 2 - Characterization of the studies analyzed according to authors, country, type of study and number of participants (children and adolescents), Brazil, 2020

| Authors                        | Country    | Type of study     | Number of children and adolescents |
|--------------------------------|------------|-------------------|------------------------------------|
| Zheng et al.,(8)              | China      | Cross-sectional   | 25 children                        |
| Dong et al.,(11)              | China      | NS                | 01 adolescent*                     |
| Escalera-Antezana et al.,(12) | Bolivia    | Cross-sectional   | 02 adolescents*                    |
| Díaz et al.,(13)              | Spain      | Clinical case     | 01 child                           |
| Chen et al.,(14)              | China      | NS                | 04 children*                       |
| Xiang et al.,(15)             | China      | NS                | 06 children*                       |
| Peng e Zhang(16)              | China      | NS                | 01 child                           |
| Park et al.(17)               | Korea      | Clinical case     | 01 child                           |
| Lu et al.(18)                 | China      | NS                | 171 children and adolescents*      |
| Ng et al.(19)                 | China      | NS                | 01 adolescent*                     |
| Wang et al.(20)               | China      | Clinical case     | 01 child                           |
| Cao et al.(21)                | China      | NS                | 02 children                        |
| Guan et al.(22)               | China      | Cross-sectional   | 09 children and adolescents*       |
| Mansour et al.,(23)           | Lebanon    | Clinical case     | 01 child                           |
| Pan et al.(24)                | China      | Clinical case     | 01 child*                          |
| Sun et al.(25)                | China      | Cross-sectional   | 08 children and adolescents        |
| Xu et al.,(26)                | China      | Cross-sectional   | 10 children and adolescents*       |
| Shi et al.,(27)               | China      | Cross-sectional   | 10 children and adolescents*       |
| Su et al.,(28)                | China      | Cross-sectional   | 09 children*                       |
| Tan et al.,(29)               | China      | Cross-sectional   | 10 children and adolescents        |
| Xing et al.,(30)              | China      | Cross-sectional   | 3 children                         |
| Yin et al.,(31)               | China      | Cross-sectional   | 1 child                            |
| Chen et al.(32)               | China      | Cross-sectional   | 12 children and adolescents*       |
| Morey-Olivé et al.,(33)       | Spain      | Clinical cases    | 2 children                         |
| Liu et al.(34)                | China      | Cross-sectional   | 04 children*                       |
| Chacón-Aguilar et al.,(35)    | Spain      | Clinical cases    | 01 child                           |
| Ji et al.,(36)                | China      | Clinical cases    | 01 child and 01 adolescent         |
| Cai et al.,(37)               | China      | NS                | 10 children and adolescents        |
| Dong et al.,(38)              | China      | NS                | 2135 children and adolescents      |
| Xia et al.,(39)               | China      | NS                | 20 children and adolescents        |
| Zhu et al.,(40)               | China      | Cross-sectional   | 10 children                        |
| Wei, et al.,(41)              | China      | Cross-sectional   | 09 children                        |

Note: *Studies that included other age groups as participants; NS - not specified.

Chart 3 - Epidemiological profile (age group, probable contamination, pre-existing disease/condition and hospitalization) of children and adolescents with COVID-19 according to the authors, Brazil, 2020

| Authors                        | Age group | Probable contamination of the disease | Pre-existing disease/condition                                                                 | Hospitalization/ length (days) |
|--------------------------------|-----------|-------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------|
| Zheng et al.,(8)               | 0 - 6y    | Travel history                      | Suspected hereditary metabolic diseases and congenital heart disease                               | Yes/10                        |
| Dong et al.,(11)               | 11y       | NS                                  | Heart failure                                                                                    | Yes/NS                        |
| Escalera-Antezana et al.,(12)  | 13 and 18y| Family transmission and NS          | No                                                                                              | No                             |
| Díaz et al.,(13)               | 8d        | Community transmission              | Prematurity                                                                                     | Yes/13                        |
| Chen et al.,(14)               | 2 - 10y   | Community transmission              | No                                                                                              | Yes/NS                        |
| Xiang et al.,(15)              | 11m-9y    | Family transmission                 | NS                                                                                              | Yes/NS                        |
| Peng e Zhang(16)               | 03y       | Family transmission                 | No                                                                                              | NS                             |
| Park et al.(17)                | 10y       | Family transmission                 | No                                                                                              | Yes/15                        |
| Lu et al.(18)                  | 0 – 16y   | Family transmission                 | Hydronephrosis and leukemia                                                                      | NS                             |
| Ng et al.(19)                  | 17y       | Community transmission              | No                                                                                              | No                             |
| Wang et al.(20)                | 36h       | Vertical transmission               | No                                                                                              | Yes/18                        |

To be continued
DISCUSSION

From this scoping review, it was possible to verify that the initial studies were developed, predominantly, in China, in 2020, with no Brazilian study concerning the disease in the studied population being identified. The fact is explained by the unexpected and recent emergence of SARS-CoV-2 infection in Wuhan, China, in December 2019(1). COVID-19 has spread throughout the world and has grown to be one of the greatest challenges facing humanity. Since then, researchers from all countries and continents have aligned, in a joint and incessant search, to produce and make available information, experiences and knowledge capable of facing, controlling, treating and preventing the disease.

Although the methodology adopted in this review is not intended to assess the methodological rigor of the studies analyzed, it was found that they were more of a descriptive character, markedly cross-sectional, without specification as to the type of study. The urgency of new evidence at the beginning of the pandemic in China, may have instigated studies whose destination was more for the sharing of experiences and/or information of people affected by COVID-19, given the speed of dissemination and the absence of a defined treatment. In this sense, sharing this preliminary knowledge was more crucial for the moment than validating a study method.

Moreover, it was found that the authors did not address the socio-demographic distinctions of children and adolescents, such as race/color, education and/or socioeconomic conditions. Such information is significant because it gives a more detailed view of the population studied and because they may have considerable links with the health issue, in addition to instigating the proposition of strategies adapted to their needs.

Thus, it is essential to draw attention to the impact of situations of social and economic vulnerability in COVID-19 dissemination(42).
Less favored people of economic class are one of the groups most vulnerable to this pandemic. The protection measures guided by PAHO and WHO recommend certain procedures, such as cleaning hands with soap and water, using masks and 70% gel alcohol\(^\text{45}\), which require additional costs in low-income families’ expenses, which often does not have minimum conditions for basic sanitation and personal hygiene.

According to the United Nations Children’s Fund (UNICEF), only three out of five people worldwide have basic requirements for correct hand hygiene\(^\text{48}\). In Brazil, a country marked by social inequalities, there is a great concern in relation to housing conditions, especially for those families who live in crowded and poorly ventilated environments, such as the peripheries of large centers. This housing factor contributes decisively to the faster spread of the disease.

In this perspective, studies describe that the contamination of the virus in children and adolescents occurred with a greater incidence through family transmission, followed by community transmission. Allied to the high transmissibility of the virus, transmission by contaminated droplets, due to the proximity to infected people or the contact with surfaces and objects used by the infected person, it was pointed out as the most frequent transmission\(^\text{44}\). As for vertical transmission, data are limited to date. Therefore, it is crucial to follow the precautions recommended during childbirth and birth care\(^\text{20,45-46}\). With regard to the laboratory diagnosis of SARS-CoV-2 in the children and adolescents participating in the studies analyzed, all of them accepted the WHO recommendations. That is, the RT-PCR test (Reverse-Transcriptase Polymerase Chain Reaction) and the serological test guarantee reliable standards for confirmation of COVID-19 by laboratories and professionals involved in the tests\(^\text{47}\). In the case of RT-PCR, the proof is obtained by sequencing nucleic acid, and, in serology, by the detection of antibodies as an immune response of the organism\(^\text{47}\). Another considerable element in the configuration of the epidemiological profile of children and adolescents with COVID-19 corresponds to pre-existing diseases or conditions. These can be taken as risk factors for the worsening of COVID-19 infection in the general population. Researchers point out that certain diseases, mainly those of the cardiovascular and immune systems, are the main responsible for the worsening of the infection in adults\(^\text{46}\). Wuhan, China, has experienced an outbreak of coronavirus disease 2019 (COVID-19) on a large scale. This housing factor contributes decisively to the faster spread of the disease, which can also be correlated to the places where the investigations took place, predominantly hospitals, centers and/or inpatient units for children and adolescents with COVID-19.

In the present study, fever, cough and diarrhea are among the most cited clinical manifestations. Chinese studies corroborate and point out fever as the most prevalent and consistent clinical sign with regard to COVID-19, especially in children\(^\text{8,24,29,30,37}\). Researchers from a study carried out with eight children and adolescents seriously ill by COVID-19 and admitted to the Intensive Care Unit of a Wuhan Children’s Hospital identified that the most common signs were dyspnea, present in all cases, followed by fever and cough in six of the analyzed patients\(^\text{24}\). Lu and collaborators\(^\text{18}\) point out that, in most cases of COVID-19 in children and adolescents, the predominant clinical characteristics were cough (48.5%), pharyngeal erythema (46.2%), and fever (41.5%). The clinical evidence of COVID-19 in children and adolescents may differ in some ways, compared to other population groups. Among adults and elderly people, dyspnea is more common than gastrointestinal symptoms, such as diarrhea, considered as a poorly referenced manifestation among adults with the disease\(^\text{31}\). This was a different result from that noted in the present scoping review, in which most studies cited diarrhea as a typical clinical occurrence of COVID-19 in children and adolescents. Some studies have marked diarrhea as the third most common clinical sign present in 33.3%, 15% and 12% of the cases surveyed, respectively\(^\text{8,32,39}\). Others pointed out diarrhea as a clinical feature present in a smaller proportion\(^\text{25-26}\) or only in severe cases\(^\text{38}\).

In general, it can be inferred that clinical manifestations in children and adolescents are assessed as milder and/or moderate than those presented by adults, progressing less frequently to critical clinical conditions and/or deaths. The curbing of the disease may result from the organic functionalities of these individuals, as well as from presence/absence of pre-existing diseases or conditions, which, in addition to being distinct, are in a lower proportion in this age group than in adults.

**Study limitations**

The results of this review should also be weighted by criteria of limitations. There is an expressive daily increase in scientific publications on the subject, and the studies analyzed correspond to those available until April 2020, the period in which data collection occurred. Moreover, the research analyzed prioritized the characteristics relevant to the clinical course of COVID-19. Thus, the scientific evidence obtained in this review shows gaps in knowledge regarding the epidemiological profile, notably regarding color/race, education and socioeconomic conditions of children and adolescents with COVID-19.

It is also noteworthy the impossibility of specifying the outcome and behavior of the disease in Brazilian children and adolescents,
given that no studies carried out in the country were identified. However, despite these limitations, this review has the potential to foster and subsidize research that, in the future, takes into account the social, economic and family contours in COVID-19 dissemination and worsening in children and adolescents from different countries, developed and developing, like Brazil. 

**Contributions to nursing and health**

Nursing is at the forefront of the global pandemic of the new SAR-Cov-2 and is considered a key member of health teams to control and prevent the spread of this new infectious disease[9]. The performance of these professionals is indispensable for health care at this time, at all levels of assistance, with roles that pertain to health education and screening of patients, surveillance and control of hospital infections, in addition to direct care for infected individuals. The emergence of the new disease COVID-19 imposes important challenges on nursing professionals with regard to the management and prognosis of infected people, especially children and adolescents.

It is important to highlight that the present scoping review gathered information from international studies on the epidemiological profile of children and adolescents with COVID-19. As it is a new disease, without treatment, with high dissemination and recognized as an international public health emergency, it can contribute to health care improvement for this specific population affected by the disease. Thus, health professionals, especially nurses, working in direct assistance to these patients and families, in teaching or research, will be able to use the results of the study on screen to subsidize lines of care, taking into account the epidemiological profile of children and adolescents who are falling ill with COVID-19 worldwide, as well as promoting new studies on the subject.

**CONCLUSION**

The results assessed in this review provided data to screen the epidemiological profile of children and adolescents with COVID-19. It was possible to categorize the studies submitted to the analysis, as well as to know information about age group, sex, probable source of disease contamination, presence of pre-existing disease/condition, hospitalization, deaths and clinical manifestations in children and adolescents with COVID-19. The main limitations they encounter are the absence of certain information, such as race/color, education and/or socioeconomic conditions of participants, not addressed by the studies analyzed in this review, and the absence of national studies on the topic of interest.

Thus, the relevance of investments in research that focuses on the previous health, social and economic conditions of children and adolescents with COVID-19, in different contexts, is reinforced, in order to establish measures to control, prevent and combat the disease that affects Brazil and societies worldwide.

**FUNDING**

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