







## **DIAGNOSTIC TESTS AND CLINICAL CHARACTERISTICS OF COVID-19 IN CHILDREN: AN INTEGRATIVE REVIEW**

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### **ABSTRACT**

**Objective:** to identify in nursing literature scientific production on tests and clinical characteristics of COVID-19 in children and discuss the role of nursing in their care.

**Methods:** an integrative review, which took place between April and June 2020, at Web of Science, CINAHL, BDNF, IBECs, LILACS, MEDLINE (via PubMed) to answer the guiding question: what do research articles on COVID-19 in children reveal? Original research articles published from January to May 2020 were included. Studies without research methodology (case reports, reflection, recommendations), review articles, studies focusing on other themes or conducted exclusively with neonates, infants, adolescents, and adults were excluded.

**Results:** database search found 314 references. After exclusions, 59 studies were selected to be read in full. Of these, 14 articles were selected to compose this review, empirically grouped according to their similarities into two categories: *Tests used in COVID-19 in children* and *Main clinical findings of COVID-19 in children*.

**Conclusion:** studies emphasize clinical tests and findings of COVID-19 in children; therefore, the role of nursing at the time of preparation and performance of such tests stands out, since they are an instrument for assessment and follow-up of children with coronavirus as well as in the promotion of adequate and qualified care to minimize the signs and symptoms of this disease, with a view to prompt restoration of their health.

**DESCRIPTORS:** Child preschool. Child. Coronavirus. Pediatric nursing. Review.

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## EXAMES DIAGNÓSTICOS E MANIFESTAÇÕES CLÍNICAS DA COVID-19 EM CRIANÇAS: REVISÃO INTEGRATIVA

**Objetivo:** identificar na literatura a produção científica sobre exames e manifestações clínicas da COVID-19 em crianças e discutir o papel da enfermagem no atendimento a elas.

**Métodos:** revisão integrativa, cuja busca ocorreu entre abril e junho de 2020, nas bases de dados *Web of Science*, CINAHL, BDNF, IBECs, LILACS, MEDLINE (via PubMed) para responder à questão norteadora: “o que revelam os artigos de pesquisa sobre a COVID-19 em crianças?”. Foram incluídos artigos de pesquisa originais, publicados de janeiro a maio de 2020. Excluíram-se estudos sem metodologia de pesquisa (relatos de caso, reflexão, recomendações), artigos de revisão, estudos que focavam outras temáticas ou realizados exclusivamente com neonatos, lactentes, adolescentes e população adulta.

**Resultados:** as buscas nas bases de dados pesquisadas capturaram 314 referências. Após as exclusões, selecionaram-se 59 estudos para serem lidos na íntegra; destes, 14 artigos foram selecionados para compor esta revisão, agrupados empiricamente, conforme suas similaridades, em duas categorias: exames utilizados na COVID-19 em crianças e principais achados clínicos da COVID-19 em crianças.

**Conclusão:** os estudos enfatizam os exames e achados clínicos da COVID-19 em crianças; logo, destaca-se o papel da enfermagem no momento do preparo e realização desses exames, uma vez que se constituem instrumento de avaliação e acompanhamento da criança com Coronavírus, bem como na promoção de um adequado e qualificado cuidado para minimizar os sinais e sintomas dessa doença, com vistas ao pronto restabelecimento de sua saúde.

**DESCRITORES:** Pré-escolar. Criança. Coronavírus. Enfermagem pediátrica. Revisão.

## EXÁMENES DE DIAGNÓSTICO Y MANIFESTACIONES CLÍNICAS DE COVID-19 EN NIÑOS: REVISIÓN INTEGRATIVA

### RESUMEN

**Objetivo:** identificar en la literatura la producción científica sobre exámenes y manifestaciones clínicas de COVID-19 en niños y discutir el papel de la enfermería en su atención.

**Métodos:** revisión integradora, cuya búsqueda tuvo lugar entre abril y junio de 2020, en las bases de datos de *Web of Science*, CINAHL, BDNF, IBECs, LILACS, MEDLINE (a través de PubMed) para responder a la pregunta orientadora: lo que revelan los artículos de investigación sobre COVID -19 en niños? Se incluyeron artículos de investigación originales, publicados de enero a mayo de 2020. Estudios sin metodología de investigación (informes de casos, reflexión, recomendaciones), artículos de revisión, estudios que se centraron en otros temas o se llevaron a cabo exclusivamente con recién nacidos, bebés, población de adolescentes y adultos.

**Resultados:** las búsquedas en las bases de datos buscadas capturaron 314 referencias. Después de las exclusiones, se seleccionaron 59 estudios para ser leídos en su totalidad; de estos, se seleccionaron 14 artículos para componer esta revisión, agrupados empíricamente, de acuerdo con sus similitudes, en dos categorías: *Exámenes utilizados en COVID-19 en niños*; y *Principales hallazgos clínicos en COVID-19 en niños*.

**Conclusión:** los estudios enfatizan los exámenes COVID-19 y los hallazgos clínicos en niños; por lo tanto, el papel de la enfermería se destaca al preparar y realizar estos exámenes, ya que son un instrumento para evaluar y monitorear a los niños con COVID-19, así como para promover una atención adecuada y calificada para minimizar los signos y síntomas de esta enfermedad. enfermedad, con miras a la pronta restauración de su salud.

**DESCRIPTORES:** Preescolar. Niño. Coronavírus. Enfermería pediátrica. Revisión.

## INTRODUCTION

Worldwide, the beginning of 2020 was marked by the appearance of Coronavirus Disease 2019 (COVID-19), caused by a new virus, called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). This virus was first detected in China, and by June 18, 2020, cases were reported in more than 181 countries: 8,242,998 confirmed and 445,535 dead. In Brazil, to date, there were 978,142 official cases of infection and 47,748 deaths.<sup>1</sup>

SARS-CoV-2 belongs to the family *coronaviridae*, whose majority of the infections caused by it are of low pathogenicity; however, it may eventually lead to serious infections in immunosuppressed patients as well as especially affect children, people with comorbidities and elderly individuals.<sup>2</sup>

The infection's average incubation period is 5.2 days, with an interval that can reach up to 12.5 days. Available information on the transmission pattern of this disease suggests that the main mode of diffusion occurs through contact with infected people, through respiratory droplets from cough, sneezing, saliva droplets or nasal secretion that individuals have contact with. It can also occur by hand contamination with respiratory secretions, by direct contact (handshake) or indirect contact (touching contaminated surfaces). Another possible way to get infected is when susceptible individuals put contaminated hands in contact with the oral, nasal or ocular mucosa.<sup>3</sup>

The signs and symptoms of COVID-19 are primarily respiratory, similar to a cold. It can also cause lower respiratory tract infection such as pneumonia. The main symptoms known to date are fever, cough, difficulty breathing<sup>1</sup>, in addition to fatigue, myalgia, nasal congestion, runny nose, sneezing, sore throat, headache, dizziness, nausea, vomiting, abdominal pain, and diarrhea.<sup>4</sup>

To date, studies show that children have less severe conditions than adults and elderly individuals. Some hypotheses to explain this peculiarity are the cellular and humoral immune systems of developing children, unable to generate an exaggerated inflammatory response; certain protection by BCG vaccine or due to previous respiratory syncytial virus infections; immature ACE2 receptors in childhood, which can hinder cell invasion.<sup>5</sup>

There is still no specific treatment for COVID-19; therefore, symptoms are treated in order to avoid worsening of COVID-19 and reduce discomfort.<sup>1</sup>

However, children present some risk factors that may contribute to the increase in the severity of the disease and the development of SARS, namely: being under two years old, with chronic lung diseases, asthma and cystic fibrosis, heart disease, diabetes mellitus, renal failure, and immunosuppression.<sup>6</sup>

We highlight the new clinical presentations of COVID-19 in children, in which they revealed a multisystemic inflammatory syndrome, with severe clinical manifestations and a condition similar to those observed in children and adolescents with Kawasaki syndrome, incomplete Kawasaki syndrome and/or toxic shock syndrome.<sup>7</sup>

Therefore, this study is justified, given the recent findings on the serious complications of COVID-19 in children and the need for continuous updating on the theme. Moreover, it is emphasized that nursing professionals have knowledge about clinical characteristics and transmission of COVID-19 for team training and guidance to caregivers.

In this sense, this article aims to identify in nursing literature scientific production on tests and clinical characteristics of COVID-19 in children and discuss the role of nursing in their care.

## METHOD

An integrative literature review was carried out.<sup>8</sup> The following steps to develop the research were delimited: identification of the theme and selection of the research question; establishment of criteria for inclusion and exclusion; definition of the information to be extracted from the selected studies and; assessment of studies included in the integrative review; interpretation of results, presentation of the review; and synthesis of knowledge.<sup>9</sup>

As a theme, studies on COVID-19 were determined in children, aiming to answer the following guiding question: what do research articles on tests and clinical characteristics of COVID-19 in children reveal? In building the appropriate question to solve the clinical question studied, PICO strategy was used:<sup>10</sup> “P” corresponds to population (children aged 2 to 12 years); “I” to intervention (research articles); “C” when compared (does not apply, as this is not a comparative study); and “O” to outcome (tests and clinical characteristics of COVID-19).

Controlled descriptors identified at Health Sciences Descriptors (*Descritores em Ciências da Saúde*, abbreviated DeCS), Medical Subject Headings (MeSH), and CINAHL Headings were used: “preschool”, “child” and “coronavirus”, in addition to the keywords: “novel coronavirus” and “2019-nCoV”. The search using the Boolean operator AND and OR was: (“preschool” OR “child”) AND (“coronavirus” OR “novel coronavirus” OR “COVID-19”), and occurred in Brazilian Portuguese and English, depending on the researched database.

Data were collected between April and June 2020. The databases searched were MEDLINE (via PubMed), Web of Science, and Cumulative Index to Nursing and Allied Health (CINAHL). Research was also carried out at the following health sciences databases: Latin American & Caribbean Literature on Health Sciences (LILACS), Índice Bibliográfico Español en Ciencias de la Salud (IBECS), and Nursing Database (*Banco de Dados em Enfermagem*, abbreviated BDENF).

Original research articles were included, whose theme answered the guiding question, published between January and May 2020. Studies without research methodology (case reports, reflection, recommendations), review articles, studies focusing on other themes or conducted exclusively with neonates, infants, adolescents, and adults were excluded. However, when the age group of the study was different from the one delimited for review, but included children of the intended age group, the studies were also included, considering the limitation in the number of studies with children, in order to achieve maximum information about this population.

A thorough reading of titles and abstracts was carried out independently between two authors to ensure that the texts contemplated the guiding question of the review and met the inclusion and exclusion criteria established. In case of doubt regarding the selection, it was decided to include, initially, the study, and decide on its selection only after reading its content in full.

Analysis of the integrative review data was elaborated descriptively. We used a chart, constructed by the authors, to extract and synthesize the data of each primary study included in the review. This chart had the following information: title, country of origin, field of activity of authors, objectives, participants, study design, level of evidence and main results and conclusions. Chart 1 allowed the comparison and organization of data, according to their differences, similarities and the question of the review, which were critically analyzed and grouped into two categories.<sup>11</sup>

**Chart 1** – Characterization of the selected studies, according to variables of interest. Rio de Janeiro, RJ, Brazil, 2020.

Citation/Year/ Country/Field	Objective	Subjects	Method	Main results obtained	Level of evidence
Feng K et al <sup>14</sup> . 2020 China Medicine	To analyze the characteristics of the site and shape of pulmonary lesions in CT scan of children with new coronavirus.	15 children (4 to 14 years old)	Non-randomized clinical study	The lesions were located mainly under the pleura and showed irregular subpleural shadows or single nodular frosted glass shadows and halo signs.	III
Li W et al <sup>15</sup> 2020 China Medicine	To describe thoracic CT scan findings in children with COVID-19.	5 children (10 months to 6 years)	Retrospective study	Two children showed no signs of abnormality on thoracic Ct. Three showed characteristic radiological abnormality.	IV
Wang D et al <sup>16</sup> 2020 China Medicine	To analyze the clinical characteristics of coronavirus-infected children.	31 children (1 month to 7 years old)	Retrospective cohort study	Four cases were asymptomatic. Twenty cases had fever, fourteen had cough, three had fatigue, and three had diarrhea.	IV
Zheng F et al <sup>17</sup> 2020 China Medicine	To describe the clinical characteristics of pediatric cases infected with COVID-19.	25 children (2 to 9 years old)	Cross-sectional multicenter cohort study	Children under 3 years old accounted for the majority of critical cases.	IV
Sun D et al <sup>18</sup> 2020 China Medicine	To describe the clinical characteristics of severe pediatric patients with COVID-19.	8 children (2 months to 15 years old)	Retrospective cohort study	The most common symptoms were tachypnea, fever, cough, expectoration, and nausea/vomiting.	IV
Lu X et al <sup>19</sup> 2020 China Medicine	To assess the clinical characteristics of children infected with COVID-19.	171 children (1 day to 14 years old)	Observational study	Fever was present in most children. Other common signs and symptoms include cough and erythema.	IV
Liu W et al <sup>20</sup> 2020 China Medicine	To observe the clinical characteristics of COVID-19 in hospitalized children.	366 children (1 to 6 years old)	Retrospective study	All had high fever (>39°C). Only 1 required hospitalization in a pediatric intensive care unit.	III
Xu Y et al <sup>21</sup> 2020 China Medicine	To assess the clinical characteristics of children infected with COVID-19.	10 children (2 months to 15 years old)	Prospective observational	Seven had fever on admission. Other symptoms were cough (5), sore throat (4), nasal congestion and rhinorrhea (2), and diarrhea (3). One was asymptomatic.	III

Chart 1 – Cont.

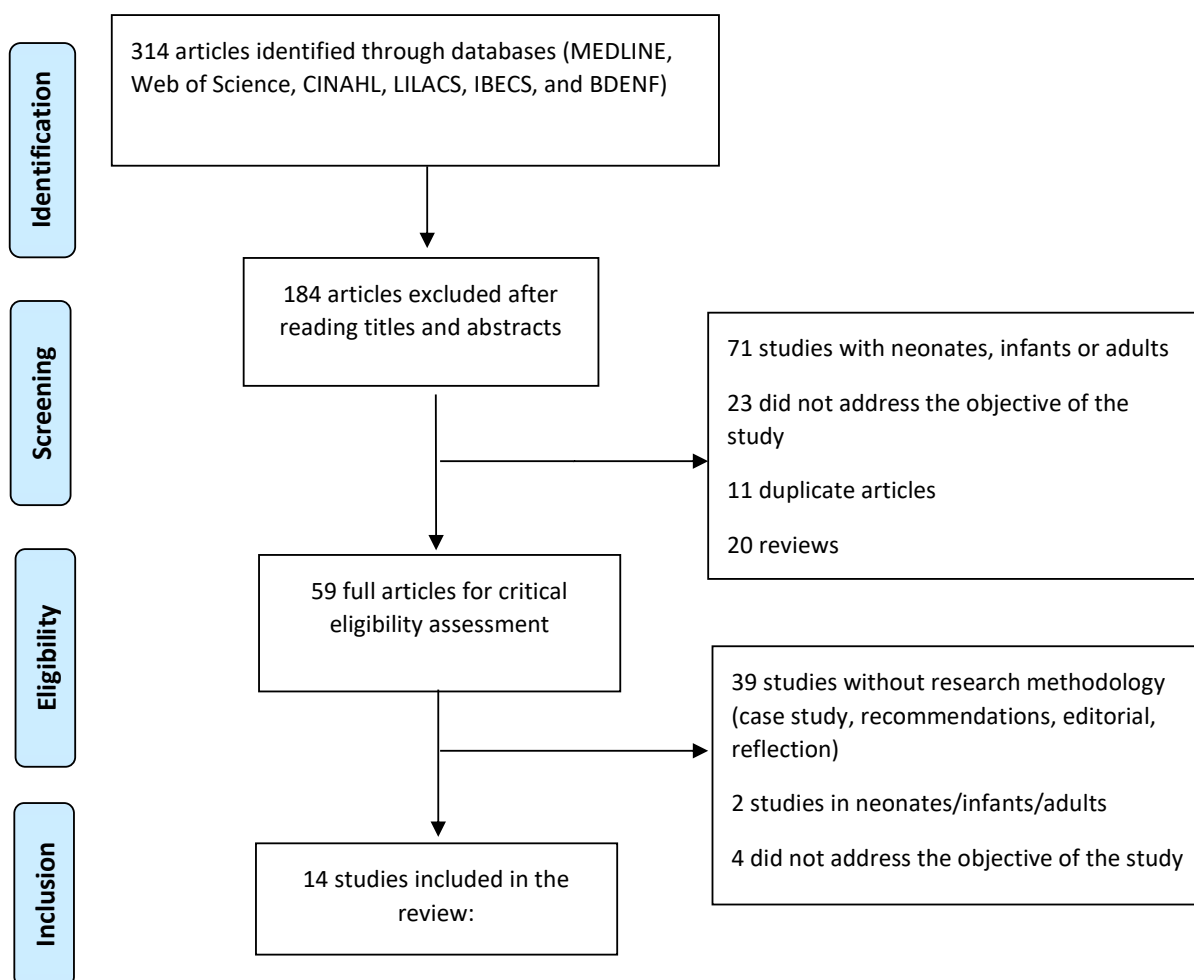
Citation/Year/ Country/Field	Objective	Subjects	Method	Main results obtained	Level of evidence
Li Y et al <sup>22</sup> 2020 China Medicine	To investigate the thoracic imaging characteristics of COVID-19.	8 children (1 to 5 years old)	Retrospective study	COVID-19 thoracic CT scan findings in preschool children may be atypical and varied.	IV
Li H et al <sup>23</sup> 2020 China Medicine	To investigate c-reactive protein, procalcitonin, serum creatinine, alanine aminotransferase, lymphocyte subsets, and cytokines.	40 children with pneumonia 2019-nCoV (16 days to 14 years old) and 16 due to respiratory syncytial virus (RSV) (2 to 5 years old)	Prospective descriptive study	All tests showed higher rates in children with RSV pneumonia, except for one child with COVID -19 who had much higher Interleukin-10 levels and was the only one with severe pneumonia.	IV
Xia W et al <sup>24</sup> 2020 China Medicine	To discuss the clinical characteristics in pediatric patients with COVID-19.	20 children (16 days to 14 years old)	Retrospective study	Clinical characteristics included fever (12), cough (13), diarrhea (3), nasal secretion (3), sore throat (1), vomiting (2), tachypnea (2), and fatigue (1).	IV
Lu Y et al <sup>25</sup> 2020 China Medicine	To identify the common findings of COVID-19 in children.	9 children (2 months to 15 years old)	Retrospective study	Four children had only fever, two fever and cough, one had cough and a nasal obstruction and rhinorrhea. One was asymptomatic.	IV
Soltani et al <sup>26</sup> 2020 Iran Medicine	To study the clinical characteristics of pediatric patients infected with COVID-19.	30 children (1 day to 14 years old)	Prospective descriptive study	The most common symptoms were tachypnea, fever, cough, and dyspnea. None of them presented runny nose.	IV
Ma et al <sup>27</sup> 2020 China and USA Medicine	To report relevant findings of patients positive for COVID-19.	50 children (2 to 16 years old)	Retrospective study	There was no clear association between changes in CT lesions and clinical outcomes.	III

The level of evidence was identified based on the study design. Thus, I was assigned for systematic reviews and meta-analysis of randomized clinical trials; II for randomized clinical trials; III for non-randomized controlled trial; IV for case-control or cohort studies; V for systematic reviews of qualitative or descriptive studies; VI for qualitative or descriptive studies; and VII for the opinion of authorities and/or expert committee reports. This hierarchy classifies levels I and II as strong, III to V as moderate, and VI to VII as weak.<sup>12</sup>



## RESULTS

Database search found 314 references, 169 at MEDLINE (via PubMed), 75 at CINAHL, 46 at Web of Science, 21 at LILACS and none at other databases (IBECS and BDEFN). A total of 184 articles were excluded (Figure 1). After exclusions, 60 studies were selected to be read in full, of which 14 were included in the results of this review.



**Figure 1 – PRISMA Flowchart.**<sup>13</sup>

Among the selected articles, according to the countries where the researches were conducted, it was identified that the 14 articles included were from China,<sup>14–25,27</sup> Iran<sup>26</sup> and United States.<sup>27</sup>

In relation to field, all studies came from medicine.<sup>14–27</sup> Concerning design, 4 studies<sup>14,20,21,27</sup> were non-randomized controlled trials (almost experimental), with level of evidence III, and 10 studies<sup>15–19,22,23–26</sup> were case-control or cohort, thus possessing level of evidence IV.

The studies were empirically grouped, based on their content, and two categories were defined: *tests used in COVID-19 in children*,<sup>14,15,22,23,27</sup> and *main clinical findings of COVID-19 in children*.<sup>16–21,24–26</sup>

## Tests used in COVID-19 in children

In this category, the studies that focused on the main tests used in COVID-19 in children and their peculiarities were grouped. Thus, five articles that could be included for analysis were found.<sup>14,15,22,23,27</sup>

The first study aimed to analyze the characteristics of the site and shape of pulmonary lesions on computed tomography (CT) scan of children with COVID-19. The authors of this research studied thoracic CT scan of 15 children between 4 and 14 years old, in addition to clinical data, which were separated into two groups: children admitted with and without fever.<sup>14</sup>

The authors showed that, in the group that presented fever, three of the five children had images compatible with small nodular frosted glasses. In relation to those who did not present fever, 4 out of 10 showed the same images. CT was repeated between the third and fifth day after treatment, and three children who did not present lesions with ground glass characteristics initially started to present. In this study, only 5 of the 15 cases of infection by COVID-19 in this group had fever, a lower proportion than that previously found in nursing literature, whose justification may be the fact that there are still few studies regarding the pediatric group.<sup>14</sup>

The second study also used thoracic CT findings, performed in children aged between 10 months and 6 years old, with confirmed COVID-19, based on a comparison to what has already been reported in adults. Among the five children analyzed in this study, three initially had abnormal pulmonary CT with ground-glass opacities, all asymptomatic. Two had CT without abnormalities, one of which was symptomatic and the other was asymptomatic. Among those who presented abnormality on CT, a similar alteration was found to be those observed in adults with COVID-19. Thus, based on current diagnostic criteria, laboratory tests (such as swabs) have become the standard and formative assessment for diagnosis of COVID-19 infection.<sup>15</sup>

However, authors recommend that CT may be useful in diagnosis, as current laboratory tests are time-consuming - sometimes return false-negative results - do not always meet the needs of an increasing number of infected people.<sup>14,15</sup> Thus, studies indicate that CT scans can detect lesions earlier, and suggest that, in imaging screening of children with suspected cases, thoracic CT should be preferred, which is useful for both diagnosis and early treatment.<sup>14,15</sup>

It should be noted that the data from an article published in May 2020 indicate that findings of thoracic CT of COVID-19 in preschool children may be atypical and varied, and should therefore be accompanied by clinical, epidemiological and other complementary tests. The authors consider this information fundamental, both with regard to the follow-up of cases and the establishment of criteria for discharge of these children.<sup>22</sup>

Regarding the use of polymerase chain reaction with reverse transcription (PCR-RT), in a study with 50 children aged between 2 and 16 years old, with a positive chain reaction to COVID-19, five had negative results in PCR-RT initially, but showed positive results in subsequent tests. This study emphasizes that the current gold standard for the diagnosis of COVID-19 is PCR-RT, besides showing that there was no clear association between changes in CT lesions and clinical outcomes. This is because, even clinically re-established and with indication of discharge, some children in this study did not present improvement in the thoracic CT pattern at discharge. Thus, for the authors, thoracic CT is an excellent tool to detect and characterize COVID-19 pneumonia, but not to assess the resolution of COVID-19 in children.<sup>27</sup>

In another study, with 40 children (16 days to 14 years old) who had pneumonia by the new coronavirus, and 16 children (2 to 5 years old) with RSV pneumonia were collected the following laboratory tests: C-reactive protein, procalcitonin, serum creatinine, alanine aminotransferase, subsets of lymphocytes and cytokines (IL-2, IL-4, IL-6, IL-10, TNF- $\alpha$ , IFN- $\gamma$ ). This research showed significant differences in the laboratory findings of children - with pneumonia by COVID-19 and RSV - which



highlighted the important role of the immune response in the development of pneumonia by COVID-19. Therefore, it is noted that such tests may contribute to the differential diagnosis of infections.<sup>23</sup>

## **Main clinical findings of COVID-19 in children**

In this category, the studies focusing on the main clinical findings of COVID-19 in children were grouped. Nine articles make up this category.<sup>16–21,24–26</sup>

The first study was conducted with 31 children aged between 1 month and 7 years, diagnosed with COVID-19 and with no previous history of under-the-heart disease. It also pointed out that children are asymptomatic or have mild symptoms such as fever, cough, fatigue and diarrhea. Sore throat, runny nose, dizziness, headache, myalgia and vomiting were rare. No child evolved to mechanical ventilation.<sup>16</sup>

The second study corroborates the first, since it described the clinical characteristics of a group of 25 children aged 2 to 9 years with COVID-19, and found that the most common symptoms at the onset of COVID-19 were: fever (13), followed by dry cough (11), diarrhea (3), nasal congestion (2), dyspnea (2), abdominal pain (2) and vomiting (2). It also pointed out that children are as susceptible to coronavirus infection as adults; however, they present milder forms of the disease.<sup>17</sup>

The third assessed eight children aged between two months and 15 years hospitalized in pediatric intensive care. The findings were very similar, pointed out as main symptoms: tachypnea, fever, cough, expectoration, nausea and vomiting. They also compared it to the adult public and observed that common symptoms in these patients - such as fatigue, myalgia and headache - rarely occurred in children.<sup>18</sup>

The fourth study observed 171 children with a mean age of 6.7 years, hospitalized with a diagnosis of COVID-19, and found that 71 (41.5%) had fever, cough and laryngeal erythema, and 39 (22.8%) were asymptomatic. Three patients with comorbidities (hydronephrosis, leukemia and intussusception) required intensive support and mechanical ventilation, and one of the 171 children (aged 10 months and intussusception) died.<sup>19</sup>

The fifth retrospective, multicenter study showed that of 366 children under 16 years old who were hospitalized for COVID-19 investigation, six were positive for the disease. All were aged between one and six years and had high fever (> 39°C) and cough, four had vomiting, four had pneumonia and one required hospitalization in a pediatric intensive care unit.<sup>20</sup>

In the sixth study of this category, 10 children aged 2 months to 15 years, with a positive result for COVID-19, presented on admission: fever (7), cough (5), sore throat (4), diarrhea (3), nasal congestion, and rhinorrhea (2), and 1 was asymptomatic. However, none of their guardians sought medical attention; all were diagnosed by active search due to the history of exposure to coronavirus.<sup>21</sup>

The following study was conducted in Iran, with 30 children with a mean age of 5.5 years, hospitalized with COVID-19. Of these, 19 cases were diagnosed by PCR-RT and 11 cases suspected by CT. Fever, cough, dyspnea and tachypnea were identified as the most common symptoms. The length of hospital stay was 7 to 10 days for 80% of the children. Five other children required more length of hospital stay, and one of them - diagnosed with Acute Lymphoblastic Leukemia (ALL) and febrile neutropenia - died.<sup>26</sup>

The eighth study, conducted in Wuhan, China, with 20 children aged two years and two months indicated cough and fever as the main symptoms, followed by rhinorrhea, diarrhea, vomiting, sore throat and fatigue. However, it pointed out that the clinical characteristics of COVID-19 in children are lighter when compared to adults.<sup>24</sup>

As in the previous study, the latest study, conducted in a children's hospital in southern China, with children aged between two months and 15 years, identified fever and cough as the main

symptoms, followed by nasal congestion and rhinorrhea. No child showed severe signs of COVID-19 and one was asymptomatic.<sup>25</sup>

## DISCUSSION

In light of the findings, it is noted that the levels of evidence of the articles included in this review varied between III and IV, being considered levels of moderate evidence. Such assessment is of paramount importance, because evidence-based practice promotes greater professional development and quality in care.<sup>28</sup>

This review found only articles published by physicians, which identified the need to expand studies in pediatric nursing.

Although the population most susceptible to COVID-19 is composed mainly of elderly with low immunity,<sup>15</sup> it is highlighted that respiratory viruses are a common cause of respiratory tract infection in children, considered an important reason for hospitalizations. In this sense, the rapid and accurate diagnosis of viral infections - in addition to assertive complementary tests - can improve clinical outcomes, reduce the use of medications and length of hospital stay, fundamental points in the current moment when hospitals lack the number of beds for those affected by COVID-19.<sup>29</sup>

It is also noteworthy the lack of any clear clinical discomfort initially in children, a fact that may hinder the diagnosis. Therefore, for asymptomatic children who have suspected infection, screening needs to be combined with epidemiological history and, in addition, CT acts as an important resource.<sup>14</sup>

In the studies present in this review, used mainly PCR-RT for detection of the virus.<sup>14-27</sup> A survey conducted in 2020 showed high detection of the method that uses PCR-RT for respiratory viruses, the suggestion of which is that the diagnostic tools based on it may be practical to detect a wide range of respiratory viruses.<sup>29</sup>

In addition to diagnostic tests, it is necessary to perform complementary tests throughout the hospitalization period.

In this sense, it is noteworthy that the performance of several procedures requires special care when applied in children, because the whole process can be especially frightening for them. Thus, nurses play a fundamental role, since they compose one of the categories that longest remains close to patients. When performing the procedures, these professionals should guide and explain the procedures to be performed by using playful resources to prepare the child.<sup>30</sup> With this, professionals can facilitate understanding about the hospitalization and treatment process they are going through. This care action contributes to problem-solving care, and, consequently, helps in reducing anxiety and stress, providing environmental-individual balance.<sup>31</sup>

With regard to this aspect, pediatric nurses should be even more attentive, as children remain accompanied by a guardian during hospitalization. In this sense, the orientations regarding hand hygiene, cleaning of belongings and toys, in addition to the restriction of circulation in the sector, are indispensable and become an even greater challenge, since they involve, in addition to children, their relatives/companions.<sup>32</sup>

In addition, it is noteworthy that carrying out procedures and tests in children with a pathology caused by a virus still little known requires more specific care. In this respect, the risk of virus transmission and cross-infection should be mitigated by a team composed, preferably, of professionals with greater experience and training in contact precautions. Thus, the nursing team is highlighted, because adapting, supervising and implementing norms and routines, in order to reduce hospital infections, is a common practice of this category.<sup>33,34</sup>

In relation to the main clinical characteristics of COVID-19, found in the studies included in the second category of the review, fever and cough were present in all studies,<sup>16-21,24-26</sup> followed by diarrhea,<sup>16,17,21,24</sup> nausea and vomiting,<sup>17,18,20,24</sup> rhinorrhea,<sup>16,21,24,25</sup> sore throat,<sup>16,21,24</sup> fatigue,<sup>16,18,24</sup>

dyspnea<sup>17,26,24</sup>, and nasal congestion.<sup>17,21,25</sup> Other signs and symptoms such as headache and myalgia, are shown to be rarer in children.<sup>16,18</sup>

Regarding nursing care for children with fever, nurses should take some actions to minimize the discomfort of the symptom and the concern of children and family, among them: increase comfort; reduce parents' anxiety; stimulate hydration; remove excess clothing; use warm compresses in cases of sweating; ensure air circulation in the environment; administer antithermals as prescribed; and perform a thermal curve for the monitoring of clinical evolution and assessment of the efficacy of medicines.<sup>35</sup>

Concerning care for respiratory manifestations such as cough, dyspnea, sore throat, nasal congestion, rhinorrhea, and fatigue, nursing literature points out the importance of a thorough assessment to identify early signs of respiratory failure. Thus, in caring for children with COVID-19, nurses should observe the following objectives: relieve dyspnea and hypoxemia; ensure effective cough and stable breathing; monitor respiratory rate and oxygen saturation through pulse oximetry and supply oxygen through an oxygen catheter or reoxygenating mask as needed.<sup>36</sup>

Regarding the observation of such symptoms, the Brazilian Society of Pediatric Nurses (*Sociedade Brasileira de Enfermeiros Pediatras*, abbreviated SOBEP) recommends at this time that, during hospitalization, pediatric nurses are able to instrumentalize the companions to maintain constant observation for any sign of respiratory distress of children and, if it occurs, immediately activate nurses in the sector.<sup>32</sup>

In relation to management of headache and throat, nurses should be aware of the signs emitted by the child in order to identify and value them as facial expression and crying, followed by changes in vital signs. To this end, applying pain scales can be a resource.<sup>32</sup>

Concerning nutritional and gastrointestinal function, nutritional support and application of probiotics are suggested to regulate the balance of the intestinal microbiota and reduce the risk of secondary infection due to translocation of the virus. It is observed that, as the severity of COVID-19 increases, digestive symptoms become more intense.<sup>37</sup>

Furthermore, nurses should observe signs of electrolyte disturbances and dehydration; offer meals in small quantities and at fractional times; encourage oral hygiene two or three times a day, in addition to ensuring that children's oxygen supply is not interrupted during meals.<sup>36</sup>

It is important to highlight that, in addition to these cares, the interactional dimension translated in the form of care, delicacy and readiness to children with COVID-19 are determinant in the development of this care. Therefore, nurses, together with the entire nursing team, should seek the well-being of children in their entirety.<sup>32</sup>

## CONCLUSION

The findings of this review point to clinical studies focused on two main themes: diagnostic tests used in COVID-19 and the main clinical characteristics in children.

Regarding tests, the performance of PCR-RT for the detection of COVID-19 cases in children and for the importance of pulmonary tomography for rapid identification of possible complications proved to be important. The clinical characteristics involve several symptoms, among which fever and cough stand out.

It is important to show that, because it is a new disease and little known by science, many studies are still underway and none of those found in this review proved a strong level of evidence; therefore, further reviews should be made in order to compile the results, and facilitate the search for evidence that guides new practices for professionals who are ahead of care. In addition, it points out the urgent need to expand studies in pediatric nursing, about COVID-19, since all the findings were studies in medicine.

Considering these findings, it is possible to highlight the relevance of the role of nursing at the time of preparation and performance of the exams, since these are an instrument for assessing and monitoring the children affected by COVID-19 as well as in promoting adequate and qualified care to minimize the signs and symptoms of this disease, with a view to prompt restoration of their health.

It is noteworthy that pediatric nursing care should be individualized, based on current knowledge about this disease and on the interventions implemented to date.

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## **NOTES**

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### **CONFLICT OF INTEREST**

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