Ro J Pediatr. 2022;71(3)
DOI: 10.37897/RJP.2022.3.9

Current systematic reviews of the burden of covid-19 pandemic in children and adolescents

Doina Anca Plesca[1,2], Cristina Radulescu[1,2], Alexandra Vilaia[1,4], Plesca Vlad Stefan[1,3], Anca Cristina Dragnescu[1,3]

[1]"Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania
[2]"Victor Gomoiu" Children's Clinical Hospital, Bucharest, Romania
[3]"Matei Bals" National Institute for Infectious Diseases, Bucharest, Romania
[4]Colentina Clinical Hospital, Bucharest, Romania

ABSTRACT

The coronavirus disease 2019 (COVID-19) is profoundly affecting life of the children and adolescents around the globe. The authors present a synthesis of the characteristics of SARS CoV-2 infection in the pediatric population. The role played by children in the transmission of infection as well as the changes related to the clinical picture and the severity of symptoms that changed during the 5 pandemic waves. Another objectives of this review was to describe the diverse facets of the burden of COVID-19 in children and adolescents. The authors presented the direct effects of hospitalization during the acute phase of the disease, multisystem inflammatory syndrome in children, long COVID and the sequelae after infection with the new coronavirus. In addition, the indirect effects of social isolation and interruption in education are discussed. Isolation, contact restrictions and economic shutdown impose a complete change to the psychosocial environment in affected countries. Mental health problems among children and adolescents are increasingly reported amidst the coronavirus disease (COVID-19) pandemic. Anxiety, lack of peer contact and reduced opportunities for stress regulation are main concerns. Another main threat is an increased risk for parental mental illness, domestic violence and child maltreatment.

The burden of the COVID-19 pandemic manifested in various ways: there was an increase in poverty, a major crisis arose in education, and new threats concerning children's health and even survival emerged.

Keywords: Child, adolescent, COVID-19, mental health, poverty

For over two years and a half, all of mankind is facing the COVID-19 pandemic. The knowledge that has gathered so far regarding SARS-CoV-2 infection is insufficient and there are many questions awaiting answers, but what is apparently obvious thus far is that there is a lower incidence and decreased disease severity of COVID-19 infection in children.

MORBIDITY AND MORTALITY IN SARS-COV-2 INFECTION IN CHILDREN AND ADOLESCENTS

Most children with SARS-CoV-2 infection are asymptomatic or have mild symptoms and usually recover with no sequelae. COVID-19 morbidity and mortality are very low in children when compared to adults [1]. Even so, one must not fail to recognize the possibility of severe disease in children. An underlying medical condition in children aged 15 to 11 years carries a 12-fold increase in hospitalization rates and a 19-fold increase in the risk of admission to a pediatric intensive care unit (PICU). However, the vast majority in this age group that were hospitalized (78%) were previously healthy children [1].

A review of 1475 children from various countries who were hospitalized with acute COVID-19 reported a moderate to severe degree of illness in 615 (42%). In a recent prospective study in Israel [2], including 579 children with SARS-CoV-2 infection that

Corresponding author:
Doina Anca Plesca
E-mail: doina.plesca@umfcd.ro

Article History:
Received: 27 August 2022
Accepted: 2 September 2022

were either hospitalized or developed multisystem inflammatory syndrome in children (MIS-C), 103 had moderate to severe illness. Moreover, 20% of those with COVID-19 and 56% of those with MIS-C were hospitalized in PICUs, and 7% and 20% of these respective groups required mechanical ventilation.

An element of great interest is persistence of symptoms after COVID-19. Starting 2021, prolongued COVID-19 symptoms have also been described in the pediatric setting. However, the exact prevalence of persistent symptoms after SARS-CoV-2 infection in children (long COVID-19) is not currently known.

Children play an important role in the transmission of SARS-CoV-2. New virus variants are expected to emerge, and the disease breaks out particularly in populations with low immune coverage, like pediatric patients.

Children and adolescents have similar or higher viral loads of SARS-CoV-2 compared to adults [3,4].

Several studies showed lower infectivity rates among children. Infectivity correlates with age. Adolescents and adults exhibit similar infectivity rates.

To note, the infectivity rate changed throughout the waves of the pandemic!!!

- During the first and second waves (February – November 2020), only 23-32% of children and 15% of adults contracted COVID-19 infection from children [3]!!!
- During the third wave, there was an increase in the number of children and adults that contracted the disease from children, with 40-51% of children and 29% of adults;
- During the fourth wave, the role that children played in infection transmission increased. 49% of all infected individuals were found to have contracted the disease from children and adolescents aged under 17 years and 1/3 from children aged 5-12 years;
- During the fifth wave, the ascending trend of infection transmission involving children has remained.

The number of hospitalizations of children aged 0–17 years due to COVID-19 DRAMATICALLY increased during the DELTA wave of the pandemic; there was a 5-fold increase, however the degree of severity remained constant [2]. The rate of hospitalizations of unvaccinated adolescents was 10-fold higher than in those fully vaccinated, and COVID-19-related hospitalizations were 4-fold higher in countries with low COVID-19 immunization coverage [2].

LONG-TERM COMPLICATIONS OF SARS COV-2 INFECTION

The most frequent long-term complications of SARS-CoV-2 infection in children are: myocarditis, multisystem inflammatory syndrome in children (MIS-C/PIMS) and long COVID-19.

SARS-CoV-2 infection is associated with an increased risk of myocarditis of 30-fold higher in children under age 16 years and 16-fold higher in the general population, according to data from the Centers for Disease Control and Prevention (CDC). Moreover, scientific data suggest that myocarditis in the setting of SARS-CoV-2 infection, both in severe COVID-19 and in multisystem inflammatory syndrome, exhibits a much higher risk than derives from vaccination with a mRNA COVID-19 vaccine [1]. Clinical symptoms of myiocarditis have been identified in 0.5% (1:200 cases) [1].

Multisystem inflammatory syndrome in children (MIS-C/PIMS) associated with SARS-CoV-2 infection [5,6,7] was first described in April 2020 in the UK. Clinical manifestations occur approximately 2-4 weeks after SARS-CoV-2 infection and include: *persistent fever, gastrointestinal signs and symptoms, mucocutaneous* and *cardiac symptoms,* and *elevated inflammatory markers* [7]. Some signs and symptoms are similar to those seen in Kawasaki disease, toxic shock syndrome and/or acute COVID-19 disease [6]. Most cases are found in children aged 1-14 years with a median of 9 years. More than half (56%) of MIS-C cases are males. Most children that developed this long-term complication of SARS-CoV-2 infection were free from comorbidities [1]. 53–80% children diagnosed with MIS-C had cardiac involvement and 20% needed mechanical ventilation [1,2].

Depending on the population assessed, methods of data collection and the time elapsed from the acute illness, the incidence of long COVID varies, reaching nearly 30% (physical and mental symptoms in children recovering from SARS-CoV-2 infection) [1]. In the UK there was an online survey among 297,743 individuals over age 2 years based on self-reported or parental reports of symptoms. 4 weeks after infection, 0.2% of children aged 2–11 years and 0.9% of children aged 12-16 years had symptoms of long COVID. The most frequent symptoms were: fatigue, shortness of breath, headache, cough, dizziness, muscle and joint pain, hair loss, tremor and difficulty sleeping.

SIGNIFICANT INDIRECT EFFECTS OF COVID-19 IN CHILDREN AND ADOLESCENTS

Although children are not in the frontline of this pandemic, they risk becoming its greatest victims, as their lives changed significantly. All children, regardless of age, have been deeply affected, especially from a socio-economic standpoint and, in some cases, by the measures aimed at limiting SARS-CoV-2 infection [1].

Moreover, the negative effects of the COVOD-19 pandemic on child welfare were not equally distributed. Children from low-income areas, already at a

disadvantage, have experienced and continue to bear a disproportionately large burden stemming from the COVID-19 pandemic.

For long periods, schools have been closed, influencing not only the educational process, but also child nutrition, growth and development, and social wellbeing.

Preventive strategies that mandated isolation lead to an increase in domestic violence involving children, with significant psycho-emotional consequences in the medium and long-term [8].

The burden of the COVID-19 pandemic manifested in various ways: there was an increase in poverty, a major crisis arose in education, and new threats concerning children's health and even survival emerged.

Around 42-66 million children wound up living in extreme poverty as a direct consequence of the ongoing health crisis. This is an addition to the over 386 million children already suffering from extreme poverty in 2019.

In addition, there are approximately 150 million children living in multidimensional poverty, with no or limited access to essentials such as education and/or health services. A study by UNICEF that compared access to education and/or healthcare before and during the COVID-19 pandemic shows how the impact of the pandemic generated a significant increase (from 47% to 56%) in the number of children with no access to these facilities. Children's education and health have been gravely altered.

In 2020, 188 countries resorted to long-term school closure, affecting over 1.5 billion children and young adults. Over 2/3 of countries introduced social distancing and distance learning (using e-platforms); in low-income countries however, only 30% of children could access this type of learning system. This aspect meant that at least 463 million children from poor families could not attend classes due to lack of funding for digital learning (no internet access, no electronic devices, no financing etc).

Opening/closing schools, social distancing, and medical care disruptions could have negative medium and long-term effects on children's and adolescent's health and welfare.

The negative impact of closing schools manifested as: decreased reading abilities and poor outcomes in tests, poor critical thinking skills, reduced creativity and information processing, behavioral changes (depression, anxiety, eating disorders etc), low financial resources for children with disabilities (including access to specialized educators and structured learning environments).

Financial difficulties resulted in hundreds of thousands of additional deaths in children, due to nutritional deficiencies, malnutrition, and reduced access to health services.

An increase in numbers of children with malnutrition is to be expected, as around 368.5 million children from 143 countries have stopped receiving a warm meal at school, which, in normal circumstances, would have been provided daily. Another 6 to 7 million children under 5 years of age have suffered from acute malnutrition in the year 2020.

Healthcare services utilization has decreased substantially during the pandemic, which resulted in a drop in immunization rates (by 34%), children's health status screening (by 49%), dental procedures (by 69%), and mental health services (by 58%).

There was also a significant impact on national immunization programs, threatening objectives such as the eradication of vaccine-preventable diseases (VPDs) like *poliomyelitis* and *measles* [9].

OMS, UNICEF, GAVI reported that over 80 million children aged under 1 in more than 68 countries were affected by disruptions in immunization programs. Over 24 million children risked infection with *polio, measles, diphtheria, pertussis, tetanus, hepatitis B, flu, Haemophilus influenzae type b, pneumococcus, and rotavirus* [9].

In 129 countries where statistical data were available, more than half reported moderate to significant disruption, or even complete cessation of routine immunization services in March – April 2020, owing to personnel relocation to areas where patients with COVID-19 were being treated [9].

The spread of the SARS-CoV-2/COVID-19 and the various measures employed during the pandemic have had significant impact on children's health and welfare [10]. Health services and social assistance disruption (changes in the usage of the emergency pediatric medical service during the COVID-19 pandemic) manifested in various ways in emergency departments (EDs), such as increasing numbers of presentations for medical conditions in children and adolescents with psychosocial issues [10].

Many children experienced important obstacles in accessing health services, emotional stress and financial difficulties owing to parents having lost their employment, which could have negative medium and long-term effects on their respective quality of life.

The COVID-19 pandemic has had significant impact on children's and adolescents' mental health. There is an alarming increase in depression and anxiety rates for this category. The number of calls to social assistance hotlines has risen, including those for suicide crises. Eating disorders, worsening symptoms of preexisting eating disorders (including hospitalizations) have dramatically increased [11].

Rethinking health policies to ensure adequate access to health services, mental health services in particular, as well as facilitating access to social services in order to support monetary poor households

with children may help in tackling some of the consequences children and adolescents are facing at this time.

- The impact of the COVID-19 pandemic on children and adolescents is multifaceted:
- The aspects of morbidity and mortality rates secondary to SARS-CoV-2 infection;
- Community stress generated by the novel coronavirus infection;
- Child, adolescent and family trauma;
- Additional consequences (delayed medical care, delayed immunization, obesity etc.).

In this difficult time for us all, we need to focus more on children and adolescents in order to improve their physical and mental health and, in the end, their overall wellbeing.

Moreover, as the pandemic continues to unfold, political decision makers and healthcare providers must ensure continuous, good quality essential health and social services, including specific strategies for vulnerable patients.

Conflict of interest: none declared
Financial support: none declared

REFERENCES

1. Stein M, Ashkenazi-Hoffnung L, Greenberg D, Dalal I, Livni G, Chapnick G, Stein-Zamir C, Ashkenazi S, Hecht-Sagie L, Grossman Z. The Burden of COVID-19 in Children and Its Prevention by Vaccination: A Joint Statement of the Israeli Pediatric Association and the Israeli Society for Pediatric Infectious Diseases. *Vaccines* (Basel). 2022 Jan 6;10(1):81. doi: 10.3390/vaccines10010081. PMID: 35062742; PMCID: PMC8781684
2. Ben-Shimol S, Livni G, Megged O, Greenberg D, Danino D, Youngster I, Shachor-Meyouhas Y, Dabaja-Younis H, Scheuerman O, Mor M, Somekh E, Yakub Hanna H, Givon-Lavi N, Guri A et. al COVID-19 in a Subset of Hospitalized Children in Israel. *J Pediatric Infect Dis Soc.* 2021 Aug 17;10(7):757-765.
3. Heald-Sargent T, Muller WJ, Zheng X, Rippe J, Patel AB, Kociolek LK. Age-Related Differences in Nasopharyngeal Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Levels in Patients With Mild to Moderate Coronavirus Disease 2019 (COVID-19). *JAMA Pediatr.* 2020 Sep 1;174(9):902-903.
4. Li X, Xu W, Dozier M, He Y, Kirolos A, Lang Z, Song P, Theodoratou E; UNCOVER. The role of children in the transmission of SARS-CoV2: updated rapid review. *J Glob Health.* 2020 Dec;10(2):021101.
5. Royal College of Paediatrics and Child Health Guidance: Paediatric multisystem inflammatory syndrome temporally associated with COVID-19, https://www.rcpch.ac.uk/sites/default/files/2020-05/COVID-19-Paediatric-multisystem-%20inflammatory%20 syndrome-20200501.pdf. 11.07.2022
6. https://emergency.cdc.gov/han/2020/han00432.asp. accesat 15.06.2022
7. https://www.cdc.gov/mis-c/index.html: Multisystem Inflammatory Syndrome (MIS) – CDC, 19.05.2022
8. Save the Children Year in Review 2021: Reporting results against our Humanitarian Plan UNICEF, 2021. Accesat in 20.05.2022, https://stage.gdc.unicef.org/resource/save-children-year-review-2021-reporting-results-against-our-humanitarian-plan
9. Operational Considerations for Immunization Services during COVID-19 in Non-US Settings Focusing on Lower-Middle Income Countries, CDC, Updated Feb. 10, 2021. Accesat 20.05.2022
10. Impact of COVID-19 on children living in poverty, UNICEF Data: Monitoring the situation of children and women, December 2021. Accesat 21.05.2022 https://data.unicef.org/covid-19-and-children/
11. Orgilés M, Espada JP, Delvecchio E, Francisco R, Mazzeschi C, Pedro M, Morales A. Anxiety and Depressive Symptoms in Children and Adolescents during COVID-19 Pandemic: A Transcultural Approach. *Psicothema.* 2021 Feb;33(1):125-130.