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Covid-19 in Children with Emphasis on Prevention: A Rapid Review

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Abstract

Children of all ages can be infected with coronavirus disease (COVID-19), and experience complications. Children with COVID-19 might present with many symptoms, a few symptoms, or be asymptomatic. The most common symptoms in children are fever and dry cough, and other common symptoms include nasal congestion or a runny nose, fatigue, and headache. Evidence suggests that many children develop long-term COVID-19. As of September 22, 2020, no vaccine trials were conducted on children under 18 years. According to the CDC, adolescents aged 16 or 17 are eligible for the Pfizer COVID-19 vaccine, but not Moderna or Janssen (Johnson & Johnson) vaccines. As of March 2021, Moderna and Pfizer/Biotech had begun vaccine trials on children, and Johnson & Johnson planned to do the same. Children and adolescents are generally at a lower risk of infection, and if an infection occurs, it is likely to be mild. However, some children and young people have had severe experiences with the disease, and a few have died. COVID-19-related measures have a profound effect on health and well-being, and for some, the impact will be lifelong.

Key Words: COVID-19, Children, Symptoms, Prevention, Vaccine.

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1- INTRODUCTION

In the current time, outbreaks of SARS in 2003, MERS in 2012 (both caused by a coronavirus), H1N1 swine flu in 2009-2010, Ebola in 2014-2016, Zika in 2015-2016, and the recent COVID-19 have occurred (1). The virus causing COVID-19 is the third coronavirus that has raised global concern in the last two decades with a sudden epidemic and increase in hospitalizations following pneumonia and involvement of various organs. COVID-19 was first identified in December 2019 after an outbreak of pneumonia of unknown cause in patients in Wuhan, China. By July 2020, it had spread to more than 200 countries (2). The disease presents with milder symptoms in children. It can occur in four forms: respiratory involvement, gastrointestinal involvement, multi-systemic inflammatory syndrome (MIS-C), and fever and rash (3-5). Shen et al. identified the disease as a significant threat to physical and mental health, as the outbreak of COVID-19 disease has changed the normal life of families and, in particular, their lifestyle (6).

Higher susceptibility and vulnerability of children to infectious and contagious diseases than adults is an area for more attention in this group. A probable reason for children's vulnerability is that they have specific behavior patterns of exposure to infectious diseases, like a habit of putting things in their mouth and sucking on fingers during infancy, which are suitable paths to getting infected. Furthermore, children under five are strongly dependent on their caregivers, and their need for love, comfort, and nutrition complicates social distancing. Therefore, transmitting the disease to children is more likely. Children are also less likely to follow health measures and adherence to hygienic protocols, such as washing hands and using face masks or gloves. The immune and defense systems are weaker in children because they are not fully developed and are in the growth phase. As a result, infectious diseases might have long-term effects, even into adulthood. Children are more susceptible to malnutrition as food is vital in the early years. Malnutrition increases the risk of developing various diseases (7-9). This study aimed to investigate the effects of the COVID-19 epidemic on children and coping strategies and treatment against this disease.

2- MATERIALS AND METHODS

2-1. Data sources

In this review study, a systemic search of electronic databases of Medline (via PubMed), SCOPUS, Web of Science, ProQuest, Cochrane Library, SID, Magiran, CIVILICA, and Google Scholar search engine was performed with no time limit up to May 2021, using the following keywords alone or in combination: "COVID-19", "Vaccines", "Treatment", "Symptoms", "Children", "Child", "Infants", and "Baby". The search was performed independently and in duplication by two reviewers, and any disagreement between the reviews was resolved by the supervisor.

2-2. Study selection

The database search was done for suitable studies. Abstracts of the studies were screened for identification of eligible studies, full-text articles were obtained and assessed, and a final list of eligible studies was made. This process was done independently and in duplication by two reviewers, and any disagreement was resolved by a third reviewer. References were organized and managed using EndNote software (version X8).

3- RESULTS

As a vulnerable population, children and youth may be affected by the COVID-19 pandemic in various domains, including education, mental health, safety,

and socioeconomic stability. The infection may lead to separation from or loss of their family. As with other crises, the COVID-19 pandemic may exacerbate existing vulnerabilities and inequalities experienced by children (10-12).

3-1. Infection with COVID-19 in children

It appears that women infected with the coronavirus can, in very rare cases, pass the disease to their babies. Infants can also become infected shortly after birth. According to the U.S. Centers for Disease Control and Prevention (CDC), most newborns who test positive for the coronavirus have mild symptoms or are asymptomatic and recover in a short time. Nevertheless, severe cases have also been observed. Pregnant women should take extra precautions, including considering a COVID-19 vaccine. When a child is infected with COVID-19, they are more likely to be asymptomatic or have mild to moderate symptoms. They are also less likely to become hospitalized than adults (13-16). Still, severe illness is possible, and in such cases, respiratory support (e.g., ventilator) may be required. Some children have experienced multiple organ failure. These severe, critical cases were most common in children with underlying health conditions, such as asthma (especially more severe cases), and compromised immune systems (14, 15, 17). Children have a lower mortality rate when infected with COVID-19. They are, however, more likely to experience gastrointestinal symptoms than adults (16). There is no evidence that the virus causing COVID-19 is present in breast milk. However, because there is a possibility of spreading COVID-19 through respiratory droplets while breastfeeding, it is critical to follow safety guidelines.

3-2. How COVID-19 affects children?

Children, even at a very young age, can get infected with COVID-19. Many children have no symptoms, and those who do get sick tend to experience milder symptoms, such as low-grade fever, fatigue, and cough. Some children develop severe complications, but this is much less common. Children with underlying health conditions may be at an increased risk for a severe illness. A severe and potentially fatal complication in children is the multisystem inflammatory syndrome (MIS-C). This syndrome can lead to life-threatening problems in the heart and other organs and cause inflammation in body parts, such as the heart, lungs, kidneys, brain, skin, eyes, or gastrointestinal system.

3-3. Symptoms of MIS-C can include

- Fever lasting more than a few days;
- Rash;
- Bloodshot eyes (redness of the sclera);
- Abdominal pain;
- Vomiting, diarrhea;
- Swollen lymph nodes in the neck;
- Neck pain;
- Red and cracked lips;
- Unusually red, strawberry-looking tongue;
- Swollen hands and feet; and
- Irritability, unusual sleepiness, or weakness.

A systematic review notes that children with COVID-19 have milder effects and better prognoses than adults (13, 18). However, children are susceptible to the multisystem inflammatory syndrome in children (MIS-C), a rare but life-threatening systemic illness involving persistent fever and extreme inflammation following exposure to the SARS-CoV-2 virus (19, 20).

3-4. Signs and symptoms of COVID-19 in children

Children with COVID-19 might present with many symptoms, a few symptoms, or might be asymptomatic. The most common symptoms of COVID-19 in children are cough and fever. Possible signs and symptoms include:

- Fever;
- Productive (wet) cough;
- Chest pain;
- New loss of taste or smell,
- Changes in the skin (e.g., discoloration of areas on the feet and hands);
- Sore throat;
- Nausea, vomiting, abdominal pain, or diarrhea;
- Chills;
- Muscle ache and pain;
- Extreme fatigue;
- New severe headache; and
- New nasal congestion.

COVID-19 symptoms appear on average about six days after exposure to the COVID-19 agent (21-23).

3-5. Risk Factors for severe COVID-19 in Children

Data from the CDC study indicate that some children may be at a higher risk for a severe case of COVID-19 and require medical care in a hospital, including:

- Children younger than two;
- Children of an ethnic minority (e.g., black and Latino) who might be affected by health disparities, being disproportionately vulnerable to severe COVID-19 complications;
- Children born prematurely; and
- Children with obesity or chronic lung disease (24).

3-6. Infectivity of COVID-19 in children

Most children who become infected with the COVID-19 have no symptoms or mild symptoms such as low-grade fever, fatigue, and cough. Early studies suggested that children do not contribute significantly to the spread of coronavirus. However, more recent studies indicate that children may spread the infection. Although the studies varied in methods, their findings were similar. Infected children had the same amount or more coronavirus in their upper respiratory tracts as infected adults. A study by Harvard researchers in November 2021 confirmed that children carry live viruses capable of infecting others. The viral load (the amount of virus present) in children had no correlation with the severity of their symptoms. In other words, a child with mild or no symptoms may have just as many viral particles in their mouth and nasal tracts as those with more severe symptoms. Therefore, a high viral load in infected children increases the likelihood of spreading the infection, even in asymptomatic cases (25- 30).

3-7. The probability of COVID-19 infection in children

While the probability of COVID-19 infection in children and adults is the same, children are less likely to become severely ill. Approximately 50% of children and adolescents might have COVID-19 with no symptoms. However, some children with COVID-19 require hospitalization and treatment in intensive care units or using a ventilator.
Several medical conditions might increase the risk of serious illness with COVID-19 in children, including:

- Obesity;
- Diabetes;
- Asthma;
- Congenital heart disease;
- Genetic conditions; and
- Conditions affecting the nervous system or metabolism.

Research also indicates disproportionately higher rates of COVID-19 in Hispanic and Black children. Babies younger than one

might be at higher risk of severe illness with COVID-19 than older children. Newborns can get COVID-19 during childbirth or exposure to infected caregivers after delivery (31-36).

3-8. COVID-19 vaccines, additional primary shots, and booster shots approved for children

In the U.S.A, COVID-19 vaccines are available to children by the following age groups (year):

- **5 to 11:** The US Food and Drug Administration (FDA) has given emergency use authorization to a Pfizer-BioNTech COVID-19 vaccine for this age group. This vaccine involves two shots at a three-week interval. It contains a lower dose than the Pfizer-BioNTech COVID-19 vaccine for people aged 12 and older. This vaccine is approximately 91% effective in preventing COVID-19 in children aged five to 11.
- **12 to 15:** The FDA has given emergency use authorization to a Pfizer-BioNTech COVID-19 vaccine for this age group. This vaccine involves two shots at a three-week interval. It contains the same dose as the Pfizer-BioNTech COVID-19 vaccine for people aged 16 and older. The second dose can be administered up to six weeks after the first dose. This vaccine is 100% effective in preventing COVID-19 in children aged 12 to 15.
- **16 and older:** The FDA has approved a Pfizer-BioNTech COVID-19 vaccine, now called Comirnaty, for this age group. This vaccine involves two shots at a three-week interval. The second dose can be administered up to six weeks after the first dose. This vaccine is 91% effective in preventing severe illness with COVID-19 in people aged 16 and older. This vaccine is 91% effective in preventing severe illness with COVID-19 in people age 16 and older.

An additional primary shot of a COVID-19 vaccine can help vaccinated people who did not have a strong enough immune response. The CDC recommends that children aged five to 11, who have moderately or severely compromised immune systems, receive an additional dose of the Pfizer-BioNTech COVID-19 vaccine. This shot should be administered 28 days after the second shot. Booster doses can help vaccinated people whose immune response has weakened over time. Research suggests that a booster dose can decrease the risk of infection and severe illness with COVID-19. Children aged 12 to 17 should get a Pfizer-BioNTech COVID-19 vaccine booster shot if they have received both doses of the Pfizer-BioNTech COVID-19 vaccine at least five months before. The CDC also recommends a single-dose Pfizer/BioNTech COVID-19 booster shot for children aged 12 to 17, at least five months after receiving their second dose of the vaccine. In addition, the CDC advises that children aged five years and older who are moderately or severely immunocompromised should get an additional primary dose of the vaccine 28 days after their second shot (37-45).

4- CONCLUSION

Children are the innocent victims of the pandemic as their lives are changed in profound ways. Children of all ages and countries are being affected, in particular by the socio-economic impacts and, in some cases, by protective measures that may inadvertently do more harm than good. Coronavirus variants, including the highly contagious omicron variant, continue to spread, particularly in areas

with low COVID-19 vaccination coverage and in children under five who cannot yet be vaccinated. For children too young to be vaccinated (and adults who have not received any coronavirus vaccine), it is crucial to follow proven COVID-19 precautions such as wearing masks in public areas and keeping indoors to reduce the chance of infection with the coronavirus.

The CDC recommends that children aged five to 17 receive the two-dose Pfizer/BioNTech COVID-19 vaccine. Children aged 12 to 17 years may be vaccinated with the standard Pfizer/BioNTech vaccine, while children aged five to 11 years should receive Pfizer/BioNTech's pediatric vaccine with a lower dose (10 micrograms, compared to 30 micrograms for 12-year-olds and older). Currently, only the Pfizer/BioNTech vaccine is authorized in the US for children younger than 18.

5- CONFLICT OF INTEREST: None.

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