

# An Epidemiological Characteristic of the COVID-19 Among Children

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**Abstract:** A novel Coronavirus disease 2019 (COVID-19) is an infectious disease caused by SARS coronavirus 2 (SARS-CoV-2), which affects the respiratory system of human beings. Until now, numbers of COVID-19 cases have been reported among children; in China, less than 2.4% of the total cases occurred in those aged under 19 years old. SARS-CoV-2 transmission in children mostly occurs through contact with adult patients, primarily through exposure in the home. This article discusses the epidemiological features of COVID-19 in children.

**Keywords:** COVID-19; adolescent; ACE2; infection; children; SARS-CoV-2.

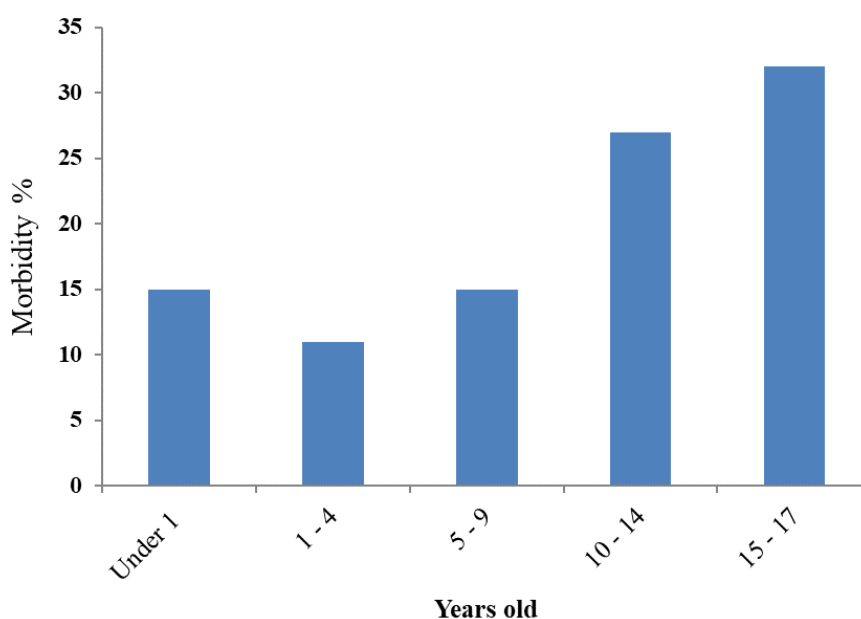
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## 1. Introduction

Among the first cases in Wuhan/China, the place where COVID-19 was spread and detected, there were no children involved, which suggested that children are not symptomatic of the disease [1-8]. Now on Jun 13<sup>th</sup> 27<sup>th</sup>, 2020, the disease is pandemic with nearly 7.8 million confirmed cases and 430 thousand deaths, including around 2% confirmed cases among children. Children have been described as being under the age of 18 years old. Results reported preliminary from china, and these recently reported from Europe and the United States show that elderly people, in particular, those with underlying health conditions, are at a higher risk of serious COVID-19- accompanied diseases and death comparing to children [9-15]. In the Chinese Center for Disease Control and Prevention's (China CDC) first major study, where 44,672 confirmed COVID-19 cases were covered, only one case of death recorded in an individual of 19 years old, while nearly 80% of the total deaths took place within elderly people of the age  $\geq 60$  years [16-27]. However, no children under the age of 10 died except a 1-year old child who had a serious form of the disease. Similarly, for patents of age between 10-19 years, one death was reported [28-37]. In the United States, the age distribution relationship with cases ratios was shown in Figure 1 [38-45]:

There are very few pregnancies and neonatal studies on COVID-19 to clarify whether or not babies can become infected in utero. A case series of 31 COVID-19 pregnant women showed none of their babies or placenta positively screened for the virus [46-51]. There is one case of a newborn baby who was born by cesarean section with a positive SARS-CoV-2. Swab

(PCR) test was used 16 hours after birth with no detectable maternal SARS-CoV-2 antibodies until after delivery, indicating a possible vertical transmission [52-56].



**Figure 1.** Age distribution among COVID-19 patients aged less than 18 years old in the United States

## 2. Symptoms

COVID-19 has different symptoms that could differ from a person to another. However, the most common symptoms and signs in children were cough, follow by pharyngeal erythema, and fever. Table 1 shows the percentage of the common COVID-19 symptoms that appear among children [57-63].

**Table 1.** Common COVID-19 symptoms appearance in children.

Symptoms	Appearance ratio (%)
Cough	48.5%
Pharyngeal erythema	46.2%
Fever	41.5%
Tachypnea	28.7%
Diarrhea, rhinorrhea, and nasal congestion	10%

The ratio of children identified with critical and/or severe conditions of COVID-19 was significantly lower than those of adults with values of 0.6% and 2.5%, respectively. Children with COVID-19 who had asymptomatic cases were more than children with influenza infection, while pneumonia was more prevalent [64-66].

## 3. Epidemiology in children

The main reason to have a lower incident of COVID-19 cases among children (agreeing with earlier Middle East respiratory syndrome [MERS] and SARS coronaviruses) is remaining elusive. In comparison with older age groups, many theories have been suggested to understand this phenomenon, such as various behaviors of immunological responses over the age ranges. Adults are possibly developing unbalanced immune responses when they get infected with COVID-19, leading to cytokine storms that frequently cause lungs damage and low prognosis for adult patients compared to children and infants. A variation in innate immunity within the different age categories and more successful response of T cells could be found in children to prevent lung harm [67-70].

Cross-protection is obtained from previous contact with human coronavirus (HuCoV), which is commonly accompanied by mild infections within children. Thereby, it was considered as a possible comprehend for lower risk in babies, though it does not seem to be a plausible theory because of the serious cases recorded for very young infants. This age group is improbably exposed to these HuCoV contagions before [71-78]. Another possibility is that the presence of other simultaneous viruses in the mucosa of lungs and airways, which are common in young children, could limit the growth of SARS-CoV2 by direct virus-to-virus interactions and competition [68].

Recently the role of measles, mumps, and rubella (MMR) vaccination has also been proposed in the children protections against COVID-19. The authors suggested that a broad neutralizing antibody can be produced as the result of MMR vaccine which can protect children from a number of diseases including COVID-19. Such hypothesis was based on short amino acid sequence similarities between Spike (S) glycoprotein of SARS-COV-2 with both Fusion (F1) glycoprotein of Measles virus and envelope (E1) glycoprotein of Rubella virus [79-84].

The highly reasonable hypothesis for low COVID-19 infection among children have been also linked to the production of angiotensin-converting enzyme 2 (ACE2) on alveolar epithelial cells of type I and II. ACE2 was discovered to be SARS-CoV-2 receptor, necessary for entry of host cells and subsequent viral replication [85-89]. Consequently, a restricted existence of ACE2 in childhood, a period of age where lungs are still developing, could prevent the children from serious cases of illness. It is worth mentioning that men tend to have more ACE2 compared to women in their alveolar cells, this may also explain the reason of higher infection rate among males comparing to females [90-94]. This pattern was also noticed in children's research, by comparing the hospitalization infection rates among boys and girls [64]. In addition, children frequently undergo winter respiratory infections (e.g. respiratory syncytial virus (RSV)) and may have a higher number of antibodies to the virus than adults [95-98]. Also, the immunity system of children has still been going to develop and can respond to pathogens differently for adults.

#### **4. Conclusions**

COVID-19 is found to cause low-risk infections in children comparing with older people for unknown reasons. However, for those who got infected, it is still unclear if the chronic diseases have affected the outcome. In addition, children with asymptomatic or mildly symptomatic could be a carrier to spread the disease to other people such as parents and relatives. Even though, no transmitting of the COVID-19 has been identified to date from children to adults. Children and their families could take action to prevent respiratory infections from spreading [99-103]. To reduce the chances of infection, the following points should be considered:

- Washing hands with soap and water more often for at least 20 seconds, it is the most effective method to prevent infection.
- Alcohol-based disinfection wipes should be used for hand cleaning and disinfection.
- Proper hand hygiene is recommended after coughing or sneezing.

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## Conflicts of Interest

The authors declare no conflict of interest.

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