

# Coronavirus disease 2019 in children

## Surprising findings in the midst of a global pandemic

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### Abstract

**Question** Coronavirus disease 2019 (COVID-19) is affecting millions of people worldwide. It seems that it affects mostly adults older than 40 years of age, and the death rate is highest for older individuals in the population. What should I tell parents worried about their children contracting the coronavirus (SARS-CoV-2) causing COVID-19, and what symptoms should I look for to determine if there is a need to test for the virus?

**Answer** The COVID-19 global pandemic affects all ages. Severe respiratory manifestations have been the mainstay of illness in adults, with what seems to be rapid deterioration necessitating mechanical ventilation. Only 5% of those tested and found to have COVID-19 have been younger than 19 years, possibly owing to limited testing, as the symptoms in children are usually mild. Symptoms in children include fever, dry cough, rhinorrhea, sore throat, and fatigue, and in 10% diarrhea or vomiting. Rarely dyspnea or hypoxemia were also described. Blood tests and imaging have been shown to be of little value in children and should only be ordered for those in whom you would normally order these investigations for viral-like illness. No specific therapy is available and supportive care with rest, fluids, and antipyretics for children is the recommended approach. Ibuprofen or acetaminophen for fever and pain can be given. Antiviral and immunomodulatory treatment is not recommended at this time for otherwise healthy children, and corticosteroids should also not be used. Children with immunocompromised states should be isolated and avoid contact with others.

## L'infection au coronavirus 2019 chez les enfants

Découvertes surprenantes au milieu d'une pandémie mondiale

### Résumé

**Question** L'infection au coronavirus 2019 (COVID-19) touche des millions de personnes dans le monde. Elle semble cibler principalement les personnes de plus de 40 ans, et le taux de mortalité est plus élevé chez les personnes plus âgées dans la population. Que devrais-je dire aux parents qui s'inquiètent que leurs enfants contractent le coronavirus (SARS-CoV-2) qui cause la COVID-19, et quels symptômes devrais-je surveiller pour déterminer la nécessité de procéder à un dépistage du virus?

**Réponse** La pandémie mondiale de la COVID-19 touche tous les groupes d'âge. De graves manifestations respiratoires ont principalement caractérisé la maladie chez l'adulte, suivies par ce qu'il semble être une détérioration rapide exigeant une ventilation mécanique. Seulement 5% des personnes ayant subi un test et ayant été diagnostiquées de la COVID-19 avaient moins de 19 ans, probablement en raison du nombre limité de tests, puisque les symptômes chez l'enfant sont habituellement bénins. Parmi les symptômes observés chez les enfants figurent la fièvre, une toux sèche, une rhinorrhée, un mal de gorge et de la fatigue, et chez 10%, de la diarrhée ou des vomissements. La dyspnée ou l'hypoxémie ont aussi été documentées, mais rarement. Il a été démontré que les analyses sanguines et l'imagerie sont peu utiles chez les enfants, et elles ne devraient être prescrites que pour ceux à qui vous prescririez normalement de telles investigations en raison d'une maladie de type viral. Il n'existe pas de traitement spécifique, et les soins de soutien comme le repos, l'ingestion de beaucoup de liquides et les antipyrétiques pour enfants constituent l'approche recommandée. On peut donner de l'ibuprofène ou de l'acétaminophène pour la fièvre et la douleur. Un traitement antiviral et immunomodulateur n'est pas recommandé pour l'instant chez les enfants par ailleurs en santé, et on ne devrait pas non plus utiliser de corticostéroïdes. Il faut isoler les enfants dont l'état est immunodéprimé et éviter les contacts avec les autres.

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) illness that started spreading in humans in the end of 2019, now called coronavirus disease 2019 (COVID-19), is a global pandemic<sup>1</sup> that has affected millions of people, some of whom are children. The death toll from this pandemic has been considerable and has surpassed previous global pandemics such as the 2002–2003 severe acute respiratory syndrome coronavirus (SARS-CoV).<sup>2</sup> Severe respiratory manifestations have been the mainstay of illness in adults, with what seems to be rapid deterioration necessitating intubation and mechanical ventilation.

Since December 2019, when a cluster of acute respiratory illness occurred in Wuhan, Hubei province, China, the illness has been seen mostly in adults (median age in the 50s), and the highest morbidity and mortality has been reported for those with chronic illnesses and immunocompromised states.<sup>3</sup> Children have also faced a burden of illness from COVID-19, although current data in Canada suggest that only about 5% of patients testing positive for SARS-CoV-2 have been children, and only a few needed hospitalization.<sup>4</sup> The rates are the same as those reported from 3 hospitals in Zhejiang province, China, which is 900 km from Wuhan, where the virus emerged.<sup>5</sup> The reported low rate of infections among children in Canada might be related to selective testing, as COVID-19 testing kits in some Canadian provinces were reserved for patients admitted to the hospital and for symptomatic health care workers.

Transmission of COVID-19 is primarily through respiratory droplets inhaled by contacts within close range. Some have suggested other types of transmission such as from fomites and the fecal-oral route. The median incubation period is 5 days (range of 2 to 14 days). Current epidemiologic reports propose that children might be sick with COVID-19, but unlike seasonal influenza, symptoms and severity appear to be milder than among adults, and many children are likely to be asymptomatic.<sup>5,6</sup> Among 36 hospitalized children, 28% were asymptomatic.<sup>5</sup> Dong et al from the Chinese Center for Disease Control and Prevention<sup>7</sup> reported more than 2000 cases of COVID-19 illness in children during a period of a month, with 13% of confirmed cases being asymptomatic. In a large series from Korea, only 75 of more than 7700 patients (1%) were younger than 9 years of age, and another 405 (5%) were 10 to 19 years old.<sup>8</sup> Korea is a country notable for a low prevalence of severe morbidity and mortality during the pandemic as of the time of writing, likely owing to intensive strategies for community testing and mitigation. Rare admissions or deaths were reported among minors (< 19 years of age) by the US Centers for Disease Control and Prevention among 4226 patients with COVID-19 through March 16, 2020.<sup>9</sup>

A simulation model prepared by investigators from the London School of Hygiene & Tropical Medicine examining the relatively low prevalence among children

suggested 3 possible explanations: first, a possible bias in favour of older patients because schools were closed, limiting the spread among school-aged children; second, the fact that children are exhibiting lower susceptibility to infection; and third, that children have a lower propensity to show clinical symptoms. Fitting an age-structured model to epidemic data from 6 countries (China, Japan, Singapore, South Korea, Italy, and Canada), they found strong age dependence in the probability of developing clinical symptoms.<sup>10</sup>

## Symptoms

When symptomatic, children presented with fever, dry cough, rhinorrhea, sore throat, and fatigue, similar to adults. More recent reports suggest that diarrhea or vomiting are present in about 10% of children and might be the sole symptoms of COVID-19. Moderate illness in one series included fever (47%), cough (24%), vomiting or diarrhea (10%), or headache (10%).<sup>5</sup> Abdominal pain was described in a minority of children with COVID-19; dyspnea or hypoxemia were also described; and less than 1% had acute respiratory distress syndrome or systemic illness.

While children have not been presenting with severe illness, these findings suggest that they have been contracting the illness, likely have SARS-CoV-2 particles in their nasopharyngeal secretions, are very likely to contribute to early transmission to close contacts,<sup>11,12</sup> and might infect adults who can suffer a serious and life-threatening illness.<sup>13</sup>

There are several theories as to why children have been less sick with COVID-19 compared with adults. It is possible that children have a more active innate immune response and healthier respiratory tracts because they have not been exposed to smoke and air pollution to the extent adults have. Limited immune response in children might also explain an association with the abridged rate of acute respiratory distress syndrome.<sup>14</sup>

A difference in the distribution, maturation, and functioning of viral receptors is frequently mentioned as a possible reason for the age-related difference in incidence. Both SARS-CoV and SARS-CoV-2 use angiotensin-converting enzyme 2 as the cell receptor in humans. Some evidence shows that angiotensin-converting enzyme 2 is involved in protective mechanisms of the lungs, and studies have demonstrated that this type of infection is more common in adults than in children.<sup>14</sup> However, such evidence is based on animal models and might not be applicable to humans.

## Testing for COVID-19

Blood tests are not necessary for patients with COVID-19. Leukopenia, lymphopenia, and increased myocardial enzymes in children with COVID-19 were found at rates similar to adults. Adults have increased C-reactive protein response compared with children, suggesting a


much milder immunologic response in children and less immune damage.<sup>5</sup>

Radiographic features do not seem to add much to the diagnosis of COVID-19 in children, as findings from both x-ray and computed tomography (CT) scans of the chest are often normal, while some children with minimal symptoms can present with bilateral pneumonia on an x-ray scan and even with changes on CT scan. Half (53%) of 36 children from 3 hospitals in China had ground-glass opacities on CT scan, meeting the case definition for moderate illness.<sup>5</sup> At this time there is no recommendation to obtain any radiologic tests in children with suspected COVID-19 and to order imaging only if the provider would plan imaging for viral-like illness in the child.

## Therapy

While there has been speculation, and anecdotal treatment successes have been reported,<sup>15</sup> at the time of writing this review, no therapy is available. Supportive care with rest, fluids, and antipyretics for children is the recommended approach.

Initial considerations reported by the World Health Organization to avoid nonsteroidal anti-inflammatory drugs have been dismissed, and the Canadian Paediatric Society suggests that ibuprofen or acetaminophen can be administered for fever and pain.<sup>16</sup> Despite some reports of pneumonia in children with COVID-19, there is no current recommendation for antiviral and immunomodulatory treatment for some or all children with the illness.<sup>17</sup> Some authors have proposed systemic corticosteroids for COVID-19 infection, while others have suggested they would have a deleterious effect.<sup>18</sup> Current World Health Organization guidance suggests that corticosteroids should not be used for SARS-CoV-2-induced lung injury or shock.<sup>18</sup>

Children with immunocompromised states, such as those receiving chemotherapy or other drugs affecting the immune system, are at greater risk from COVID-19 and should be isolated and avoid contact with others. Similarly, isolation is needed for children with underlying pulmonary pathology and immunocompromising conditions that have been associated with more severe outcomes with other coronavirus infections. 

**Competing interests**  
None declared

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## References

1. WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020. Geneva, Switz: World Health Organization; 2020. Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>. Accessed 2020 Apr 7.
2. Wilder-Smith A, Chiew CJ, Lee VJ. Can we contain the COVID-19 outbreak with the same measures as for SARS? *Lancet Infect Dis* 2020 Mar 5. Epub ahead of print. Available from: [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30129-8/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30129-8/fulltext). Accessed 2020 Apr 7.
3. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA* 2020 Feb 7. Epub ahead of print. Available from: <https://jamanetwork.com/journals/jama/fullarticle/2761044>. Accessed 2020 Apr 8.
4. Canada COVID-19 situational awareness dashboard. Ottawa, ON: Public Health Agency of Canada; 2020. Available from: <https://phac-aspc.maps.arcgis.com/apps/opsdashboard/index.html#/e968bf79f4694b5ab2902050e5cfdca6>. Accessed 2020 Apr 7.
5. Qiu H, Wu J, Hong L, Luo Y, Song Q, Chen D. Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study. *Lancet Infect Dis* 2020 Mar 25. Available from: [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30198-5/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30198-5/fulltext). Accessed 2020 Apr 7.
6. Shen KL, Yang YH. Diagnosis and treatment of 2019 novel coronavirus infection in children: a pressing issue. *World J Pediatr* 2020 Feb 5. Epub ahead of print. Available from: <https://link.springer.com/article/10.1007/s12519-020-00344-6>. Accessed 2020 Apr 8.
7. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, et al. Epidemiological characteristics of 2143 pediatric patients with 2019 coronavirus disease in China. *Pediatrics* 2020 Mar 16. Available from: <https://pediatrics.aappublications.org/content/early/2020/03/16/peds.2020-0702.long>. Accessed 2020 Apr 7.
8. COVID-19 National Emergency Response Center. Coronavirus disease-19: the first 7,755 cases in the republic of Korea. *Osong Public Health Res Perspect* 2020;11(2):85-90.
9. Centers for Disease Control and Prevention. Severe outcomes among patients with coronavirus disease 2019 (COVID-19)—United States, February 12–March 16, 2020. *Morb Mortal Wkly Rep* 2020;69(12):343-6.
10. Davies NG, Klepac P, Lui Y, Prem K, Jit M; CMMID COVID-19 working group. Age dependent effects in the transmission and control of COVID-19 epidemics. *MedRxiv* 2020 Mar 24. Available from: <https://www.medrxiv.org/content/10.1101/2020.03.24.20043018v1>. Accessed 2020 Apr 7.
11. Wölfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Mülleer MA, et al. Virological assessment of hospitalized cases of coronavirus disease. *MedRxiv* 2020 Mar 8. Available from: <https://www.medrxiv.org/content/10.1101/2020.03.05.20030502v1.article-info>. Accessed 2020 Apr 7.
12. Zou L, Ruan F, Huang M, Liang L, Huang H, Hong Z, et al. SARS-CoV-2 viral load in upper respiratory specimens of infected patients. *N Engl J Med* 2020;382(12):1177-9.
13. Hagmann SHF. COVID-19 in children: more than meets the eye. *Travel Med Infect Dis* 2020 Mar 28. Epub ahead of print. Available from: <https://www.sciencedirect.com/science/article/pii/S147393920301174?via%3Dihub>. Accessed 2020 Apr 7.
14. Ogimi C, Englund JA, Bradford MC, Qin X, Boeckh M, Waghmare A. Characteristics and outcomes of coronavirus infection in children: the role of viral factors and an immunocompromised state. *J Pediatric Infect Dis Soc* 2019;8(1):21-8.
15. BC Centre for Disease Control. *Unproven therapies for COVID-19*. Vancouver, BC: BC Centre for Disease Control, BC Ministry of Health; 2020. Available from: [http://www.bccdc.ca/Health-Professionals-Site/Documents/Guidelines\\_Unproven\\_Therapies\\_COVID-19.pdf](http://www.bccdc.ca/Health-Professionals-Site/Documents/Guidelines_Unproven_Therapies_COVID-19.pdf). Accessed 2020 Apr 7.
16. Rieder M, Jong G, Salvadori M; Canadian Paediatric Society, Drug Therapy and Hazardous Substances Committee. *Can NSAIDs be used in children when COVID-19 is suspected?* Ottawa, ON: Canadian Paediatric Society; 2020. Available from: [www.cps.ca/en/documents/position/can-nsaids-be-used-in-children-when-covid-19-is-suspected](http://www.cps.ca/en/documents/position/can-nsaids-be-used-in-children-when-covid-19-is-suspected). Accessed 2020 Apr 8.
17. Kelvin AA, Halperin S. COVID-19 in children: the link in the transmission chain. *Lancet Infect Dis* 2020 Mar 25. Available from: [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30236-X/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30236-X/fulltext). Accessed 2020 Apr 8.
18. Bousquet J, Akdis C,utel M, Bachert C, Klimek L, Agache I, et al. Intranasal corticosteroids in allergic rhinitis in COVID-19 infected patients: an ARIA-EAACI statement. *Allergy* 2020 Mar 31. Epub ahead of print. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/all.14302>. Accessed 2020 Apr 8.



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