

Coronavirus Disease (COVID-19) in Children: Indian Perspectives

(This is a preprint version of an article submitted for publication in Indian Pediatrics. Changes may be made before final publication)

PII: S097475591600167

Balasubramanian, *et al.* [1] have concisely described various aspects related to coronavirus disease (COVID-19) in children in the Indian setting. We would like to address additional issues related to epidemiology of COVID-19, reasons for uneventful clinical course in children, and the contributions of Indian judiciary to the health of children during the pandemic.

From the point of epidemiology, reporting and testing of children for COVID-19 are less, which lead to under-sampling and under-reporting of the disease [2]. Decreased illness severity and an overall resilience to this disease in children facilitate transmission of the organism by rendering children as carriers. Moreover, children can shed COVID-19 virus through stools for a longer time. This is attributed to increased viral load through the act of swallowing the virus containing sputum or saliva [3] and the expression of angiotensin converting enzyme 2 (ACE2) in the intestine.

From a physiological perspective, a higher frequency of beating lung cilia [4] in children hinders the virus entry into lung pneumocytes. Apart from that, they have low risk for COVID-19 associated acute respiratory distress syndrome (ARDS) due to decreased generation of thrombin, and fibrin formation [5,6]. The other reasons for the protection of lungs and airways are lack of co-morbidities and less exposure to particulate matter and pollutants [7], as also mentioned by Balasubramanian, *et al.* [1]. In addition, increased expression of ACE2 in pediatric lungs and other tissues gives additional protection and contributes to uneventful clinical course [4]. Moreover, they escape from cytokine storm [6,8] and hence, fatal complications are rarely observed [8,9]. In addition, exposure of pediatric population to various vaccines [10] carried out as per the Universal immunization program in India enhance the activation of the immune system [11,12], and contribute to uneventful clinical course. Further, relative lack of physical and mental stress in children likely gives additional protection *via* psychoneuroimmunology.

Understanding the gravity of the current and emerging situations of COVID-19, the Supreme Court of India has given directions [13] and measures to Child Welfare Committee, Juvenile Justice Boards, Children's courts, Child Care Institutions and State Governments across India towards the care and attention of children in conflict with law and those kept in various types of homes including those under foster and kinship care. Thus, Indian judiciary is the first in the globe to look into the needs of marginalized children and give specific directions for their care in this pandemic.

Over all, we believe that Indian children will withstand the outbreak of the novel coronavirus pandemic, but may be a link in transmission due to possibility of under-reporting of cases, sub-clinical syndrome and longer shedding period of virus. We have to urgently address these through effective public health approached, including possible vaccination against COVID-19, as and when available [14].

Funding: None; Competing Interests: None stated.

**SUBRAMANIAN SENTHILKUMARAN¹, RAMACHANDRAN MEENAKSHISUNDARAM¹,
SWENI SHAH^{2*} AND PONNIAH THIRUMALAIKOLUNDUSUBRAMANIAN³**

From ¹Department of Emergency and Critical Care, Manian Medical Centre, Erode, India; ²Royal Free NHS Foundation Trust, London, United Kingdom; and ³Trichy SRM Medical College Hospital and Research Centre, Irungalur, Tiruchirapalli, India.

*Email: *sweni.shah@nhs.net*

REFERENCES

1. Balasubramanian S, Rao NM, Goenka A, Roderick M, Ramanan AV. Coronavirus disease (covid-19) in children – what we know so far and what we do not. *Indian Pediatr.* 2020 Apr 9. Available from: <https://www.indianpediatrics.net/CONVID29.03.2020/SA-00159.pdf>. Accessed April 22, 2020.
2. 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. Available from: <https://pediatrics.aappublications.org/content/pediatrics/early/2020/03/16/peds.2020-0702.full.pdf>. Accessed April 19, 2020.
3. Ma X, Su L, Zhang Y, Zhang X, Gai Z, Zhang Z. Do children need a longer time to shed SARS-CoV-2 in stool than adults? *J Microbiol Immunol Infect.* 2020. Available from: <https://www.sciencedirect.com/science/article/pii/S1684118220300700>. Accessed April 18, 2020.

4. Chilvers MA, Rutman A, O'Callaghan C. Functional analysis of cilia and ciliated epithelial ultrastructure in healthy children and young adults. *Thorax*. 2003;58:333-8.
5. Moore HB CDB, Moore EE, McIntyre RC, Moore PK, Talmor DS, Moore FA, *et al*. Yaffe. Is there a role for tissue plasminogen activator (tPA) as a novel treatment for refractory COVID-19 associated acute respiratory distress syndrome (ARDS)? *J Trauma Acute Care Surg*. 2020. Available from: https://journals.lww.com/jtrauma/Citation/9000/Is_There_a_Role_for_Tissue_Plasminogen_Activator.97967.aspx. Accessed April 18, 2020.
6. Ignjatovic V, Pelkmans L, Kelchtermans H, Al Dieri R, Hemker C, Kremers R, *et al*. Differences in the mechanism of blood clot formation and nanostructure in infants and children compared with adults. *Thromb Res*. 2015;136:1303-9.
7. Yang J, Chen Y, Yu Z, Ding H, Ma Z. The influence of PM2.5 on lung injury and cytokines in mice. *Exp Ther Med*. 2019;18:2503-11.
8. Ng PC, Lam CW, Li AM, Wong CK, Cheng FW, Leung TF, *et al*. Inflammatory cytokine profile in children with severe acute respiratory syndrome. *Pediatrics*. 2004;113:e7-14.
9. Liniger M, Zuniga A, Tamin A, Azzouz-Morin TN, Knuchel M, Marty RR, *et al*. Induction of neutralising antibodies and cellular immune responses against SARS coronavirus by recombinant measles viruses. *Vaccine*. 2008;26:2164-74.
10. Prompetchara E, Ketloy C, Palaga T. Immune responses in COVID-19 and potential vaccines: Lessons learned from SARS and MERS epidemic. *Asian Pac J Allergy Immunol*. 2020;38:1-9.
11. Ruf BR, Knuf M. The burden of seasonal and pandemic influenza in infants and children. *Eur J Pediatr*. 2014;173:265-76.
12. Benn CS, Netea MG, Selin LK, Aaby P. A small jab - A big effect: Nonspecific immunomodulation by vaccines. *Trends Immunol*. 2013;34:431-9.
13. Bureau IL. India Legal Bureau. Supreme court issues directions for prevention of children from Covid-19. 2020. Available from: <https://www.indialegalive.com/constitutional-law-news/supreme-court-news/supreme-court-issues-directions-prevention-children-covid-19-94696>. Accessed April 18, 2020.
14. Ella KM, Krishna Mohan V. Coronavirus vaccines: Light at the end of the tunnel. Available from: <https://www.indianpediatrics.net/CONVID29.03.2020/PERS-00163.pdf>. Accessed April 24, 2020.