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Review Article

Severe acute respiratory syndrome corona virus-2 among children in India: can the risk of outbreak be prevented during the subsequent waves of COVID-19 pandemic?

Rajath Rao[1], Binod Kumar Pati[2], Srikanta Kanungo[3], Santosh Kumar Nirala[1], Bijaya Nanda Naik[1]*

[1]Department of Community and Family Medicine, All India Institute of Medical Sciences, Patna, Bihar, India
[2]Department of Microbiology, All India Institute of Medical Sciences, Patna, Bihar, India
[3]Scientist C, Public Health, ICMR-RMRC, Bhubaneshwar, Orissa, India

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***Correspondence:**
Dr. Bijaya Nanda Naik,
E-mail: dr.bijaya02@gmail.com

ABSTRACT

The COVID-19 pandemic believed to be originated from Wuhan, China has devastated the health and wealth of the entire world with multiple waves. An age shifting phenomenon towards younger age has been observed with SARS-CoV-2 (severe acute respiratory syndrome corona virus-2) with subsequent waves across the world including India. With vaccination being already in place for adults and elderly, younger especially children less than 18 years may be assumed to be susceptible to SARS-CoV-2 in the subsequent waves. However, few research suggests that children are less susceptible to SARS-CoV-2 due to immature sinuses in the nasopharynx and less number of ACE-2 receptors to which generally the SARS-CoV-2 attaches. On the other hand, poor health and nutrition status of the children, unreached target of immunization services, poor sanitation and fragile health system in India makes children more vulnerable to SARS-CoV-2. Children may get affected if new variant of virus emerges during the subsequent waves. So, we need to prepare to protect the children who if at all get affected during the third wave of COVID-19 by preventing infection among adult and elderly, strengthening the health system and immunizing the children.

Keywords: SARS-CoV-2, COVID-19 in children, Third wave, COVID-19 vaccine

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered novel coronavirus also known as SARS-CoV-2.[1] The COVID-19 outbreak was first reported in the Wuhan city, Hubei province, China during December 2019. Soon, it spread to other countries resulting in one of the deadliest global pandemics the world has ever witnessed with more than 215 countries being affected.

Globally, as on 11 May 2021, there have been 158,651,638 confirmed cases of COVID-19 including 32,99,764 deaths reported to WHO. Similarly in India, from 3 January 2020 to 11 May 2021, there have been 22,992,517 confirmed cases of COVID-19 with 249,992 deaths, reported to WHO.[2] During the peak of first wave of COVID-19, India reported nearly 100,000 cases per day. After a period of low transmission for 3-4 months and starting from first week of April 2021 acute surge and steep rise in number of cases was seen resulting in daily count of over 400,000 cases and nearly 4,000 deaths during the peak of second wave of COVID-19 pandemic.

Many countries around the world including India saw a pattern of the COVID-19 pandemic where a first wave occurred in the spring last year that substantially subsided

during the summer/early winter and a second wave emerged in the beginning of 2021 and various countries are seeing peak and major calamities at present. Experience of Spanish flu pandemic during second decade of last century showed the second and subsequent waves were more devastating till the epidemic brought under control.[3]

Two studies around the world have shown that children of all age group can get affected by COVID-19, though SARS-CoV-2 infection is more common among the older children.[4-6]

Many countries including India have already witnessed the second wave to be more devastating than first. Many questions still remain unanswered during the current COVID-19 pandemic. The biggest question remains whether children, who were largely unaffected during the previous waves, will contract the COVID-19 in the subsequent COVID-19 wave with adult and elderly getting vaccinated? What will be the features and how severe will be COVID-19 in children? What measures can be adopted to protect the children from the COVID-19 pandemic?

Health status of children in India

Population aged less than 18 years accounts for 40% of total in India. The children in India are less healthy compared to their counterparts in developed and many of the developing countries making them very much susceptible to varied infections. Unsafe water and poor sanitation in combination with increasing air pollution increased their proneness to infection. Although approximately 90% of Indian population have access to safe water source, less than half (48%) have satisfactory sanitary practices. India is still enroute to achieve the National health policy 2017 target of >90% immunization coverage by 2025, which in combination with the poor nutritional status is also responsible for increased risk of infection especially among the older children due to declining immunity. In India, full vaccination coverage is only 62% with region wise disparity. The coverage of BCG and measles vaccinations are only 92% and 81% respectively (Figure 1). More than 50% children were anemic in India (Figure 2). Nearly every third child under 5 years of age is underweight.[7]

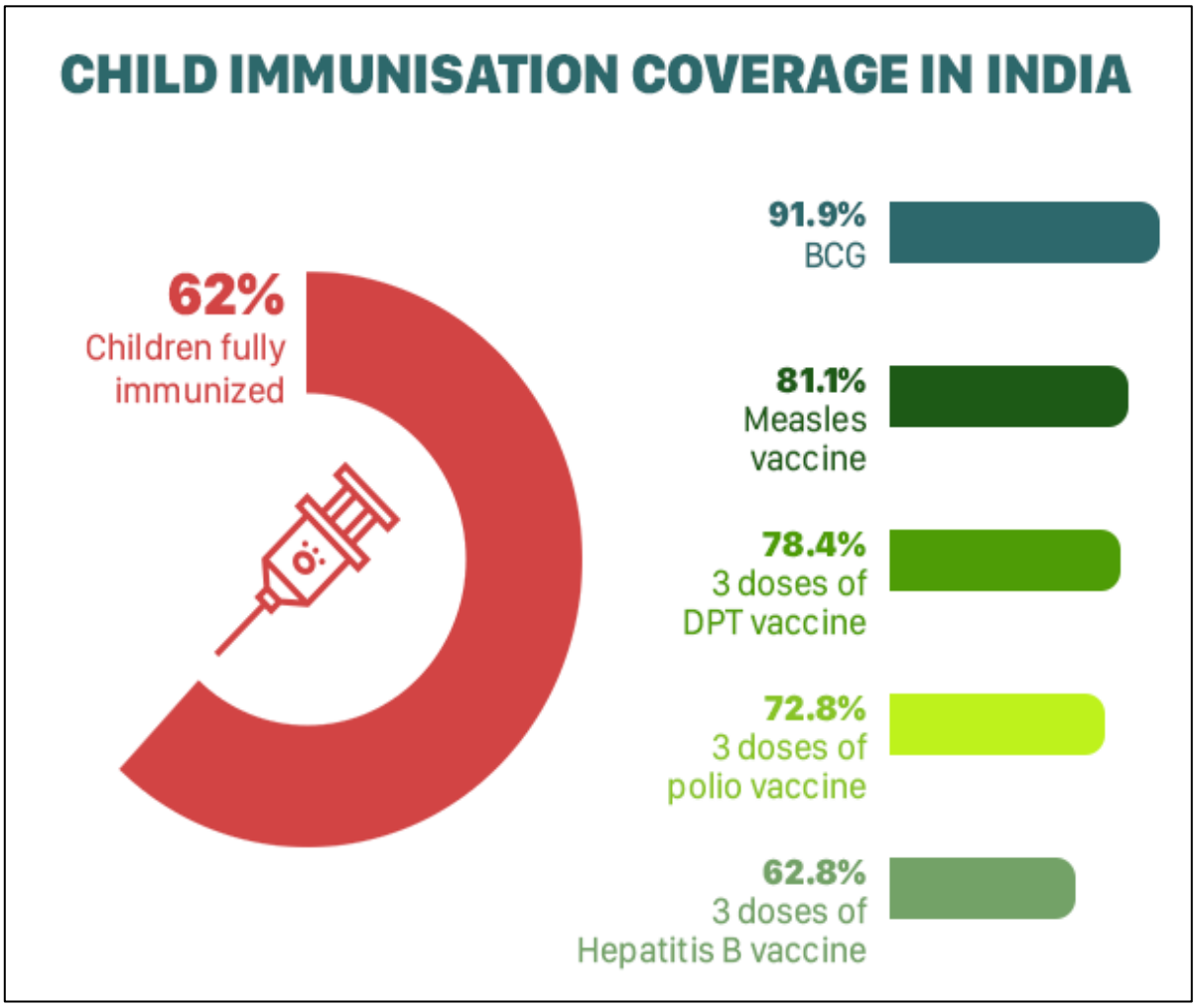

Figure 1: Immunization coverage in India (Source: NFHS 4).[7]

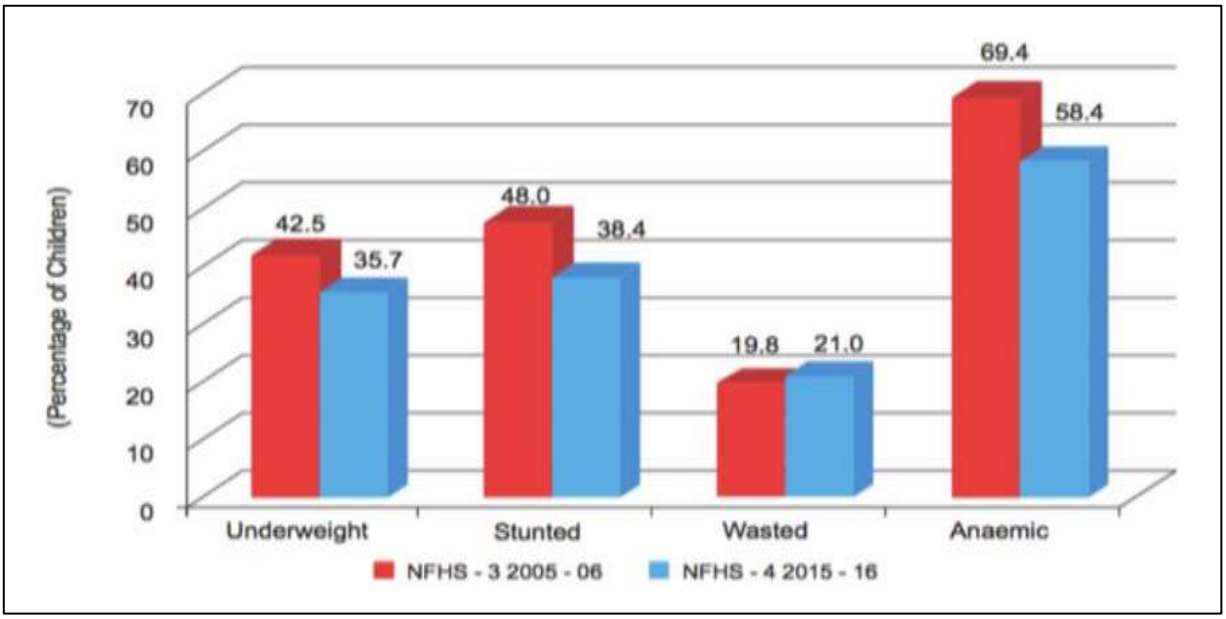

Figure 2: Prevalence of anemia and malnutrition among under 5 children(Source: NFHS 4).[7]

Frequent exposure to non-specific viral infection provides some amount of protection against SARS-CoV-2 infection. Few ecological research have argued this, based on the ecological observation, as one the reasons behind less morbidity and mortality in India compared to other developed countries in the first wave of COVID-19.[8]

Based on this the children in India were expected to be less affected by COVID-19. On the contrary, poor health, poor nutrition, incomplete vaccination made the children vulnerable to COVID-19.

Pattern of age group affected during the COVID-19 pandemic in India

The pattern of cases distribution of first and second wave of COVID-19 pandemic in India brought us a key question, whether the age distribution of COVID-19 cases both morbidity and mortality remained steady between the two waves or not.

Data from many of seroprevalence studies done in different countries have suggested that not all age groups have been equally infected during the spread of the virus in the first wave (Figure 3). Protecting the older, elderly and high-risk people had reduced their involvement in second wave.[9] An increased and rapid vaccine coverage in elderly and high risk people and relaxation of curbs led to increase in social activity, poor social distancing, poor contact tracing, failure to enforce interventions to due public fatigue have caused a shift in age of involvement in subsequent waves.[10]

Stark differences in age group involved was noticed between the two waves in India. The morbidity and mortality were more prevalent among elderly and adults with co-morbidities during first wave. Age shifting phenomenon was observed with younger age group being more affected during the second wave. During the second wave of COVID-19 in India, majority of the people affected were in the middle age group. Empirical observations had shown increase in number of children being affected with few deaths being reported among them due to COVID-19. The government data released from NCDC based on IDSP data showed that people aged 20 years or less accounts for nearly 12% of total cases.[11] The statement released from government showed no difference in demography of COVID-19 affected population between first and second waves of the pandemic.[12]

However, empirical observations showed younger age group and children being more affected by COVID-19 during the second wave. Hippich et al had shown increase in SARS-CoV-2 antibody frequency among preschool and school going children in second wave compared to first wave.[13] This indicated higher rate of exposure among children during the second wave of COVID-19. There was lack of enough evidence to show greater involvement of children, but age shifting can't be rule out.

This age shifting can be due to phased manner of mass vaccination being done. The virus targeting the unvaccinated middle age group for its survival amidst the complacency in COVID-19 appropriate behaviour. In the

next phase, all the citizens above 18 years of age were scheduled to be vaccinated. This exposed the children age group susceptible to SARS CoV-2 who were largely unaffected during the first and second waves of the pandemic. Experience from other countries had shown age shifting during the second wave with children and younger age group being more affected in Brazil, US.[14,15]

Children in general are less susceptive to SARS-CoV-2 infection. The reasons being immature sinus and low level of ACE 2 receptors in the nasopharynx of children.[16-18] One school of proponent reasoned the immature sinuses hampering the survival probability of the virus. Another school of proponent believed that the children had low level of ACE-2 receptors, to which the virus get attached, compared to adults and hence, low level of infection rate among children.[18]

However, there was insufficient data to support these viewpoints. The SARS-CoV-2 in India is continuously evolving with new strains being reported from different regions. There is a the possibility that the new strain being evolved during third wave, if it occured, may attach new receptor and involve children who were largely less affected so far. Age shifting to look out for new hosts have been reported in other infections previously.[19-21] The risk of children getting affected by SARS CoV-2 is high, if the third wave of COVID-19 came with a new variant.

Observation of disease profile in children

Respiratory infections in children were not uncommon. Majority of children with COVID-19 infection may be asymptomatic or mildly symptomatic. COVID-19 in children was milder compared to adults.[22] However, range of symptoms were similar to that of adults. Common symptoms included fever, cough, difficulty breathing, myalgia, rhinorrhoea, sore throat, diarrhoea, loss of smell, loss of taste. Like other acute illnesses like pneumonia, diarrheal diseases, the most common symptoms of COVID-19 in children were fever, chills, cold and cough.[23] However, severe infection leading to death have been reported among children with COVID-19.[22]

Ministry of health and family welfare, government of India in their latest update in April 2021 documented that children were less commonly affected with this novel corona virus infection. A small proportion around 10-20% of symptomatic children may need hospitalization and around 1-3% of symptomatic children may have severe illness requiring intensive care admission.[24] Here like any other respiratory illness, direct person to person transmission occured through close contact, mainly through respiratory droplets that were released. Like other respiratory illnesses children were known to drive transmission in households and communities.[25] As per current evidence, the period of infectivity starts 2 days prior to onset of symptoms and lasts upto 8 days with Median incubation period of 5.1 days (range 2 to 14 days).[24]

Indian association of paediatrics (IAP), in their update mentioned that few children may present with gastrointestinal symptoms and atypical symptoms like rash, conjunctival congestion and mucositis. Fast breathing determines whether condition was mild or moderate and severe grunting, chest indrawing, seizures showed severe disease.[26]

Recently in a WHO published commentary, a new syndrome had been defined called multi system inflammatory syndrome in children (MIS-C) linking to paediatric COVID-19 for age group 0-19 years. Such cases were characterized by unremitting fever >38 degree celsius, epidemiological linkage with SARS-CoV-2 and clinical features suggestive of MISC.[27]

Another commentary showed that almost all ages of the paediatric population were affected including neonate, with a median age of 7-11 years. Among children, the largest proportion (56-84%) affected was 9-19 years old.[28] The older children were more commonly affected than younger children in India too.[11] The case notification rates found in few studies were 9.74 cases/100000 children among 0-19 years with 65% children having family contact, 54.7% asymptomatic and fever being most common presenting complaint.[29]

Contributing risk factors

Children with pre-existing adverse health conditions were at higher risk of contracting SARS-CoV-2 infection or developing severe COVID-19 compared to healthy counterpart.[30,31]

Published research finding from other countries have shown obesity, cardiovascular diseases, chronic pulmonary diseases, immunosuppression, genetic abnormality condition to increase the susceptibility to SARS-CoV-2 infection among children.[23,32-34]

Burden of childhood infections was relative high like prevalence of diarrhoea was 9.2% and that of ARI was 2.7% in India. Almost 35.8% under 5 children were underweight, 7.5% were severely wasted. Only 9.6% of children 6-23 months were receiving adequate diet. More alarming was that 58.6% under 5 children were anaemic.[7]

These will be significant contributing factors to upcoming infection if at all it happens. Co-morbidities like chronic kidney disease, congenital heart disease, chronic liver disease, neuro-disability, morbid obesity, severe malnutrition, current malignancy, diabetes, immunocompromised state were also major contributing factor for COVID-19 and MISC-C.[26]

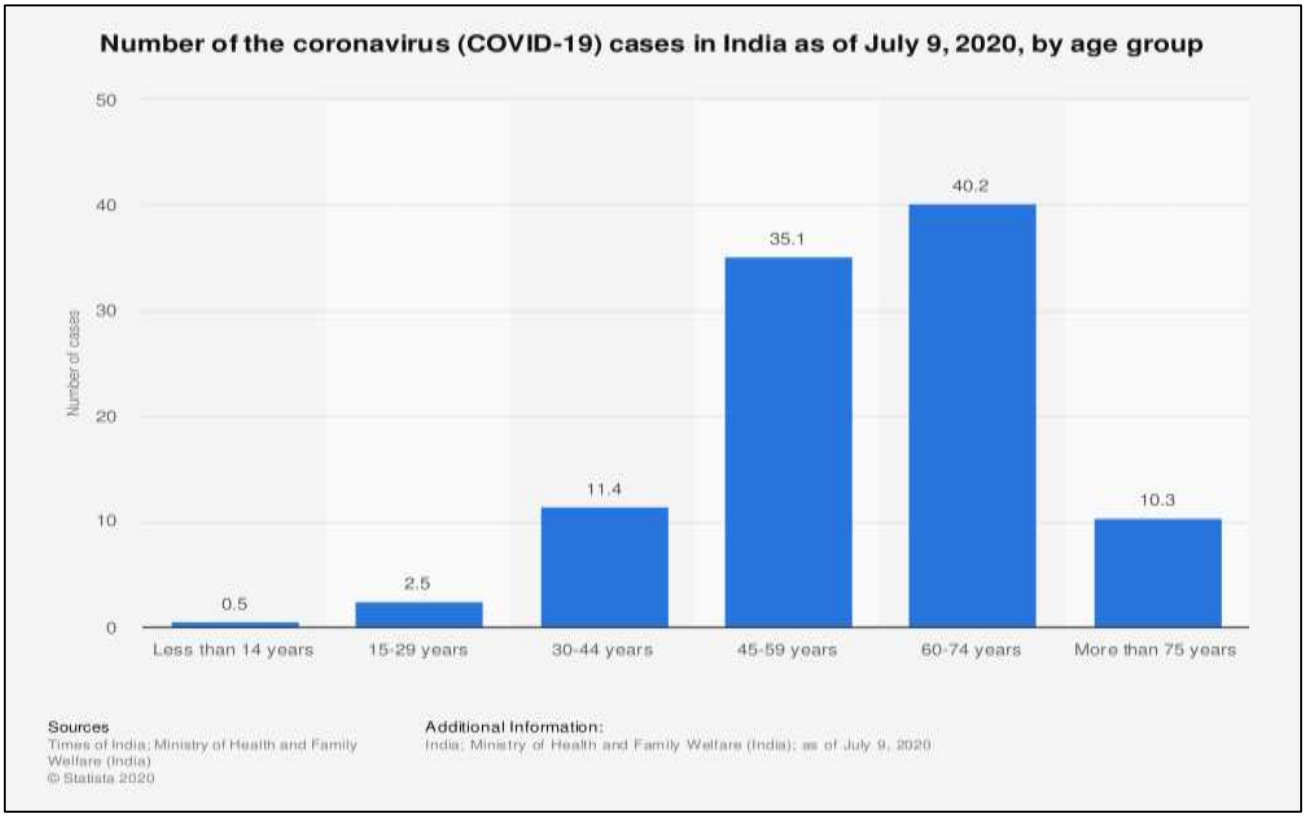

Figure 3: Age group wise distribution of COVID-19 cases during first wave in India (source: Statista 2020).[45]

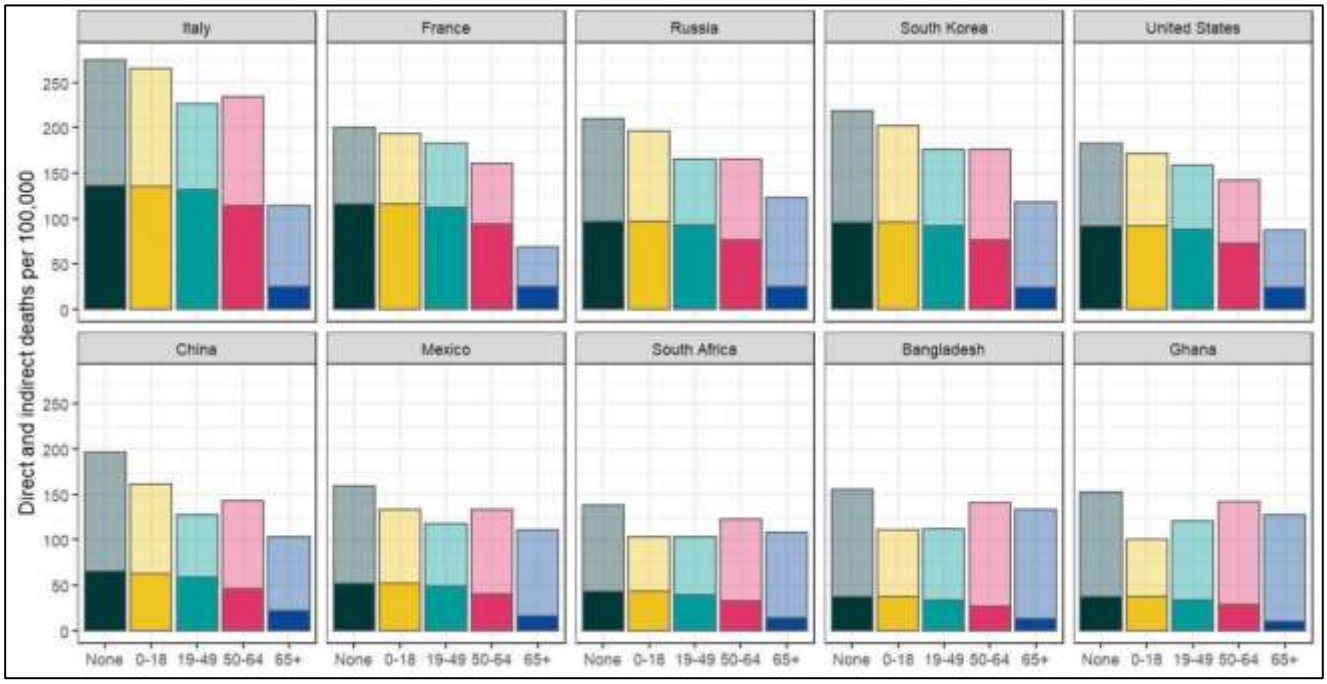

Figure 4: Estimated direct (dark) and indirect (light) deaths per 1,00,000 individuals if primary infections of specific age groups are avoided (source: Esteve et al).[44]

According to a study by Praveen et al in 2016, prevalence of childhood overweight was 5.3% in males and 5.2% in females. Based on a population projection, 3.16 million urban boys and 5.39 million urban girls in India have abdominal obesity. Along with this the overall prevalence of metabolic syndrome in 10-18 years was 4.3%.[35]

Literature have already demonstrated that presence of underlying co-morbid conditions increases the severity of COVID-19 in children.[36] Poor sanitation, poor living conditions and inaccessibility to appropriate health care services, which were common in developing countries like India, facilitates the SARS-CoV-2 infection among children.[37]

Way forward-challenges and solutions

With over 40% of Indian population being below 18 years of age and increasing every day, the age-shift in COVID-19 can have devastating effects on health and economy of the country if appropriate measures were not taken. Poor health status of children in India may further facilitate and escalate the various respiratory infections including SARS-CoV-2. SARS-CoV-2 infections in children were majorly asymptomatic and most of the time go un-noticed. Though transmission probability from younger children was less, but it was comparable to adults from older children.[38]

Compliance to COVID-19 appropriate behaviors like wearing mask, frequent hand washing, use of sanitizers and physical distancing cannot be expected from children especially younger ones. Hence, protecting the child from contracting SARS-CoV-2 infections was very much important and that will prevent the adults and elderly from getting the infections. Also, improving the nutrition status of children holds still good. Reports around the corner (print media) showed high level of antibodies among children, no scientific literature had so far published that. We can't be complacent and need to adopt appropriate public health measures so that the children are not affected greatly in the subsequent waves. The children contract infection from the confirmed or probable SARS-CoV-2 infected family members or relatives through social gathering or being exposed at home.[39] Compliance to COVID-19 appropriate behavior was impractical among children in our setting where classes are overcrowded, most of the schools lack sanitary facilities and hand-washing facilities. Screening of children for SARS-CoV-2 infection also remained a difficult and daunting task due to lack of adequate skilled manpower. Spreads of SARS-CoV-2 infection from asymptomatic confirmed cases have been documented.[40]

Also, preventing primary infection among children would lead to decrease in significant amount of mortality when age specific infections are averted (Figure 4).[41]

Few candidates COVID-19 vaccines for children have been in trial around the world.[42-44]

CONCLUSION

The two waves of the pandemic have already exposed the poor public health infrastructure like shortage of drugs, health facilities, logistics and human resources. Hence, now itself measures should be taken to improve the health system capabilities keeping in mind the future consequences. With schools, public parks being shut during this pandemic, house/social gatherings remain the primary source of infection among children. Hence, prevention and control of infection and disease among adults is of paramount importance. Also, re-opening of schools should not be done horridly and need to wait till children are vaccinated against COVID-19.

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