

# “Vaccinate every child against COVID-19”: A scientific or socioeconomic need?

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## ABSTRACT

The global pandemic of COVID-19 has created havoc worldwide. By the first week of December 2021, 0.26 billion COVID-19 infected cases and 5.2 million deaths have been reported globally.<sup>[1]</sup> United Nations Children Fund (UNICEF) reports that more than 10,000 children and adolescents have died from COVID-19, with a case fatality rate of 0.3%. Out of 299 vaccine candidates, 28 are available to the general population in less than 1 year.<sup>[2]</sup> For children, WHO permitted vaccine Pfizer/BioNTech, Sinovac, and Sinopharm, Drug Controller General of India’s approved ZyCov-D and Covaxin, and the Cuban government approved Soberna 2, and Soberna plus are available.<sup>[3]</sup> Italy, Germany, France, Norway, Switzerland, Israel, Dubai, Japan, Canada, and the US have already started vaccinating their children. This step may decrease the transmissibility and mutations of the virus and thus restore normalcy. For India, it is a question of “To be or not to be?” Indian researchers have warned of the long-term impact of the pandemic on the health, development, learning, and behavior of children, thus pushing the agenda of vaccination and opening of schools. All attempts at opening schools have failed in the last 2 years. Vaccinating children is not easy as it has taken nearly 1 year to vaccinate half of the adult Indian population. In these circumstances, rather than “vaccine for all,” “vaccine for (chronically) ill” is the only feasible solution for children.

**Keywords:** Children, COVID-19, review, vaccination

## Introduction

In 1545, Goa, India, 8000 children died due to a smallpox outbreak. This death toll continued globally until Edward Jenner discovered the smallpox vaccine in 1798.<sup>[4]</sup> Later, as we know, World Health Organization (WHO) declared the world free of smallpox on May 8, 1980, saving an estimated 5 million people annually. In 1951, Max Theiler of the Rockefeller Foundation received the Nobel Prize in Physiology or Medicine to discover an effective vaccine against yellow fever.<sup>[5]</sup> Over two centuries, vaccines developed for smallpox, diphtheria, tetanus, yellow fever, whooping cough, polio, and measles have improved children’s survival, growth, and health.

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Vaccines save more than five lives every minute – preventing up to three million deaths a year.<sup>[6]</sup> No wonder some experts worldwide consider the invention of vaccines as the eighth wonder!<sup>[7]</sup>

The 1918 Spanish Flu pandemic killed more than 50 million; measles killed 2.6 million yearly before 1963<sup>[8]</sup>; 2009 H1N1 killed 22 million Americans, 2014 Ebola more than 11 thousand before vaccination. The role of immunization in flattening the curve has been seen for decades. The faster a vaccine is deployed, the faster an outbreak can be controlled, the Smallpox and Measles vaccine being an apt example.<sup>[9]</sup>

Conventionally, it takes between 5 and 10 years to develop a vaccine for an infectious agent. This approach is not well suited for the needs imposed by the emergence of a new pathogen during an epidemic. The quickest vaccine made

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during non-pandemic times was Mumps and Hepatitis B vaccine which took 4 years. Owing to the alarming crisis caused by the COVID-19 pandemic, the global scientific community swiftly developed 299 vaccine candidates, out of which 28 are available to the general population (after approvals by certifying agencies) in a year.<sup>[10]</sup> The list includes AstraZeneca/Oxford, Johnson, and Johnson, Moderna, Pfizer/BioNTech, Sinopharm, and Sinovac vaccines.<sup>[11]</sup> The vaccines approved for Indian use, Covishield, Covaxin, Sputnik V, and Moderna, have 66.7%, 77.8%, 91.6%, and 94.1% efficacy in reducing the mortality and severity of the disease, respectively [Table 1].<sup>[12-14]</sup>

## Children and COVID-19 Vaccine

The symptoms of COVID-19 in children and adults are similar, but COVID-19 appears to be milder in children better prognosis than adults. Deaths are infrequent.<sup>[23]</sup> The case fatality due to COVID in the population under 20 years is less than 1% (0.3%). Most of the pediatric population is asymptomatic for COVID-19 infection, and the rest who present symptoms lack any specificity regarding COVID-19 Symptoms.<sup>[24]</sup>

Children and adolescents can experience prolonged clinical symptoms (known as “long COVID-1,” post-COVID-19 condition Post COVID-19 condition,<sup>[25]</sup> or post-acute sequelae of SARS-CoV-2 infection). However, the frequency and characteristics of these conditions are still under investigation. In addition, a hyperinflammatory syndrome, referred to as pediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 in Europe and multisystem inflammatory syndrome in children in the United States, although rare, has been reported to occur worldwide and complicate recovery from COVID-19.<sup>[26]</sup>

Like adults, risk factors including type 2 diabetes, asthma, heart and pulmonary diseases, neurologic, neurodevelopmental (in particular, Down Syndrome) and neuromuscular conditions, and obesity have been found to affect the severity of the disease among children.<sup>[27]</sup>

So far, there have been 269 million COVID infected cases and 5.2 million deaths reported globally.<sup>[1]</sup> UNICEF reports 10,300 children and adolescents have died from COVID-19, which is 0.3% of the 3.0 million COVID-19 deaths in 80 countries. Furthermore, in 21 countries, by April 30, 2021, more than 8,62,000 children had been orphaned or lost a custodial grandparent due to COVID-19 associated death.<sup>[28]</sup> Of these, 788,704 children were orphaned of a mother, father, or both, with most losing one parent; 73,661 lost at least one custodial grandparent and 355,283 lost at least one coresiding grandparent or older kin.<sup>[29]</sup>

One systematic review suggests that there may be a more significant impact of pediatric COVID-19 related fatality in low- to middle-income countries versus high-income countries.<sup>[30]</sup>

Among indirect impacts of COVID-19 on children, the pandemic has pushed 142 million more children into poor monetary households in developing countries, according to projections as of November 2020. An additional 140 million children in developing countries are projected to be in families living below the poverty line.<sup>[28]</sup> Furthermore, around 214 million children globally—or 1 in 7—have missed more than three-quarters of their in-person learning due to the closure of schools. Also, it is estimated that at least 463 million children worldwide were unable to access remote learning during COVID-19 school closures in 2020. In India, this number is close to 3 crores.<sup>[31]</sup> Due to COVID-19 measures, approximately 80 million children under

**Table 1: Covid 19 Vaccines approved by WHO-Emergency Use Listing (EUL)<sup>[15]</sup>**

Vaccine	Country of Origin	Eligible age <sup>[16]</sup>	Doses	Cost <sup>[17,18]</sup> (In ₹)	Efficacy (in %)
Sinovac-CoronaVac	China	3+	2 Doses 14-28 days apart	54 \$ (4005)	51 <sup>[19]</sup>
Sinopharm	China	3+	2 Doses 21-28 days apart	19-36\$ (1440-2728)	79 <sup>[20]</sup>
Pfizer/BioNTech	Germany	5+	2 Doses 21 days apart	20\$ (1431)	95 <sup>[21]</sup>
Spikevax/Moderna	USA	18+	2 Doses 28 days apart	32-37 \$ (2348-2715)	94.1
Johnson and Johnson	Netherlands and USA	18+	1 Dose	10\$ (740)	66.3 <sup>[22]</sup>
Covaxin	India	18+	2 Doses 28 days apart	4\$ (295)	77.8
Covishield	Developed in the UK and manufactured in India	18+	2 Doses After 24 days but within 84 days	2-16\$ (200-1200)	66.7
<b>Vaccines approved for use in India (not in WHO-EUL)</b>					
ZyCov-D	India	12+	3 Doses 0, 28 <sup>th</sup> day, and 56 <sup>th</sup> day	Not Declared Yet	66.6
Sputnik V	Russia	18+	2 Doses 21 days apart	10\$ (740)	91.6

\*Other available vaccines: Comirnaty, Sputnik Light, BBIBP-CorV, EpiVacCorona, Convidicea (PakVac, Ad5-nCoV), WIBP-CorV, CoviVac, ZF2001 (ZIFIVAX), QazVac (QazCovid-in), COVIranBarakat, Abdala (CIGB 66), Soberana 02/Soberana Plus, MVC-COV1901, Spikogen (COVAX-19), FAKHRAVAC (MIVAC), NVX-CoV2373 (Covovax in India)<sup>[5]</sup>

the age of 1 in at least 68 countries may miss out on receiving life-saving vaccines. Around 10 million more child marriages may occur before the end of the decade due to COVID-19.

The importance of vaccination is much greater in COVID-19, as no rationale treatment options are available. Except for India, most African nations, a few South American countries (Peru, Bolivia, Paraguay, Surinam, and Uruguay), and a few Middle East countries, the entire world has started vaccinating their children, including neighboring countries of Nepal, Bhutan, Bangladesh, Pakistan, and Srilanka.<sup>[32]</sup> As of July 2021, France and the USA had vaccinated 66% and 42% of 12 to 17 years of children with the first dose of vaccine, respectively.<sup>[33]</sup> The rationale of the government of these countries to vaccinate children is to decrease the transmissibility and mutations of the virus and thus restore normalcy. The experts are still weighing the risks and benefits as initial trials show 75.1% of the efficacy of vaccines in adolescents.<sup>[34]</sup> India's hope is on ZyCoV-D, the world's first DNA vaccine against COVID-19 manufactured indigenously. The phase-III clinical trials showed a 66.6% efficacy rate against the coronavirus. It has become the first vaccine in India to be licensed for adolescents.<sup>[35]</sup> Recently, Covaxin has also been approved for the age indication of 12 to 17 years by the government of India.<sup>[36]</sup>

As per the WHO's guideline on Vaccine Introduction, 2005, there are four criteria in considering whether to introduce a vaccine.<sup>[37]</sup> as described in Figure 1.

### The first is “What is the burden of the disease? Is it of public health concern”

Is it too infectious, affects too many, has too many complications, or is it too fatal? Covid is a pandemic of global concern. As per various studies, the symptoms of Covid-19 in children and adults are similar, but COVID-19 appears to be milder in children.<sup>[23]</sup> The case fatality due to covid in the population under 20 is less than 1%.<sup>[24]</sup> Also, the transmissibility of COVID-19 by children and among children is yet to be established.

### The second is vaccine efficacy, effectiveness, quality, and safety

The vaccine available should reduce the morbidity and mortality among children and adolescents, reduce the risk of disease transmission, and be safe. The current candidate by Pfizer is 75% efficacious. Myocarditis, pericarditis, and risk of Thrombosis with Thrombocytopenia Syndrome following adenoviral-vector vaccines have been reported in younger adults, but no data are available on the risk below the age of 18 years.<sup>[38]</sup>

### The third is financial implications

The vaccine should be cost-effective, that is, the best buy. As per census 2011, there are 36 crore children and adolescents (0–14 years) in India, and the vaccine cost is 700 to 1500 per unit, implying a cost of 25,200 to 54,000 crore to vaccinate each child in the country.

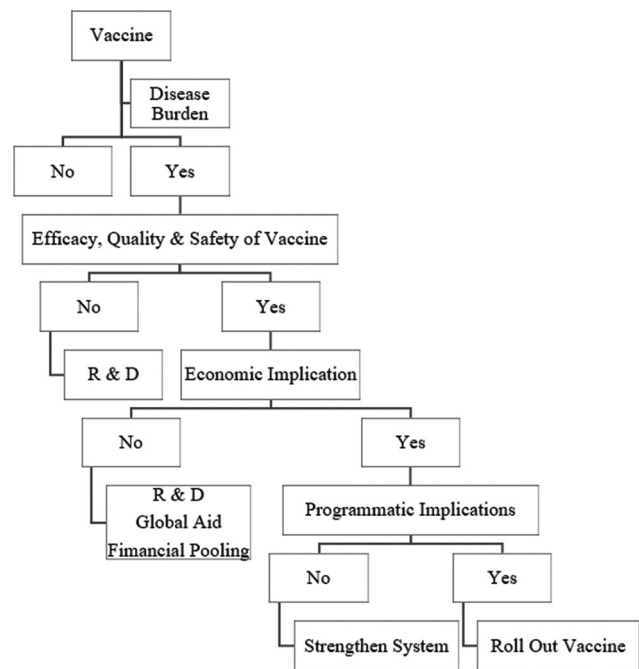


Figure 1: Criteria for vaccine introduction

In the initial stages, when the vaccination was rolled out in the country, cost sharing between the state and center became a significant issue, but later, they arrived at a consensus, and the center agreed to bear three-fourths of the cost leaving the rest to the private sector. This colossal amount can again create a financial hardship to the governments in bearing and sharing the cost. Apart from mere cost, the program will also have its own cost, like the cold chain of vaccines, human resources, and logistics.

### The fourth is programmatic issues and availability

India's public health sector has championed immunization programs and campaigns. Vaccines for 13 diseases are given free to children, adolescents, and pregnant women in the current immunization program. India is one of the largest manufacturers and consumers of vaccines and cold chains globally and has a well-established vaccination system. However, for covid vaccination, the nation depended on a single private corporation for a long time. For this reason, momentum in vaccination could not be established soon. Currently, three vaccines are under production in India, viz. COVISHIELD manufactured by M/s Serum Institute of India Pvt. Ltd., Pune, COVAXIN is manufactured by M/s Bharat Biotech International Limited, Hyderabad, Telangana, and SPUTNIK-V is either imported by M/s Dr. Reddy's Laboratories Ltd, Hyderabad or manufactured by M/s Ra (biologicals) Panacea Biotech Ltd., New Delhi.<sup>[39]</sup> It is time that the government transfers the knowledge and technology to at least half of the 26 private and public vaccine production companies in India.<sup>[40]</sup>

Second, a significant challenge is the vast, heterogeneous, and diverse population and its attitudes toward vaccination. India started COVID-19 vaccination in the country from January 2021. It took nearly 1 year to immunize half of Indian adults.<sup>[39,41]</sup>

Experts estimate that it may require one more year to inoculate every adult citizen at this speed.<sup>[42]</sup>

## Conclusion

Indian researchers warn of the long-term impact of the pandemic on the health, development, learning, and behavior of children. Return of pre-COVID routine, which includes reopening schools, may revert this effect. Hence, there is an urgency to restore normalcy in the lives of children and their wards. Reopening the schools at an inappropriate time had triggered a second wave in many countries, including Israel. Experts say schools can be opened when positivity is less than 5% and if all teachers and staff are vaccinated.<sup>[43]</sup> The fourth seroprevalence study of ICMR estimated that 50-60% of children being infected; however, high morbidity rates or mortality rates have not yet been documented in Indian children.<sup>[44]</sup>

The existing vaccine shortage and programmatic challenges make this proposal no difficult than an astronomical expedition of enormous costs! A new strategy could be to prioritize the vulnerable. Mahatma Gandhi said, “*the true measure of any society can be found in how it treats its most vulnerable members*” Children with disabilities, mental health conditions, chronic diseases, financial hardship, migrants, refugees, and rural inhabitants require more attention and effort.<sup>[45]</sup>

Flu pandemics occur when populations are new to a virus, but when a pandemic virus becomes seasonal, much of the population has immunity to it.<sup>[8]</sup> It is also possible that COVID-19 will become a less severe problem soon, just like regular flu. With recent appearance of a variant of concern – Omicron, the path of coronavirus from becoming pandemic to endemic is quite uncertain. Until we have the vaccine for all, the vaccine for (chronically) ill is the only solution. The health department can vaccinate children with chronic disease and congenital anomalies enumerated through the Rashtriya Bal SwasthyaKaryakram (A program aiming at early identification and intervention for children from birth to 18 years to cover disease, deficiency, defect, and developmental delays, including disability).<sup>[46]</sup> In India, Primary Health Care is the foremost pillar of the health system, with a vast network of community health & primary health centers and health workers. These have been the mainstay for the covid 19 response ranging from surveillance, risk communication, treatment, and vaccination. Their active involvement and private sector primary physicians can help accelerate the vaccine drive. Their participation can accelerate coverage of immunization.<sup>[47]</sup>

## Author contribution

SA and SD conceptualised and wrote the manuscript. AG reviewed the manuscript. All authors contributed to finalise the final draft.

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## Conflicts of interest

There are no conflicts of interest.

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