

## **Covid19 Vaccines for all in India: Is the country doing it right?**

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**Abstract:** Universal vaccination is essential for flattening and crushing the Covid19 (SARS-Cov2) pandemic in India. Given that India was one of the countries who got affected by Covid19 in its first wave, we got relatively adequate time to prepare for upcoming waves of the infection. However, policy uncertainty and under prioritisation of health sector damaged the life and livelihood of the population adversely. Progress in vaccination has substantially slowed down in the past few weeks and is sure to miss the herd immunity target. The truncated pricing policy as per the new vaccine policy of the Union government is bad economics because each unvaccinated or under-vaccinated individual poses threat to the rest.

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It would be never an exaggeration to state that there is hardly any other episode in contemporary India that has put the health system under stress beyond imagination especially the public sector. This is also a rare instance where traditional boundaries of health care diminished with sanitation workers, police, local self-government, revenue department, local self-government, teachers working together. It is also painful to note that there is hardly any other recent episode where humanitarian crises in terms of SOS for medical assistance, mass deaths, unending queues for cremation, dumped bodies in rivers and grounds, deepening hunger, uncertain employment, widening inequality, etc. Initially started the response as a one lump sum episode, it turned out to be a marathon (no signs of coming to an end in the near future) where scientific and systematic approach is needed. Some regions have done extra-ordinary well in terms of managing infections, health care management, creation of first line treatment centres, community kitchen, provision of additional assistance to households of 'wage goods', enhancement of oxygen supply while some others have responded without any well-laid plan.

Vaccine is found to be one of the most successful and cost-effective methods to flatten and crush the pandemic curve. Given the background on India, being the largest producer of vaccines in the world, on 19<sup>th</sup> December 2020, Union Minister for Health and Family Welfare, Harsh Vardhan declared that 30 crore people would be inoculated by June-July 2021. He reiterated that Rs 35,000 crores allocated in the Budget 2021-22 will be utilised for the purpose. In the initial stage, the Centre used to purchase Covishield at Rs 150 and share with the States. It has allocated vaccines to States based on the criteria of burden of infection (active cases) and performance (pace of administration). However, in a recent policy change in the vaccination strategy by the Union government, there are two channels for the supply of vaccines. Of those, one involves the Government of India, while the other is called "Other than Government of India" channel. In the former, the Centre will procure 50% of the manufactured doses from the vaccine producers in India, while the remaining 50% of the doses can be supplied by manufacturers directly to states and private hospitals. With the change, there is a three layered pricing for Covishield at Rs.150 for the Centre, Rs 300 for States and Rs 600 for independent domestic purchasers. Started off slowly, vaccination gained momentum in late March and early April 2021 and sharply declined since mid-April 2021. Due to acute shortage of Covid19 vaccine, many States had to shut down vaccination drive completely throwing questions of incomplete vaccination and herd immunity. Understanding the progress and pace of vaccination of Indian States forms the central objective of the paper.

### **Epidemiology of vaccination**

Vaccination has been found to be the most cost-effective method of controlling infectious diseases through acquired immunity so that when the body encounters the real disease-causing agent, body is ready to defend. There is a collective social benefit in a high vaccination coverage. Herd immunity creates group defence when a high proportion is vaccinated so as to arrest infectious disease spread. As is widely known, herd immunity stands as protective barrier especially for those who cannot be immunized (like children, individuals with multiple health risks etc). When the number of persons in a population that are immune to an ailment is reached so that it ceases to exist in the population is called herd immunity threshold (HIT). See table 1, for details of vaccine preventable diseases and its corresponding herd immunity thresholds. Given that SARS-CoV-2 is estimated to have a median R value of 5.7 (95% CI 3.8-8.9), 80-82 percent population need to be

immunised to stop its transmission and create herd immunity (Sanche S et al 2020). The extent to which vaccine can stop the surge also depends on how fast a community reaches the threshold because the effect of vaccines may last for a period of two years.

**Table 1. Herd Immunity Thresholds of vaccine-preventable disease**

Disease	Transmission	Basic reproduction number	Herd Immunity Threshold
Measles	Airborne	12–18	92–95%
Pertussis	Airborne droplet	12–17	92–94%
Diphtheria	Saliva	6–7	83–86%
Rubella	Airborne droplet	6–7	83–86%
<b>SARS-CoV-2</b>	<b>Airborne droplet</b>	<b>5.7*</b>	<b>80-82 %</b>
Smallpox	Airborne droplet	5–7	80–86%
Polio	Fecal-oral route	5–7	80–86%
Mumps	Airborne droplet	4–7	75–86%
SARS	Airborne droplet	2–5	50–80%
Ebola	Bodily fluids	1.5–2.5	33–60%
Influenza	Airborne droplet	1.5–1.8	33–44%

Source: <https://ourworldindata.org/vaccination>(accessed on May 8, 2021)and Sanche S et al 2020\*

### **Economics of vaccination**

As vaccination produces externalities reducing transmission of a disease, it can provide an incentive for individuals to be free-riders who benefit from the vaccination of others while avoiding the cost of vaccination. Vaccination for infectious diseases produces herd immunity, providing indirect benefit to unvaccinated individuals. As the result of herd immunity, the risk of infection for an individual depends on other individuals' vaccination status; risk of infection generally decreases as the vaccination coverage in a community increases regardless of an individual's vaccination status. In economic theory, a free-riding problem occurs in the market of public goods that have two main characteristics: non-rivalry and non-exclusion of consumption. Vaccination holds both characteristics. Non-rival consumption indicates that consumption of a good by one person does not affect the quantities consumed by other individuals. Goods involving non-exclusion are costly or sometimes impossible to restrict their benefits to certain individuals. Production of public goods results in positive externalities, and accordingly, herd immunity effects are described as positive externalities. Since no one is safe till everyone is safe (irrespective of national boundaries), vaccine is considered a global public good which justifies vaccination to all. Pricing vaccines at the point of consumption is, thus, found to be bad economics. This has implications for India's change in its recent vaccine policy whereby the Centre can buy at half the price of States and the private health sector will be offered four times higher price than the Centre's rate (*The Hindu, 21<sup>st</sup> April 2021*). Due to better bargaining power and authority, it makes better economics sense by the Centre to procure vaccines at the lowest possible rate and share with the States according to norms already in place.

Truncated supply chain in the name of market efficiency is expected to compound the agonies of vaccine coverage and effectiveness in India. According to official sources, Covid vaccine could cost anywhere between Rs 1,000 and Rs 1,500 per dose in private hospitals in India if the market prices announced for Covishield and Covaxin are any indication. When good number of people would skip the vaccination programme. This would create more chaos as the country would not get the desired result when a large number of the under-privileged skip vaccination. This will lead to the emergence of new strains of the virus, caused by mutations, which would help the virus dodge more frequently the immune system of even those vaccinated. The appropriate price for the people must be zero and the vaccine of such significance cannot be at the whims of the market. If not provided free-of-charge, herd immunity will elude the country.

### **Covid19 Vaccination Story in India**

National Expert Group on Vaccine Administration for COVID-19 (NEGVAC), which is providing guidance on prioritisation of population groups, procurement and inventory management, vaccine selection and vaccine delivery and tracking mechanism. The prioritised population groups for vaccination include — (i) approximately 10 million healthcare workers (HCWs) healthcare providers and workers in the healthcare setting, (ii) about 20 million frontline workers (FLWs) which includes personnel from state and central police, armed forces, home guards, civil defence and disaster management volunteers, municipal workers, (iii) approximately 270 million prioritised age group population above 50 years and persons below 50 years with associated co-morbidities. Launched on 16<sup>th</sup> January 2021 for the front line workers, from 1<sup>st</sup> March for the age

appropriate groups of above 60. Though vaccination was set to open for 18-45 age groups from 1<sup>st</sup> May, it still remains a non-starter for most States due to scarcity of vaccines and confusion over financing expenses.

Vaccine drive has roped in the private health sector and almost all hospitals empanelled under the PMJAY; all hospitals empanelled under the CGHS; all hospitals empanelled under the health insurance scheme(s) of the States and other private hospitals as decided by each State Health Department. While selecting the health facilities, following conditions were to be met (sufficient cold chain equipment and capacity, sufficient rooms/space for waiting area, vaccination and observation post vaccination, sufficient number of trained vaccinators and verifiers, ability to manage the Adverse Events Following Immunization [AEFI], as per the norms and guidelines of the MoHFW). The COVID19 vaccines would be provided by the district health office while other logistics will be made available by the private hospital. The human resource at the vaccine centres manage CoWIN portal including scheduling sessions and ensuring all vaccinations are recorded on CoWIN. Private hospitals can charge a maximum of Rs 250/dose for vaccine administration (service charge is Rs. 100/dose and cost of vaccine shot is Rs. 150/).

**Table 2 States' performance in Covid19 vaccine administration**

States	Public	Private	Total	Dose 1 (in millions )	Dose 2 (in million s)	Total doses (in millions )	Populatio n (in millions)	Percent of populatio n covered with one dose	Percent of populatio n covered with two doses	Wastag e
Andhra Pradesh	1584 (87)	245 (13)	1829	5.4	1.9	7.3	52	10	3.6	-0.80
Assam	790 (96)	32 (4)	822	2.3	0.6	2.9	34	6.7	1.7	6.04
Bihar	<b>2428 (98)</b>	<b>48 (2)</b>	2476	6.4	1.4	7.8	120	5.3	<b>1.1</b>	5.2
Chattisgarh	3012 (97)	103 (3)	3115	4.9	0.8	5.7	29	16.8	2.7	2.49
Delhi	<b>573 (75)</b>	<b>194 (25)</b>	767	3	0.8	3.8	20	15	4	2.26
Gujarat	4395 (96)	128 192 (4)	4587	10.7	3.2	13.9	68	15.7	4.7	1.49
Haryana	1026 (89)	(11)	1154	3.6	0.7	4.3	29	12.4	2.4	6.54
Himachal Pradesh	496 (98)	9 (2)	505	1.7	0.3	2	7.3	<b>23.2</b>	4.1	-2.95
J&K	1236 (99)	13 (1)	1249	2.2	0.4	2.6	13	17	3	1.77
Jharkhand	1429 (94)	725 92 (6)	1521	2.7	0.5	3.2	37	7.2	1.3	2.22
Karnataka	6255 (90)	(10) <b>421</b>	6980	8.6	2	10.6	66	13	3	-9
Kerala	<b>1401 (77)</b>	<b>(23)</b>	1822	6.2	1.7	7.9	35	17.7	<b>4.8</b>	<b>-5.2</b>
Madhya Pradesh	3550 (96)	164 (4)	3714	7.2	1.4	8.6	82	8.7	1.7	2.85
Maharashtra	3940 (91)	389 (9)	4329	14.7	3.3	18	122	12	2.7	0.22
Odisha	376 (89)	45 (11)	421	5	1.1	6.1	44	11.3	2.5	-2.92
Punjab	3019 (94)	202 (6)	3221	3.2	0.6	3.8	30	10.6	2	4.94
Rajasthan	3520 (95)	692 202 (5)	3722	11.4	2.6	14	77	14.8	3.3	5.56
Tamil Nadu	3772 (84)	(16) 628	4464	4.9	1.6	6.5	76	6.4	2.1	3.98
Telangana	1050 (80)	(20)	1318	4.3	0.8	5.1	37	11.6	2.1	6.73
Uttar Pradesh	4811 (95)	273 (5)	5084	10.9	2.7	13.6	225	<b>4.8</b>	<b>1.2</b>	2.74
Uttarakhand	512 (89)	66 (11)	578	1.8	0.5	2.3	11	16.3	4.5	-0.16
West Bengal	1504 (92)	136 (8)	1640	8.8	3.1	11.9	97	9	3.1	3.37
<b>INDIA</b>	<b>64348 (92)</b>	<b>5405 (8)</b>	<b>6975 3</b>	<b>133.8</b>	<b>34.4</b>	<b>168.2</b>	<b>138</b>	<b>9.7</b>	<b>2.5</b>	

Source: [www.cowin.gov.in](http://www.cowin.gov.in) (as on 8<sup>th</sup> May 2021)

Percentage of the population fully vaccinated helps us understand how close a particular State is in achieving a level of immunity that could slow or stop transmission of the virus. The proportion of population covered with one shot of any vaccine was 9.7 percent and two shots was 2.5 percent as on 8<sup>th</sup> May 2021. Covishield (90.3 percent) and Covaxin (9.7 percent) have been the vaccines in use since the launch (GoI 2021). Among the population provided with at least one dose, 52.4 percent were males and the rest were females and other genders. In all the States, more than 92 percent of all vaccination centres are in the public sector and more than 96 percent of vaccinations by the public sector (*ibid*). Number of vaccine centres were as high as 70000

during 1<sup>st</sup> week of April which were reduced to as low as 40000 during early May primarily due to acute vaccine shortage. Number of vaccine doses administered was as high as three million per day in early April which came down to less than one million in early May. Due to better spread of public sector vaccination centres and utilisation is free at the point of service, it is natural that public sector is the preferred choice. Media reports indicate that people were willing to pay for vaccines but could not get appointments even in private sector.

States like Himachal Pradesh and Kerala made strong progress in coverage earlier and is facing serious shortages and majority of the vaccination centres had to be shut down in these States. Odisha is one State which has made greater improvements in coverage probably due to better governance, despite its traditionally poor human development record. It has done reasonably well in minimising case fatality rate, higher oxygen stock, and minimisation of spread of infection possibly due to better planning and vibrant disaster management system. Uttar Pradesh continues to be on the lower side in terms of coverage of first and second doses of vaccination. Since coverage can be logically correlated with magnitude of spread of Covid19 virus, States having higher reported cases and fatality are expected to have a higher consumption of vaccines (Kerala, Maharashtra etc). Kerala has a better coverage of vaccines due to multiple factors including its higher HDI record, accessible health services, responsive health system etc. Covid19 has once again proved its significance of the public health care delivery system, whatever dilapidated it is. Hilly States like Himachal Pradesh, Jammu & Kashmir have relatively better coverage of vaccines primarily due to concerted efforts of the public health system where role of private sector is very minimal. In high income States, coverage has increased, thanks to better developed private health care delivery system too. Generally, about 90 percent of all preventive and promotive care in India are provided by the public health care delivery system while, in case of curative care, private sector serves the majority (GoI 2019). In States where the private health care delivery system is predominantly hospital oriented (better developed), private hospitals also partner in a relatively major way in vaccine administration. Evidence suggests that regions with higher income tend to have more private hospitals than individual run private medical practitioners and clinics (Baru 1994; GoI 2019).

Assuming a herd immunity of 80-82 percent of the population, the total number to be inoculated is roughly between 1080-1110 million population. At the current pace of 1.5 – 2 million people per day, India will need roughly another 450-600 days (15-20 months). Given that the life of antibodies created by the vaccines last for a maximum of 18-24 months, vaccine might not give the desired outcomes. Besides, it may take about 10 years for full vaccination (two doses per person) for full vaccination for 80 percent population. Thus, the government's proclaimed targets of July 2021 (300 million people) and September 2021 (60 percent population) deadlines are certain to be missed.

### **Efficiency in vaccine administration**

Wastage has become a serious issue when an RTI in early April revealed that thousands of doses were wasted at different levels of vaccine administration. Many regions have wasted beyond the acceptable level of loss meanwhile many regions were facing shortages of vaccines. Wastage normally occurs at three levels: during transportation, at the cold chain point and at the vaccination centre. Far flung areas (such as NE India, Andaman, and Lakshadweep) are likely to have more wastage. Wastage in unopened vials can happen due to reasons such as delayed arrival of the destination after its expiry date, exposure to temperature beyond normal levels, suspected contamination and inefficient vaccine administration. In the case of unopened vials, there are problems of expiry, heat exposure, theft and breakage that lead to wastage. Underused vials need to be discarded at the end of the session. The date and time of opening of vials needs to be written on the vial because all open vaccine vials need to be discarded after 4 hours of opening or at the end of session, whichever is earlier. This is used as a primary indicator of wastage of vaccines and States with lower utilisation have wasted thousands of doses. States having higher ability to encourage those eligible to accept vaccinations on time, training of staff and inventory management are important in minimising vaccine wastage.

Among the States, Haryana accounts for the second highest state with wastage of 6.65 per cent Covid-19 vaccines followed by Assam (6.07 per cent), Ministry of Health and Family Welfare's (MoHFW), GoI reported the data till first week of May. Rajasthan has reported 5.50 per cent wastage of Covid-19 vaccine, Punjab reports 5.05 per cent and Bihar recorded 4.96 per cent wastage of Covid-19 vaccines. However, States like Kerala, Odisha, Himachal Pradesh have done extremely well in avoiding wastage. Rather, they have extracted more from each vial. For example, due to vigilant administration of vaccines, Kerala nurses could additionally provide more than 100,000 doses allocated to the State. In some States, higher wastage is reported in private hospitals as high as 10-15 percent and it is channelled for the non-eligible groups. Universal vaccination, instead of rationing, for whole population will arrest such practices.

As is fairly known, infrastructure to provide vaccines in the country have also been skewedly distributed. For example, one in four cold chain points, iced lined refrigerators and deep freezers in India were reported to be in four states--Tamil Nadu, Andhra Pradesh, Kerala and Rajasthan, according to data from the National Cold Chain Management Information System as on December 6, 2020. This seriously indicates the significance of

strengthening health infrastructure beyond the block PHC levels. Some of the measures to save vaccines include: daily vaccination drives must be well mobilised and planned, vials must be opened only when approximately 10 participants arrive, adequate training must be given to healthcare workers on how to draw doses, rumours and misinformation about vaccines must be dealt with addressed through authentic information through social media platforms as well.

Ensuring vaccination for all is not an easy task if the history of vaccination in the country is any pointer. Despite being free and evidence-based only 65 percent of the children are fully immunised in India (IIPS 2020). Financing could be the single most important barrier for immunization drive as presence of out-of-pocket expenses drive down coverage (NSSO 2020, IIPS 2020). Inequality in coverage of vaccines is a well-known story in India. For instance, urban infants have higher coverage than rural infants and those living in urban slums and a strong positive relationship between household wealth and vaccination rates (Mathew 2012). In States like Uttar Pradesh, Bihar, Rajasthan, Odisha and Jharkhand where the last point of the cold chain stops at block level (Selvaraj&Farooqui 2014), which covers roughly 2-3 lakh population, reaching wider coverage itself would be a daunting task. In a country where universal immunization is hampered by lack of knowledge about immunization (30.3%), apprehension about side effects of vaccination (28.8%), and lack of knowledge about subsequent doses (22.09%) (Kumar et al 2010), addition of financial burden on the households is sure to dampen the pace of immunisation and “crushing the corona curve” will be a slow process.

India's vaccine diplomacy failed its citizens where the country exported 66 million doses to 84 countries at a rate cheaper than domestic price. The irony is that 64 countries had lower percent case load and death rate per million population compared to India (Asianet News 8<sup>th</sup> May 2021). Israel has become one of the first countries with a sizeable population to undertake mass vaccination and bring back a near normal life for its population. Quick coverage may bring about herd immunity swiftly and reduce costs on the government and households. Currently, there is uncertainty in the frequency of vaccine supply to States and most of them demanded that stocks may be ensured for at least for a week for to plan the administration of vaccines. Opening up of more camps may be needed and structures like schools and colleges could be used. Active surveillance, contact tracing, quarantine and early physical distancing efforts are complementary to vaccination to stop the contagion.

Union Budget 2021-22 has earmarked Rs 35000 crores for vaccines which will be adjusted in the Finance Ministry's grants to States (Budget documents 2021-22, GoI). It effectively means that the actual burden of Covid-19 vaccination is borne by the States and not the Centre. Appropriate explanation was not forthcoming regarding why the amount could have used for vaccine procurement by the Centre. If the Union government can force the vaccines to be available at the originally agreed price of Rs. 300 per person (two shots), India will need approximately Rs 33,000 crores to inoculate 80 percent population which is below the allocated Budget figures. However, in the present case of 50 percent quota to be bought by States at the rate of Rs 600 per person (two shots), the expenditure commitment of the States will double. Since prevention of communicable diseases is in the Concurrent List, the Centre should have, indeed, taken the responsibility and should not have passed on the burden to already pauperised provincial governments. Though a number of States have already committed to its residents that they will provide free vaccines, there are many who have not declared free vaccines, there is every chance that some population will not get protected which is a serious risk factor.

Besides, there is not much information available in the public domain about the PM-CARES fund and the resource inflow or outflow except some privately audited information for the year 2019-20. In May 2020, it was announced that 50000 ventilators would be supplied to State and Central owned public sector hospitals with an allocation of Rs, 2000 crores under 'Make in India' and two of the firms given supply orders failed clinical evaluation (*The Hindu* 20<sup>th</sup> August 2020). Financial burden imposed by Covid19 treatment is beyond any parallel as every day stories of extortionary pricing by private sector emerge from all almost all States. In the second wave, the situation is so grim that people are willing to overcommit any amount to obtain a hospital bed and medical oxygen. Earlier studies suggest that in States where public sector performs efficiently, the difference in cost of treatment between public sector and private sector is minimum (Krishnan 1994; GoI2006) implying that a vibrant public sector helps in controlling the cost of treatment. Thus, public sector is crucial in setting up quality and quantity benchmarks in health care market. Case-fatality rate is likely to shoot up in the coming days as lots of positive cases are now being treated at home and hospital beds are in extreme short supply. Governments should immediately arrange alternative arrangements like mass setting up of first line treatment centres in schools, colleges in the private and public sector, utilise university students for mapping critical areas and identify cases. States with resilient public health care delivery system tend to reduce mortality as well. For example, Kerala has one of the lowest case fatality rate (0.3) among major States in India. This shows that investment in public health is a worthy action fetching significant returns in the long run.

To sum up, despite the second most affected country in terms of case load and third in terms of lives lost, India's vaccine coverage is substantially below the world average. For example, India is in the 55<sup>th</sup> position in terms of coverage despite own domestic capabilities. Given the current pace of vaccination (1.5 million doses

per day), during the next 90 days (July 2021), we may reach a maximum of 253 million population which will be just 17-18 percent of population. Scaling up coverage requires well laid planning and resources which is not yet forthcoming. Given the uncertainty looming large over pricing of vaccines with three layered pricing for Covishield (Rs.150 for the Centre, Rs 300 for States and Rs 600 for independent domestic purchasers), the States might have different approaches to vaccine coverage and is certain to affect consumption of vaccines. With Covaxin being priced at Rs 800 and Rs 1200, the cost of vaccines are to shoot up and the goal of universal vaccine is to remain a pipe dream. Shifting a big part of the financial burden to 28 state governments and letting private hospitals buy doses at 600 to 1200 and sell them to patients at even higher prices are both poor economics. In a country already suffering from loss of livelihood and inequalities amidst continuous lockdown since March 2020, charging them is sure to lead to unfair and lopsided distribution. The current system gifts enormous power on the pharma firms to decide who consumes medicine and where. Contemporary history tells that it took eight years for the poor in India and Africa access to ART for HIV/AIDS. Pfizer and Glaxo-SmithKline own patent for the last twenty years for pneumococcal conjugate vaccines (PCV), but still 2000 children dies, not able to afford it (Oxfam 2021). The only way before us is to put people first and profit later. Intellectual property should not be a constraint for a global public good like essential vaccine. Though private sector is independent, in the era of extra-ordinary emergency, they should act as agents of the state in vaccination and Covid19 case management. It is time for a massive Covid Budget incorporating components of transparency and cooperation among the Union and federal units and local self-governments and strengthen the public sector in an enormous way. Since the potency of vaccines is below two years, it will have to be a routine item in the Budgets of governments for many years. With exponential vaccine demand, more human resources in logistics and administration are to be planned and implemented effectively. For all this to happen, the distance between the citizens and the political administration need to be minimum. That is a moot question.

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