EXAMINING INDIA'S TRYST WITH INDIGENOUS VACCINES:

Role of Technology, Equity, Accessibility, and Diplomacy During COVID-19

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VACCINE EQUITY, TRANSPARENCY, AND ACCOUNTABILITY IN ASIA:
Realities and Dilemmas

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PART I: INTRODUCTION TO INDIA'S VACCINATION EXPERIENCE

1.1. State and trends of COVID-19 and vaccination in India

The outbreak of COVID-19 created a crisis in India. As in other countries, socio-economic challenges were magnified during this period as the Indian government imposed a lockdown on 24 March 2020, and many states continued to implement lockdowns where infections surged (Ministry of Home Affairs [MHA], 2020). India's lockdown was considered among the most stringent in the world. It halted all economic, commercial, transport, and educational activities, except essential services, magnifying challenges including unemployment, malnutrition, poverty, and the urban-rural divide (Iyer & Maiorana, 2021; MHA, 2020).[1]

On 20 January 2020, India reported its first COVID-19 case in Kerala. As of 29 March 2023, India has seen over 44,707,525 reported COVID-19 cases nationwide, and 530,841 reported COVID-19 deaths (WHO, 2023). India has been hit by three waves of the pandemic as the virus mutated into different variants, resulting in vulnerability over a long period of time. The fatality rate for the first wave was low, and the stringent lockdown imposed by the government deterred local transmissions. However, during the second wave (driven by the Delta variant) there were over 400,000 cases reported daily (Bhatt, Srivastava, Schmidt-Sane, and Mehta, 2021), leading the country into utter panic amid overwhelmed public health infrastructure and a slow vaccine rollout. The third wave, driven by the Omicron variant, was milder than the second, with fewer deaths and a faster peak.

The impact of this crisis was felt differently across diverse social groups. Studies identified migrant workers, women, "backward castes", and tribal and religious minorities as disproportionately affected (Dalberg, 2021; Iyengar & Jain, 2021; Behera & Dassani, 2021). Among the most impacted were migrant workers employed at construction or industry sites, at factories, and as domestic help in urban areas. The sudden lockdown led to loss of jobs and income, and individuals were forced to move from rural to urban areas in search of better wages and employment opportunities. It posed questions about their uncertain future in urban areas (Iyengar & Jain, 2021). With transport facilities suspended, many migrant workers were forced to take hazardous journeys or walk hundreds of kilometres to reach home, only to find their fellow villagers blocking their entry out of fear of transmission (Jesline, Romate, Rajkumar et al., 2021; Anonymous 2, personal communication, 4 December 2022).

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[1] These essential services include defence, police, home guards, emergency forces, district administration and municipal bodies focused on water supply, electricity, sanitation, etc.

1.1.2. India's vaccination strategy

India's Ministry of Health and Family Welfare (MOHFW) formulated India's vaccination drive in January 2021. The strategy was informed by the recommendations of task forces, namely the National Expert Group on Vaccine Administration (NEGVAC)[2] and the Empowered Group on Vaccine Administration for COVID-19, which strived to identify scope for domestic vaccine production, methods of vaccine procurement, methods for vaccine distribution, and priority groups for vaccine administration (PIB, 2021). In light of this, the Government of India (GoI) operationalised its vaccination drive on 16 January 2021, intending to vaccinate 300 million Indian citizens belonging to the highest priority groups[3], at 3,006 vaccination sites across the country (WHO, 2021).

The GoI was responsible for formulation of the vaccination strategy, vaccine procurement, and vaccine administration, while state governments were to provide logistical and operational support (Kumar, Pandi-Perumal, Trakht & Thyagarajan, 2021). State governments were also responsible for creating awareness and local capacity building, such as ensuring adequate vaccination sites, human resources, and cold chain points across the state. Initially, vaccines were procured solely by the GoI and administered at government public healthcare facilities, government-run schools and colleges, and other locations, free of cost. However, as the GoI expanded the coverage of the vaccination drive, under the 'Liberalised Pricing and Accelerated National Covid-19 Vaccination Strategy' scheme, it permitted state governments and private stakeholders to procure vaccines directly from vaccine manufacturers and establish vaccination sites (MOHFW, 2021).

India has now administered over 2.2 billion COVID-19 vaccine doses, of which 1.2 billion are primary doses, 951 million secondary doses, and 227 million precautionary doses (Co-WIN, 2023).[4] Of India's population eligible for vaccination, 87.8% (1,084,173,000) had been fully vaccinated as of 16 March 2023 (Vaccinate-India, 2023).

1.1.3. Vaccines approved in India

The first vaccine approved by Indian regulatory authorities was Covishield, developed by Oxford-AstraZeneca and manufactured by the Serum Institute of India (SII) in January 2021. Since then, the GoI has granted restricted emergency-use authorisation to 12 vaccines (see Table 1). While some of these vaccines were domestically produced, the rest were developed by local pharmaceutical companies in collaboration with foreign-based vaccine developers. As the pandemic evolved, certain foreign vaccines such as Jcovden, Spikevax, and Vaxzevria were permitted to be used in India.

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[2] This working group was constituted in 2020 and comprised of members from different government departments and ministries, with a few technical experts. https://pib.gov.in/PressReleasePage.aspx?PRID=1694439

[3] As per GoI policy, healthcare workers and frontline workers were identified as the top priority groups due to their vulnerability to COVID-19.

[4] Updated as of 18 February 2023.

An exception was the early entry of Sputnik V (Gam-COVID-Vac) developed by Gamaleya in Moscow, Russia. This entry was possible due to the regulatory approval of Dr Reddy's Laboratories, an Indian research and diagnostics centre, which conducted human trials with the Sputnik vaccine (Kumar, Pandi-Perumal, Trakht & Thyagarajan, 2021). Eventually, Russia's Russian Development Institute Fund and the Gamaleya Center for Epidemiology and Microbiology collaborated with Indian companies to manufacture the vaccine at a large scale.

Table 1: COVID-19 vaccines in India

No.	Vaccine	Producer	Type of Vaccine	Country of Origin
1	Covishield (Oxford/ AstraZeneca formulation)	Serum Institute of India with Oxford	Non-replicating Viral Vector	India
2	Covaxin	Bharat Biotech	Inactivated	India
3	Jcovden	Johnson and Johnson	Non-Replicating Viral Vector	Developed in Netherlands, parent company from US
4	Sputnik V	Gamaleya	Non-Replicating Viral Vector	Russia
5	ZyCoV-D	Zydus Cadila	DNA	Developed in India by Cadila Healthcare
6	Corbevax	Biological E Limited	Protein Subunit	Developed in US; Vaccine licensed for development and production to Indian pharmaceutical company.
7	Spikevax	Moderna	RNA	US
8	Covovax (Novovax formulation)	Serum Institute of India	Protein Subunit	India
9	Gemcovac-19	Gennova Biopharmaceuticals Limited	RNA	India
10	Sputnik Light	Gamaleya	Non-Replicating Viral Vector	Russia
11	Vaxzevria	Oxford/ AstraZeneca	Non-Replicating Viral Vector	Developed by Europe Medical Agency

| 12 | iNCOVACC | Bharat Biotech | Non-Replicating Viral Vector | India |

Source: COVID-19 Vaccine Tracker (as updated on December 2022)

Covishield and Covaxin were the first vaccines to be approved under the condition of "restricted use in emergency situations" (The Hindu, 2021). Covishield, developed by the SII in association with Oxford-AstraZeneca, Codagenix, and Novovax, is an Adenovirus vector-based vaccine (Voysey et al., 2021). The vaccine's efficacy, safety, and immunogenicity data showed over 70% vaccine efficacy, which led to its approval. Thus, in the case of Covishield, the research and development and initial manufacturing of the vaccine was done through foreign assistance; however, mass production of the vaccine was undertaken by the SII (The Economic Times, 2021). The second vaccine approved was Covaxin, produced by Bharat Biotech International Limited in collaboration with the National Institute of Virology of the Indian Council of Medical Research (ICMR) (Kumar, Pandi-Perumal, Trakht & Thyagarajan, 2021).

It is interesting to note that an analysis of the administered vaccines by type identifies Covishield as India's most administered vaccine, with over 1.696 billion doses administered (Kanwal, 2022), followed by Covaxin (351 million doses), Corbevax (70 million), Sputnik (1.23 million), and Covovax (0.02 million) (Kanwal, 2022).

1.1.4. India's vaccine export policy and competition with China

After the national vaccination drive was launched, India's External Affairs Minister, Dr S. Jaishankar, announced the Vaccine Friendship (Vaccine Maitri) campaign, to export vaccines to other countries as a goodwill gesture. India sent vaccines to its South Asian neighbours and some low and middle-income countries of the Global South, among others (PIB, 2021).[5] This campaign focused on utilising India's vaccine production and delivery skills to meet the vaccine requirements of the Global South and contribute towards vaccine equity (Rai, 2021).

In consonance with India's "Neighbourhood First Policy", Bhutan was the first recipient, on 20 January 2021 (Rai, 2021). Over the next few months, the SII manufactured over 66.4 million doses and exported to 95 countries across Asia, Africa, the Middle East, and South America (Iyer & Maiorano, 2021). It sent approximately 20 million of these doses to the Global Alliance for Vaccines and Immunization (GAVI), sold 35.8 million through commercial contracts, and gave over 10 million as grants (Iyer & Maiorano, 2021). The Vaccine Maitri campaign had two implications. Domestically, it allowed the GoI to declare a victory over COVID-19, emphasising the efficiency and self-reliance of the elected government. Globally, it allowed India to earn goodwill with its immediate neighbours, with whom it shares a rocky relationship, and to strengthen its relations with its key partners. The campaign was also viewed as successfully countering China's aggressive vaccine diplomacy in the Global South (Iyer & Nachiappan, 2021).

In April 2021, a surge in COVID-19 infections, with 300,000 cases reported daily and 2,000 deaths in a single day,[6] brought into focus the shortages and weaknesses in India's public healthcare system (Johns Hopkins University and Medicine, 2021). The GoI was unable to increase the pace of vaccination despite increased demand, resulting in internal vaccine supply shortages and leading it to halt vaccine exports (Gettleman, Schmall, & Mashal, 2021). This halt meant that countries expecting vaccine doses from India did not receive them, creating shortages in other countries and hurting India's ability to position itself as a prominent global vaccine supplier; China took the opportunity to fill the supply gap for low-income countries in South and South-East Asia (Pal, 2021; Bose, 2021). By providing "a more diversified and stable" regional supply of vaccines, China emerged as a reliable alternative in the vaccine supply stream.

India remained one of the only global south countries not importing vaccines from China. Consultation with experts in India revealed that the GoI was apprehensive about importing Chinese vaccines because there were doubts regarding their safety — in particular the limited evidence, in the first phase of the pandemic, demonstrating the effect of the Chinese vaccines on the human body (Anonymous 5, personal communication, 10 December 2022).

As India pushed through this crisis, it re-initiated its vaccine diplomacy endeavours by exporting vaccines to over 100 countries and continuing to contribute to GAVI, the UN Peacekeeping force, and others. As of January 2023, India had exported 291.5 million vaccine doses, of which 224.6 million doses were sold and 14 million doses exported as grants (MEA, 2023). The largest recipients of India's vaccine exports have been Bangladesh (28 million doses), Myanmar (21 million), Nepal (9 million), and Bhutan (550,000), followed by Maldives, Sri Lanka. and Brazil (MEA, 2023).

1.2.   Research methodology

The author conducted in-person and virtual interviews with academics, policy practitioners, members of international and domestic non-governmental organisations (NGOs), and officials from the GoI and Indian state governments.

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[5] Some of the countries India exported vaccines to were Bangladesh, Nepal, Bhutan, Myanmar, Maldives, Mauritius, Seychelles, Sri Lanka, Bahrain, Brazil, Morocco, Oman, Egypt, Algeria, South Africa, UAE, Barbados, Dominica, Argentina, and Ukraine.

[6] These figures are believed to be under-reported, with actual figures much higher.

Table 2: Details of interviews

No.	Name	Position/ affiliation	Area of expertise	Type of stakeholder	Date of interview	Mode of interview
1	Dr Anurag Aggrawal	Dean of Biosciences and Health Research, Ashoka University, India; Former Director, CSIR Institute of Genomics and Integrative Biology, New Delhi	Health research	Academia; practitioner	3 Dec 2022	In-person meeting
2	Dr Shamika Ravi	Member, Economic Advisory Council to Prime Minister (EAC-PM); Non-resident Senior Fellow, Brookings Institution, Washington D.C.; Vice-President of Economic Policy, Observer Research Foundation (ORF)	Economics of development with a focus on finance, health, urbanisation, and gender	Academia; policy advisor	19 Dec 2022	Virtual meeting
3	Dr Raj Shankar Ghosh	Senior Advisor, Vaccine Delivery Program	Vaccination in India	Academia; policy practitioner	16 Dec 2022	In-person meeting
4	Dr Anant Bhan	Advisor, Sangath; Past president, International Association of Bioethics (2017-19); Key resource person for trainings in global health and public health ethics	Bioethics; global health and public health ethics	Academia and policy practitioner	9 Dec 2022	Virtual meeting
5	Dr Santosh Shukla	State Immunization Officer in Bhopal, Madhya Pradesh	Responsible for Vaccine immunisation, including COVID-19 vaccines	Government	8 Dec 2022	In-person meeting
6	Dr Bali Deepak	Professor of Chinese and China Studies, Jawaharlal Nehru University (JNU), India	China expert	Academia	13 Dec 2022	In-person meeting
7	Anonymous 1	-	Vaccine delivery system in India	NGO	8 Dec 2022	In-person meeting
8	Anonymous 2	Civil Servant (District Magistrate) from Chattisgarh, India	Policy implementation	Government	4 Dec 2022	Virtual meeting
9	Anonymous 3	Civil Servant in Maharashtra	Policy implementation	Government	4 Dec 2022	Virtual meeting
10	Anonymous 4	Chief District Medical Office		Government	7 Dec 2022	Virtual meeting
11	Anonymous 5	Consultant at a think tank	Health research	Academia	10 Dec 2022	In-person meeting
12	Anonymous 6	Advisor to the state government in Madhya Pradesh	Policy implementation	Government	7 Dec 2022	In-person meeting
13	Anonymous 7	Professor at a think tank	Health policy expert	Academia	5 Dec 2022	Telephone

Primary interviews were triangulated with secondary research from government reports, official policy documents, and academic research. Data was also retrieved from COVID-19-related dashboards such as the Covid Vaccine Intelligence Network (Co-WIN) portal, the COVID-19 vaccine website of the Indian Council of Medical Research (ICMR), and Our World in Data.

PART II: INFORMATION ACCESSIBILITY ON COVID-19 VACCINES IN INDIA

2.1. India's communication strategy

One of the first steps taken by the MOHFW in developing India's vaccination drive was to build a roadmap of its communication strategy, titled 'COVID-19 Vaccine Communication Strategy' (Ghosh, personal communication, 16 December 2022). The strategy identified five critical pillars through which information around COVID-19 vaccines and vaccination was to be disseminated: advocacy, capacity building, media and social media engagement, social mobilisation and community engagement, and Adverse Event Following Immunisation (AEFI) crisis communication (see Figure 1).

Figure 1: Key elements of India's communication strategy

Source: MOHFW (2021)

2.1.1. Advocacy

The GoI and state governments engaged with key influential stakeholders such as the Prime Minister, parliamentarians, politicians, and religious or faith-based leaders, encouraging them to utilise their

platforms to influence citizens to get vaccinated (MOHFW, 2021; Ghosh, personal communication, 16 December 2022). Vaccinations of national leaders were televised, and their vaccination experiences were recorded to inform the public. Meanwhile, this also acted as a trust-building mechanism (The Indian Express, 2021).

The GoI developed multimedia awareness campaigns and distributed leaflets at the household-level in different languages. Additionally, interviews and frequent question-and-answer sessions were conducted with experts from the medical field, which were nationally broadcast across television and social media outlets (The Indian Express, 2021; Ghosh, personal communication, 16 December 2022).[7] At the state and district level, local networks, including the local Panchayat (village council), Accredited Social Health Activist (ASHA) workers,[8] and political and religious leaders, informed people about the benefits of vaccination. These local networks moved door-to-door to spread awareness, but also to collect data regarding the number of people showing COVID-19 symptoms (Anonymous 2, personal communication, 4 December 2022). Often, government and medical officers posted in districts and villages travelled with health workers to raise awareness, as their academic and technical expertise was assumed to reassure citizens, ensure citizens' trust in these officials, and make them more receptive to the information being provided (Anonymous 2, personal communication, 4 December 2022; Anonymous 3, personal communication, 4 December 2022).

2.1.2. Capacity building

The pandemic revealed deep cracks in India's public healthcare system, and one challenge that emerged was a shortage of healthcare workers and frontline workers across India (Perappadan, 2019). This limited the country's ability to disseminate information and was a barrier to providing healthcare. Therefore, GoI, state, and local governments re-invigorated pre-existing community networks, such as those formed by ASHA workers and self-help groups, and supported the engagement of more personnel in the vaccination process. Through engagement with civil society, a network of people who could inform wider society of the ongoing vaccination drive was formed (Anonymous 1, personal communication, 8 December 2022). However, there were instances of citizens reporting little knowledge of the efficacy of vaccines — a few even believing that vaccines only had water in them — illustrating an information gap (Ghosh, personal communication, 16 December 2022).

2.1.3. Media engagement and social media

Anticipating that misinformation could negatively affect the vaccination drive, one of the GoI's first steps was to build a communication cell in the MOHFW, with a mandate to address misinformation around vaccine efficacy and the overall vaccination process (Anonymous 5, personal communication, 10 December 2022). This communication cell was replicated across all levels of government,[9] with each cell tracking instances of misinformation across social media forums (Ghosh, personal communication, 16 December 2022).

The GoI leveraged social media platforms by creating FAQ infographics, videos, animations, and other materials informing people of the vaccination drive. On the MOHFW's official website, it built a toolkit which provided information on government guidelines around vaccination, international travel, and digital vaccine records.[10] It also regularly published real-time updates on the number of COVID-19 cases in India, by state, and the number of cases treated and discharged (see Figure 2). The easy accessibility of such information for the public was a unique feature of India's vaccination drive and the GoI's communication strategy.

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[7] The following video is an example of the videos and interviews created to inform the public on various themes surrounding vaccination: https://www.youtube.com/watch?v=Bzxe1x_2I4Y&ab_channel=DDNewsPanaji

[8] ASHA workers are volunteers from within the community who are trained to provide information and aid people in accessing benefits of various healthcare schemes of the government. More can be read on them here: https://indianexpress.com/article/explained/explained-who-asha-workers-women-healthcare-volunteers-who-7932479/

[9] At the state-level, Rapid Response Cells (RRC) were created to monitor vaccine eagerness, hesitancy, and misinformation.

[10] Link to the MOHFW's official website: https://www.mohfw.gov.in/

Figure 2: COVID-19 Dashboard on MOHFW website
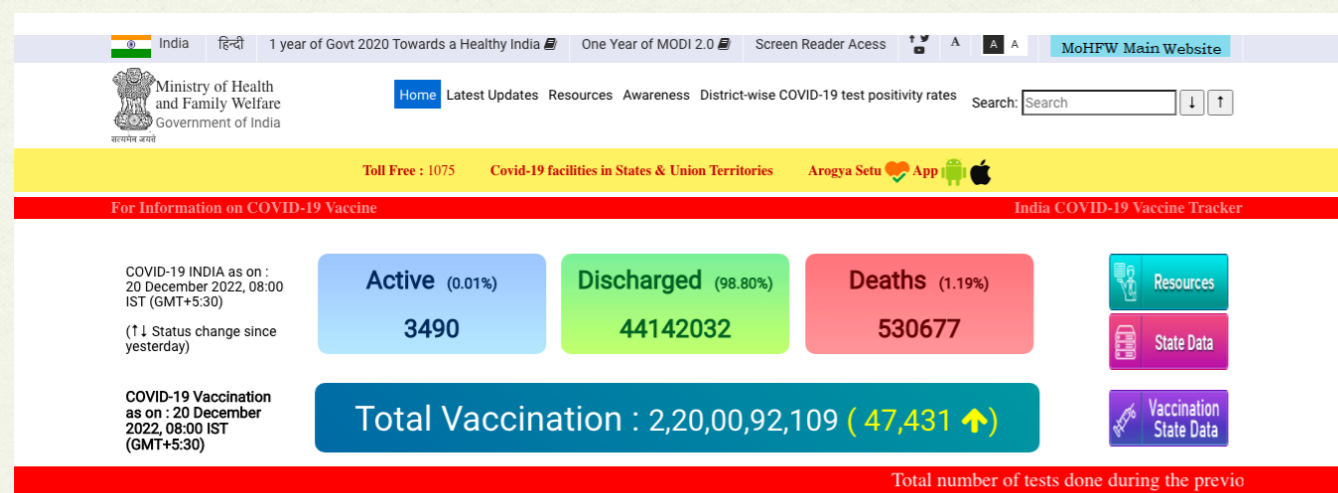
Source: MOHFW website

A novel element of the GoI's communication strategy was the accelerated use of technology to make information more accessible. Nationally, two such applications are "Arogya Setu" and Co-WIN. The Arogya Setu mobile application aims to limit infection transmission (MEITY, 2021). The Co-WIN application functions as a registration site for vaccinations and a dashboard displaying the total number of vaccinations in each state and district in the country on a real-time basis. The dashboard captures inter-state and inter-district variations across India, allowing respective governments to ramp up awareness efforts in areas with low vaccination.

Technology is a critical enabler of information access to citizens, and several other technological interventions were adopted by state governments to disseminate information based on local needs. In the Indian state of Kerala, the local government launched an application called "GOK Direct-Kerala" to provide information related to COVID-19, government guidelines, helpline numbers, and vaccination information in a multilingual format (The Print, 2020). Similarly, in Chhattisgarh's Bastar area, a mobile application called "Bastar Noni" was developed to provide information to children and address their questions about health and COVID-19-related symptoms through animations, cartoons, and videos. The motive was to increase awareness of sanitation, physical distancing, and vaccination among children and their families (Anonymous 2, personal communication, 4 December 2022). Since Bastar is a rural region reliant on agriculture and affected by socio-political turmoil, such awareness campaigns were cornerstones of public health.

2.1.4. Social mobilisation and community engagement

In this pillar, the GoI focused on government-civil society collaboration in improving information accessibility on vaccination. At the national level, the GoI called on religious leaders and clerics to spread awareness about inoculation — of particular importance in rural areas, where faith leaders often hold greater influence. The Prime Minister and other elected government leaders met with such religious leaders and urged them to collaborate with their respective governments to dispel rumours about the

vaccination drive (Press Bureau of India, 2021). Such measures led religious leaders like M. Hasnain, from the city of Arrah in Bihar, to record a video message discussing his vaccination and post-vaccination experience and urging his fellow community members to receive vaccine doses (Times of India, 2021). Similarly, Hindu priests and Christian pastors across the country lent their support.

At the state and district levels, the government's strategy focused on organising orientation for officials, community leaders, healthcare workers, and others to support social mobilisation, mobilising priority groups which are traditionally hesitant about vaccines; and holding talks with village headman, religious/faith-based leaders, and medical facility owners to encourage them to support the drive (MOHFW, 2021). As a result of this strategy, healthcare and frontline workers in villages of Chhattisgarh, Odisha, and Arunachal Pradesh went door-to-door to vaccinate citizens. Certain districts and villages in states across the country witnessed ASHA and Methani workers (traditional health providers) travel across mountains, marshy lands, and desert fields to inoculate people (Anonymous 4, personal communication, 4 December 2022).

2.1.5. Adverse Event Following Immunisation (AEFI) communication crisis

The fifth pillar emphasised responding to post-immunisation crises. It focused on ensuring that information on the adverse effects of a vaccination were systematically revealed to the public, with an investigation conducted and reasons for the adverse effect provided (Ghosh, personal communication, 16 December 2022). It emphasised engagement with stakeholders such as political, faith-based and local leaders, and civil society members to improve outreach. Meanwhile, technology was also used to inform the public. Therefore, several communication channels were used to reach the public and, to an extent, these measures realised their goal; India reported an 84% vaccine acceptance rate (Dhalaria, Arora, Singh & Mathur, 2022). This was not uniform across all states in India. Some states reported vaccine hesitancy above 50%. Given the correlation between vaccine hesitancy and misinformation, then, one can safely assume that states experienced varied information accessibility around vaccines.

2.2. Barriers to information accessibility

As noted above, the government adopted measures to improve information accessibility. However, these efforts were criticised on two grounds: information asymmetry and over-bureaucratisation.

1. Information asymmetry
   The central government prepared platforms for widespread acceptance of the COVID-19 vaccination drive. The strategy emphasised the logistical and "opinion-based" aspect of the drive, with limited sharing of information and data related to scientific trials conducted during production of the vaccines (Anonymous, personal communication, 8 December, 2022). While expert groups and task forces closely monitored the nature of vaccines, including their safety, efficacy, and immunology, there was a lack of public information on the process. As a result, misinformation surrounding these vaccines significantly impacted perceptions, directly fuelling hesitancy.

2. Over-bureaucratisation

The structure and functioning of the government in India do not support whistle-blowers (Anonymous 7, personal communication, 5 December 2022). This means that the individual cost of whistleblowing can often be higher than the cost of deterring a challenge, such as a surge in infections due to a new variant. Inevitably, this negatively incentivises stakeholders within the government to flag upcoming challenges. This has had two negative results: under-preparedness during the COVID-19 Delta variant, despite evidence of its seriousness, resulting in severe infections and deaths; and the public perception that the government is withholding information from its people.

PART III: ENSURING EQUITY

India accounts for almost 18% of the world's population,[11] and a deeper dive into its demographics would reveal a high age dependency ratio of 49%, with approximately 8.6% of the population above the age of 60 years and 40% below the age of 18 years (MOSPI, 2016; Worldometer, 2023; World Bank, 2023). This means that India's population is highly vulnerable to infectious diseases, such as COVID-19, but also that the country needs to prioritise the protection of its vulnerable population through measures like vaccination. The vaccination programme was informed by the country's demographic landscape, identifying those who needed the vaccine first and subsequently utilising existing knowledge on mass vaccination campaigns to deliver vaccines across the country. In a dynamic country like India, equitability can be evaluated through the lens of access and affordability of vaccines: between states, between rural-urban areas, and between genders.

3.1. Measures adopted by the Government of India for equitability

3.1.1. Vaccine prioritisation and procurement policy

The vaccination program launched on 16 January 2021 adopted a needs-based approach in which specific groups were identified for prioritisation. These priority groups were identified based on their risk of getting infected by COVID-19.

At the same time, pre-existing shortages of specialised human resources in medical and paramedical fields also contributed to the prioritisation (Byatnal, 2020). The existing supply constraints informed the vaccine policy, leading to a phase-by-phase approach. The first phase, launched on 16 January 2021, initially targeted inoculating healthcare workers, given their high susceptibility, and was subsequently expanded to include frontline workers (WHO, 2021). The two groups account for 2.19% of the total population and require procurement of 60 million vaccine doses (Singh, Verma and Lakshminarayan, 2022).[12] Some policymakers also viewed their prioritisation as a trust-building initiative to reassure medical and frontline workers of their safety in their fight against COVID-19.

As per the strategy, the GoI was solely responsible for the procurement of required vaccine doses, which were then distributed to state and union territory[13] governments for vaccine administration (MOHFW, 2021; Purohit, Chugh, Bahuguna and Prinja,

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[11] 1.4 billion people.

[12] Assuming a 2-dose regime, wastage not factored in.

2022). In January 2021, India granted an emergency use authorization to Covishield (manufactured by the SII) and Covaxin (manufactured by Bharat Biotech) for their use in the vaccination program.

In the second phase, the priority group within the vaccination program was expanded to include citizens above the age of 60 and those above 45 with comorbidities.[14] In this phase, the GoI engaged with private sector hospitals to increase vaccine coverage nationwide. As part of this arrangement, private hospitals could purchase vaccines from the government at USD2-3. Unlike government-run vaccination sites, where vaccination was free, in private hospitals, vaccination was chargeable; however, as part of GoI equitability and accessibility efforts, service charges for private units were capped at USD1.35 (Rs.250) (MOHFW, 2021; Hindustan Times, 2021). As can be viewed in Table 3, the vaccination program expanded to include vaccination for all citizens above the age of 45.

Table 3: Priority sequence for vaccination in India

Phase	Priority group	Eligible population (in millions)	Estimated no. of vaccine doses required (in millions)	% of total population
1	Healthcare workers	10	20	2.16
	Frontline workers	20	40	
2a	Senior citizens (over 60) and citizens over 45 years with co-morbidities	138	276	10.07
2b	Population ages 45-59	209	418	15.27
3	Population ages 18-44	597	1,194	43.57
4	Population ages 15-18	74	148	5.41
5	Population ages 12-14	46	92	3.39

Source: WHO (2021); Singh, Verma and Lakshminarayan (2022)

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[13] India is a federal union comprising 28 states and eight Union Territories (UTs). State governments are elected while UTs are governed by the central government. States and UTs are further subdivided into districts and blocks.

[14] The Indian government had identified 20 comorbidities including heart, kidney and liver diseases and all forms of cancer, patients suffering from which could submit a medical certificate requesting for vaccination in Phase 2. A certificate attesting to such conditions was to be signed by a registered medical practitioner and digitally uploaded on the Co-WIN website during self-registration (Hindustan Times, 2021).

In the third phase of the vaccination program, the GoI strived to scale up vaccine coverage in India by expanding to the population above 18 years of age (MOHFW, 2021). It also liberalised the vaccine procurement and pricing processes, earmarking only 50% of the vaccines manufactured domestically; state governments and the private sector could procure the rest. The liberalisation of the vaccination program in this stage eventually led to increased involvement of the private sector, which contributed towards equitability as it allowed for more vaccination sites to be developed by private hospitals, which could vaccinate more people at a capped price. Meanwhile, the GoI and state governments continued to offer free vaccinations across the country, which cumulatively led to the convergence of affordability and accessibility as citizens who were eligible for vaccination and could afford to pay for it could visit private healthcare centres, indirectly reducing pressure from overburdened public vaccination centres. The government's strategy also envisaged this liberalisation policy as a mechanism to create parallel streams for vaccination, with state governments and private healthcare centres focusing on the procurement of vaccines for citizens ages 18-44 years while the GoI focused on the original priority groups (Purohit, Chugh, Bahuguna and Prinja, 2022).

On 7 June 2021, within a few months of phase three beginning, the GoI's decentralised approach was reversed, the state government's quota of vaccine procurement was removed, the private sector's quota was reduced to 25%, and the GoI's quota was increased to 75% (Ananthakrishnan, 2021). This change resulted from states reporting vaccine scarcity due to their inability to procure vaccines at high prices (higher than the price paid by the GoI), which led to the Indian Supreme Court rebuking the GoI and emphasising price neutrality (The Hindu, 2021). As a result, the GoI centralised vaccine procurement; it decided to procure vaccines on behalf of the states too. Another critique by the Supreme Court on vaccine distribution in phase three concerned the GoI's criteria for allocating vaccines amongst states. Allocation was based on three factors: the infection rate, which evaluated the active caseload in a state; the vaccination rate, which was computed through a seven-day average of vaccine consumption; and vaccine wastage. Although these factors were devised to improve efficiency and reduce vaccine wastage, they had negligible impact on the equitable distribution, as over 4.6 million vaccine doses were wasted in India in April 2021 (Nagarajan, 2021). Such data and reports on vaccine shortages indicated an equity challenge.

During fourth and fifth phases of the vaccine program, Covaxin and Corbevax were authorised for vaccination in children 15-18 years old and 12-14 years old, respectively. India is amongst the few countries that have expanded vaccine coverage to children, striving to deliver equitable healthcare through vaccination. For children below 12 years, Corbevax and Covaxin have been approved for usage by the Drug Controller General of India (DCGA); however, the GoI has not formally expanded the vaccination drive to this group (Sharma, 2022).

3.1.2. Developing the Co-WIN platform

The second significant measure to improve equitability, especially in terms of improving vaccine accessibility, was the development of the Co-WIN platform. A cloud-

based information and technology platform, Co-WIN provided data and information on vaccination centres, near and far; supported the scheduling of vaccination appointments through self-registration; generated digital vaccination certificates; and supported reporting of AEFIs.

From a policy perspective, the Co-WIN platform empowered Indians to make decisions regarding their vaccination experience. It allowed them to choose, based on availability, the vaccine they wished to be vaccinated with; it enabled them to choose the place, date, and time for their vaccination — a rare achievement in a low-income, populous country like India. The Co-WIN platform's support for nationwide vaccine access and affordability was remarkable. However, despite this incredible feat, certain structural challenges like low digital literacy and limited internet penetration continued to be hurdles in the realisation of equitability, as discussed further in section 3.4.

3.2.   Inter-State variations in vaccines

Indian states and union territories received vaccine doses in the five phases of the vaccination program. The allocation of vaccines was driven by the infection rate, speed of vaccination rate, and vaccine wastage, resulting in some geographical areas being given higher priority in vaccination (Reuters, 2021). This prioritisation was done at both the national and the local level. In January 2022, the MOHFW reported that over 69.8% of the total adult population was fully vaccinated, and 93% of the adult population (above the age of 18) was vaccinated with the first dose (The Hindu, 2022). Image 1 is a commemorative stamp issued by the MOHFW and the GoI on successfully administering over 1.5 billion vaccine doses within a year of the program launch (PIB,2021).

Image 1: Stamp issued by Government of India on COVID-19 vaccination drive's first anniversary
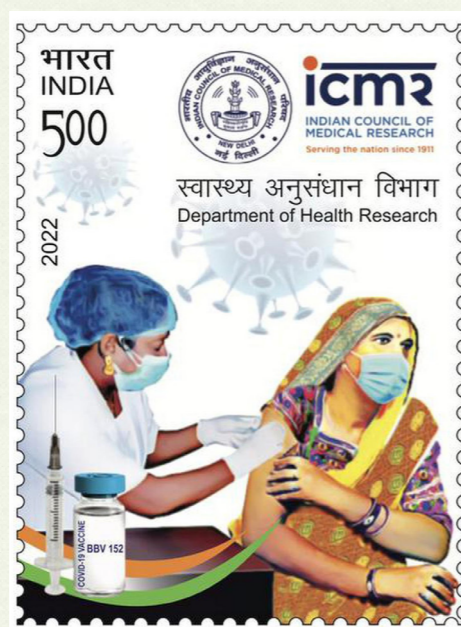
Source: The Hindu (2022)

These stark differences between states were visible in registration for initial and subsequent vaccination. Nationally, of the identified 30 million healthcare workers and frontline workers, approximately 18 million had registered for vaccination, and only 11 million were vaccinated, demonstrating a slow pick-up in vaccination from the GoI, but also showing vaccine hesitancy. As seen in a study on state vaccinations in phase one by Pandey et al. (2021), these two trends were exaggerated in some states and minimal in others. The study identified that only four states (Gujarat, Rajasthan, Chattisgarh, and Uttarakhand) could vaccinate 50% of their eligible population. Pandey et al. (2021) linked poor state performance in phase one of the vaccination program to existing vaccine delivery infrastructure in the region; states with one vaccination site per 1,000 eligible people had lower vaccine coverage. Therefore, from the initial phase, weak vaccine delivery infrastructure played a prominent role in vaccine coverage in that state. This, in turn, indicates that a weak vaccine delivery system was the first barrier to vaccine equity among states.

The second barrier to achieving equity in vaccination was vaccine hesitancy. Vaccination rollouts have been slower in states like Nagaland, Manipur, Meghalaya, Mizoram, Tamil Nadu, and Punjab due to low vaccine acceptance rates (Dhalaria, Arora, Singh & Mathur, 2022). Vaccine hesitancy in these states has varied from 53% to 95%. This hesitancy was embedded in concerns around the safety and efficacy of indigenous vaccines such as Covaxin, especially since this vaccine was briefly suspended in European countries, the third trial phase of the vaccine was skipped, and it was approved under emergency use (Thiagarajan, 2021). Such concerns negatively impacted citizens' faith in the vaccination program and made them unwilling to be vaccinated. In some states, vaccine hesitancy was also fuelled by political motives; for instance, in Uttar Pradesh, the most populous state of India, the opposition party leader, Akhilesh Yadav, refused to be vaccinated due to his distrust of the Union government's vaccine (Hindustan Times, 2022).[15]

The third barrier was the digitalisation of vaccine registration on the Co-WIN platform. Vaccine registration became a challenge because only 31% of India's rural population uses the internet (KANTAR, 2020). Despite the initially slow coverage, India's vaccination campaign expanded as some of these challenges were resolved, such as by allowing walk-in registrations as well as online registration. In villages of many rural areas, citizens were approached by local government officials who registered on their behalf (Anonymous 2, personal communication, 4 December 2022).

Meanwhile, the decline in COVID-19 cases and interim results of Covaxin clinical trials affirmed citizens' trust in Covaxin and other indigenous vaccines (Pandey et al., 2021). The MOHFW's "Liberalised Pricing and Accelerated National COVID-19 Strategy" also expanded the scope of the coverage, allowing private hospitals and state government healthcare infrastructure to contribute towards improving equitability (MOHFW, 2021) and resulting in over 1.2 billion Indians having received a primary dose and 77% of the

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[15] Uttar Pradesh holds significant power in the Lower House of the Indian Parliament and is touted to be the decision maker of who will form the government.

total population fully vaccinated (Co-WIN, 2023; Johns Hopkins Vaccine Tracker, 2023).

3.3. Gender equity in vaccines

There exists gender inequity in access to vaccines in India. As per current data, there is a 10% gap between the number of men and the number of women who have been vaccinated. In the early phases of the vaccination program (e.g., on 10 April 2021) the difference was 2%; however, gender disparity in vaccines expanded to 24% by 6 May 2021 (Deccan Herald, 2021). At least three reasons contributed to this inequity. First, there exists gender discrimination in India which favours the male child, resulting in the allocation of resources towards men. This bias dictates access to basic facilities, including healthcare. Access to healthcare services is highly discriminatory towards women; a study conducted to analyse gender differences in access to hospitals in India indicated that approximately 63% of men were likely to make an annual visit to the hospital, compared to only 37% of women (BMJ, 2022). This suggests that nearly half of the total female population is 'missing' from receiving healthcare (BMJ, 2022).

Given that vaccination falls under healthcare services, it is unsurprising to find women missing; this is particularly life-altering in rural areas where physical access to vaccination centres and public healthcare infrastructure is located far away. In such scenarios, families are likely to dissuade, discourage, or even prohibit women from seeking out healthcare services.

Second, there exists a gendered digital divide which disempowered women from registering for vaccination on the Co-WIN application and receiving their doses. Although 67% of Indian women own mobile phones, only 30% of them had access to the internet in 2020; this likely prevented them from accessing information related to COVID-19 or the vaccination drive and registering themselves to receive the vaccine (Nikore & Uppadhayay, 2021).

Lastly, misinformation surrounding vaccine safety for women's bodies fuelled public concerns (BBC, 2021). To dispel such falsehoods, the government launched a campaign with posters, slogans, and chants to discredit misinformation (India Today, 2021). In addition, the government removed the rule for pre-registration on the Co-WIN application; prior to this, registration could only be done online. By changing the rule, the government permitted walk-in registration at vaccination sites, expanding the prospect of vaccine coverage. It also positively influenced the chances of women accessing vaccines, by addressing the gendered digital divide (Ravi, personal communication, 19 December 2022). It is likely that this measure had a positive effect on reducing gender disparity in access to COVID-19 vaccines.

PART VI: SELF-RELIANCE, ACCOUNTABILITY, AND TRANSPARENCY

4.1. Self-reliance

At the start of the COVID-19 pandemic, the GoI recognised the need for self-reliance in a populous country like India. The GoI identified its inability to procure vaccines from abroad due to their steep prices and long waiting lines. In light of this, the GoI launched the Self-Reliant India Campaign (Atma Nirbhar Bharat Abhiyan) (Invest India, 2020). Launched on 12 May 2020, the program allocated economic stimulus and comprehensive packages worth USD265 billion (Rs. 20 lakh crores) to support India's fight against COVID-19.

Under this initiative, the GoI launched Mission COVID-19 Protection (Covid Suraksha), which strived to provide monetary support for indigenous vaccine development (Press Bureau of India, 2020). The GoI supported 5-6 vaccine candidates in their vaccine development processes. The program attempted to assist prospective vaccine candidates, from the preclinical stage to final licensing of the vaccine, in navigating regulatory authorities in India. By providing step-by-step assistance, the GoI strived to support vaccine candidates by creating an ecosystem that could allow for their growth. Additionally, the government wished to empower domestic vaccine candidates to embolden and quicken their attempts (Ministry of Science and Technology, 2020). Through such efforts, India was able to develop vaccine candidates like Covishield (Manufactured by the SII), Covaxin (developed and manufactured by Bharat Biotech), and ZyCoVd (developed by Cadilla), which contributed to ensuring India's supply of COVID-19 vaccines.

4.2. Accountability and transparency

The vaccination strategy attempted to improve transparency in vaccine procurement, distribution, and inoculation through the Co-WIN platform. At the logistical (back) and the consumer (front) ends, the platform strived to reduce information and vaccine leakages (Anonymous 7, personal communication, 5 December 2022). The platform also envisaged bringing transparency to vaccine usage by tracking the number of vaccine doses administered across geographical regions, which could aid in identifying areas with low immunisation or requiring better vaccine delivery infrastructure. Therefore, by systematically streamlining the vaccine supply, the GoI strived to improve transparency. However, other challenges embedded in the vaccination program raised questions about the degree of transparency exercised by the GoI. First, there was not a more detailed public discussion on the safety and efficacy of vaccines in India (Anonymous 7, personal communication, 5 December 2022). Lack of such discussions can lead to erosion of trust between the government and its citizens

in healthcare services and can have long-term effects. All health interventions are premised on trust, and any scope of mistrust in public healthcare services can fuel scepticism and hesitancy; evidence of this mistrust could be the degree of vaccine hesitancy, as high as 53%-95% in some states (Thiagarajan, 2021).

India's vaccination strategy and the three waves of COVID-19 infection surges created multiple crisis-like situations, such as halting India's vaccine export policy due to a domestic vaccine shortage, and vaccine scarcity driven by a hike in vaccine prices impacting the procurement policy of states. These crises pushed citizens to hold the decision-maker (i.e., the GoI) accountable for its actions. A key enabler for this accountability test was news media. Despite lockdowns nationwide, news media contributed to disseminating information about COVID-19 and vaccination. It also played its role as the fourth institution of democracy as it held the government accountable for challenges of vaccine wastage, vaccine distribution across states, and inequities (Kapoor & Ravi, 2021).

The judiciary also played a crucial role in ensuring government accountability. In the third phase of the vaccination program, as vaccination coverage was accelerated to include all citizens above the age of 18, there was a change in the process of procuring vaccines (MOHFW, 2021). This change allowed state governments to procure vaccines directly from the manufacturer, but at a higher cost than those from the GoI. These cost differences, accompanied by state governments' budgetary constraints, led to the issue being heard before India's Supreme Court. The court resolved the challenge by asking the GoI to alter its procurement policy to provide a fair deal for state governments. Subsequently, the GoI altered the vaccine procurement policy by volunteering to procure vaccines for states.

4.3. India's campaign for global equity

Since public health interventions, including lockdowns, had limited effects, the GoI, both independently and through partnerships, looked into development and equitable distribution of vaccines. A step in that direction was India's proposal to the World Trade Organisation (WTO) and South Africa to waive certain Trade-Related Aspects of Intellectual Property Rights (TRIPs) to aid in dealing with COVID-19. The TRIPs waiver aimed to enable generic drug manufacturers to override intellectual property rights on COVID-19-related vaccines, therapeutics, and other equipment to facilitate low-cost vaccine production and supply in low-income economies (The Economic Times, 2021). This waiver has received the support of 63 other co-sponsor countries during the pandemic. Despite ongoing discussions in the WTO assembly, there has been no final result (Business Standard, 2022).

PART V: CONCLUSION AND WAY FORWARD

India dealt with three variants of the coronavirus, all cumulatively contributing to creating insurmountable pressure on its pre-existing public healthcare infrastructure. India had the herculean task of vaccinating its population of 1.4 billion people, so vaccine supply and coverage were the country's priorities. To address this, the Indian government, through its Covid Suraksha policy, supported 5-6 vaccine candidates in their development processes, resulting in domestically manufactured and developed vaccines, namely Covaxin and Covishield. These vaccine candidates emerged as key protection providers in India, ensuring accessibility and affordability. Thus, indigenous vaccine manufacturing and self-reliance aided in addressing India's challenge of scalability. India was able to administer over two billion vaccine doses within one year of launching its vaccination policy.

Meanwhile, the government also focused on information accessibility around its vaccination program. It formulated India's COVID-19 Vaccination Communication Policy, as part of which central and state governments jointly worked with religious, political, and local leaders and members of civil society to improve information accessibility surrounding vaccines. Technology and digital platforms such as the Co-WIN platform emerged as critical contributors in centralising the vaccination process and providing all information concerning COVID-19 vaccines. By linking local vaccine delivery infrastructure to vaccine manufacturers, the platform streamlined India's vaccine delivery process and reduced chances of vaccine leakage and loss. Importantly, technological platforms empowered Indian citizens to make decisions on the time, type, and nature of their vaccination experience and to subsequently possess a digital record, a novel achievement for a low-income country. Despite such measures, India's vaccination experience has not been equitable for all, as some states, such as Nagaland, Mizoram, Manipur, Jharkhand, and Punjab, have been slow in vaccinating eligible populations. Such slow uptakes resulted from high vaccine hesitancy and a lack of appropriate vaccine delivery infrastructure. Existing socio-structural norms such as gender discrimination, lack of digital access, and limited internet penetration have been other contributing factors.

In India's case, three measures that need to be adopted are the improvement of physical public health infrastructure, trust building between the state and its citizens, and the development of data that informs future vaccine allocation plans.

1. Improving public health infrastructure

    The pandemic, by revealing existing weaknesses in India's health infrastructure, has provided an opportunity to develop more appropriate resources. One problem has been the introduction of health interventions vertically, which individualise

a healthcare program but tend to isolate it, resulting in more resources spent and less efficiency. Therefore, developing an integrated approach to dealing with respiratory and infectious diseases could allow for more effective use of time and resources (Ravichandran, 2022). Second, there exist disparities in healthcare infrastructure between states and between urban and rural areas. To improve such situations, local and national governments need to consistently make efforts to expand the range of primary healthcare centres and build first referral units that build capacity within healthcare clinics, enabling them to fight against future viruses.

2. Trust building between state and citizens

India's high reportage of vaccine hesitancy has revealed a need to reflect on the causes driving this phenomenon. There have been instances reported where citizens were shamed for refusing to accept vaccines. While the rationale behind such actions of "building population immunity" is understandable, given COVID-19's high volatility, forced or even indirect health interventions are deplorable. Vaccine hesitancy results from the government's inability to provide sufficient information regarding health interventions; in India's case, the limited information shared on vaccine efficacy and the changing government guidelines regarding the timeline for receiving first and second doses fuelled fear regarding the vaccine.

In such scenarios, appropriate and timely communication must occur between the state and its citizens. In the long term, there is a requirement for longer, constant communication between the two sets of stakeholders around medical interventions and healthcare in general.

3. Development of data for vaccine allocation plans

The Co-WIN platform was built to streamline the vaccination process. It aimed to identify individuals for vaccination. However, no data repository was available to identify at-risk populations without self-registration on the Co-WIN portal. There is a dire need for India to couple its healthcare infrastructure with data on at-risk populations so that future vaccine allocation programmes can prioritise at-risk populations based on not just demographic and comorbidity factors but expand to include geographic and other risk factors. This would allow for efficient usage of limited resources like vaccines while maximising their impact.

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