

## Covid-19 Vaccines

July 10, 2026 • vajiramandravi.com



The **COVID-19 vaccines** represent a significant achievement in the history of medical science. Developed in response to the global pandemic caused by the **SARS-CoV-2 virus**, these vaccines were designed at an **unprecedented pace** and yet underwent rigorous testing to ensure their safety and efficacy. Leveraging various technologies, from **mRNA platforms to viral vector and protein subunit approaches**, these vaccines have been instrumental in curbing the spread of the virus, reducing severe disease, and saving countless lives. They acted as a pivotal tool in the world's collective effort to end the pandemic and restore normalcy to societies worldwide.

### Background of Covid-19 Vaccine

In 2020, COVID-19 caused by the SARS-CoV-2 virus emerged as a **global pandemic** with significant health and socio-economic impacts. This necessitated the development of a vaccine.

### Need for the Development of Covid-19 Vaccine

The world has faced several pandemics, however, vaccines were not made for each of them. But in the case of the COVID-19 pandemic, there were several reasons responsible for the development of COVID-19 vaccines such as:

- **Transmission dynamics:** SARS-CoV-2 has a **high transmission rate**, with many cases spread by asymptomatic or pre-symptomatic individuals, thereby making containment a challenging task.
- **Overwhelmed healthcare systems:** Rapid spread led to overwhelmed hospitals and healthcare providers, leading to scenarios where individuals were not able to receive adequate care.
- **Comorbidities:** People with underlying health conditions like obesity, diabetes, cardiovascular diseases, etc were at larger risk and in the absence of an established treatment procedure were at larger risk.
- **Variants of concern:** Multiple variants of the virus have emerged, some of which are associated with increased transmissibility, altered disease severity, or reduced vaccine efficacy.
- **Economic impact:** The pandemic led to unprecedented global economic downturns, necessitating a swift medical solution to allow a return to normalcy.
- **Public pressure:** The daily toll on lives and healthcare systems generated immense public demand for a vaccine.

## Types of Covid-19 Vaccines

Several vaccines for COVID-19 developed are mentioned below:

| About                                                                   | Type                      | Mechanism                                                                                                                     |
|-------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Pfizer-BioNTech (Comirnaty)</b>                                      | mRNA vaccine              | Introduces a piece of genetic code (mRNA) that prompts cells to produce a protein resembling the spike protein of SARS-CoV-2. |
| <b>Moderna (Spikevax)</b>                                               | mRNA vaccine              | Uses mRNA to induce cells to produce a version of the spike protein.                                                          |
| <b>AstraZeneca (Vaxzevria)</b><br>(Known as <b>Covisheild</b> in India) | Viral vector vaccine      | Uses a modified version of a different virus (chimpanzee adenovirus) to deliver a piece of genetic material from SARS-CoV-2.  |
| <b>Sinopharm</b>                                                        | Inactivated virus vaccine | Uses a virus that has been killed so it cannot cause disease but can still prompt an immune response.                         |
| <b>Sputnik V</b>                                                        | Viral vector vaccine      | Uses two different adenoviruses for the first and second doses to introduce SARS-CoV-2 genetic material.                      |
| <b>Johnson &amp; Johnson's Janssen</b>                                  | Viral vector vaccine      | Uses a human adenovirus to introduce a piece of SARS-CoV-2 genetic material.                                                  |

## India and COVID-19 Vaccine Development

India, a **global pharmaceutical powerhouse**, spearheaded COVID-19 vaccine development, producing indigenous vaccines like **Covaxin** and facilitating large-scale manufacturing of global candidates, **reinforcing its pivotal role in global health solutions**.

### Vaccines Developed in India

India has been at the forefront of the global COVID-19 vaccine development and production efforts. Major vaccines developed in India are:

| Vaccine Name                    | Developed by                                                                                  | Type                                                          | Mechanism                                                                                                                                                                                                                                                  |
|---------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Covaxin</b>                  | <b>Bharat Biotech</b> , ICMR and National Institute of Virology                               | Inactivated virus vaccine                                     | Covaxin uses a sample of the coronavirus that has been killed so that it cannot infect cells or replicate but can still trigger an immune response.                                                                                                        |
| <b>Covovax</b>                  | Novavax but manufactured by <b>Serum</b> Institute of India (SII)                             | Protein subunit vaccine.                                      | <ul style="list-style-type: none"> <li>- It uses a spike protein of the SARS-CoV-2 virus to stimulate an immune response.</li> <li>- It also contains an adjuvant to boost this response</li> </ul>                                                        |
| <b>ZyCoV-D</b>                  | Zydus Cadila.                                                                                 | DNA-based vaccine.                                            | <ul style="list-style-type: none"> <li>- It is a plasmid DNA vaccine that, when administered, instructs the human cells to produce the spike protein of the SARS-CoV-2 virus.</li> <li>- This, in turn, elicits an immune response in the body.</li> </ul> |
| <b>Incovacc (Nasal Vaccine)</b> | <b>Bharat Biotech</b> , Precision Virologics and the Washington University School of Medicine | Recombinant replication-deficient adenovirus vectored vaccine | It stimulates an immune response in the mucosal membrane, potentially producing antibodies in the upper respiratory tract that can reduce infection and transmission.                                                                                      |
| <b>Corbevax (Booster Dose)</b>  | Biological E Limited                                                                          | Recombinant protein sub-unit                                  | Spike protein is introduced into the body by itself, without the rest of the virus, it doesn't cause harm but triggers an immune response                                                                                                                  |

## Araogya Setu

To aid in the fight against COVID-19 in India, the government developed Aarogya Setu, a smartphone app. This smartphone app combines GPS and Bluetooth to track the virus and determine whether or not someone has been in contact with an infected person. Key features include:

- **COVID-19 cases and updates:** Aarogya Setu tracks the number of COVID-19 cases in India, including new cases, recoveries, and deaths. This tool keeps users informed about COVID-19 trends and its national impact.

- **Self-assessment:** A key element of the software is the self-assessment tool. Users can quickly self-assess by answering questions about their symptoms, travel history, and COVID-19 exposure. Based on responses, the app calculates a risk score and advises users on medical advice or precautions.
- **Covid-19 testing centers:** Aarogya Setu helps consumers find nearby testing centers. This information helps people discover testing facilities if they suspect virus exposure or symptoms.
- **COVID-19 helpline and resources:** The app lists government helplines and assistance services. Emergency helplines, state-specific helplines, and other tools can help users report COVID-19 concerns.
- **Safety guidelines and best practices:** Aarogya Setu provides health authorities' COVID-19 prevention guidelines. These instructions encompass masks, hand hygiene, social distancing, and other precautions.
  - Users can obtain quarantine protocols to learn how to self-isolate owing to exposure or travel history.
- **Vaccination:** The app provides information about the Indian COVID-19 vaccination push, including eligibility criteria, vaccination centers, and registration.

## India's Vaccination Strategy

India faced a humongous task of vaccinating over 1 billion population. However, with the effective **use of ICT** and efficient planning and implementation, India achieved a big milestone of administering over 220 crore vaccine doses. Key aspects of India's strategy were:

- **Phased approach:** The drive began with healthcare and frontline workers, followed by those above 60 years, and then those above 45 years with co-morbidities.
- **Co-WIN platform:** A digital platform for real-time monitoring of vaccine delivery, registration, and scheduling for beneficiaries, and for reporting adverse events.
- **Decentralized delivery:** Both government and private sector health facilities were used as vaccination centers.
- **AEFI (Adverse Event Following Immunization) monitoring:** A surveillance system to monitor and address any side effects or adverse reactions post-vaccination.
- **Equitable distribution:** Ensuring that vaccines reach every state and union territory in proportion to their population and the number of cases.
- **Continuous review and feedback loop:** Regular reviews of the vaccination strategy to address any challenges and feedback from the ground level.
- **Diversified Vaccine portfolio:** Granting emergency use authorization to multiple vaccines to ensure a broad supply.
- **Community engagement:** Engaging with community influencers, leaders, and organizations for widespread advocacy and acceptance of the vaccine.

## Vaccine Maitri

- **Meaning:** A facet of global health diplomacy where nations use vaccine development/delivery to enhance ties with other countries.
- **Importance of India's vaccine diplomacy:**
  - **Strategic:**
    - Earn long-term goodwill by assisting neighbouring countries.

- Aligns with India's "neighbourhood first" initiative.
- Counter China's vaccine diplomacy in the region.
- Gain leverage as Western countries focus on their issues.
- **Economic:**
  - Position India as a global vaccine supply hub.
  - Boost pharmaceutical manufacturing in India.
  - Enhance India's GDP by becoming a primary vaccine manufacturer.
  - **Rescue from Vaccine Cold War:** India's early shipments counteract the US-China vaccine distribution tug-of-war.
  - **Earning moral right:** India's actions contrast with criticisms of rich countries' vaccine distribution priorities.
  - **Disrupting Vaccine Nationalism:** India's distribution disrupts the trend of countries prioritizing their citizens over others.
  - **Facilitating global collaboration:** India supports global efforts, notably the WHO-backed COVAX Facility.

## Significance of Covid-19 Vaccine

The COVID-19 vaccines represent a critical step in fighting the pandemic, significantly lessening disease impact. Several benefits associated with COVID-19 vaccines are:

- **Prevention of Severe Disease and Death**
  - **Reduction in mortality:** Dramatic decrease in COVID-19-related deaths among vaccinated populations.
  - **Lower hospitalization rates:** Vaccinated individuals are less likely to require hospital care if infected.
- **Curbing the Spread**
  - **Community immunity:** Reduced transmission rates help approach herd immunity.
  - **Protection of the vulnerable:** Vaccinating a majority indirectly protects those who can't be vaccinated.
- **Economic Revival**
  - **Reopening economies:** As more people get vaccinated, businesses and markets can reopen safely.

**Employment:** Resumption of work leading to reduced unemployment rates.

- **Travel resumption:** Eased travel restrictions and quarantines for vaccinated travellers.
- **Psychological and Mental Health Benefits**
  - **Reduced anxiety:** Lesser fear of contracting severe disease.
  - **Social interaction:** Human connections and interactions vital for mental well-being resume.
- **Research and Scientific Collaboration**
  - **Global collaboration:** Countries collaborated for vaccine research and distribution.
  - **Rapid advancements:** Demonstrated potential for quick scientific solutions in emergencies.
- **Political and Diplomatic Cooperation**

- **Vaccine diplomacy:** Nations helping others by providing vaccines, and fostering cooperation.
- **Preparedness for Future Pandemics**
  - **Research base:** The rapid vaccine development sets a precedent for future challenges.
  - **Infrastructure development:** Better-equipped labs and research facilities for the future.

## Challenges associated with Covid-19 Vaccines

COVID-19 vaccines, while groundbreaking, faced hurdles in development, distribution, and acceptance, highlighting the complexities of global health interventions during unprecedented times. Several challenges associated with Covid-19 vaccines were:

- **Production and Supply Chain Issues**
  - **Scaling production:** Rapidly increasing manufacturing capacity to meet global demand.
  - **Raw materials:** Shortages of essential vaccine components.
  - **Logistics:** Ensuring cold storage and timely distribution.
  - **Efficacy and Variants**
    - **Variable efficacy:** Different vaccines show varied efficacy rates.
    - **Emerging variants:** Some variants reduce vaccine effectiveness, necessitating updates and boosters.
  - **Administration and Distribution**
    - **Cold storage:** Some vaccines require ultra-cold storage, complicating distribution.
    - **Equitable distribution:** Ensuring vaccines reach all countries, especially low-income nations.
- **Acceptance and Hesitancy**
  - **Misinformation:** Addressing false information and conspiracy theories.
  - **Vaccine trust:** Building and maintaining public trust in vaccine safety and efficacy.
  - **Safety Concerns and Monitoring**
    - **Side effects:** Addressing and monitoring both common and rare side effects.
    - **Long-term data:** Accumulating long-term safety and efficacy data.
  - **Regulatory and Approval Hurdles**
    - **Emergency use:** Many vaccines were initially approved for emergency use, requiring further study for full approval.
    - **Global standards:** Varied approval processes and standards across countries.
- **Economic and Political Challenges**
  - **Cost barriers:** Making vaccines affordable or free for all.
  - **Geopolitical tensions:** Vaccine diplomacy and potential misuse for political leverage.
  - **Future Preparedness**
    - **Long-term strategy:** Determining the need for booster shots and updated vaccines.
    - **Infrastructure:** Building a resilient global infrastructure for potential future pandemics.

## Covid-19 Vaccines UPSC PYQs

**Question 1:** In the context of vaccines manufactured to prevent Covid-19 pandemic, consider the following statements:

1. The Serum Institute of India produced a COVID-19 vaccine named Covishield using mRNA platform.
2. The Sputnik V vaccine is manufactured using a vector-based platform.
3. COVAXIN is an inactivated pathogen-based vaccine.

Which of the statements given above are correct?

1. 1 and 2 only
2. 2 and 3 only
3. 1 and 3 only
4. 1, 2 and 3

**Answer: (b)**

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Source: <https://vajiramandravi.com/upsc-exam/covid-19-vaccine/>

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