

How India's Vaccine Renaissance Rests on Innovative & Equitable Solutions

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Thanks to its strong R&D ecosystem and smart partnerships, India will be able to play a bigger role in redefining global health equality by making innovative vaccines accessible. The Indian vaccine environment will undergo a dramatic transformation in the next few years due to a spike in investments in innovative vaccine technologies, production platforms, and logistics solutions.

India is renowned for its prowess in scalable and affordable vaccine manufacturing, producing a diverse range of vaccines, including inactivated and live vaccines, protein subunit vaccines, and next-generation vaccines like viral vector vaccines, mRNA, and DNA vaccines. It manufactures 50 per cent of the world's vaccines, and in the last year alone, 4 billion doses of the 8 billion vaccine doses manufactured and distributed globally, were produced in India. Key developers, including global leaders like Serum Institute of India (SII), Bharat Biotech, and Biological E have been instrumental in addressing many globally relevant health challenges and improving preventive healthcare for millions of people.

Improved R&D ecosystem to develop cutting-edge vaccines for global access

In recent years, Indian companies have shifted their focus from mass manufacturing to a more streamlined approach that aims to improve R&D capabilities, building innovative platforms, vaccines, and delivery solutions indigenously. Some of the groundbreaking vaccines launched in the last 2 years include innovative ones such as ZyCoV-D, the world's first COVID DNA vaccine and GEMCOVAC-19 - India's first indigenously developed mRNA vaccine. World Health Organization (WHO) also granted emergency use listing (EUL) for CORBEVAX-India's first protein subunit COVID vaccine developed by Biological E in 2024.

Besides COVID, India has also been at the forefront of innovations launching many "First in India" vaccines for infectious diseases with high unmet needs. Indian Immunologicals Limited (IIL), a fully-owned subsidiary of the National Dairy Development Board (NDDB), launched India's 'first' indigenously developed Hepatitis A vaccine, Havisure, earlier in 2024. In August 2024, Bharat Biotech launched Hillchols, India's first oral cholera vaccine (OCV), developed in collaboration with MSD, Wellcome-Trust Hilleman Laboratories, to address the critical shortage of OCVs.

Another innovation-driven organisation, Novo Medi Sciences, has been making rapid progress and is set to launch its three next-gen vaccines for Meningitis, Pneumonia, and Shingles in 2025. These are already in Phase 3 clinical trials in India, and the commercialisation of this shingles vaccine will make it India's first and only indigenous live vaccine requiring a single dose to provide lifetime immunity. The company also aims to roll out phase 3 trials for India's first Hand Foot Mouth disease in 2025, as well as other vaccines for cervical cancer and typhoid.

Malaria, Zika and other vector borne diseases are a critical concern in many tropical countries and the demand for effective vaccines is on the rise. The only two WHO-approved malaria vaccines, which were developed by UK scientists at GSK and Oxford University, are now manufactured at scale in India by Bharat Biotech and Serum Institute of India. These next-gen malaria vaccines can be manufactured at scale and low costs, enabling wide adoption across countries where the disease burden is very high. Public private partnerships (PPPs) are also notable to foster innovation and recently, IIL entered a collaboration with the Indian Council of Medical Research (ICMR) to develop India's first codon-deoptimised live attenuated virus-based Zika vaccine.

Transforming challenges into opportunities through innovation

Few Indian companies are working on developing stable formulations and easier-to-deliver oral, needle-free, and intranasal formulations for mass immunisation. After, iNOVACC, which was the world's first and India's indigenously developed intranasal COVID-19 vaccine, the launch of Indian Immunologicals Limited's needle-free intranasal COVID-19 vaccine is another milestone in advancing delivery by using live-attenuated virus and codon deoptimisation platform.

The industry buzz around mRNA vaccines and therapeutics continues, and there is a notable surge in developments around this versatile and flexible platform.

PopVax, an Indian full-stack biotechnology company that used computational tools to develop mRNA vaccines and therapeutics, received a \$1.5 million grant from Bill & Melinda Gates Foundation in October 2023 to develop thermostable vaccines using lipid-polymer delivery. It also received a \$2 million "Patch Forward Prize" from BARDA grant in January 2025 to develop its seasonal influenza vaccines using its novel mRNA platform that will be delivered via a dissolvable microarray patch.

Developing pain-free vaccines will significantly impact improving adoption, and other companies are also working on integrating needle-free technologies into their solutions. For example, SII made a strategic investment in IntegriMedical in May 2024, acquiring 20 per cent stake in the company to advance the patented Needle-Free Injection System technology to develop accessible vaccines.

Addressing last-mile challenges with robust supply chain solutions that can address cold chain challenges is highly relevant in many emerging nations. To address cold chain gaps in delivering life-saving vaccines and drugs, Indian health tech company Enhanced Innovations launched its portable cooling solution Phlton in May 2024, designed for vaccine delivery in resource-limited areas. This cold chain solution aims to address the last-mile delivery challenge by maintaining the required temperature of vaccines using integrated solar panels. The solution addresses the last-mile challenges in healthcare delivery, particularly in remote areas with limited access.

Enhancing preparedness and vaccine delivery

Global collaboration in vaccine research and development is critical in navigating the public health crisis.

National agencies and organisations are collaborating to build a robust vaccine landscape and a resilient supply chain. In May 2024, Department of Animal Husbandry & Dairying (DAHD), entered a memorandum of understanding with the United Nations Development Programme (UNDP) to improve vaccine cold chain digitalisation in India and build manufacturing capacity.

International organisations and vaccine networks, such as WHO, GAVI (the Vaccine Alliance), the Coalition for Epidemic Preparedness Innovations (CEPI), and the Gates Foundation are partnering with many Indian companies and research organisations, to boost vaccine innovation, manufacturing, and distribution.

GAVI inked a new partnership with the Government of India in 2023 that aims to provide vaccinations to children who haven't received routine vaccinations. Gavi will pump in \$250 million in this three-year partnership, which will provide vaccinations to millions of children and reduce the number of zero-dose children in India by 30 per cent by 2026.

In addition to prophylactic vaccines, developing therapeutic vaccines for cancer and other serious diseases is also a growing R&D focus in the US and a few European nations. India has also embarked on its journey to develop therapeutic vaccines for common cancers like Human papillomavirus (HPV) and is a part of the Quad Countries Cancer initiative, the Quad Cancer Moonshot will serve to strengthen the overall cancer care ecosystem in the Indo-Pacific. India has also committed a \$7.5 million grant to strengthen local efforts for the prevention and detection of HPV and aims to provide 40 million vaccine doses to combat cervical cancer as a part of this Cancer Moonshot initiative.

The threat from emerging pathogens is looming, and nations must brace themselves to face such possible endemics and pandemics with a robust and resilient healthcare infrastructure to roll out vaccines for both known and novel pathogens within a short turnaround time. Recently, Indian Immunologicals, in collaboration with the government of India, hosted a scientific conclave in Hyderabad. The conclave called for collaboration and focused on pandemic preparedness and vaccine innovation. Including SII in the CEPI vaccine manufacturing network is a notable measure to address possible future infectious disease outbreaks by supporting an organisation like SII. CEPI will invest \$30 million in SII to improve and build its capabilities. Being a part of this network would enable SII to produce large doses of vaccines within 100 days of an outbreak.

Not just a manufacturing powerhouse

The future of India's vaccine innovations is expected to be transformative, and the country's role in redefining global health equity by making cutting-edge vaccines accessible will be augmented with its robust R&D ecosystem and strategic collaborations. In the next few years, investments into novel vaccine technologies, manufacturing platforms, and logistics solutions will surge, and the Indian vaccine landscape will evolve significantly.

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