



Credit: Indian Council of Medical Research

India's crusade against COVID-19

The COVID-19 response in India has been rapid, strategic and multipronged and has adapted to the evolving pandemic situation.

The COVID-19 pandemic has impacted almost every country in the world. With 9.93 million people infected, India is one of the worst-affected countries and is faced with multiple challenges. It is the world's largest democracy, with a population of more than 1.35 billion, of which 2.75 million are below the poverty line, and an additional 300–400 million are working in informal sectors, making them vulnerable to economic stress caused by the lockdown. India's health infrastructure is grossly inadequate, with government spending on healthcare being only 1.17% of GDP. Private-sector healthcare accounts for 55% of the total hospital bed capacity and 90% of the doctors (Rajagopalan, S. & Choutagunta, A. *Assessing Healthcare Capacity in India*. (Mercatus, 2020; <https://doi.org/10.2139/ssrn.3570651>), and healthcare needs are largely met as out-of-pocket expenditures.

Despite challenges and setbacks, the overall response of India to the COVID-19 pandemic has been commendable. The 'Oxford COVID-19 Government Response Tracker,' which assesses countries on key policies implemented by governments, gave India a score of 100% in the crucial initial months. The pandemic and subsequent lockdowns set a new normal in India. The entire healthcare system was meticulously reoriented to tackle the pandemic. By May, an operational network of 7,700 dedicated COVID-19 care hospitals, health centers and COVID-19 care centers with a systematic referral system was established. Central and state health departments conducted several virtual training workshops for healthcare professionals on diagnosis, clinical management and infection control practices. The laboratory network was massively expanded from a single lab to 2,250 labs, with a testing capacity of 1.2 million per day. This expansion was steered by the Indian Council of Medical Research (ICMR) through daily virtual interactions, troubleshooting with labs and quality assurance and quality control programs to ensure high-quality testing. ICMR also established 24 diagnostics validation centers across the country, which enabled the evaluation of 1,100 COVID diagnostic products. Of the 600 approved kits, 397

are indigenous. Local manufacturers were guided through processes to improve quality and availability.

The efforts of the government were equally supported by community participation, generous contributions from philanthropists and the engagement of the private sector. Many inspiring success stories like the 'Dharavi model' (combating COVID-19 in the world's largest slum) have emerged through efficient governance, public–private partnership and community engagement.

A National Task Force on COVID-19 was set up by the Indian Government to carve out the research roadmaps. It was steered by ICMR, Niti Aayog and the Ministry of Health. Leading research organizations, including ICMR, Department of Science and Technology (DST), Council of Scientific & Industrial Research (CSIR), Defence Research & Development Organisation (DRDO) and Indian Institutes of Technology (IITs), were recruited to conduct COVID-19-related research and development activities. This massive effort resulted in two nation-wide serological surveys to determine the seroprevalence of SARS-CoV-2, indigenous diagnostic kits and vaccine development, the establishment of COVID-19 biorepositories and clinical registries in 15 tertiary medical institutes, and a national consortium for genome sequencing of SARS-CoV-2. Additionally, India participated in multiple clinical trials like the WHO SOLIDARITY trial and the world's largest plasma therapy trial (PLACID). Reusable nanofiber N95/99 masks and portable ventilators were also developed. Hundreds of antiviral molecules have been screened, and the promising ones are being pursued further. The potential of traditional medicine as antivirals or immunomodulators is also being explored. Following a phase of severe crisis due to the limited availability of personal protective equipment (PPE) in February, India has now emerged as one of the major global PPE manufacturers.

Being the largest global vaccine provider, India has taken the lead in the development and production of COVID-19 vaccines. Two indigenous vaccine candidates, COVAXIN from Bharat Biotech

International and ICMR and a DNA vaccine (ZyCov-D) from Cadila Healthcare, along with other vaccines developed in partnership with foreign collaborators, including the Oxford–AstraZeneca ChAdOx1-S, manufactured by Serum Institute of India (SII) as Covishield; the RBD-S protein vaccine from Biological Evans; the mRNA vaccine of Genovax; and the Sputnik V vaccine, are in various stages of clinical trials. The Indian regulator has provided restricted emergency use authorization for Covishield and Covaxin. On 16 January 2021, India launched the world's largest immunization program for COVID-19 with the two indigenous vaccines. So far, 2.5 million healthcare workers have been immunized.

Despite the encouraging response, the COVIDization of systems has caused a major setback to research activities in non-COVID areas, especially those involving fieldwork. Non-COVID healthcare has also suffered enormously. To address this issue, the Ministry of Health has focused on promoting telemedicine since March 2020. This action provided much-needed relief to non-COVID patients and a boost to the health-tech sector. Telemedicine has emerged as a useful tool for quality care provision in rural and remote areas.

With the academic curriculum being taught online, the lack of human interaction and excessive exposure to electronic media are likely to have a lasting psychosocial impact on the youth. The indefinite postponement of admissions processes, the cancellation of fellowship programs and problems in online evaluation systems are taking a toll on students.

However, on a positive note, the high-level engagement of the population to understand the disease transmission dynamics; testing modalities; public health preventive actions, particularly vaccine development; and expected timelines of delivery was overwhelming. Intensive campaigns promoting hand hygiene, the use of masks and the adoption of hygienic social habits will have a positive impact in reducing the overall burden of tuberculosis and other respiratory infections in India in the near future.

Though the pandemic has hit hard, India is attempting to overcome the challenges through innovation and self-reliance as 'Atma-Nirbhar Bharat', a nation that has the capacity to walk tall in the world with the ideology of 'Vasudhaiva Kutumbakam' (the world is one family).

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Competing interests

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