Editorial

Covid-19: What the pandemic has taught us and the way forward

The past two years have redefined lives across the globe, as the impact of one of the most deadly virus outbreaks has left an indelible mark on everyone. It all began on 31 December 2019, when a new RNA virus responsible for a cluster of cases of pneumonia, emerged in Wuhan city of the Hubei province of China, leaving the scientific community perplexed. Little did we know that this virus, later known as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2),[1] would lead to one of the largest pandemics to grip humanity, causing substantial impact on the global economy, healthcare and our normal way of life. As on 31 August 2022, globally, there have been over 600 million confirmed cases of Covid-19 and 6.4 million deaths.[2] International travel from China spread the disease, with Europe being the second continent to get affected. In January 2020, India reported its first cases when three Indian medical students tested positive after returning from Wuhan. The constellation of symptoms of this novel infection were non-specific and closely resembled the common cold. On 30 January 2020, WHO declared it a 'Public Health Emergency of International Concern', and later, on 11 March 2020, a 'pandemic'.

Covid-19 quickly spread from one country to another and led to a total collapse of public health systems, even in the most developed countries. News from China and European nations such as Italy, regarding the spread of this infection, with emerging scientific evidence backing the infectivity and high mortality of this disease, helped initiate preventive measures early by the Government of India. Globally, urgent research into the biology of the virus, pathophysiology of the disease, epidemiology, preventive strategies, clinical features, diagnosis and management progressed with an understanding among the scientific community to share data freely and openly. Research from China explained the possible origin of the virus from the bat coronavirus,[3] and its infectivity assessed using the R_0 number (or basic reproduction number), which is the expected number of cases infected by one case in a population. Early reports showed an R_0 from 1.4 to 6.5,[4] and it was underlined that this statistic depended not only on the biological properties of the virus, but also the population behaviour, being higher in a densely populated area. (R_0 above 1 meant exponential rise in infections.) Research into the mechanisms of spread of the infection was debated to be via droplet, aerosols and from infected surfaces.[5] It was established that the virus in open spaces spread via droplets, which settle down within 4–6 feet. However, closed rooms with indoor ventilation were postulated to have circulation of the virus to a longer distance along the air current. Among patients admitted in an intensive care unit (ICU), aerosol-generating procedures (AGPs) such as endotracheal intubation/suctioning or cardiopulmonary resuscitation (CPR) could lead to generation of droplet nuclei, which would circulate within the enclosed space for a longer time. In experimental models, the virus could be isolated from infected surfaces for 4–72 hours, based on the type of surface and dose of inoculums.[5]

Taking lessons from other nations, the Indian government declared a nationwide lockdown from 25 March 2020. All workplaces and non-essential recreational facilities such as malls, theatres, swimming pools were shut down, along with a complete ban on non-essential travel. In India, efforts to curtail the spread of Covid-19 infection started earnestly with construction of dedicated Covid-19 health centres (DCHC) and nomination of certain hospitals as dedicated Covid-19 hospitals (DCH), spearheaded by the Indian Council of Medical Research (ICMR) and All India Institute of Medical Sciences (AIIMS), New Delhi. From the very beginning, the government launched an

extensive information campaign to educate and inform the public about infection control measures such as the use of masks, handwashing and social distancing. The campaign was led by the Prime Minister himself, who bolstered the public's trust by directly addressing the nation via mass media. He also launched a mass campaign, *Jan Andolan* to make India's Covid-19 response a 'people or community-led movement'. The government adopted a 'Test, Track, Treat' strategy to contain the virus from spreading. This required quick scaling up of laboratories and training of laboratory personnel, including technicians. The National Institute of Virology (NIV), Pune, isolated a strain of the novel coronavirus, making India the fifth country to do so. This enabled India to develop rapid diagnostic tests and vaccines. India started with 52 testing centres for Covid-19 but increased them to over 3000 centres in a short time. It developed a capacity of performing 2 million (20 lakh) tests per day and has crossed the half-billion mark of total samples tested. The government approved the 'India Covid-19 Emergency Response and Health System Preparedness Package' worth ₹15 000 crores in April 2020. The Prime Minister's office set up multiple empowered groups for multisectoral management of Covid-19. This helped in understanding the rapidly changing scenario of the pandemic and developing implementation programmes. Telemedicine guidelines and e-sanjeevani helped provide care to millions of patients using the online platform. A dedicated Covid-19 task force was set up to discuss issues and solutions for tackling the pandemic. Research was initiated in collaboration with multiple organizations including ICMR and AIIMS, to develop novel diagnostic approaches. Educational material was prepared to train professionals all over the country in the aspects of testing, prevention, personal protective equipment (PPE) and management of Covid-19 disease. The steps of donning and doffing of PPE were emphasized multiple times, as these were the most critical in prevention of infection, while taking care of affected individuals.

On 2 April 2020, the first patient of Covid-19 pneumonia was admitted to the Jai Prakash Narain Apex Trauma Centre of AIIMS, New Delhi, which had been transformed into a DCH. AIIMS released an interim clinical management protocol for patients who were asymptomatic or had mild, moderate or severe disease. The protocol was based on evidence extrapolated from management of viral acute respiratory distress syndrome (ARDS), i.e. SARS or H1N1 influenza, which was updated as newer evidence emerged following large-scale multicentre phase 3 randomized controlled trials.[6–8] Groups at risk for moderate to severe Covid-19 were identified.[9] Since the first nationwide lockdown in March 2020, it was stressed that all individuals must practise 'Covid appropriate behaviour' via physical distancing and protective measures such as wearing a mask, practising hand hygiene and cough etiquette. Although the mortality was low among healthy individuals, those with comorbid conditions and at-risk individuals had a higher mortality rate,[9] and it was imperative that those with asymptomatic or mild disease did not spread the infection. These efforts did curtail the infection successfully, but after the lockdown was lifted from most areas, and normal lifestyle was restored, the number of people infected in India started to rise between July and November 2020, which overburdened the existing healthcare facilities. With closure of many healthcare facilities, an increase in telemedicine facilities was observed, with consultations held via video conferencing or through use of other platforms/applications. The economic impact was substantial, with a large number of people losing their jobs. The concept of work-from-home started, especially in the information technology sector, with shutting down of most offices. Daily wage labourers and the marginalized community were the worst hit, with large-scale migration of these workers to their places of origin across state borders, which unfortunately fuelled the pandemic in India.

The Indian subcontinent has witnessed the scourge of the pandemic in three major waves followed by smaller epidemiological ripples. The second wave of the infection, from March to June 2021, almost crippled the nation's healthcare infrastructure, with a major shortage of hospital beds, non-availability of essential drugs and medical equipment, lack of oxygen and a sharp peak in the number of Covid-19-related deaths, leading to mass hysteria. The government responded with increased healthcare spending, set up new DCHs and oxygen plants, and enforced law to prevent hoarding of essential drugs and oxygen cylinders by the public. Lockdowns were implemented in specific hotspots, which were the source of spread of infection, with gradual re-opening. Physical distancing and wearing a mask in certain areas was mandated by law.

The ground-breaking discoveries in Covid-19 vaccination strategies provided some relief. Initially, the novel mRNA-based vaccines by Pfizer and Moderna, and

Oxford/AstraZeneca's vector-based vaccine, ChAdOx1, were approved by WHO. This was the first instance of the use of mRNA-based technology. In line with the philosophy of 'Atmanirbhar Bharat', India produced two vaccines locally and in January 2021, launched the largest vaccination drive in the world. This is remarkable progress since the H1N1 pandemic when we had to rely on WHO and global donations for vaccines. Later, with government's support, the country was able to develop multiple innovative vaccines for Covid-19, including the world's first plasmid DNA vaccine. The vaccines were rolled out in a phased manner, with priority for essential workers, the elderly, and those with comorbid illnesses. The vaccination campaign has been successfully implemented nationwide for adults and children alike. While anti-vaccination sentiments erupted across the globe, citizens in India ensured a disciplined response to the vaccination drive. India was able to vaccinate 2 billion people in less than 18 months. So far, 11 vaccines have been granted emergency use authorization by WHO.[10] Covaxin (BBV152), a whole virion inactivated vaccine indigenously developed by Bharat Biotech in India, with efficacy of about 78% against Covid-19 disease,[11] has been approved in 14 countries. However, evidence suggests that the efficacy of all existing vaccines against prevention of asymptomatic and mild infections is much less than that against moderate-to-severe disease and death.[11–14]

The journey ahead is fraught with perils as complete cessation of Covid appropriate behaviour can result in a widespread increase in asymptomatic and mild infections in the population. This can lead to the emergence of mutant strains, such as the Omicron variants, as the virus is resilient and mutates to prolong its existence in nature. It does this through increased contagiousness, immune evasion and lesser potential to cause fatal disease. Circulation of newer strains can be detrimental to the health of the at-risk population. Lessons from the 1918 Spanish flu and the H1N1 pandemic of 2009 tell us that the SARS-CoV-2 virus is here to stay. Our future armamentarium against this virus must include active surveillance for any new variant of concern, strengthening the vaccination drive and emergency preparedness strategies. The concern regarding waning of immunity in vaccinated individuals[15] was addressed by the administration of booster doses of the vaccine, which has shown efficacy against the Omicron variant as well.[16] However, efficacy of vaccines against all future strains of the virus is not certain. This makes emergency preparedness strategies essential, which include early recognition of an outbreak within a community, adopting Covid appropriate behaviour, increasing testing of exposed individuals and implementing lockdowns in specific hotspots (with >5% of tests positive). We need to invest more in research to develop novel antiviral drugs with a broader class effect and develop platforms to deploy new vaccines quickly. Research into 'One Health' is also needed. For the future, we need to enhance the healthcare budget, expand the health infrastructure, and employ newer technologies to develop cheaper and more durable medical equipment.

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