
IN DEPTH

Senior citizens wait in line at a COVID-19 vaccination center in Mumbai, India.

COVID-19

# India speeds up vaccinations as cases soar again

## Relaxed control measures, virus variants, and weather may drive powerful second wave

*By* **Vaishnavi Chandrashekhar**

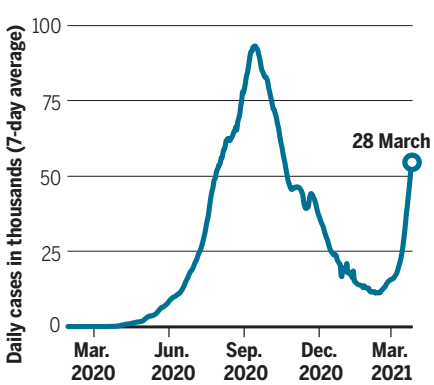
Just over 1 month ago, many Indians believed the pandemic was winding down. Cases of COVID-19 had declined continuously and dramatically for five straight months, travel restrictions had been lifted, and wedding season was in full swing.

But now a second wave is hitting. Nationwide, cases have soared from just over 11,000 daily in mid-February to more than 60,000 per day as *Science* went to press, more than half of them in Maharashtra state, of which Mumbai is the capital. The remainder are concentrated in seven other states, but scientists worry the disease may soon surge across the country again. India is fighting the rise with new restrictions and efforts to step up vaccination. But although the country produces two authorized COVID-19 vaccines, its immunization campaign has yet to gather steam.

Coming after India's first giant wave of cases, which peaked in September 2020, the spectacular decline defied dire predictions. Antibody surveys, which suggested densely populated areas in cities such as New Delhi and Mumbai were near herd immunity, raised hopes that transmission was burning out. But the optimism may have been unfounded; a more recent survey across 700 districts found only about 22% of Indians had been exposed overall. Meanwhile, control measures such as wearing masks were loosened, travel and social gatherings increased, and testing and contact tracing stumbled. "We let our guard down too quickly," says virologist Shahid Jameel of Ashoka University.

### Exponential growth returns

After a sharp 5-month decline, COVID-19 cases are rising rapidly in India. Most new cases are in eight states, but scientists worry about a nationwide surge.




Mutations may also be reigniting the pandemic. Just over 800 of more than 11,000 samples sequenced in recent months tested positive for B.1.1.7, a variant first discovered in the United Kingdom that is known to be more infectious. In Punjab, it was detected in 81% of 400 sequenced samples. Scientists are also investigating a variant with two mutations, E484Q and L452R, found in certain districts that are seeing an exceptional surge in cases. The two mutations are associated with "immune escape," or an ability to elude antibodies, and increased infectivity, health ministry officials said last week, although there is no evidence yet that this variant is causing the surge.

Climate could play a role as well. In Europe and the United States, the winter drives people indoors, where the virus spreads easily. In India, the increasing heat of spring may lead people to retreat to the fans and air conditioners of their homes, says epidemiologist Prabhat Jha, director of the Centre for Global Health Research, which has offices in India and Canada.

Meanwhile, less than 5% of India's 1.3 billion people have received at least one dose of vaccine. The government is striving to accelerate the pace, now about 2 million

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to 3 million shots per day; on 23 March it announced that everyone over age 45 can get a shot starting 1 April. The AstraZeneca vaccine, manufactured by the Serum Institute of India, accounts for most of the shots delivered so far. The other locally produced vaccine, Covaxin, was developed by Bharat Biotech in collaboration with the Indian Council of Medical Research.

India has reportedly put on hold exports of the AstraZeneca vaccine to help meet domestic demand. Since January, India had exported 60 million doses to some 80 countries, through bilateral aid, commercial contracts, and the COVID-19 Vaccines Global Access Facility, a global scheme to increase access to the vaccine.

Vaccine coverage among the country's poor is lowest, because of low awareness and day workers' inability to take time off, social workers say. In Mumbai, authorities have begun to set up vaccination centers in slums. Also needed, says Arun Kumar, head of Apnalaya, a nonprofit that works in the city's slums, are "massive community-based programs to clear vaccine fears."

Some of those fears stem from Covaxin's hasty approval in early January, before data from phase 3 trials were available. "It created a doubt," says former federal health secretary K. Sujatha Rao. "Once trust is broken, it's not easily regained." (On 3 March, Bharat Biotech announced the vaccine had 81% efficacy, based on an as-yet-unpublished initial analysis of 43 cases.)

Reports of violations of informed consent in trials and inadequate transparency around adverse events may have also shaken confidence. On 16 March, a group of 29 doctors and researchers wrote a letter about reported deaths, about 100 so far, of vaccinees. Although the vaccines may not be responsible, the petitioners say, the government should investigate them and disclose its findings. Unlike at least 20 European countries, India has not paused use of the AstraZeneca vaccine after reports of serious clotting disorders (see p. 14); officials say they are reviewing the data.

In an attempt to slow the second wave, several states and cities have reintroduced curbs on social gatherings, imposed temporary lockdowns, and stepped up testing and tracing. In Mumbai, once again a hot spot of the pandemic, the city banned public celebrations of the spring festival of Holi. "We were lucky compared to what might have been," says epidemiologist Giridhar Babu of the Public Health Foundation of India. "But the story is not over. The virus keeps surprising us." ■

Vaishnavi Chandrashekhar is a journalist in Mumbai, India.

COVID-19

# Pandemic scientists fight burnout

## Running on empty at bedside, bench, and beyond

*By* **Meredith Wadman**

When not caring for COVID-19 patients—her latest was a man with bacterial lung and blood infections superimposed on SARS-CoV-2 pneumonia—Krutika Kuppalli has been helping oversee the rollout of pandemic vaccines at the Medical University of South Carolina (MUSC), where she's an infectious disease physician. She has also been meeting with vaccine-hesitant hospital staff, sitting on a committee that reviews all planned COVID-19 clinical trials at MUSC, applying for funding to study patients with Long COVID, and handling online harassment that has followed her numerous media appearances and two rounds of congressional testimony last summer.

Asked recently during a Zoom interview how she is doing, she paused for nearly 20 seconds, struggling to regain her composure. "We have been busting our butts for 12, 14 months," she says. "I just feel I'm empty."

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From academic research centers to intensive care units (ICUs) to scientific journals to government agencies, scientists fighting the pandemic say they are hitting a wall, 15 months after the first report of a cluster of cases of pneumonia in Wuhan, China, introduced the virus that would upend their lives. "The pace that led to the incredible generation of knowledge on SARS-CoV-2 and COVID-19 has put enormous demands on the people who are expected to generate that knowledge," says David O'Connor, a viral sequencing expert at the University of Wisconsin, Madison, who has been tracking the spread of the virus, doing Zoom Q&A sessions with the vaccine hesitant, and helping neighborhood schools set up diagnostic testing. "This is a terrible time and we should all do what we can to help. But is it going to be sustainable?"

Throughout higher education many are feeling a strain from campus closures, remote teaching, disrupted research, work-from-home challenges, and more. For example, a survey of more than 1100 U.S. faculty members found 55% had seriously considered changing careers or retiring early because of the pandemic. The survey, conducted in October 2020 by *The Chronicle of Higher Education* and Fidelity Investments, also found that 69% of respondents felt stressed, 68% felt fatigued, and 35% felt angry—more than double the 2019 numbers. An international survey by the publishing house De Gruyter found a similarly bleak picture among medical and life scientists, specifically, although the numbers were small: Of 116 respondents, 76% said the pandemic had impacted their well-being; 30% said the impact was "severe."

Physicians have borne much of the burden, says Mona Masood, a Philadelphia-area psychiatrist and founder of the Physician Support Line, a free call-in service staffed by volunteer psychiatrists. The help line has fielded calls from more than 2000 people since it launched 1 year ago; calls have peaked during pandemic surges, Masood says. Some are from doctors on the front lines—for example, an ICU physician who had just lost his 20th patient and broke down on the phone after a 48-hour shift. Others come from physician-scientists who, despite their work on vaccines or variants, feel guilty that they are not caring for COVID-19 patients alongside their colleagues.

For junior scientists, the crisis has magnified stresses already present in the academic system. "Everyone is working nights, weekends, every spare minute of their lives. There's no extra pay. There's no guarantee of any extra recognition," says Emma Hodcroft, a computational biologist and postdoc at the University of Bern who has been tracking SARS-CoV-2 evolution for the project Nextstrain. "I am precariously employed; I don't have a long-term job. I feel a lot of pressure that this is my opportunity and I cannot waste that," says Hodcroft, who has been an author on 18 SARS-CoV-2 papers and preprints since February 2020.

Some academic scientists—especially those with young children—say their institutions have done little to alleviate their stress. "A few 'atta-boys' are tossed by the Provost to thank faculty for their flexibility with coping with challenging times, but no real differences implemented," one senior lecturer commented in a recent National Academies of Sciences, Engineering, and Medicine report that found a disproportion-

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