INDIA'S COVID-19 EMERGENCY

# DEAD GIVEAWAY

A crematorium in New Delhi on April 21, 2021

COVID-19

LET'S FIX BLAME

WHAT LED TO THE ALL-ENGULFING SECOND WAVE? HOW DID WE MISS THE EARLY SIGNALS? WHY ARE WE STILL UNPREPARED?

By Richard Mahapatra, Banjot Kaur, Vibha Varshney, Shagun Kapil Vivek Mishra, Kiran Pandey and Rajit Sengupta in Delhi with Rituparna Palit from Varanasi; Rakesh Kumar Malviya from Bhopal; Ajit Panda from Nuapada; K A Shaji from Thiruvananthapuram; Jayanta Basu from Kolkata; Jumana Shah from Ahmedabad; Tamanna Naseer from Bengaluru; and Aishwarya Sudha Govindarajan from Chennai
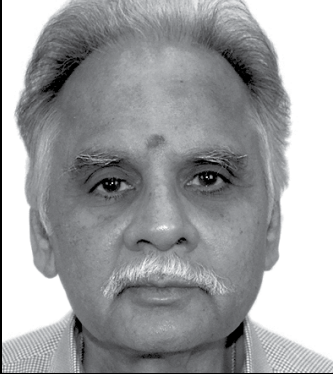
OCTOBER 18, 2020

The peak of active coronavirus cases came in late September at around 10 lakh, and by this time, India was far better equipped to handle the pandemic in terms of diagnostics and vital equipment inventories. In short, the lockdown flattened the curve

M VIDYASAGAR
Professor, IIT Hyderabad, and chair of government's COVID-19 India National Supermodel committee
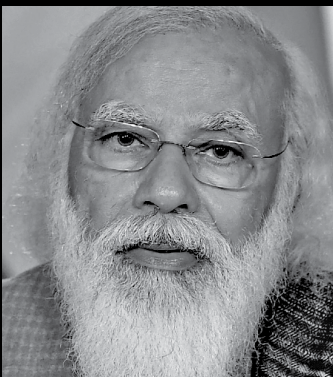
OCTOBER 18, 2020

We cannot rule out a second coronavirus wave this winter in India. Things can happen and we are still learning about the virus

V K PAUL
Member, NITI Aayog

JANUARY 28, 2021

I remember what many reputed experts and top institutions in the world said in February-March-April last year. It was predicted that India would be the most affected country from corona all over the world. It was said that there would be a tsunami of corona infections in India

NARENDRA MODI
Prime Minister at the World Economic Forum's Davos Dialogue

Owing to limited testing and delayed results, the official COVID-19 numbers are likely to be misleadingly low. This is particularly so in rural areas where people due to lack of awareness are hesitant to get themselves tested and reluctant to take treatment

FEBRUARY 26, 2021

India is unlikely to see a second wave in infections

MANINDRA AGRAWAL
Deputy Director, IIT Kanpur, and member of the
COVID-19 India National Supermodel Committee

MARCH 8, 2021

We are in the endgame of the COVID-19 pandemic in India

HARSH VARDHAN
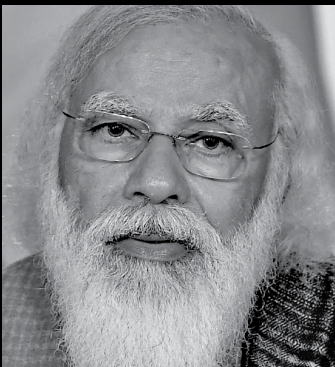Union health minister at a meeting of the Delhi
Medical Association

MARCH 30, 2021

The situation is going from bad to worse... No part of the country should be complacent. Trends show that the virus is still very active and can penetrate our defences

V K PAUL
Member, NITI Aayog

APRIL 20, 2021

The country is today fighting a very big battle against COVID-19. The situation had improved for a while, but the second COVID-19 wave has come like a storm

NARENDRA MODI
Prime Minister in his address to the nation

Sudhir Mahajan, a resident of Bhajanpura in northeast Delhi, lost his parents and younger brother to COVID-19 in just 100 hours. "My parents died due to lack of oxygen, without even entering a hospital. While I was arranging for their cremation, my neighbour called me to inform that my brother was having trouble breathing," he says. "It took me almost a day to get him admitted to the Lok Nayak Jai Prakash Narayan Hospital, while volunteers outside the hospital provided him oxygen support. Just hours after his admission, the doctors declared him dead. He was just 29 years old," says Mahajan. All the deaths took place between April 19 and April 22, he says, as he waits for the last rites of his brother at a makeshift cremation ground on the banks of the Yamuna on April 24. "First you wait for hospital admission, then for treatment, then for oxygen and, in case of death, for cremation," Mahajan says. "I was told to leave the body at the crematorium with my name and phone number. I waited for two days. When nobody called, I decided to come to the crematorium and wait. I have been here for almost 10 hours. If we can't get oxygen, what else can we expect?" Mahajan tells *Down To Earth* (DTE).

The whole of April, Delhi gasped for oxygen. As COVID-19 cases soared, so did the number of people seeking hospitalisation. Doctors say that unlike last year, the COVID-19 patients in the second wave have severe bloating of lungs, which could be due to the new virulent SARS-COV-2 strains. The mutant strains seem to cause lung inflammation on the very first day of infection, and by the third day, the body's immune system triggers what is called a cytokine storm. Cytokines are proteins deployed by the immune system to kill the body's own cells and tissues. The cytokine storm results in lung inflammation, severe damage to lungs and ultimately leads to hypoxia, a condition in which the body or a region of the body is deprived of adequate oxygen supply at the tissue level. At this stage medical oxygen (contains at least 82 per cent pure oxygen, as per the World Health Organization) is vital to help the patient keep breathing. Ajoy Sarkar, a critical care expert at Peerless Hospital, Kolkata, says the second wave is different from the first in many ways. "Infectivity is extremely high which has led to such a high spike compared to the first wave. The virus also seems to be invading the lungs much quickly compared to earlier, pushing up the oxygen requirement." Agrees Arup Haldar, a pulmonologist based in Kolkata. "Compared to earlier, the number of critical oxygen dependent patients is much more in hospitals," he says.
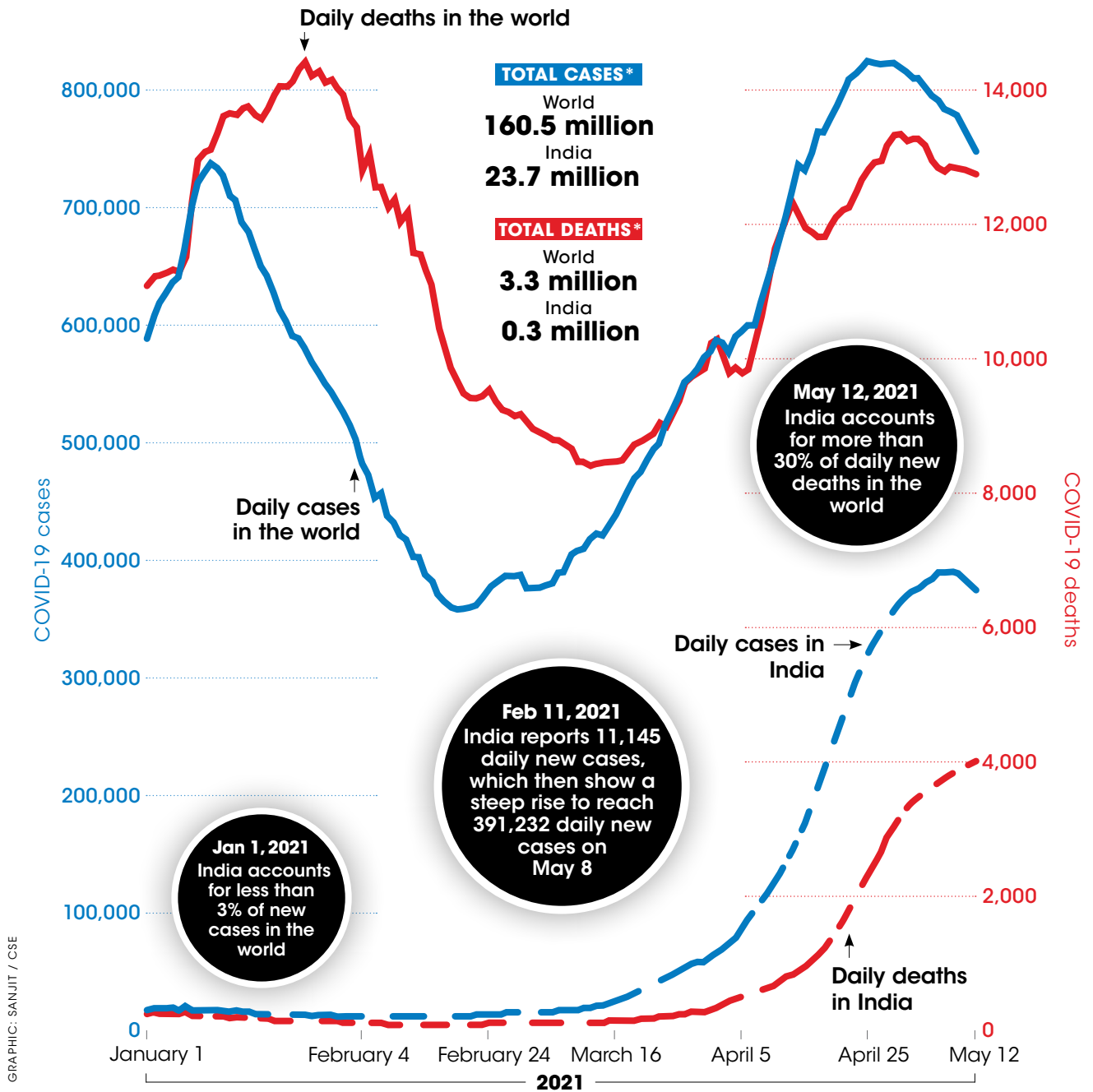
Patients with such conditions thronged hospitals in Delhi by the thousands everyday throughout April, with the number of new cases shooting up from 3,548 on April 5 to 28,395 on April 20, as per the Center for Systems Science and Engineering at Johns Hopkins University in the US. By the second week of April, hospitals started reporting shortage of beds and oxygen. Hospital after hospital went public with SOS calls for oxygen supply. Eventually, the Delhi High Court and the Supreme Court of India took note of the emergency situation in the capital city, which had more people dying due to oxygen support than other COVID-related complication. On May 1, a Saturday, the Supreme Court ordered the Union government to ensure supply of oxygen to the city hospitals within two days. The Delhi High Court passed a similar order the same day: "Enough is enough. No one is asking for more than allocated. If you can't supply the allocation today, we will see your explanation on Monday (May 3)."

The High Court had ordered the Centre to supply 700 tonnes of oxygen per day to Delhi. The Centre allotted 590 tonnes of oxygen per day while the Delhi government had asked for 970 tonnes. The Delhi High Court on May 3 initiated contempt proceedings against the Centre for failing to comply with its as well as the Supreme Court's directions to supply oxygen to the

UNWANTED PEAKS

India's COVID-19 cases have been rising since February, and in the first two weeks of May, there were five days when the country had more new cases than rest of the world put together

Daily deaths in the world

TOTAL CASES*	
World	
160.5 million	
India	
23.7 million	

TOTAL DEATHS*
World
3.3 million
India
0.3 million

Daily cases in the world

May 12, 2021
India accounts for more than 30% of daily new deaths in the world

Daily cases in India →

Feb 11, 2021
India reports 11,145 daily new cases, which then show a steep rise to reach 391,232 daily new cases on May 8

Jan 1, 2021
India accounts for less than 3% of new cases in the world

Daily deaths in India

COVID-19 cases

COVID-19 deaths

800,000 — 14,000
700,000 — 12,000
600,000
500,000 — 10,000
400,000 — 8,000
300,000 — 6,000
200,000 — 4,000
100,000 — 2,000
0 — 0

January 1   February 4   February 24   March 16   April 5   April 25   May 12

2021

Source: Our World in Data; Figures are based on seven-day rolling average; *From the start of the pandemic till May 12, 2021

capital. The Centre moved the apex court, which stayed the order on May 5 but asked for an explanation. The Centre responded saying it had released 730 tonnes of oxygen to Delhi that day.

Ironically, on August 18 last year, the Solicitor General of India told the Supreme Court that "there was no requirement of special plan" for the situation. According to a calculation by Milind Sohoni of IIT Bombay and independent researcher Alakhya Deshmukh, India should have planned for five deaths per million people per day, while currently all medical emergencies and stock of essential supplies like oxygen are based on two deaths per million a day—the mortality rate witnessed during the first wave. With this planning, we would have known that "the national capacity of 7,000 tonnes per day of oxygen was not adequate and urgent measures were required," the researchers say. Currently, India's estimated demand of oxygen stands at 4,000 tonnes per day. On May 2, at least 15 states reported 10-50 per cent deficit supply.

Throughout the last two weeks of April and in the first week of May, crematoriums in the National Capital Region were overwhelmed with the constant arrival of bodies. Additional spaces were carved and platforms built for funerals in Delhi; the government allowed cremations on pavements in Ghaziabad, Uttar Pradesh; while at Dwarka, in southwest Delhi, a cremation ground for dogs was opened up for human use. In many instances, multiple bodies were cremated together to reduce the queue. At most crematoriums, bodies were burnt at undesignated spots, with the protective clothing on. Sights of half-burnt bodies were quite common.

"I have never seen a war, but the situation in Delhi must be similar to it," says Rishab Gupta, a student at Delhi University and member of a volunteer group that has been helping COVID-19 families with basic facilities. "I never imagined that in a health emergency, I would be more involved in organising cremations than arranging medicine," he says.

Like Rishab, the world watched the lethal second wave of the pandemic in India with disbelief and shock. Between April 26 and May 2, India recorded the highest number of new cases of COVID-19 in the world—2.6 million—with 23,800 deaths (see 'Unwanted peaks' on *p*21). This was the second consecutive week India held this unfortunate record. In the week before, there were 2.25 million new cases. By comparision, the US—the world's most COVID-19-affected country—recorded 1.77 million new cases as its worst outbreak in January 4-10. On May 11, India had more new COVID-19 cases than the rest of the world put together.

> **Our analysis shows the infection detection rate is below 5 per cent...This means the number of cases being detected needs to be multiplied by 20 or more to get the number of infections occurring in India**
>
> **CHRISTOPHER J L MURRAY**
> **Professor at the Institute for Health Metrics and Evaluation, University of Washington, US**

LEADING CAUSE OF DEATH

COVID-19 has emerged as the biggest cause of death in India (earlier, it was ischemic heart disease) in merely nine weeks preceding April 26, estimates the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in the US. On February 22, it was the 26th main cause of death, accounting for an average 180 deaths per day. By April 26, it was causing an average 4,800 deaths a day. The death toll from COVID-19 in India will be 0.96 million by August 1, 2021, according to the latest projection by IHME. With an estimated global toll of over 5 million, India would account for nearly a fifth of the total deaths.

There were many more COVID-19 cases in India than the Government of India has declared, says Christopher J L Murray, professor at IHME, in a statement on the analysis on April 27, 2021. "Our analysis of seroprevalence surveys shows that the infection detection rate is below 5 per cent—maybe even around 3-4 per cent. This means that the number of cases that are being detected needs to be multiplied by 20 or more to get the number of infections that are occurring in India. The number of infections right now is extraordinarily large," Murray said. "Our latest projections show that the number of infections driven by the surge in India (and perhaps also driven by the surges in Bangladesh and Pakistan) will be reaching 15 million a day globally," he adds.

Murray argues that infection in India is so high that "COVID-19 may run out of people to infect pretty soon". This means after mid-May transmission in India would start declining, estimates the report. IHME projected India's daily death toll at 13,050 by May 15.

SURGE IN CASES

April turned out to be the cruellest month for India in the 15 months of the pandemic so far. The country recorded an unprecedented 6.6 million new cases, with 46,000 deaths, according to the World Health Organization. On the last day of the month,

India became the only country to record over 400,000 new cases in a single day, suggesting that the onslaught is unlikely to ebb anytime soon. By the last week of April, the countrywide demand for medical oxygen went up by eight-fold—from 700 tonnes a day to over 6,000 tonnes a day.

Uttar Pradesh, given its poor health infrastructure and high population density, become a veritable COVID-19 hell in the pandemic's second wave. Some 12,238 people have succumbed to the disease in the state, as of April 30, 2021, while 1.2 million have tested positive, making it India's fourth worst-affected state. Hospitals have run out of oxygen and beds, and crematoriums are falling short of space. While the situation went out of control, the chief minister kept claiming the numbers were not "significant", there was "no scarcity of oxygen". The government also promised "free cremation for COVID-19-related deaths".

Between April 19 and May 3, the oxygen demand in the state increased by over 300 per cent. Of the state's 0.28 million active cases on May 5, a huge 82 per cent were in home isolation, and, as health officials say, might be needing hospitalisation if not properly treated. That adds on to the already collapsing health system. Giridhar R Babu, professor and head of life course epidemiology at Public Health Foundation of India, a public-private initiative, says, "In Uttar Pradesh and Bihar, the health infrastructure is poor and human resources to provide critical care at the field level are not enough. Owing to the chronic weakness in the health systems of these states, it is unrealistic to expect them to perform better than metropolitan cities during such a health crisis."

On May 5, the Allahabad High Court directed the district magistrates of Lucknow and Meerut to verify news of COVID-19 patients dying due to oxygen shortage and observed: "Death of COVID patients just for non-supplying of oxygen to the hospitals is a criminal act and not less than genocide."

Doctors are in a dilemma, as resources are scarce. "I had only seen these real life ethical dramas in sci-fi movies. It is so overwhelming when a group of 15-20 patients, all with oxygen saturations ranging from 30 per cent to 40 per cent (the normal level is 95-100 per cent), arrive at the same time and require ventilator support. Whom should we give it to? Should it be on a first-come-first-served basis? When I did this the first time, I had to deny a ventilator to a 30-year-old against a 73-year-old. The senior person passed away within a few hours. The younger one, too, died later. I wondered if I should have given a chance to the 30-year-old. But who am I to choose; everybody has an equal right to live. I will always feel guilty that I couldn't save either of them," vents Vivek Gundappa, deputy medical superintendent and assistant professor of pulmonology at Rajarajeswari Medical College and Hospital, Bengaluru, one of India's worst impacted metropolitan cities.

RURAL SPREAD

In April, the worst fears of health experts also came true. Unlike the first wave, the virus spread to rural districts, causing much more deaths. In fact, India had more deaths in rural districts than in urban districts in April, even though the overall caseload in rural areas was lower—a first since the start of the pandemic. An analysis by DTE shows rural districts accounted for 45.4 per cent (3.1 million) of the new cases in April 2021, but saw 50.8 per cent (24,000) of COVID-19 deaths (see 'Hinterland hit hard' on *p*34). This is a deviation from the overall trend (March 2020-April 2021), where urban districts accounted for 54 per cent cases and 56 per cent deaths. September 2020 is the only other month when rural India recorded more than 50 per cent deaths; but at that time, the rural caseload was also higher than in urban areas.

The spread in rural areas that started in April is likely to worsen in the coming months because of two reasons. First, the second wave is yet to peak in India—with health experts predicting an upward trend for at least another month. Second, most of the worst-hit states including Delhi, Karnataka and Maharashtra, are imposing lockdowns, triggering reverse migration which leads to rural deaths. This was seen last year, when after a nationwide lockdown between March 24, 2020, and May 30, 2020, the Centre started the unlocking process in a phased manner. This continued till September 2020, when the first wave peaked in the country.

Health infrastructure in rural India is substantially weaker than that in cities. Over 65 per cent of India lives in rural districts, as per the World Bank, yet only 37 per cent of beds in government hospitals are in rural India, says the Union Ministry of Health and Family Welfare's National Health Profile 2019. Lack of awareness, hesitation to get tested and reluctance to take treatment make the rural population more susceptible to COVID-19. Owing to limited testing and delayed results, the official COVID-19 numbers, especially in rural districts, are likely to be misleadingly low.

Nuapada, a rural district of Odisha and one of India's poorest, offers a snapshot of the havoc that the pandemic can wreak in such areas. The biggest problem here is shortage of oxygen, which leads to deaths. Duryodhan Majhi, a member of the Silva Gram Panchayat in the district, had COVID-19 and died on April 24 when the supply ran out at the district COVID-19 hospital, says his brother Sadhuram. Dolley Hota, a resident of Bhubaneswar, sent a letter to the chief district medical officer (CDMO) of Nuapada after her father Janmejaya Joshi died at Khariar's COVID hospital on April 24. She claims her father died due to oxygen shortage.

"The situation in the COVID hospital at Nuapada was good during the first wave of the pandemic. But the situation now is bad," says a local journalist, requesting anonymity. "There are no timely visits by staff. Patients have to run to the emergency section frequently to complain of their problems," says the journalist whose wife

Humanity's experience with pandemics shows that these scourges can have multiple waves. What was, then, the hurry for India to bestow upon herself congratulatory superlatives of having fought off the disease?
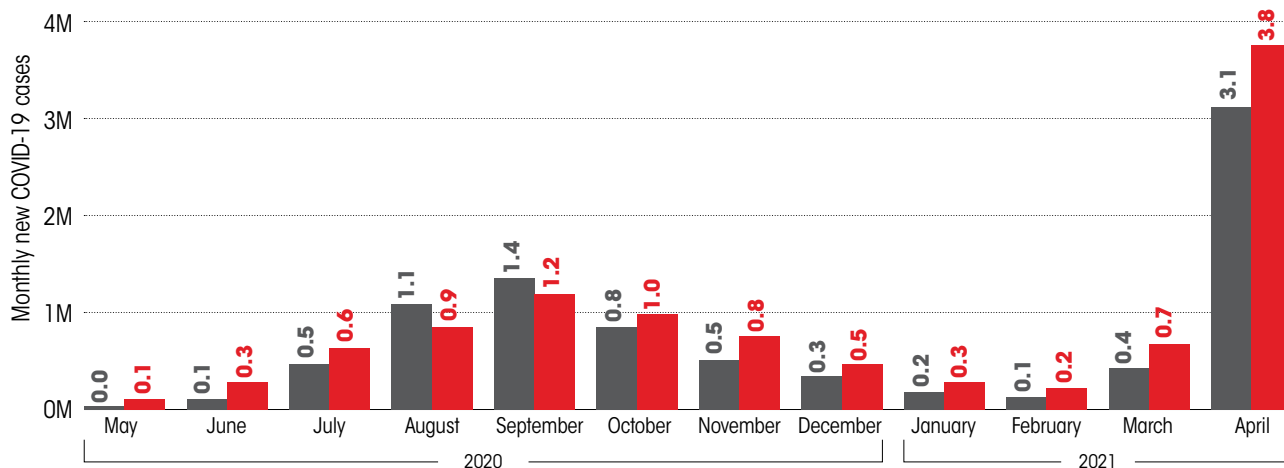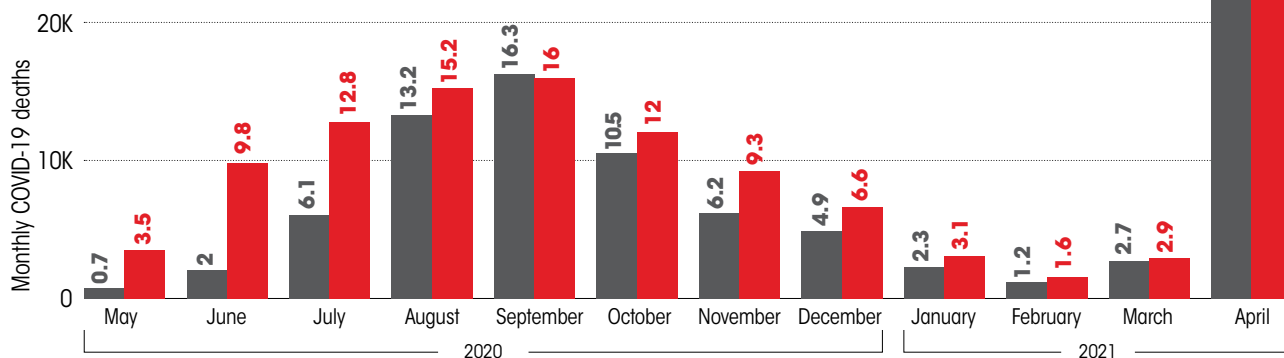
Hinterland hit hard

India had more deaths in rural districts than in urban in April 2021, even though the overall caseload in rural areas was lower—a first since the start of the pandemic

■ Rural ■ Urban

MONTHLY NEW COVID CASES (IN MILLION)

	Rural	Urban
May 2020	0.0	0.1
June	0.1	0.3
July	0.5	0.6
August	1.1	0.9
September	1.4	1.2
October	0.8	1.0
November	0.5	0.8
December	0.3	0.5
January 2021	0.2	0.3
February	0.1	0.2
March	0.4	0.7
April	3.1	3.8

Monthly new COVID-19 cases

MONTHLY COVID-RELATED DEATHS (IN 1,000)

	Rural	Urban
May 2020	0.7	3.5
June	2	9.8
July	6.1	12.8
August	13.2	15.2
September	16.3	16
October	10.5	12
November	6.2	9.3
December	4.9	6.6
January 2021	2.3	3.1
February	1.2	1.6
March	2.7	2.9
April	24.3	23.6

Monthly COVID-19 deaths

Source: How India Lives; Census 2011; Data as on April 30, 2021

died of COVID-19 in the hospital. Kali Prasad Behera, CDMO, Nuapada, told DTE that there was no question of negligence at the hospital, nor was there a shortage of oxygen, and that the hospital was getting 250 cylinders every day.

The number of daily new COVID-19 positive cases in the district as well as the percentage has not shown any decline in recent weeks. This indicates the spread has not just continued but the demand for hospitalisation is also increasing. The total number of positive cases from March 1 to April 25 was 5,399, which was 10.16 per cent of the total people tested. The number of people found positive in the district on April 25 was 300, which is about 30 per cent of the total 1,003 people tested. Deaths due to COVID-19 in Nuapada have also significantly increased in April, at an average of five deaths daily. Nuapada has already witnessed 87 deaths in the second wave of COVID-19, with the number rising by four to six deaths every day. Sill, most people

GRAPHIC: SANJIT / CSE

in the villages of the district are shy of testing. Radheshyam Behera of Sargimunda village says most people in his village had COVID-19 symptoms. Hence, he requested the CDMO to depute a team to conduct antigen tests. "When a team reached the village the next day, only three families volunteered for testing. Six of the 20 people tested were found COVID-19 positive," Radheshyam says. For most people in the villages, COVID-19 carries a stigma that leads to restrictions on the use of village commons, especially the water sources.

Rural areas in India's relatively more developed states have similar stories. Take the case of Gujarat, where Prime Minister Narendra Modi served as chief minister for over a decade. The state's 18,000 villages spread over 33 districts face a severe shortage of doctors and medical personnel, oxygen supply, beds and other life-saving equipment, say senior government officials on condition of anonymity. Many districts in Gujarat have a single community or healthcare centre for some 10 villages. Some of these centres do not even have facilities for rapid antigen tests. People's reluctance to follow COVID-19 guidelines and social distancing norms as well as "vaccine hesitancy" is making the situation worse.

Mehsana district in north Gujarat has the highest caseload among the rural districts of the state. It is the home district of Gujarat's health minister, Nitin Patel. Chandrakant Parmar from the prosperous Kherva village in Mehsana told DTE that there were more than 80 deaths in March and April.

The village that lies on the state highway between Gandhinagar and Mehsana, has a population of 15,000 and is reportedly seeing three to four deaths daily after the infection numbers surged in April. The village has a primary healthcare centre with a staff of 25 to 30 people, including a doctor, 10 to 15 nurses and paramedics. But it lacks intensive care units, CT-scans, sonography and oxygen cylinders. The village sarpanch did arrange for a 200-bed quarantine centre, but a lot of people are still quarantined at home. Kherva also receives patients from some 15 neighbouring villages. The administration has converted the Ganpat University in the village into an isolation centre. COVID-19 testing and vaccination are free but village residents are hesitant. Kherva has about 500 COVID-19 patients, says the sarpanch of the village.

Another affected village is Khanpur in Patan district in north Gujarat. The village is inhabited by 800 families and has seen three deaths so far. Dev Desai, a resident of Khanpur says people in the village die within three to four days after getting fever.

"

Compared to the first wave, the infectivity this time is extremely high which leads to such a high spike. The virus seems to be invading the lungs much quickly pushing up the oxygen requirement

AJOY SARKAR
Critical care expert at Peerless Hospital, Kolkata

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FALSE NEGATIVE

The Centre said worst was over, states dismantled hospitals, people celebrated festivals and polls were held. All too soon

There is no definitive way to pronounce the arrival of a second wave in a pandemic. Still the pertinent question for India now is: why did the country look so hapless in face of the second wave? There are reasons for us to ask this question. Across the world, countries were reporting a second wave deadlier than the first one. The Spanish Flu in the last century and even other recent pandemics, like the 2002 SARS outbreak and 2009 H1N1 influenza, show these scourges can have multiple waves. What was, then, the hurry for India to bestow upon herself congratulatory superlatives of having fought off the disease? There has been a distinct difference between the approach of the scientific community and the political leadership, particularly the prime minister and his cabinet, who have been declaring India's success in curbing the pandemic.

India, thus, entered 2021 with the bravado of having tamed the once-in-a-century pandemic. In September 2020, new cases had peaked at 93,000 a day before the curve started to flatten. In mid-February this year, India was registering some 12,000 cases a day, which was much less than what rich countries in Europe were reporting. Soon, the call for lockdown was replaced by "unlockdown", and the country almost returned to its pre-COVID-19 level of activities.

Complacency set in. Many states dismantled the emergency COVID-19 treatment facilities that were put in place in March-July 2020. Madhya Pradesh created 40,000 extra beds for COVID-19 patients last year. By April 2021, at least 50 per cent of them were dismantled, as per the Union health ministry data. Similarly, Uttar Pradesh had set up 503 COVID-19 hospitals, with 0.15 million beds, but by February this year, just 83 hospitals with 17,000 beds were functional. People continued to report symptoms and got cured as well. Testing came down as a result of complacency.

Even amid a second surge, Haryana, Punjab, Puducherry, Goa, Himachal Pradesh, Rajasthan, Assam, Andhra Pradesh, Telangana and Jharkhand decreased the number of ICU beds. Haryana and Punjab, where cases are still rising, reduced ICU beds by 79 and 70 per cent respectively in the past one year, according to health ministry data presented in Rajya Sabha on February 2, 2021. These states have also reduced the number of ventilators by 73 and 78 per cent respectively. While 26 states, including Maharashtra, have strengthened their critical care infrastructure by adding ventilators, the number has reduced in nine states, shows the data. Overall, India has added 10,461 ventilators since April 2020.

PREMATURE VICTORY

The first assurance that India was winning the battle came in October 2020 from the COVID-19 India National Supermodel Committee, a 10-member panel appointed by the Department of Science and Technology. In its study titled *Progression of the Covid-19 Pandemic in India: Prognosis and Lockdown Impacts*, the committee said without the stringent national lockdown imposed in March 2020, we would have hit a peak load of over 14 million cases in June 2020—the month when restrictions were withdrawn gradually. "No fresh lockdowns should be imposed on district or state level

COVID-19 has emerged as the biggest cause of death in India in merely nine weeks preceding April 26, 2021. Earlier, the cause was ischemic heart disease
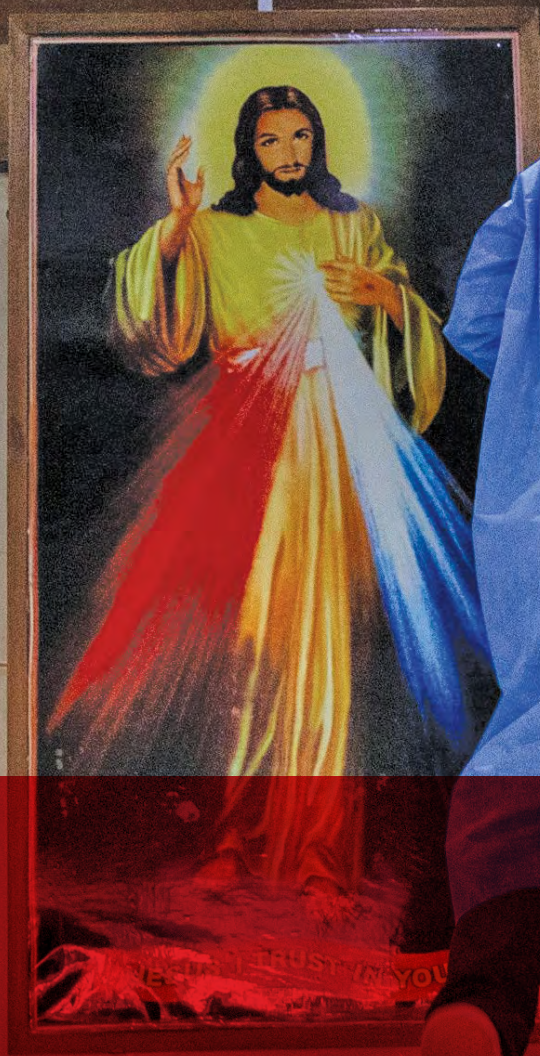
> ## After the initial success in flattening the curve, priorities of the state changed drastically. COVID-19 took a back seat in the face of two successive elections and the celebration of different festivals

V RAMAN KUTTY
Public health expert and epidemiologist based in Thrissur, Kerala

to contain the spread of COVID-19 unless there is an imminent danger of healthcare facilities being overwhelmed," committee chairperson and professor at the Indian Institute of Technology (IIT) Hyderabad M Vidyasagar told the media on October 18, 2020, based on the supermodel, Susceptible, Asymptomatic, Infected, Removed (SAIR). "If all protocols are followed, the pandemic can be controlled by early next year with minimal active symptomatic infections by the end of February," said Vidyasagar. "The peak of active coronavirus cases came in late September at around 1 million, and by this time, India was far better equipped to handle the pandemic in terms of diagnostics and vital equipment inventories. In short, the lockdown flattened the curve."

The same day, V K Paul, member of the NITI Aayog and head of the National Expert Group on Vaccine Administration, while reiterating that the spread of the pandemic had "stabilised" in most of the states, cautioned of a second wave in the winter months. He cited examples of European countries that were witnessing second waves with the onset of winter. Like Vidyasagar, he also warned that without COVID-19-appropriate behaviour during the "festival season and winter months" the disease could pose a challenge.

On January 28, 2021, while speaking at the Davos Dialogue of the World Economic Forum, Prime Minister Narendra Modi declared that naysayers had been proved wrong. "I remember what many reputed experts and top institutions in the world said in February-March-April last year. It was predicted that India would be the most affected country from corona all over the world. It was said that there would be a tsunami of corona infections in India…In a country which is home to 18 percent of the world population, that country has saved humanity from a big disaster by containing corona effectively," he claimed.

On February 26, 2021, Manindra Agrawal, deputy director, IIT-Kanpur, and part of the COVID-19 India National Supermodel committee, told media that a second wave was unlikely despite a surge in cases weeks before his forecast. The "supermodel" forecast said that there would be up to 11.5 million total cases by April 2021 (all cases since March 2020), or 30,000 to 50,000 new cases a week till April 2021. At that time, Maharashtra was reporting the highest number of cases. Agarwal claimed that as per the model, 60 per cent of the population was already infected, thus, reaching herd immunity.

On February 4, 2021, Balram Bhargava, director general of the Indian Council of Medical Research, told media that only 21 per cent of population was infected, based on its third national serological survey conducted from December 17, 2020 to January 8, 2021. While these multiple forecasts churned out conflicting messages, the month saw the forecast by "supermodel"

SUTRA going wrong. In October 2020, this model said that there would be just 40,000 active infections by February. The actual number was four times higher.

On March 8, speaking at a meeting of Delhi Medical Association, Union health minister Harsh Vardhan declared: "We are in the endgame of the COVID-19 pandemic in India." While he was speaking, his officials were collating data that would contradict his claim. For the week ending March 12, the seven-day average of new COVID-19 cases across India rose by 67 per cent from the lows seen after the end of the first wave of the pandemic. Seventeen of India's 20 most populated states reported 20 per cent more new cases from their troughs.

Again, on March 30, the health minister, while releasing a status report on India's battle against the pandemic, said: "This is a historical moment for all of us. On 30th January we had our first case and today, after one year and two months, we have chased more than 1.2 crore [12 million] COVID-19 cases." He termed India's experience as an "exceptional opportunity", adding, "We have fared better than many countries." The same day, NITI Aayog member V K Paul went public saying the "situation was going from bad to worse" and that the virus almost "penetrated our defences".

Two days later, scientists working on another government-backed model for charting the trajectory of COVID-19, using SUTRA (Susceptible, Undetected, Tested-positive, and Removed Approach) predicted that India's second wave will peak by the third week of the same month at 100,000 cases a day (see 'Model talk' on *p*43). A month later, the scientists admitted that the model predictions were incorrect, primarily because of the nature of the virus that has been changing very rapidly.

By then, India had launched one of its most expansive global relief operations. The country's oxygen export increased by 734 per cent in January. It also exported around 193 million doses of vaccines. "We kept warning that the pandemic was not over but no one was listening," says Rakesh Mishra,

senior principal scientist and director of the Hyderabad-based Center for Cellular and Molecular Biology. Mishra is currently investigating whether the variant B.1.617, found first in India, is behind the second wave in the country. He is also the scientist who went public with information that shows the government was informed of a deadly wave in early March.

REALITY HITS HOME

From mid-April, India's daily cases were above 0.2 million. This is the time when almost all states reported an increase in cases. An acute shortage of oxygen and hospital beds overwhelmed the country. On April 20, Modi addressed the nation: "The country is today fighting a very big battle against COVID-19. The situation had improved for a while, but the second COVID-19 wave has come like a storm." His acknowledgement of a crisis that had been brewing for over six months was of little use. It is a national emergency-like situation, said the Supreme Court two days later.

Soon after Modi's acknowledgement of the deadly second wave, heads of the government's top institutes hinted that the second wave in India might have been driven by its variants—the UK variant, South African variant, Brazilian variant and the "Indian" variant—which was speculated since September last. At a webinar on April 23, 2021, Sujeet Singh, director of the National Centre for Disease Control, said that the UK variant might be driving the surge in Delhi. "In the second week of March, it was found in 28 per cent of the samples. In the last week of March, it was found in 50 per cent samples," he said. The Indian variant's prevalence in Delhi is also on the rise, he added. "The surge in Delhi is clearly due to the variants," he said. Punjab's surge has been driven by the UK variant, while in the case of Maharashtra, the "Indian variant" is the key factor, he said.

T Jacob John, a virologist and professor at Christian Medical College, Vellore, says, around mid-March, when the number of

NOT QUITE THERE

In the first 118 days since January 16, when India began its COVID vaccination drive, **only 5 per cent of its adult population** had received both the jabs. Uttar Pradesh, Bihar, Madhya Pradesh and eight more states are below 5 per cent

AS ON MAY 14

16%
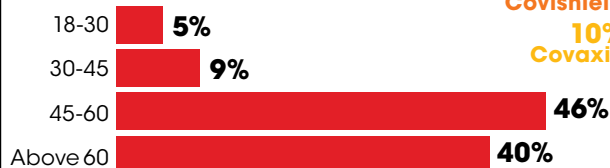Indians received the first vaccine dose

5%
Indians received the second vaccine dose

3%
Indians have tested COVID-19 positive

INDIA HAS SO FAR ADMINISTERED 179 MILLION DOSES

Break-up by age

Age	%
18-30	**5%**
30-45	**9%**
45-60	**46%**
Above 60	**40%**

90% Covishield
10% Covaxin

Vaccine type

% OF ADULT POPULATION THAT HAS BEEN

00 Partially vaccinated   **00 Completely vaccinated**
00 Infected with COVID-19

1. Ladakh
49% | 21% | 9%
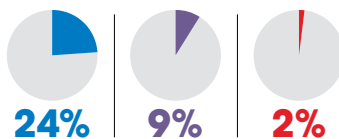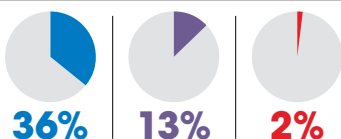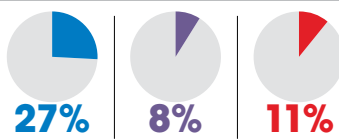
2. Tripura
34% | 18% | 1%

3. Sikkim
36% | 13% | 2%

4. Uttarakhand
27% | 10% | 4%

5. Gujarat
26% | 9% | 2%

6. Arunachal Pradesh
24% | 9% | 2%

7. Delhi
27% | 8% | 11%

8. Himachal Pradesh
32% | 8% | 3%
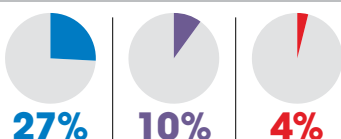
9. Kerala
24% | 7% | 10%
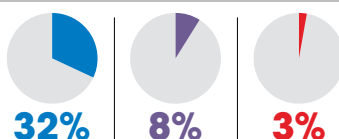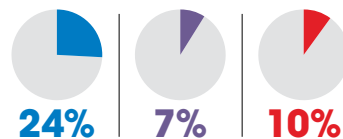
10. Goa
26% | 7% | 10%
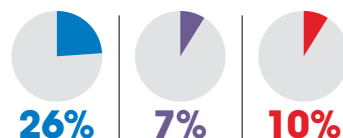
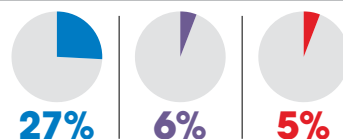### 11. Mizoram
31% | 7% | 1%
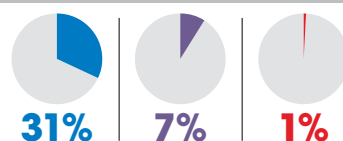
12. Jammu & Kashmir
28% | 6% | 3%
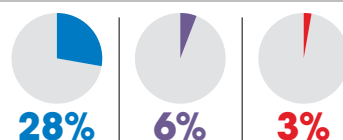
Tender by Municipal Corporation of Greater Mumbai

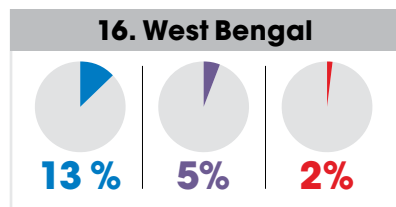### 13. Rajasthan
25% | 6% | 2%

14. Chhattisgarh
27% | 6% | 5%

15. Andhra Pradesh
14% | 5% | 4%

16. West Bengal

13% | 5% | 2%
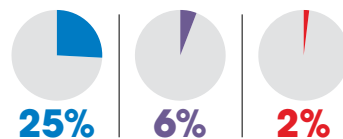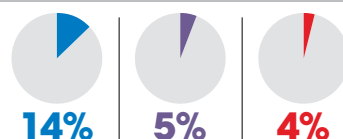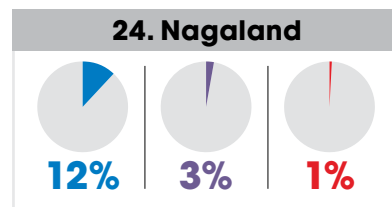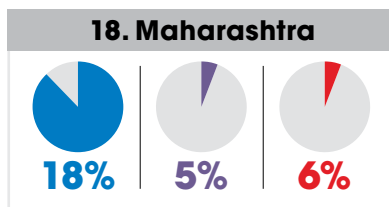
% OF COMPLETELY VACCINATED ADULT POPULATION
- Less than 5%
- 5 - 10 %
- Over 10%

GLOBAL TENDER FOR VACCINES
- Floated
- In the pipeline

18. Maharashtra

18% | 5% | 6%

19. Odisha

17% | 5% | 2%

20. Haryana

20% | 5% | 3%

24. Nagaland

12% | 3% | 1%

25. Assam

12% | 3% | 1%

26. Tamil Nadu

9% | 3% | 3%

27. Punjab

16% | 3% | 2%

28. Madhya Pradesh

14% | 3% | 1%

21. Meghalaya

17% | 4% | 1%

22. Telangana

17% | 4% | 2%

29. Jharkhand

12% | 3% | 1%

30. Bihar

10% | 2% | 1%

17. Karnataka

19% | 5% | 5%

23. Manipur

14% | 3% | 2%

31. Uttar Pradesh

8% | 2% | 1%
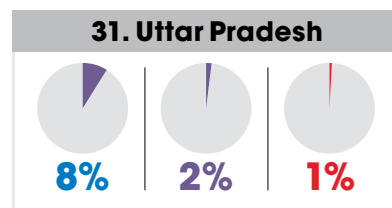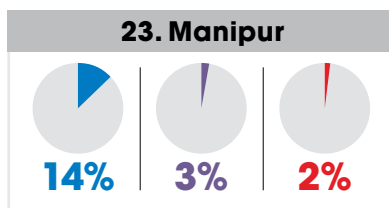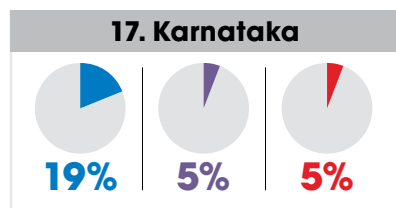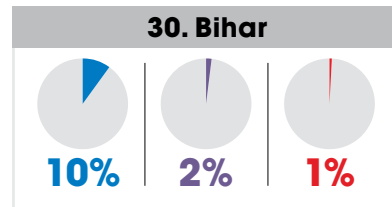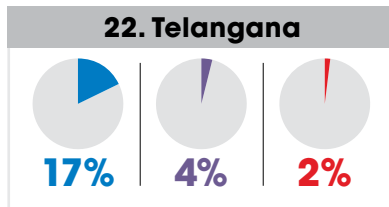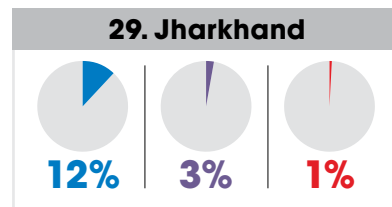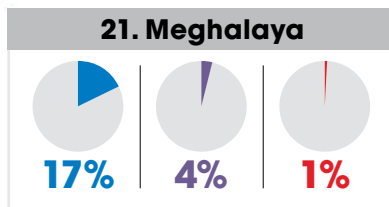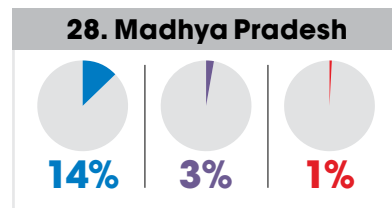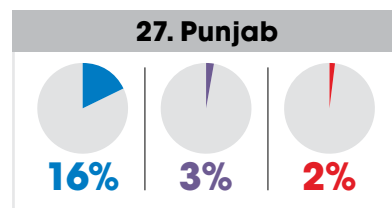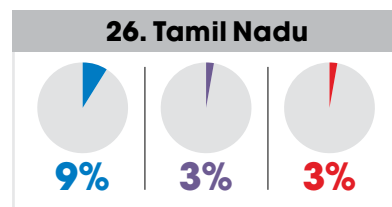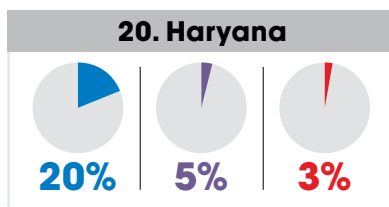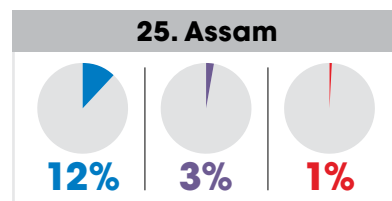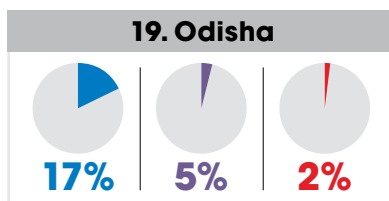
Source: CoWin dashboard, Union health ministry and Unique Identification Authority of India; Data as on May 14

cases increased, no one had the idea that the second wave was caused by a new variant of coronavirus. The spreading strain was assumed to be the dominant variant (D164G). "We thought the Centre has been regularly monitoring the spread of the UK variant (originated in September 2020), the South African variant (October 2020), and the Brazilian variant (November 2020), which have a higher transmission potential. However, we were completely wrong. The fast-spreading B.1.617 (double mutant) was already present in India," says John. In December 2020, the government assigned the genomic analysis consortium Indian SARS-COV-2 Consortium on Genomics, comprising 10 public health institutions and laboratories across India, to test 5 per cent of all the samples tested positive. The consortium has not given a report on it till the magazine went to press.

SUPERSPREADER EVENTS

India is a diverse and big geography that can have simultaneous outbreak of multiple COVID-19 variants, says experts. A new variant always leads to faster spread. It means, there could have been multiple outbreaks in the country, each requiring a customised strategy to curtail. That did not happen because we did not acknowledge the outbreak. State after state opened up while allowing super-spreader events like religious festivals and election rallies. The Election Commission on February 26, 2021 declared state elections spanning over two months. "We laid the red carpet for the

variants through events like the Kumbh Mela, assuming there was no virus around us. Even when we knew of the problem, there was a delay in the government to contain the spread, leading to unimaginable circumstances," says John.

Take the case of Kerala, which remains an outstanding example of managing the pandemic and has deployed a well-thought-out strategy. Though India's first cases of the pandemic were reported from Kerala on January 30, 2020, the state successfully flattened the curve by May, even as cases were multiplying in other states. Its deft handling of the pandemic through "delay the peak" model was recognised worldwide. There were even days when Kerala reported no cases. It took the state four months to report its first 1,000 cases.

"After the initial phase of success in flattening the curve, priorities of the state changed drastically. COVID-19 took a back seat in the face of two successive elections and the celebration of different festivals. The state seemed a little apprehensive of the possible second wave, which had now turned into an alarming reality. The state even failed to anticipate evolving of the genetic variations of the virus," says V Raman Kutty, a public health expert and epidemiologist based in Thrissur. Even the state health department admits that two successive elections—the first one to the *panchayat*s, municipalities and city corporations in December 2020, and the second to the state assembly in April 2021— contributed immensely to the rise in cases.
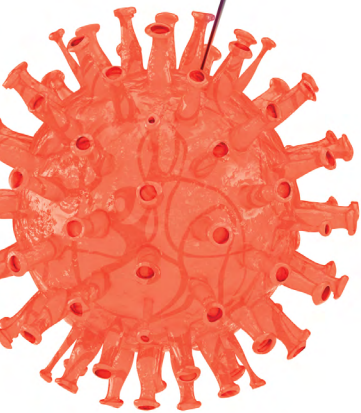
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In states that have not had elections, the spurt in cases is due to the congregations of different kinds. But in West Bengal, large congregations at the moment are mostly linked to the election

GIRIDHAR R BABU
Epidemiologist associated with Public Health Foundation of India, Bengaluru

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MODEL TALK

A look at the three popular models being used to predict COVID-19 trajectory in India and what they say about the future

SUTRA

WHAT IS IT
SUTRA or the Susceptible, Undetected, Tested and Removed Approach has been **used by the Centre to fight the second wave of the pandemic**. The predictions have been modelled by two IIT professors and a scientist from the Union Ministry of Defence

PROJECTIONS
The model **on April 2, 2021 wrongly predicted that India's second wave** will peak in the third week of the same month at 100,000 cases a day

The model on **April 26, 2021, predicted that India's second wave will peak** in May 4-8, 2021 and at 340,000-440,000 cases a day

Why did SUTRA go wrong
On **May 2**, the scientists working with SUTRA blamed the rapid changing nature of the virus for the model's incorrect predictions about the second wave. Experts also say the model relies on too many parameters

IHME MODEL

WHAT IS IT
The Institute of Health Metrics and Evaluation, a global health research centre, released its latest COVID-19 briefing on **India on May 5, 2021**. The model relies on its own estimations of mortality as it **maintains the official numbers are grossly underreported**

PROJECTIONS
India to record 1.5 million **deaths due to COVID-19 till September 1, 2021**. It predicts 101,000 fewer deaths if the country achieved universal mask coverage by second week of May

Daily deaths will peak **on May 17, 2021 at 15,430 deaths**

IISc MODEL

WHAT IS IT
Two professors from the Indian Institute of Science in Bengaluru have developed a multi-dimensional Partial Differential Equations model to predict the pandemic. Their **latest prediction was released on April 27, 2021 and it looks at the trajectory till June 11, 2021**

PROJECTIONS
India's projected cumulative case count to reach **50 million on June 11, 2011**. The current count is 24 million cases (May 13).

The model looks at active cases, instead of new cases, and predicts over 11 million active COVID-19 patients on **June 11, 2021**, up from **3.71 million** active patients on **May 13, 2021**

IHME prediction | Cumulative deaths

1.5 million
Sept 1, 2021

Current projection →

Total (Higher than official figures)

642,774
May 2, 2021

Number of deaths

1.6M
1.4M
1.2M
1.0M
800K
600K
400K
200K
0

Sep '20 Nov '20 Jan '21 Mar '21 May '21 Jul '20 Sep '21

IISc prediction | Cumulative cases

49.8 million
June 11, 2021

Current projection →

Official figures

20.2 million
May 3, 2021

Number of confirmed cases

50M
40M
30M
20M
10M

Mar 28 Apr 11 Apr 25 May 9 May 23 Jun 6

Source: Press Information Bureau, Sutra, IHME and IISc

As per the state health department, COVID-19 cases have risen by 255 per cent since April 14, a day when the state celebrated its harvest festival Vishu and people in large numbers engaged in shopping and festivities. "The elections and unprotected interactions in the society have created a situation in which the state failed to find a breathing period between the two waves," he adds. K K Shailaja, the outgoing health minister of Kerala, says, "Other than elections and celebration of festivals, people across the state found the post lockdown period as an occasion for what experts call revenge socialisation."

As a result, Kerala's situation in the second wave is similar to the rest of the country. ICU and ventilator beds earmarked for COVID-19 patients are fast filling up. The pandemic, which was earlier confined to the elderly and to those with comorbidities, is now prevalent among the young with little health problems. The state known for the country's most robust public healthcare system seems grossly unprepared for the second wave in which active cases crossed the 0.3 million mark on April 30. Kerala's positivity rate (percentage of positive cases to total tests) is about 25 per cent and the state has lost over 5,300 lives to the virus.

In West Bengal, which had an eight-phase elections and saw over 100 mega rallies, a state health ministry official concedes that the government saw signs of the second wave in the first half of March, as the cases started to rise. There was little anyone could do since the state was in election mode and the Model Code of Conduct was in place, says the official requesting anonymity. "Along with the obvious role of election, the new variants must have also played a role," says Manas Gumta, a physician in North 24 Parganas and general secretary of the Association of Health Service Doctors, West Bengal. Subhrojyoti Bhowmick, clinical director of Peerless Hospital, Kolkata, says the spread of the contagion beyond Kolkata also hints towards the role of elections. "Most of the areas that went to election in later phases,

and hence had more meetings and rallies, are recording more cases," says Bhowmick.

As per the West Bengal government data, 19 districts apart from Kolkata urban agglomeration contributed 56 of the state's 216 cases (26 per cent) on February 26—the day election schedule was announced. On May 3, total number of cases had spiralled almost 81 times to reach 17,501. Districts like Birbhum and Malda that went to poll in the last phase on April 29 had two and one cases respectively on February 26, but 833 and 522 cases on May 3.

"In states that have not had elections, the spurt in cases is due to the congregations of different kinds. But in West Bengal, large congregations at the moment are mostly linked to the election," says Giridhar R Babu, an epidemiologist associated with the non-profit initiative, Public Health Foundation of India based in Bengaluru. "We may not have the data from West Bengal or India but the analysis of the US presidential election clearly establishes the correlation between large electoral meetings or rallies, often without maintaining COVID-19 norms, and a spurt in COVID-19 cases," says Bhowmick. "A long election is definitely contributing to the COVID-19 rise because it is maximising exposure," says Arunava Majumdar, a former director of All India Institute of Hygiene and Public Health, Kolkata.

Sukumar Mukherjee, member of the State Advisory Committee on COVID-19, and a physician based in Kolkata, says COVID-19 cases in West Bengal may reach around 25,000 per day by mid-May, triggering "a Delhi like situation", with Kolkata and adjoining districts likely to be most affected. Doctors say the positivity rate is already 40-90 per cent in Kolkata and adjoining areas, with hospitals generally recording the higher range. The overall positivity rate in the state has reached 29 per cent. "The second wave is proving to be much bigger than the initial wave. During April, we had a vertical rise in the number of cases. The situation is already difficult with virtually no bed left in most hospitals," he says.

During the first wave, COVID-19 infection was more prevalent in people above 60 years and in those with comorbidities. This time it is the 20-50 age group, which has been hit hard. There is a good chance of a third wave, which is likely to affect those under 20—the ones not vaccinated

COVID GONE NATIVE?

Vaccination and herd immunity are our only shield against the novel coronavirus which is likely to become endemic

Close to 70 per cent of India's 700-odd districts have a test positivity rate of over 10 per cent, shows the Indian Council of Medical Research (ICMR) data released on May 10, 2021. The national positivity rate is 20-21 per cent, but 42 per cent of the country's districts have reported a rate higher than this. This clearly establishes that the second wave of the pandemic has not just reached rural areas, but has become quite widespread. Given the lack of test infrastructure, the government has had to amend its testing guidelines by allowing more Rapid Antigen Tests. Earlier, the government had capped Rapid Antigen Tests at 30 per cent of total tests, while recommending RT-PCR tests because they are more accurate. As testing and isolation is key to break the transmission, and RT-PCR tests results take time, the government changed its guideline.

While India is still in the middle of the second wave, K Vijay Raghavan, principal scientific advisor to the Centre, has warned of another wave. "Phase 3 is inevitable, given the high levels at which this virus is circulating. But it is not clear at what time scale this Phase 3 will occur," he said at a press conference on May 5. However, at another press conference two days later, he mellowed down the warning by making it conditional on the absence of "strong measures". There is a growing consensus among epidemiologists and public health experts that India has to endure the pandemic for months to come. "COVID-19 is far from over. Allowing a third wave has grave consequences," warned Shekhar C Mande, director general of the Council of Scientific and Industrial Research during the virtual "National Science Day Lectures" organised on February 28 by Rajiv Gandhi Centre for Biotechnology in Thiruvananthapuram, Kerala.

While waves are temporary crises in a pandemic, the bigger and scarier scenario that experts are reconciling to is the circulation of the novel coronavirus for years to come. According to epidemiologists, and going by historical trends, COVID-19 would soon become endemic to India, meaning the health infrastructure will have to fight outbreaks regularly, just like it prepares for outbreaks like dengue.

The journal *Nature* in January this year undertook a survey among 100 immunologists, infectious-disease researchers and virologists on whether the novel coronavirus can be eradicated. Nearly 90 per cent of the respondents said it would become endemic. "Eradicating this virus right now from the world is a lot like trying to plan the construction of a stepping-stone pathway to the moon. It is unrealistic," Michael Osterholm, an epidemiologist at the University of Minnesota in Minneapolis, US, told *Nature* in his response to the survey. However, a third of the respondents thought that in some regions the virus could be eradicated while in some it would become endemic.

One scenario visualised by scientists and epidemiologists goes like this: in a not-so-distant future, children will catch the virus, get mild symptoms and develop immunity. Vaccines will be part of childhood inoculation regime.

This scenario is based on our experiences with four endemic coronaviruses (OC43, 229E, NL63 and HKU1) that affect humans

currently. Three of these four are believed to have been circulating in human populations for hundreds of years. People have developed immunity against them through infections, but that might wane when viruses mutate into new variants. The same could happen with COVID-19. We might develop immunity against it, aided by vaccines, but the virus might just evolve to escape this shield. More than half of the scientists who responded to *Nature*'s survey think that waning immunity will be one of the main drivers of the virus becoming endemic.

ELIMINATION UNLIKELY

Angela Rasmussen, a virologist affiliated to the US' Georgetown University Center for Global Health Science and Security, and a research scientist at the Vaccine and Infectious Disease Organization in Canada, told *Down To Earth* that in countries like India, Canada and US, which have runaway community transmission, the virus cannot really be eliminated. "COVID-19 is something that countries will have to learn how to live with and again this is going to vary a lot," she says. India, Canada, Brazil are in a crisis situation, while in countries like the US and in parts of Europe the virus is on the decline, she adds. "But a lot will depend on the prevalence of the virus and immunisation... it is a complicated question… I don't honestly know," Rasmussen says.

"Some argue it is already endemic… India is a good example. Beginning 2021 infection was so less that people were writing pieces that India had reached herd immunity. There was ongoing community transmission at low level. To some, it is a general definition of endedicity. It was not causing an acute epidemic," she says. "It may also go back to new animal reservoirs and that new zoonotic transmission, back to human. We have seen in Denmark and in the Netherlands. I am worried about infection getting into cats…as they are everywhere and people interact with them a lot.. That is why it is so important to vaccinate so that future outbreaks in COVID-19 endemic world are small and easy to contain," says Rasmussen.

Gautam Menon, professor of physics and biology at Ashoka University in Sonipat, Haryana, believes that the novel coronavirus will soon be part of our usual disease system. "We know that there are other coronaviruses causing something like the common cold, and they are seasonal. They are part of the bigger viruses that circulate. They are endemic. In principle, there is no reason COVID-19 will also not become an endemic," he says. But do we now when will it become endemic? Menon says it all depends on how the past infections build immunity response and how good are the vaccines in averting fresh infections. "If it turns out that reinfection is rare and the vaccination highly protective, you may find it just fizzling out, not even becoming endemic here," he says.

T Jacob John, a virologist and professor at the Christian Medical College, Vellore,

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Some argue it is already endemic… India is a good example. Beginning 2021, infection was so less that people were writing pieces that India had reached herd immunity

ANGELA RASMUSSEN
Virologist affiliated to Center for Global Health Science and Security, Georgetown University, US

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says COVID-19 will end as a "pan-endemic", covering the world, and the newborns will be the new addition to the existing vulnerable population of senior citizens and patients with comorbidities. "We can expect at least 5 per cent of the people in the country to develop symptomatic COVID-19 per day. Though we have faced many endemic diseases from time to time, the government has never had a plan to control them. Influenza H1N1 was once a pandemic. It still kills people. In fact, tuberculosis in India is hyper-endemic. We do not have any national policy to control it but to treat it free of cost. Treating the virus does not control the disease per se. We were living with endemics and we will learn to live with COVID-19, too," he says.

Vijay Kohli, who has worked with the Ahmedabad Municipal Corporation (AMC) health department for 15 years and with the Indian Council of Medical Research (ICMR) for a similar period, says that except malaria, there is no "system" to handle a new virus or bacteria. "Everything happens in a firefighting mode. Health infrastructure delivery systems need vertical programmes—meaning a set of people specialising in dealing with every aspect of a specific disease in a region. Malaria workers are experts in their regions. Now we are only developing horizontal systems. Meaning everyone knows a little about everything, but no region-wise disease experts," says Kohli.

Regional factors like the weather, a community's demographic and genetic makeup and its impact on the behaviour of the virus, are not sufficiently understood. Kohli, now retired, says he was with AMC when the city battled Crimean Congo haemorrhagic fever, chikungunya, dengue, swine flu, Zika virus and bird flu. "We could achieve success due to surveillance and accurate data processing. Without data, we cannot learn," Kohli says, and adds that though these diseases are under control, standard operating procedures are missing. "Doctors are learning on the job. This casual approach needs to stop," he asserts.

VACCINATE ALL

Experts are near unanimous in saying that vaccination and herd immunity are the only ways to fight the virus (see 'Not quite there' on *p*40). "Lots of people are getting infected, so we should develop herd immunity. Once 70-80 per cent of the population is vaccinated, vaccination and natural immunity together will bring the virus down," says Asima Banu, professor of microbiology at Bengaluru Medical College and Research Institute, and nodal officer of Trauma and Emergency Care Covid Centre at the Victoria Hospital. "Last time, the severity of disease was a bit different. It was more prevalent in people above 60 years of age, and in those with comorbidities. This time it is the 20-50 age group which is really badly hit. People with no comorbidities, absolutely healthy people, have been hit. Last year, symptoms were cough, soar throat, fever and the patient would go on to develop pneumonia. Now, it is mild fever one day, cough the next day and then they are absolutely okay. Or mild symptoms for three-four days and suddenly on the fifth or sixth day, they will develop breathlessness. Even children are getting increasingly affected; last year they were asymptomatic," Banu says.

She suggests that vaccination might not be the only reason a different age group is getting impacted this time. "How many have we vaccinated? Maybe just 1 per cent. So, that would not make such a huge difference," she says. "I can't comment on the dominant variant now, as we have to do lots of sequencing. Right now, we are in the process of handling the pandemic, so that data has to be released by ICMR. The virus has mutated, there are double mutants and triple mutants also. If we do genetic sequencing of all the people, we will know which mutant is dominant. But there definitely is a new mutant," she says.

Banu adds there is a good chance of a third wave. "We may not see the third wave in this population. Maybe it will affect those under 20. They are the ones not vaccinated. But again, we cannot say." DTE

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