Cambridge Judge Business School Cambridge Centre for Health Leadership & Enterprise

COVID-19 TRACKER: INDIA

3 January 2022

Centre for Health Leadership & Enterprise





National Institute of Economic and Social Research As of 3 January 2022, the reproduction number for India as a whole stood at 2.48. The daily growth rate stood at 22.7%.

Reproduction number exceeds 1 in all states and union territories. The number of states with daily growth rate exceeding 5%, and reproduction number exceeding 1.2, has risen to 32.

Across India, daily growth rates are on increasing trends, implying that cases are accelerating, not merely increasing in almost all states and union territories. This phase of super exponential growth in cases is likely to end in a few days. The daily growth rate is approaching its maximum in some states that are currently leading in terms of growth in infection. In the phase that follows cases will continue to increase but at smaller and smaller rates.

A reliable forecast of when daily cases will peak can be obtained only after its growth rate has reached its peak and begun to decline towards zero.

Filtered daily growth rates of new cases: days leading up to 3 January 2022

India





Reproduction numbers on 3 January 2022

Bar chart shows point estimates of R and the ± 1 standard deviation confidence intervals

Note: Small numbers in Andaman and Nicobar Islands, Arunachal Pradesh, Dadra and Nager Haveli and Daman and Diu, Ladakh, Lakshadweep, Manipur, Meghalaya, Nagaland, Puducherry, Sikkim, Tripura, make their estimates less reliable.

Reproduction numbers and Filtered growth rates as on 3 January 2022

As on 03/01/2022	Reproduction Number	Filtered growth rate of daily cases
India	2.48	22.7%
Bihar	9.80	57.1%
Jharkhand	9.13	55.3%
Delhi	8.23	52.7%
Uttar Pradesh	5.21	41.3%
Rajasthan	4.74	38.9%
Chhattisgarh	4.73	38.9%
Goa	4.42	37.2%
Haryana	4.35	36.7%
West Bengal	4.13	35.5%
Maharashtra	4.05	35.0%
Gujarat	3.87	33.9%
Punjab	3.84	33.6%
Uttarakhand	3.72	32.8%
Chandigarh	2.82	25.9%
Andaman and Nicobar Islands	2.78	25.6%
Madhya Pradesh	2.70	24.9%
Tripura	2.32	21.0%
Karnataka	2.17	19.4%
Himachal Pradesh	1.83	15.1%
Odisha	1.75	14.1%
Assam	1.69	13.1%
Tamil Nadu	1.67	12.9%
Puducherry	1.62	12.0%
Telangana	1.60	11.7%
Arunachal Pradesh	1.41	8.7%
Sikkim	1.41	8.6%
D and NH and D and D	1.40	8.4%
Andhra Pradesh	1.33	7.2%
Mizoram	1.32	6.9%
Ladakh	1.31	6.8%
Jammu and Kashmir	1.23	5.1%
Manipur	1.22	4.9%
Lakshadweep	1.13	3.2%
Kerala	1.13	3.1%
Nagaland	1.11	2.6%
Meghalaya	1.02	0.6%

Note: States and UTs with less reliable estimates due to small numbers are shaded grey.



Filtered daily growth rates of new cases: days leading up to 3 January 2022



-0.2

Dec 15

Jan 15

Jan 01

Date



Delhi













Jharkhand













-0.10

Dec 15



Jan 15







Rajasthan









Uttarakhand







Notes

This tracker was developed by researchers at Cambridge Judge Business School and National Institute of Economic and Social Research, working with Health Systems Transformation Platform in India, as part of a pandemic monitoring series devoted to India and its states and union territories. It provides short term forecasts of the trajectory of the pandemic, identifying states and union territories that are at risk of increases in infection incidence.

Data: COVID-19 confirmed cases and deaths data are sourced from Johns Hopkins University (JHU), Center for Systems Science and Engineering (CSSE).

New cases: forecasts. Forecasts above are based on a structural time series model that uses all the data in estimation but adapts to the trend emerging in the most recent period.

The method is described in: Harvey, A. and P. Kattuman (2020). Time series models based on growth curves with applications to forecasting coronavirus. *Harvard Data Science Review*, Special issue 1 - COVID -19. <u>https://hdsr.mitpress.mit.edu/pub/ozgjx0yn/release/2</u>, and Harvey, A., P. Kattuman, and C. Thamotheram (2021). Tracking the mutant: forecasting and nowcasting COVID-19 in the UK in 2021. *National Institute Economic Review*. 256, 110-126. doi:10.1017/nie.2021.12.

New cases: growth rate. The filtered trends presented for daily growth rates of cases are estimated using the Kalman filter, applied to the observed series. The method filters out day of the week effects and random noise to reveal the underlying signal. Unlike methods such as the moving average, this method adapts the trend to changes in real time and characterises underlying patterns of surges or attenuations that are hidden in the volatile series. The method is described in the papers listed above.

R: The *R*-estimates are based on the nowcast of the growth rate; the estimation approach is described in Harvey, A. and P. Kattuman (2021). A farewell to R: Time series models for tracking and forecasting epidemics. Journal of the Royal Society Interface, 18, 20210179, https://royalsocietypublishing.org/doi/10.1098/rsif.2021.0179.The confidence interval is based on one standard deviation, with coverage of 68%.

Note: The accuracy of forecasts rely on the quality of the published data. Further, changes in government pandemic policies and in transmission relevant social behaviour may lead realised numbers to deviate from forecasts.

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