This tracker\(^1\) has been 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. The forecasts are based on a structural time series model that uses historical data in estimation but adapts to the trend emerging in the most recent period. The model is described in Harvey and Kattuman (2021) "Time series models based on growth curves with applications to forecasting coronavirus". *Harvard Data Science Review*, Special issue 1 - COVID -19.

The reproduction number (Rt) for India edged up over the last week and now stands at 0.93. The trend value of the daily growth rate of cases continues to be negative, but has risen to -1.75%. Newly reported COVID-19 cases are likely to decline at a reduced rate in the coming days. By 18 July 2021, reported cases per day can be expected to be about 31,500.

Based on reproduction numbers, daily reported cases are likely to increase in Arunachal Pradesh, Kerala, Manipur, Meghalaya, Sikkim and Tripura. Of particular concern are Arunachal Pradesh, Kerala, Manipur, Sikkim and Tripura due to the likelihood that their positive daily growth rates of cases are accelerating. Daily reported cases are likely to remain stable in Maharashtra.

In all but a few of the remaining states and union territories the daily growth rates of new cases, though currently negative, are trended upwards, indicating the need for close monitoring and prompt policy corrections. The exceptions to this at present are Assam, Chandigarh, Delhi, Karnataka, Punjab and Telangana.

Mean absolute percentage error of the forecasts of daily cases in India given in the 27 June tracker, for the week beginning 28 June, was 7.1%. The accuracy of forecasts rely on the quality of the reported data. Changes in government pandemic policies and in transmission relevant social behaviour may cause realised numbers to depart from forecasts.

\(^1\) CJBS COVID-19 Tracker for India can be accessed at: [www.jbs.cam.ac.uk/covid-india](http://www.jbs.cam.ac.uk/covid-india)
The companion spreadsheet contains all the estimates and forecasts.

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Forecasts of daily new cases for the period 5 July 2021 to 18 July 2021, based on data till 4 July 2021. New COVID-19 cases is likely to number about 31,500 per day by 18 July 2021.

The filtered trend in the growth rate of daily new cases. Final date: 4 July 2021.
Bar chart shows point estimates of $R$ and the ±1 standard deviation confidence intervals.
Case forecasts and growth rates: States and Union territories

Andhra Pradesh

- Data
- Forecast
- New cases
- Forecast Trend

New Cases

Jun 01 | Jun 15 | Jul 01 | Jul 15

Growth rate of daily cases

Jun 01 | Jun 15 | Jul 01 | Jul 15
Maharashtra

- Data
- Forecast
- New cases
- Trend

New Cases

20,000
15,000
10,000
5,000

Jun 01  Jun 15  Jul 01  Jul 15

Maharashtra

- Growth rate of daily cases

Growth rate of daily cases

0.05
0.00
-0.05
-0.10

Jun 01  Jun 15  Jul 01  Jul 15
Odisha

- Data
- Forecast New cases
- Forecast Trend

New Cases

Jun 01 | Jun 15 | Jul 01 | Jul 15

Growth rate of daily cases

Jun 01 | Jun 15 | Jul 01 | Jul 15
The nature of growth in new cases:
States where daily growth rates are likely to be accelerating
Kerala: Probability that case growth rate is increasing at an increasing rate as on 2021-07-04 : 0.51

Maharashtra: Probability that case growth rate is increasing at an increasing rate as on 2021-07-04 : 0.41
Manipur: Probability that case growth rate is increasing at an increasing rate as on 2021-07-04: 0.5

Meghalaya: Probability that case growth rate is increasing at an increasing rate as on 2021-07-04: 0.41
Data: COVID-19 confirmed cases and deaths data are sourced from COVID19-India API: https://api.covid19india.org/


Forecast accuracy: When estimated with data up to June 26, the mean absolute percentage error of the forecasts of cases for India over the period, June 28 – July 4, is 7.1%. Forecast accuracy will in general be lower for the smaller states / union territories. It is important to pay attention to the confidence intervals around the forecasts. The coverage of the confidence intervals presented is 68%, implying there is 16% probability of the upper bound being exceeded.

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 (2020b). A farewell to R: Time series models for tracking and forecasting epidemics. *Center for Economic Policy Research* (CEPR) working paper, 51. [https://cepr.org/content/covid-economics](https://cepr.org/content/covid-economics). The confidence interval is based on one standard deviation, with coverage of 68%.

Probability The probability that the growth of new cases is increasing at an increasing rate is extracted from the statistical model. The pandemic phase is of extreme concern when this probability exceeds 0.5.

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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