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 effective reproduction number \((R_t)\) for India as a whole has dropped further over the past week, to 0.90. The trend value of the growth rate of new cases is lower at -2.5% as of now. The trend value of reported cases is likely fall below 21,000 per day by 5th September.

At present the epidemic is settling concurrently with very few exceptions across states: reported cases are expected to stay relatively steady in Haryana, Jammu and Kashmir and Mizoram, but accelerate in Goa (page 40).

The current settling of the epidemic in India can be attributed for the most part to a substantial proportion of the population acquiring partial immunity, due to prior infection from the Delta or earlier variants, combined with vaccinal immunity of the small vaccinated proportion, as well as local restrictions. It is important to note that immunity of either type is known to be imperfect and transient with respect to the Delta variant. The waning of the immune response is liable to prepare the ground for successive outbreaks in the foreseeable future as the susceptible population grows and then declines recurrently. This is broadly consistent with the oscillating patterns in the growth rates of reported cases in most states. Boosting the vaccination rate, combined with prompt containment when necessary can reduce the risk of acute surges, while global efforts to develop more effective vaccines continue.

Mean absolute percentage error of the forecasts of daily cases in India given in the August 15 tracker, for the period August 16 to 22, was 6.96%. Changes in government pandemic policies and in transmission relevant social behaviour may cause realised numbers to depart from forecasts.

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\(^1\) 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.

Contact: Paul Kattuman  <p.kattuman@jbs.cam.ac.uk>
Forecasts of daily new cases for the period 23rd August to 5th September 2021, based on data till 22nd August 2021. The trend value of new COVID-19 cases is likely to be just under 21,000 per day by 5th September 2021.

The filtered trend in the growth rate of daily new cases was -2.5% as on 22nd August 2021.
Note: Data anomaly for Chandigarh, and small daily numbers (less than 30) currently for Andaman and Nicobar Islands, Bihar, Chhattisgarh, Dadra and Nagar Haveli, Delhi, Gujarat, Haryana, Jharkhand, Ladakh, Lakshadweep, Madhya Pradesh, Rajasthan, Uttar Pradesh and Uttarakhand make the forecasts and estimates less precise.
Daily growth rates of cases (%)
Trend values as on 15 August 2021
Daily growth rates of cases (%)  
Trend values as on 07 August 2021
Case forecasts and growth rates: States and Union territories

Andhra Pradesh

- Data
- Forecast
- New cases
- Forecast Trend

New Cases

- Aug 01
- Aug 15
- Sep 01

Growth rate of daily cases

- Aug 01
- Aug 15
- Sep 01
Madhya Pradesh

- **Data**
- **Forecast**
  - New cases
  - Trend

**New Cases**

<table>
<thead>
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<tr>
<td>Aug 15</td>
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</tr>
<tr>
<td>Sep 01</td>
<td>10</td>
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</tbody>
</table>

**Growth rate of daily cases**

<table>
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<tr>
<td>Sep 01</td>
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</tbody>
</table>
Nagaland

**Nagaland**

**Data**

**Forecast**

**Trend**

**New Cases**

- Aug 01
- Aug 15
- Sep 01

**Growth rate of daily cases**

- Aug 01
- Aug 15
- Sep 01
Puducherry

- Data
- Forecast
- New cases
- Trend

**New Cases**

- Aug 01
- Aug 15
- Sep 01

Puducherry

- Growth rate of daily cases

**Growth rate of daily cases**

- Aug 01
- Aug 15
- Sep 01
The nature of growth in new cases:
States/UTs with high odds that case numbers are currently accelerating
India: Accuracy of last week's forecasts
Mean Absolute Percentage Error: 6.96%

2021-08-16 / 2021-08-22

Cases

Actual Forecast Trend
Forecast lower bound upper bound

10/08/2021  22/08/2021
Notes

Data: COVID-19 confirmed cases and deaths data are sourced from COVID19-India API: https://api.covid19india.org/

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.


Forecast accuracy: is assessed using mean absolute percentage error of the forecasts of cases over the past week. 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. 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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