Cambridge Judge Business School Cambridge Centre for Health Leadership & Enterprise

COVID-19 TRACKER: INDIA

26 December 2021

Centre for Health Leadership & Enterprise







Eleven Indian states (Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Jharkhand, Madhya Pradesh, Maharashtra, Punjab, Rajasthan and Uttar Pradesh) are of significant concern, as they are currently experiencing rapid growth in infection, with their filtered <u>daily</u> growth rates of new COVID-19 cases exceeding 5% and reproduction number exceeding 1.25, as of 26 December.

In addition, **Goa, Jammu and Kashmir, Karnataka** and **Uttarakhand** are of some concern, with their **filtered** <u>daily</u> growth rates of new COVID-19 cases exceeding 1% and reproduction number exceeding 1, as of 26 December.

At the national level, the **filtered** <u>daily</u> growth rate of new COVID-19 cases while still negative, is edging up towards positive territory, and is likely to turn positive in a few days.



CJBS COVID-19 Tracker for India can be accessed at: <u>www.jbs.cam.ac.uk/covid-india.</u> Contact: <u>Paul Kattuman</u>



Rt: 26 December 2021

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

Note: Due to small numbers, estimates are not reliable for: Andaman and Nicobar Islands, Arunachal Pradesh, Chandigarh, D and NH and D and D, Himachal Pradesh, Ladakh, Lakshadweep, Manipur, Meghalaya, Nagaland, Puducherry, Sikkim, Tripura and Uttarakhand.

Filtered daily growth rates of daily cases for States and Union territories currently of significant concern

							Madhya				Uttar
Date	Bihar	Chhattisgarh	Delhi	Gujarat	Haryana	Jharkhand	Pradesh	Maharashtra	Punjab	Rajasthan	Pradesh
22/12/2021	-0.9%	-1.4%	8.4%	3.8%	6.6%	13.1%	1.6%	1.3%	1.1%	-2.2%	5.2%
23/12/2021	-0.9%	0.8%	8.0%	4.9%	6.6%	12.8%	3.4%	3.0%	1.2%	1.8%	6.5%
24/12/2021	2.1%	0.2%	9.8%	4.8%	9.1%	13.5%	5.0%	6.0%	2.1%	4.7%	8.8%
25/12/2021	2.6%	1.9%	12.6%	7.8%	11.7%	13.9%	7.2%	7.3%	4.6%	6.7%	<mark>8.6</mark> %
26/12/2021	8.2%	5.8%	14.7%	10.0%	12.6%	15.1%	7.9%	8.1%	5.6%	10.3%	10.5%

Daily growth rate exceeding 5% as on 26 December 2021

Forecasts of daily cases for States and Union territories currently of significant concern:

Date	27/12/2021	02/01/2022	09/01/2022	
Bihar: Forecast of new cases	11	26	46	
Bihar: Forecast trend	14	23	40	
Chhattisgarh: Forecast of new cases	40	44	66	
Chhattisgarh: Forecast trend	39	55	82	
Delhi: Forecast of new cases	190	636	1798	
Delhi: Forecast trend	261	632	1785	
Gujarat: Forecast of new cases	149	276	558	
Gujarat: Forecast trend	162	295	596	
Haryana: Forecast of new cases	85	200	485	
Haryana: Forecast trend	94	199	482	
Jharkhand: Forecast of new cases	70	150	437	
Jharkhand: Forecast trend	77	192	558	
Madhya Pradesh: Forecast of new cases	39	66	114	
Madhya Pradesh: Forecast trend	39	63	109	
Maharashtra: Forecast of new cases	1277	2643	4662	
Maharashtra: Forecast trend	1587	2576	4544	
Punjab: Forecast of new cases	41	65	96	
Punjab: Forecast trend	47	65	96	
Rajasthan: Forecast of new cases	47	84	173	
Rajasthan: Forecast trend	47	88	180	
Uttar Pradesh: Forecast of new cases	40	96	199	
Uttar Pradesh: Forecast trend	47	89	185	

27 December 2021 2 January 2022 (7 days)

Note: Forecasts beyond the 2 January are indicative, given the high daily growth rate of new cases in the states of significant concern which is likely to lead to the introduction of mitigation measures and changes in social behaviour. The forecast for Bihar is based on small numbers and is less reliable. New cases forecasts (14 days ahead: 27 December 2021 to 9 January 2022) and filtered daily growth rates for States and Union territories of concern¹

¹ There is 25% probability that realized values exceed the upper bound of the confidence interval.

Goa

Note: 7 day forecast

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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