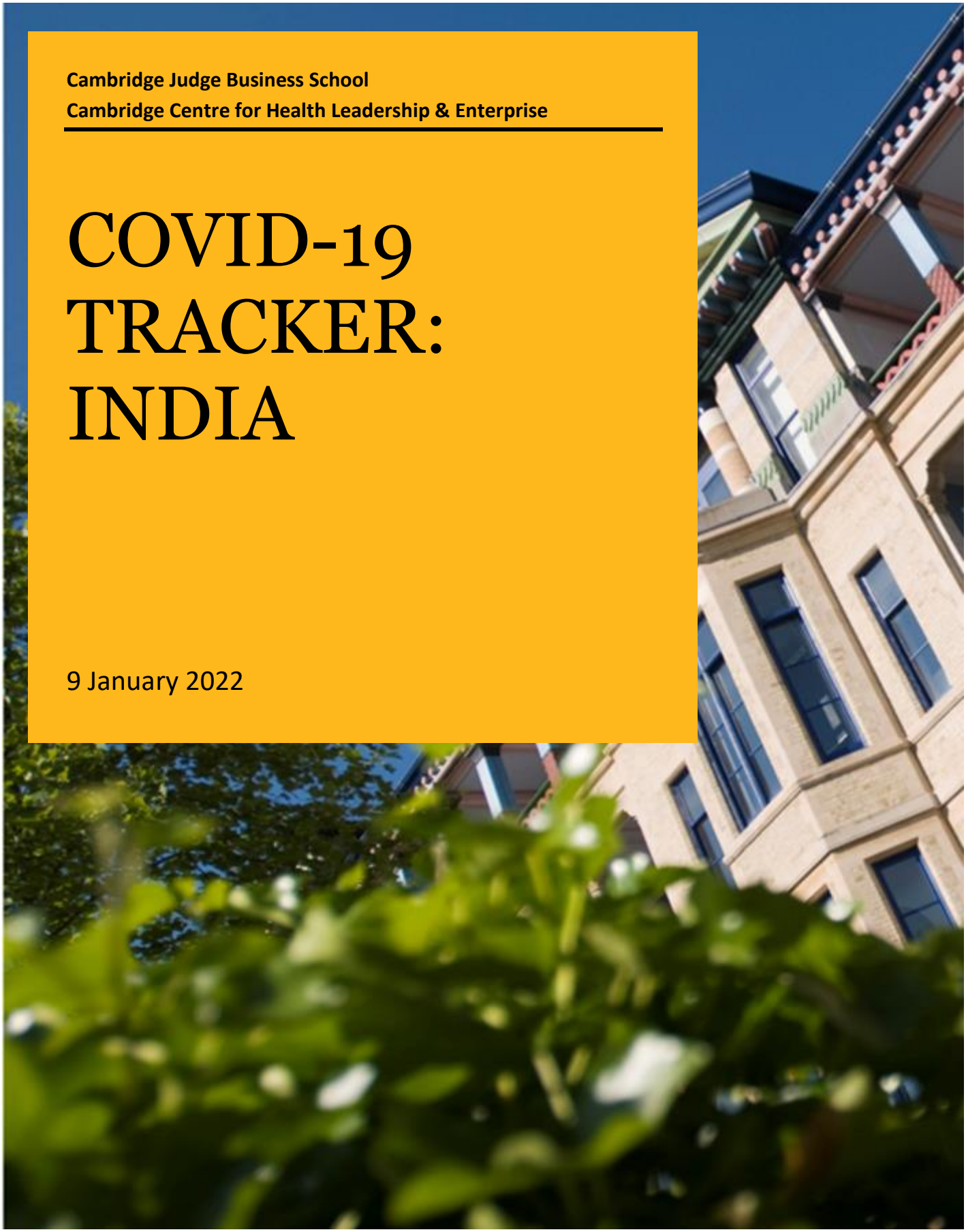
Cambridge Judge Business School
Cambridge Centre for Health Leadership & Enterprise

COVID-19 TRACKER: INDIA

9 January 2022



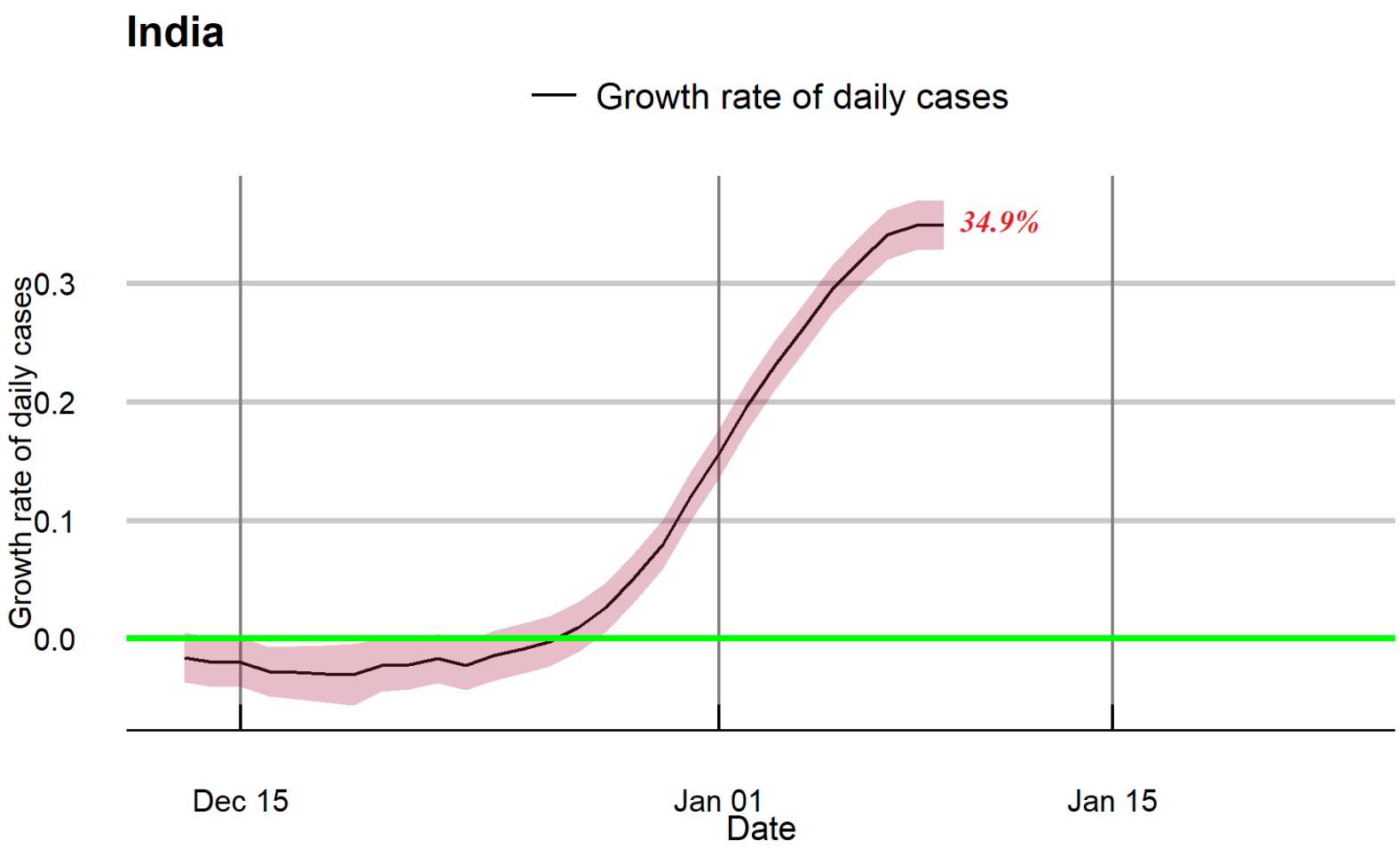
Centre for Health Leadership & Enterprise
UNIVERSITY OF CAMBRIDGE Judge Business School
HSTP Health Systems Transformation Platform
National Institute of Economic and Social Research

As of 9 January 2022, the reproduction number for India as a whole stood at 4.03. The filtered daily growth rate of cases at the national level has now *plateaued* at 34.9% (page 3). This reflects the *end of the super exponential growth phase* of the current wave in a number of states and union territories.

Even though the number of states with filtered daily growth rate exceeding 10%, and reproduction number exceeding 1.2, stands at 34, daily *growth rates* have peaked and are now clearly declining in Bihar, Chhattisgarh, Delhi, Jharkhand and West Bengal. A number of other states are tiptoeing into the declining growth phase, having just reached their peak daily growth rates.

In Jharkhand, the daily growth rate peaked at 57% on 4 January, and has since declined to 23% (page 13). In Delhi, after peaking at 53% on 5 January, the daily growth rate has declined to 36% (page 10). Experiences of other countries suggest that the decline in daily growth rate will be erratic in this phase, depending as it does on changes in social behaviour and on mitigation measures. But on current trends, *daily cases* are likely to peak in the second half of January in Jharkhand and around end-January in Delhi. Assessments for more states should be possible in a few days.

Filtered daily growth rates of new cases: days leading up to 9 January 2022



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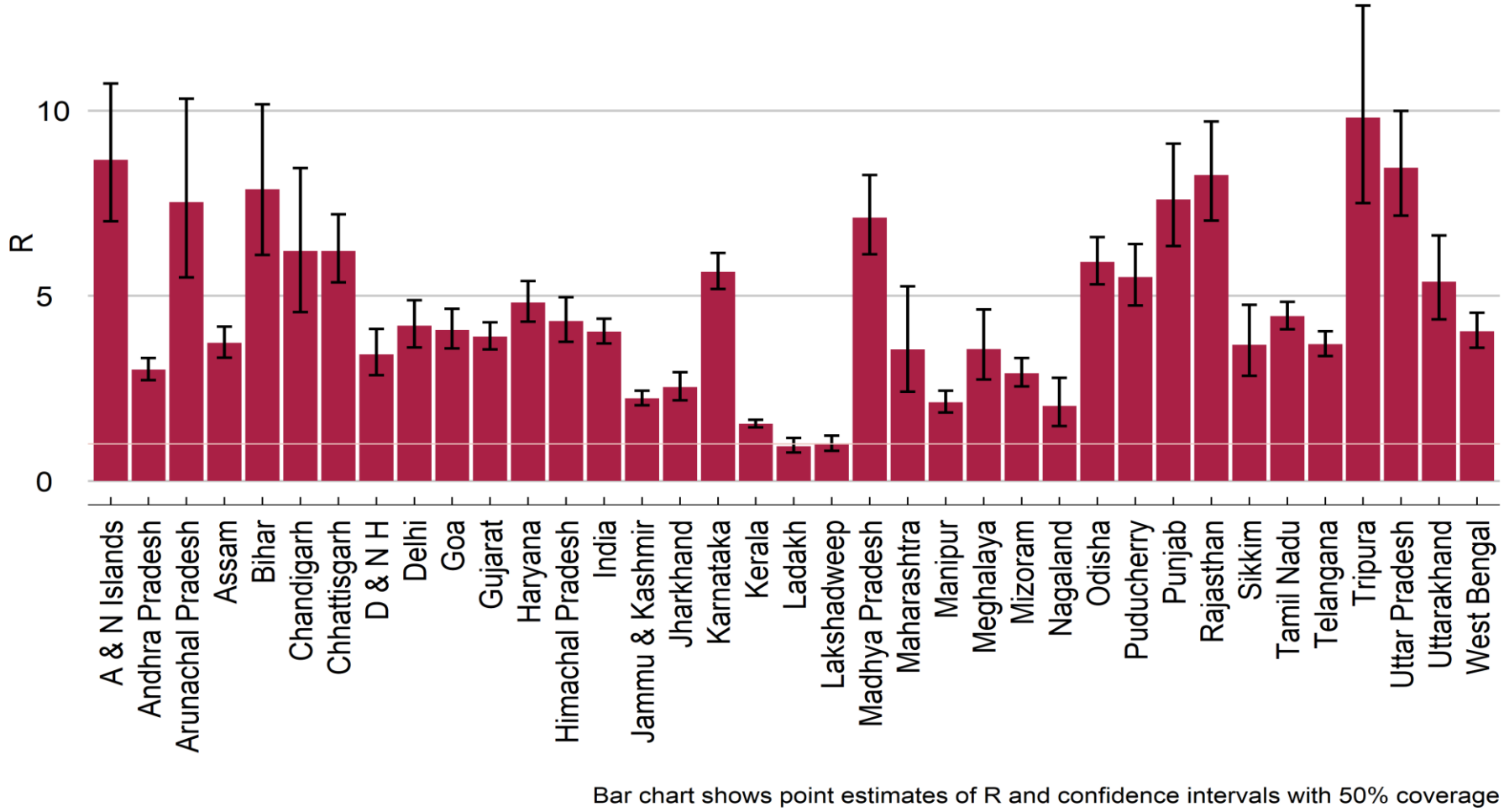
Reproduction numbers on 9 January 2022



Bar chart shows point estimates of R and confidence intervals with 50% coverage

Note: Small numbers in Dadra and Nager Haveli and Daman and Diu, Ladakh and Lakshadweep make their estimates less reliable.

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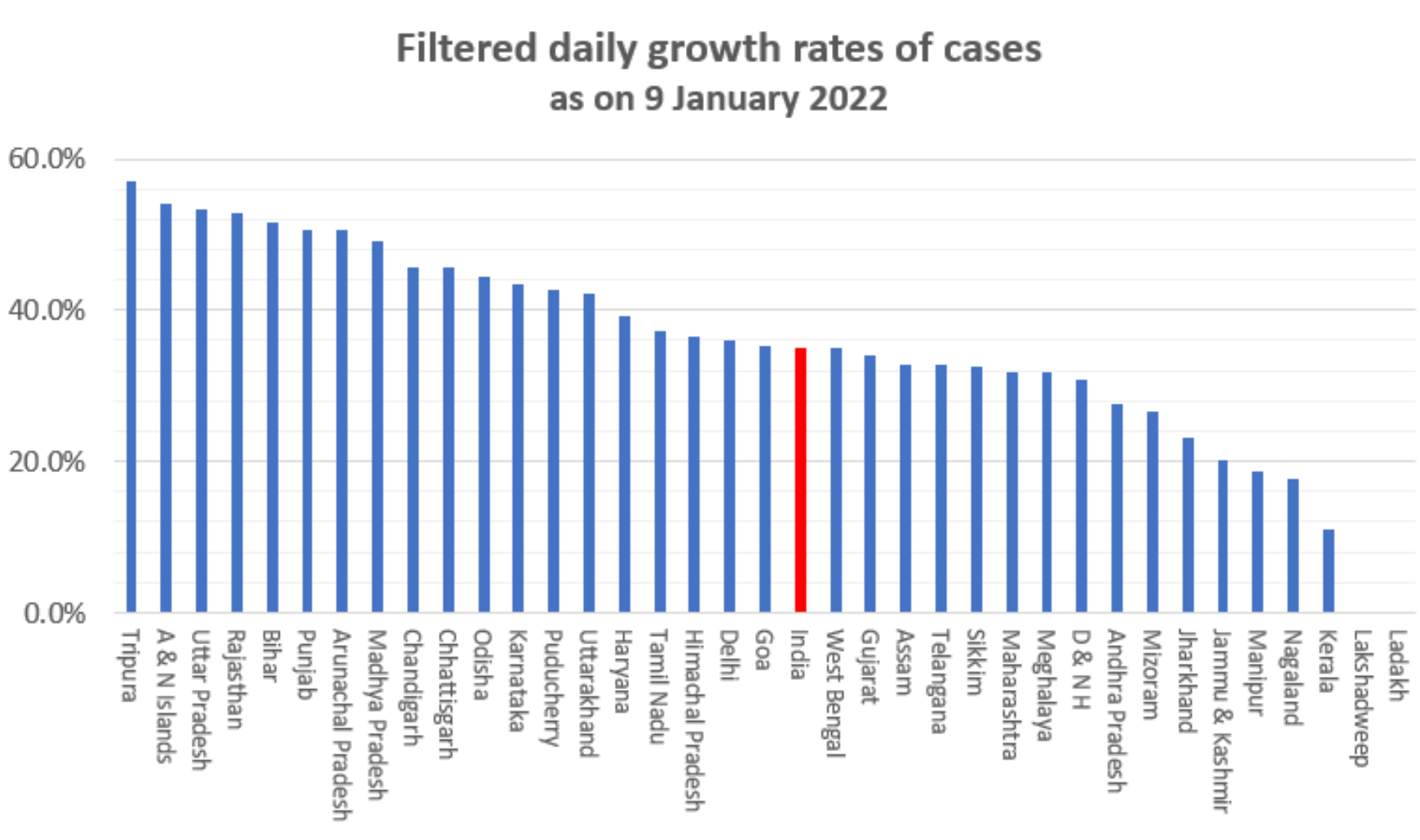

Note: Small numbers in Dadra and Nager Haveli and Daman and Diu, Ladakh and Lakshadweep make their estimates less reliable.

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Reproduction numbers and Filtered growth rates as on 9 January 2022

	Reproduction number	Filtered daily growth rate
India	**4.03**	**34.9%**
Tripura	9.81	57.1%
A & N Islands	8.67	54.0%
Uttar Pradesh	8.46	53.4%
Rajasthan	8.26	52.8%
Bihar	7.87	51.6%
Punjab	7.60	50.7%
Arunachal Pradesh	7.53	50.5%
Madhya Pradesh	7.11	49.0%
Chandigarh	6.21	45.6%
Chhattisgarh	6.21	45.6%
Odisha	5.91	44.4%
Karnataka	5.65	43.3%
Puducherry	5.50	42.6%
Uttarakhand	5.38	42.1%
Haryana	4.82	39.3%
Tamil Nadu	4.45	37.3%
Himachal Pradesh	4.32	36.6%
Delhi	4.20	35.9%
Goa	4.08	35.2%
West Bengal	4.04	34.9%
Gujarat	3.90	34.0%
Assam	3.73	32.9%
Telangana	3.69	32.7%
Sikkim	3.67	32.5%
Maharashtra	3.55	31.7%
Meghalaya	3.56	31.7%
D & N H	3.42	30.7%
Andhra Pradesh	3.01	27.5%
Mizoram	2.91	26.7%
Jharkhand	2.53	23.2%
Jammu & Kashmir	2.23	20.1%
Manipur	2.12	18.8%
Nagaland	2.03	17.7%
Kerala	1.55	10.9%

Note: Small numbers in Dadra and Nager Haveli and Daman and Diu, Ladakh and Lakshadweep make their estimates less reliable.

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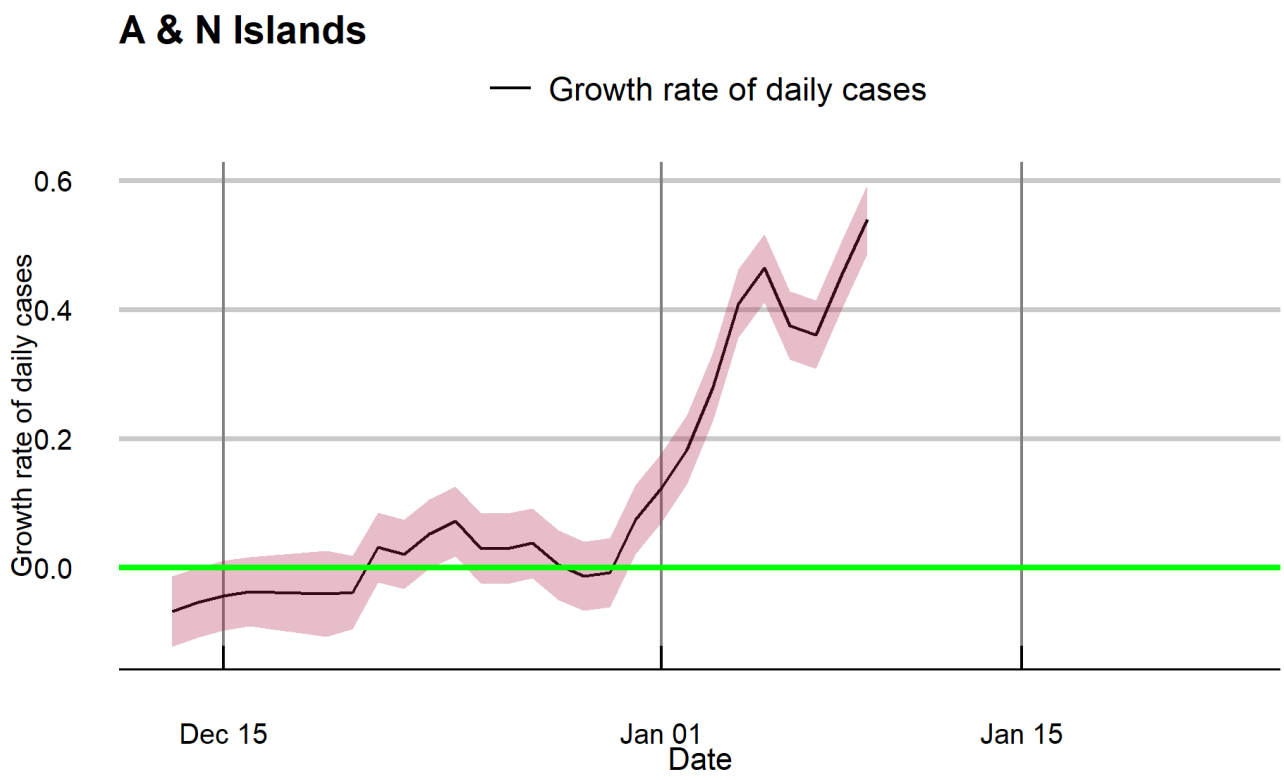
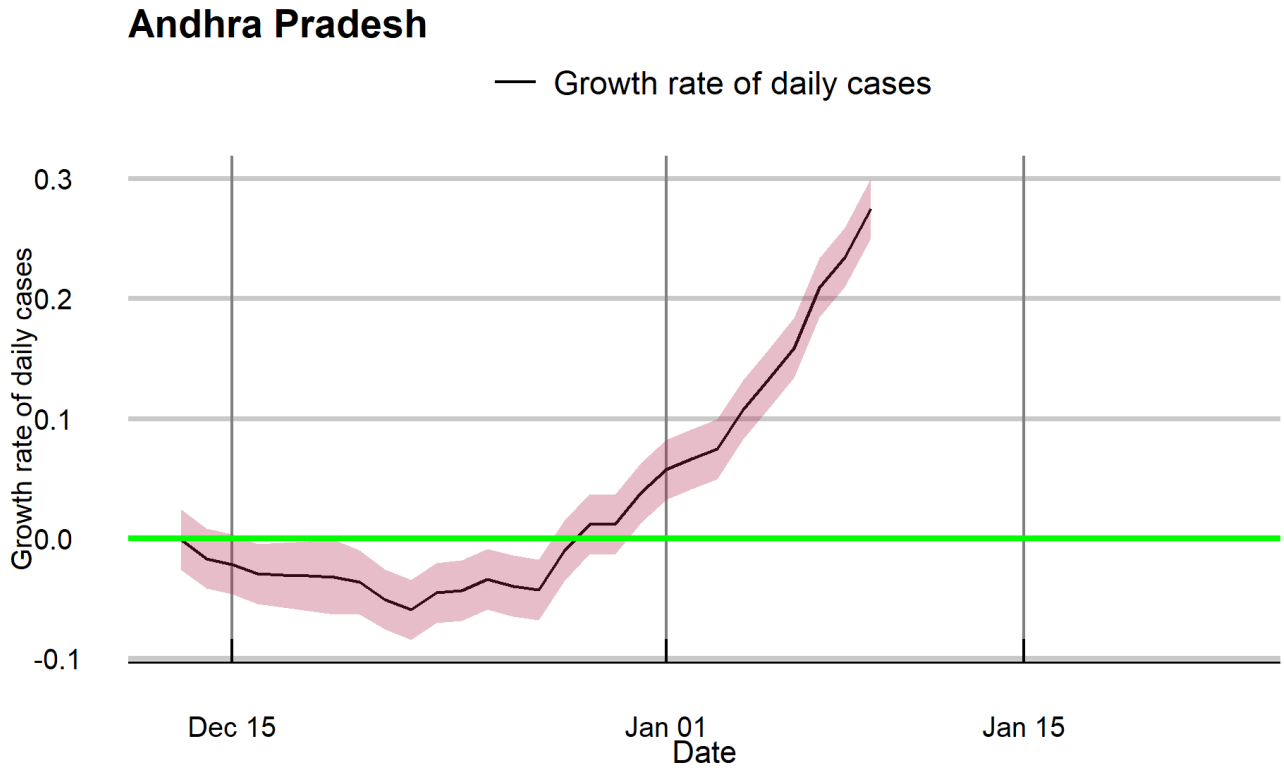
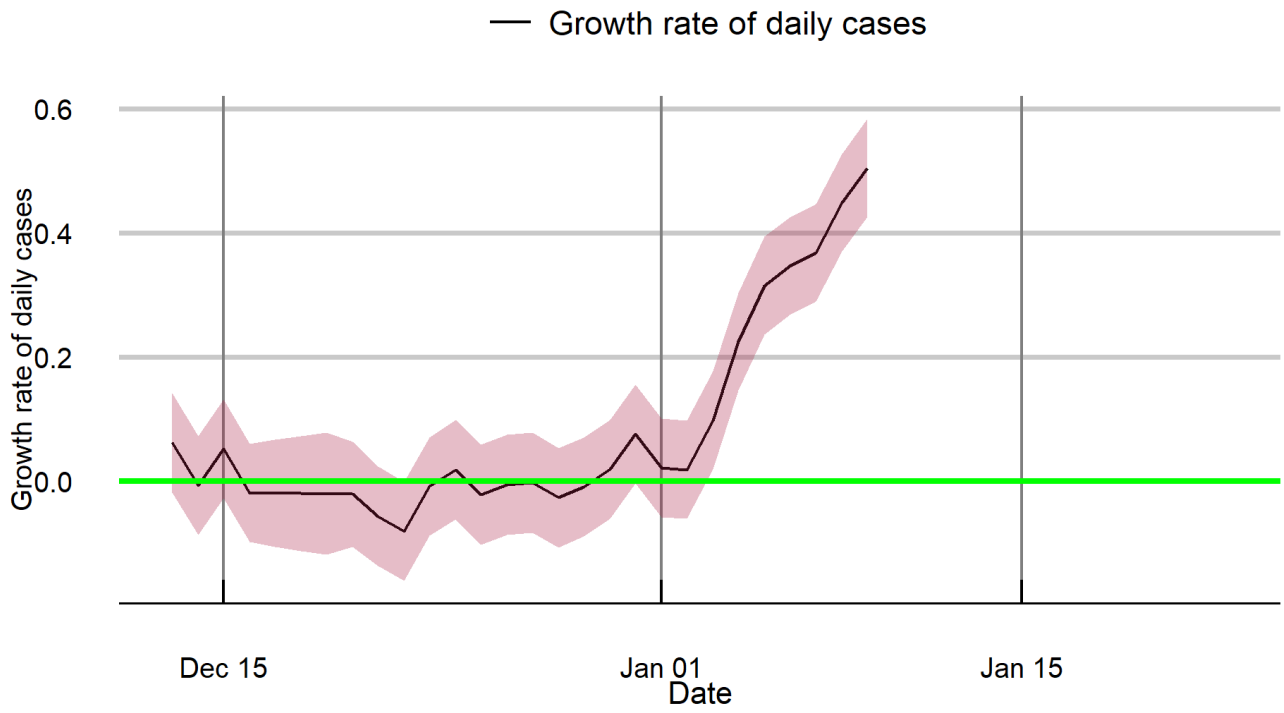
Filtered daily growth rates of new cases: days leading up to 9 January 2022

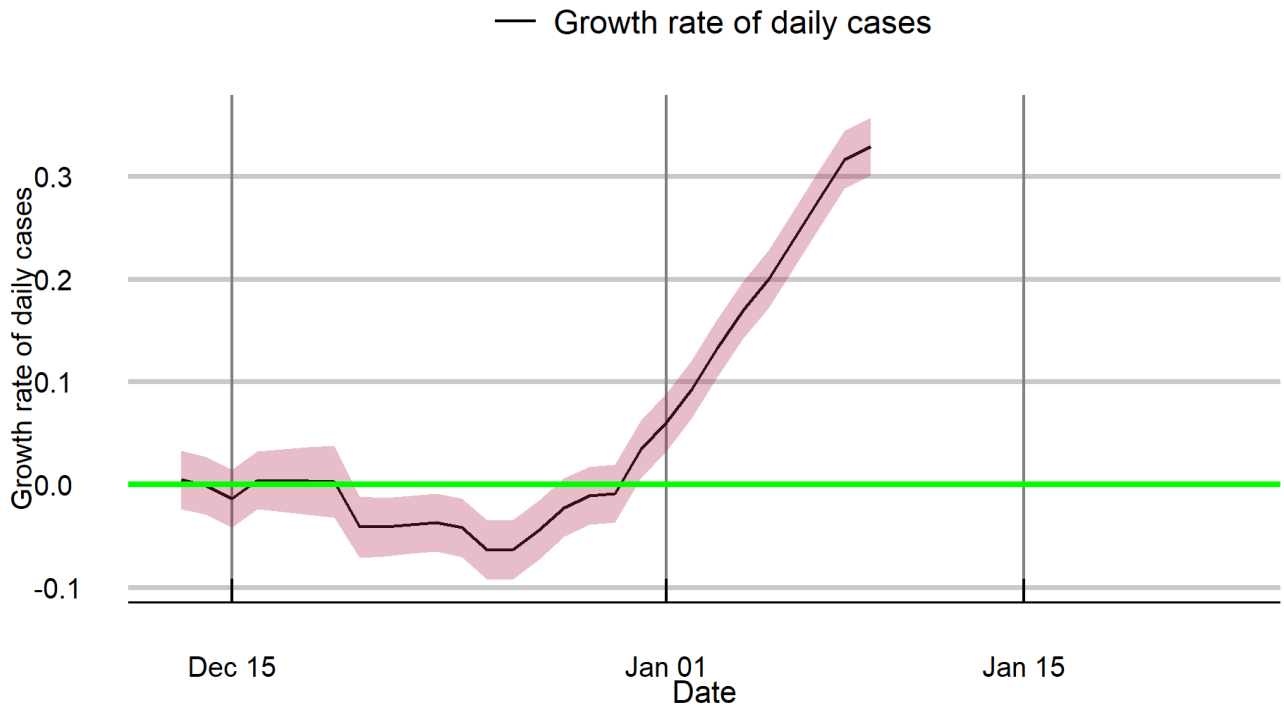




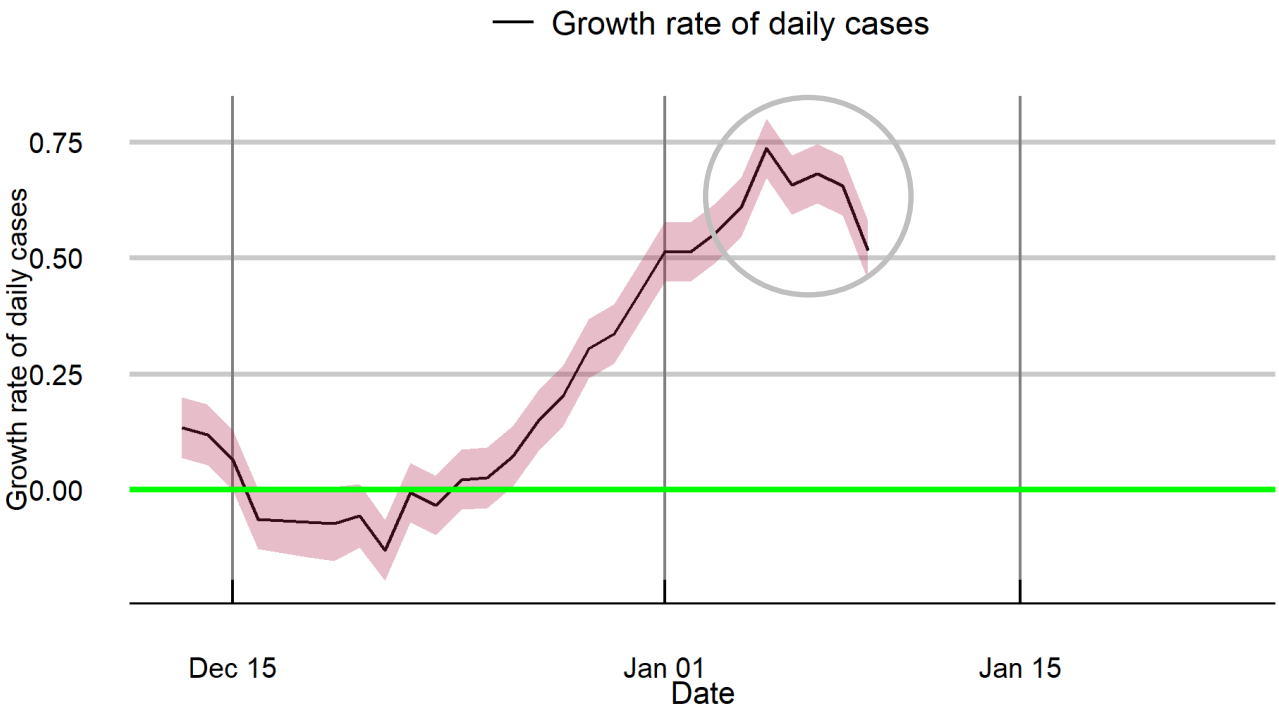
Arunachal Pradesh



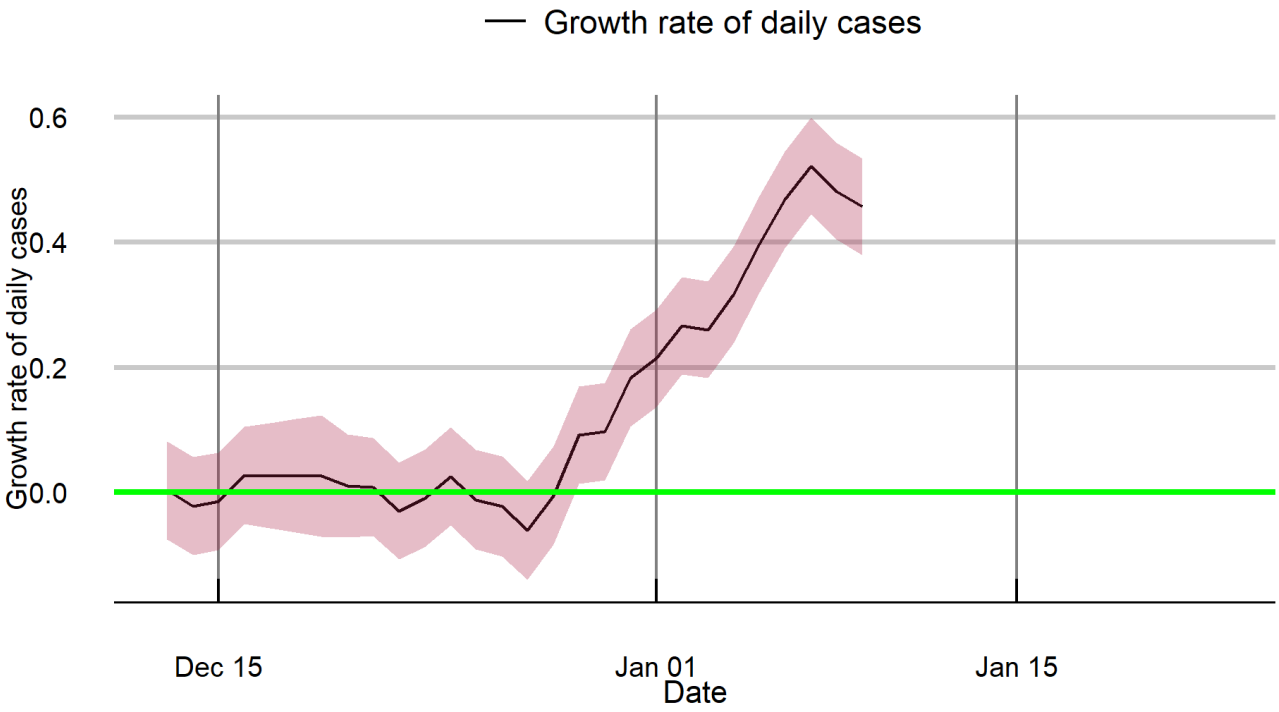
Assam



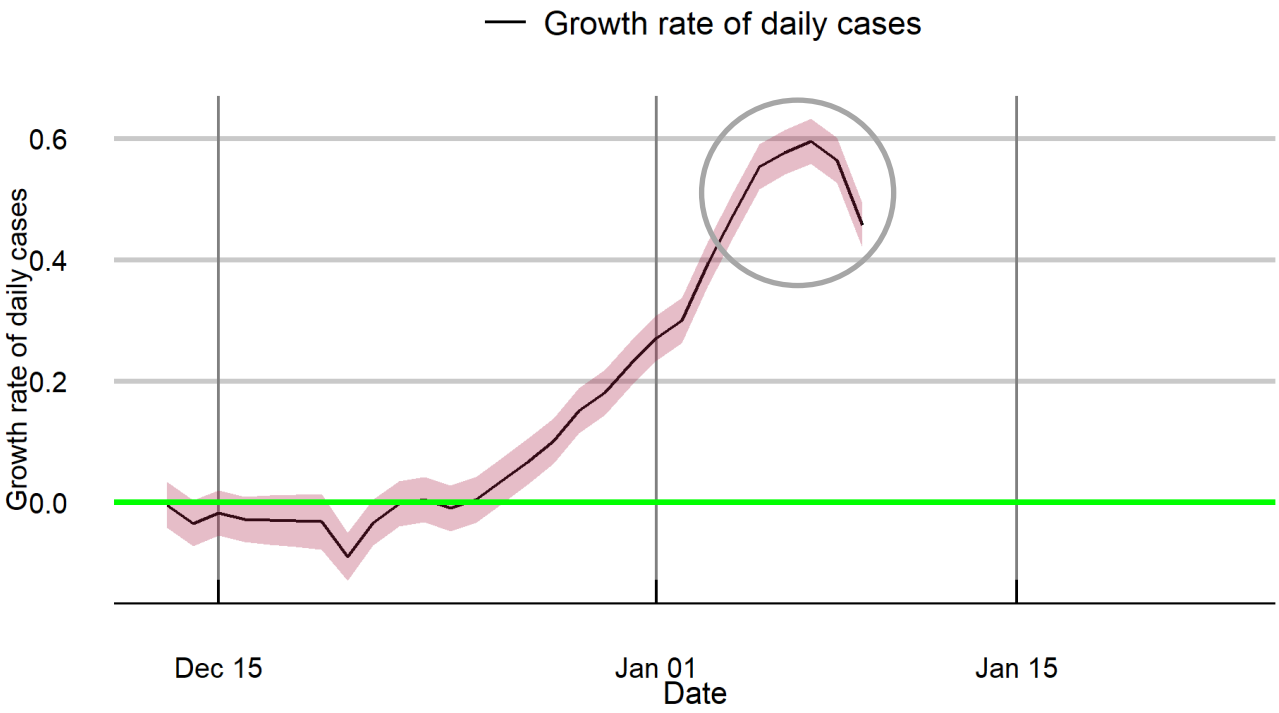
Bihar



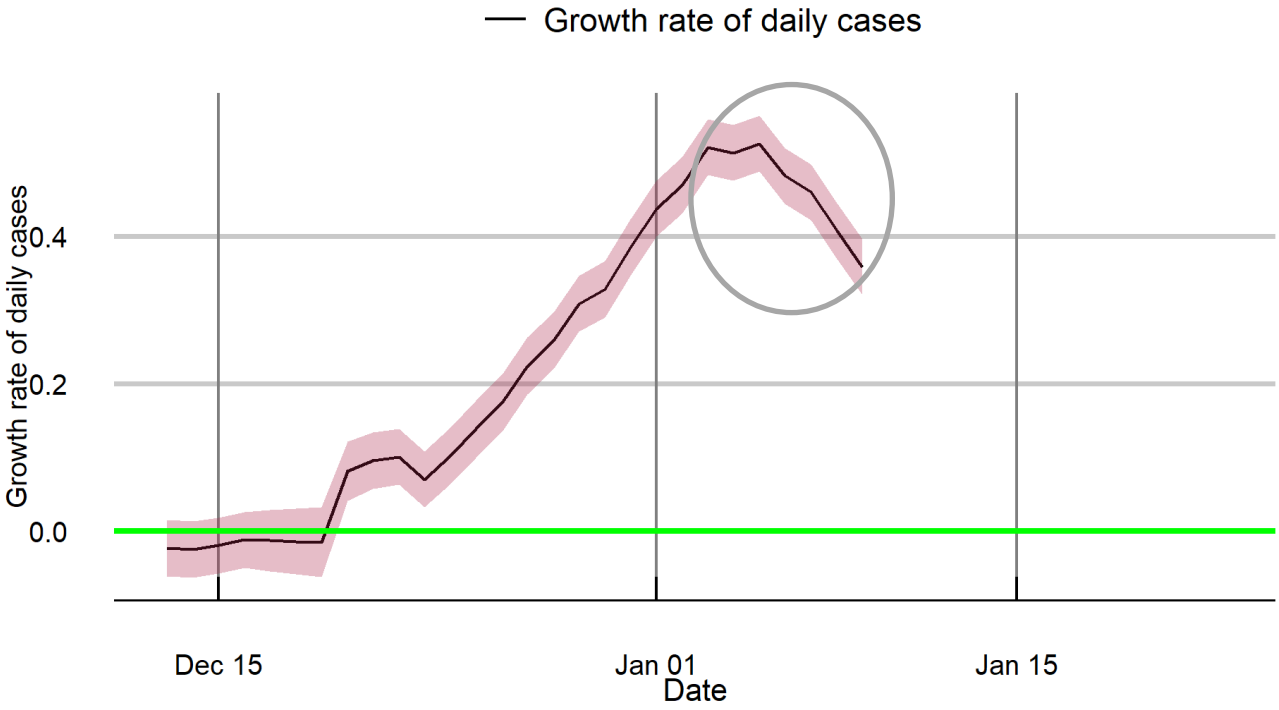
Chandigarh



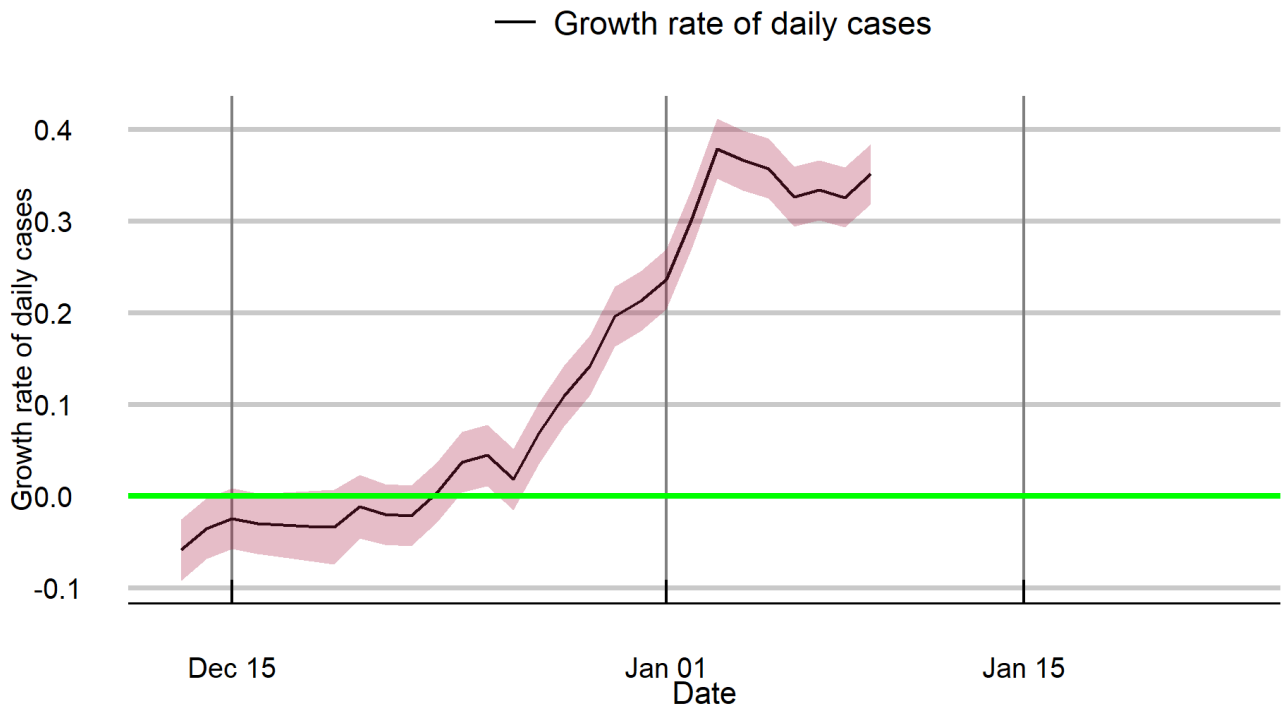
Chhattisgarh



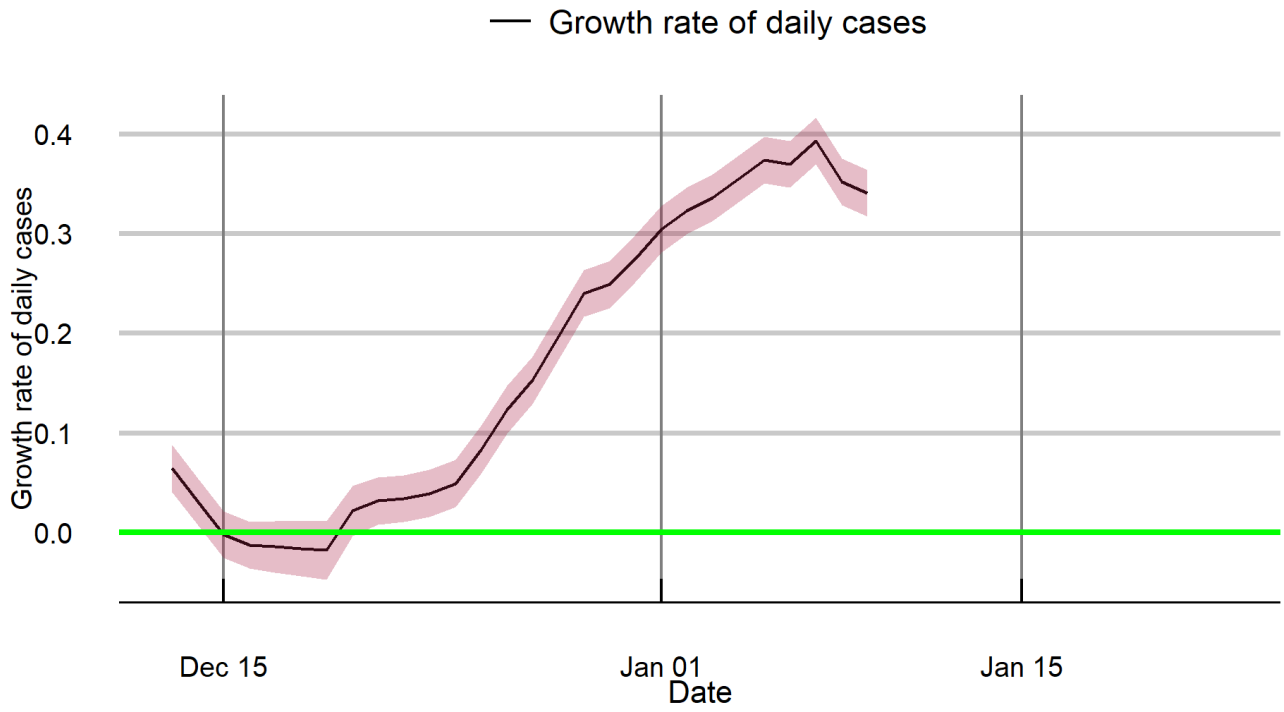
Delhi



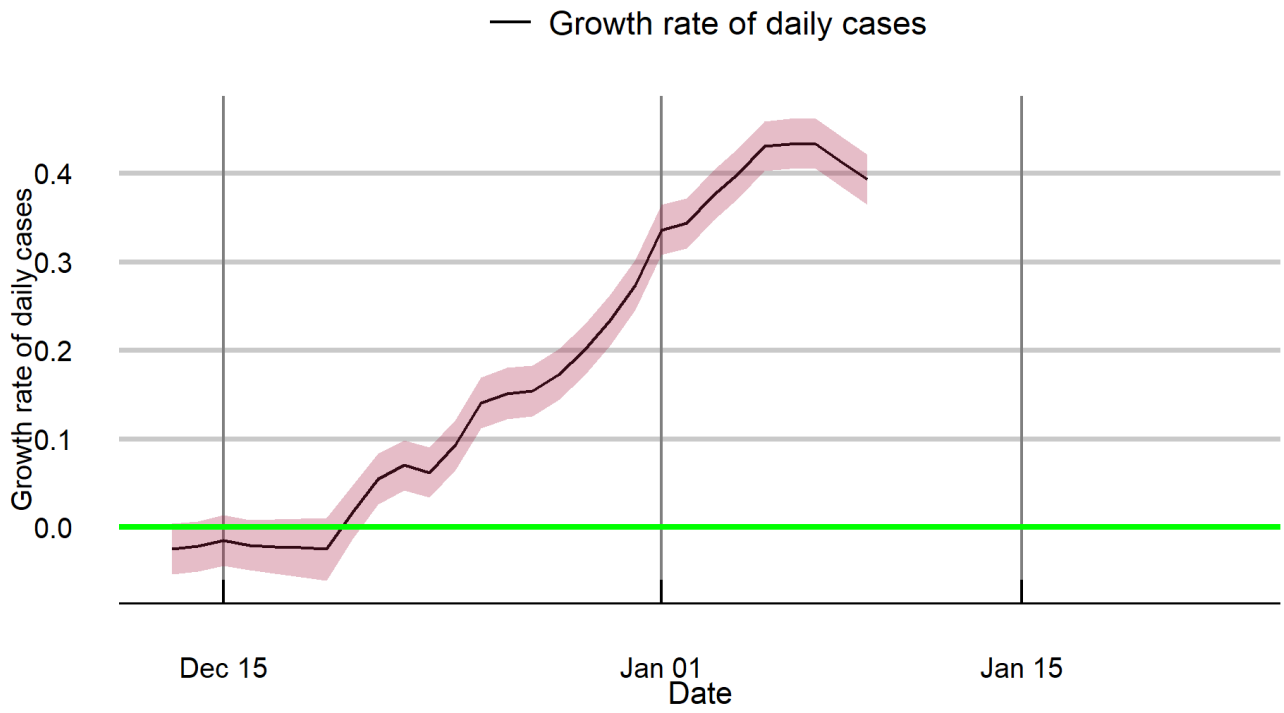
Goa


Growth rate of daily cases
Growth rate of daily cases
0.4
0.3
0.2
0.1
0.0
-0.1
Dec 15
Jan 01
Jan 15
Date

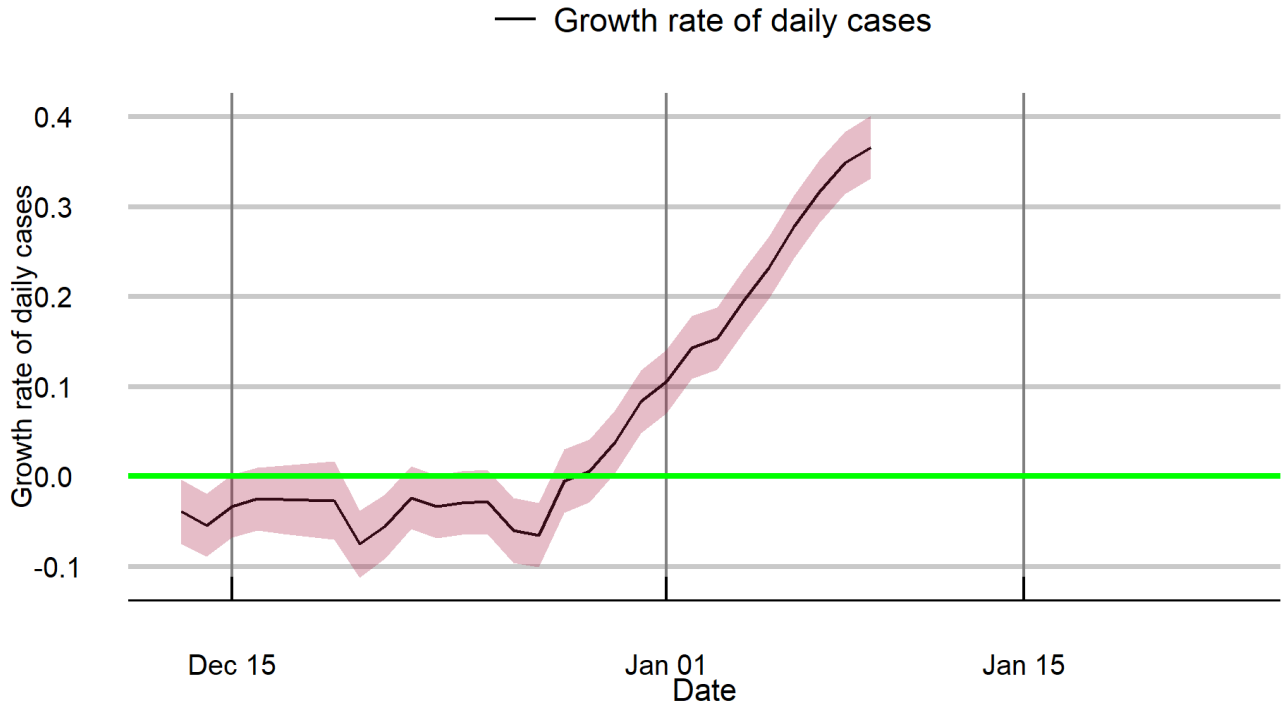
Gujarat


Growth rate of daily cases
Growth rate of daily cases
0.4
0.3
0.2
0.1
0.0
Dec 15
Jan 01
Jan 15
Date

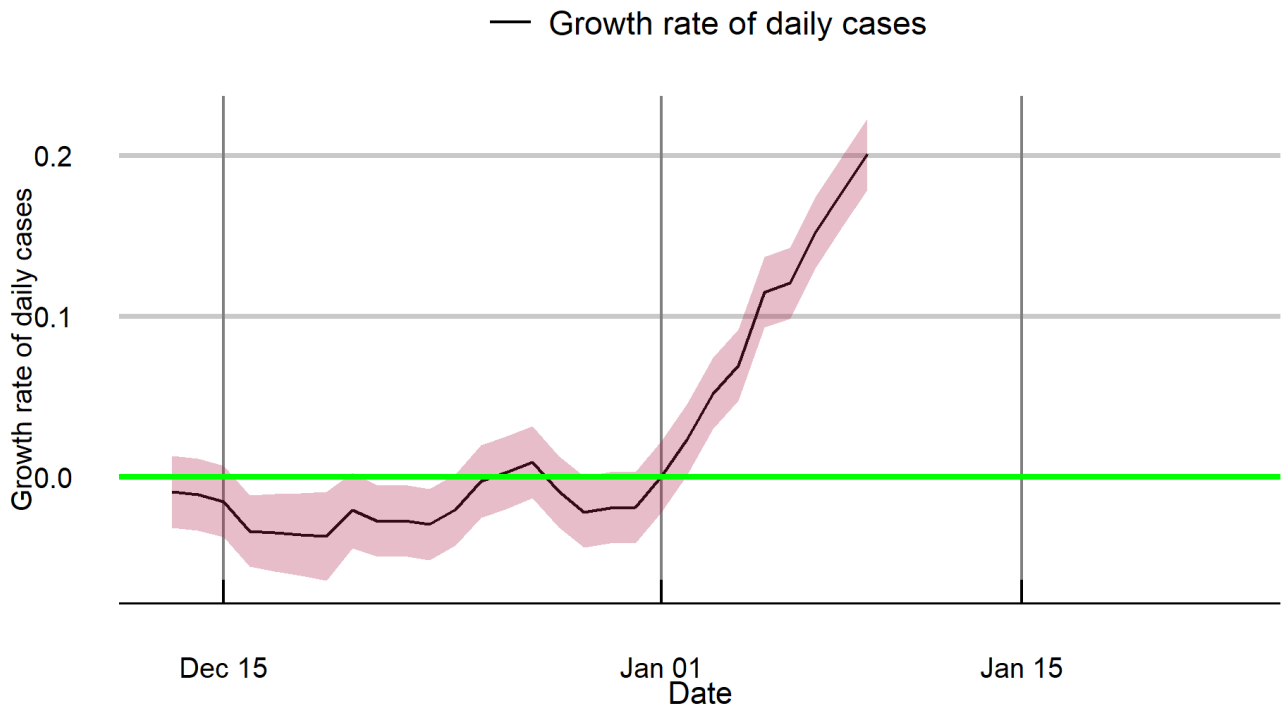
Haryana



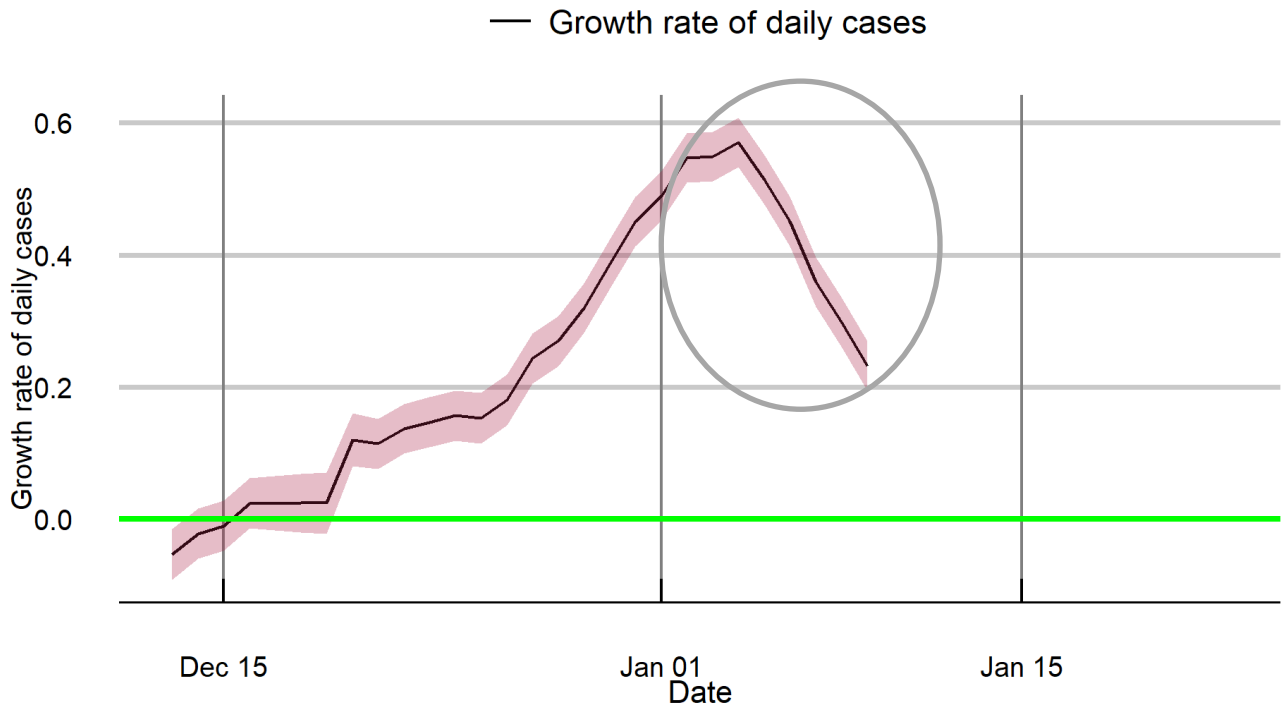
Himachal Pradesh



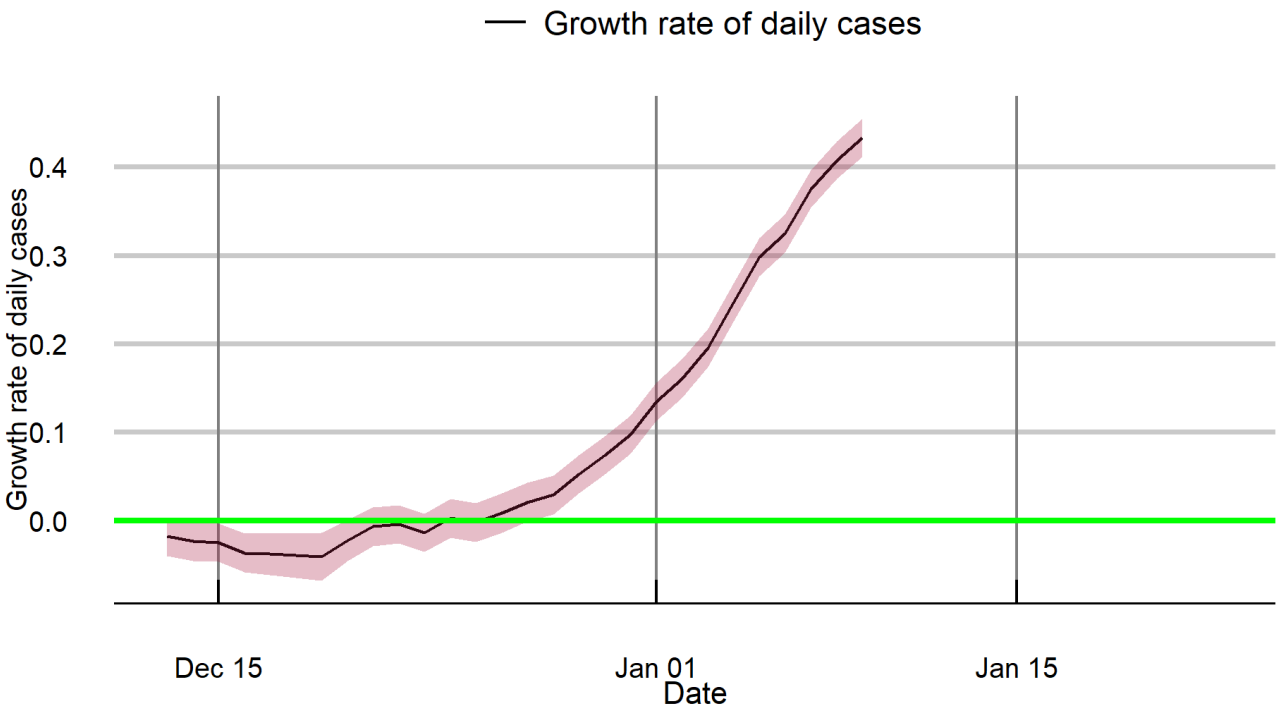
Jammu & Kashmir



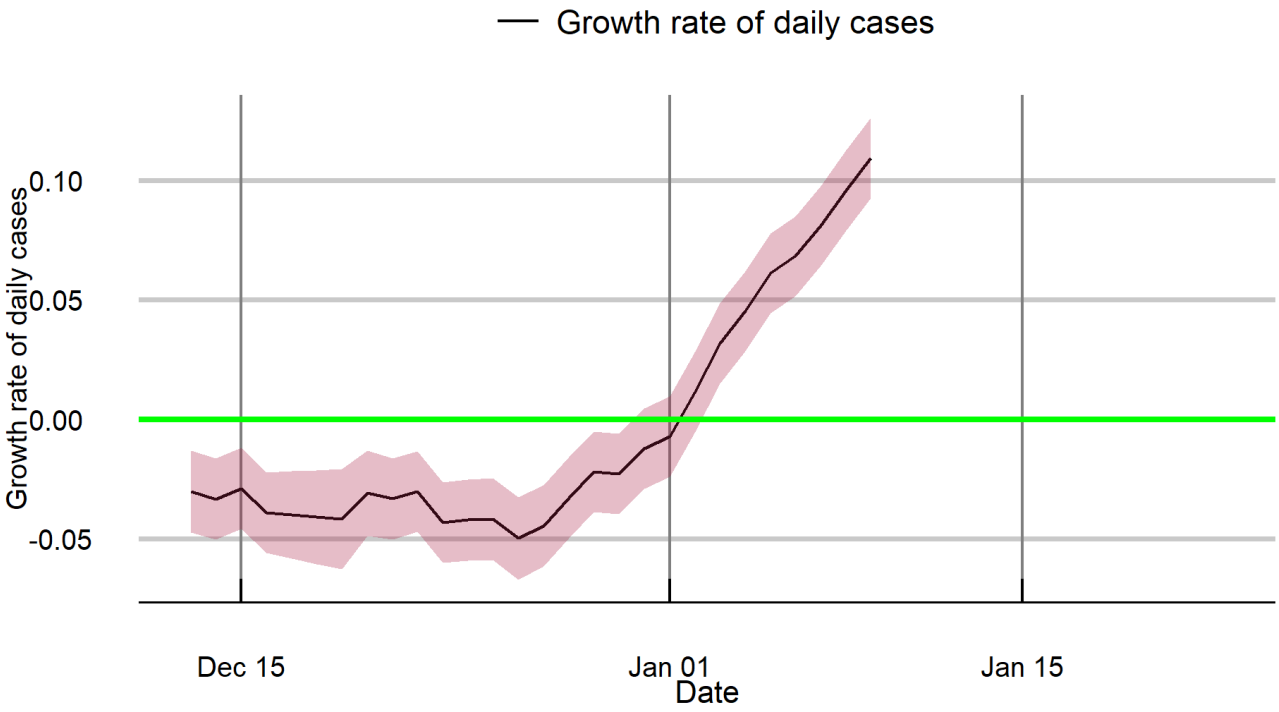
Jharkhand



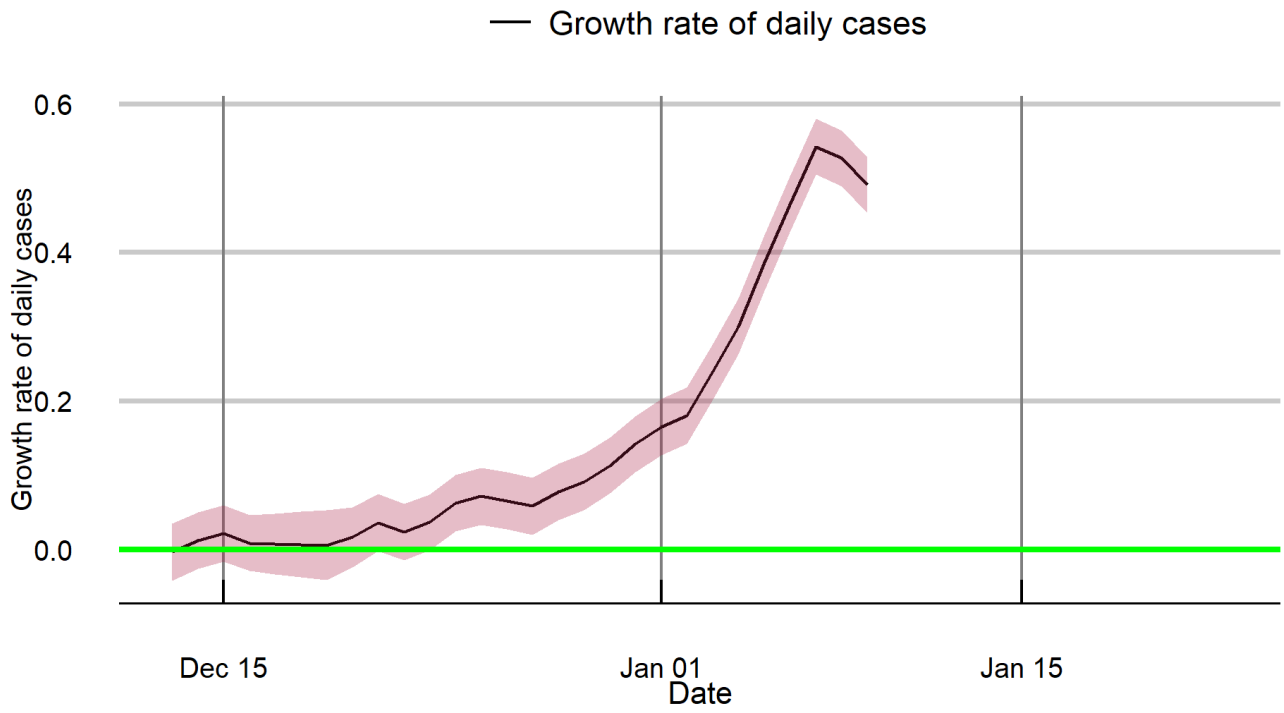
Karnataka



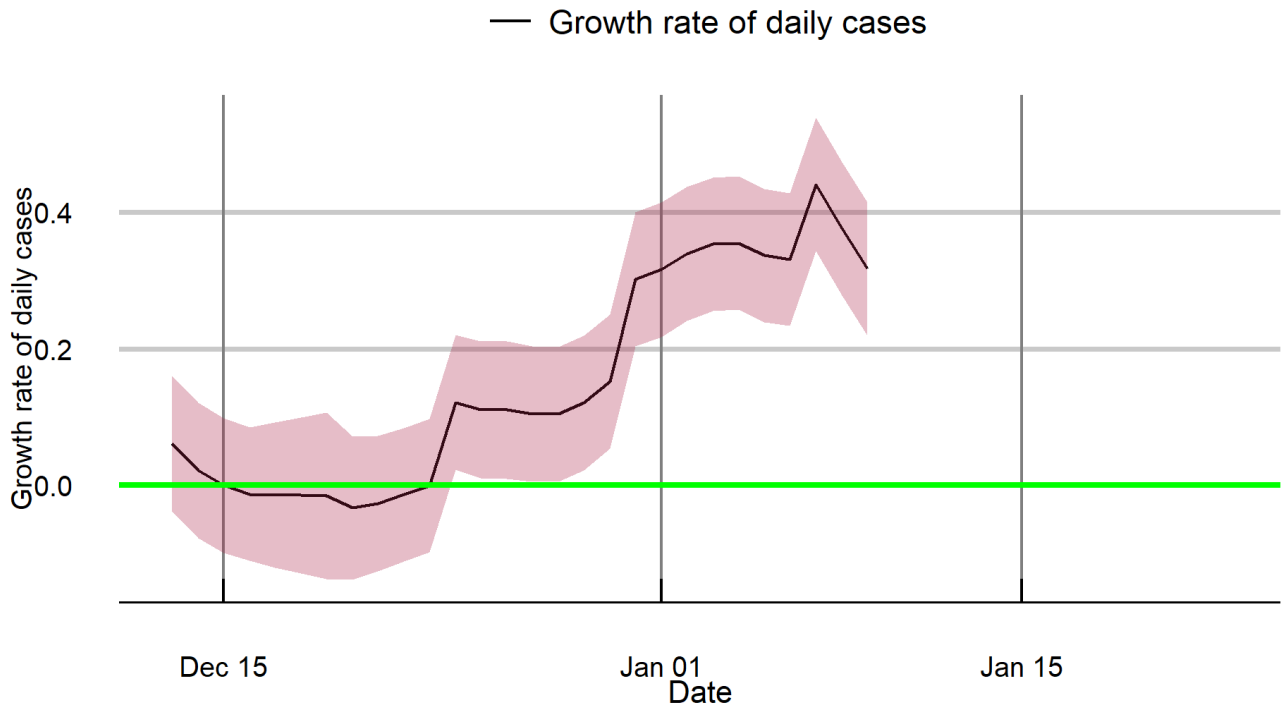
Kerala



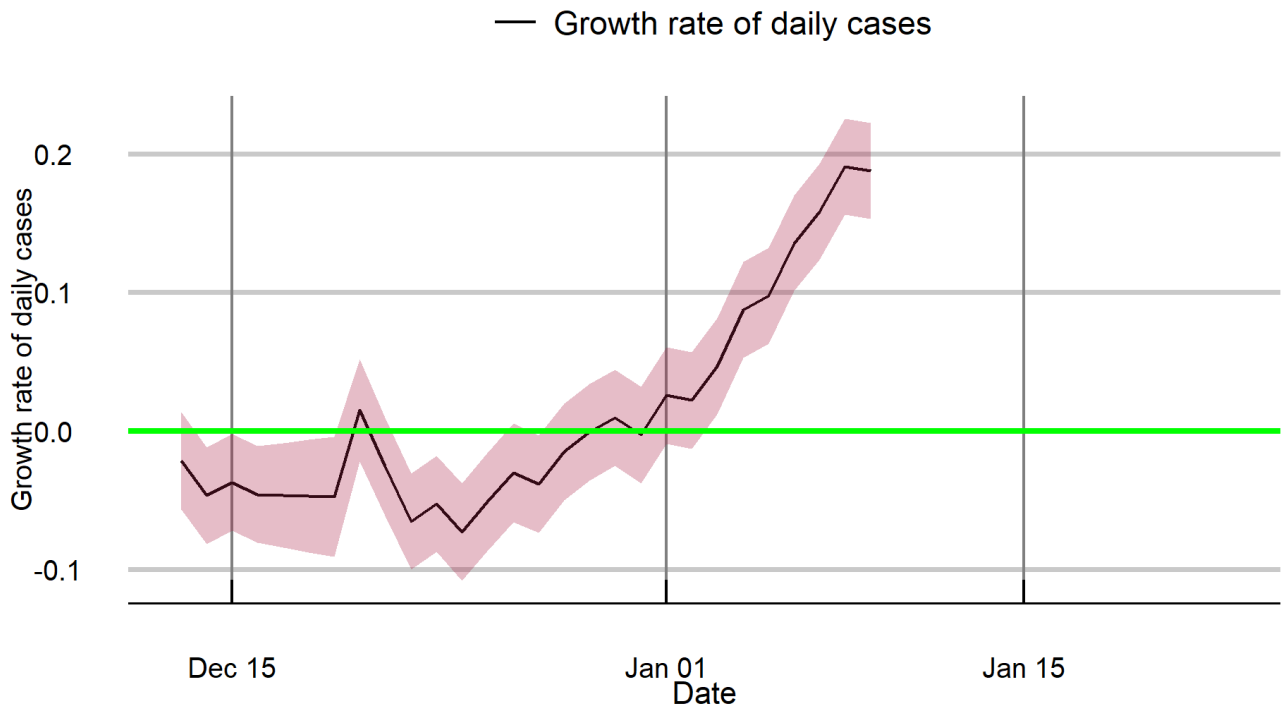
Madhya Pradesh



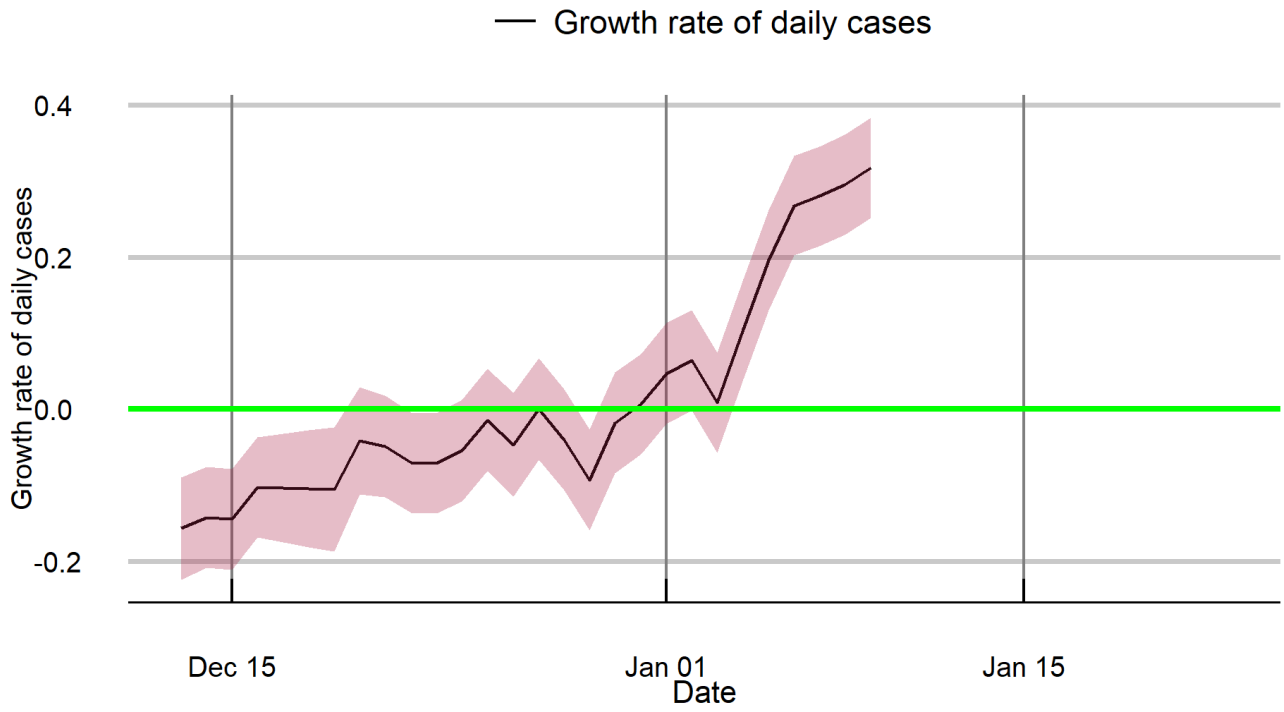
Maharashtra



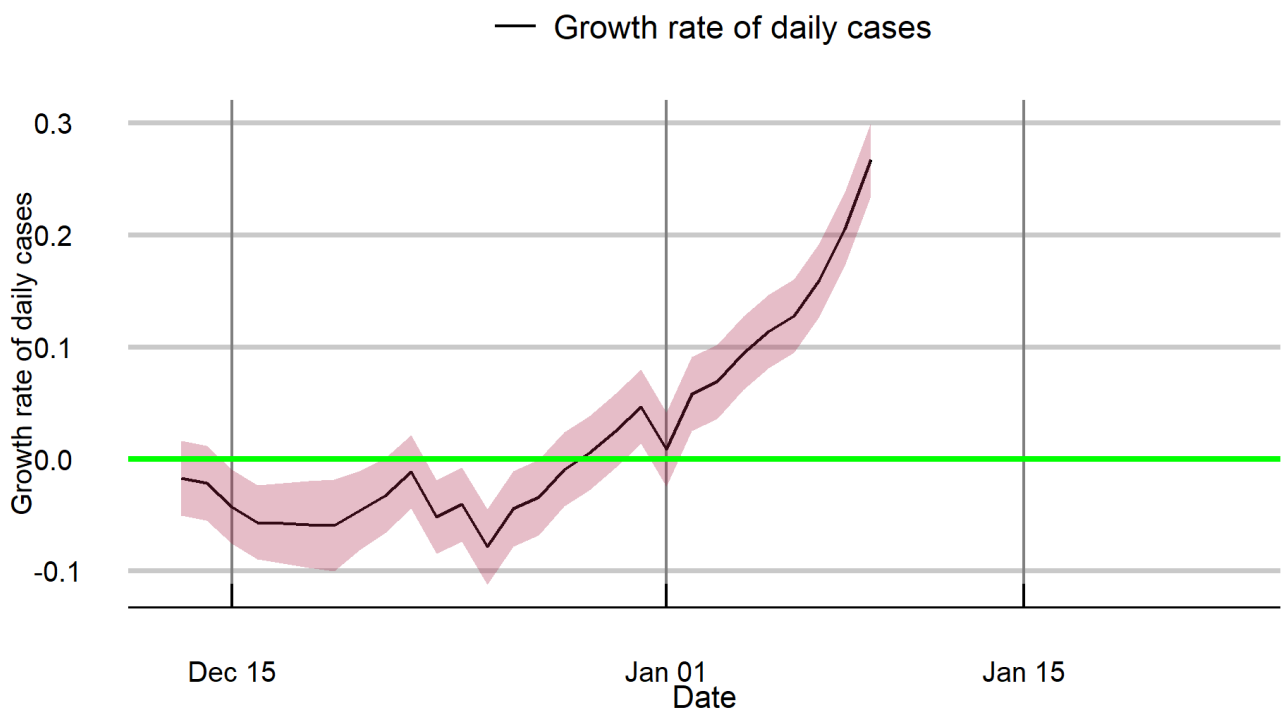
Manipur



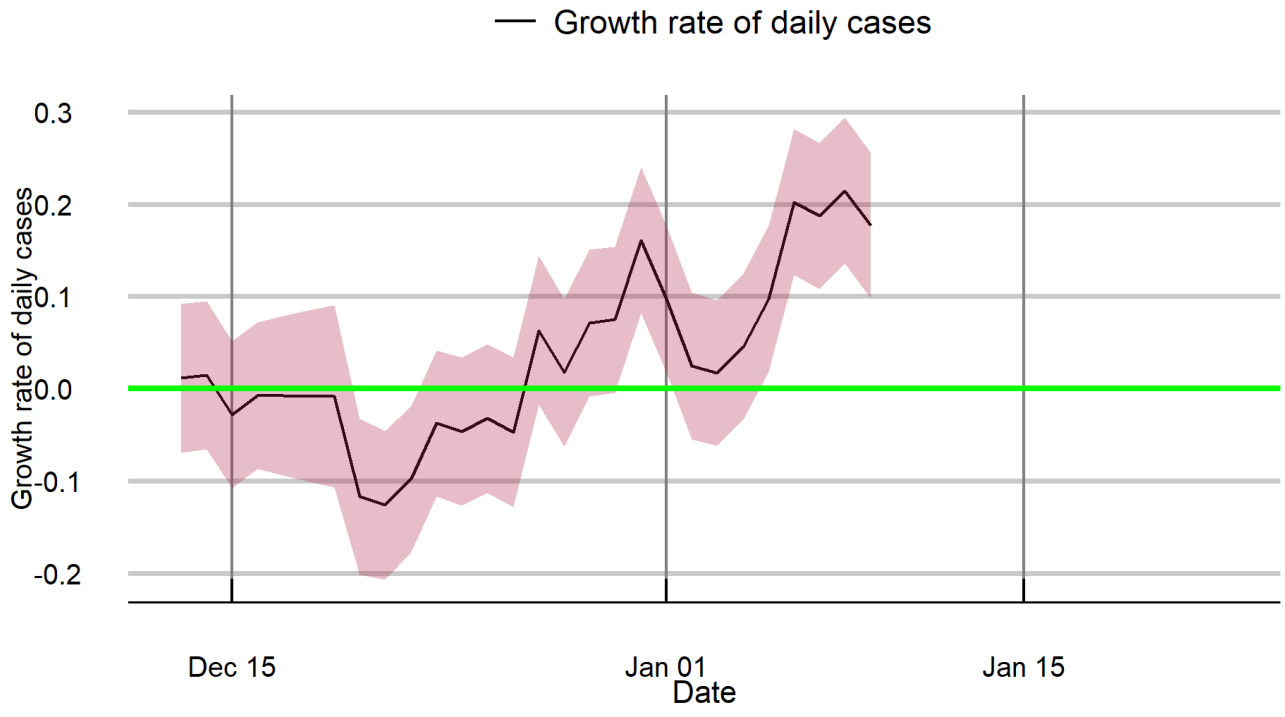
Meghalaya



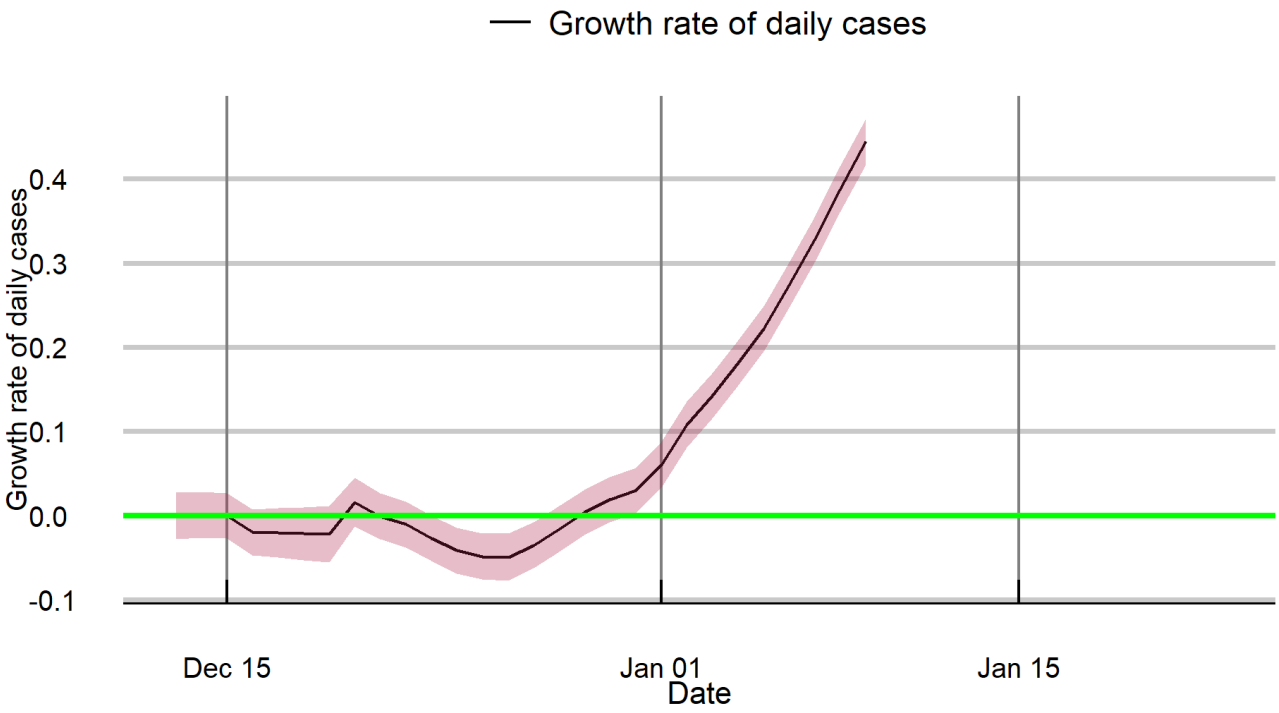
Mizoram



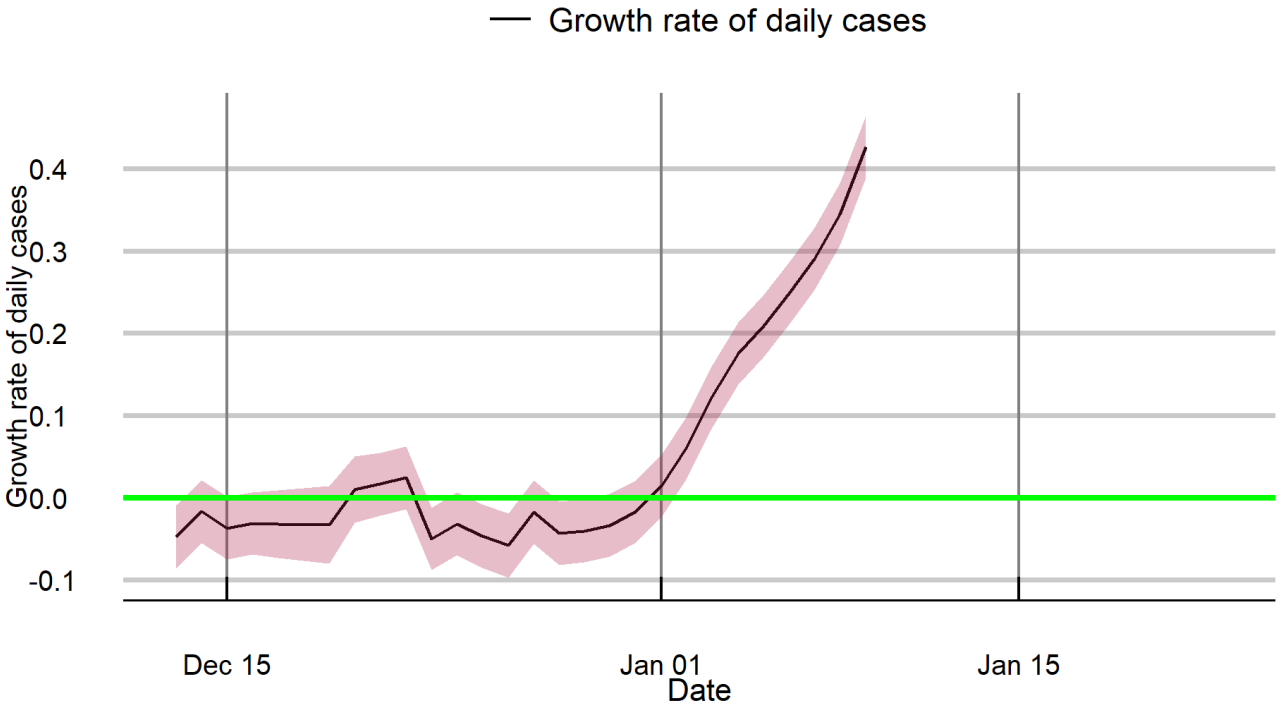
Nagaland



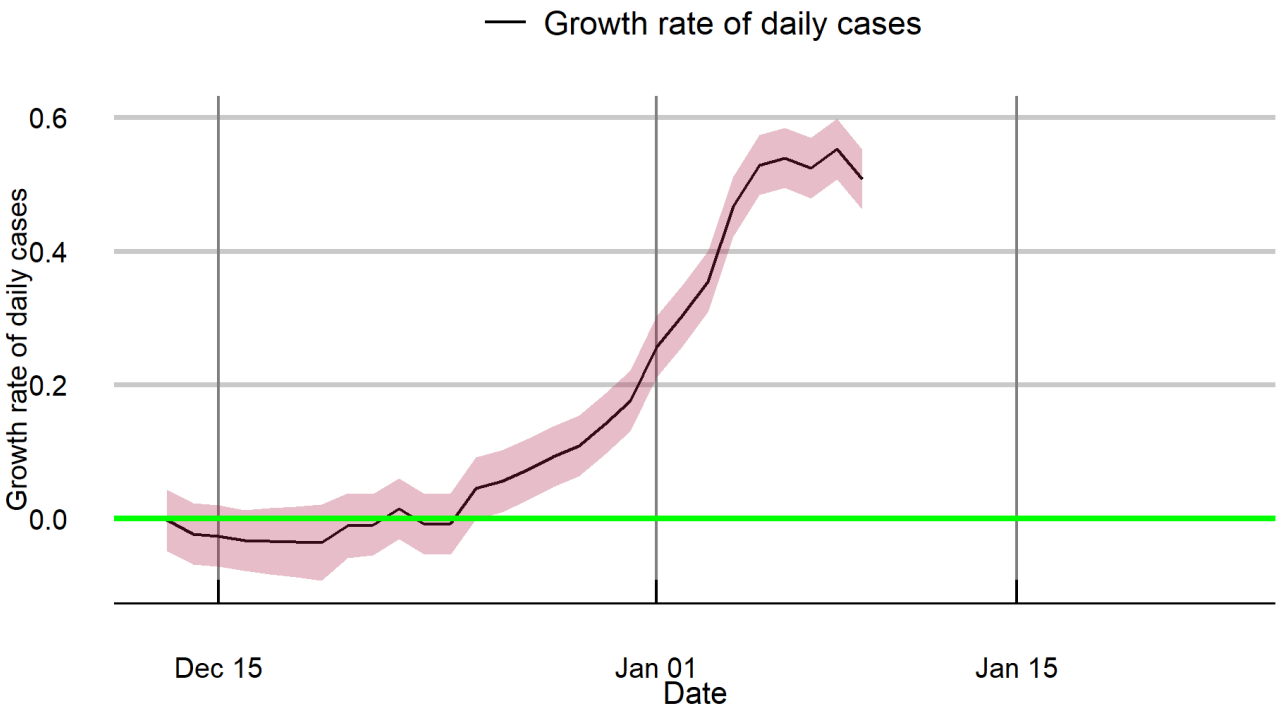
Odisha



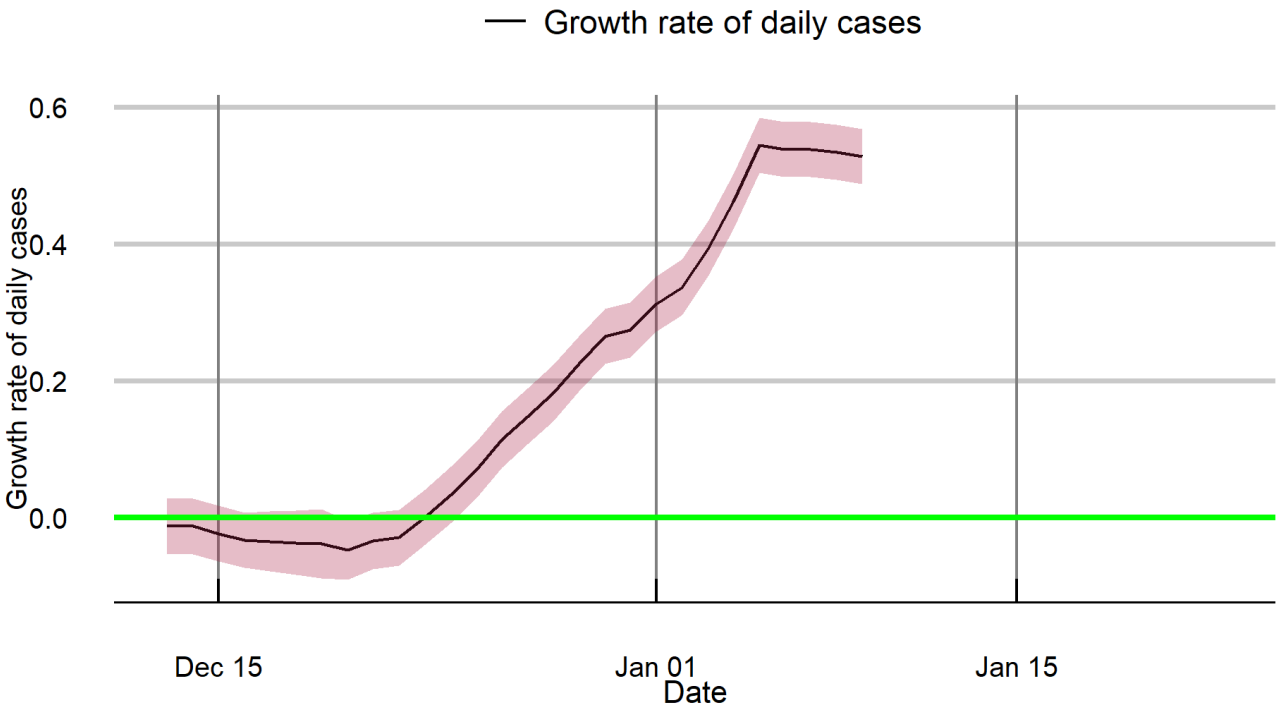
Puducherry



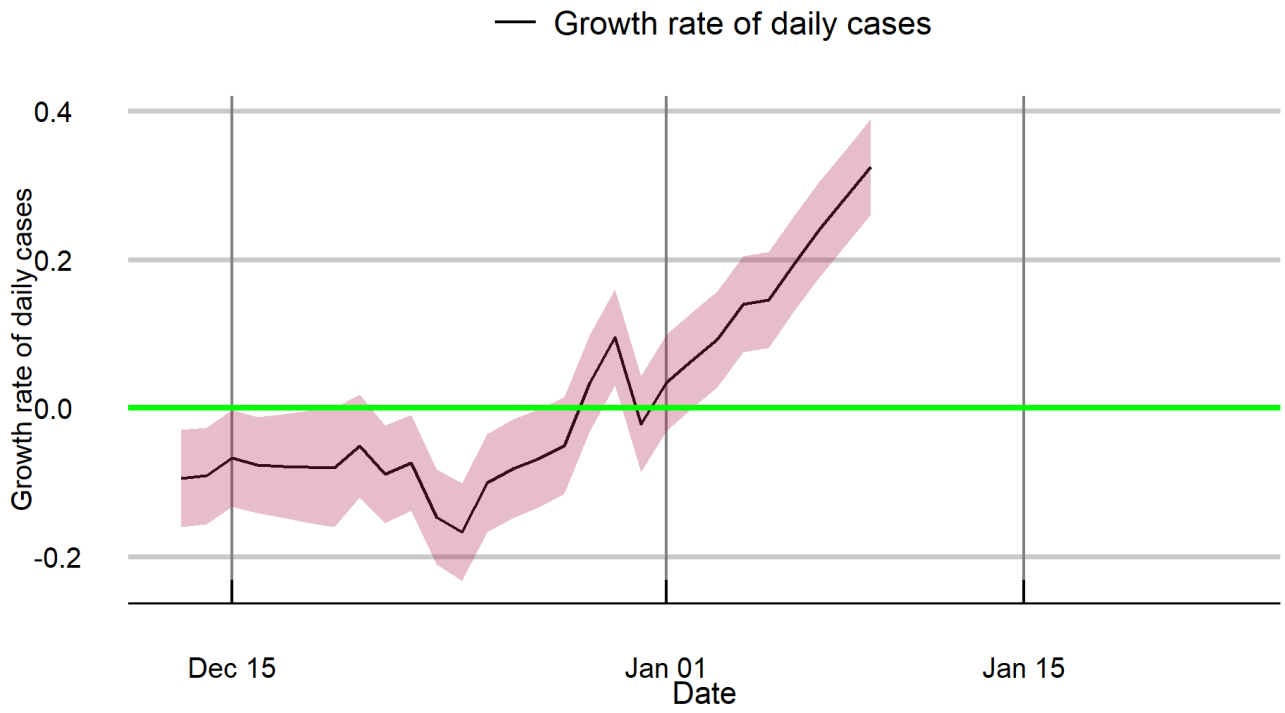
Punjab



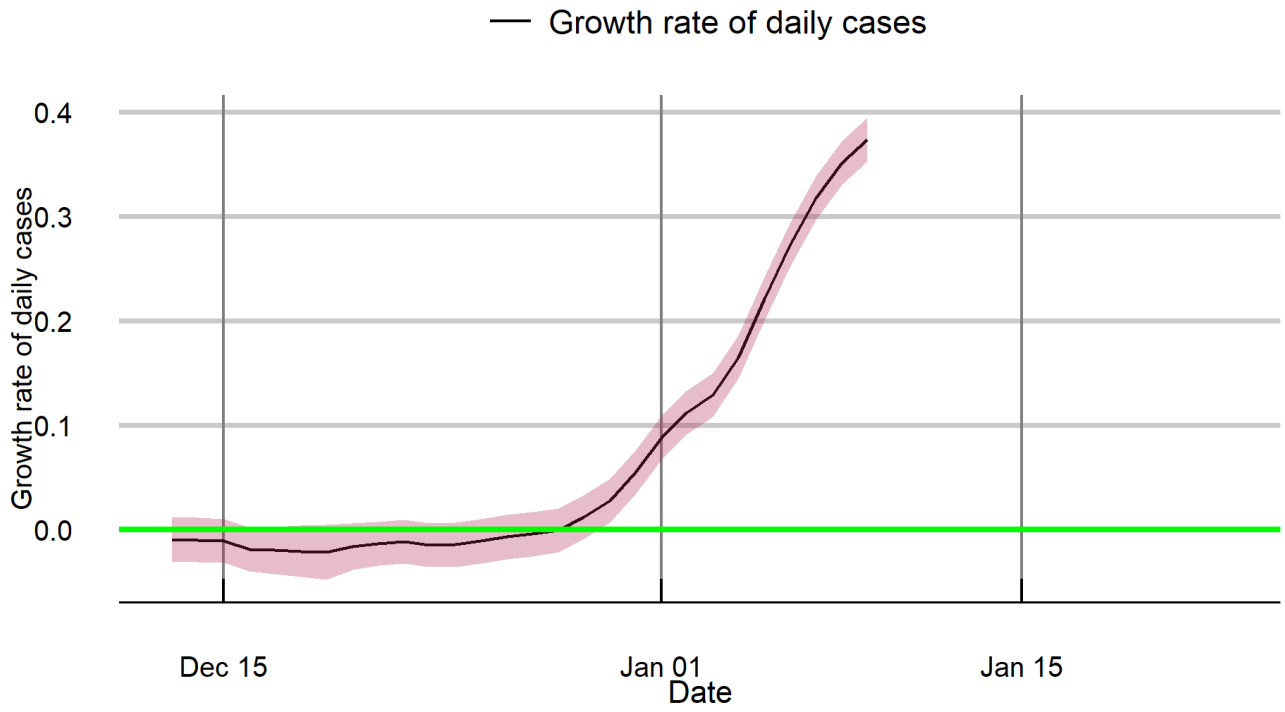
Rajasthan



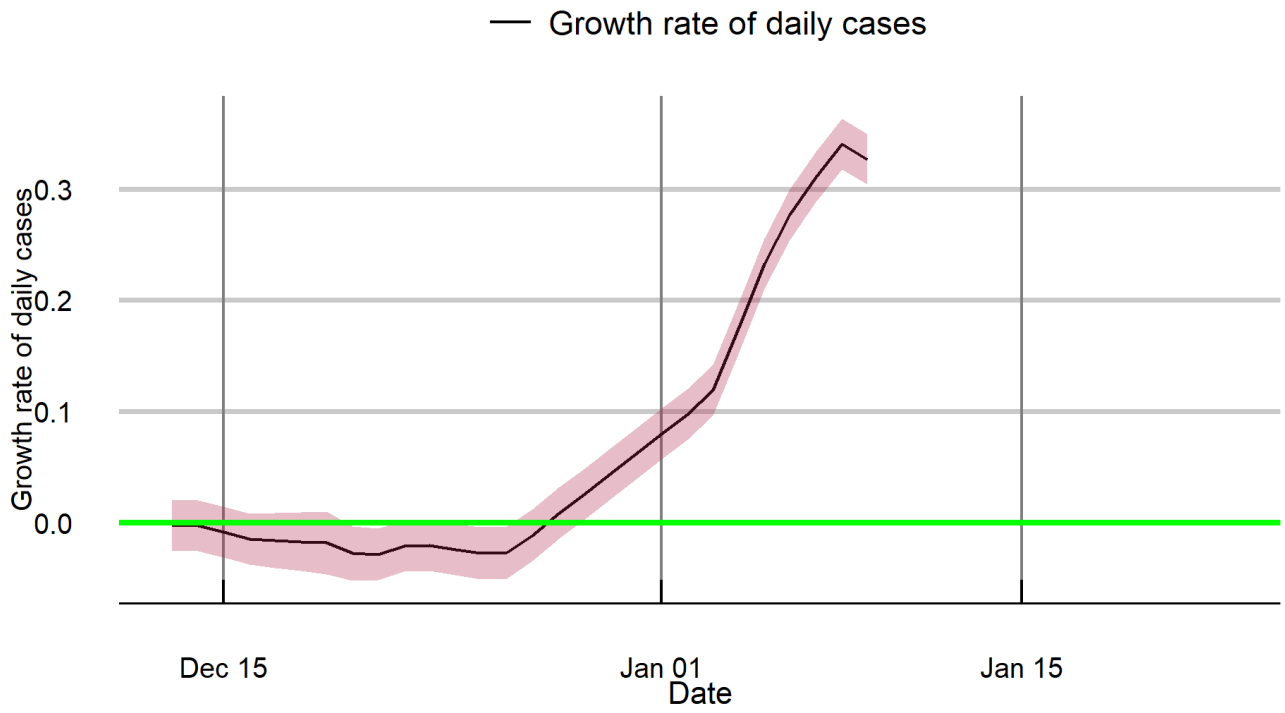
Sikkim



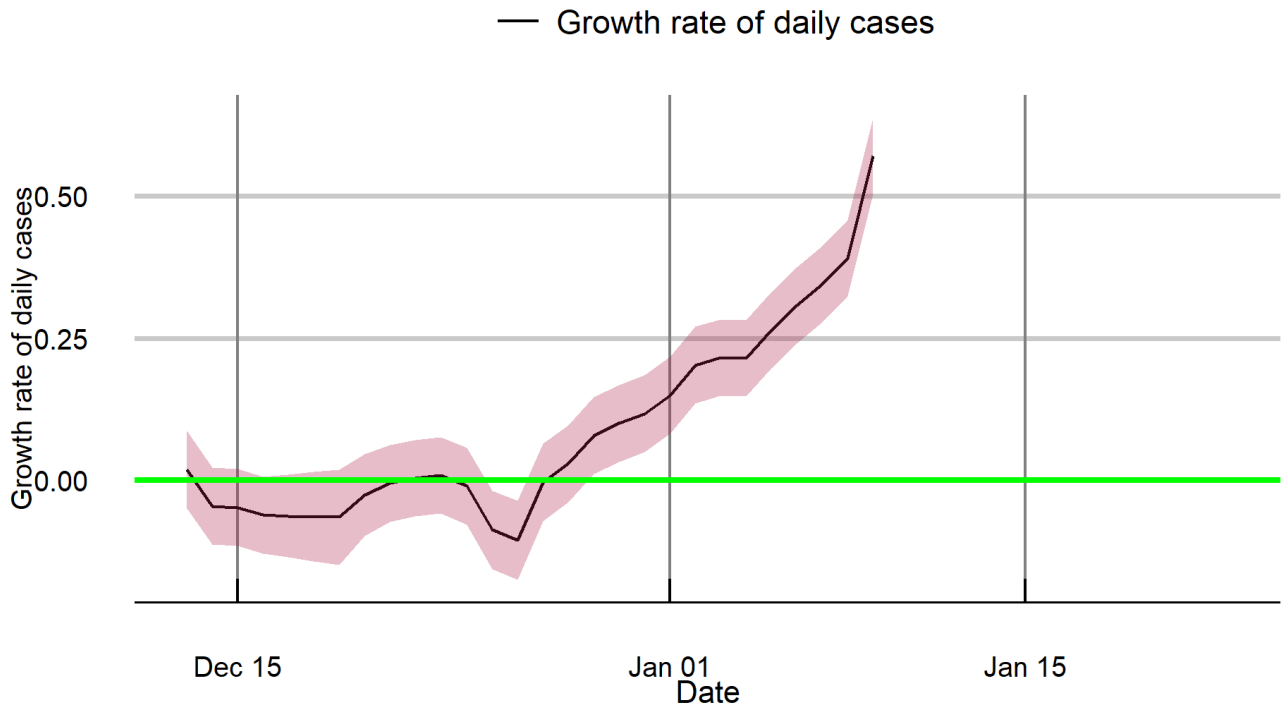
Tamil Nadu



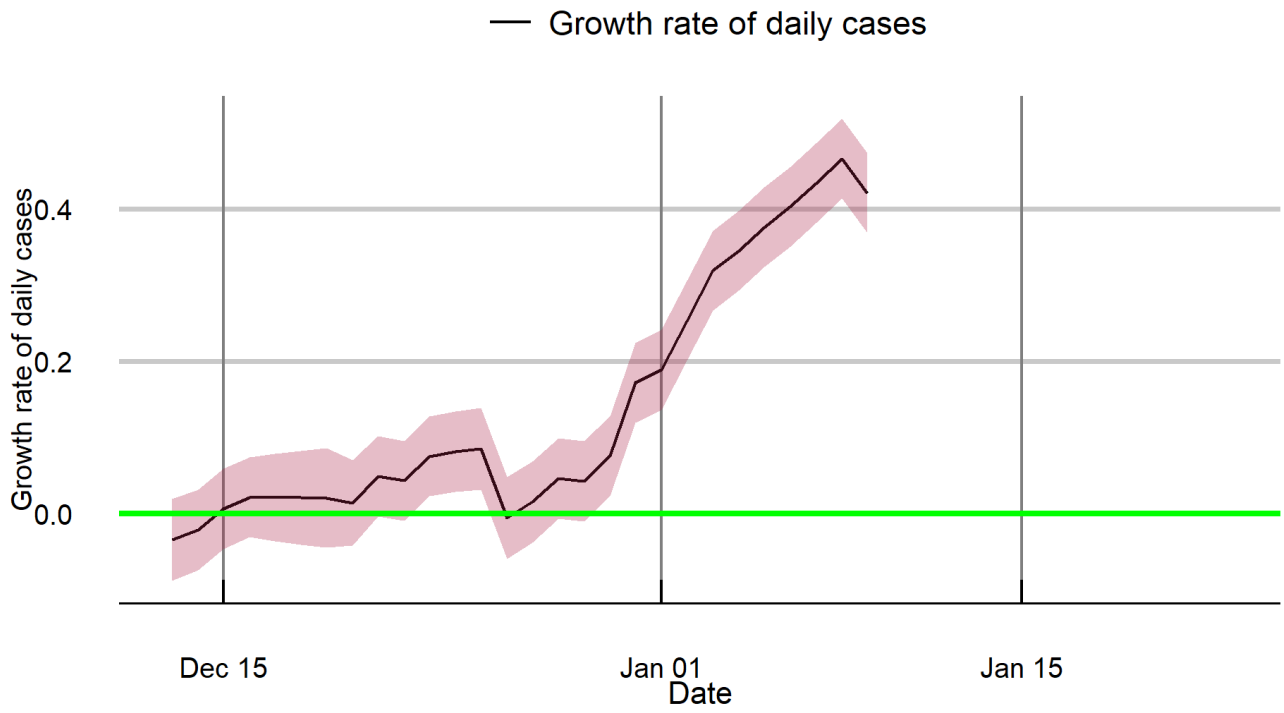
Telangana



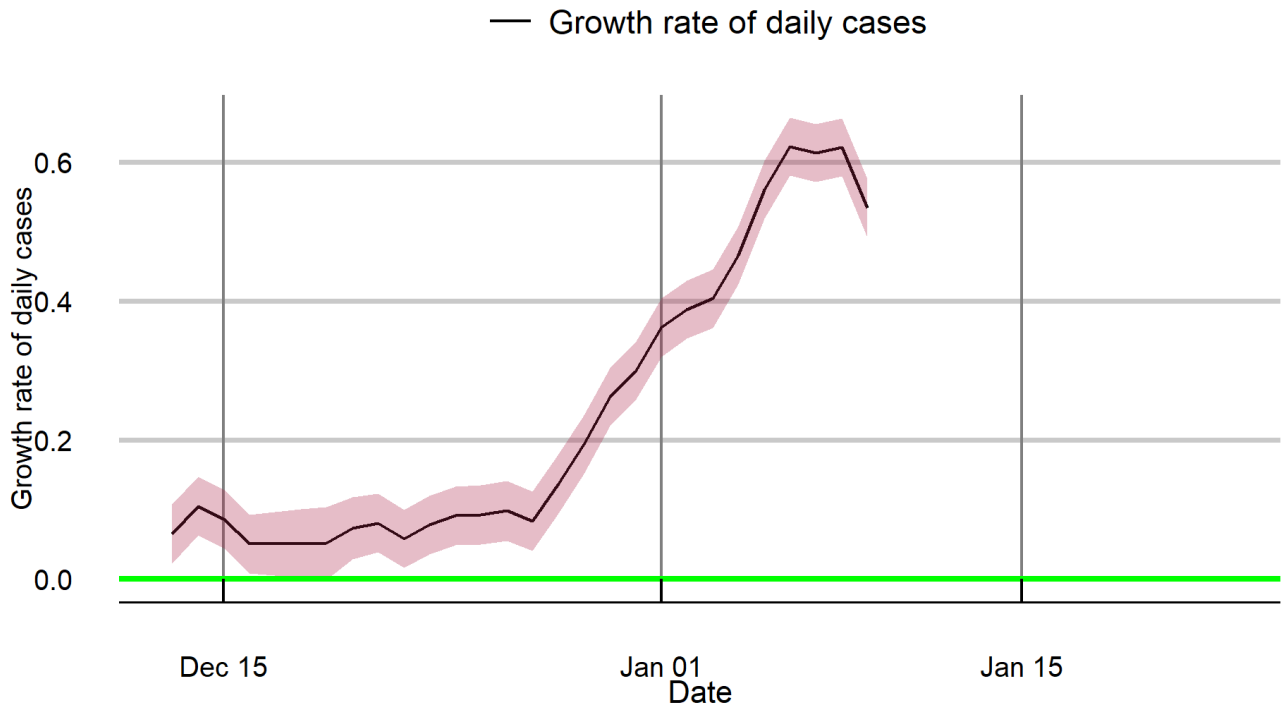
Tripura

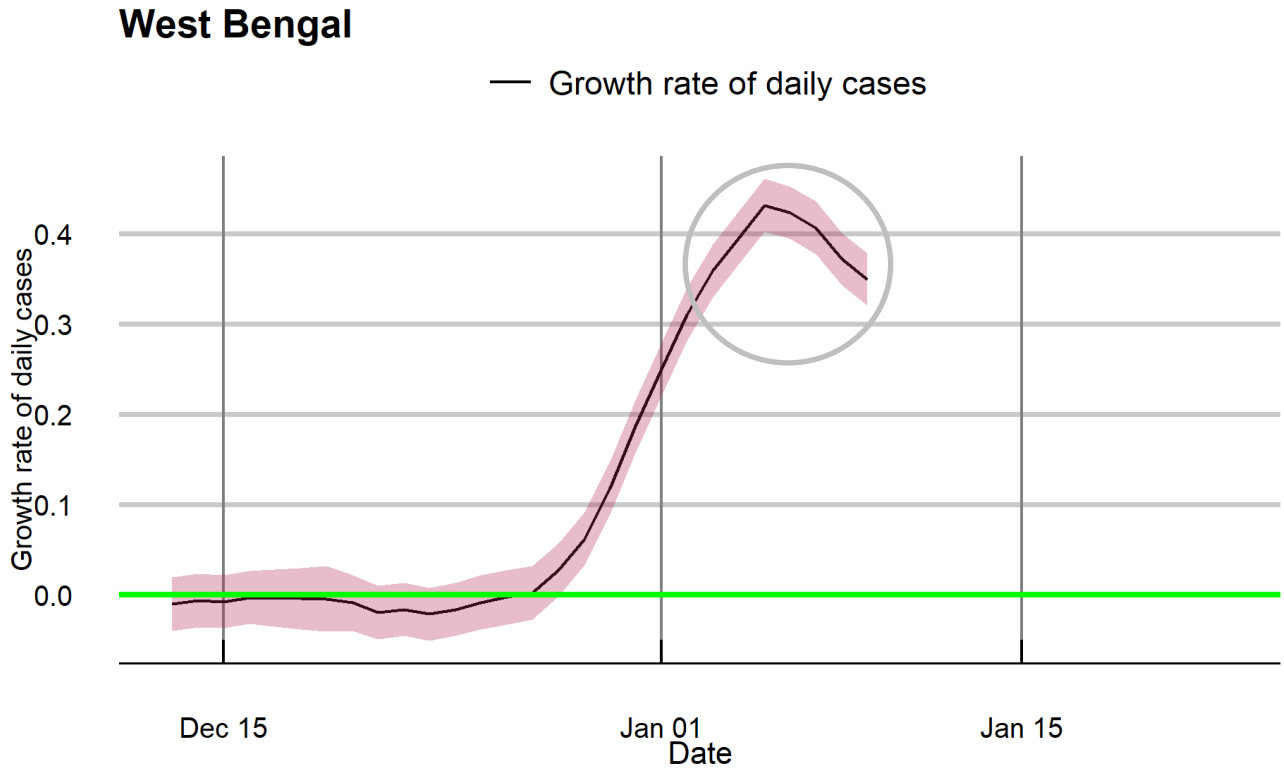


Uttarakhand



Uttar Pradesh




West Bengal
Growth rate of daily cases
Growth rate of daily cases
0.4
0.3
0.2
0.1
0.0
Dec 15
Jan 01
Jan 15
Date

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), and COVID19-Bharat API.

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. https://hdsr.mitpress.mit.edu/pub/ozgjx0yn/release/2 , 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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