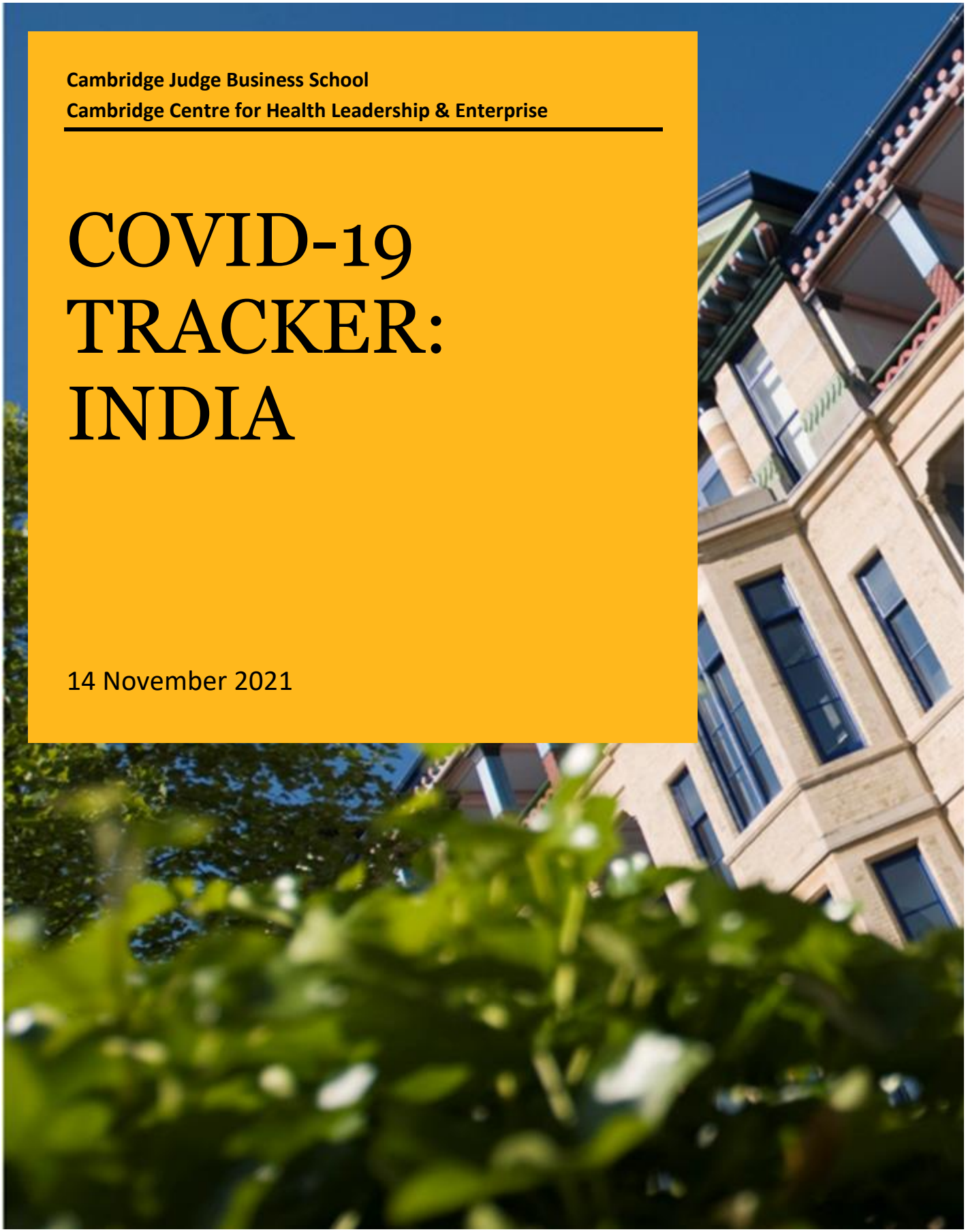
Cambridge Judge Business School
Cambridge Centre for Health Leadership & Enterprise

COVID-19 TRACKER: INDIA

14 November 2021



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

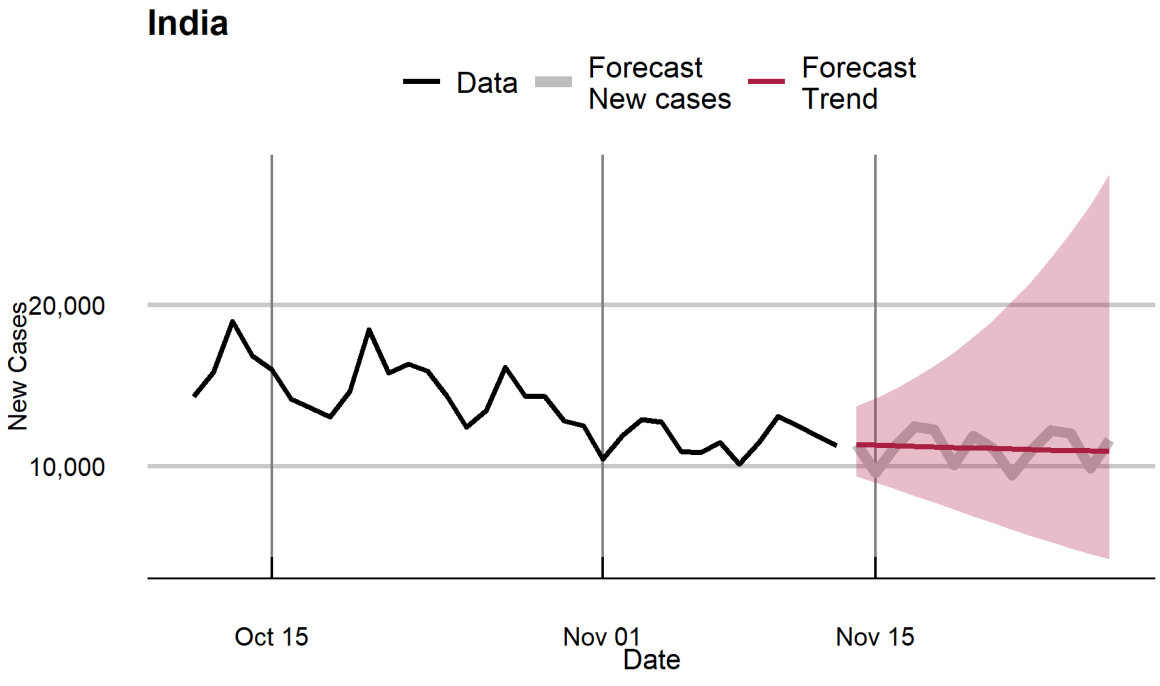
Chhattisgarh, Delhi, Jammu and Kashmir, Ladakh, Punjab, Rajasthan, Uttarakhand are currently seeing flare ups, with their filtered daily growth rates exceeding 5%.

Himachal Pradesh, Maharashtra, Mizoram, Telangana and West Bengal currently have a combination of relatively high infection incidence and positive, if mild, growth in cases.

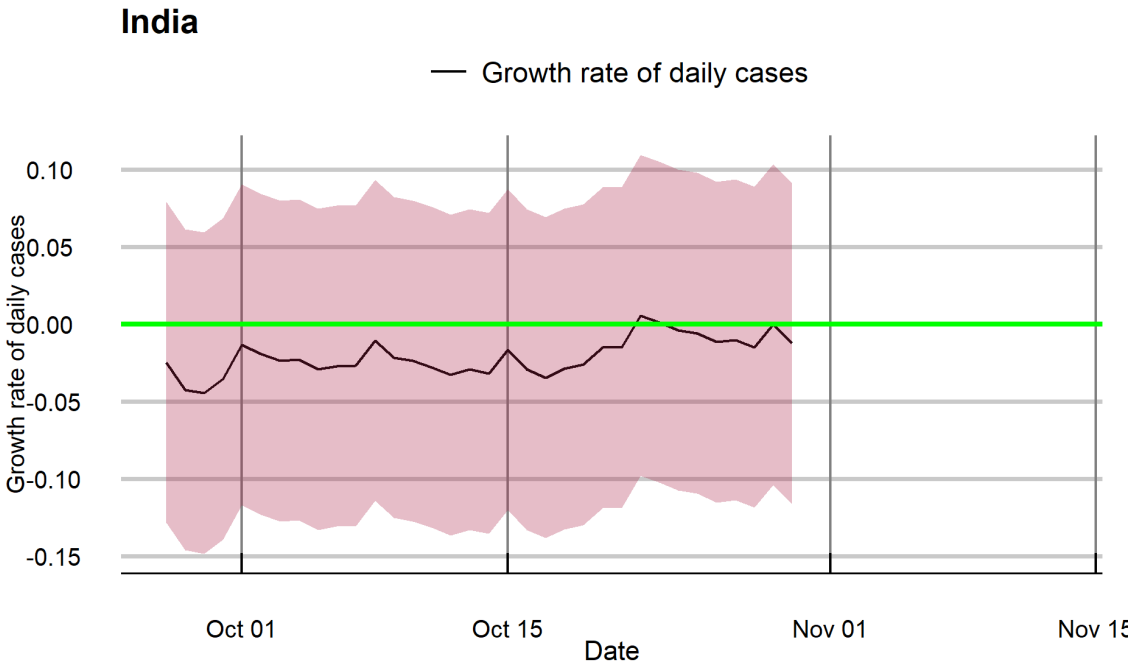
For India as a whole, the trend value of new COVID-19 cases is likely to be about 11,000 per day in two week's time, by 27 November.

Daily Covid-19 cases in India: Forecast

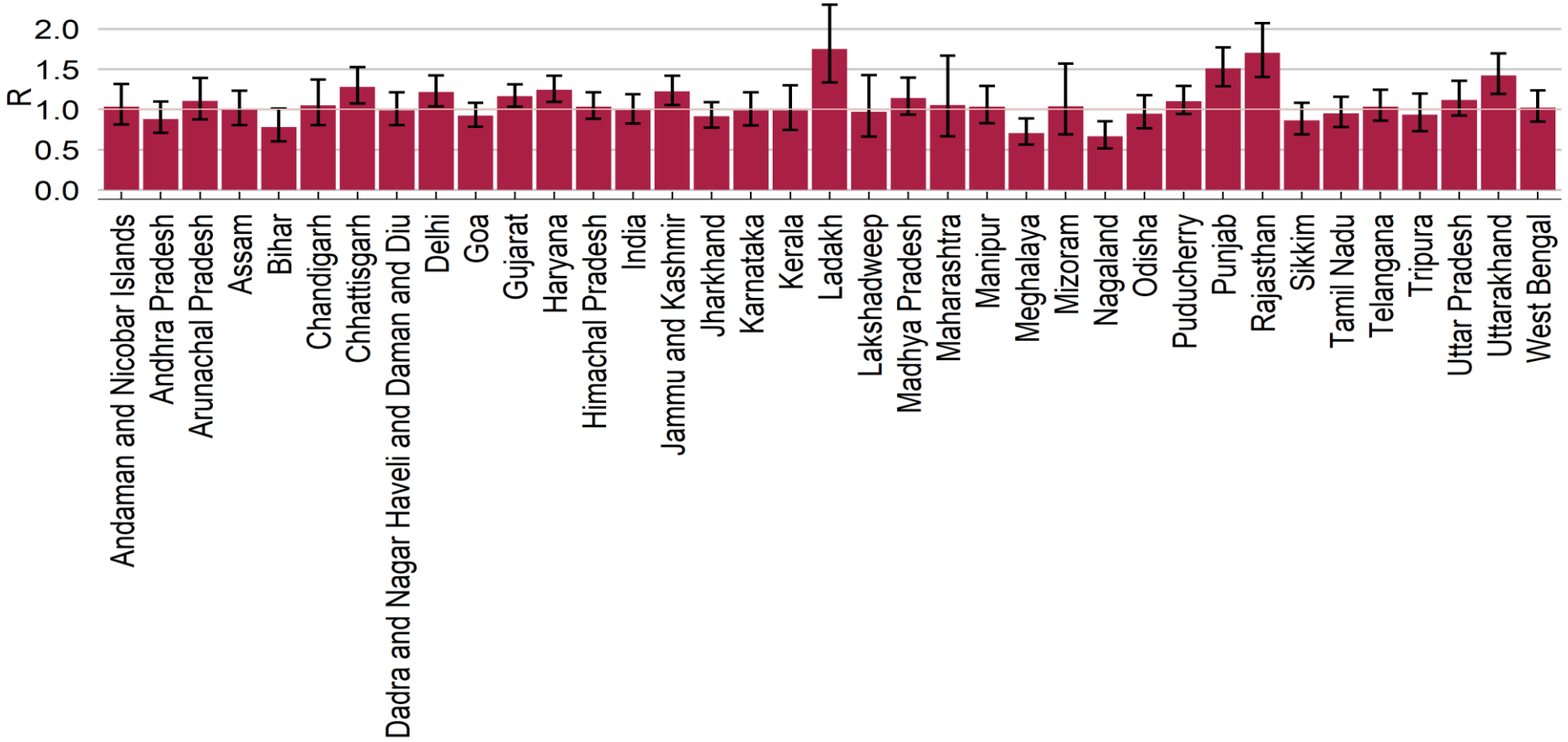
Forecasts of daily new cases for the period 14 to 27 November 2021, based on data till 13 November 2021. The trend value of new COVID-19 cases is likely be about 11,000 per day by 27 November.



The filtered growth rate of daily new cases was -0.003 (-0.3 %) as on 13 November 2021.



R_t: 13 November 2021



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

Note: Estimates are reliable for: Andhra Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala , Maharashtra, Mizoram, Odisha, Tamil Nadu, Telangana, West Bengal. Small numbers make the estimates and forecasts of other states and union territories imprecise.

Filtered daily growth rates of daily cases for States and Union territories currently seeing flare ups

Date	Chhattisgarh	Delhi	Jammu and Kashmir	Ladakh	Punjab	Rajasthan	Uttarakhand
31/10/2021	4.6%	3.5%	1.9%	13.3%	1.3%	5.2%	-1.7%
01/11/2021	1.3%	0.1%	3.4%	12.8%	-0.3%	8.7%	-1.7%
02/11/2021	-1.1%	-0.9%	3.7%	9.9%	-3.3%	8.4%	-3.6%
03/11/2021	-2.1%	-0.5%	2.7%	11.2%	-1.4%	10.5%	-5.3%
04/11/2021	-9.4%	0.1%	1.7%	6.7%	-20.1%	3.3%	-6.4%
05/11/2021	-18.0%	-0.3%	2.4%	-7.3%	-11.1%	-5.5%	-9.9%
06/11/2021	-11.3%	-0.3%	4.1%	-15.0%	-7.1%	-12.2%	-4.6%
07/11/2021	-8.5%	1.4%	5.4%	-1.5%	-0.8%	-5.6%	-6.9%
08/11/2021	-3.9%	0.6%	5.1%	2.6%	4.2%	-2.5%	-8.8%
09/11/2021	-1.6%	-0.6%	4.7%	4.9%	6.9%	5.5%	0.6%
10/11/2021	0.7%	1.3%	4.9%	6.5%	7.1%	0.8%	0.7%
11/11/2021	2.5%	1.2%	5.2%	4.1%	9.8%	1.6%	4.3%
12/11/2021	3.5%	4.1%	5.2%	12.7%	10.2%	11.0%	6.5%
13/11/2021	6.2%	4.8%	5.0%	14.0%	10.3%	13.3%	8.8%

Forecasts of daily cases for States and Union territories currently seeing flare ups

14 to 27 November 2021

Date	Chhattisgarh: Forecast of new cases	Chhattisgarh: Forecast trend	Delhi: Forecast of new cases	Delhi: Forecast trend	Jammu and Kashmir: Forecast of new cases	Jammu and Kashmir: Forecast trend	Ladakh: Forecast of new cases	Ladakh: Forecast trend	Punjab: Forecast of new cases	Punjab: Forecast trend	Rajasthan: Forecast of new cases	Rajasthan: Forecast trend	Uttarakhand: Forecast of new cases	Uttarakhand: Forecast trend
14/11/2021	20	26	53	52	198	186	33	23	47	47	8	9	9	12
15/11/2021	30	28	40	54	163	195	25	27	47	52	10	10	12	13
16/11/2021	32	30	62	57	207	205	32	31	53	57	10	11	16	15
17/11/2021	35	31	68	60	230	216	41	36	72	64	13	13	19	16
18/11/2021	37	33	66	63	242	227	54	41	73	70	15	14	19	17
19/11/2021	30	36	65	66	223	238	42	47	74	78	16	17	17	19
20/11/2021	40	38	72	69	262	251	31	54	92	87	21	19	23	21
21/11/2021	31	40	74	73	281	264	88	63	96	96	21	22	18	23
22/11/2021	46	43	57	76	231	277	67	72	98	106	25	25	22	25
23/11/2021	49	45	88	80	294	292	88	84	109	118	25	28	30	27
24/11/2021	54	48	95	84	328	307	110	97	147	131	33	32	36	29
25/11/2021	57	51	92	88	344	323	147	112	151	145	38	37	34	32
26/11/2021	46	55	91	93	318	339	115	130	153	161	41	42	32	35
27/11/2021	62	58	101	97	374	357	85	151	189	178	54	48	42	38

Filtered daily growth rates for States and Union territories with relatively high infection incidence and positive growth in daily cases

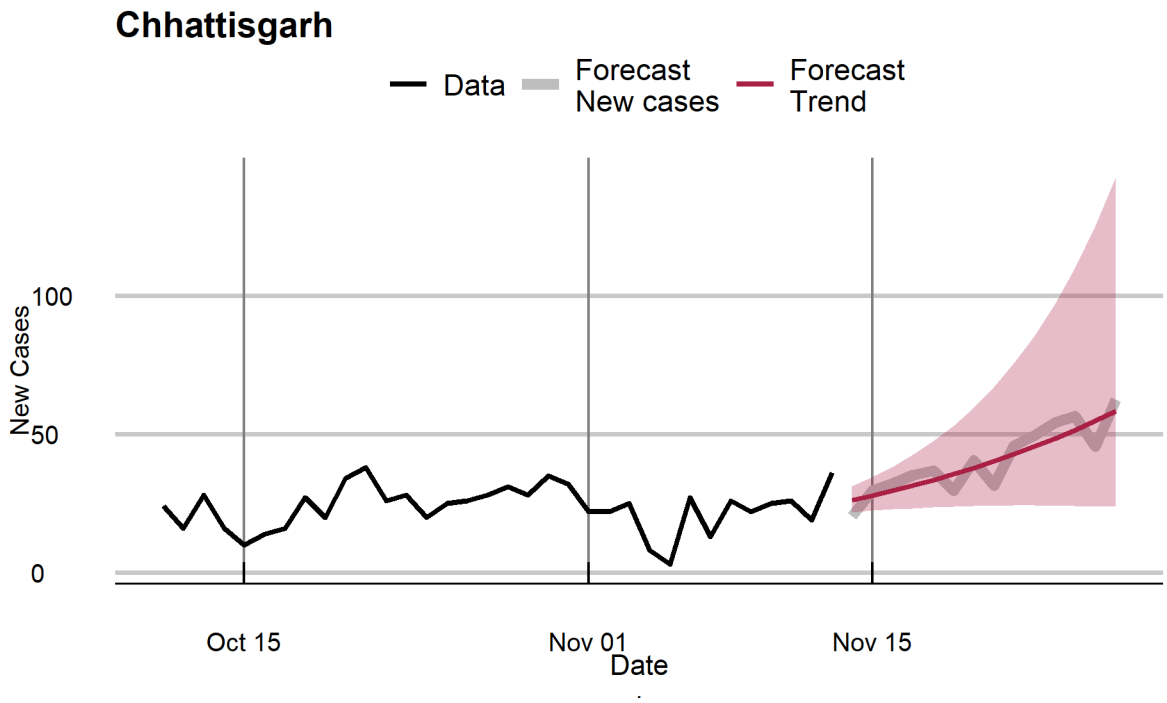
Date	Himachal Pradesh	Jammu and Kashmir	Maharashtra	Mizoram	Telangana	West Bengal
31/10/2021	-1.3%	1.9%	-4.9%	-3.6%	-1.1%	1.7%
01/11/2021	-3.0%	3.4%	-4.6%	-1.0%	-1.5%	0.4%
02/11/2021	-3.1%	3.7%	-4.0%	-0.2%	-1.6%	0.0%
03/11/2021	-4.3%	2.7%	-4.0%	-1.7%	-2.1%	-0.4%
04/11/2021	-9.7%	1.7%	-2.6%	-2.5%	-4.4%	-0.6%
05/11/2021	-9.1%	2.4%	-2.2%	-0.6%	-2.5%	-0.6%
06/11/2021	-8.0%	4.1%	-4.2%	-1.1%	-1.8%	-2.7%
07/11/2021	-7.7%	5.4%	-3.7%	-4.7%	-1.2%	-3.3%
08/11/2021	-4.7%	5.1%	-3.2%	-1.9%	-0.7%	-3.6%
09/11/2021	-3.1%	4.7%	-2.2%	-1.3%	0.0%	-2.6%
10/11/2021	-1.0%	4.9%	-2.0%	-1.6%	0.0%	-1.8%
11/11/2021	0.1%	5.2%	-0.8%	-0.3%	-0.1%	-1.2%
12/11/2021	1.1%	5.2%	0.9%	3.0%	1.5%	0.6%
13/11/2021	0.8%	5.0%	1.3%	0.9%	0.8%	0.6%

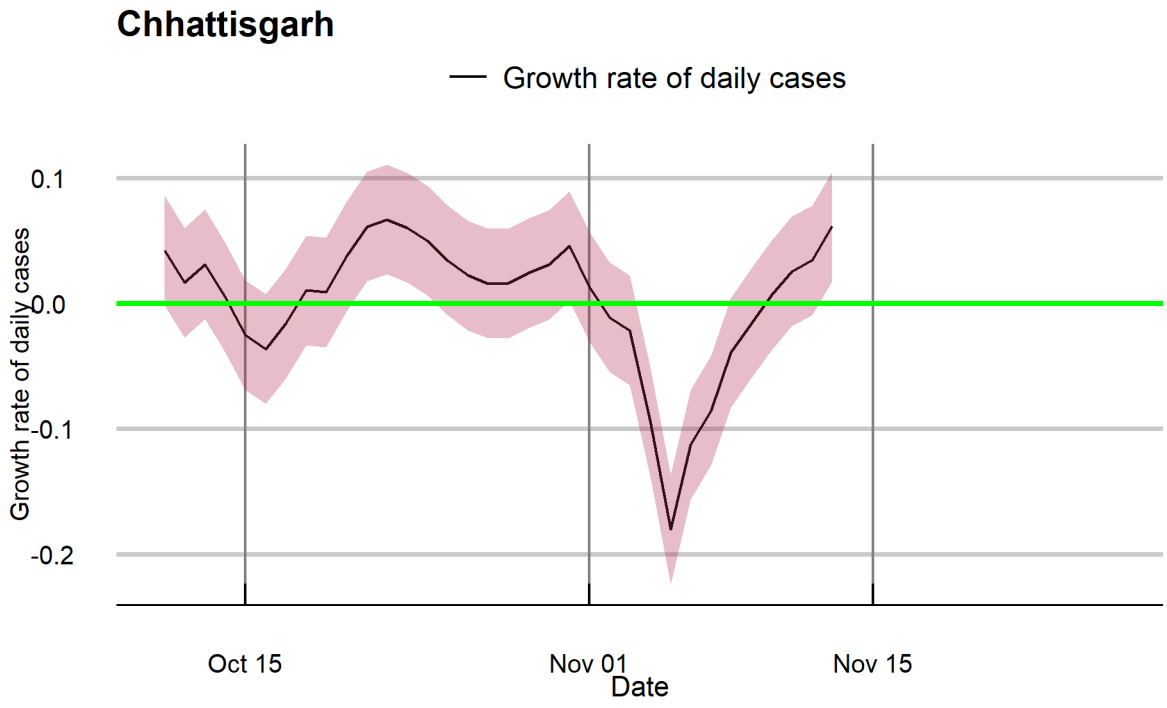
Forecasts of trend values of daily cases for States and Union territories with relatively high infection incidence and growth in daily cases

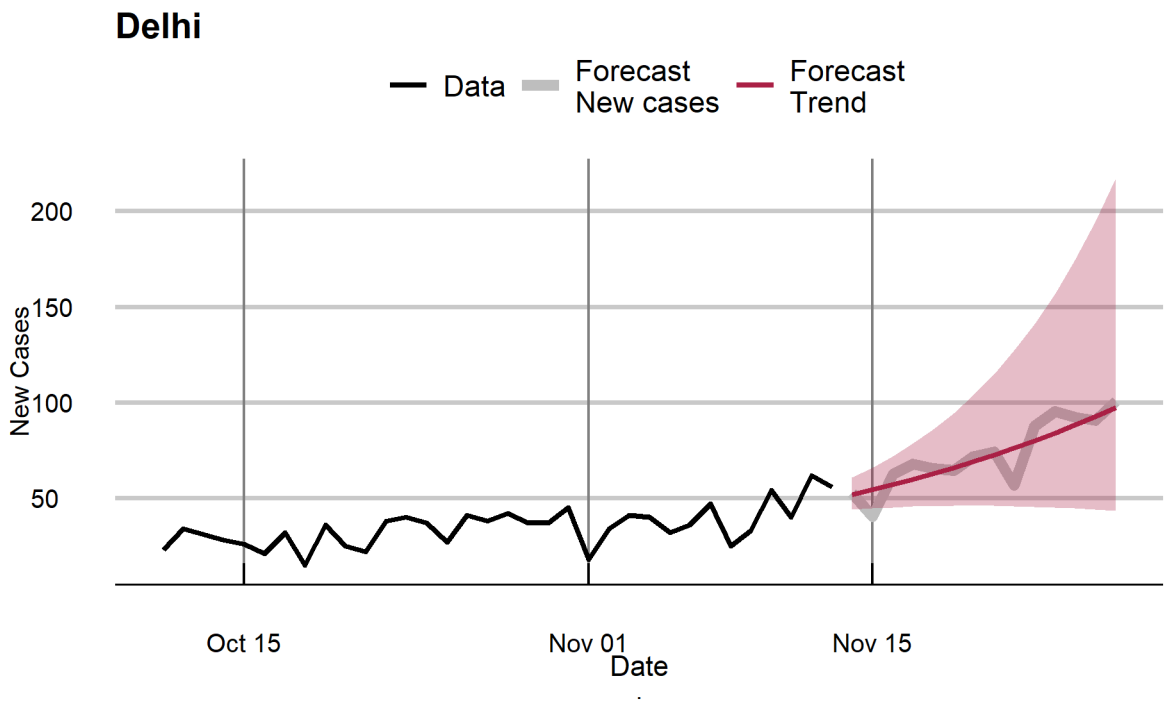
14 to 27 November 2021

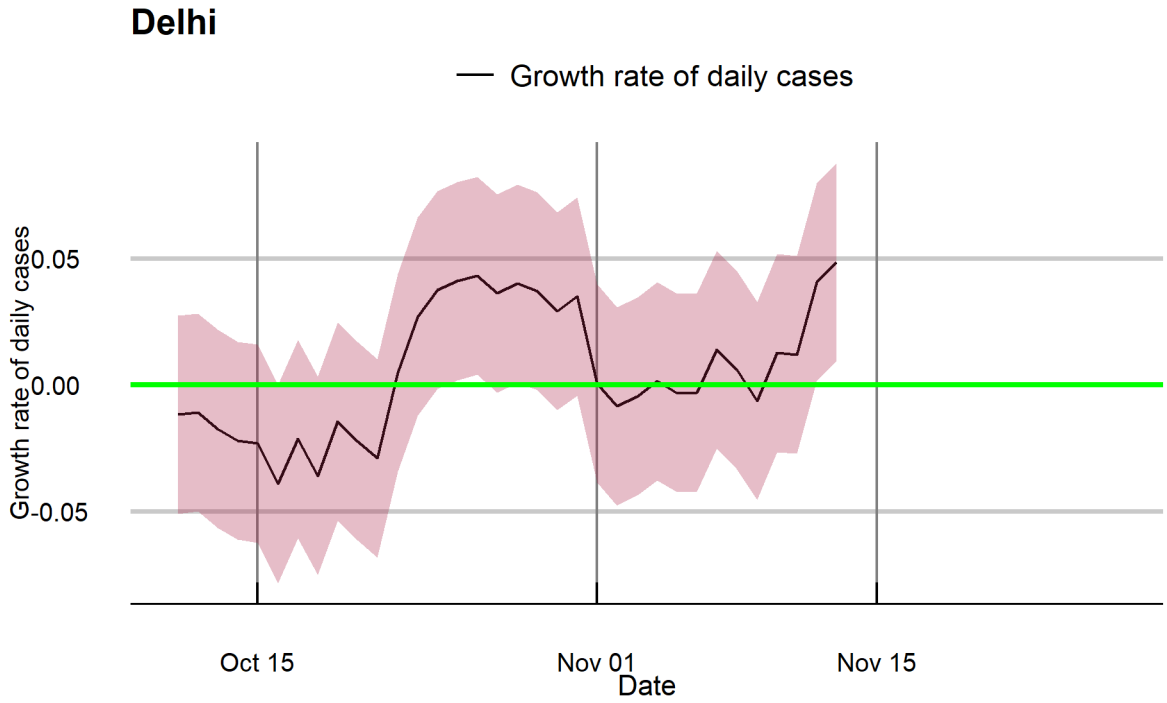
Date	Himachal Pradesh: Forecast of new cases	Himachal Pradesh: Forecast trend	Jammu and Kashmir: Forecast of new cases	Jammu and Kashmir: Forecast trend	Maharashtra: Forecast of new cases	Maharashtra: Forecast trend	Mizoram: Forecast of new cases	Mizoram: Forecast trend	Telangana: Forecast of new cases	Telangana: Forecast trend	West Bengal: Forecast of new cases	West Bengal: Forecast trend
14/11/2021	78	**119**	198	**186**	1007	**962**	265	495	127	**159**	844	**809**
15/11/2021	130	**120**	163	**195**	786	**974**	620	500	167	**160**	729	**814**
16/11/2021	133	**121**	207	**205**	1058	**987**	566	505	174	**161**	802	**818**
17/11/2021	137	**122**	230	**216**	1299	**1000**	655	510	178	**163**	880	**823**
18/11/2021	139	**123**	242	**227**	1039	**1013**	626	514	174	**164**	884	**827**
19/11/2021	118	**124**	223	**238**	850	**1026**	448	519	146	**165**	732	**832**
20/11/2021	134	**125**	262	**251**	1040	**1039**	523	524	181	**167**	908	**836**
21/11/2021	83	**127**	281	**264**	1101	**1052**	283	529	135	**168**	878	**841**
22/11/2021	138	**128**	231	**277**	860	**1066**	663	534	177	**169**	758	**846**
23/11/2021	141	**129**	294	**292**	1157	**1080**	605	540	185	**171**	834	**851**
24/11/2021	146	**130**	328	**307**	1421	**1094**	701	545	188	**172**	915	**855**
25/11/2021	148	**131**	344	**323**	1137	**1108**	670	550	184	**174**	919	**860**
26/11/2021	125	**132**	318	**339**	930	**1122**	480	555	154	**175**	761	**865**
27/11/2021	142	**133**	374	**357**	1138	**1137**	561	561	191	**177**	944	**870**

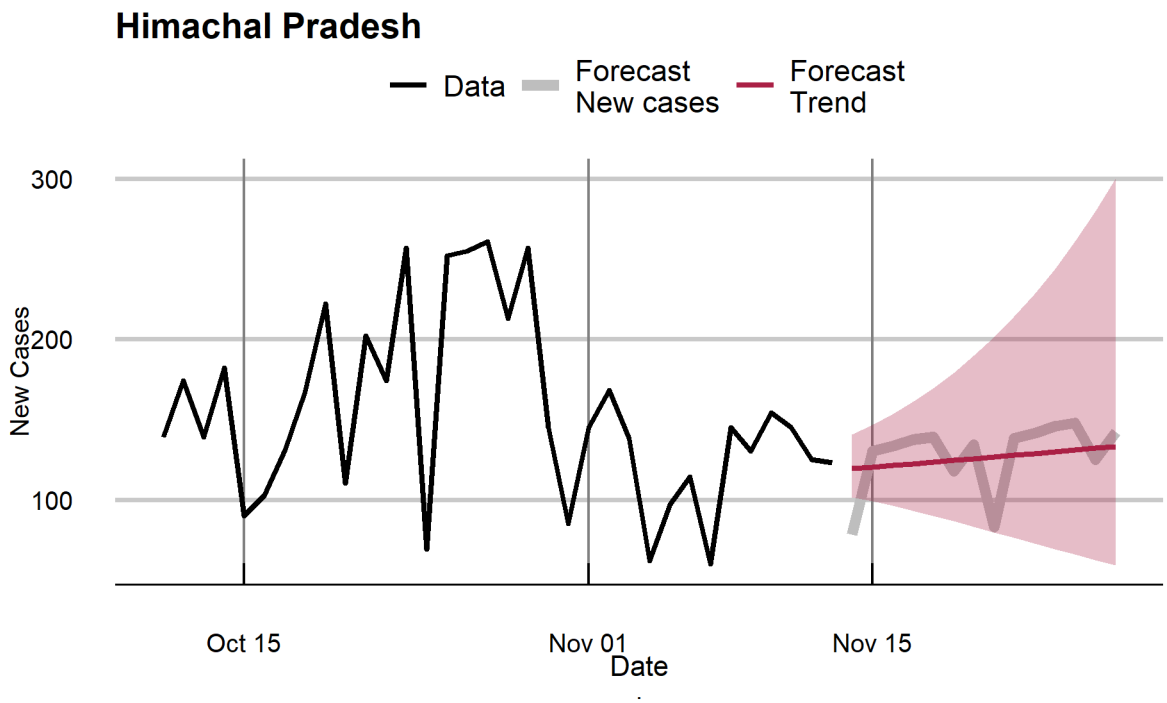
New cases forecasts and daily growth rates for States and Union territories currently of concern

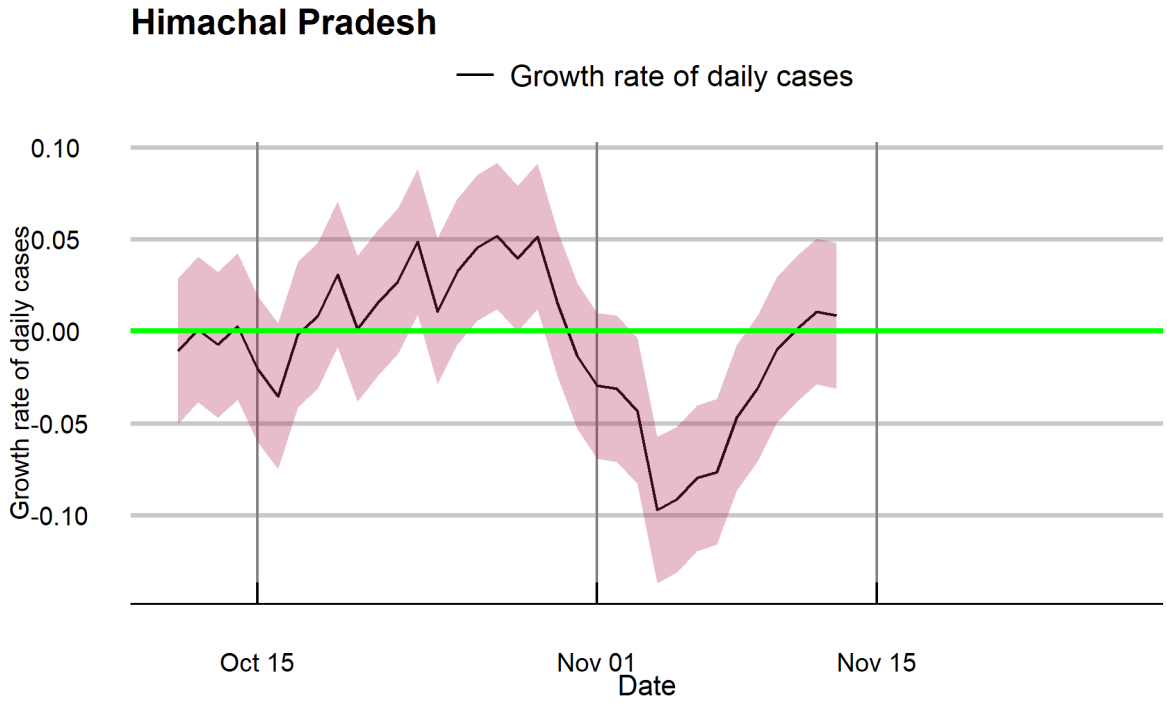


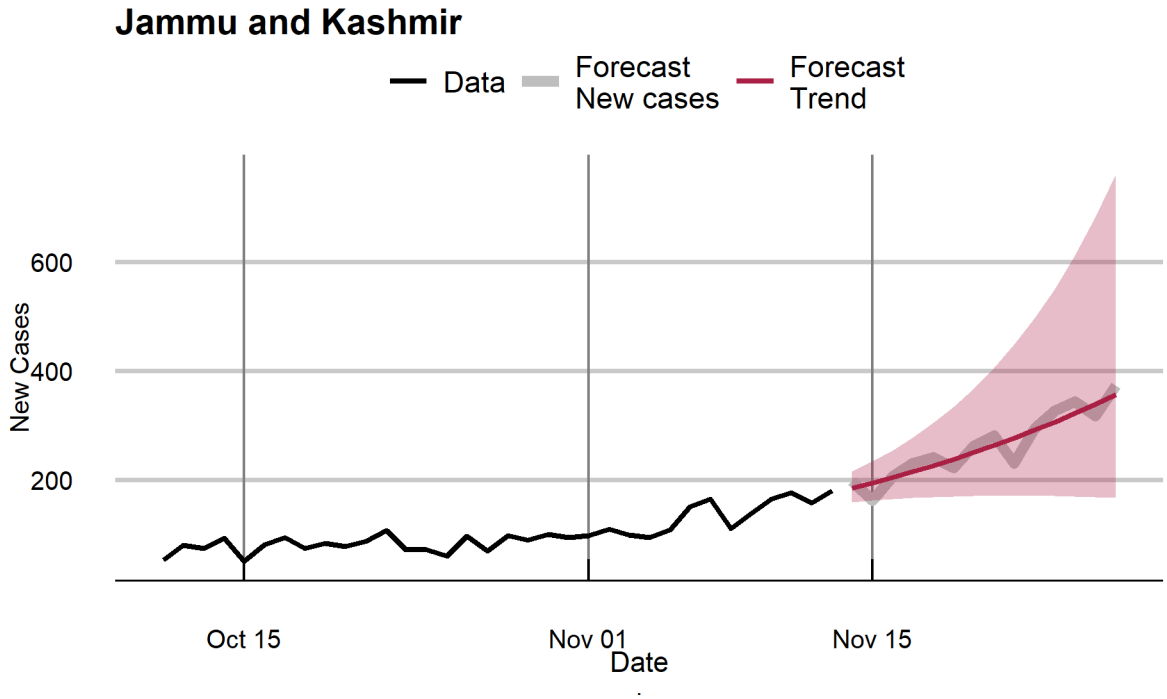


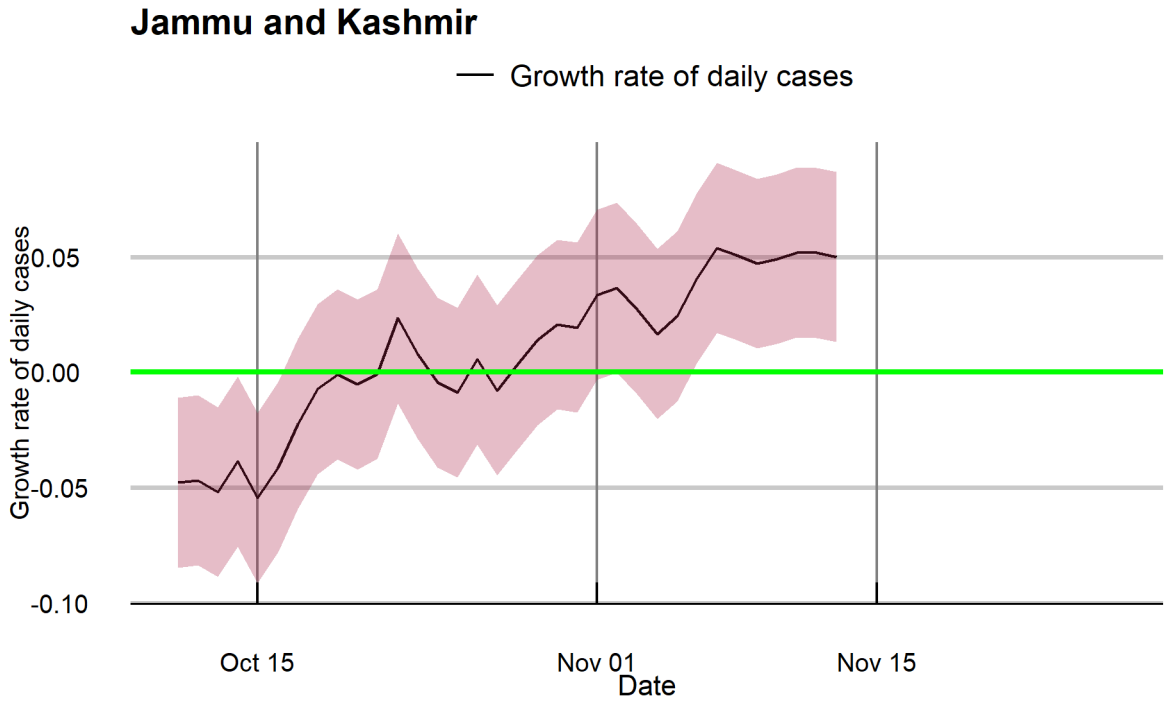

Delhi
Data
Forecast
New cases
Forecast
Trend
200
150
100
50
New Cases
Oct 15
Nov 01
Nov 15
Date


Delhi
Growth rate of daily cases
0.05
0.00
-0.05
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date

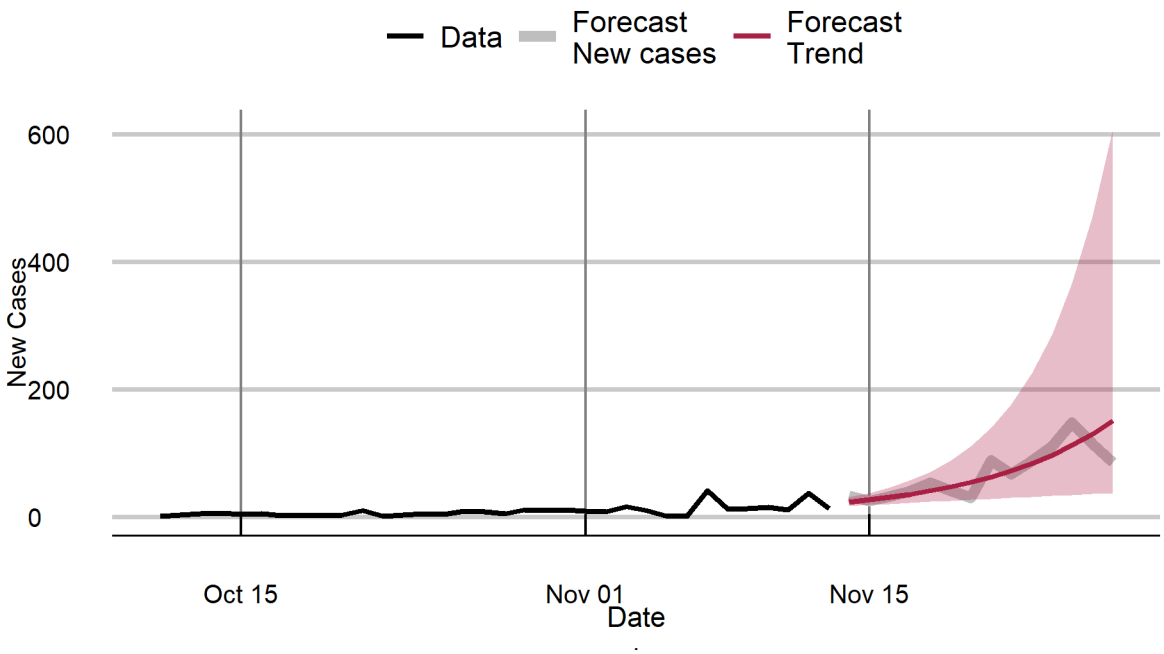

Himachal Pradesh
Data
Forecast
New cases
Forecast
Trend
300
200
100
New Cases
Oct 15
Nov 01
Nov 15
Date


Himachal Pradesh
Growth rate of daily cases
0.10
0.05
0.00
-0.05
-0.10
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date

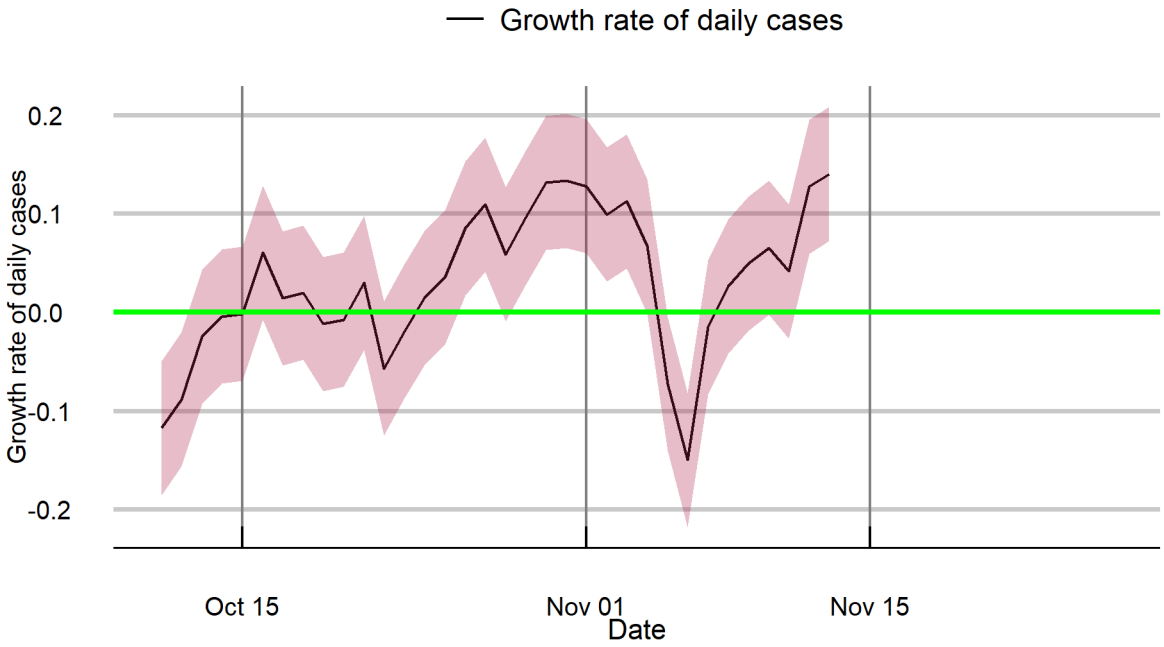

Jammu and Kashmir
Data
Forecast
New cases
Forecast
Trend
600
400
200
New Cases
Oct 15
Nov 01
Nov 15
Date

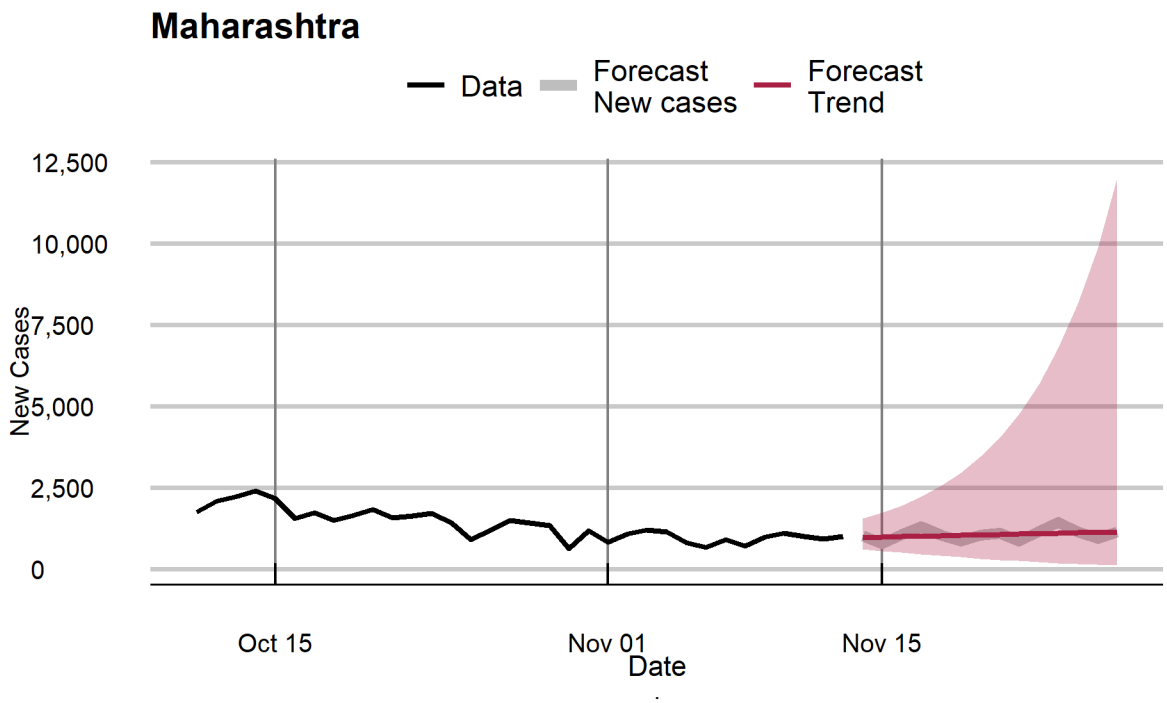

Jammu and Kashmir
Growth rate of daily cases
0.05
0.00
-0.05
-0.10
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date

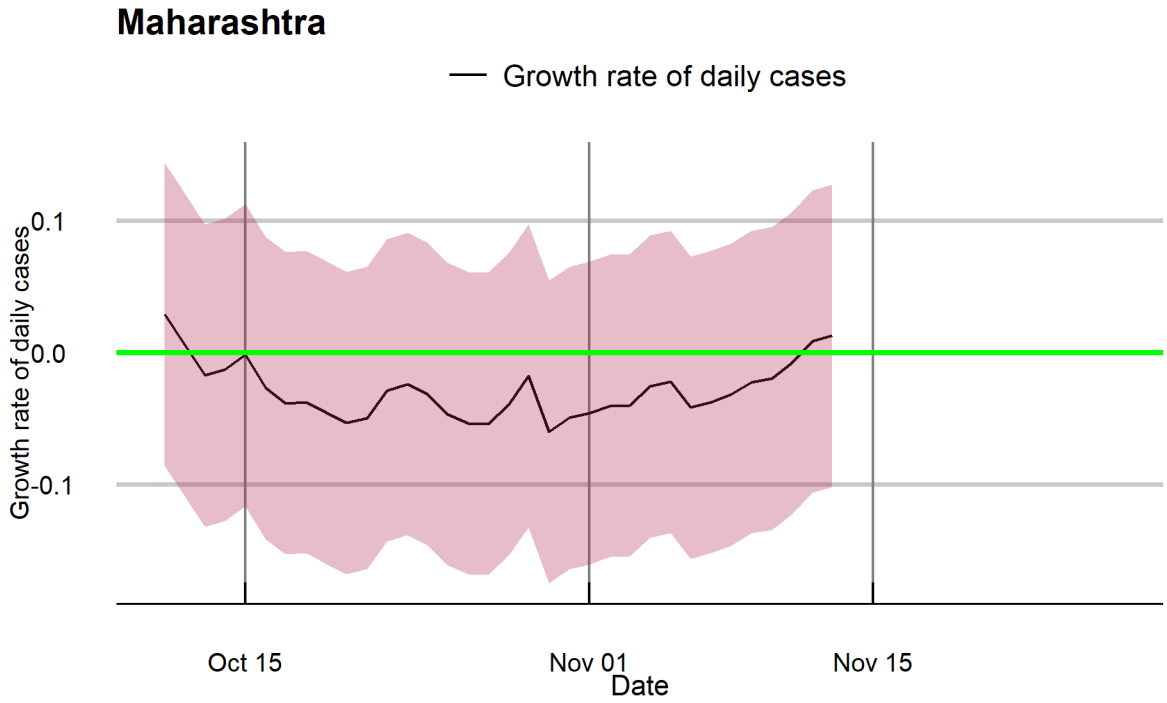
Ladakh

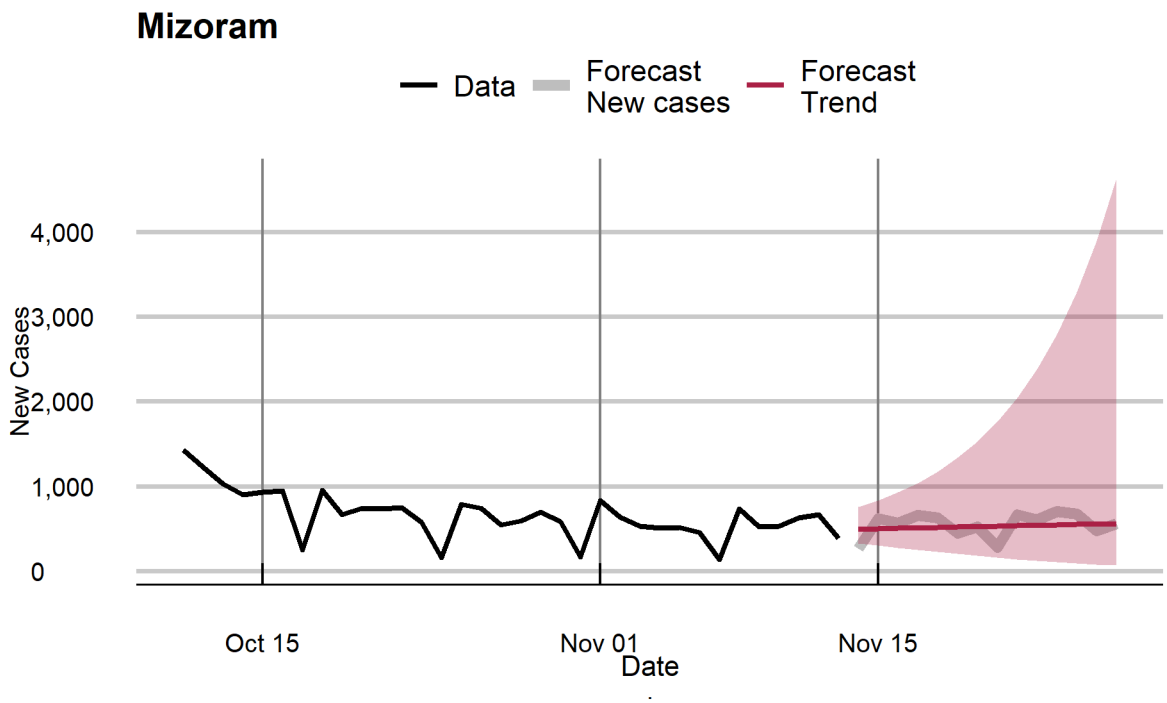


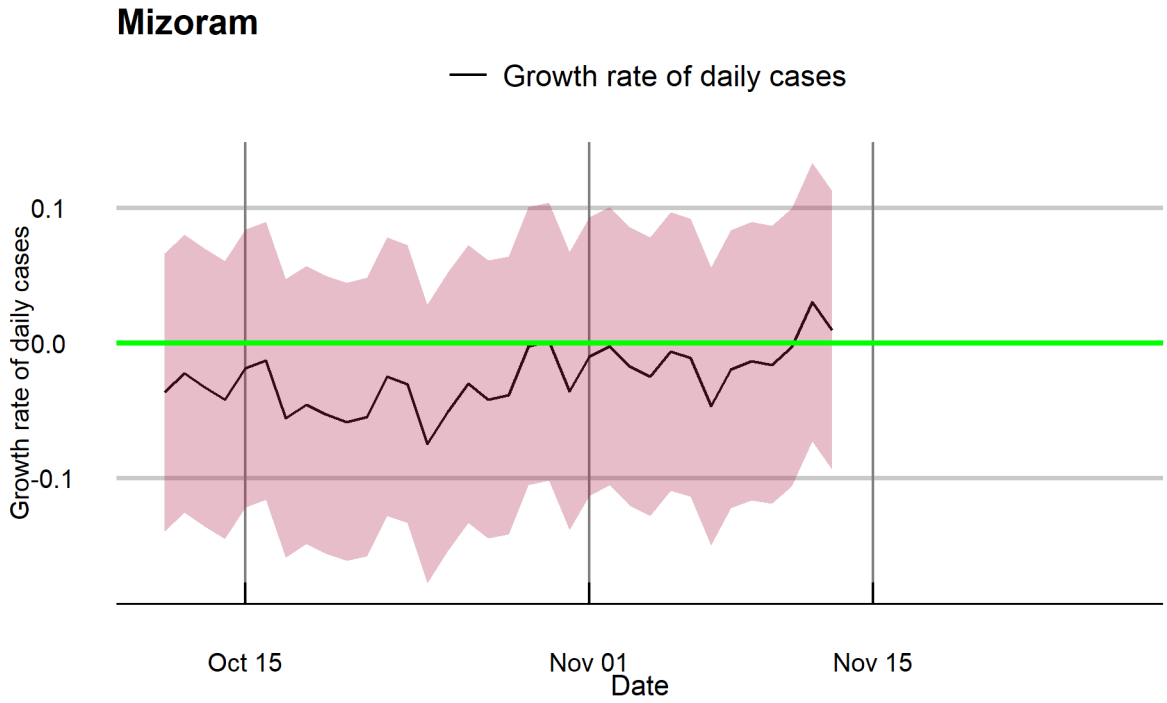
Ladakh



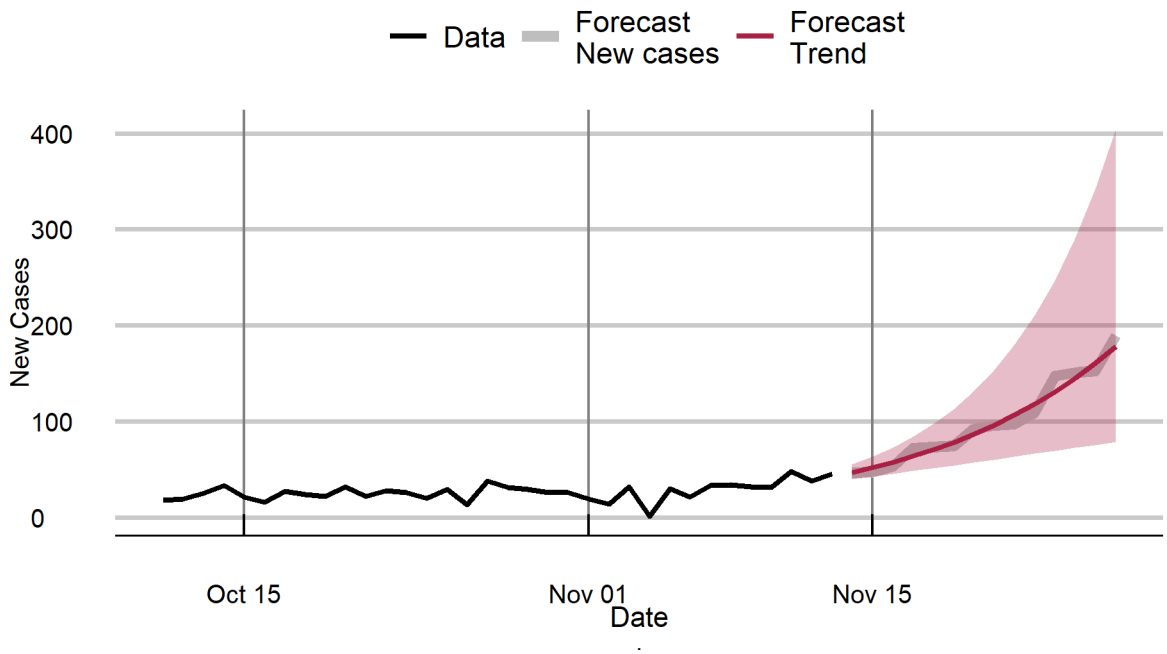

Maharashtra
Data
Forecast
New cases
Forecast
Trend
12,500
10,000
7,500
5,000
2,500
0
New Cases
Oct 15
Nov 01
Nov 15
Date


Maharashtra
Growth rate of daily cases
0.1
0.0
-0.1
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date

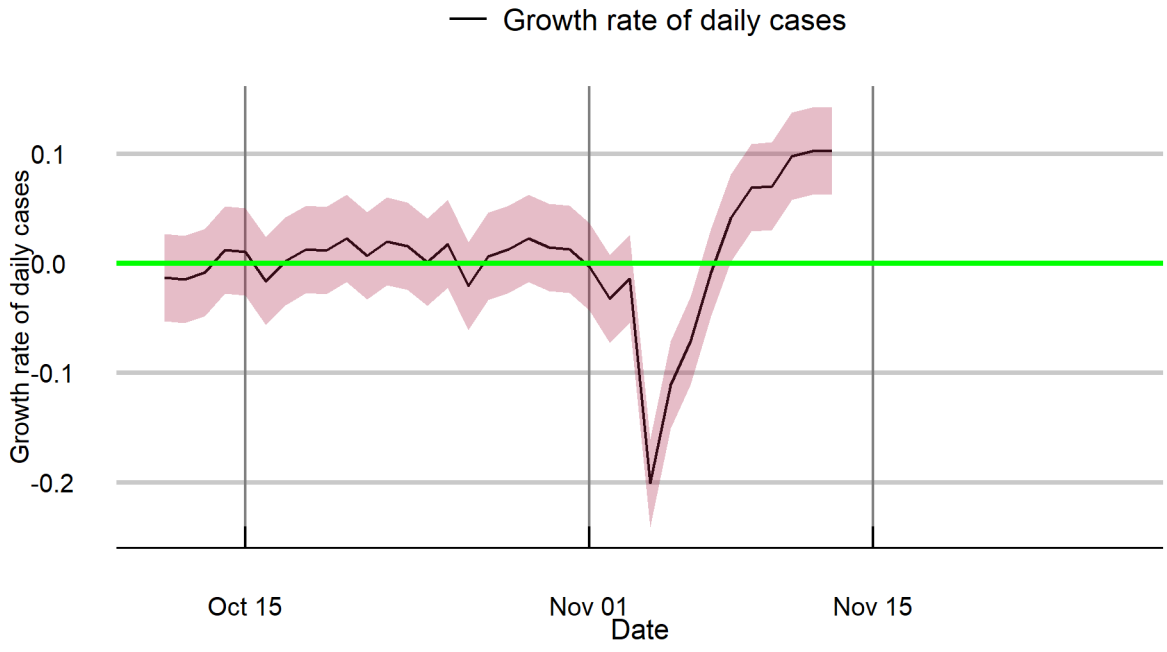

Mizoram
Data
Forecast
New cases
Forecast
Trend
4,000
3,000
2,000
1,000
0
New Cases
Oct 15
Nov 01
Nov 15
Date

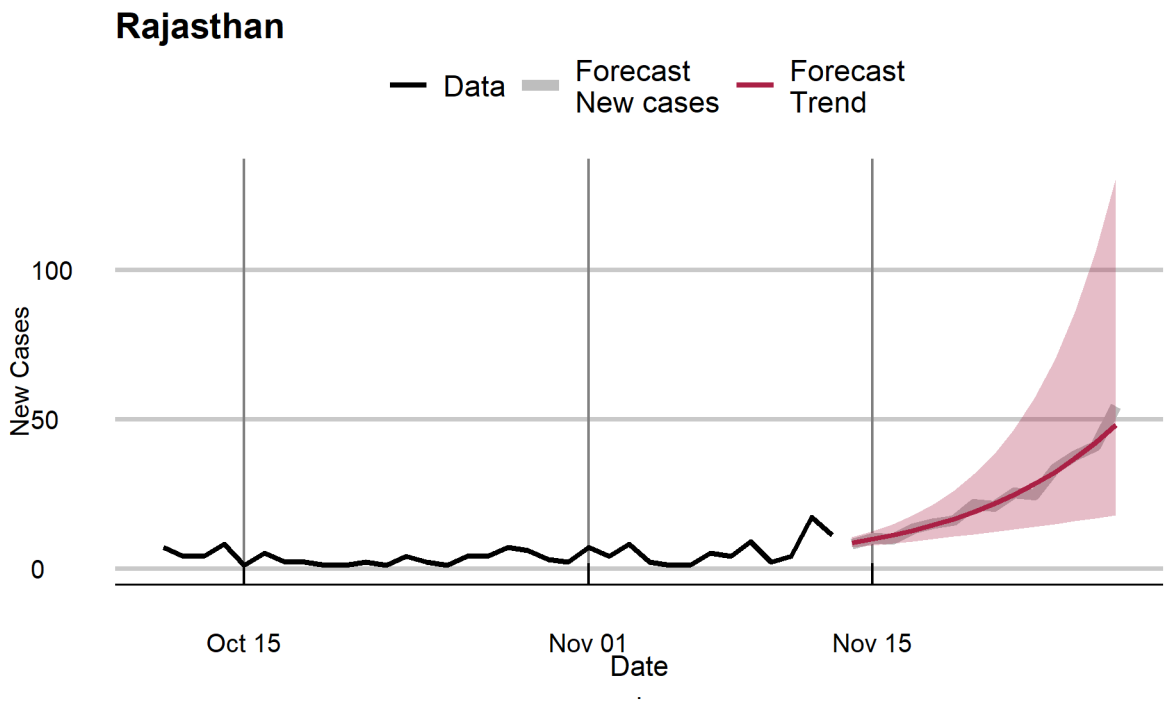

Mizoram
Growth rate of daily cases
0.1
0.0
-0.1
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date

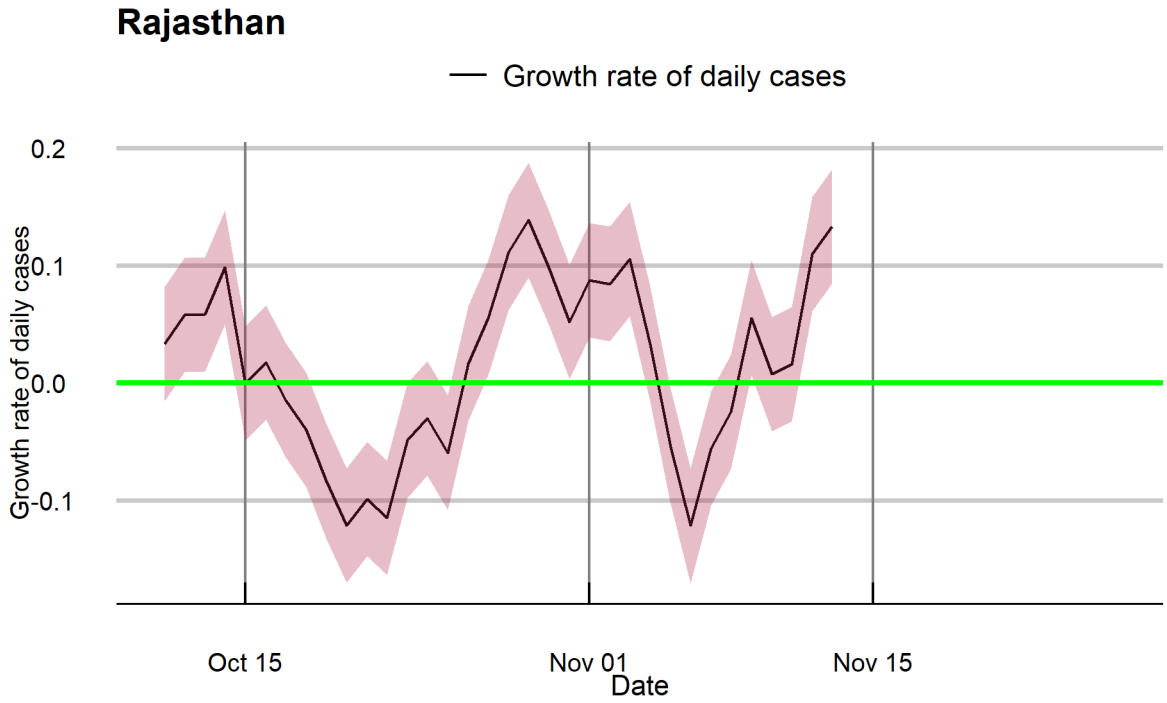
Punjab

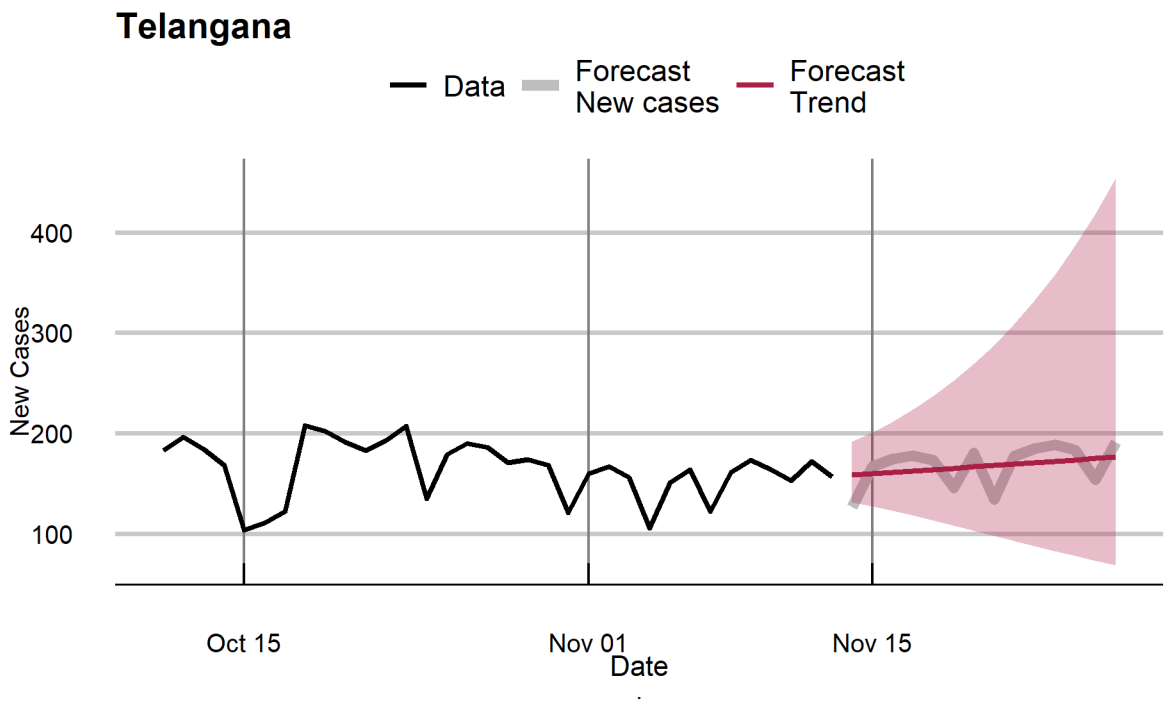


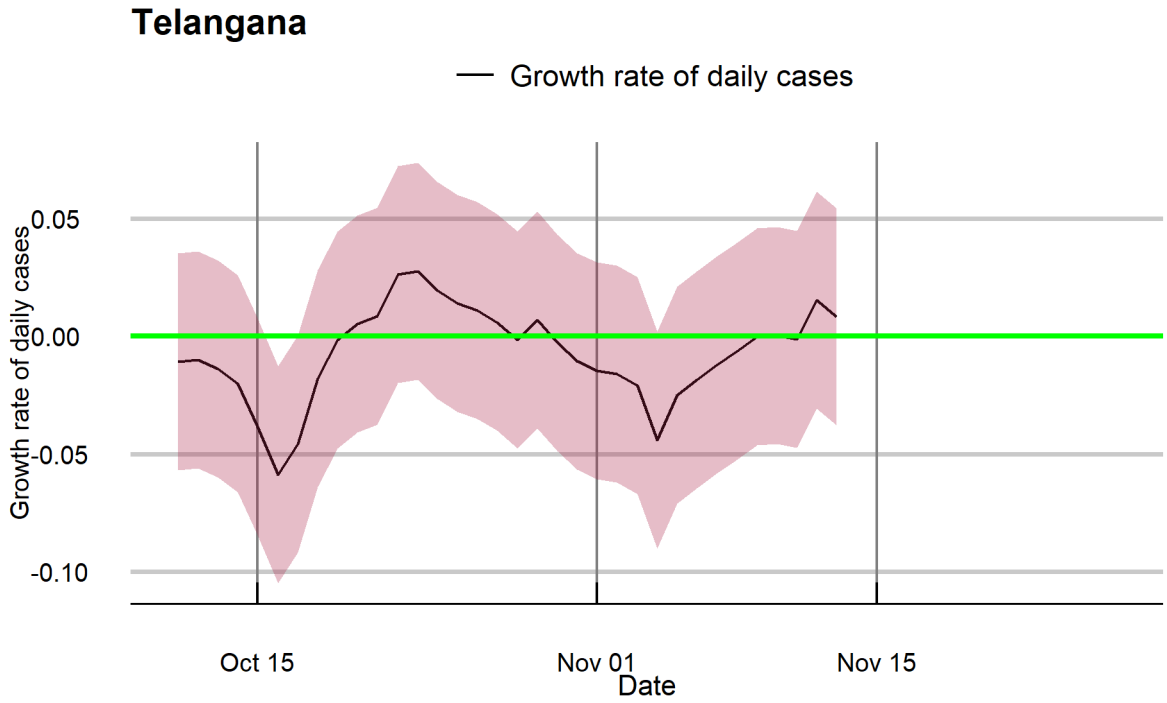
Punjab

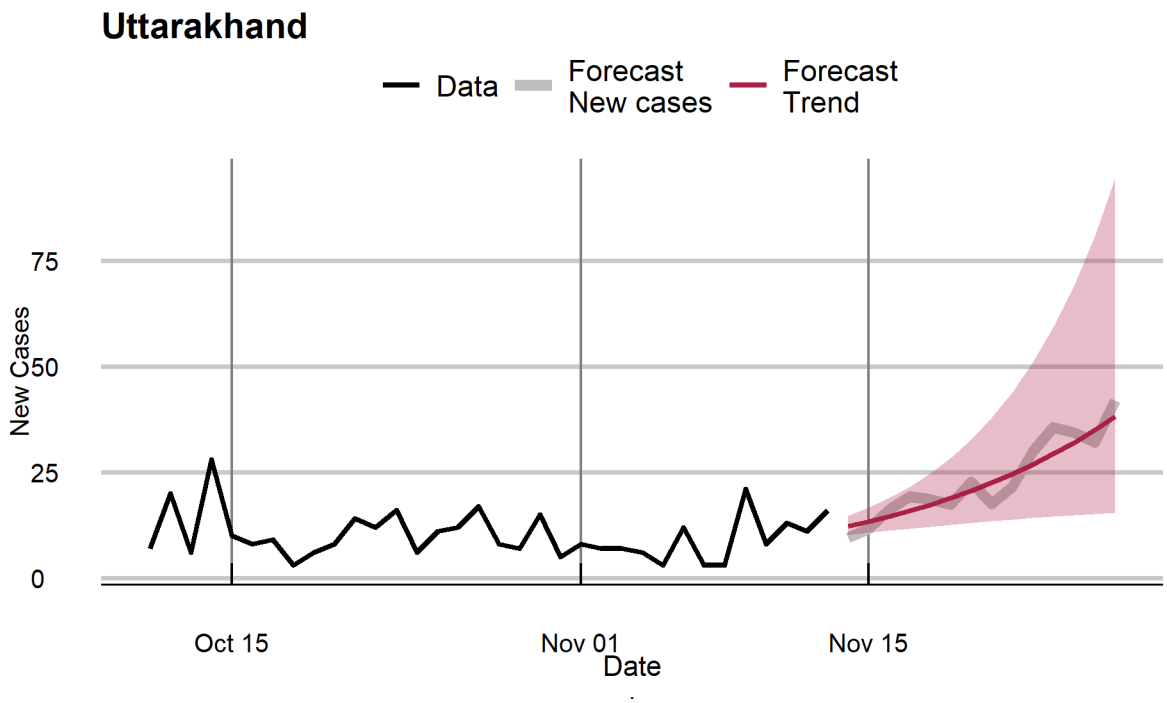


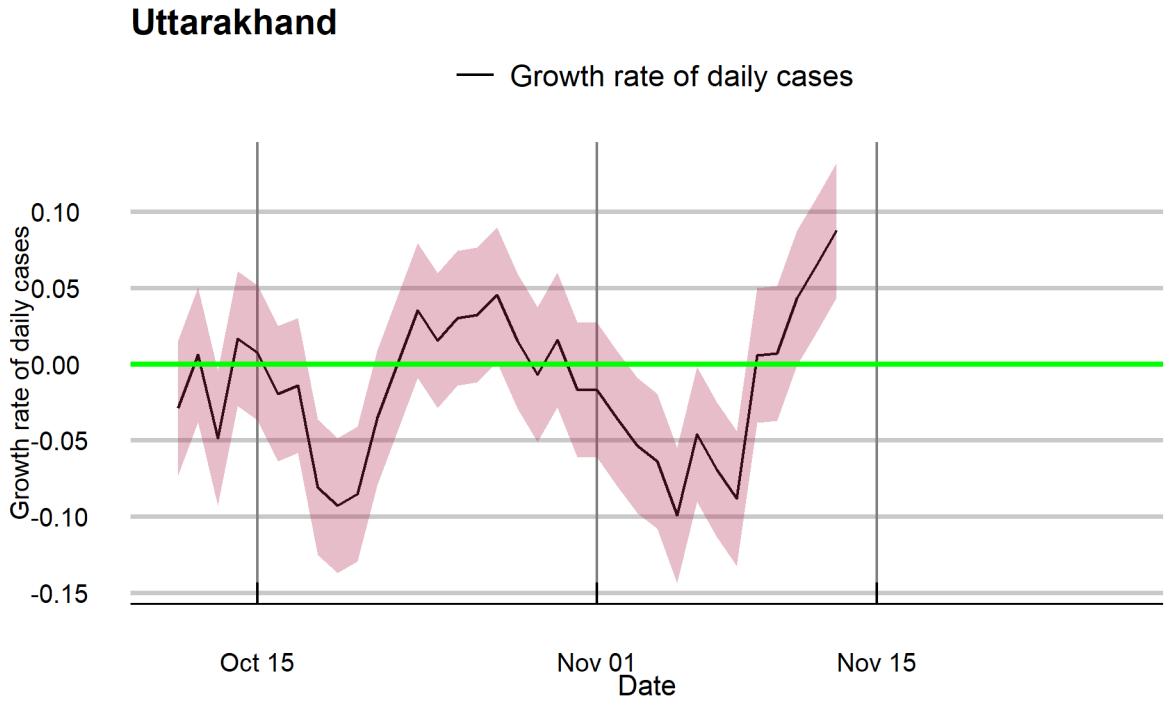

Rajasthan
Data
Forecast
New cases
Forecast
Trend
100
50
0
New Cases
Oct 15
Nov 01
Nov 15
Date

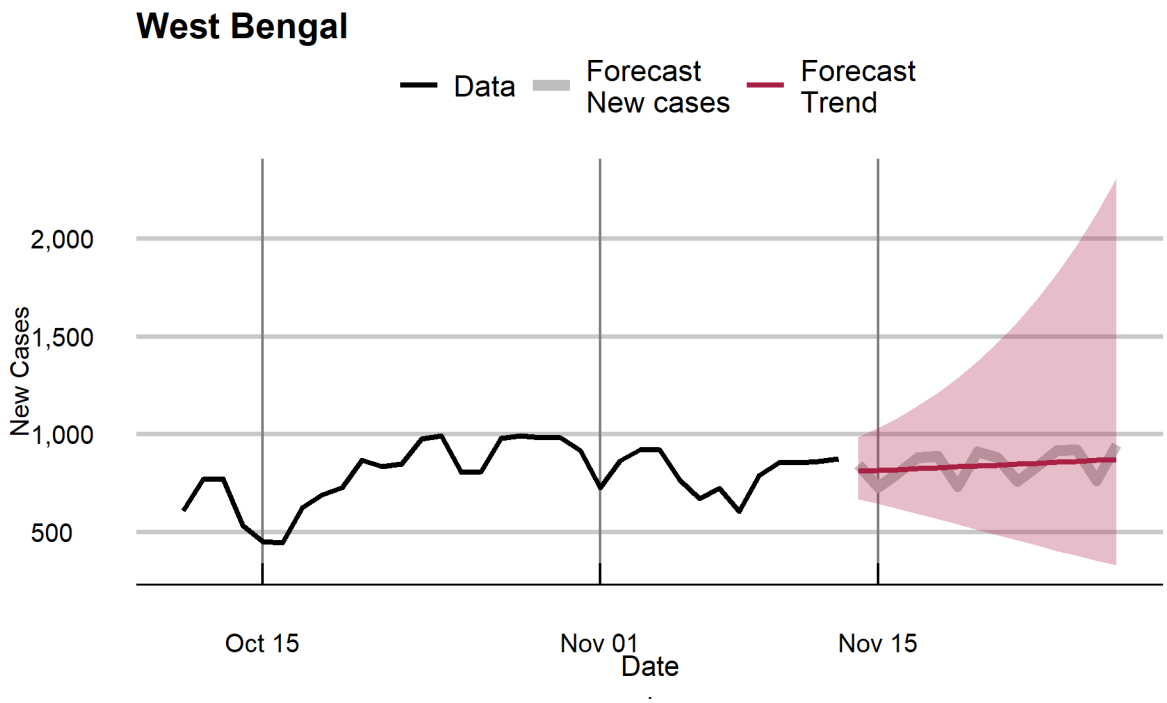

Rajasthan
Growth rate of daily cases
0.2
0.1
0.0
-0.1
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date

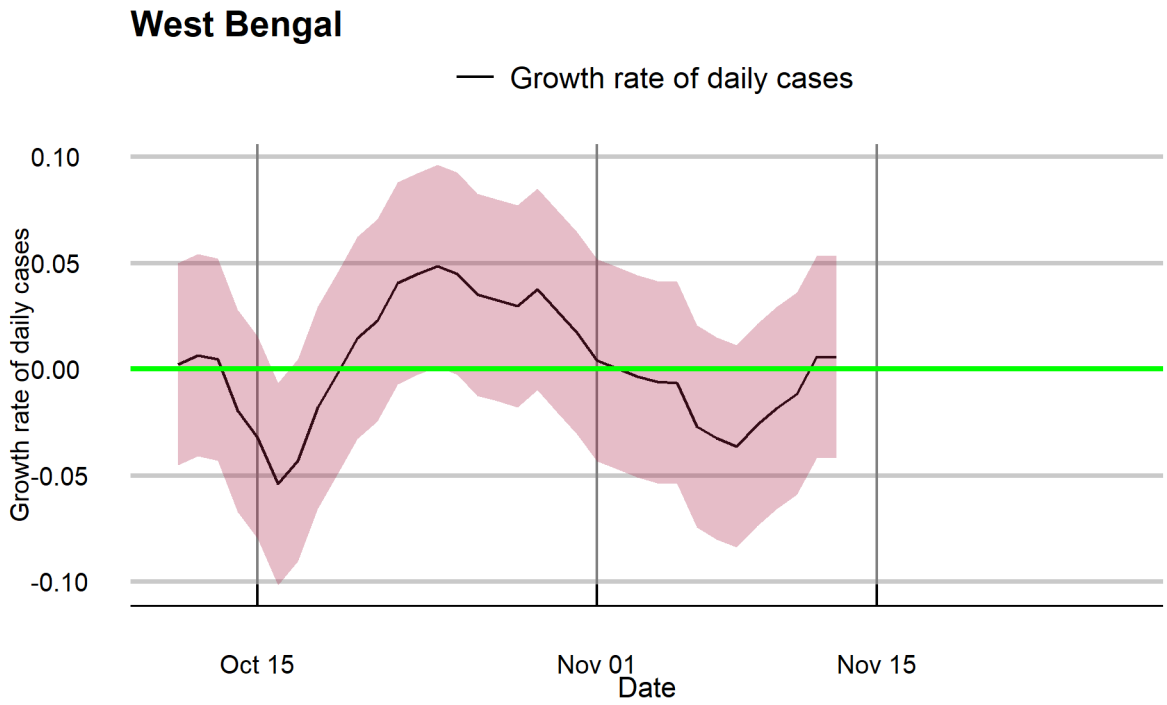

Telangana
Data
Forecast
New cases
Forecast
Trend
400
300
200
100
New Cases
Oct 15
Nov 01
Nov 15
Date


Telangana
Growth rate of daily cases
0.05
0.00
-0.05
-0.10
Growth rate of daily cases
Oct 15
Nov 01
Nov 15
Date


Uttarakhand
Data
Forecast
New cases
Forecast
Trend
New Cases
75
50
25
0
Oct 15
Nov 01
Nov 15
Date


Uttarakhand
Growth rate of daily cases
Growth rate of daily cases
0.10
0.05
0.00
-0.05
-0.10
-0.15
Oct 15
Nov 01
Nov 15
Date


West Bengal
Data
Forecast
New cases
Forecast
Trend
2,000
1,500
1,000
500
New Cases
Oct 15
Nov 01
Nov 15
Date


West Bengal
Growth rate of daily cases
0.10
0.05
0.00
-0.05
-0.10
Growth rate of daily cases
Oct 15
Nov 01
Nov 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).

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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