COVID-19 Results Briefing: India

November 19, 2020

This document contains summary information on the latest projections from the IHME model on COVID-19 in India. The model was run on November 18, 2020.

There was a declining trend of daily COVID-19 cases and deaths since mid-September in India, but there has been a slight increase in these daily numbers since last week. The recent substantial increase in daily cases and deaths in Delhi is of particular concern. In addition, the increase in social mixing in the current festive season in India and the upcoming winter season may lead to increases in cases and deaths across the country if effective face mask use is not enhanced and the social distancing and hygiene precautions are not adequately exercised. IHME's reference scenario forecasts 236,000 COVID-19 deaths in India by March 1, 2021. This number can be reduced by 45,000 if the effective mask use rate is increased to 95% rapidly.

Current situation

- Daily reported cases in the last week increased to 46,100 per day on average, compared to 45,500 the week before (Figure 1).
- Daily deaths in the last week increased to 520 per day on average compared to 505 the week before (Figure 2).
    - This makes COVID-19 the number 15 cause of death in India this week (Table 1).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 15 states (Figure 3).
    - The states with the greatest expected increase in transmission are Delhi, Jharkhand, and Uttarakhand.
- We estimated that 4% of people in India have been infected as of November 16. Among states, this ranged from less than 1% in Mizoram to 24% in Delhi (Figure 4).
- Approximately 15% of infections were detected on November 16, 2020 (Figure 5).
- The daily death rate is greater than 4 per million in Delhi (Figure 6).

Trends in drivers of transmission

- Across each state and Union Territory in the country, the median number of social distancing and mask mandates for each location as of November 16 was four (Table 2).
- Mobility last week was 31% lower than the baseline mobility (average of the period January 1 to March 1, 2020; Figure 8).
    - Mobility was near baseline (within 10%) in Dadra and Nagar Haveli and Daman and Diu, and Himachal Pradesh.
    - Mobility was lower than 30% of baseline in Chhattisgarh, Delhi, Goa, Gujarat, Jammu & Kashmir and Ladakh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mizoram, Punjab, Tamil Nadu, Telangana, and West Bengal.
- As of November 16, according to survey data, we estimated that 66% of people always wore a mask when leaving their home (Figure 9), about the same as last week.

    - Among states, mask use was highest in Goa, Kerala, and Maharashtra, and lowest in Arunachal Pradesh, Bihar, and Manipur.
    - Mask use was lower than 50% in Bihar.
- There were 80 diagnostic tests per 100,000 people on November 16 (Figure 10).
- All states of India are estimated to have a substantially higher risk of death due to pneumonia in the coming winter months as shown in the comparison between August 1 and February 1 (Figure 11).

Projections

- In our reference scenario, which represents what we think is most likely to happen, our model projects 162,000 cumulative deaths on January 1, 2021, and 236,000 on March 1, 2021.
    - Our results suggest that COVID-19 will have been the number 15 cause of death in the calendar year 2020.
    - Between November 16 and the end of 2020, our model projects 32,000 additional deaths in India.
    - We expect there to be about 875 deaths per day on January 1, 2021, and 1,500 deaths per day on March 1, 2021.
    - We expect there to be about 496,000 infections per day on January 1, 2021, and 657,000 infections per day on March 1, 2021.
    - We estimate that about 5% of people will have been infected by January 1, 2021, and 8% by March 1, 2021.
    - We forecast that 11 states will re-impose mandates by March 1, 2021.
- In our universal mask scenario, which assumes that mask use reaches 95% in all locations, our model projects 157,000 cumulative deaths on January 1, 2021, and 191,000 on March 1, 2021.
    - If universal mask coverage (95%) were attained in the next week, our model projects 45,000 fewer cumulative deaths compared to the reference scenario on March 1, 2021.
- Under our mandates easing scenario, which assumes that no new mandates or measures are put in place to affect transmission, our model projects 163,000 cumulative deaths on January 1, 2021, and 247,000 cumulative deaths on March 1, 2021.

Model updates

We have substantially revised the infection-fatality rate (IFR) used in the model. To date, we had used an IFR that was derived from an analysis of population-representative antibody surveys where we disaggregated prevalence by age and matched COVID-19 death rates. The age-specific IFR from this analysis was assumed to be the same across locations and time.

We have now accumulated considerable empirical evidence that suggests that 1) the IFR has been declining since March/April due to improvements in the clinical management of patients, and 2) the IFR varies as a function of the level of obesity in a community. The evidence supporting these observations includes:

- An analysis of detailed clinical records of more than 15,000 individuals from a COVID-19 registry organized by the American Heart Association. This registry covers patients in more than 150 hospitals. Our analysis suggests that after controlling for age, sex, comorbidities, and disease severity at admission, the hospital-fatality rate has declined by about 30% since March/April.
- An analysis of more than 250,000 individuals admitted to hospitals in Brazil with COVID-19 shows that after controlling for age, sex, obesity, and oxygenation at admission, the hospital-fatality rate has declined by about 30% since March/April.
- An analysis of age-standardized IFRs from more than 300 surveys also suggests that the population-level trends in the IFR are consistent with a 30% decline since March/April. These data also suggest that the prevalence of obesity at the population level is associated with a higher IFR and that the magnitude of the effect is similar to that found in the individual-level analysis.

Based on these empirical findings, we have switched to a new estimated IFR. The new IFR varies over time (declining since March/April by approximately 0.19% per day until the beginning of September), varies across locations as a function of obesity prevalence, and varies across locations (as before) as a function of the population distribution by age. The implication of lower IFRs over time is that for a given number of observed deaths there are more cumulative infections.

Current situation

Figure 1. Reported daily COVID-19 cases

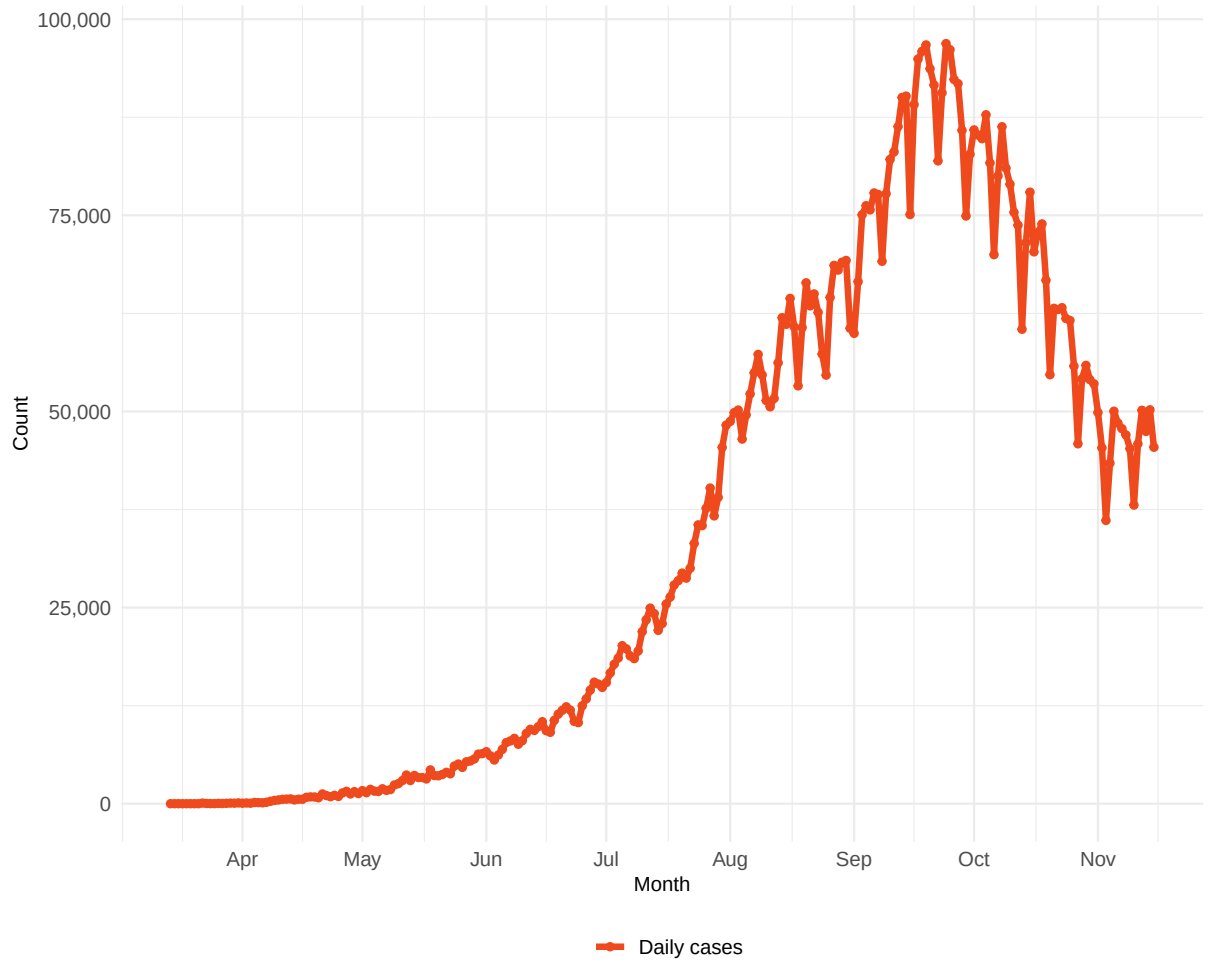


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	29,214	1
Chronic obstructive pulmonary disease	17,278	2
Stroke	13,444	3
Diarrheal diseases	12,160	4
Neonatal disorders	8,423	5
Lower respiratory infections	8,340	6
Tuberculosis	8,128	7
Diabetes mellitus	5,252	8
Cirrhosis and other chronic liver diseases	5,193	9
Falls	4,494	10
COVID-19	3,663	15

Figure 2a. Reported daily COVID-19 deaths.

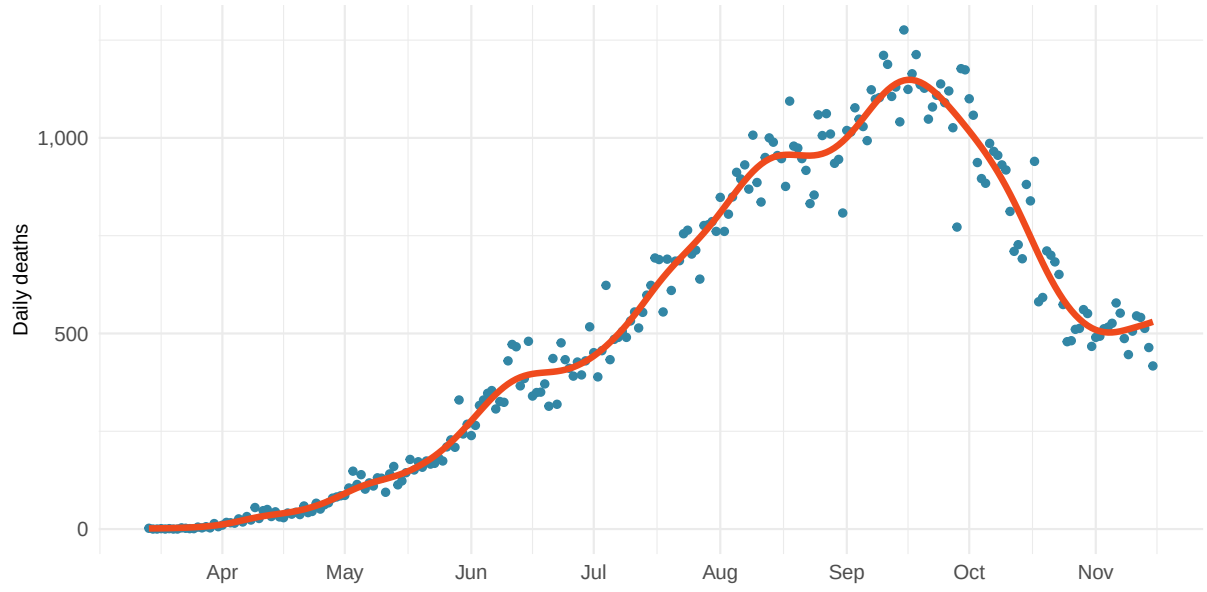


Figure 2b. Estimated cumulative deaths by age group

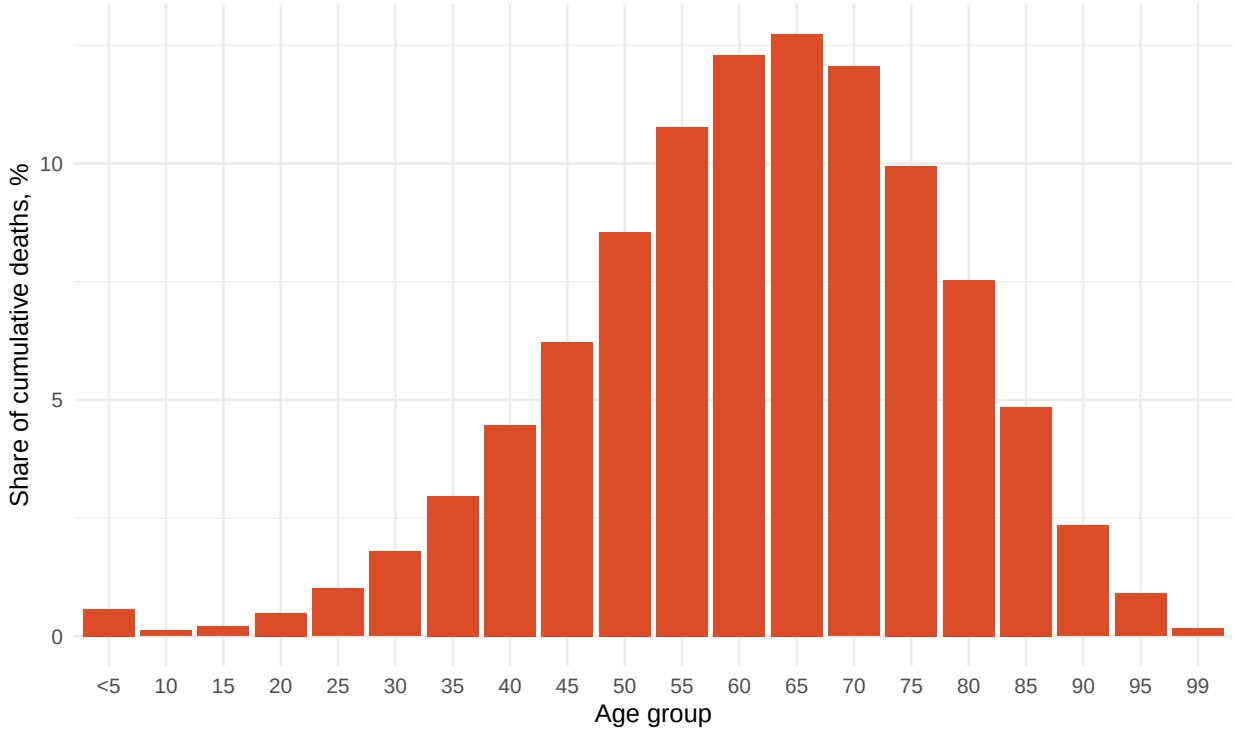


Figure 3. Mean effective R on November 05, 2020. The estimate of effective R is based on the combined analysis of deaths, case reporting and hospitalizations where available. Current reported cases reflect infections 11-13 days prior so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline all other things being held the same.

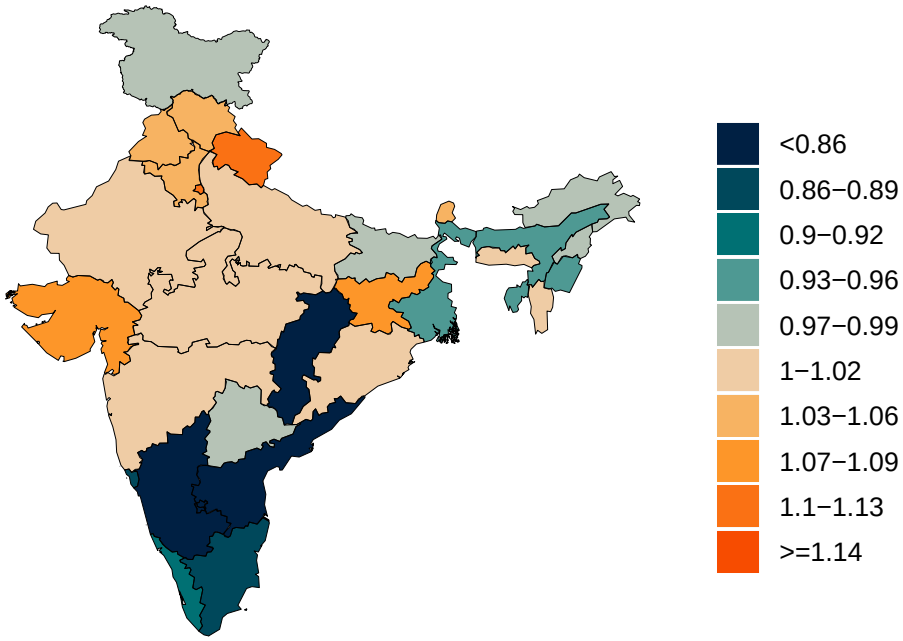


Figure 4. Estimated percent of the population infected with COVID-19 on November 16, 2020

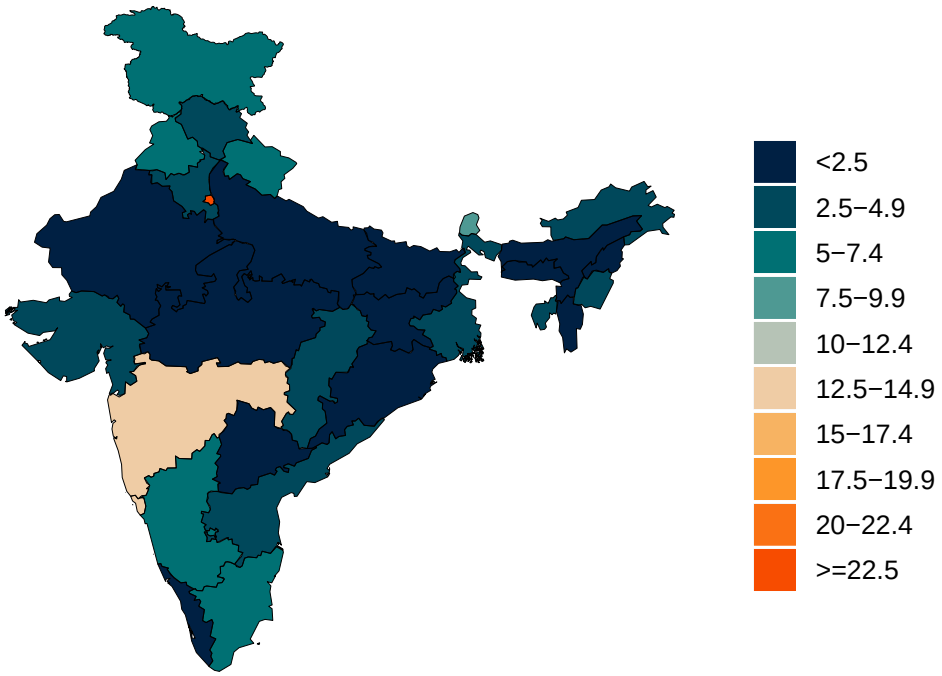


Figure 5. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.

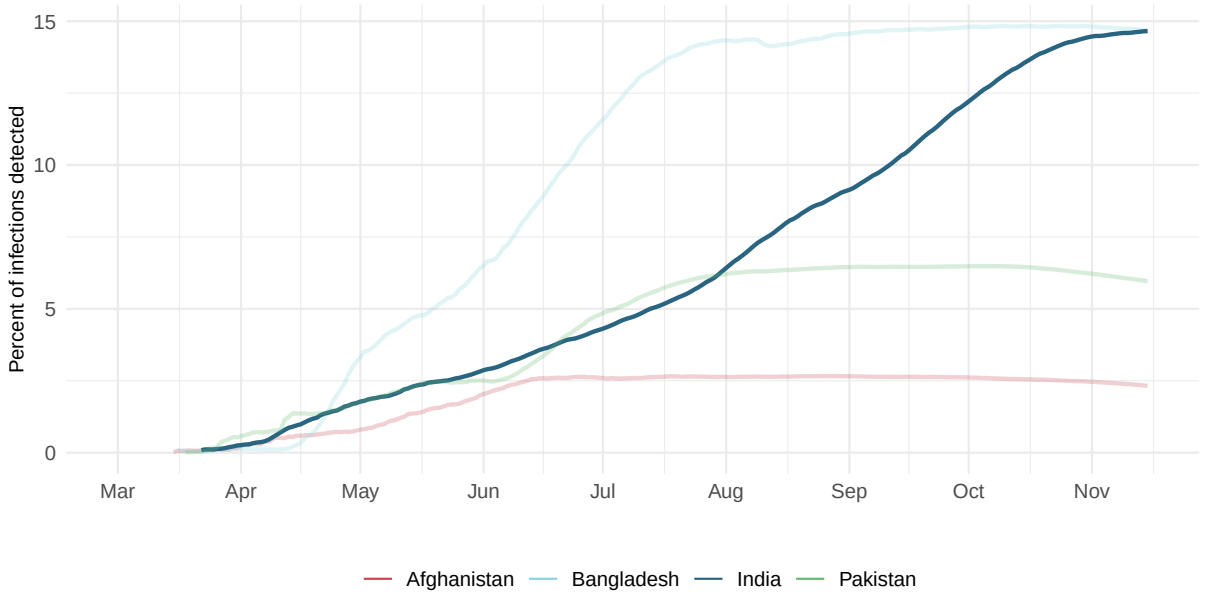
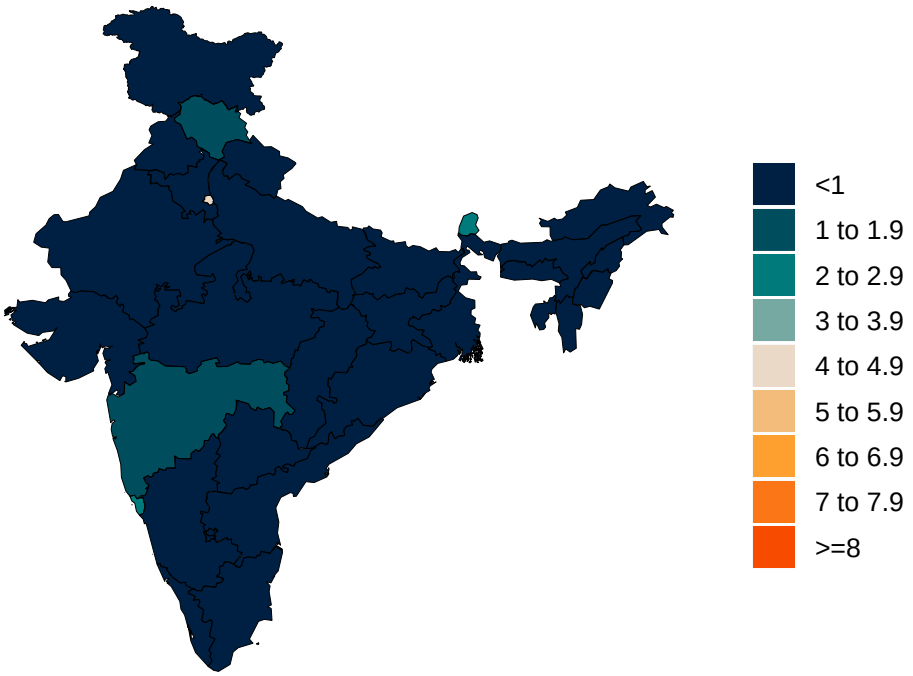


Figure 6. Daily COVID-19 death rate per 1 million on November 16, 2020



Critical drivers

Table 2. Current mandate implementation

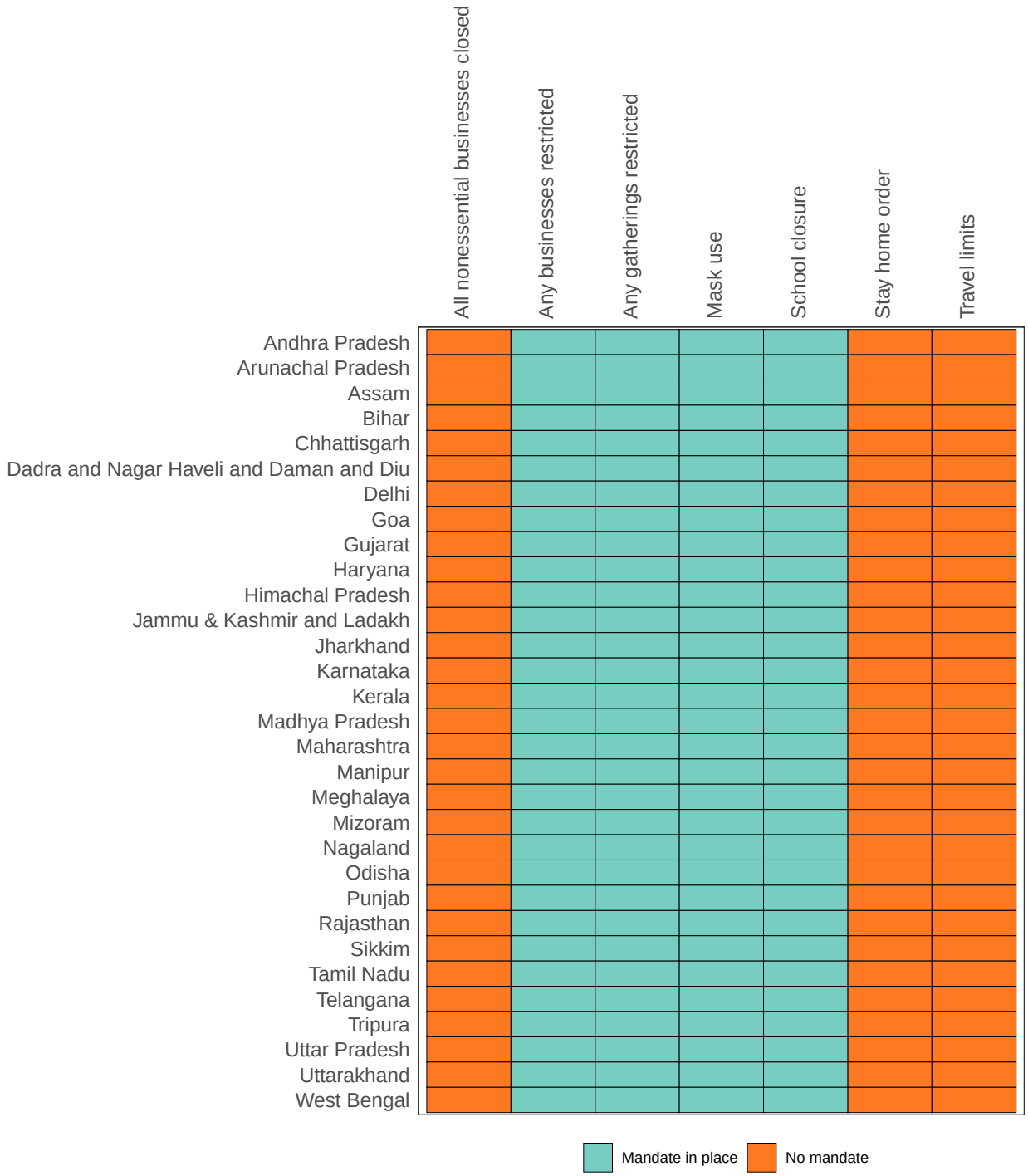


Figure 7. Total number of social distancing mandates (including mask use)

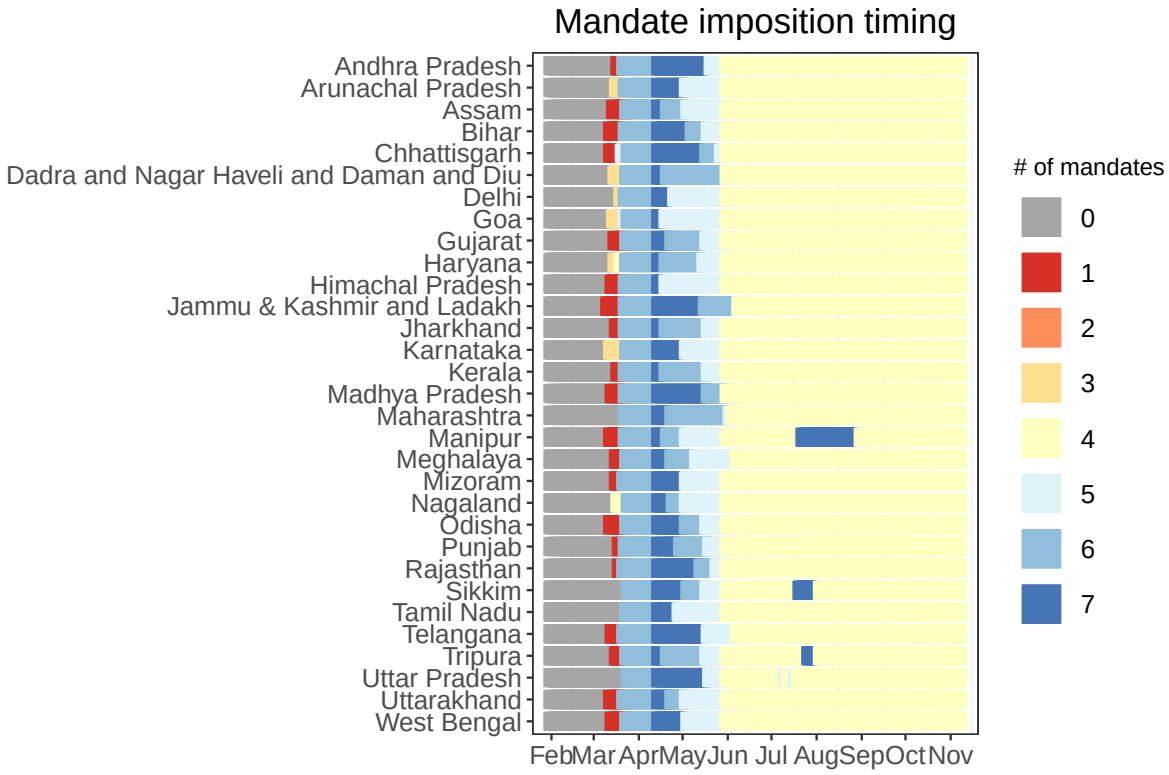


Figure 8a. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

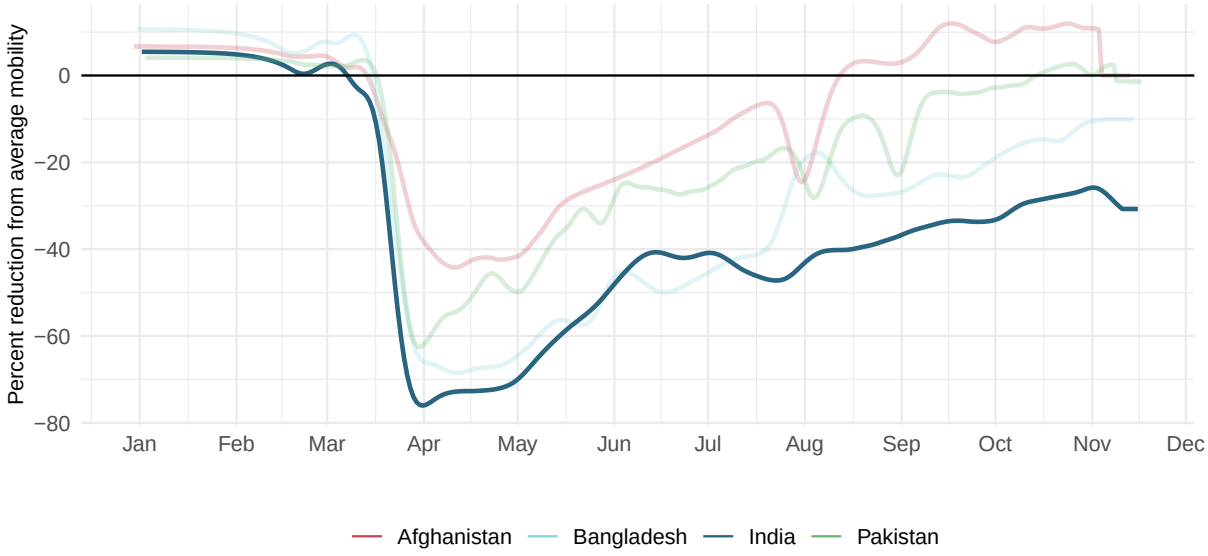


Figure 8b. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on November 16, 2020

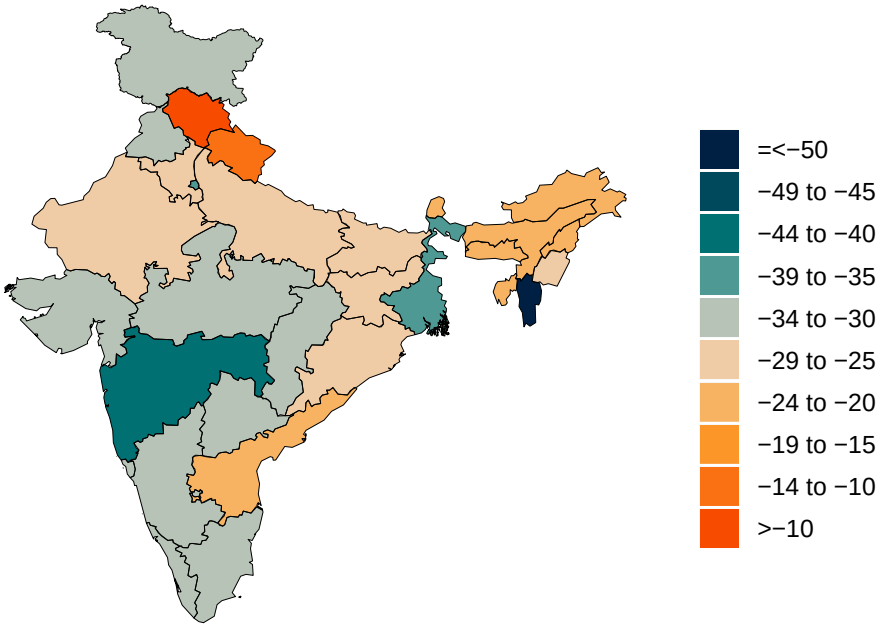


Figure 9a. Trend in the proportion of the population reporting always wearing a mask when leaving home

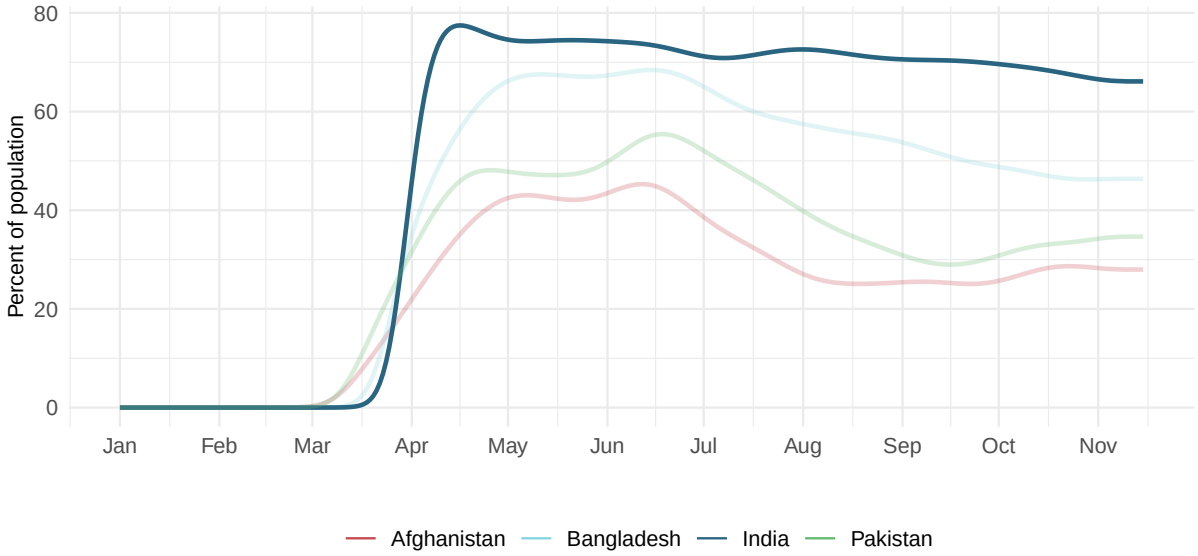


Figure 9b. Proportion of the population reporting always wearing a mask when leaving home on November 16, 2020

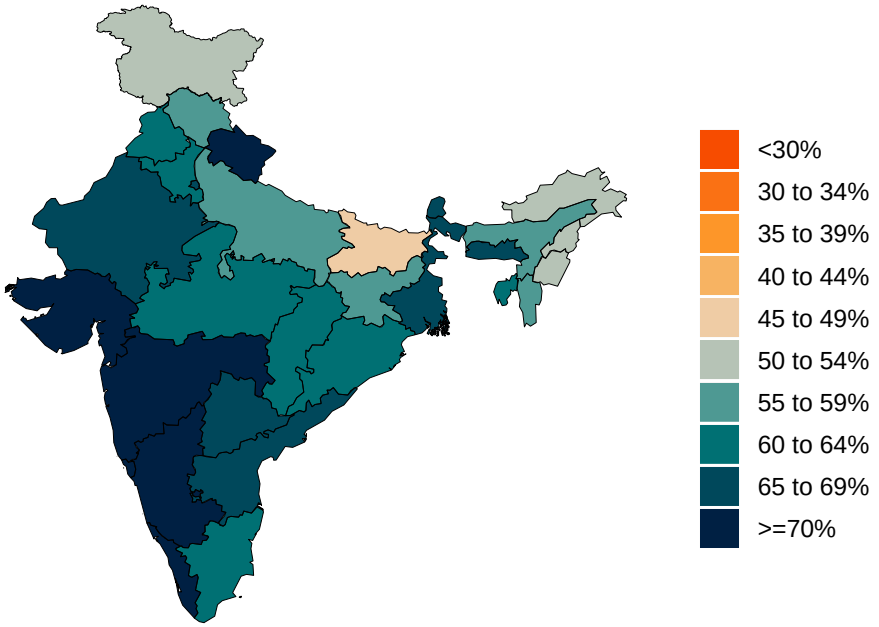


Figure 10a. Trend in COVID-19 diagnostic tests per 100,000 people

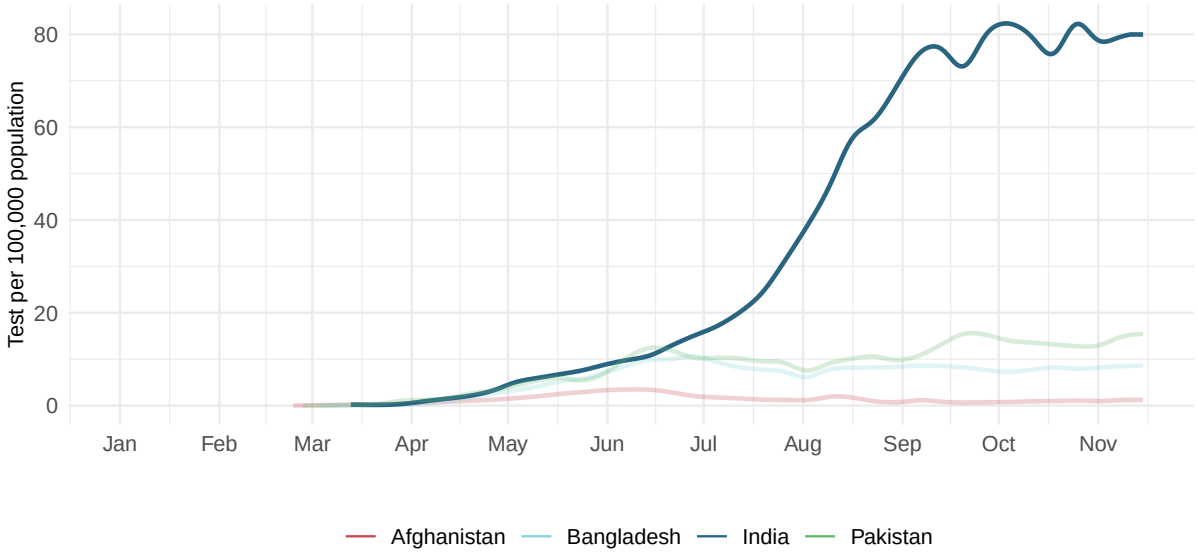


Figure 10b. COVID-19 diagnostic tests per 100,000 people on November 13, 2020

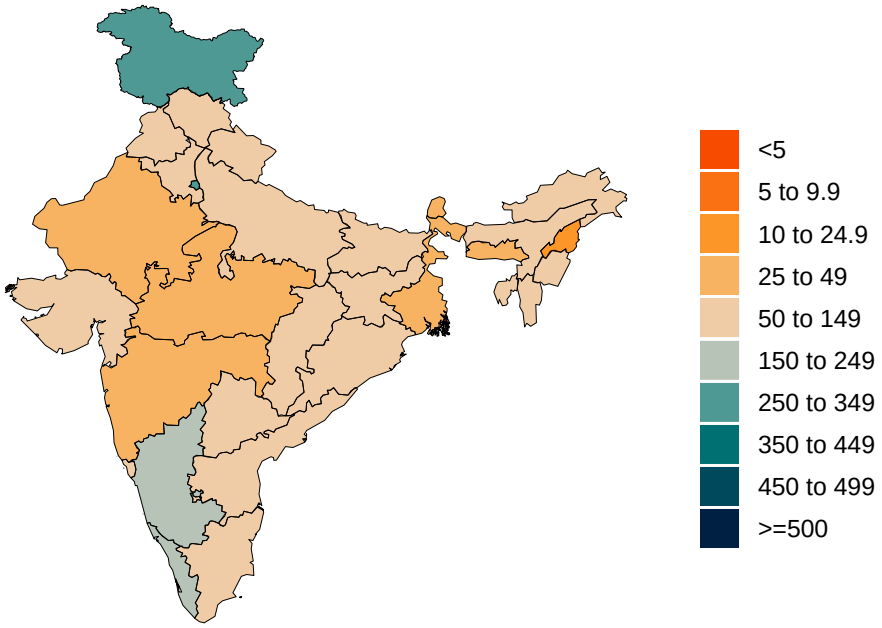
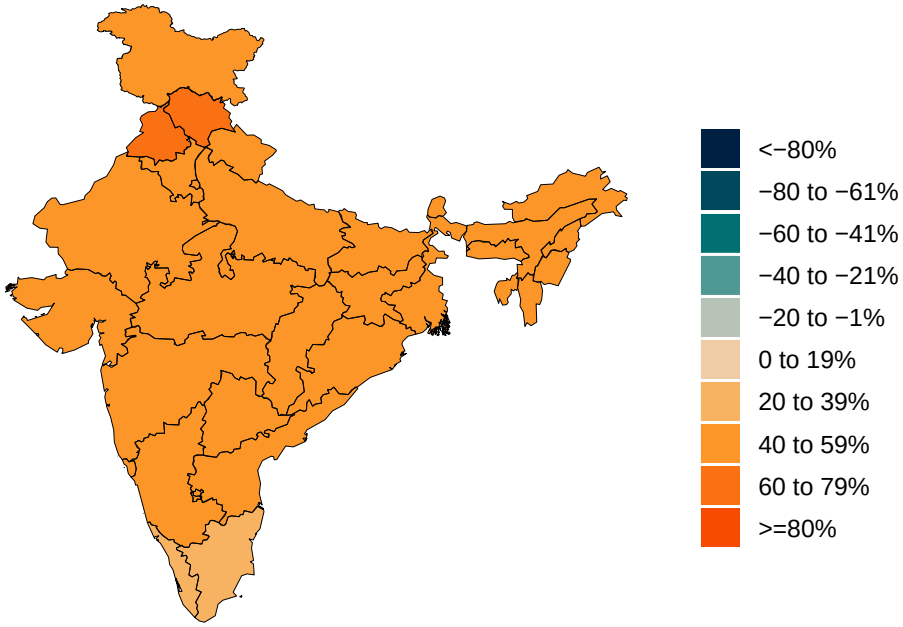


Figure 11. Increase in the risk of death due to pneumonia on February 1 compared to August 1



Projections and scenarios

We produce three scenarios when projecting COVID-19. The reference scenario is our forecast of what we think is most likely to happen. We assume that if the daily mortality rate from COVID-19 reaches 8 per million, social distancing (SD) mandates will be re-imposed. The mandate easing scenario is what would happen if governments continue to ease social distancing mandates with no re-imposition. The universal mask mandate scenario is what would happen if mask use increased immediately to 95% and social distancing mandates were re-imposed at 8 deaths per million.

Figure 12. Cumulative COVID-19 deaths until March 01, 2021 for three scenarios.

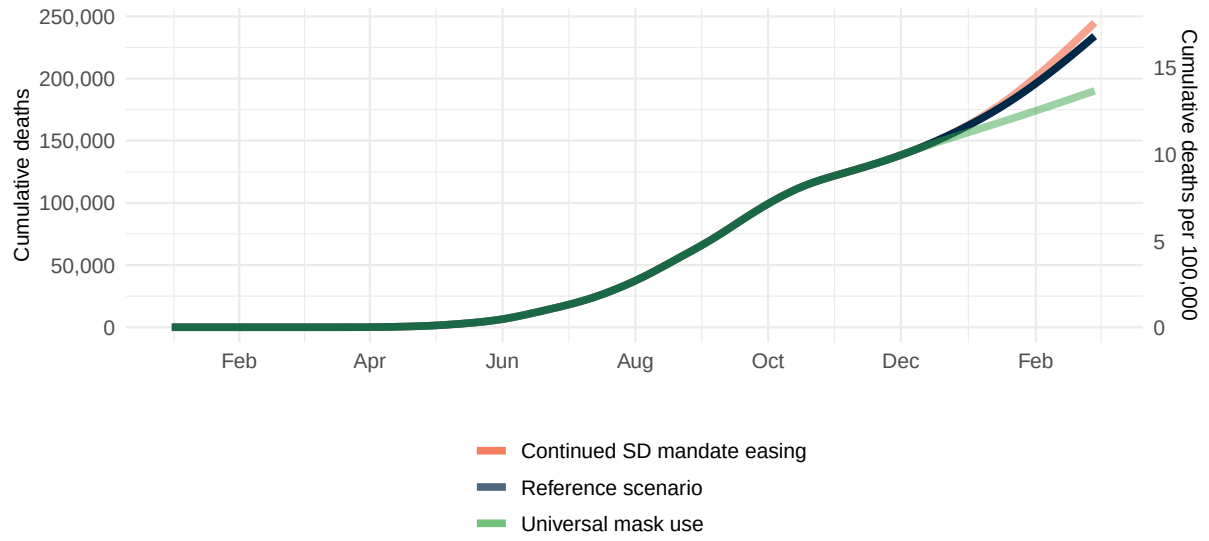


Fig 13. Daily COVID-19 deaths until March 01, 2021 for three scenarios.

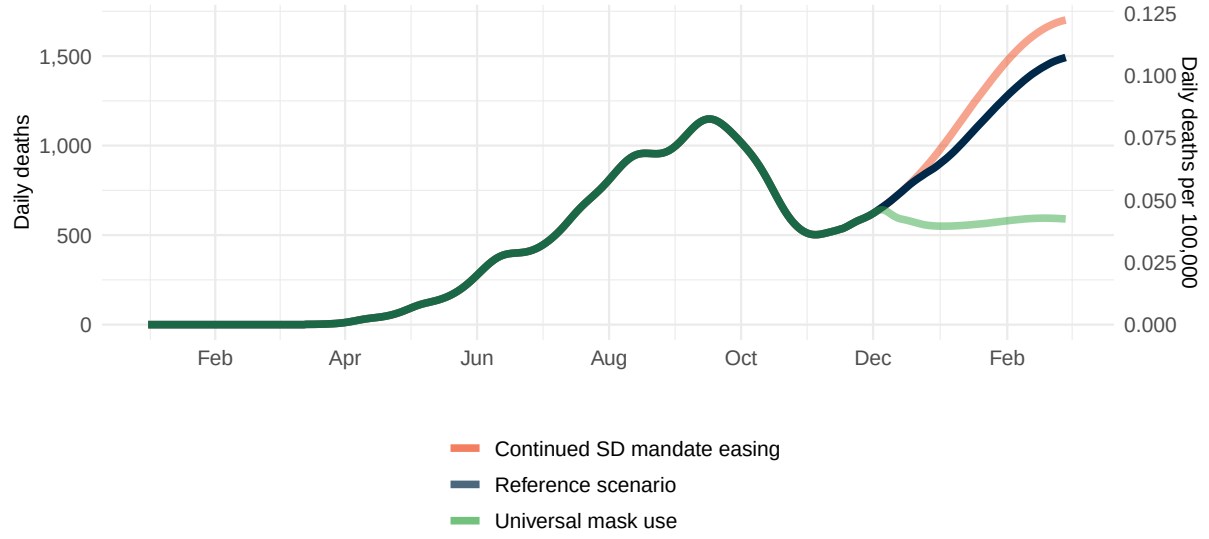


Fig 14. Daily COVID-19 infections until March 01, 2021 for three scenarios.

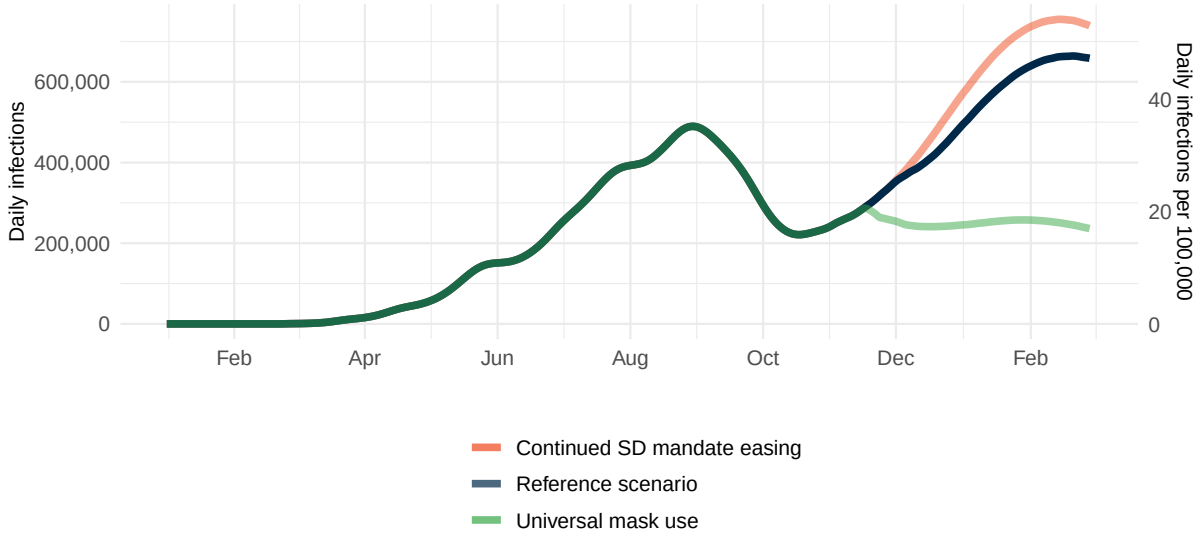


Fig 15. Month of assumed mandate re-implementation. (Month when daily death rate passes 8 per million, when reference scenario model assumes mandates will be re-imposed.)

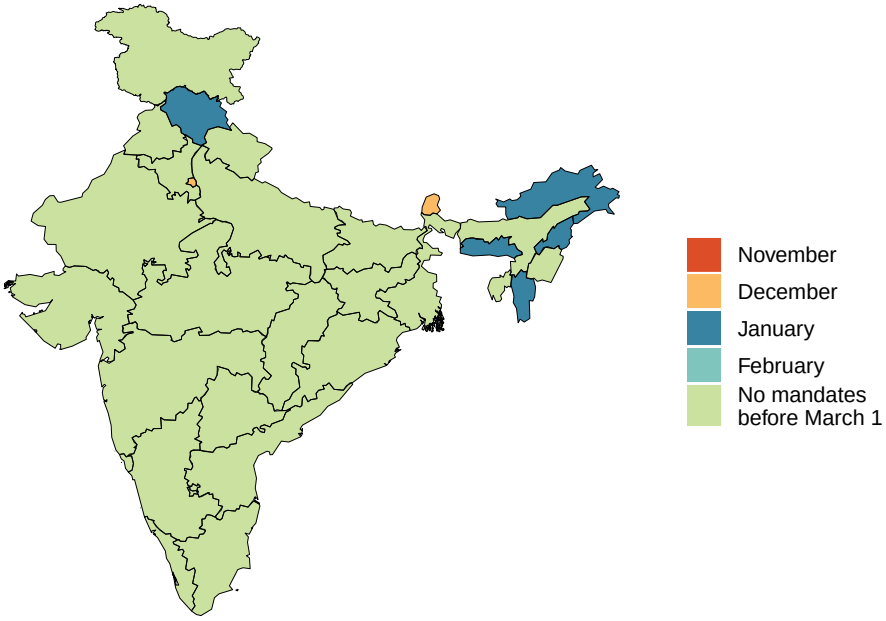


Figure 16. Forecasted percent infected with COVID-19 on March 01, 2021

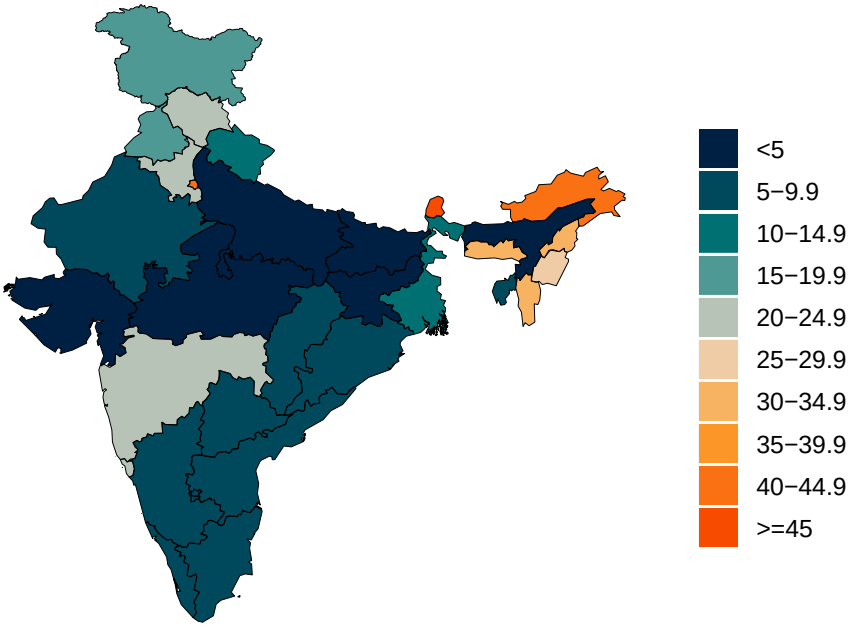


Figure 17. Daily COVID-19 deaths per million forecasted on March 01, 2021 in the reference scenario

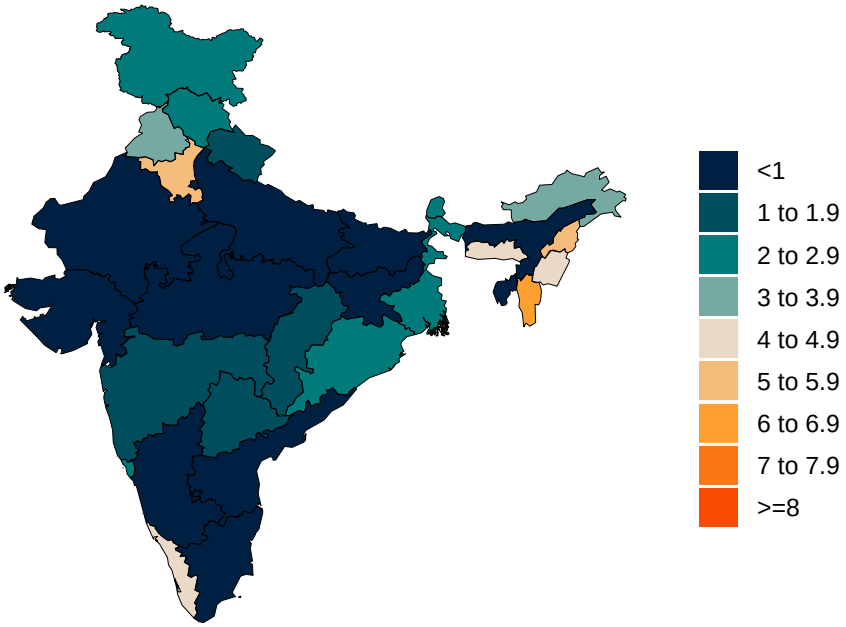


Figure 18. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachussets Institute of Technology (Delphi; https://www.covidanalytics.io/home), Imperial College London (Imperial; https://www.covidsim.org), The Los Alamos National Laboratory (LANL; https://covid-19.bsvgateway.org/), and the SI-KJalpha model from the University of Southern California (SIKJalpha; https://github.com/scc-usc/ReCOVER-COVID-19). Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from availble locations in that region.

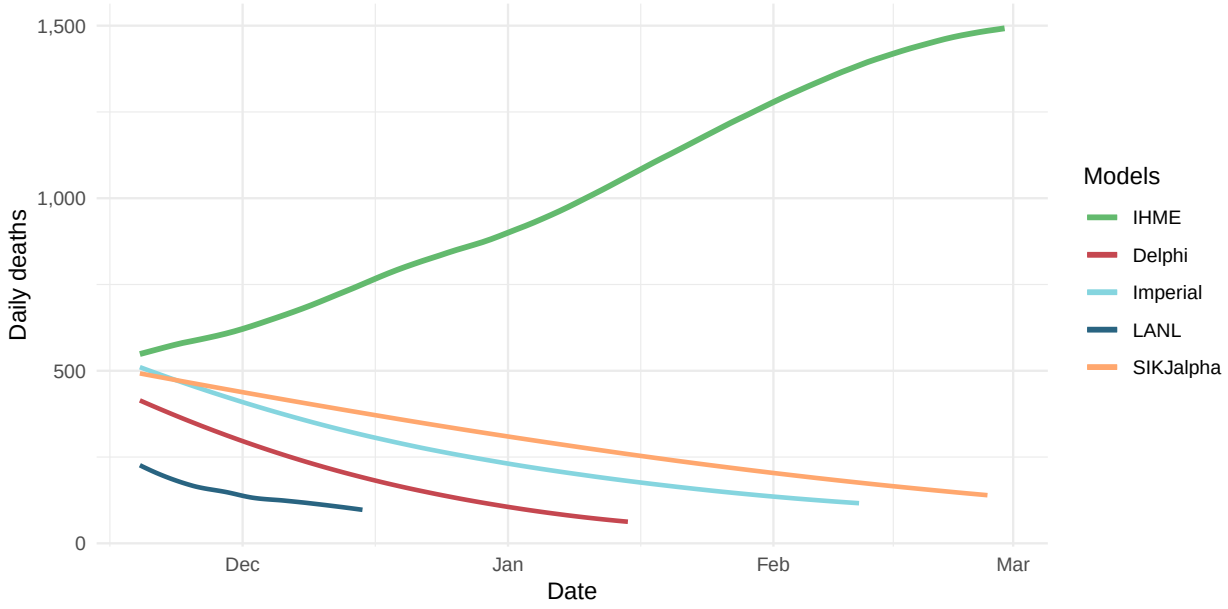


Table 3. Ranking of COVID-19 among the leading causes of mortality in the full year 2020. Deaths from COVID-19 are projections of cumulative deaths on Jan 1, 2021 from the reference scenario. Deaths from other causes are from the Global Burden of Disease study 2019 (rounded to the nearest 100).

Cause name	Annual deaths	Ranking
Ischemic heart disease	1,519,100	1
Chronic obstructive pulmonary disease	898,400	2
Stroke	699,100	3
Diarrheal diseases	632,300	4
Neonatal disorders	438,000	5
Lower respiratory infections	433,700	6
Tuberculosis	422,600	7
Diabetes mellitus	273,100	8
Cirrhosis and other chronic liver diseases	270,000	9
Falls	233,700	10
COVID-19	162,253	15

Table 4. Table of the number of deaths at varying levels of the cumulative percent of the population that is infected with COVID-19. The infection fatality rate can be used to figure out how many people may eventually die from COVID-19 before a community arrives at herd immunity. Since we do not know the level at which herd immunity may be reached for COVID-19, the table below shows the total number of deaths that would be expected in India for various levels of herd immunity. These estimates assume that there does not exist an effective vaccine and that no significant improvements in treatment will be made. We estimated that the all age infection fatality ratio as of November 18, 2020 in India was 0.2%.

Cumulative incidence	Deaths
30%	887,000
35%	1,035,000
40%	1,183,000
45%	1,331,000
50%	1,479,000
55%	1,627,000
60%	1,775,000
65%	1,923,000
70%	2,071,000
75%	2,219,000
80%	2,367,000
85%	2,514,000
90%	2,662,000
95%	2,810,000

Recognition and thanks

Mask data sources:

PREMISE; Facebook Global symptom survey (This research is based on survey results from University of Maryland Social Data Science Center) and the Facebook United States symptom survey (in collaboration with Carnegie Mellon University); Kaiser Family Foundation; YouGov COVID-19 Behaviour Tracker survey.

A note of thanks:

We would like to extend a special thanks to the Pan American Health Organization (PAHO) for key data sources; our partners and collaborators in Argentina, Brazil, Bolivia, Chile, Colombia, Cuba, the Dominican Republic, Ecuador, Egypt, Honduras, Israel, Japan, Malaysia, Mexico, Moldova, Panama, Peru, the Philippines, Russia, Serbia, South Korea, Turkey, and Ukraine for their support and expert advice; and to the tireless data collection and collation efforts of individuals and institutions throughout the world.

In addition, we wish to express our gratitude for efforts to collect social distancing policy information in Latin America to University of Miami Institute for Advanced Study of the Americas (Felicia Knaul, Michael Touchton), with data published here: http://observcovid.miami.edu/; Fundación Mexicana para la Salud (Héctor Arreola-Ornelas) with support from the GDS Services International: Tómatelo a Pecho A.C.; and Centro de Investigaciones en Ciencias de la Salud, Universidad Anáhuac (Héctor Arreola-Ornelas); Lab on Research, Ethics, Aging and Community-Health at Tufts University (REACH Lab) and the University of Miami Institute for Advanced Study of the Americas (Thalia Porteny).

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