COVID-19 Results Briefing

Pakistan

May 27, 2021

This document contains summary information on the latest projections from the IHME model on COVID-19 in Pakistan. The model was run on May 26, 2021 with data through May 24, 2021.

Current situation

Cases are decreasing, but deaths are rising. Effective R is above 1 in three provinces. We estimate that B.1.617 is the main circulating variant, but B.1.1.7 and B.1.351 are also circulating. Our model projects about 109,000 cumulative deaths on September 1, 2021, which represents about 25,000 additional deaths from May 24 to September 1. Efforts to reduce the spread of the escape variant B.1.617 are needed to avoid a surge.

- Daily reported cases in the last week decreased to about 3,000 per day on average compared to about 3,300 the week before (Figure 1).
- Daily deaths in the last week increased to about 400 per day on average compared to about 380 the week before (Figure 2). Estimated total daily COVID-19 deaths were 4 times larger than the reported number of deaths. This makes COVID-19 the number 3 cause of death in Pakistan this week (Table 1).
- No locations had daily death rates greater than 4 per million (Figure 3).
- We estimated that 42% of people in Pakistan have been infected as of May 24 (Figure 5).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in three provinces (Figure 6).
- The infection-detection rate in Pakistan was close to 1% on May 24 (Figure 7).
- In Pakistan, we estimate that the primary circulating variant is B.1.617. Both B.1.1.7 and B.1.351 are also circulating but at lower levels.

Trends in drivers of transmission

- Mobility last week was 1% lower than the pre-COVID-19 baseline (Figure 10). Mobility was near baseline (within 10%) in Balochistan, Khyber Pakhtunkhwa, Punjab, and Sindh. Mobility was not lower than 30% of baseline in any locations.
- As of May 24, we estimated that 56% of people always wore a mask when leaving their home (Figure 12). Mask use was lower than 50% in Balochistan, Gilgit-Baltistan, and Khyber Pakhtunkhwa.
- There were 16 diagnostic tests per 100,000 people on May 24 (Figure 14).
• In Pakistan 77.5% of people say they would accept or would probably accept a vaccine for COVID-19. This is up by 0.7 percentage points from last week. The fraction of the population who are open to receiving a COVID-19 vaccine ranges from 52% in Balochistan to 81% in Punjab (Figure 18).

• In our current reference scenario, we expect that about 14 million people will be vaccinated by September 1 (Figure 19).

Projections

• In our reference scenario, which represents what we think is most likely to happen, our model projects about 109,000 cumulative deaths on September 1, 2021. This represents about 25,000 additional deaths from May 24 to September 1 (Figure 20). Daily deaths are expected to decline steadily until September 1 (Figure 21).

• If universal mask coverage (95%) were attained in the next week, our model projects about 7,900 fewer cumulative deaths compared to the reference scenario on September 1, 2021 (Figure 20).

• Figure 23 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.

• At some point from May through September 1, six provinces or territories will have high or extreme stress on hospital beds (Figure 24). At some point from May through September 1, seven provinces or territories will have high or extreme stress on ICU capacity (Figure 25).
Model updates

We made an update to our vaccine coverage projections this week to better account for the observed scale-up of vaccination. We used data from countries and states with minimal supply constraints (Israel, Chile, Bahrain, states in the United States, locations in the United Kingdom). We used a hierarchical spline model with a monotonicity constraint. Specifically, we model the logit fraction of the population that has been vaccinated among the population that reported that they would probably or definitely get vaccinated as a function of time since the first day of vaccination. The model was used to predict an average scale global curve for the predicted percentage of the population that is likely to be vaccinated. The resulting scale-up curve approximates better the observed slowing rate of vaccination as countries approach the maximum number of people who are willing to get vaccinated. The average scale-up curve was calibrated to the observed number of vaccinations reported to be delivered in each location. This was done by calculating the ratio of the predicted cumulative percentage vaccinated over the observed percentage vaccinated for the most recent time period. This ratio was then used to adjust the average scale-up curve. For locations without observed data, we used the regional average ratio to calibrate the scale-up curve.

Our previous model update, made the week of May 3, included the transition to measuring total COVID-19 mortality; more details are available here.
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

<table>
<thead>
<tr>
<th>Cause name</th>
<th>Weekly deaths</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal disorders</td>
<td>4,804</td>
<td>1</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>3,527</td>
<td>2</td>
</tr>
<tr>
<td>COVID-19</td>
<td>2,777</td>
<td>3</td>
</tr>
<tr>
<td>Stroke</td>
<td>2,028</td>
<td>4</td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>1,481</td>
<td>5</td>
</tr>
<tr>
<td>Lower respiratory infections</td>
<td>1,311</td>
<td>6</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1,207</td>
<td>7</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>1,205</td>
<td>8</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>917</td>
<td>9</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>854</td>
<td>10</td>
</tr>
</tbody>
</table>
Figure 2. Smoothed trend estimate of reported daily COVID-19 deaths (blue) and total daily COVID-19 deaths (orange).
**Figure 3.** Daily COVID-19 death rate per 1 million on May 24, 2021

**Figure 4.** Cumulative COVID-19 deaths per 100,000 on May 24, 2021
**Figure 5.** Estimated percent of the population infected with COVID-19 on May 24, 2021

**Figure 6.** Mean effective R on May 13, 2021. 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 7. 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.

*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.*
Figure 8. Estimated percent of circulating SARS-CoV-2 for primary variant families on May 24, 2021.

A. Estimated percent B.1.1.7 variant

B. Estimated percent B.1.351 variant
C. Estimated percent B.1.617 variant

D. Estimated percent P.1 or P.3 variant
Figure 9. Infection fatality ratio on May 24, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.
### Critical drivers

**Table 2. Current mandate implementation**

<table>
<thead>
<tr>
<th>Province</th>
<th>All nonessential businesses closed</th>
<th>Any businesses restricted</th>
<th>Any gatherings restricted</th>
<th>Mask use</th>
<th>School closure</th>
<th>Stay home order</th>
<th>Travel limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azad Jammu &amp; Kashmir</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Balochistan</td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Gilgit–Baltistan</td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Islamabad Capital Territory</td>
<td><img src="#" alt="Green" /></td>
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<td><img src="#" alt="Green" /></td>
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<tr>
<td>Khyber Pakhtunkhwa</td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Punjab (Pakistan)</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Sindh</td>
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</tbody>
</table>

- **Mandate in place**: Mandate implemented this week
- **Mandate in place (imposed this week)**: Mandate lifted this week
- **No mandate**: Mandate lifted this week

*Not all locations are measured at the subnational level.*
Figure 10. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

Figure 11. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on May 24, 2021
Figure 12. Trend in the proportion of the population reporting always wearing a mask when leaving home.

Figure 13. Proportion of the population reporting always wearing a mask when leaving home on May 24, 2021.
Figure 14. Trend in COVID-19 diagnostic tests per 100,000 people

Figure 15. COVID-19 diagnostic tests per 100,000 people on May 19, 2021
Figure 16. Increase in the risk of death due to pneumonia on February 1 compared to August 1.
**Table 3.** The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (http://www.healthdata.org/node/8584).

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Efficacy at preventing disease: D614G &amp; B.1.1.7</th>
<th>Efficacy at preventing infection: D614G &amp; B.1.1.7</th>
<th>Efficacy at preventing disease: B.1.351, B.1.617, &amp; P.1</th>
<th>Efficacy at preventing infection: B.1.351, B.1.617, &amp; P.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AstraZeneca</td>
<td>74%</td>
<td>52%</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>CoronaVac</td>
<td>50%</td>
<td>44%</td>
<td>38%</td>
<td>33%</td>
</tr>
<tr>
<td>Covaxin</td>
<td>78%</td>
<td>69%</td>
<td>59%</td>
<td>52%</td>
</tr>
<tr>
<td>Janssen</td>
<td>72%</td>
<td>72%</td>
<td>64%</td>
<td>56%</td>
</tr>
<tr>
<td>Moderna</td>
<td>94%</td>
<td>89%</td>
<td>79%</td>
<td>75%</td>
</tr>
<tr>
<td>Novavax</td>
<td>89%</td>
<td>79%</td>
<td>49%</td>
<td>43%</td>
</tr>
<tr>
<td>Pfizer/BioNTech</td>
<td>91%</td>
<td>86%</td>
<td>76%</td>
<td>72%</td>
</tr>
<tr>
<td>Sinopharm</td>
<td>73%</td>
<td>65%</td>
<td>55%</td>
<td>49%</td>
</tr>
<tr>
<td>Sputnik-V</td>
<td>92%</td>
<td>81%</td>
<td>70%</td>
<td>61%</td>
</tr>
<tr>
<td>Tianjin</td>
<td>66%</td>
<td>58%</td>
<td>50%</td>
<td>44%</td>
</tr>
<tr>
<td>CanSino</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vaccines</td>
<td>75%</td>
<td>66%</td>
<td>57%</td>
<td>50%</td>
</tr>
<tr>
<td>Other vaccines</td>
<td>91%</td>
<td>86%</td>
<td>76%</td>
<td>72%</td>
</tr>
<tr>
<td>(mRNA)</td>
<td></td>
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</tbody>
</table>
**Figure 17.** Trend in the estimated proportion of the adult (18+) population that have been vaccinated or would probably or definitely receive the COVID-19 vaccine if available.

**Figure 18.** This figure shows the estimated proportion of the adult (18+) population that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available.
Figure 19. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.
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:

- Vaccines are distributed at the expected pace.
- Governments adapt their response by re-imposing social distancing mandates for 6 weeks whenever daily deaths reach 8 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate and not yet re-imposed social distancing mandates. In this case, the scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants B.1.1.7 (first identified in the UK), B.1.351 (first identified in South Africa), and P1 (first identified in Brazil) continue to spread from locations with (a) more than 5 sequenced variants, and (b) reports of community transmission, to adjacent locations following the speed of variant scale-up observed in the regions of the UK.
- In one-quarter of those vaccinated, mobility increases toward pre-COVID-19 levels.

The worse scenario modifies the reference scenario assumptions in three ways:

- First, it assumes that variants B.1.351 or P1 begin to spread within 3 weeks in adjacent locations that do not already have B.1.351 or P1 community transmission.
- Second, it assumes that all those vaccinated increase their mobility toward pre-COVID-19 levels.
- Third, it assumes that among those vaccinated, mask use starts to decline exponentially one month after completed vaccination.

The universal masks scenario makes all the same assumptions as the reference scenario but also assumes 95% of the population wear masks in public in every location.
Figure 20. Cumulative COVID-19 deaths until September 01, 2021 for three scenarios

Cumulative deaths


Cumulative deaths per 100,000

Reference scenario
Universal mask use
Worse

Figure 21. Daily COVID-19 deaths until September 01, 2021 for three scenarios,

Daily deaths


Daily deaths per 100,000

Reference scenario
Universal mask use
Worse
Figure 22. Daily COVID-19 infections until September 01, 2021 for three scenarios.
Figure 23. 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 available locations in that region.
**Figure 24.** The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and greater than 20% is considered *extreme stress*. 
**Figure 25.** The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and greater than 60% is considered *extreme stress*. 
More information

Data sources:
Mask use and vaccine confidence data are from the Global COVID-19 Symptom Survey (this research is based on survey results from University of Maryland Social Data Science Center with Facebook’s support) and the US COVID-19 Symptom Survey (this research is based on survey results from Carnegie Mellon University’s Delphi Research Group with Facebook’s support). Mask use data are also from Premise, the Kaiser Family Foundation, and the YouGov COVID-19 Behaviour Tracker survey.

Genetic sequence and metadata are primarily from the GISAID Initiative. Further details available on the COVID-19 model FAQ page.

A note of thanks:
We wish to warmly acknowledge the support of these and others who have made our COVID-19 estimation efforts possible.

More information:
For all COVID-19 resources at IHME, visit http://www.healthdata.org/covid.