COVID-19 Results Briefing

Global

April 22, 2021

This document contains summary information on the latest projections from the IHME model on COVID-19 globally. The model was run on April 21, 2021 with data through April 19, 2021.

The global epidemic is now dominated by the extraordinary surge in cases and deaths in India. Bangladesh is reporting a peak in cases, but this may be an artifact of delayed reporting during Ramadan. The surge in India is likely related to the escape variant B.1.617. Limited sequence data released in India suggests some states are dominated by this escape variant, but there are also considerable reported numbers of isolates of B.1.1.7 and B.1.351. The timing of the surges across South Asia, however, make it more likely that the cause in all locations is similar: a highly transmissible escape variant. In the absence of detailed data on the immune escape and transmissibility of this variant, other countries should take precautions to limit the spread of B.1.617 to their populations. In Brazil, the increase in cases is slowing and may have peaked in some states. In Europe, cases and deaths appear to have peaked in aggregate, but a number of countries still show increasing transmission. In the US, cases are slowly increasing, but deaths are not, indicating the differential impact of vaccination on the trend in cases compared with deaths. At the global level in our reference scenario, we expect daily deaths to increase to nearly 25,000 by mid-May and then decline. The decline, if it occurs, will be driven by declining seasonality in the Northern Hemisphere and rising vaccination rates in high-income countries. The global trend in the next weeks will be driven largely by the trends in India. Vaccination in India with AstraZeneca – which may be minimally effective against escape variants – will probably not change the trajectory much in the next months. However, declining seasonality and imposition of various social distancing measures may be enough to stop the exponential rise in cases and deaths. Global infections at this point have likely exceeded 15 million a day, marking the worst phase of the pandemic by a factor of three or more.

Current situation

- Daily reported cases in the last week increased to 726,300 per day on average compared to 641,000 the week before (Figure 1). This is a 13% increase over the last week.

- Daily deaths in the last week increased to 14,400 per day on average compared to 13,200 the week before (Figure 2), a 9% increase. This makes COVID-19 the number 3 cause of death globally this week (Table 1).

- The daily death rate is greater than 4 per million in 36 countries (Figure 3). The locations with daily death rates over 4 per million include much of South America, Central and Eastern Europe, and some states in India.
• We estimated that 18% of people globally have been infected as of April 19 (Figure 4). Our estimate of the number of people previously infected has increased because we have corrected for waning antibodies in our analysis of seroprevalence surveys – see the model updates section for more details.

• Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 93 countries (Figure 5). Transmission is increasing in many regions, but the increase is most intense in South Asia and parts of Southeast Asia.

• The infection-detection rate (IDR) globally was close to 8% on April 19 (Figure 6). The IDR is down from last week for two reasons. First, correcting for waning antibodies in the analysis of seroprevalence surveys has reduced the IDR. Second, the shift of global infections to South Asia, which has a low IDR, has reduced the global average.

• Based on GISAID and national databases of sequencing that are publicly released, combined with our variant spread model, we estimate current prevalence of key variants (Figure 7). B.1.1.7 is the dominant variant in Europe, parts of the Middle-East, the US, and Canada. B.1.351 is the dominant variant in Central and Southern Africa, and P1 is the dominant variant in all of South America. Given limited publicly available sequence data in India, we suspect that B.1.617 is an important component of transmission in that surge.

Trends in drivers of transmission

• Mobility last week was 19% lower than the pre-COVID-19 baseline (Figure 9). Mobility was near baseline (within 10%) in 67 countries. Mobility was lower than 30% of baseline in in 37 countries.

• This week 64% of people self-reported in Facebook surveys that they always wore a mask when leaving their home (Figure 11). Mask use was lower than 50% in in 41 countries, the majority of which are in sub-Saharan Africa.

• There were 133 diagnostic tests per 100,000 people on April 19 (Figure 13).

• Globally, 69.8% of people have been vaccinated or say they would accept or probably accept a vaccine for COVID-19. The fraction of the population who are open to receiving a COVID-19 vaccine ranges from 27% in Latvia to 96% in Gabon (Figure 17).

• In our current reference scenario, we expect that 2.9 billion will have received at least one dose of vaccine by August 1 (Figure 18).

Projections

• In our reference scenario, which represents what we think is most likely to happen, our model projects 5,050,000 cumulative deaths on August 1. This represents 1,507,000 additional deaths from now until August 1 (Figure 19). Daily deaths will peak at over 25,000 in mid-May (Figure 20).

• If universal mask coverage (95%) were attained in the next week, our model projects 279,000 fewer cumulative deaths compared to the reference scenario on August 1 (Figure 19).
• Under our **worse scenario**, our model projects 5,403,000 cumulative deaths on August 1, an additional 353,000 deaths compared to our reference scenario (Figure 19).

• By August 1, we project that 390,300 lives will be saved by the projected vaccine rollout. This does not include lives saved through vaccinations that have already been delivered.

• In the reference and worse scenarios, daily infections are expected to decline from early May until August 1 (Figure 21).

• At some point between now and August 1, 86 countries will have high or extreme stress on hospital beds (Figure 23). At some point between now and August 1, 102 countries will have high or extreme stress on ICU capacity (Figure 24).

**Model updates**

Estimates of infections by day are the critical input into SEIR models. Many early models assumed that cases equaled infections or that the infection-detection rate (IDR) was constant over time and across locations. Early scarcity of PCR testing for COVID-19 in some high-income countries and continued low testing rates in many low-resource settings means that it is very likely that the IDR varies over space and time. Until January 2021, the IHME model used deaths that have been less affected by PCR testing availability to estimate infections using empirical estimates of the infection-fatality ratio (IFR). Estimates of the IFR based on seroprevalence surveys matched to deaths vary over time and location. Starting with the January 21 release, we adopted an approach mapping: 1) cases to infections, 2) hospitalizations to infections, and 3) deaths to infections, and then generating a best estimate of past infections based on these three series. For the April 22, 2021, release, we made further improvements to this model to take into account the effect of waning immunity on seroprevalence surveys and a more appropriate method for predicting the IDR, infection-hospitalization rate (IHR), and IFR in settings without seroprevalence surveys.

Our approach has six distinct components. First, we address certain types of missingness and reporting anomalies present in daily reported COVID-19 statistics. Second, we correct seroprevalence surveys for vaccination rates, re-infection from escape variants (B.1.351 and P1), and test-specific information on antibody test sensitivity. Third, we use corrected cumulative infections derived from seroprevalence surveys that are representative paired with cumulative cases, cumulative hospitalizations, and cumulative deaths to get empirical estimates of the IDR, IHR, and IFR. Statistical models for each have been developed to project the IDR, IHR, and IFR for each location and day taking into account population age structure where appropriate. Fourth, a smooth curve of daily cases, daily hospitalizations (where available), and daily deaths is generated. Fifth, all three smooth series of cases, hospitalizations, and deaths are divided by the relevant IDR, IHR, and IFR to generate three estimates of past daily infections. All three of these series are combined into a single best estimate of past infections. Sixth, daily infections are used to estimate the cumulative percent of individuals with one or more infection, which can be compared to seroprevalence surveys to assess internal consistency in each step of the process.

A detailed description of the approach, available [here](https://covid19.healthdata.org), provides more on the statistical models used and the diagnostic plots generated as part of the analysis.
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>Ischemic heart disease</td>
<td>175,727</td>
<td>1</td>
</tr>
<tr>
<td>Stroke</td>
<td>126,014</td>
<td>2</td>
</tr>
<tr>
<td>COVID-19</td>
<td>100,639</td>
<td>3</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>63,089</td>
<td>4</td>
</tr>
<tr>
<td>Lower respiratory infections</td>
<td>47,946</td>
<td>5</td>
</tr>
<tr>
<td>Tracheal, bronchus, and lung cancer</td>
<td>39,282</td>
<td>6</td>
</tr>
<tr>
<td>Neonatal disorders</td>
<td>36,201</td>
<td>7</td>
</tr>
<tr>
<td>Alzheimer’s disease and other dementias</td>
<td>31,217</td>
<td>8</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>29,830</td>
<td>9</td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>29,509</td>
<td>10</td>
</tr>
</tbody>
</table>
Figure 2. Reported daily COVID-19 deaths and smoothed trend estimate.
Figure 3. Daily COVID-19 death rate per 1 million on April 19, 2021

Figure 4. Estimated percent of the population infected with COVID-19 on April 19, 2021
Figure 5. Mean effective R on April 08, 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 6. 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 7. Percent of circulating SARS-CoV-2 for 3 primary variants on April 19, 2021.

A. Percent B.1.1.7 variant

B. Percent B.1.351 variant

C. Percent P1 variant
Figure 8. Infection fatality ratio on April 19, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.
**Figure 9.** Trend in mobility as measured through smartphone app use compared to January 2020 baseline

**Figure 10.** Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on April 19, 2021
Figure 11. Trend in the proportion of the population reporting always wearing a mask when leaving home

Figure 12. Proportion of the population reporting always wearing a mask when leaving home on April 19, 2021
**Figure 13.** Trend in COVID-19 diagnostic tests per 100,000 people

**Figure 14.** COVID-19 diagnostic tests per 100,000 people on April 19, 2021
Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020.
Table 2. 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 &amp; P.1</th>
<th>Efficacy at preventing infection: B.1.351 &amp; P.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AstraZeneca</td>
<td>75%</td>
<td>52%</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>CoronaVac</td>
<td>50%</td>
<td>43%</td>
<td>38%</td>
<td>25%</td>
</tr>
<tr>
<td>Janssen</td>
<td>72%</td>
<td>72%</td>
<td>64%</td>
<td>42%</td>
</tr>
<tr>
<td>Moderna</td>
<td>94%</td>
<td>85%</td>
<td>72%</td>
<td>47%</td>
</tr>
<tr>
<td>Novavax</td>
<td>89%</td>
<td>77%</td>
<td>49%</td>
<td>32%</td>
</tr>
<tr>
<td>Pfizer/BioNTech</td>
<td>91%</td>
<td>86%</td>
<td>69%</td>
<td>45%</td>
</tr>
<tr>
<td>Sinopharm</td>
<td>73%</td>
<td>63%</td>
<td>56%</td>
<td>36%</td>
</tr>
<tr>
<td>Sputnik-V</td>
<td>92%</td>
<td>80%</td>
<td>70%</td>
<td>45%</td>
</tr>
<tr>
<td>Tianjin</td>
<td>66%</td>
<td>57%</td>
<td>50%</td>
<td>32%</td>
</tr>
<tr>
<td>CanSino</td>
<td>75%</td>
<td>65%</td>
<td>57%</td>
<td>37%</td>
</tr>
<tr>
<td>Other vaccines</td>
<td>95%</td>
<td>83%</td>
<td>72%</td>
<td>47%</td>
</tr>
<tr>
<td>Other vaccines</td>
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<td></td>
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<tr>
<td>(mRNA)</td>
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covid19.healthdata.org 13 Institute for Health Metrics and Evaluation
Figure 16. Trend in the estimated proportion of the adult (18+) population that have been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

Figure 17. This figure shows the estimated proportion of the adult (18+) population that has been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).
Figure 18. 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 19. Cumulative COVID-19 deaths until August 01, 2021 for three scenarios

Figure 20. Daily COVID-19 deaths until August 01, 2021 for three scenarios,
Figure 21. Daily COVID-19 infections until August 01, 2021 for three scenarios.
More information

Data sources:

Mask use data sources include 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.

Vaccine hesitancy data are from the COVID-19 Beliefs, Behaviors, and Norms Study, a survey conducted on Facebook by the Massachusetts Institute of Technology (https://covidsurvey.mit.edu/).

Vaccine hesitancy data are from the Facebook Global Symptom Survey (This research is based on survey results from University of Maryland Social Data Science Center), the Facebook United States Symptom Survey (in collaboration with Carnegie Mellon University), and from the Facebook COVID-19 Beliefs, Behaviors, and Norms Study conducted by the Massachusetts Institute of Technology.

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.