COVID-19 Results Briefing

United Kingdom

April 23, 2021

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

Current situation

- Daily reported cases in the last week decreased to 2,600 per day on average compared to 2,800 the week before (Figure 1).
- Daily deaths in the last week decreased to 22 per day on average compared to 45 the week before (Figure 2). This makes COVID-19 the number 17 cause of death in United Kingdom this week (Table 1).
- No locations had daily death rates greater than 4 per million (Figure 3).
- We estimated that 18% of people in United Kingdom have been infected as of April 19 (Figure 4).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 0 countries (Figure 5).
- The infection detection rate in United Kingdom is close to 64% on April 19 (Figure 6).

Trends in drivers of transmission

- Mobility last week was 34% lower than the pre-COVID-19 baseline (Figure 9). Mobility was near baseline (within 10%) in no countries. Mobility was lower than 30% of baseline in England, Northern Ireland, Scotland, and Wales.
- As of April 19 we estimated that 58% of people always wore a mask when leaving their home compared to 58% last week (Figure 11). Mask use was lower than 50% in no countries.
- There were 1239 diagnostic tests per 100,000 people on April 19 (Figure 13).
- In United Kingdom 88% of people say they would accept or would probably accept a vaccine for COVID-19. This is down by 0.2 percentage points from last week. The fraction of the population who are open to receiving a COVID-19 vaccine ranges from 84% in Northern Ireland to 90% in Scotland (Figure 17).
- In our current reference scenario, we expect that 48.74 million will be vaccinated by August 1 (Figure 18).

Projections

- In our reference scenario, which represents what we think is most likely to happen, our model projects 151,000 cumulative deaths on August 1, 2021. This represents 710 additional deaths from April 19 to August 1 (Figure 19). Daily deaths are expected to decline steadily until August 1 (Figure 20).
- If universal mask coverage (95%) were attained in the next week, our model projects 100 fewer cumulative deaths compared to the reference scenario on August 1, 2021 (Figure 19).
- Under our worse scenario, our model projects 151,000 cumulative deaths on August 1, 2021, an additional 320 deaths compared to our reference scenario (Figure 19).
- By August 1, we project that 400 lives will be saved by the projected vaccine rollout.
- Figure 22 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.
- At some point from April through August 1, 0 countries will have high or extreme stress on hospital beds (Figure 23). At some point from April through August 1, no 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, 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>1,796</td>
<td>1</td>
</tr>
<tr>
<td>Stroke</td>
<td>974</td>
<td>2</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>845</td>
<td>3</td>
</tr>
<tr>
<td>Tracheal, bronchus, and lung cancer</td>
<td>824</td>
<td>4</td>
</tr>
<tr>
<td>Lower respiratory infections</td>
<td>805</td>
<td>5</td>
</tr>
<tr>
<td>Alzheimer’s disease and other dementias</td>
<td>624</td>
<td>6</td>
</tr>
<tr>
<td>Colon and rectum cancer</td>
<td>466</td>
<td>7</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td>307</td>
<td>8</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>293</td>
<td>9</td>
</tr>
<tr>
<td>Pancreatic cancer</td>
<td>232</td>
<td>10</td>
</tr>
<tr>
<td>COVID-19</td>
<td>156</td>
<td>17</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.
Critical drivers

Table 2. Current mandate implementation

*Not all locations are measured at the subnational level.
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 13, 2021
Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020
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 &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></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vaccines</td>
<td>75%</td>
<td>65%</td>
<td>57%</td>
<td>37%</td>
</tr>
<tr>
<td>Other vaccines (mRNA)</td>
<td>95%</td>
<td>83%</td>
<td>72%</td>
<td>47%</td>
</tr>
</tbody>
</table>
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).

![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).](image)

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.
**Figure 22.** 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 Massachusetts 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 23. 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 24. 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 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.