Round 13: Planning scenarios projecting COVID-19 burden March 2022-March 2023 under current vaccination policy

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June 28, 2022 - Vaccines and Related Biological Products Advisory Committee meeting
Disclaimers

• This work is the independent work of the COVID-19 Scenario Modeling Hub, and does not reflect the views or work of the CDC or any other institution.

• I am funded under multiple CDC contracts for epidemic modeling of emerging national and global infectious disease threats, including SARS-CoV-2.

• If there are questions regarding the CDC’s views on this work, Dr. Matthew Biggerstaff is available at this meeting to respond.
What is the COVID-19 Scenario Modeling Hub?

• A multi-team effort aimed at creating and modeling planning scenarios of the mid- to long-term COVID-19 situation.

• Project cases, hospitalizations and deaths.

• Scenarios developed in close collaboration with the government agencies and other stakeholders

• To date 13 (11 public) rounds have been completed

• 6-10 submissions per round at the national level.

• Results are ensembled and summarized by the hub.
What is a scenario?

“Models are not oracles...Any model is providing an answer that is conditional on certain assumptions.”

*Alessandro Vespignani in All together now: the most trustworthy covid-19 model is an ensemble | MIT Technology Review*
COVID-19 Scenario Modeling Hub

Surveillance data

Forecast
Current data on interventions, epidemiological situations, etc.

Projections
Conditional to scenario assumptions on future NPIs, vaccination campaigns, emergence of new strains

Incident cases

Epiweek

End date for epiweek

Individual model performance vs. ensemble
# Round 13 Scenario Assumptions

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Scenario A</th>
<th>Scenario B</th>
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<tbody>
<tr>
<td>Optimistic waning of protection against infection:</td>
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<tr>
<td>• <strong>Slow immune waning, median</strong> transition time to partially immune state</td>
<td><strong>Scenario A</strong></td>
<td><strong>Scenario B</strong></td>
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<tr>
<td>= 10 months</td>
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<td>• In the partially immune state, there is a <strong>40% reduction</strong> in protection</td>
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<td>from baseline levels reported immediately after exposure (vaccination or</td>
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<td>infection)</td>
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<tr>
<td>Pessimistic waning of protection against infection:</td>
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<tr>
<td>• <strong>Fast immune waning, median</strong> transition time to partially immune state</td>
<td><strong>Scenario C</strong></td>
<td><strong>Scenario D</strong></td>
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<tr>
<td>= 4 months</td>
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<td>• In the partially immune state, there is a <strong>60% reduction</strong> in protection</td>
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<td>from baseline levels reported immediately after exposure (vaccination or</td>
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See detailed notes on each scenario below

- **No new variant.** Projections are initialized with the mix of strains circulating at the start of the projection period.
- **New variant X emerges on May 1st, 2022.** There is a continuous influx of **50 weekly infections** of variant X for the following **16 wks**. Variant X has **30% immune escape**, and the same **intrinsic transmissibility and severity** as Omicron.
RED – ~100% chance we see this many or more hospitalizations
BEIGE – ~50% chance we see this many or more hospitalizations
BLUE – Almost 0 chance we see this many or more hospitalizations
Week of June 18 – 32,000 hospitalizations
Projected Incident Hospitalizations by Epidemiological Week and by Scenario for Round 13 - US

Scenario A: Optimistic waning, No immune escape variant

Scenario B: Optimistic waning, New immune escape variant

Scenario C: Pessimistic waning, No immune escape variant

Scenario D: Pessimistic waning, New immune escape variant

Epiweek
End Date for Epiweek
Results

- Incidence is tracking with more pessimistic scenarios (scenarios C,D)
- Faster waning (C,D) and new variants (A,D) increase expected hospitalizations
- Variant leads to earlier resurgences. (A, D)
- Under the most pessimistic scenarios weekly hospitalizations are projected to remain under 170k and will likely be between 13k-52k
Results – Highly Variable Trajectories

• This is an aggregate of highly variable projections across models.

• There is not a great consensus trajectory for the ensemble to capture.
Results – Highly Variable Trajectories

- There is high sensitivity to individual model assumptions in these scenarios.
- For instance, a change in the shape of waning, even with the same median time meaningfully changes projections.
Conclusions

• Between March 2022-23 95,000 (95% PI 9,000-324,000) cumulative deaths are projected to occur in the most optimistic scenario. In the most pessimistic, 211,000 (95% 52,000-466,000) deaths are projected.

• In the most pessimistic scenario there is a >5% risk of exceeding delta hospitalization peaks in 10 of 52 projections weeks (19% of weeks). This is true for no weeks in the most optimistic scenario.

• Lots of uncertainty in precise trajectory and sensitivity to exact assumptions around waning of protection against infection.

• New variant would lead to larger and earlier peaks in most but not all models.
Caveats

• Substantial heterogeneity in projections between models reflects substantial scientific uncertainty, perhaps greater than captured by the ensemble.

• The mains scenario axes represent things on which there is substantial underlying uncertainty (e.g., speed of waning projection, nature of new variants)

• Four out of six national models include BA.2 and in some cases behavior change. Three of these four show a small resurgence in April-May time frame.

• Reporting of cases and other metrics are undergoing significant changes, making it difficult to project into the future.

• While the modeled variant is not completely dissimilar to BA4/5, it is in no way based on these variants.
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Modeling Groups Contributing Projections

- Columbia University – Age-Stratified Model: Marta Galanti, Teresa Yamana, Sen Pei, Jeffrey Shaman
- Institute for Health Metrics and Evaluation – IHME COVID
- John Hopkins University-APL: Matt Kinsey, Kate Tallaksen, R.F. Obrecht, Laura Asher, Cash Costello, Michael Kelbaugh, Shelby Wilson, Kaitlin Lovett
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- University of Notre Dame - FRED: Guido Espana, Sean Cavany, Sean Moore, Alex Perkins
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- University of Texas at Austin-ImmunoSEIRS: Anass Bouchnita, Spencer Fox, Michael Lachmann, Lauren Ancel Meyers, UT COVID-19 Modeling Consortium
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- University of Virginia-EpiHiper: Jiangzhuo Chen, Stefan Hoops, Parantapa Bhattacharya, Dustin Machi, Bryan Lewis, Madhav Marathe

Collaborators: Matthew Biggerstaff, Michael Johansson, Rachel Slayton, Jessica Healey (CDC);
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https://covid19scenariomodelinghub.org
https://github.com/midas-network/covid19-scenario-modeling-hub