Welcome to the launch of the European COVID-19 Scenario Hub!

Funded by ECDC, an agency of the European Union

With special thanks for the scientific leadership to LSHTM; the support from the US COVID-19 Scenario hub team, and all participating modelling teams!

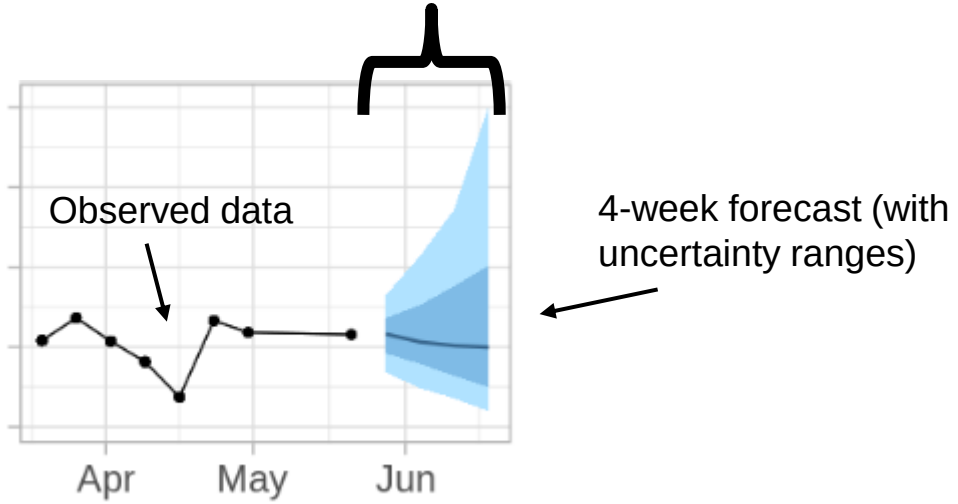
25 May 2022, 15:30-16:30 CET

ECDC's COVID-19 Modelling Hubs

2021:

- **European COVID-19 Forecast hub** with 30+ modelling teams globally forecasting COVID-19 outcomes in Europe to inform policy advice
- Focus on **short-term forecasts over 1-4 weeks**; ensemble forecasts from multiple models performed reliably well!

https://covid19forecasthub.eu



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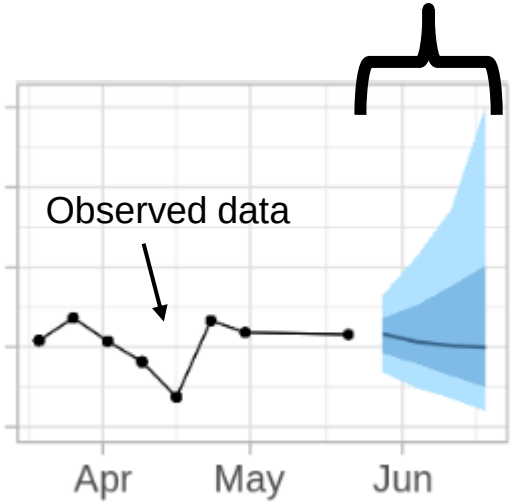
2022/Today:

- **European COVID-19 Scenario hub** for **longer-term projections of scenarios over 6-12 months** to explore leading causes of uncertainty about future COVID-19 outcomes

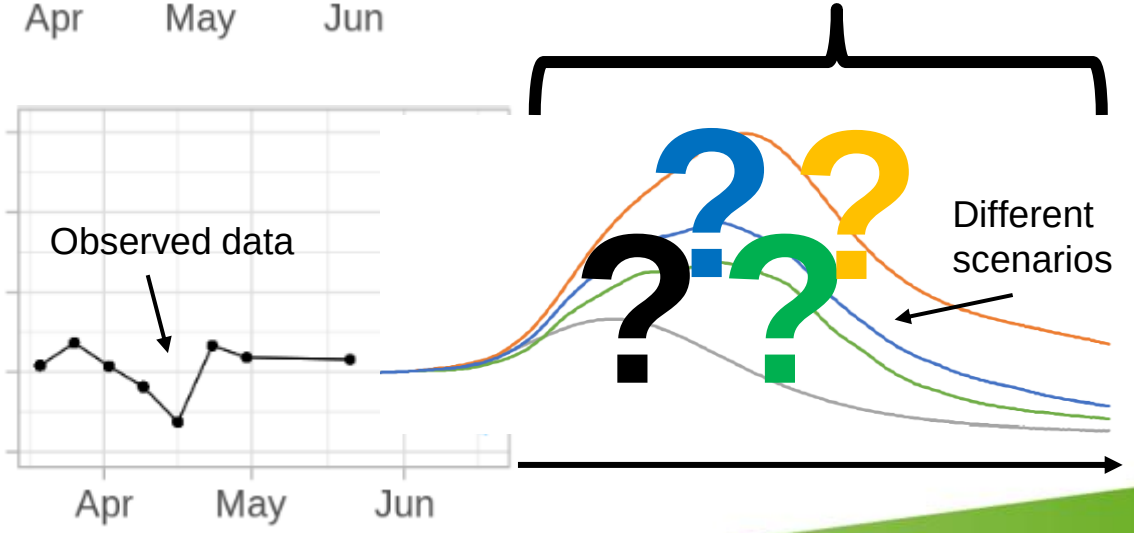
European COVID-19 ForecastHub

https://covid19forecasthub.eu



European COVID-19 ScenarioHub

https://covid19scenariohub.eu



ECDC's COVID-19 Modelling Hubs

EuropeanCOVID-19 ForecastHub

https://covid19forecasthub.eu

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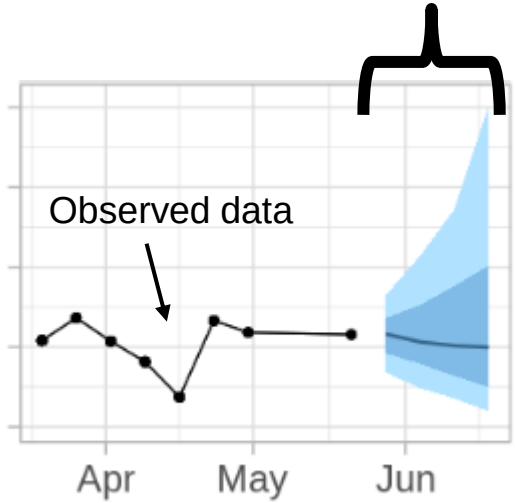

EuropeanCOVID-19 ScenarioHub

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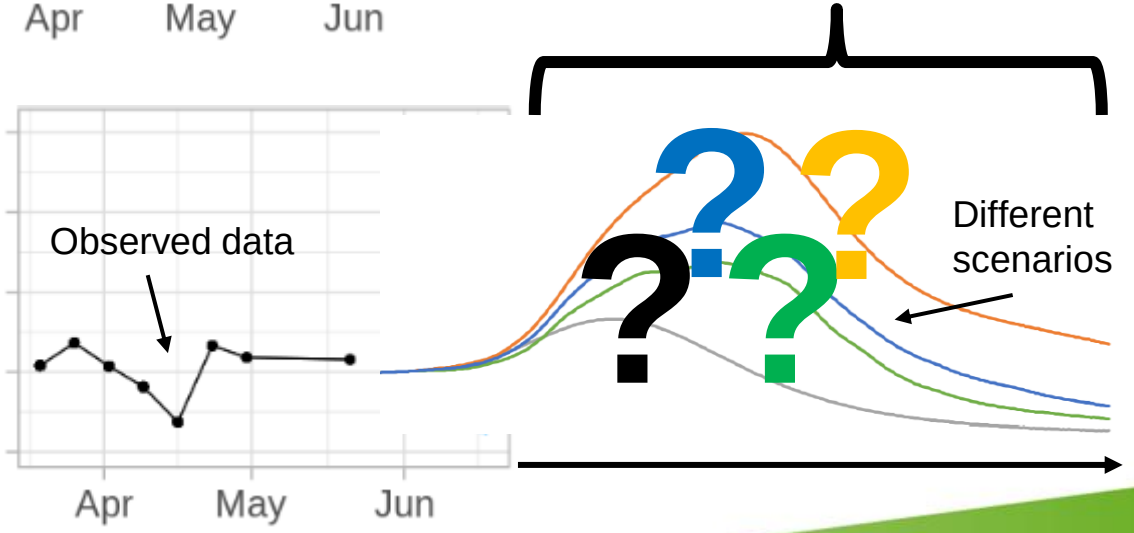


- Both hubs have focussed on building a **collaborative community** of modellers

Event aims today & agenda

- Highlight the potential of collaborative modelling
- Give context to the new European COVID-19 Scenario Hub
- Reach out to modellers interested in participating

Part	Time	Topic	Speaker
1	15:30	Welcome and introduction	Frank Sandmann (ECDC)
	15:35	European COVID-19 Forecast Hub	Sebastian Funk (LSHTM)
	15:40	US COVID-19 Scenario Modelling Hub	Katriona Shea (Penn State)
	15:50	European COVID-19 Scenario Hub	Katharine Sherratt (LSHTM)
	16:00	Address by the Chief Scientist of ECDC	Mike Catchpole (ECDC)
2	16:05	Q&A	All
	16:10	Technical discussion with modelling teams intending to submit to Round 1	All modellers interested in participating

Address by the Director of ECDC - Dr Andrea Ammon

“The launch of the COVID-19 Scenario hub today underlines ECDC’s value of using infectious disease modelling for public health decision making to strengthen Europe's health security.

As we transition into new phases of the COVID-19 pandemic, the results of this hub will support ECDC's risk analysis, assessment of public health advice, and strategic planning for anticipatory action in the EU/EEA Member States in 2022/2023.

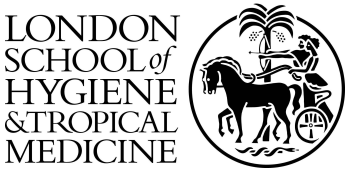
This is an exciting initiative to advance scientific collaboration and our understanding of possible future developments of COVID-19.

My heartfelt thanks to everyone being here today, and to everyone in the modelling community who has been engaging in ECDC’s COVID-19 Forecasting and Scenario hubs.”

European Covid-19 Forecast Hub

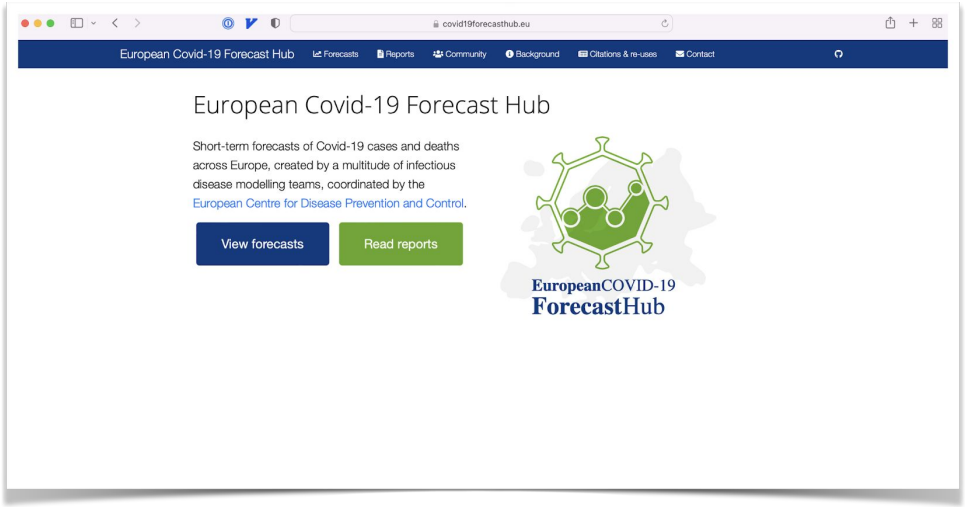
25 May 2022

Kath Sherratt, Hugo Gruson, Sebastian Funk
https://epiforecasts.io
London School of Hygiene & Tropical Medicine
with
Helen Johnson, Rene Niehus, Rok Grah,
Frank Sandmann, Bastian Prasse (ECDC)
Johannes Bracher + team (KIT)
Nick Reich + team (UMass-Amherst)



Forecast hub set up

- started in March 2021
- collates weekly forecasts (4 weeks ahead) of COVID-19 cases, hospitalisations and deaths in 32 European countries from modelling teams worldwide
- 58 unique models (currently: 18) from 37 teams
- ca. 5 million forecast values (incl. uncertainty)
- Model inputs combined into “ensemble forecast”



https://covid19forecasthub.eu

Central goals of Forecast Hub

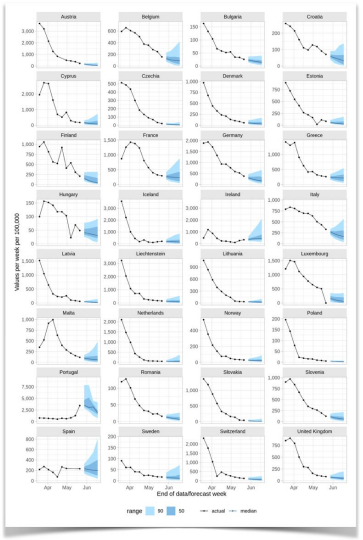
1. Provide decision-makers and general public with reliable information about where the pandemic is headed in the next month.
2. Gain insight into which modelling approaches do well.
3. Assess the reliability of forecasts for different measures of disease severity.
4. Create a community of infectious disease modelers underpinned by an open-science ethos.

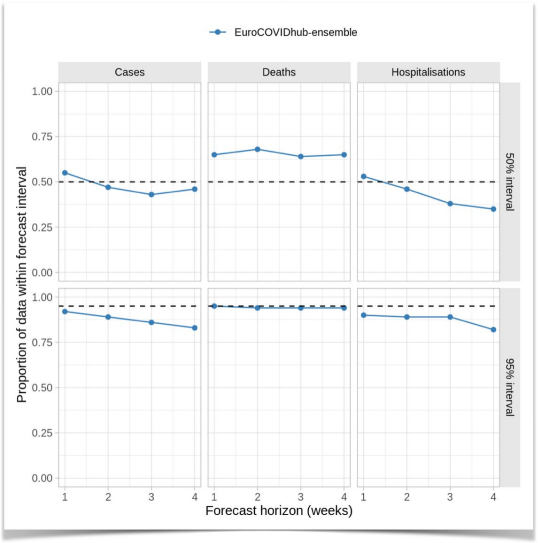
Taken from: Reich, 2021, https://covid19forecasthub.org/talks/202102-ECDC.pdf

Central goals of Forecast Hub

1. Provide decision-makers and general public with reliable information about where the pandemic is headed in the next month.

Weekly ECDC surveillance report

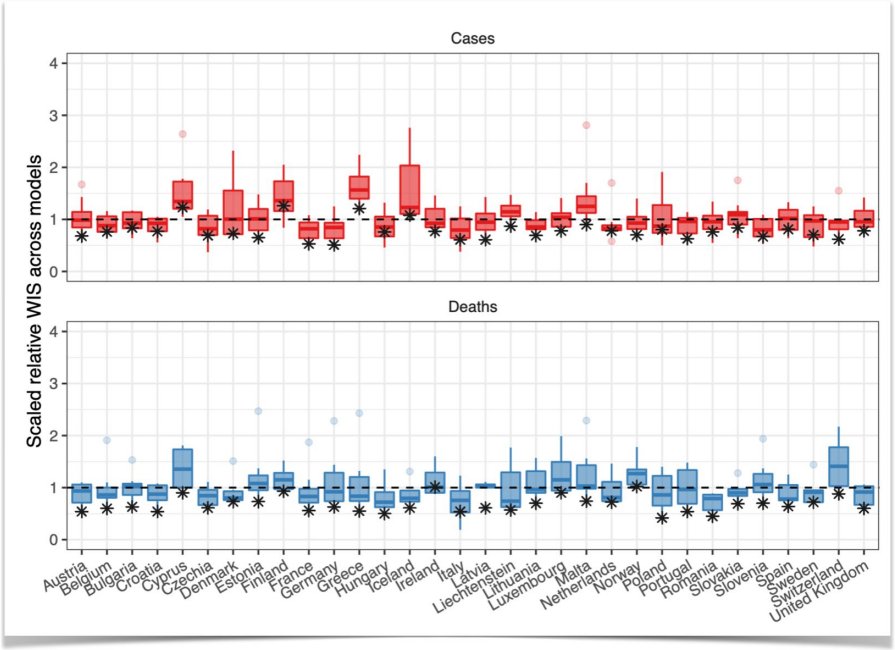


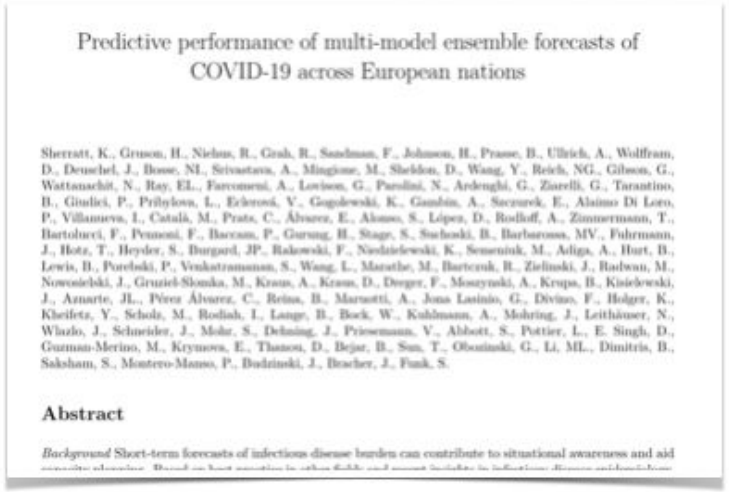


Weekly report on forecast performance

Central goals of Forecast Hub

2. Gain insight into which modelling approaches do well.
   - ensemble outperforms individual models





Predictive performance of multi-model ensemble forecasts of COVID-19 across European nations

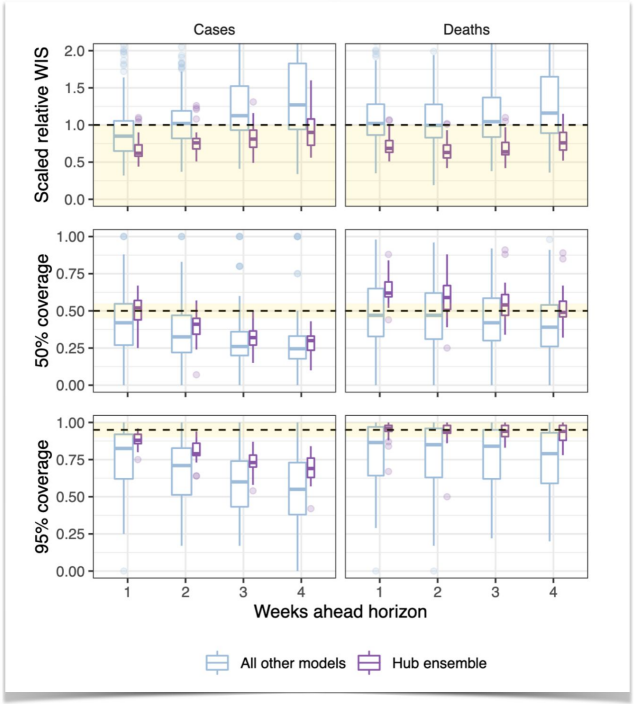
Sherratt, K., Gruson, H., Niehus, R., Grah, R., Sandman, F., Johnson, H., Prasse, B., Ullrich, A., Wolffram, D., Deuschel, J., Bosse, NI., Srivastava, A., Mingione, M., Sheldon, D., Wang, Y., Reich, NG., Gibson, G., Wattanachit, N., Ray, EL., Farcomeni, A., Lovison, G., Parolini, N., Ardenghi, G., Ziarelli, G., Tarantino, B., Giudici, P., Pribylova, L., Eclerová, V., Gogolewski, K., Gambin, A., Szczurek, E., Alaimo Di Loro, P., Villanueva, I., Català, M., Prats, C., Álvarez, E., Alonso, S., López, D., Rodloff, A., Zimmermann, T., Bartolucci, F., Pennoni, F., Baccam, P., Gurung, H., Stage, S., Suchoski, B., Barbarossa, MV., Fuhrmann, J., Hotz, T., Heyder, S., Burgard, JP., Rakowski, F., Niedzielewski, K., Semeniuk, M., Adiga, A., Hurt, B., Lewis, B., Porebski, P., Venkatramanan, S., Wang, L., Marathe, M., Bartczuk, R., Zielinski, J., Radwan, M., Nowosielski, J., Gruziel-Slomka, M., Kraus, A., Kraus, D., Dreger, F., Moszynski, A., Krupa, B., Kisielewski, J., Aznarte, JL., Pérez Álvarez, C., Reina, B., Marsotti, A., Jona Lasinio, G., Divino, F., Holger, K., Kheifetz, Y., Scholz, M., Rodiah, I., Lange, B., Bock, W., Kuhlmann, A., Mohring, J., Leithäuser, N., Wlazlo, J., Schneider, J., Mohr, S., Dehning, J., Priesemann, V., Abbott, S., Pottier, L., E. Singh, D., Guzman-Merino, M., Krymova, E., Thanou, D., Bejar, B., Sun, T., Obozinski, G., Li, ML., Dimitris, B., Saksham, S., Montero-Manso, P., Budzinski, J., Bracher, J., Funk, S.

Abstract

Background Short-term forecasts of infectious disease burden can contribute to situational awareness and aid

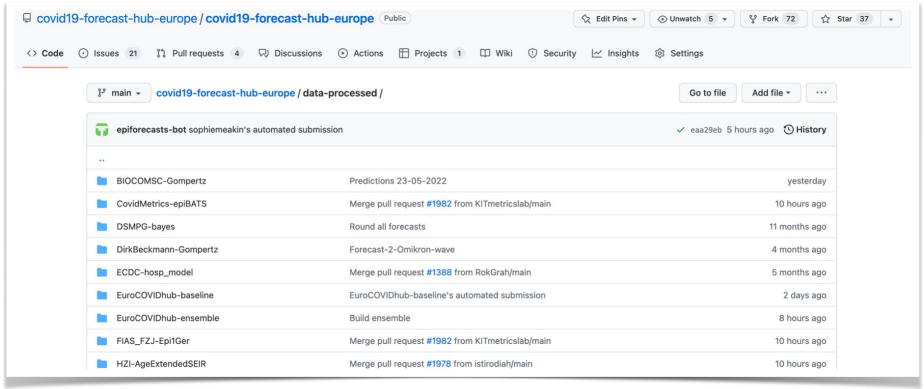
Central goals of Forecast Hub

3. Assess the reliability of forecasts for different measures of disease severity.



Central goals of Forecast Hub

4. Create a community of infectious disease modelers underpinned by an open-science ethos.
   - 58 unique models (currently: 18) from 37 teams
   - ca. 5 million forecast values (incl. uncertainty)
   - all openly available at https://github.com/covid19-forecast-hub-europe/covid19-forecast-hub-europe



Thanks to all contributors!

Agata Migalska, Ajitesh Srivastava, Akhil Sai Peddireddy, Alberto Cascajo Garcia, Alexander Kuhlmann, Alfio Quarteroni, Álvaro Ortiz, Amanda Ziemann, Andrea Kraus, Anil Vullikanti., Aniruddha Adiga, Anna Gambin, Antoine Flahault, Antoni Moszyński, Antonietta Mira, Arne Rodloff, Artur Kaczorek, Ashlynn Daughton, Barbara Pabjan, Barbara Tarantino ., Benjamin Bejar Haro, Benjamin Hurt, Berit Lange, Beth Hornbein, Blażej Miasojedow, Brad Suchoski, Brian Weaver, Bryan Lewis, Carrie Manore, César Pérez, Christine Choirat, Clara Prats, Courtney Shelley, Dan Sheldon, Dan Sheldon, Nick Reich, Daniel Israel, Daniel López, Daniel Rabczenko, Dave Osthus, David E. Singh, David Kraus, David Moriña, Dax Gerts, Dean Karlen, Deborah Shutt, Dimitris Bertsimas, Dorina Thanou, Dr. Dirk Beckmann, Ekaterina Krymova, Elisa Manetti, Enric Álvarez, Evan Ray, Ewa Rafajłowicz, Ewa Szczurek, Ewaryst Rafajłowicz, Fernando Blat, Francesco Bartolucci, Franciszek Rakowski, Frost Tianjian Xu, Fulvia Pennoni, Gavin Lee, Geoffrey Fairchild, Giovanni Ardenghi, Giovanni Ziarelli, Graham Gibson, Grzegorz Redlarski, Guillaume Obozinski, Hamza Tazi Bouardi, Heidi Gurung, Holger Kirsten, Isti Rodiah, Jakub Zieliński, Jan Fuhrmann, Jan H. Meinke, Jan Kisielewski, Jan Mohring, Jan Pablo Burgard, Jan Trnka, Janez Zibert, Jędrzej Nowosielski, Jesus Carretero, Jiangzhou Chen, Johannes Bracher, Jonas Dehning, José Almagro, José L. Aznarte, Jozef Budzinski, Julie Spencer, Karol Niedzielewski, Katharine Sherratt, Krzysztof Gogolewski, Lauren Castro, Lenka Pribylova, Lijing Wang, Loïc Pottier, Lori Dauelsberg, Luca Dede', Łukasz Górski, Maciej Radwan, Madhav Marathe, Magdalena Gruziel-Słomka, Magdalena Rosińska, Manhong Smith, Marcin Bodych, Marcin Semeniuk, Marco Mingione, Marek Bawiec, Maria Cristina Marinescu, Maria V. Barbarossa, Markus Scholz, Martí Català, Martin Camitz, Martin Šmíd, Michael Helmling, Michael Lingzhi Li, Miguel Guzman Merino, Milan Zajíček, Morgan Gorris, Neele Leithäuser, Nick Reich, Nicola Parolini, Nidhi Parikh, Nikos Bosse, Pablo Montero Manso, Paolo Giudici, Pedro Álvarez - Roxu, Pierfrancesco Alaimo Di Loro, Pierre Nouvellet, Pratizio Vanella, Przemyslaw Biecak, Przemyslaw Biecek, Przemyslaw Porebski, Rafał Bartczuk, Rene Niehus, Robert Walraven, Rok Grah, Sam Abbott, Sangeeta Bhatia, Sara Del Valle, Sebastian B. Mohr, Sergio Alonso, Sharon Kuhlmann-Berenzon, Sid Baccam, Sophie Meakin, Srinivasan Venkatramanan, Stefan Heyder, Stefan Krieg, Steve Stage, Tao Sun, Thomas Hotz, Tom Zimmermann, Tomasz Ozanski, Travis Pitts, Tyll Krüger, Veronika Eclerova, Viktor Bezborodov, Viola Priesemann, Vít Tuček, Wojciech Rafajłowicz, Wolfgang Bock, Yuri Kheifetz

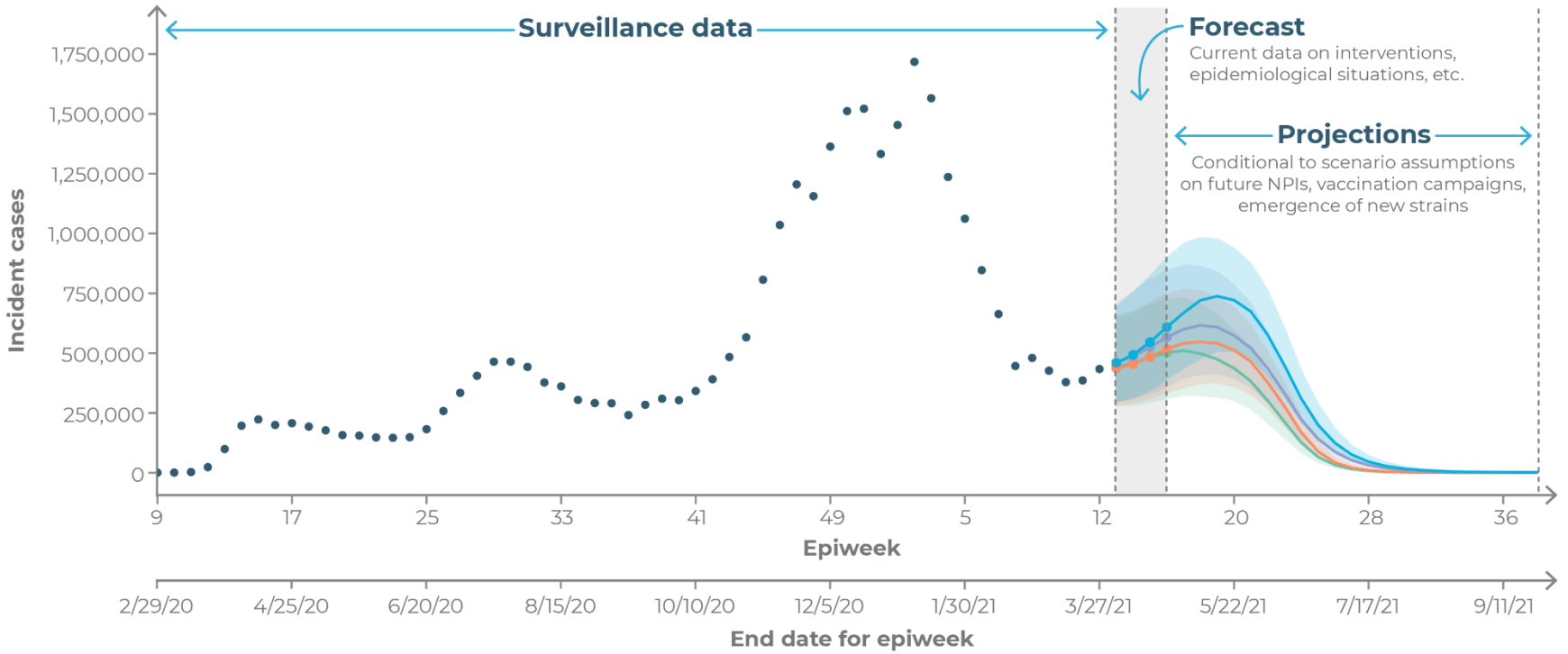
COVID-19
ScenarioModelingHub

The (US) COVID-19 Scenario Modeling Hub

Katriona Shea, The Pennsylvania State University
on behalf of all Hub collaborators

PennState Huck Institutes of the Life Sciences
Infectious Disease DYNAMICS
University of Massachusetts Amherst
NIH Fogarty
INTERNATIONAL VACCINE ACCESS CENTER
MIDAS
University of Pittsburgh
APL JOHNS HOPKINS APPLIED PHYSICS LABORATORY
UNIVERSITY of VIRGINIA BIOCOMPLEXITY INSTITUTE
USC University of Southern California
MOBS LAB
Northeastern University
UNIVERSITY OF NOTRE DAME
COLUMBIA UNIVERSITY
UNIVERSITY OF NORTH CAROLINA CHARLOTTE
COVID-19 ScenarioModelingHub
COVID-19 ForecastHub
THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

COVID-19 ScenarioModelingHub



Open Hub collects and aggregates projections from multiple modeling teams of US public health outcomes (cases, hospitalizations and deaths) over ~6 months at the state and national level.

SCIENCE AND DECISION-MAKING: COVID-19

Harnessing multiple models for outbreak management

Expert elicitation methods and a structured decision-making framework will help account for risk and uncertainty

By **Katriona Shea[1], Michael C. Runge[2], David Pannell[3], William J. M. Probert[4], Shou-Li Li[5], Michael Tildesley[6], Matthew Ferrari[1]**

lems that arise in group interactions, such as agreeing with field "leaders" (dominance effects), focusing on suggestions raised early in the process to the detriment of other ideas

SCIENCE sciencemag.org

8 MAY 2020 • VOL 368 ISSUE 6491

https://midasnetwork.us/mmods/

COVID-19 ForecastHub

The RAPIDD ebola forecasting challenge: Synthesis and lessons learnt

Cécile Viboud[a,*], Kaiyuan Sun[b], Robert Gaffey[a], Marco Ajelli[c], Laura Fumanelli[c], Stefano Merler[c], Qian Zhang[b], Gerardo Chowell[a,d], Lone Simonsen[a,e], Alessandro Vespignani[b,f,g], the RAPIDD Ebola Forecasting Challenge group[1]

[a] Division of International Epidemiology and Population Studies, Fogarty International Center, National Institutes of Health, Bethesda, MD, USA
[b] Laboratory for the Modeling of Biological and Socio-technical Systems, Northeastern University, Boston, MA, USA
[c] Bruno Kessler Foundation, Trento, Italy
[d] School of Public Health, Georgia State University, Atlanta, GA, USA
[e] Department of Global Health, George Washington University, Washington DC, USA
[f] Institute for Quantitative Social Sciences at Harvard University, Cambridge, MA, USA
[g] Institute for Scientific Interchange Foundation, Turin, Italy

COVID-19 ScenarioModelingHub

Both operational and research goals

Addresses uncertainty

- Multiple scenarios
- Multiple models
- Probabilistic projections

A collaborative multiyear, multimodel assessment of seasonal influenza forecasting in the United States

Nicholas G. Reich[a,1], Logan C. Brooks[b], Spencer J. Fox[c], Sasikiran Kandula[d], Craig J. McGowan[e], Evan Moore[a], Dave Osthus[f], Evan L. Ray[g], Abhinav Tushar[a], Teresa K. Yamana[d], Matthew Biggerstaff[e], Michael A. Johansson[h], Roni Rosenfeld[i], and Jeffrey Shaman[d]

3146–3154 | PNAS | February 19, 2019 | vol. 116 | no. 8

COVID-19 ScenarioModelingHub

Coordination Team

Katriona Shea, Justin Lessler, Cécile Viboud, Rebecca Borchering, Emily Howerton, Shaun Truelove, Claire Smith, Michelle Qin, Nicholas Reich, Michael Runge, Lucie Contamin, John Levander, Jessica Salerno, Wilbert van Panhuis, Harry Hochheiser, Luke Mullany

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
- **John Hopkins University-IDD-COVIDSP**: Joseph C. Lemaitre, Juan Dent Hulse, Kyra H. Grantz, Joshua Kaminsky, Stephen A. Lauer, Elizabeth C. Lee, Justin Lessler, Hannah R. Meredith, Javier Perez-Saez, Shaun A. Truelove, Claire P. Smith, Lindsay T. Keegan, Kathryn Kaminsky, Sam Shah, Josh Wills, Pierre-Yves Aquilanti, Karthik Raman, Arun Subramaniyan, Greg Thursam, Anh Tran
- **North Carolina State University-COVSIM**: Erik Rosenstrom, Jessica Mele, Julie Swann, Julie Ivy, Maria Mayorga
- **Northeastern University MOBS GLEAM COVID**: Matteo Chinazzi, Jessica T. Davis, Kunpeng Mu, Xinyue Xiong, Ana Pastore y Piontti, Alessandro Vespignani
- **University of Florida – ABM**: Thomas Hladish, Alexandar Pillai, Kok Ben Toh, Ira Longini Jr.
- **University of North Carolina at Charlotte – UNCC-hierbin**: Shi Chen, Rajib Paul, Daniel Janies, Jen-Claude Thill
- **University of Notre Dame - FRED**: Guido Espana, Sean Cavany, Sean Moore, Alex Perkins
- **University Southern California SlkJalpha**: Ajitesh Srivastava, Majd Al Aawar
- **University of Texas at Austin-ImmunoSEIRS**: Anass Bouchnita, Spencer Fox, Michael Lachmann, Lauren Ancel Meyers, UT COVID-19 Modeling Consortium
- **University of Victoria**: Dean Karlen
- **University of Virginia-adaptive:** Przemyslaw Porebski, Srini Venkatramanan, Anniruddha Adiga, Bryan Lewis, Brian Klahn, Joseph Outten, James Schlitt, Patric Corbett, Pyrros Alexander Telionis, Lijing Wang, Akhil Sai Peddireddy, Benjamin Hurt, Jiangzhou Chen, Anil Vullikanti, Madhav Marathe
- **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); Nicole Samay (Northeastern)

scenariohub@midasnetwork.us

https://github.com/midas-network/covid19-scenario-modeling-hub

https://covid19scenariomodelinghub.org/

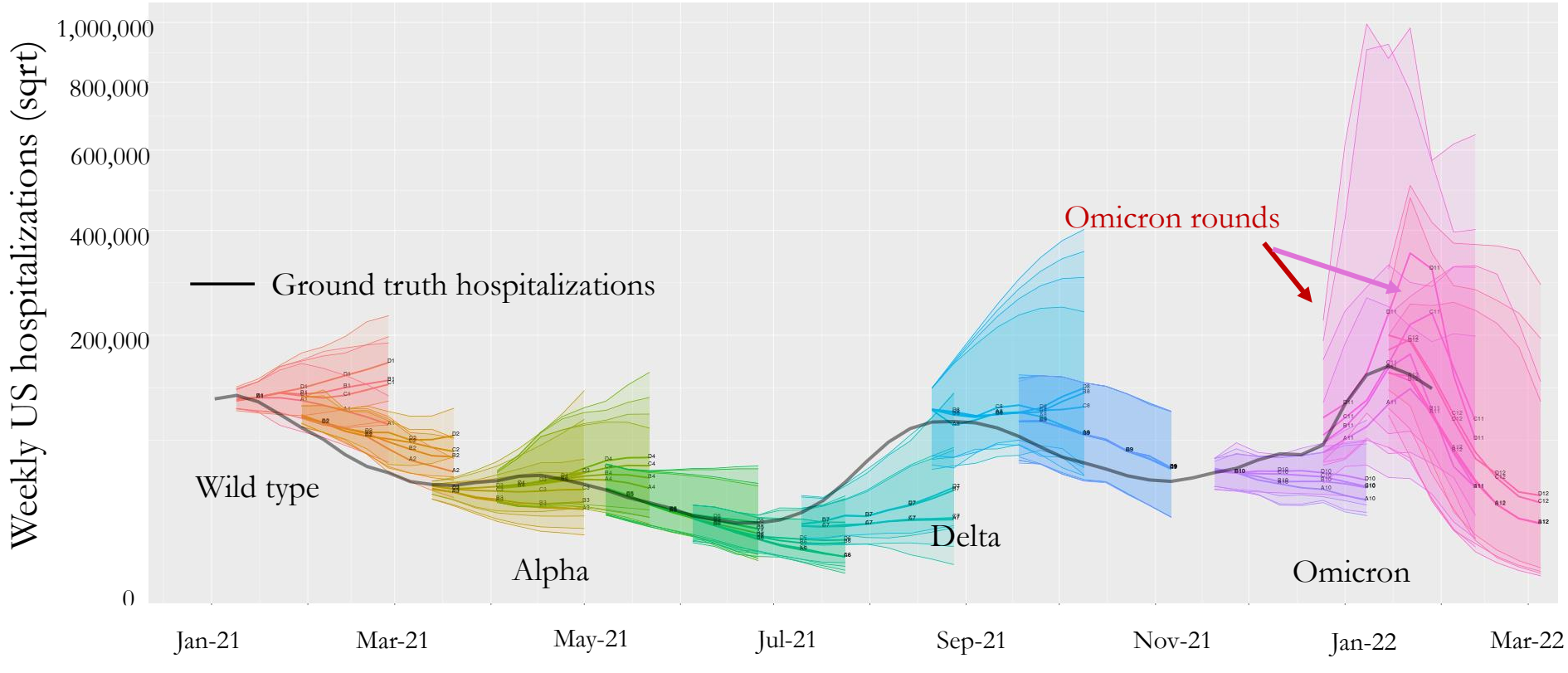
COVID-19 ScenarioModelingHub

Fourteen model rounds since Dec 2020, open call, 6-10 models projected 4 scenarios per round:

1. Vaccine supply and non-pharmaceutical interventions [2020-12-22]
2. More transmissible variant (B.1.1.7) and NPIs [2021-01-22]
3. Vaccine supply and NPIs [2021-3-5]
4. Vaccine supply and NPIs [2021-3-28]
5. Vaccine hesitancy and NPIs [2021-5-2]
6. More transmissible variant and vaccine hesitancy [2021-06-08]
7. Delta variant and vaccine hesitancy [2021-07-06]
8. Immune waning and severity of re-infection [2021-08-17, training round]
9. Childhood vaccination and variant of increased transmissibility [2021-09-14]
10. Immune waning and boosters [2021-11-09]
11. Omicron emergency round I
12. Omicron emergency round II
13. Waning and new variant
14. Boosters and new variant

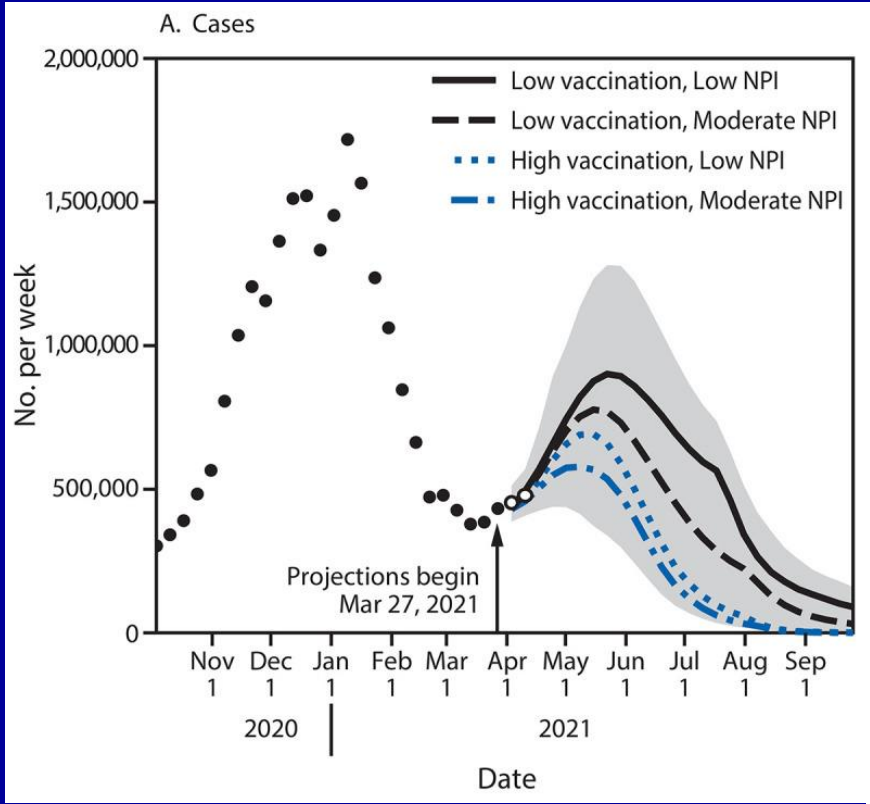
https://github.com/midas-network/covid19-scenario-modeling-hub
https://covid19scenariomodelinghub.org/

Multiple rounds of scenario projections



Projections shared with CDC, WH, CFA, CSTE, WHO, local health departments, public website, media

Round 4: Vaccination and Nonpharmaceutical Intervention (NPI) scenarios



White House COVID-19 press briefing on May 5th, 2021, by Dr. Walensky, CDC Director.

2 x 2 scenario design

- Uncertainty
- Decision

Centers for Disease Control and Prevention

MMWR

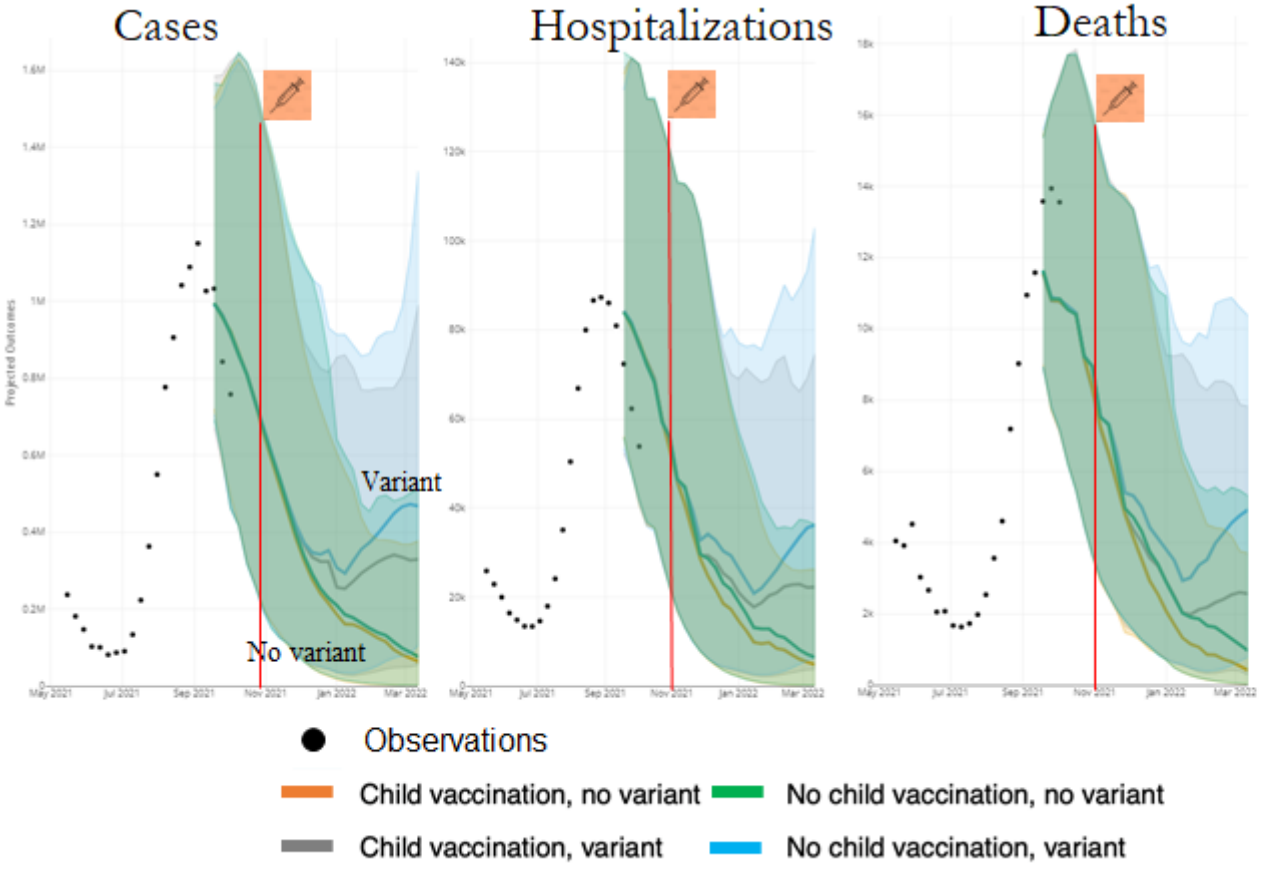
Morbidity and Mortality Weekly Report

Early Release / Vol. 70 May 5, 2021

Modeling of Future COVID-19 Cases, Hospitalizations, and Deaths, by Vaccination Rates and Nonpharmaceutical Intervention Scenarios — United States, April–September 2021

Rebecca K. Borchering, PhD[1,*]; Cécile Viboud, PhD[2,*]; Emily Howerton[1]; Claire P. Smith[3]; Shaun Truelove, PhD[3]; Michael C. Runge, PhD[4]; Nicholas G. Reich, PhD[5]; Lucie Contamin, MS[6]; John Levander[6]; Jessica Salerno, MPH[6]; Wilbert van Panhuis, PhD[6]; Matt Kinsey, PhD[7]; Kate Tallaksen, MS[7]; R. Freddy Obrecht, PhD[7]; Laura Asher, MPS[7]; Cash Costello, MS[7]; Michael Kelbaugh[7]; Shelby Wilson, PhD[7]; Lauren Shin[7]; Molly E. Gallagher, PhD[7]; Luke C. Mullany, PhD[7]; Kaitlin Rainwater-Lovett, PhD[7]; Joseph C. Lemaitre, MS[8]; Juan Dent, ScM[3]; Kyra H. Grantz[3]; Joshua Kaminsky, MS[3]; Stephen A. Lauer, PhD[3]; Elizabeth C. Lee, PhD[3]; Hannah R. Meredith, PhD[3]; Javier Perez-Saez, PhD[3]; Lindsay T. Keegan, PhD[9]; Dean Karlen, PhD[10]; Matteo Chinazzi, PhD[11]; Jessica T. Davis[11]; Kunpeng Mu[11]; Xinyue Xiong, MSc[11]; Ana Pastore y Piontti, PhD[11]; Alessandro Vespignani, PhD[11]; Ajitesh Srivastava, PhD[12]; Przemyslaw Porebski, PhD[13]; Srinivasan Venkatramanan, PhD[13]; Aniruddha Adiga, PhD[13]; Bryan Lewis, PhD[13]; Brian Klahn, MS[13]; Joseph Outten[13]; James Schlitt, PhD[13]; Patrick Corbett[13]; Pyrros Alexander Telionis, PhD[13]; Lijing Wang, MS[13]; Akhil Sai Peddireddy[13]; Benjamin Hurt, MS[13]; Jiangzhuo Chen, PhD[13]; Anil Vullikanti, PhD[13]; Madhav Marathe, PhD[13]; Jessica M. Healy, PhD[14]; Rachel B. Slayton, PhD[14]; Matthew Biggerstaff, ScD[14]; Michael A. Johansson, PhD[14]; Katriona Shea, PhD[1,†]; Justin Lessler, PhD[3,†]

Round 9: Childhood vaccination
Sep 12, 2021 – Mar 12, 2022



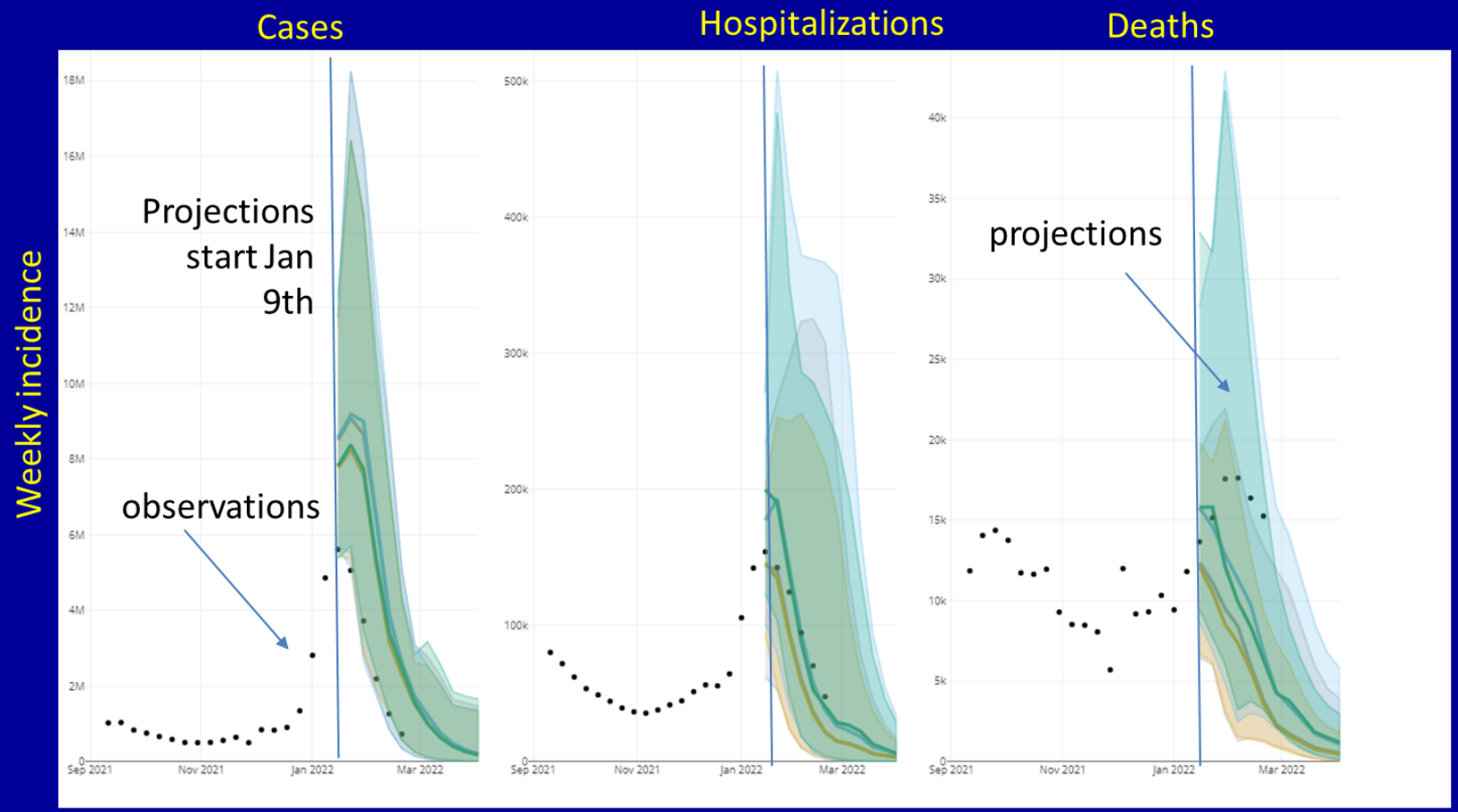
National projections and 95% projections intervals

Contributing Teams:

Columbia
JHU-APL
JHU-IDD
NEU
Notre Dame
UNCC
USC
UVA-adaptive
UVA-EpiHiper

This information was presented to the CDC's advisory committee (ACIP) as it considered authorization and guidance on vaccinating 5-11 year olds

2 Omicron rounds
Reported on Dec 31, 2021 and Jan 20, 2022



Round 12: 10 teams

Hub Benefits

Making decisions is challenging for highly uncertain, time-sensitive, consequential situations

- Multiple models help us to deal rapidly with uncertainty
- Careful scenario design allows us to address both uncertainty and decisions
- The ensemble performs consistently better than any individual model
- Aggregated long-term projections provide clear guidance for decision makers

We look forward to learning from the new EU Scenario Modelling Hub!

COVID-19 ScenarioModelingHub

Questions? Comments?
k-shea@psu.edu

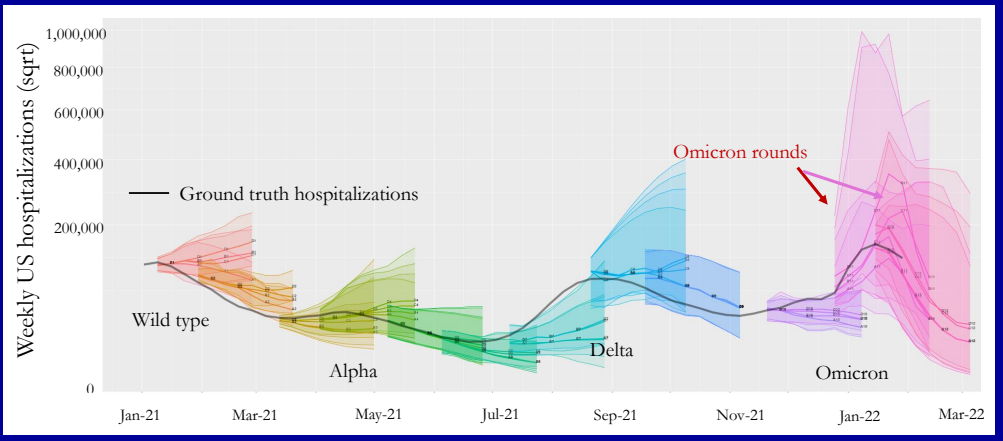
SCIENCE AND DECISION-MAKING: COVID-19

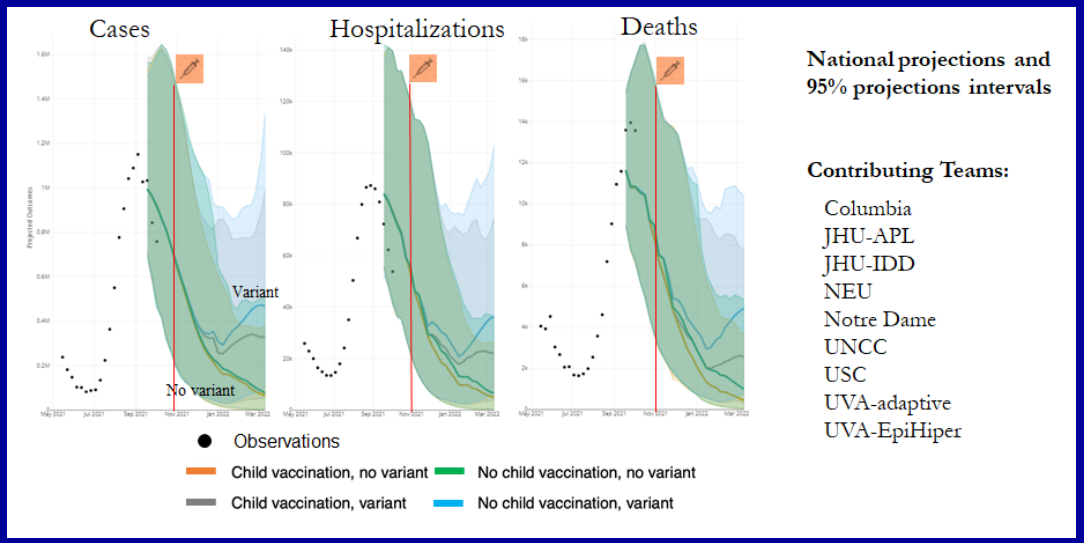
Harnessing multiple models for outbreak management

Expert elicitation methods and a structured decision-making framework will help account for risk and uncertainty

By **Katriona Shea[1], Michael C. Runge[2], David Pannell[3], William J. M. Probert[4], Shou-Li Li[5], Michael Tildesley[6], Matthew Ferrari[1]**

lems that arise in group interactions, such as agreeing with field "leaders" (dominance effects), focusing on suggestions raised early in the process to the detriment of other ideas





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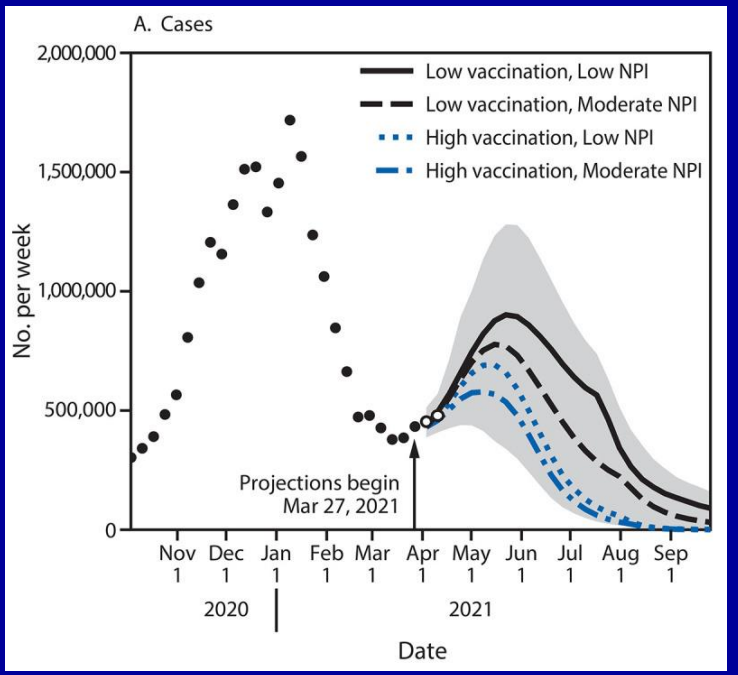


The European COVID-19 Scenario Hub

Katharine Sherratt, London School of Hygiene and Tropical Medicine
with Hugo Gruson, Sebastian Funk (LSHTM), Rene Niehus, Rok Grah, Frank Sandmann (ECDC)

The European COVID-19 Scenario Hub

Aim

To **explore and bound the uncertainty** around future COVID-19 outcomes, for 32 European countries over 3-12 months

Process

- **Scenarios** isolate fundamental drivers of COVID-19 dynamics
- **Models** encode the influence of these drivers on COVID-19 outcomes
- **Projections** demonstrate the relative impact of different variables, given current knowledge

Outcomes

- **Policy relevant knowledge:** Scenarios relevant to inform long-term public health planning for COVID-19
  - Output: ECDC policy recommendations
- **Scenario modelling methods:** Insight into how varying modelling approaches relates to variation in outcomes
  - Output: joint-authorship Hub paper
- **Collaborative open science:** Create a community of infectious disease modelers underpinned by an open-science ethos
  - Output: public, accessible data, supported by open source software

Scenarios: Round 0

Immunity to infection	Introduction of a new variant: **No new variant** • Projections are initialized with the mix of strains circulating at the start of the projection period	Introduction of a new variant: **New variant X** • *Introduction:* From May 1st 2022 is a **continuous influx** of 50 weekly infections of variant X over 16 weeks • *Characteristics:* Variant X has **30% immune escape**, and the **same intrinsic transmissibility and severity** as Omicron.
Optimistic waning of protection • *Speed:* **10 months** median time to transition to partial immunity • *Plateau:* **40% reduction** in protection from baseline (protection immediately after exposure) at plateau	*Scenario A*	*Scenario B*
Pessimistic waning of protection • *Speed:* **4 months** median time to transition to partial immunity • *Plateau:* **60% reduction** in protection from baseline level at immune plateau	*Scenario C*	*Scenario D*

Scenarios: Round 1

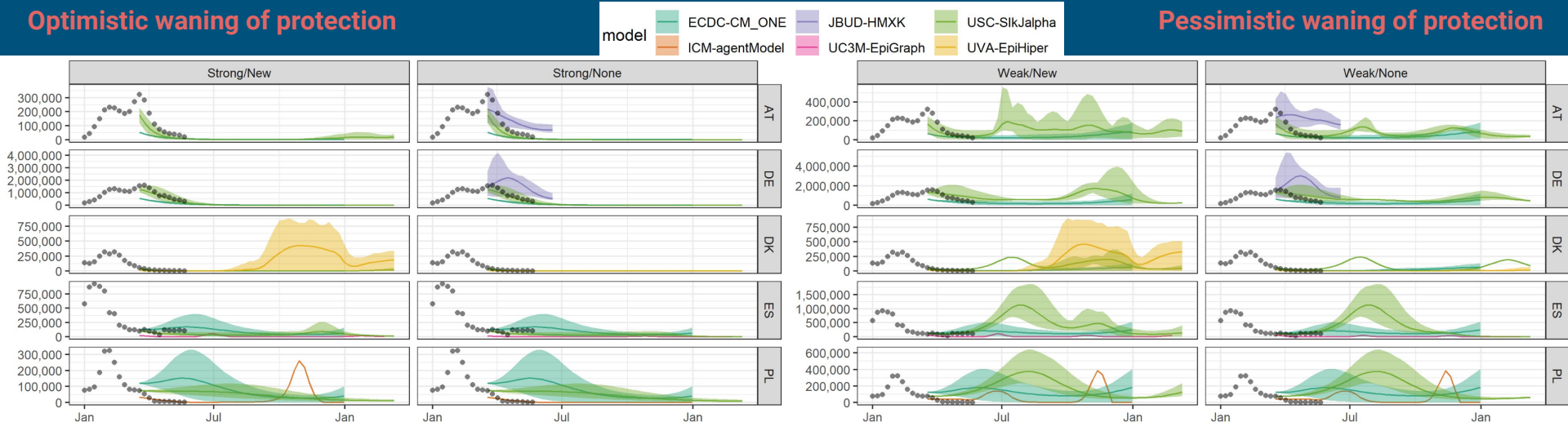
Immunity to infection	Timing of a booster vaccination: **Slow summer booster campaign** - 2nd booster recommended for 60+ - Uptake reaches 50% of 1st booster coverage by 15th December - Uptake starts **15th June**	Timing of a booster vaccination: **Fast autumn booster campaign** - 2nd booster recommended for 60+ - Uptake reaches 50% of 1st booster coverage by 15th December - Uptake starts **15th September**
Optimistic waning of protection - 60% reduction in immunity against infection - **8 months** median transition time to reduced protection	*Scenario A*	*Scenario B*
Pessimistic waning of protection - 60% reduction in immunity against infection - **3 months** median transition time to reduced protection	*Scenario C*	*Scenario D*

Round 0: multi-model projections

- 20 independent teams joined calls and/or submitted models
- 8 teams started working on Round 0; 5 teams contributed results
- Five countries with >2 model projections

Optimistic waning of protection

Pessimistic waning of protection



Round 0: challenges

Issues with the Hub set up

- Few multi-country models
  - Limited team capacity
- Quantile format prevents deeper analysis
  - Unclear to what extent quantile submissions blur the frequency/magnitude of epidemic cycles among many model simulations
  - Cannot deduce cumulative counts, so can't estimate the overall impact of each scenario
  - Mitigation: submissions can now use samples

Issues with interpretation

- Scenario specification and overlap
  - Waning protection: asymmetrical parameter values in terms of plausibility of optimistic and pessimistic scenarios
  - New variant: sensitivity to 30% immune escape?
- Technical challenge of immune waning parameters
  - For some models this meant re-estimating transmissibility between waning scenarios

Round 0: conclusions

Scientific interpretation

- Results consistent with the speed of waning protection against infection as a more significant factor in future outbreaks, compared to a new variant with some immune escape

Policy relevance

- Greater consideration for the timing of vaccination programmes relative to waning protection, rather than as a response to new variant introductions

Interpret with caution:

- Models intended as experimental for the pilot round, and we found substantial variation between models as well as between countries and scenarios
- Results may be biased by both submission constraints and scenario confounding