Center for Forecasting & Outbreak Analytics (CFA)

Better Data, Better Analytics, Better Response

CFA 101 for Industry Event

Thank you for joining us!
Our broadcast will begin shortly

April 21, 2022

Washington, DC

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Center for Forecasting and Outbreak Analytics (CFA)

Opening Remarks – Alison Kelly, CDC/CFA

April 21, 2022

Washington, DC

Participation

Online Participation

- Please email all questions to CFA@CDC.GOV

In-Person Participation

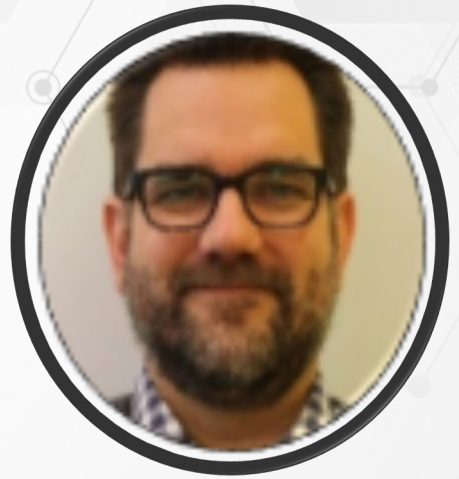
- Please raise your hand to ask a question during the designated Q&A sessions

Today's Agenda

Thursday April 21st, 2022	Agenda
10:00 – 10:15	Welcome Address – Alison Kelly, CDC/CFA
10:15 – 10:30	Introduction to CFA: Purpose, Mission, Vision – Dylan George, CDC/CFA
10:30 – 11:00	Keynote Speaker – Nirav Shah, Stanford University
11:00 – 11:10	Predict Division Overview – Marc Lipsitch, CDC/CFA
11:10 – 11:20	Inform Division Overview – Caitlin Rivers, CDC/CFA
11:20 – 11:30	Technology & Innovation Division Overview – Rebecca Kahn, CDC/CFA
11:30 – 12:00	Q&A
12:00 – 1:30	Lunch on your own
1:30 – 1:35	Afternoon Session Overview – Alison Kelly, CDC/CFA
1:35 – 2:20	Industry Panel: Data, Analytics, and Technology Requirements to Transform Health Emergency Response
2:20 – 2:55	Lightning Talks by Industry Leaders
2:55 - 3:00	Closing Remarks – Dylan George, CDC/CFA

Center for Forecasting and Outbreak Analytics (CFA)

Introduction to CFA: Purpose, Mission, Vision – Dylan George, CDC/CFA



April 21, 2022

Washington, DC

CFA Leadership & Key Players

Dylan George
Director of Operations

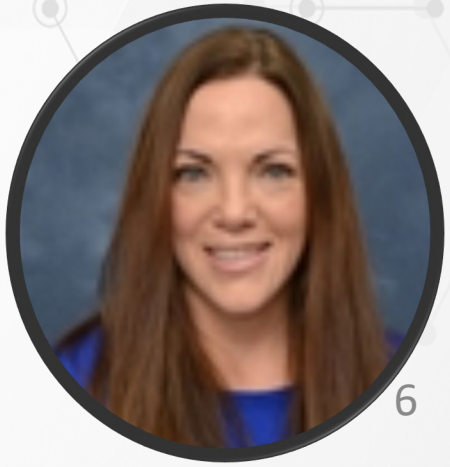
Marc Lipsitch
Director of Science

Alison Kelly
Deputy Director

Caitlin Rivers
Associate Director

Rebecca Kahn
Senior Scientist

Karen Stamey
Management Officer



Problem Statement

Data for Action in a Pandemic

- Disease outbreaks are becoming more frequent and more disruptive.
- The nation lacks data, analytical systems to identify and respond quickly, effectively.
- The U.S. must improve these systems and develop capabilities for producing forecasts and analytics that leaders can use to make timely, informed decisions about how to best prepare for and respond to infectious disease threats.
- Models and analytics need to be responsive to concerns of underserved communities, and address issues of health equity directly.

What is Forecasting and Outbreak Analytics and What is the Value?

Example COVID-19 Questions that Modeling Can Inform

- What is the probability of a future surge?
- What degree of immune escape in a variant would cause a surge?
- How many tests would be needed to support widespread diagnostic and screening testing?
- What role will vaccine availability for young children play in changing the epidemic's trajectory?
- How would 50% booster coverage change the epidemic's trajectory?

Proposed CFA Value in the Outbreak of Novel Pathogen

Make sense of uncertainty early in an outbreak

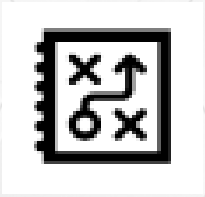
- Assess epidemic potential and severity
- Quantify risk and timing of imported cases
- Assess risk to the homeland

Provide early warning, situational awareness

- Develop good-bad-worst planning scenarios; bound uncertainty
- Assess expected impact of interventions
- Produce short term forecasts

Get critical data for the response

- Resource demand projections
- Inform design and targeting of prevention measures
- Monitor vax, treatment effectiveness over time
- Provide data to update scenarios and forecasts



Support policy and guidance

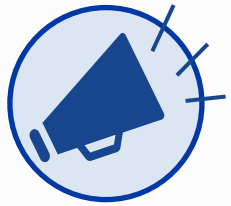
- Inform policy and guidance on:
- Border controls
- Testing, quarantine & isolation
- Countermeasure demand
- Vaccine prioritization
- Surveillance design

CDC Plans for Building the Center for Forecasting and Outbreak Analytics

CFA Organization

PREDICT

- Analytics team – Real-Time Monitoring team, Analytics Response Team
- Targeted studies
- Engagement, strategic partnerships



INFORM

- Federal support
- STLT decision support
- General public risk communication

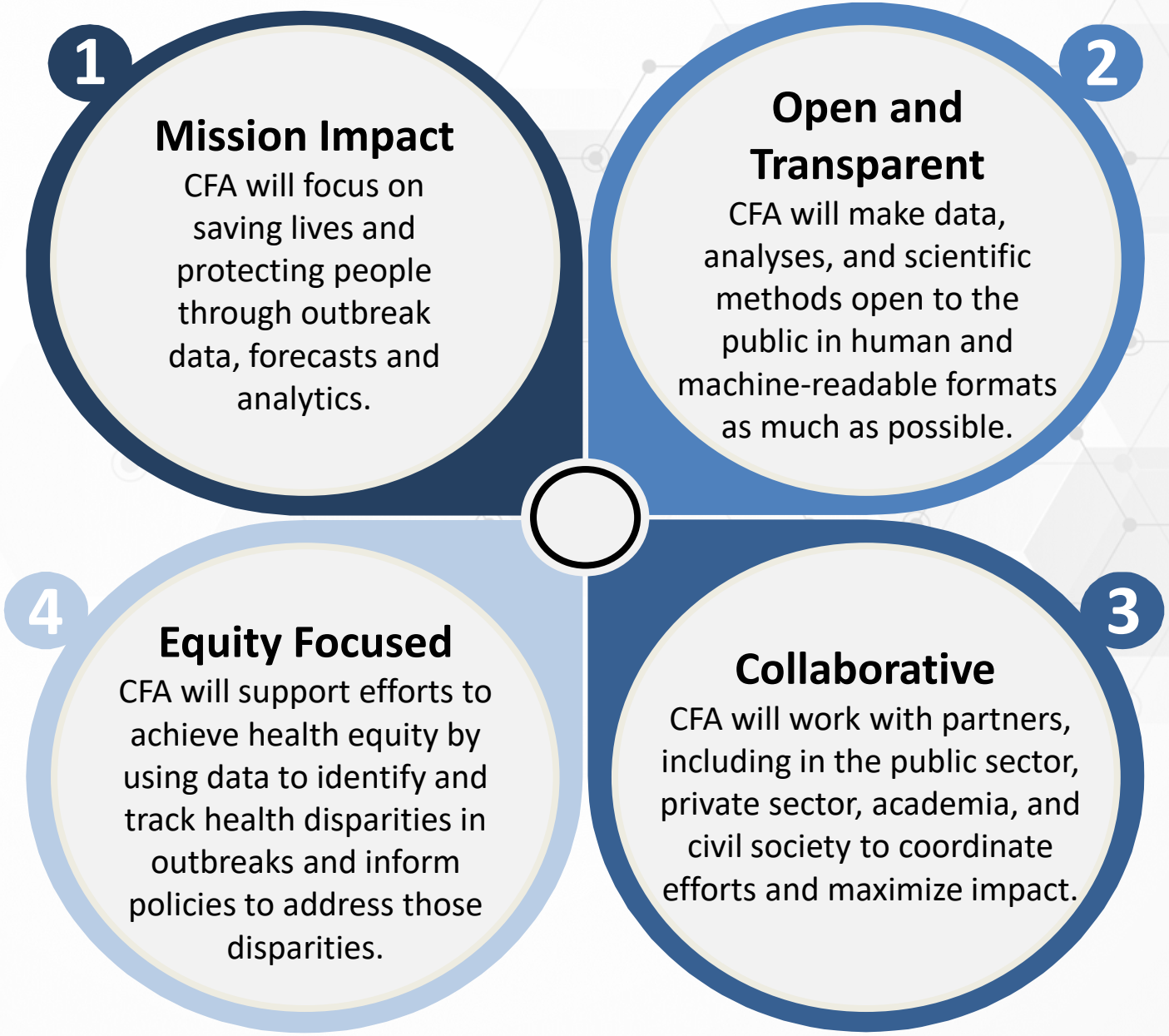
INNOVATE

- Science / contract management
- Product development – applications, enterprise
- Test beds – STLT, payer/provider

TECHNOLOGY

- Develop and Refine Technology for the Analytics Platform
- Build Products
- Establish CFA Data Requirements

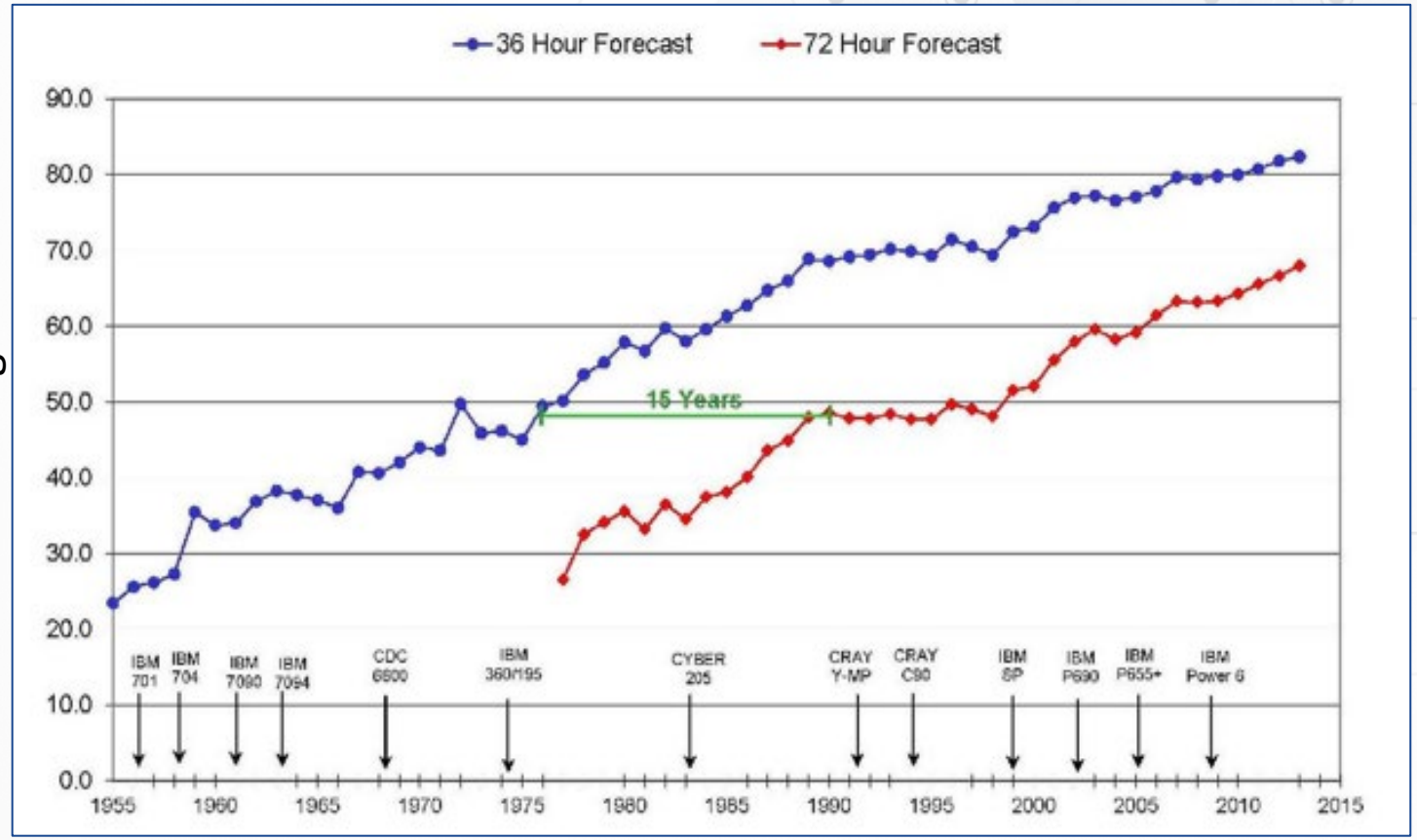
Principles to Guide Decisions



Developing Outbreak Analytics & Forecasting Will Take Time, Resources

Advancing Weather Forecasting: Took Time, Data, Models, and Resources to Develop

Increases in numerical weather forecasting skill through time



- Advancing weather forecasting capabilities took decades
- Needed ingredients:
  - Data
  - Models
  - People
  - Computational Power
  - Specific Use Cases
  - Sustained Funding
- Diseases forecasting, analytics still in early stages

Center for Forecasting and Outbreak Analytics

Keynote Speaker: Nirav Shah, Stanford University

April 21, 2022

Washington, DC

Accelerators of Actionable Data

Center for Forecasting and Outbreak Analytics
Industry Day – April 21, 2022
Great Hall, Washington, DC

Nirav R. Shah, MD, MPH
Senior Scholar, Stanford University
Chief Medical Officer, olea.health

Disclosures

- Senior Scholar at Stanford University
- Chief Medical Officer of olea.health
- Board Member at STERIS plc, CovidActNow.org, Kinsa
- Advisor to GSR Ventures

- Advisory Committee to the Director of the CDC
- Commissioner, Commonwealth Fund Commission on a National Public Health System
- Senior Fellow of the Institute for Healthcare Improvement (IHI)
- Trustee of the John A. Hartford Foundation
- Prior Board Chair, Linux Foundation Public Health
- Prior service as Commissioner, NY State Department of Health, and Chief Operating Officer, Kaiser Permanente in Southern California

All views expressed are my own

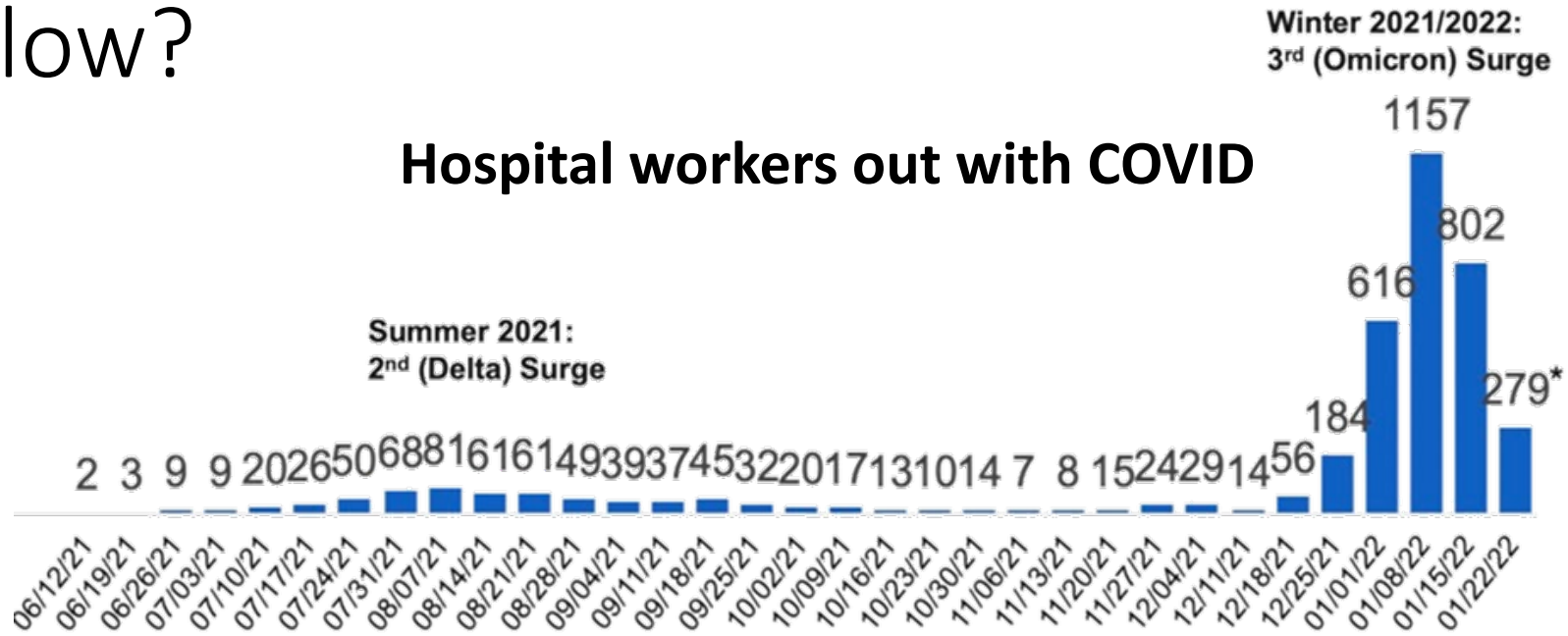
What metrics to follow?

- New infections
- ER visits (A/D/T feeds)
- Hospitalizations
- Beds available in ICUs
- Mortality

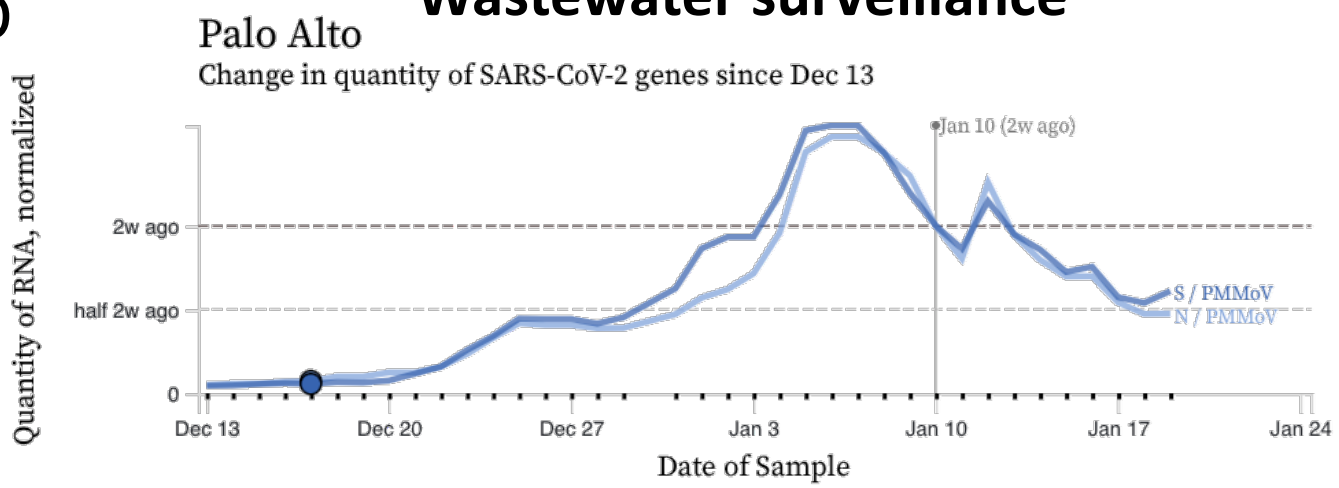
AND

- Hospital workers out with COVID
- Wastewater surveillance
- Daily average fever counts
- New data sources

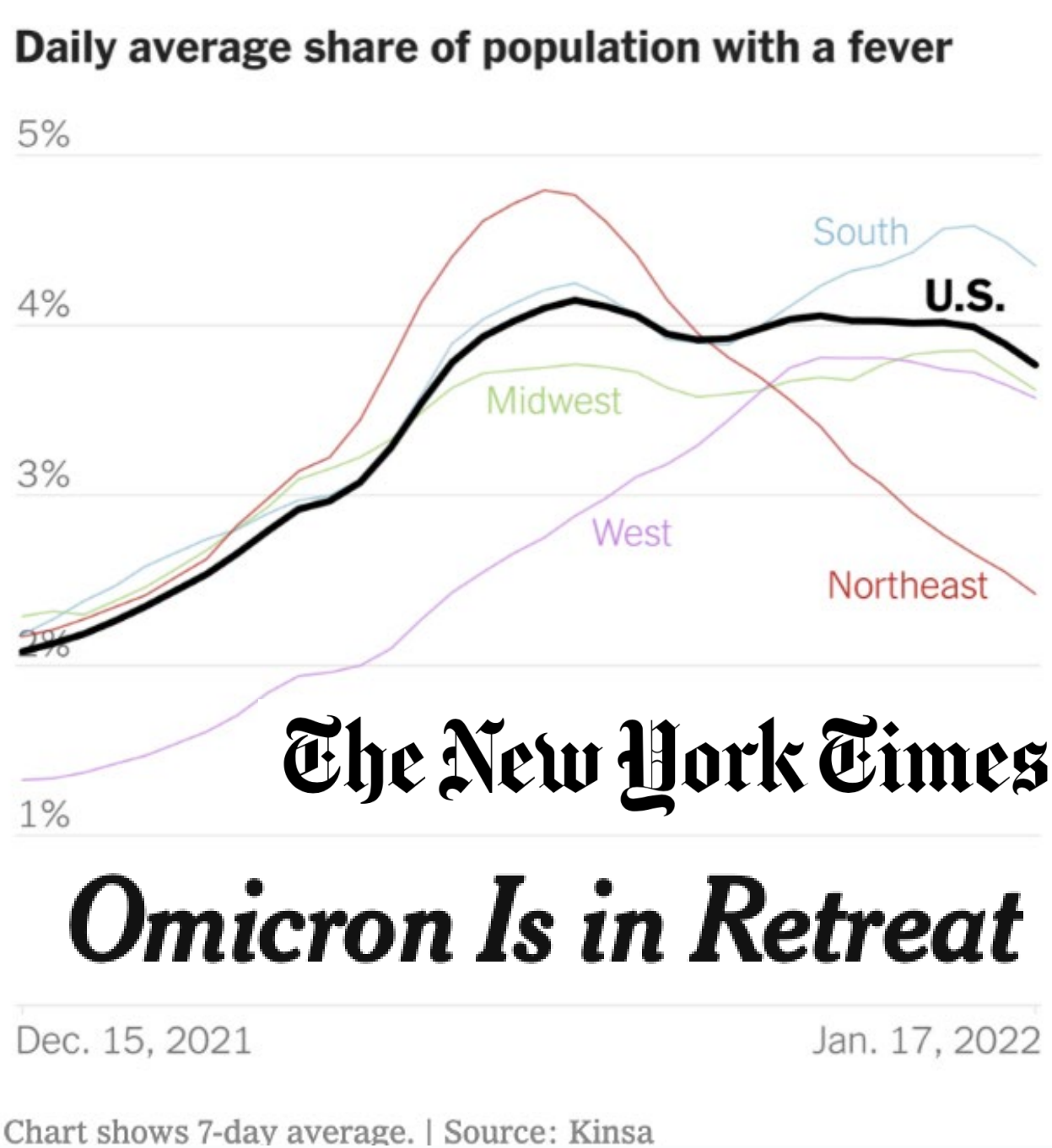
Hospital workers out with COVID



Wastewater surveillance

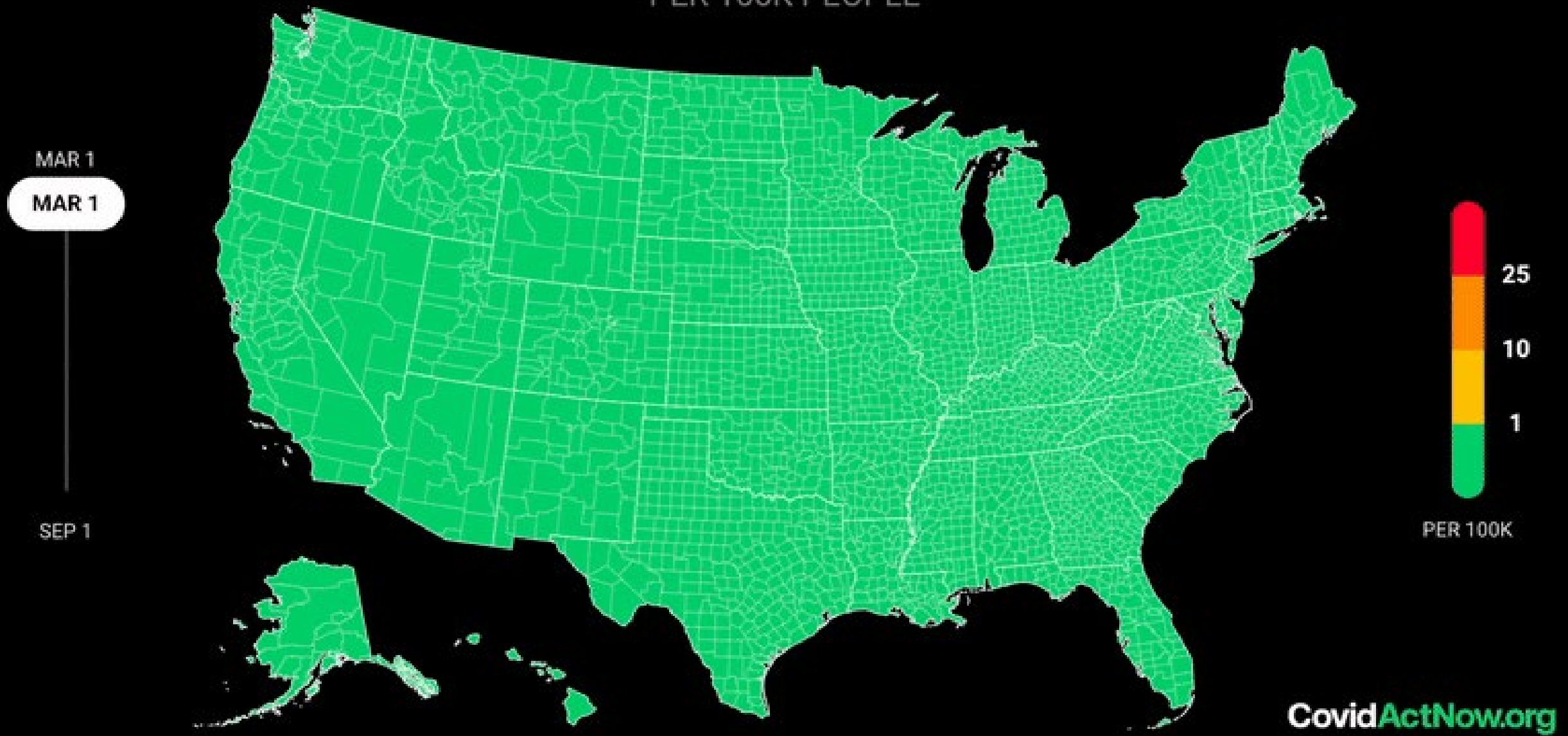


Graph title: Daily average share of pop...

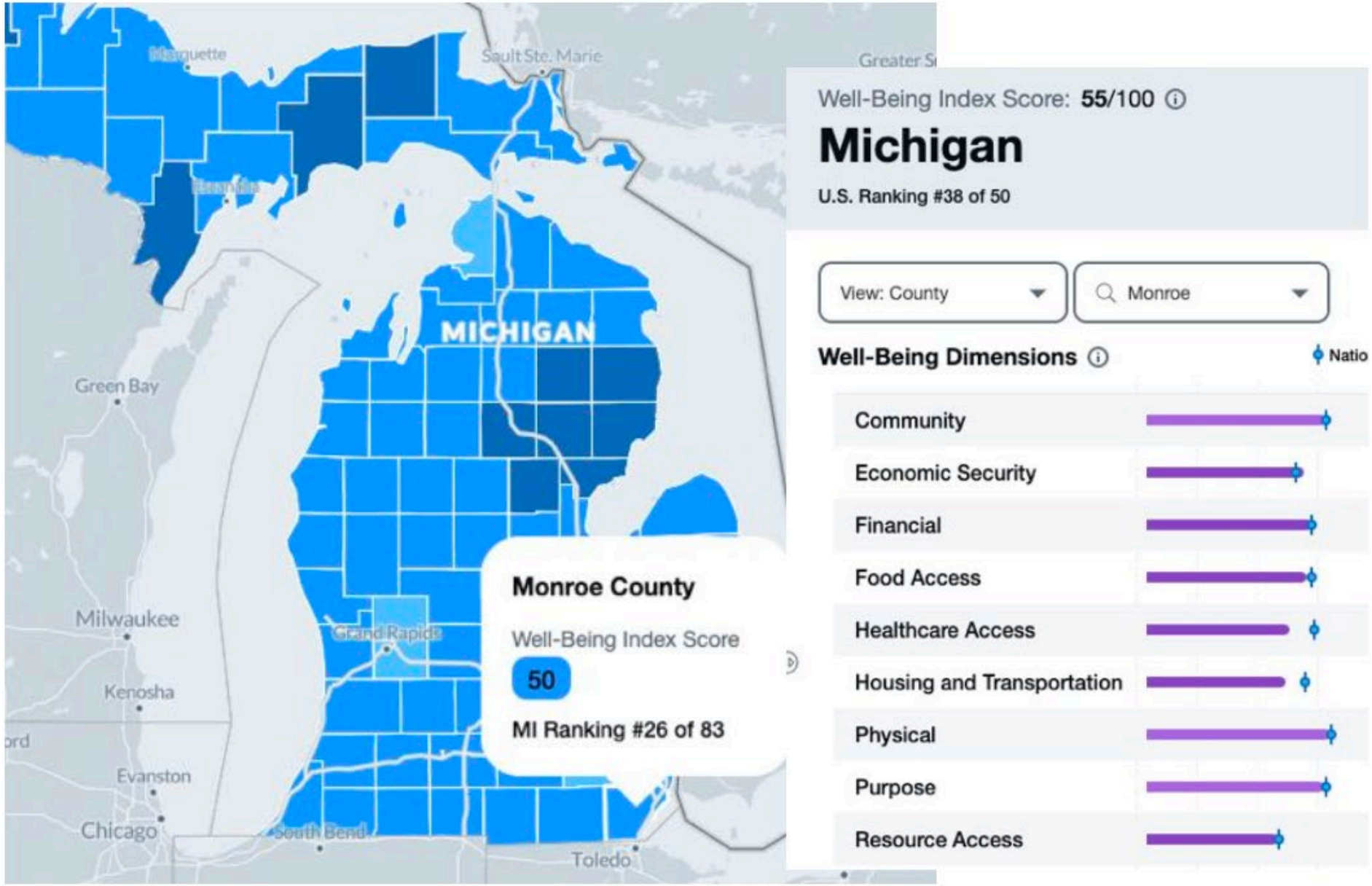


New cases

PER 100K PEOPLE



Sharecare Community
Well-Being Index



Digital Health Companies:
Addiction treatment / opioid use disorder

Digital health's investments of $37.9 billion in 2021
$793M invested in Substance Use Disorder startups

Bicycle Health

Waysprung

Boulder

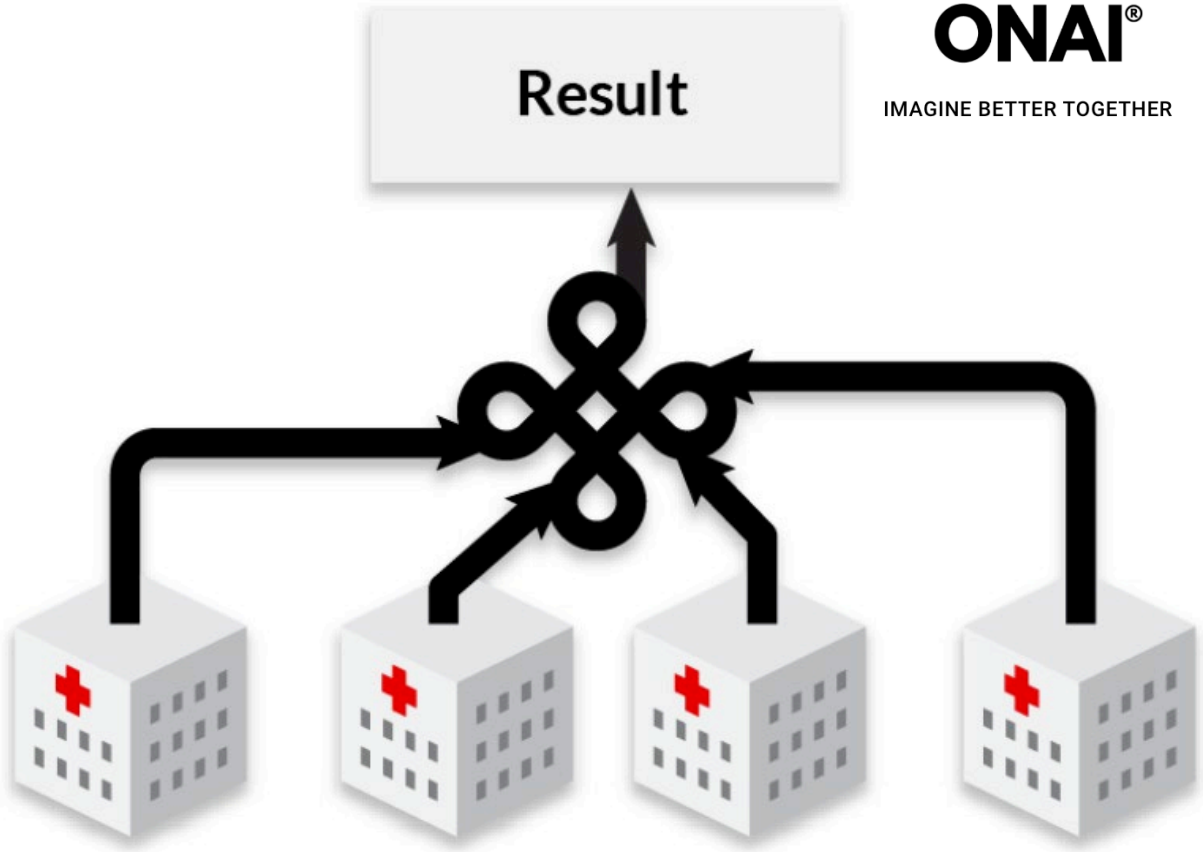
Workit

Ophelia

RECovER

In RECovER, researchers can perform queries across all institutions participating in the consortium, without any compromises on privacy or security.

Data remains local and private within each participating institution—no records ever leave each institution. Software modules from Onai run at each institution and jointly construct a single aggregate statistical result, without exposing any institution's local results to any other institution. This mechanism enables greater security and speed than traditional approaches.



ONAI®
IMAGINE BETTER TOGETHER

Lessons Learned & Next Actions

- Measurement needs and reporting needs change in real time
- Communicate about data in ways that the public can receive & understand it
- There's more than enough data, we have to look for it and accept it from the private sector and others
- Technology can already address many privacy and security concerns

What you can do…

- Standardization is Innovation, e.g. for interoperability
- Embrace private and nontraditional data
- Support people doing great work: Kenneth Mandl, Rick Hawes, Aneesh Chopra, Bala Hota, many others on the stage today, and of course Dylan, Marc, Rebecca, and Caitlin

Center for Forecasting and Outbreak Analytics (CFA)

CFA 201 – Breakdown by Division

April 21, 2022

Washington, DC

Predict Division Overview

Marc Lipsitch, DPhil

Director for Science

Center for Forecasting and Outbreak Analytics

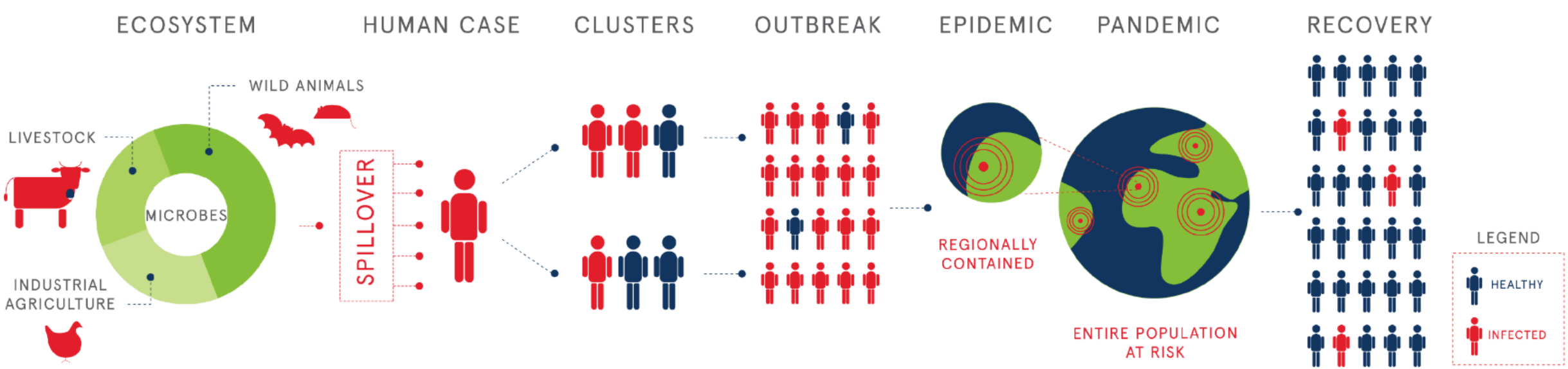
Predict: The Engine for Better Data and Better Analytics

GOALS

- **Generate forecasts and analyses** to support outbreak preparedness and response efforts
- Support **critical data collection efforts** to address response priorities
- **Respond to needs** of Federal, State, Tribal, Territorial and local leaders for analytical, forecasting results

PREDICT

Analytics Inform Response Efforts Across an Epidemic



Examples of Outbreak Analytics

- Prospective Scenario Analyses
- Risk Assessment Tools
- Parameter Estimations
- Vaccine Effectiveness
- Phylogenetics
- Disease Forecasting
- Outbreak Management Scenario Analyses
- Pathogen Characterization
- Disease Risk Mapping
- Burden, Impact Assessments
- Therapeutic Effectiveness

Graphic courtesy of bnext/iqt

Planned Analytic Products

Real-Time Monitoring (Routine, Periodic)

- Forecasting, Nowcasting
- Scenario Analysis
- Natural History / Parameter Estimation

Topical Analytics (As Needed per Response Priorities)

- Health Equity and Vulnerable Populations
- Community Mitigation
- Vaccines
- Therapeutics
- Testing and Diagnostics
- Pathogen Variants
- Mobility and Borders
- Setting-specific Transmission

Planned Critical Data Collection Activities

Targeted Studies to Answer Key Questions	Random Sample of the Population for Virologic Testing	Potential Partners Include but not Limited to:
• Transmissibility • Viral Kinetics • Severity • Immune escape • Vaccine escape • Diagnostic sensitivity	• Possible models: UK's Real-time Assessment of Community Transmission (REACT) and Office for National Statistics (ONS) studies • Continuous sampling with multiplex assays and sequencing of positives	• Payer-provider networks/managed care • Nursing homes • Academia • Industry

Work to Date & Early Successes

Early Evaluation of Omicron Surge

Scenarios developed in November/early December 2021 as South African surge was under way

Potential Rapid Increase of Omicron Variant Infections in the United States

Updated Dec. 20, 2021 Print

Summary

The Centers for Disease Control and Prevention (CDC) has identified the potential for a rapid increase in infections of the new variant of SARS-CoV-2, the Omicron variant, in the United States. Plausible scenarios include steep epidemic trajectories that would require expedient public health action to prevent severe impacts on the health of individuals and the healthcare system. The CDC Center for Forecasting and Outbreak Analytics developed this finding as a synthesis of scenario models conducted by U.S. government, academic, and international partners. The models assess the range of plausible scenarios for the epidemic trajectory based on what is currently known about the Omicron variant. Recent case data of the Omicron variant from South Africa, Botswana, the United Kingdom and elsewhere are consistent with the faster growth scenarios that were modeled.

Scenario *	Inherent transmissibility relative to Delta	Immune escape relative to all prior strains
Faster growth (Higher transmission**. Mid escape)	1.6x	43%
Slower growth (Higher transmission. Low escape)	1.5x	10%
Faster growth (Unchanged transmission. High escape)	1.0x	85%
Slower growth (Lower transmission. Mid escape)	0.8x	50%

*Parameters were chosen to span a range of apparent growth rate advantage for Omicron over Delta of ~2-3.5x in an environment where 75% of the population has immunity to infection due to vaccination or prior infection.
**Relative to Delta

Omicron Severity

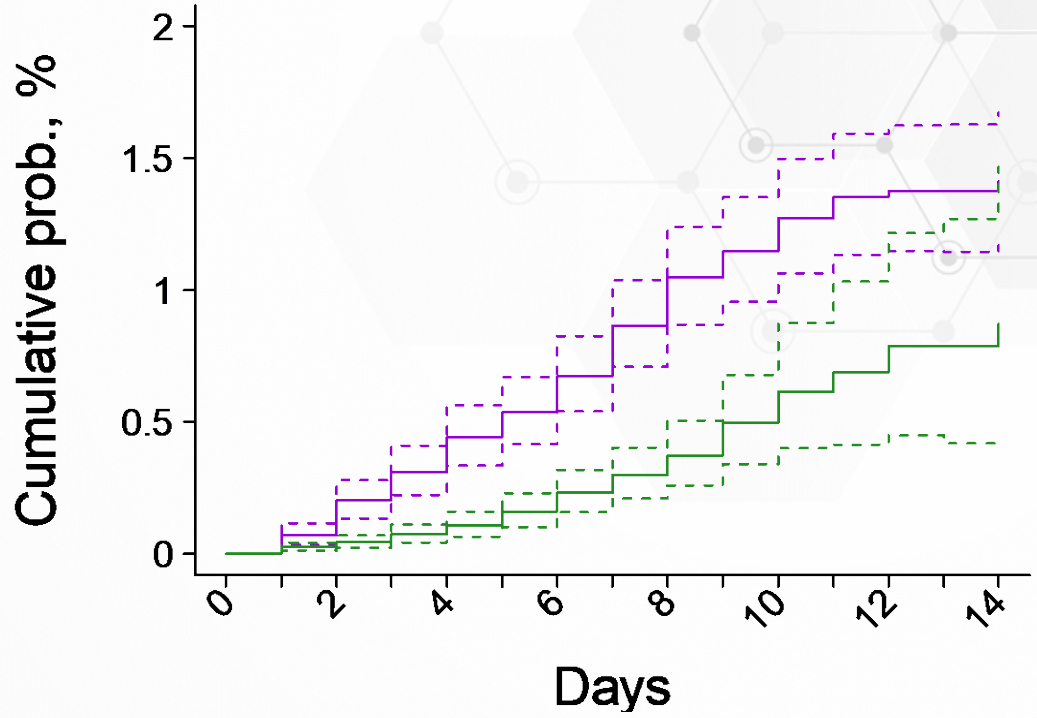
Clinical outcomes among patients infected with Omicron (B.1.1.529) SARS-CoV-2 variant in southern California

Joseph A. Lewnard, Vennis X. Hong, Manish M. Patel, Rebecca Kahn, Marc Lipsitch, Sara Y. Tartof

doi: https://doi.org/10.1101/2022.01.11.22269045

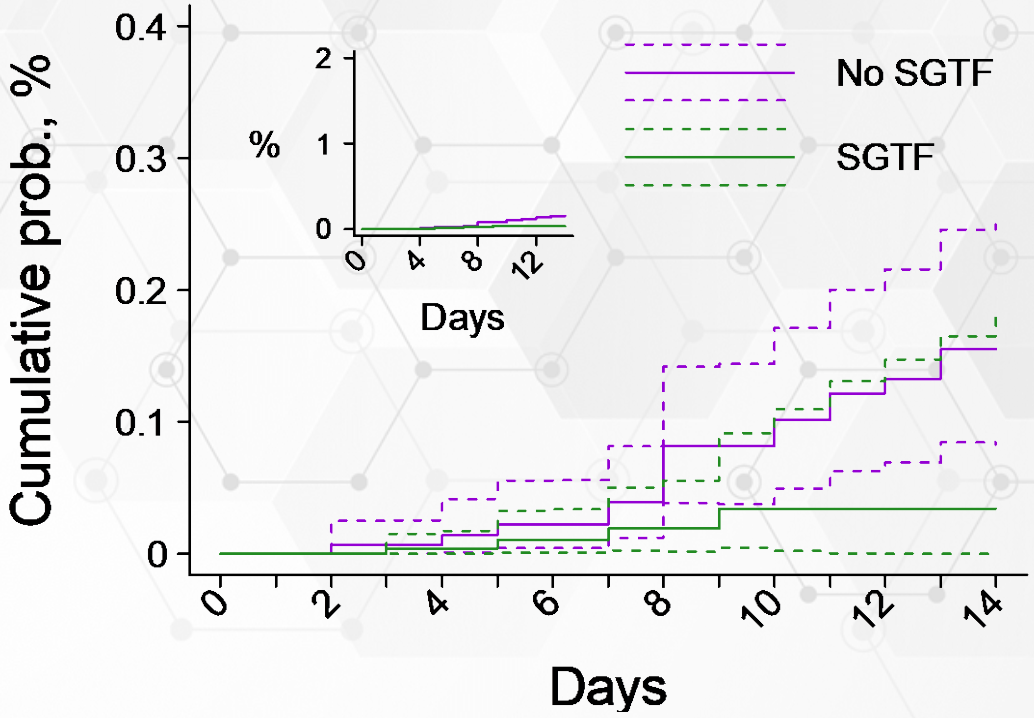
Assessed Omicron severity relative to Delta using data from Kaiser Permanente Southern California

A: Symptomatic hospitalization



52% reduction in hospitalization

B: ICU admission



74% reduction in ICU admission

For latest results:
https://www.medrxiv.org/content/10.1101/2022.01.11.22269045v2

COVID-19 Response Support

- CFA, in collaboration with teams in academia and experts in the office of the Assistant Secretary for Preparedness and Response, have contributed analyses related to:


School test-to-stay guidance


Travel policy


Nursing home guidance


Vaccine guidance

Inform Division Overview

Caitlin Rivers, PhD

Associate Director

Center for Forecasting and Outbreak Analytics

Inform: Customer-Driven Risk Communications

GOALS

- **Communicate** with expert disease modelers, emergency responders to meet the needs of decision-makers
- **Share timely, actionable information** with the Federal government; STLT leaders, and the public
- **Coordinate early warning efforts** between CDC subject matter experts and USG interagency

INFORM

Objectives & Stakeholders

- **Objectives**
  - Inform stakeholders of the **modeling results** and **analyses** produced in the Predict Division
  - Learn and relay stakeholders' **questions** and **priorities** to the Predict and Innovate Divisions
  - Raise **awareness** and **support** for the role of **modeling** and **analytics** in **outbreak preparedness** and **response**
  - Ensure communications are **fast**, **effective**, and **oriented** for decision-making

Inform Staff – Responsibilities

- **Responsibilities to Include:**
  - ✓ Maintain an informal network of **academic modelers** (and participate in existing networks, e.g., Models of Infectious Disease Agent Study (MIDAS)) to **advance R&D priorities** and establish **reserve capacity** for times of pandemic.
  - ✓ Participate in **STLT task force** in Incident Management structure
  - ✓ Coordinate with the **Federal Emergency Management Agency** and the **Department of Health and Human Services** regional coordinators and associated data analysts

Inform Staff

- Visualization Experts
- Interagency Liaisons
- Public Liaisons
- CDC Liaisons
- State and Local Liaisons

Work to Date & Early Successes

State, Tribal, Local, and Territorial (STLT) Focus Groups

- Sharing examples of **products** and **tools** CFA could **provide** and soliciting feedback on if they are useful
  - Notification of Significant Findings
  - Omicron Severity Analysis
  - Outbreak analytic tools (nowcasting, Rt, descriptive analyses)
- Collecting **feedback** from State and Local Public Health **partners**
- Feedback will help shape CFA's **work**, for example the **test bed pilot**

Requirements for Success

Information Management and Process

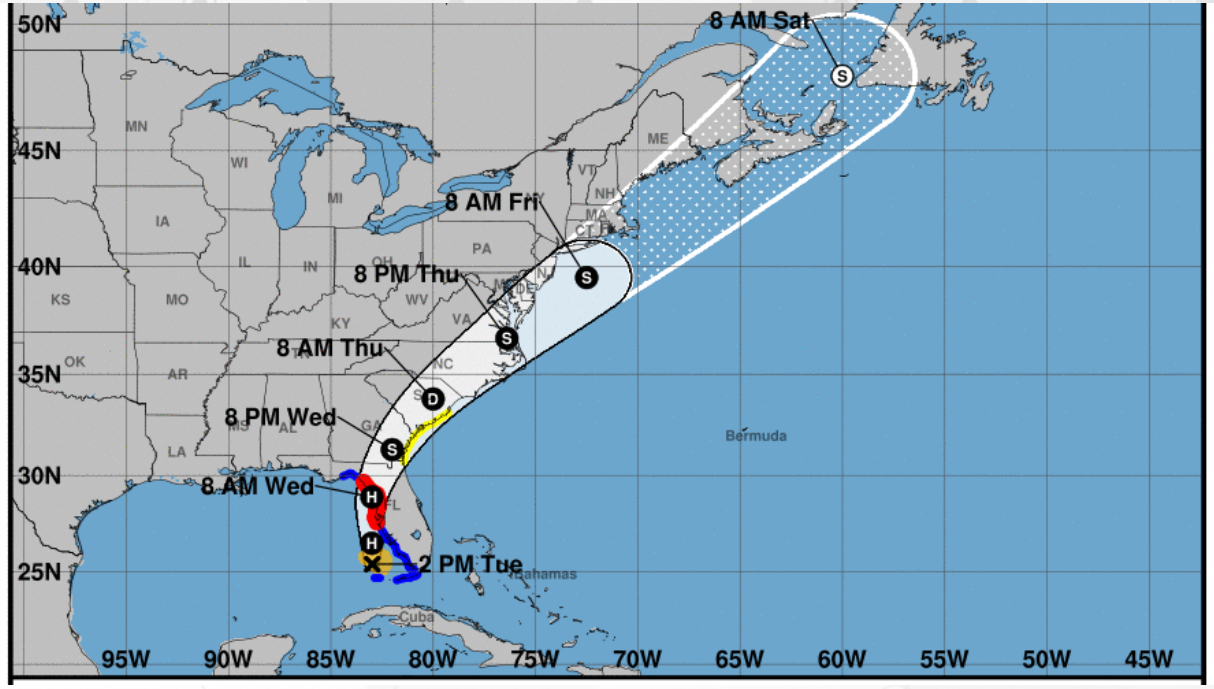
Information Management

- Data set responsibilities within CFA
- Data use agreements with key partners - other CDC programs, Federal departments and agencies, STLT partners, private sector
- Processes to manage requests for information
- Approaches for managing variations on products, e.g., one set of analytical results with communication materials tailored to different audiences

Information Management and Process contd.

Process

- Tools for communicating and visualizing modeling and analytical results
- Approaches for visualizing uncertainty



Innovation & Technology Division Overview

Rebecca Kahn, PhD

Senior Scientist

Center for Forecasting and Outbreak Analytics

Innovation: Driver of the CFA Future State

GOALS

- **Support research and development** to improve outbreak forecasts and analyses
- **Collaborate** with and support academic, private sector, and interagency partners
- **Create translational tools, products, enterprise enhancements** to make analyses of pandemic data flexible, fast, and scalable for STLT authorities

INNOVATE

Support Research and Development to Improve Outbreak Forecasts and Analyses

Initial Work

- Funded academic partners (Harvard, Utah, Johns Hopkins) to:
  - **Improve forecasting** and **outbreak analytics** for **emergency decision-making**
  - Use modeling to **inform public health actions** with **emphasis on equity**
  - **Expand** and **upskill** the **public health workforce**
- Established partnership with National Science Foundation (NSF) to
  - **Sustain** the ability to **rapidly fund** academic groups to **address emerging priorities** (modeling and non-modeling) during any **response**
- Established partnership with Department of Energy (DOE) to
  - Bring DOE's **advanced computing capabilities** in high performance **computing hardware**, **software**, **algorithms** and **expertise** to bear on **epidemiological modeling**
  - Develop **novel algorithms** and **new software** to meet CDC requirements

Create Translational Tools, Products, and Enterprise Enhancements to Make Analyses of Data Flexible, Fast, and Scalable

Test Bed: Innovating Analytical Capabilities & Developing Partnerships

- Develop **innovative, analytical capabilities and partnerships** with state/local public health agencies, healthcare organizations, private sector, and academia
- Establish a multidisciplinary **community of practice** to **evaluate**, **share**, and **scale** successes and innovations

Test Bed Objectives

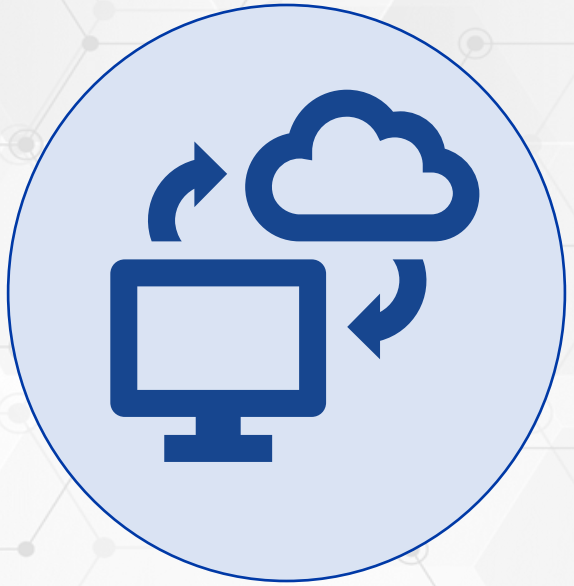
- Integrate **novel data sources** or technology into **outbreak analytic tools** or pipelines. Examples include:
  - Integrate **wastewater**, **genomic**, or **mobility** data into forecasts or analyses
  - Develop **novel survey approaches**, particularly behavior related
- Create, enhance, or integrate **analytical tools** for **outbreak response** at federal and local levels. Examples include:
  - Tools for **nowcasting** (i.e. adjusting for reporting delays), geographic **targeting of interventions**, or strategies for **implementing interventions**
- Develop and enhance **visualization**, **communication** of results to **decision makers**
- Enhance ability to **quickly respond** to **outbreaks** and **inform decisions**

Technology: Architecture Upon Which CFA is Built

GOALS

- **Develop** and **Refine** Technology for the Analytics Platform
- **Build** Products
- **Establish** CFA Data Requirements

Technology



Analytics / Decision-Support Platform

- Develop CFA **technology architecture**, **critical workflows**
  - **Cloud-first** approach
- Enable **surge capacity** – preparation, onboarding, access control for additional analysts, and technologists in an emergency situation
- Develop and maintain **back-up, "on-premise" analytical platforms**
- Develop and refine **visualization**, **communication**, and **decision-support capabilities**

Building Products – Tooling and Enterprise Capabilities

- **Develop analytical tools** and **products** for CFA and CDC enterprise systems
- Transition successful **innovations to operations**
- Create flexible analyst tools to support **rapid response needs**
- Improve and automate **mission critical workflows**

Analytics Platform – Early Products

Initial Analytics Workflows & Products

Forecasting & Scenario Models

- **Internal modeling** capability (enterprise level software)
- **External contributions**
- **Ensemble** process

Question X – Support for the Analytics Response Team

- Refine general **data science** and **analytics tools**
- Develop **rapid response** tools
- Establish an efficient, flexible and collaborative **data science platform**

High Level Technology Requirements

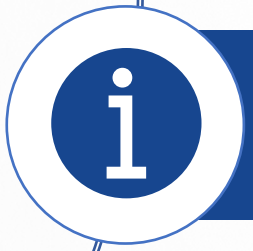
Technology Requirements & Components

Data Lake / Data Warehouse

- Secure data repository

Data Tools

- Unified data foundation: ingest, store, share



Metadata Management

- Data provenance, version control

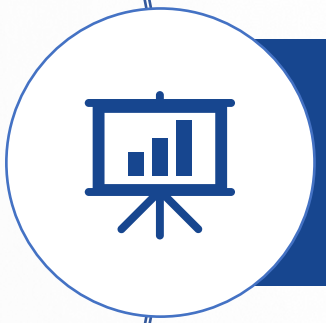
Access

- Cloud environment, on-prem capabilities, web hosting, public access

Technology Requirements & Components contd.

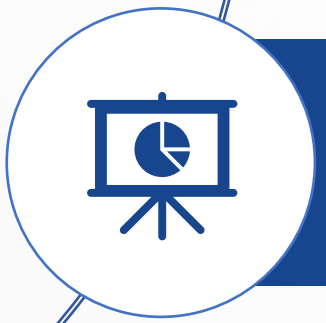
Predictive Analytics / Advanced Data Tools

- Customizable models, code repository, scalable compute



Business Intelligence Tools

- "No-code" solution for retrieving, analyzing, transforming, and reporting data



Decision Support

- Dashboards, reports, bespoke analytics, publishing tools

Questions?

Online participants:
Email questions to
CFA@CDC.GOV

CFA 101 for Industry Event

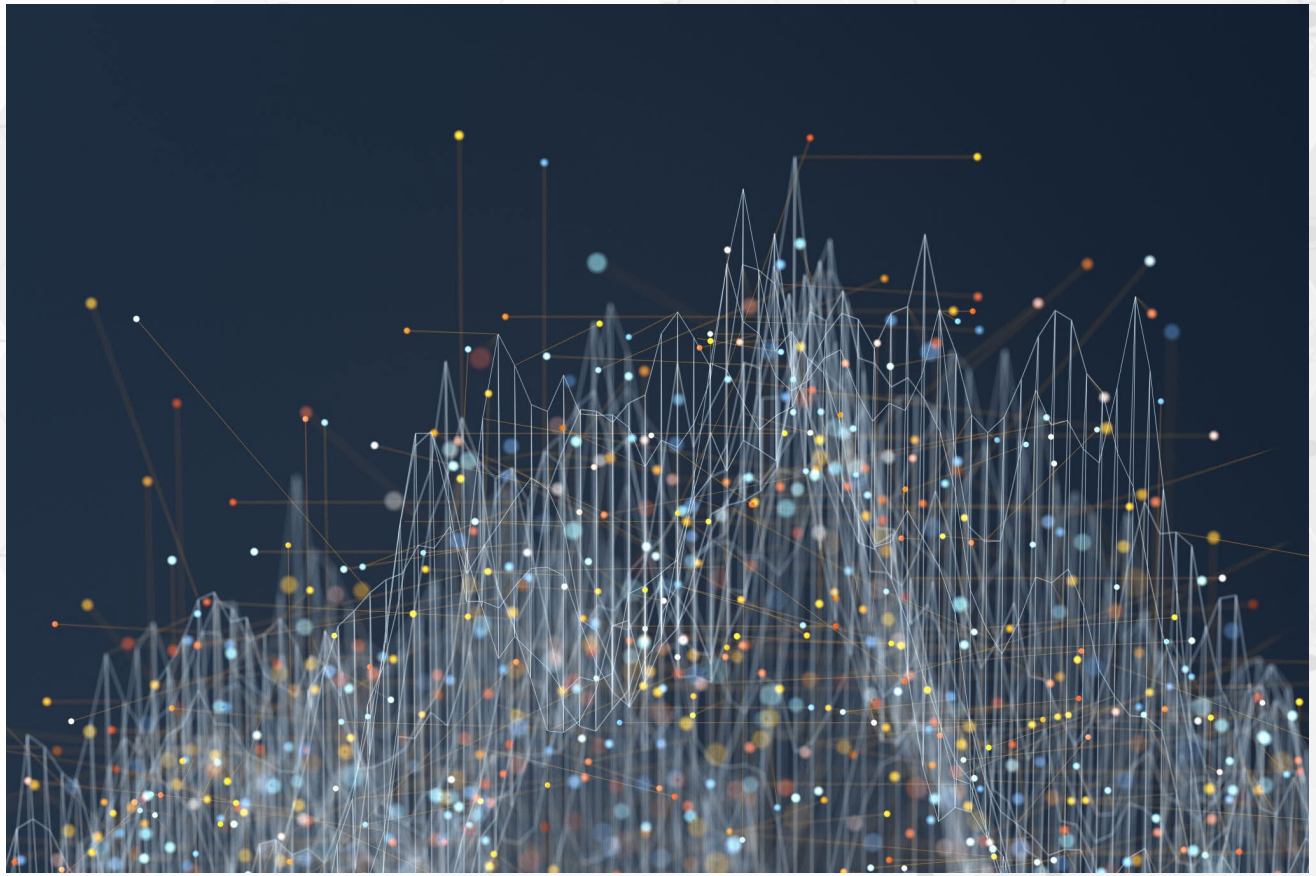
We are on lunch break – please plan to return by 1:30 PM EST

Afternoon Session Overview

- Agenda Items
  - Industry Panel (45 min)
  - Lightning Talks from Industry Leaders (35 min)
  - Closing Remarks (5 min)

Industry Panel: Data, Analytics, and Technology Requirements to Transform Health Emergency Response

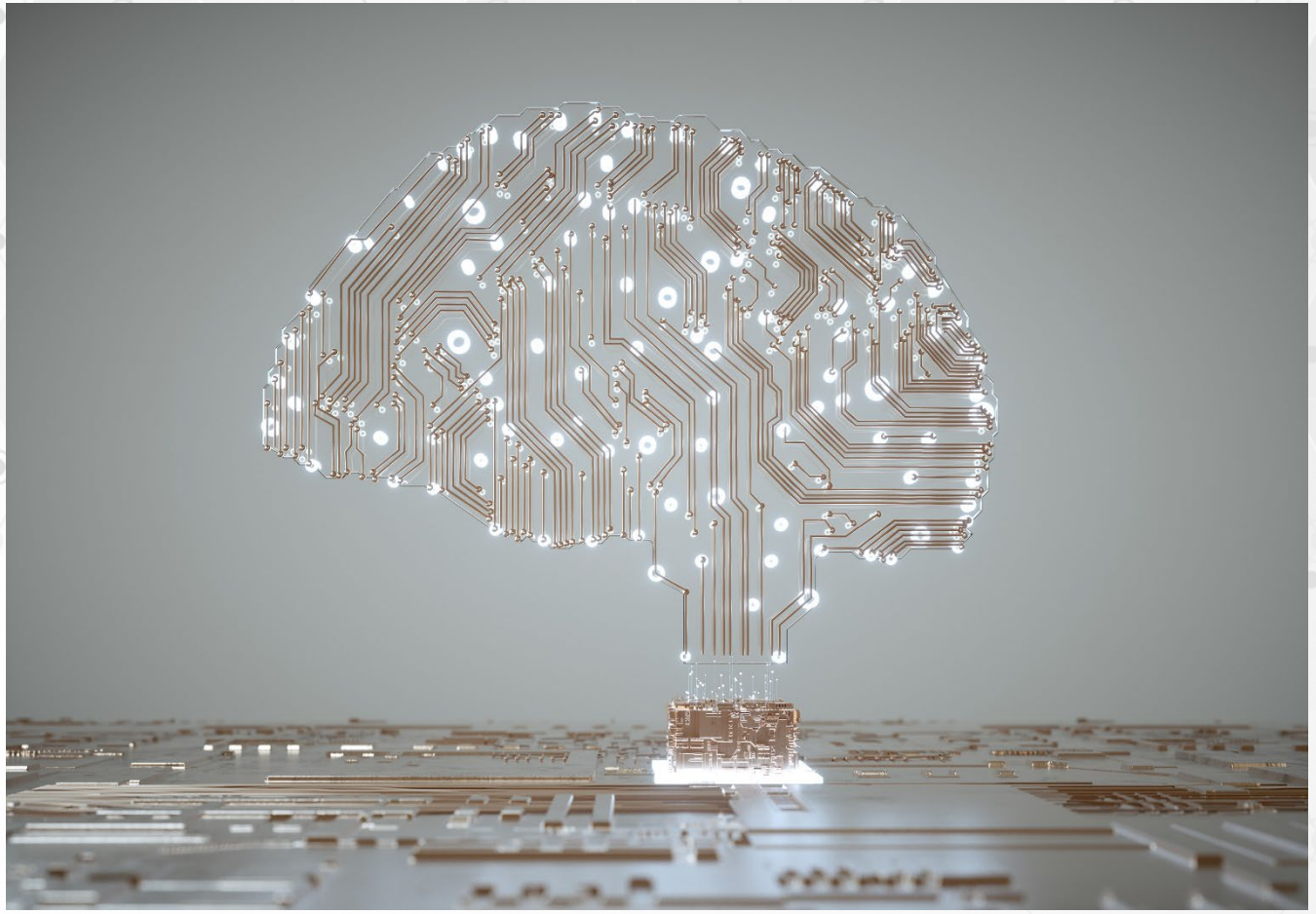
Panelists:
Michelle Holko – Google
Ethan Berke – United Health
Caitlin Rivers – CDC/CFA



Moderator:
Dylan George, CDC/CFA

Lightning Talks from Industry Leaders

Databricks
Peraton
Microsoft
RTI
Dell Technologies
Red Hat/Carahsoft
Optum Serve
Maximus Public Health Analytics



Moderator:
Alison Kelly, CDC/CFA

Closing Remarks

Please visit us at www.cdc.gov/cfa

For any outstanding questions, comments, or to stay in touch, please email CFA@CDC.GOV

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention