CENTER FOR

Forecasting & Outbreak Analytics

2023 Annual Report

Better Data,
Better Analytics,
Better Response

CDC

Greetings,

The Center for Forecasting and Outbreak Analytics (CFA), the newest Center within the Centers for Disease Control and Prevention (CDC) was created in early 2022 to deliver decision support to government entities, state and local leaders, and the public through infectious disease forecasting and outbreak analytics. CFA is an answer to the nation's need for a federal resource to forecast outbreaks and get those analyses in the hands of decision-makers as quickly as possible.

In the past year, CFA has established itself as a growing powerhouse for innovation and collaboration and as a trusted source for real-time outbreak analytics. CFA has supported disease modeling efforts in several responses simultaneously, including mpox, Ebola, polio, coronavirus disease 2019 (COVID-19), and acute pediatric hepatitis—delivering technical reports, qualitative risk assessments, and models to federal, state, and local leaders to inform their most critical response decisions.

"The new center will advance the use of forecasting and outbreak analytics in public health decision-making."

CFA has prioritized its work across three primary functions: predict, inform, and innovate.
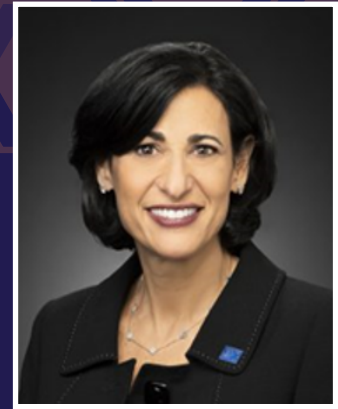
- **Predict:** Model and forecast, determine the foundational data sources needed, support research and innovation in outbreak analytics and science for real-time action, and establish appropriate forecasting horizons.
- **Inform:** Translate and communicate forecasts and connect with key decision-makers across sectors, including government, businesses, and non-profits, along with individuals with strong intergovernmental affairs and capacity for action.
- **Innovate:** Broad capability for data sharing and integration; maximize interoperability with data standards and utilize open-source software and application programming interface capabilities with existing and new data streams from the public health ecosystem and beyond.

These efforts are unified in their goal to turn the data and science into action for effective outbreak response. The establishment of CFA and continued progress toward improving outbreak response remain among my top priorities since becoming CDC Director in January 2021. I am proud to see how far CFA has come in such a short period of time, and I eagerly look forward to the progress this exceptional team will make in the coming year.

Sincerely,

Rochelle P. Walensky, MD, MPH
Director, Centers for Disease Control and Prevention (CDC), and
Administrator, Agency for Toxic Substances and Disease Registry (ATSDR)

Who We Are

The Center for Forecasting and Outbreak Analytics (CFA) at the Centers for Disease Control and Prevention (CDC) launched in 2022 to serve as a national resource to help identify infectious disease threats, model their potential spread, and rapidly alert public health officials to improve decision-making during outbreak response.

CFA expands both CDC's and the nation's ability to respond to emerging public health threats by providing modeling, forecasting, and advanced analytics quickly to leaders who make critical decisions during public health emergencies. CFA operates on three core priorities: the ability to (1) **predict** disease threats on the horizon, (2) **inform** partners, the public, and decision makers rapidly and effectively of data-driven outbreak analyses, and (3) **innovate** to advance the science and technology for disease forecasting and outbreak analysis. Over the last year, CFA worked collaboratively with public, private, and global programs to bring together next-generation public health data, infectious disease modeling, rapid outbreak response, and high-quality communications to meet CDC's 24/7 mission to save lives and protect people.

CFA accomplishes our mission guided by four core principles: Transparency, Impact, Equity, and Collaboration.
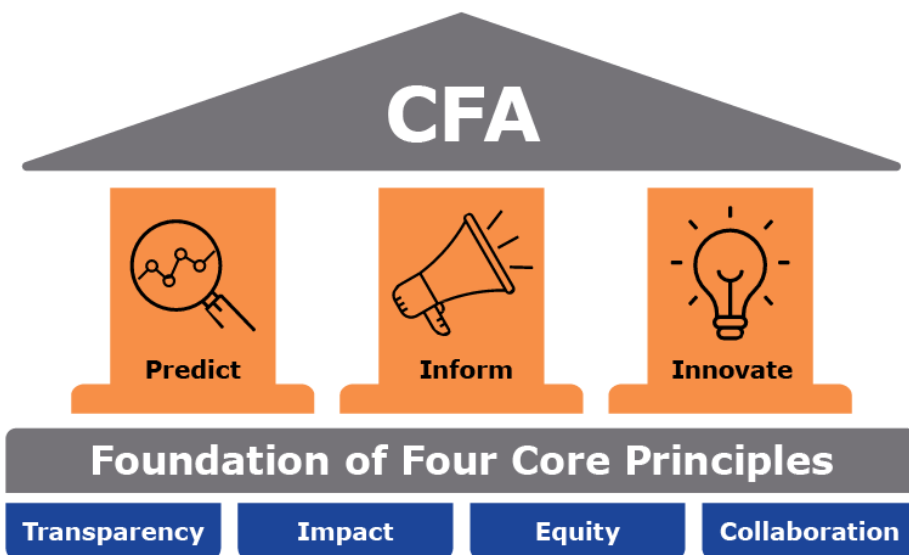
USEFUL TERMS & DEFINITIONS

Forecasting

A mechanism for predicting health outcomes or events using reliable past and present data, information, and appropriate analytical tools.

Outbreak Analytics

Tools and methods used to collect, visualize, analyze, and report on outbreak data.

Infectious Disease Modeling

Analyses that merge mathematical simulations, probabilities, and data to understand the spread of infectious diseases in populations, predict the course of an outbreak, and evaluate strategies to control spread.

CFA's Core Principles

*CFA aims to achieve **impact**, work with **transparency**, **collaborate** with partners both inside and outside of CDC, and address health **equity**.*

Impact

Transparency

Collaboration

Equity
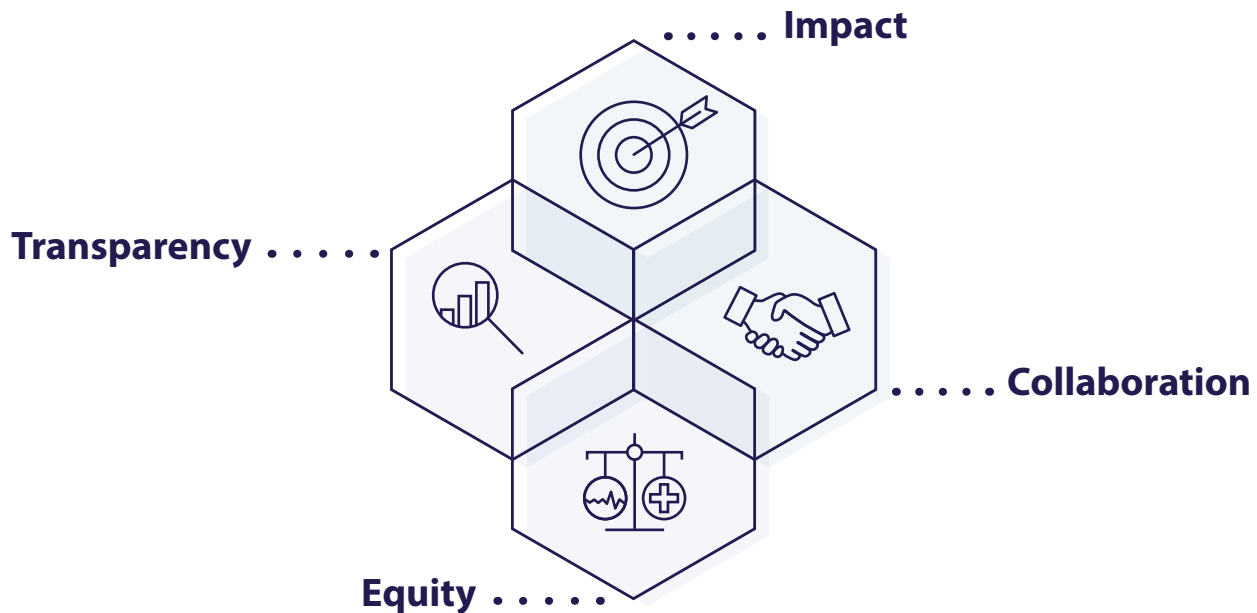
CFA is committed to rapid communication and dissemination of data from CDC systems to decision makers—making an **impact** by informing response efforts when disease threats emerge.

CFA works to promptly make data, analyses, models, and scientific methods available to the public and decision makers in human and machine-readable formats to foster **transparency** and inform action.

CFA fosters a culture of innovation and **collaboration** with public, private, and government partners. These partnerships advance outbreak forecasting science and analytics to improve outbreak response.

CDC and CFA work to promote health **equity** by using data to identify and track health disparities in outbreaks and inform policies to address them. To do this, CFA works with partners to provide access to outbreak forecasting and advanced analytics resources so that decision makers representing all populations and at all levels can make data-driven response decisions.

Implementations and Accomplishments Update

Mpox Technical Reports

These reports were developed and published quickly, matching the pace of response. They provided key data regarding the mpox outbreak in the United States, including incidence rates, factors affecting incidence, transmission levels, and potential future outbreak trajectory. They were shared widely to provide timely updates on CDC's response to the outbreak and projections of the potential course the disease could take.

State-specific analyses were also developed as a part of these reports for the jurisdictions with the highest incidence of mpox cases to help with decision-making and actions at the state and local level. These reports supported active response planning with up-to-date and timely analyses that shared what was known about the outbreak, along with CDC's projections of where the outbreak was headed.

CFA delivered [four technical reports](#) on the mpox outbreak in the United States, which served as a first-of-their-kind product, focused on providing potential future scenarios in a timely and actionable manner.

Virtual Analyst Platform

The effort is focused on developing a common suite of software, tools, and file and code-sharing capabilities for collaborating modelers. This common operating environment is currently in the pilot stage and will allow modelers to work with the data together in real-time and create a trusted, connected pathway for data analysis to be used by decision makers.

CFA is pioneering a virtual analyst platform in close collaboration with other CDC programs.

Industry Day

In April 2022, CFA hosted its first Industry Day to engage with potential partners from private sector companies in a joint mission to strengthen public health infrastructure. The event featured nearly 250 attendees and included robust discussions on what is essential to transform public health emergency response. CFA, in collaboration with CDC's Data Modernization Initiative (DMI) and the CDC Foundation, held a second Industry Day in February 2023 to continue conversations around ways to strengthen our public health infrastructure.

> *CFA is engaging with industry partners to translate data and analytical capabilities used in the private sector and engineer **innovation** into the CFA's work.*

COVID-19 Omicron Response

> *During winter of 2021, CFA performed a scenario analysis to predict the caseload associated with the COVID-19 Omicron variant.*

Within days of recognizing the potential seriousness of the variant, CFA alerted federal leaders, state, and local public health partners, and the public that a surge in cases could be severe enough to disrupt our daily lives and essential services. This early warning allowed leaders at all levels to prepare for a surge in cases, engage in prevention planning, and minimize impact of the virus. In parallel, CFA awarded a contract to Kaiser Permanente to quickly analyze COVID-19 hospital data to assess the clinical severity of the Omicron variant. This project showed that while case numbers would be large as the variant swept the country, typical severity would be lower for each case. CDC shared these data with policy makers throughout the Biden Administration within a month of initiating the study and published the results online in December 2021.

Development of Accessible Models

CFA is focused on creating innovative solutions for using and sharing data in new ways. For example, the Administration for Strategic Preparedness and Response (ASPR) has a modeling team that is focused on addressing specific questions and assessing medical countermeasure needs within the Strategic National Stockpile. CFA recognized the value of ASPR's single agent-based model for COVID-19 and, in close partnership, is transforming this from a single model to a suite of models and additional tools accessible to U.S. Government partners, enabled by CDC's DMI advancements in cloud computing infrastructure. Because of these advancements, collaborators can access and run the models directly and effectively in the cloud environment and at a much swifter pace than previous computing environments allowed.

These types of models are designed to be iterative, allowing for modelers to view others' updates and assumptions. This level of transparent collaboration keeps everyone informed. As this pilot continues, CFA will work to make model code and rigorous documentation available so the work can be reviewed, refined, and replicated.

> *CFA is working within CDC by leveraging advancements made as part of CDC's Data Modernization Initiative (DMI), collaborating with other programs to improve CDC's outbreak response.*

Research & Development

CFA is supporting the development of new approaches for mathematical modeling and is identifying strategies to optimize accuracy in disease forecasting. For example, CFA contracted with several universities throughout the country to evaluate and improve disease forecasting methods. This research is intended to provide insight into techniques that CDC can implement to increase precision in our models and forecasts. CFA will also evaluate different approaches to disease surveillance and forecasting in the United States and will help identify areas where CFA is best positioned to improve disease analytics.

CFA contracted with Harvard University, Johns Hopkins University, and the University of Utah to create Modeling Centers of Excellence that work to improve forecasting and outbreak analytics for emergency decision-making. Additionally, the Modeling Centers of Excellence assess drivers of inequity and include these factors into future models and potential intervention strategies. Utilizing modeling to inform public health actions like this has the potential to impact overall outcomes and encourage equity. These centers are focused on expanding and upskilling

CFA is partnering with public health leaders and data scientists to advance outbreak analytics and disease forecasting.

the public health workforce and are working to embed modeling experts in state, territorial, local, tribal, federal, and international public health institutions. Creating applied modeling training and building capacity will help accelerate the development of the public health workforce.

CFA partnered with CDC's Division of Healthcare Quality Promotion to establish the Nursing Home Public Health Response Network with funding provided through the Safety and Healthcare Epidemiology Prevention Research Development (SHEPheRD) Program to address health disparities of nursing home residents who have an increased susceptibility to infectious diseases. This geographically dispersed network of nursing homes will conduct rapid-response data collection of infectious pathogens.

STLT and Public Health Partners

CFA partnered with the National Association of County and City Health Officials, the Association of State and Territorial Health Officials, and the National Conference of State Legislatures to establish a forum for open and reciprocal communication to engage and hear from state, tribal, local, and territorial (STLT) partners. Through these engagements, CFA is developing approaches to help meet the needs of state and local decision makers. Within these partnerships, CFA is holding regular listening sessions to help optimize disease forecasting products that decision makers can use. CFA is also supporting the development of trainings and demonstration sites to test these products.

Through CFA's cooperative agreement with the Council of State and Territorial Epidemiologists, CFA is engaging with state and local epidemiologists to create decision support tools, evaluate the utility of new and existing products, and identify methods to make forecasting tools accessible to on-the-ground public health leaders.

CFA, in collaboration with CDC's DMI, aims to develop a partnership with STLT jurisdictions **to iteratively develop, test, provide feedback on, and scale products to be used in infectious disease outbreaks.** These products could include forecasting, analytic, communications, visualization, or decision

CFA partners with public health organizations to determine how best to communicate with leaders on the ground.

support tools. The goal is to innovate analytical capabilities and partnerships with state and local public health agencies, healthcare organizations, the private sector, and academia. Project objectives include:

Project objectives include:
- Develop a community of practice to evaluate, share, and scale what works.
- Integrate new data sources or technologies into outbreak analytics. Examples include integrating wastewater and genomic data into outbreak analyses and forecasts.
- Create and enhance analytical tools for outbreak response. Examples include tools to improve what we know about the present situation during an outbreak and what the immediate forecast is (nowcasting), targeting specific interventions by geography or group and strategies for implementing large-scale interventions.
- Develop and enhance visualization and other techniques to communicate outbreak analyses and forecasts to decision makers.

Our Path Forward

Bringing outbreak modeling, forecasting, and advanced analytics to scale will take time, and the establishment of CFA is an important step for CDC and the nation to be better equipped to prevent the spread of infectious disease and respond effectively for future outbreaks. We must make long-term sustainable investments in our public health system.

Plans for FY2023

CFA was created to support decision makers and provide them with critical information when they need it most. The resources appropriated by Congress for FY 2023 allow CDC to sustain our progress in meeting this critically important mandate at the operational level achieved with initial emergency supplemental funding. In FY 2023, CFA will continue responding with technical reports, risk assessments, and other products when the nation faces our next public health emergency, and CFA will continue building the organization—

developing modeling capabilities and honing analytics for more robust decision support. CFA will also build on our initial funded partnerships to encourage further development of innovation, integration, implementation, and coordination of advanced analytics and epidemic forecasting in the United States, and CFA will continue promoting health equity.

Prioritizing Equity

*CDC and CFA work to promote health **equity** by using data to identify and track health disparities in outbreaks and inform policies to address them. To do this, CFA works with partners to provide access to outbreak forecasting and advanced analytics resources so that decision makers representing all populations and at all levels can respond.*

CFA is identifying disparities and building our capacity to gather and analyze data with a focus on groups with highest risk of severe outcomes. We know there is more work to be done to improve outcomes for people who live and work in settings that put them at increased risk of becoming infected during an infectious disease outbreak. In the coming year, CFA will prioritize and build upon our equity work in actionable ways, including:

- Develop equity-informed data on transmission of various diseases—work that is critical to protecting people from disease outbreaks.
- Establish an analytic response team within the Predict Division that will focus on specific populations in high-risk settings for infectious diseases, such as prisons, shelters, nursing homes, and other congregate settings.

- Improve data collection methods, which will allow CFA to explore heterogeneity within racial groups in exposures and outcomes of infectious disease models.
- Use relevant demographic strata in models to identify inequities in projected disease impacts.
- Make it a principle, when analyses identify disparities in the impact of a disease or condition across demographic groups, to investigate the drivers of the disparity and potential solutions, rather than stopping with identification.

Beyond FY2023— Building State, Tribal, Local, and Territorial Modeling Capabilities

CFA's next steps include expanding our work coordinating with a diverse selection of STLT partners, building on work already underway to discover what states, territories, localities, and tribes need most to build their advanced analytics and disease forecasting capabilities. With additional resources, CFA will work to develop modeling tools and other products, and eventually STLT capacity, enabling stakeholders at multiple levels to make more and better-informed decisions on preparing for and responding to the next public health emergency. CFA will accelerate work to make advanced analytics and outbreak forecasting available at the speed and scale needed to improve decision-making; doing so will be crucial for transitioning to a common public health ecosystem. CFA will also focus on work with STLT partners to improve gathering of race, ethnicity, age, geographic, and other demographic data that are critical for the scientific study of equity in exposures and improving outcomes.

Public health threats can emerge and disrupt people's lives and the national and global economy at any given moment. The COVID-19 pandemic highlighted the need to improve the United States' ability to forecast disease threats and use data to mitigate their harmful effects. CFA is focused on improving this capability for CDC. We are excited to build a new and critical capability to support CDC's and the nation's response to emerging health threats. With our growing expertise in data science, we have an opportunity to help CDC define itself as the primary workforce for disease modeling and outbreak analytics. Doing this work will require sustained investment and effort, and it will require new ways of working, including engagements with the private sector. As CFA's internal operations are sustained and capacity building is expanded for states and other jurisdictions, CFA will be able to focus more on closing the gap between research and development and availability of tools in use within the public health sector.