Disease Forecasting and Modeling Data for Public Health Action

Disease forecasting and modeling data can be powerful tools for state and local health agencies (S/THAs) that respond to outbreaks, develop appropriate policies, and ensure interventions have maximum impact. Actions for which decision-makers can leverage such data include:

- **Surveillance.** Forecasts and modeling help public health agencies anticipate the spread of disease or outbreaks. This advance warning allows public health officials to inform public health recommendations, preparation, and response.
- **Communication**. Disease forecasts help relate the risk of disease outbreaks to various audiences accurately and quickly, which, in turn, can inform messages on important preventive measures and encourages compliance with recommended interventions.
- **Resource allocation.** Modeling data can help decision-makers better allocate resources by predicting where and when disease outbreaks are likely to intensify and create the greatest need.
- **Evaluation.** Forecasts and modeling can help make evaluating the effectiveness of public health policies and interventions more efficient by comparing predicted outcomes with observed data and adjusting as needed.

Considerations Informed by S/THA Forecasting

Jurisdictions with forecasting experience identified key indicators to monitor as part of outbreak forecasting, which fall into three main categories:

1. **Epidemic spread indicators** (e.g., symptom monitoring, morbidity and mortality data, percent positivity, regional pictures of transmission).
2. **Healthcare system capacity** (e.g., essential and/or surge personnel, available beds, ventilator usage, and supply of personal protective equipment.
3. **Public health capacity** for testing capacity and contact tracing.

Further considerations for S/THAs:

- **Know your strengths**. Identify the unique skillsets among partners in public health, academia, and the private sector and consider how they foster reciprocal relationships.
- **Recognize capacity/expertise gaps**. Consider leveraging partnerships for specific types of analytics expertise while exploring internal capacity building opportunities (e.g., job shadowing and resource-sharing programs on workflows and methodologies).
- **Engage legal and compliance teams.** Ensure policy and practice are aligned among partners.
- **Explore data access/sharing pipelines.** Connect public, private, academic partners, and their audiences.
- **Start small**. Identify discrete forecasting and modeling projects to demonstrate success.
- **Identify decision-makers' needs**. Provide quick access to analyses, metrics, dashboards.

Michigan Used Models and Forecasting for Hep C Cases

In response to Hepatitis C virus (HCV) in young adults from 2010-2018, the Michigan Department of Health and Human Services (MDHHS) simulated how HCV treatment could significantly reduce HCV prevalence among young people who inject drugs, especially for those both previously or currently injecting drugs. MDHHS used several novel predictors to paint a local picture of probable HCV diagnoses among residents up to age 40. These predictors included measures related to a variety of population characteristics (e.g., access to transportation, college education, presence of non-family households) and public health indicators (e.g., heroin treatment admissions, newborns with neonatal abstinence syndrome, and sexually-transmitted infections). MDHHS also leveraged county-level assessments of HCV vulnerability to identify locations for new syringe services programs in the state.

MDHHS has recognized several modeling and analytics use cases that benefitted their work during responses to HCV and COVID-19:

- Short-term forecasts (i.e., weeks) helped predict likely transmission patterns and potential ranges of projections.
- Longer-term forecasts (i.e., months) explored scenarios based on new recommendations and policy changes.
- Retrospective counterfactuals evaluated the impact of policies or other changes by examining "what-if" situations.

MDHHS is considering using forecasts and models for COVID-19, influenza epidemics, tuberculosis vulnerability, and C. auris spread. Resource constraints require decision-makers and public health practitioners to consider how they are using available resources for the highest return on investment. Models generated momentum to respond to threats and evaluate whether interventions were successful.

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