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# Data for Global Pandemic and Epidemic Intelligence

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May 2025



World Health  
Organization

**HUB**

Pandemic and Epidemic  
Intelligence

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# Pandemic and Epidemic Intelligence

The process of collecting, analyzing, and interpreting data from traditional, event-based, participatory and community surveillance, and field investigations, alongside contextual information, to detect, monitor, and assess public health risks.

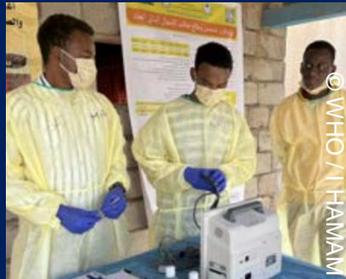
– Morgan et al., *How better pandemic and epidemic intelligence will prepare the world for future threats*. *Nat Med* 28, 1526–1528 (2022)

# Health emergencies throughout the year and on every continent

## DISEASE OUTBREAKS



Mpox / Global



Cholera / Global



As of May '25

33

Graded health emergencies



## CONFLICT



Ukraine



oPt

## Natural disaster



Myanmar



South Sudan



82

Affected countries\*



## DISPLACEMENT



Ethiopia



Haiti

# Value of good surveillance and analysis: Timely & better insights for decisions

## Rapid detection of health risks

### Public health intelligence at WHO



146 country offices  
6 regional offices  
+ WHO HQ

Every month 24/7

9 million	pieces of information retrieved
60,000	signals scanned
~1,000	signals of relevance identified
40	events highlighted
35	new events verified

## Decision support against health risks

### Surveillance systems with multiple purposes

Detect new diseases



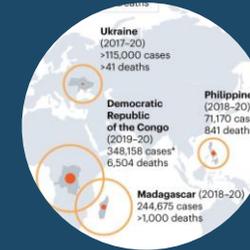
COVID-19

Re-emerging diseases



mpox

Monitor diseases



Measles

Elimination of diseases



Polio

# Pandemic and Epidemic Risks are Inherently Uncertain

## Uncertainty before a pandemic or epidemic

Pathogen?



Where?



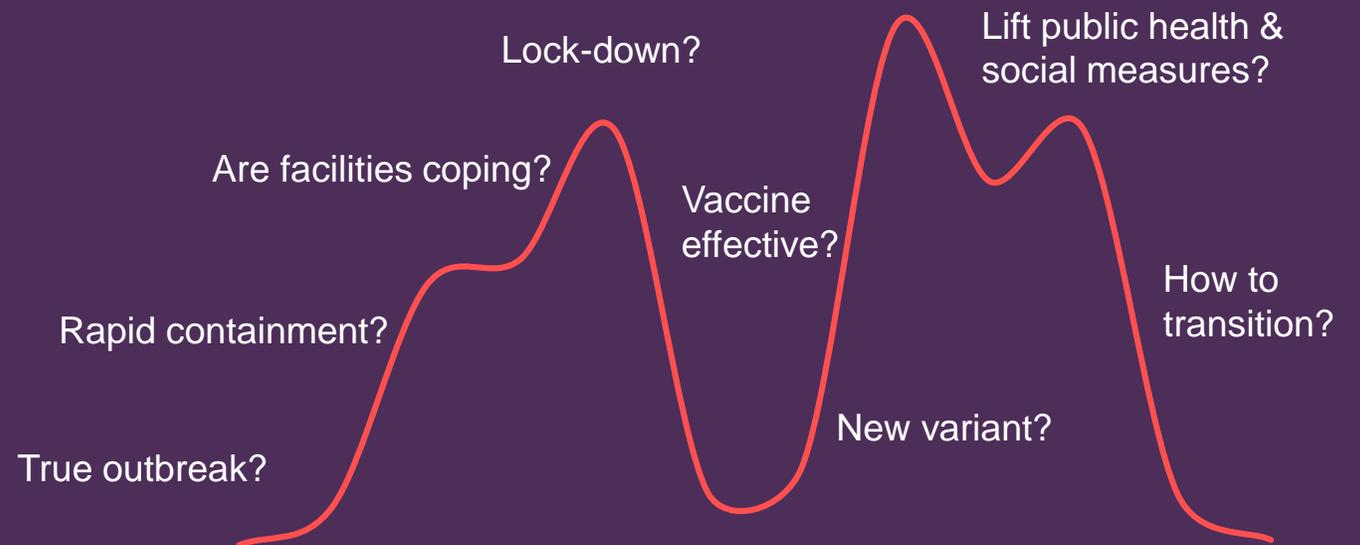
Severity?



When?



## Uncertainty during a pandemic or epidemic



# Three ways how surveillance & epidemic intelligence matters



**Detect threats early**  
to minimize effects of  
disease outbreaks



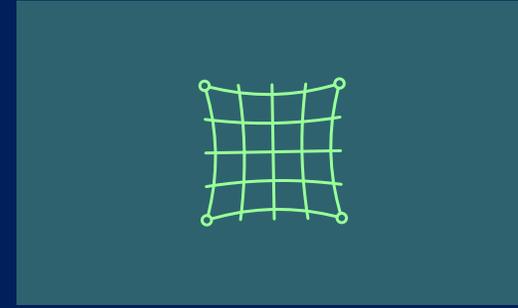
Stopping the worst before  
it happens



**Continuously inform**  
decisions for better  
population health



Better decisions in public  
health

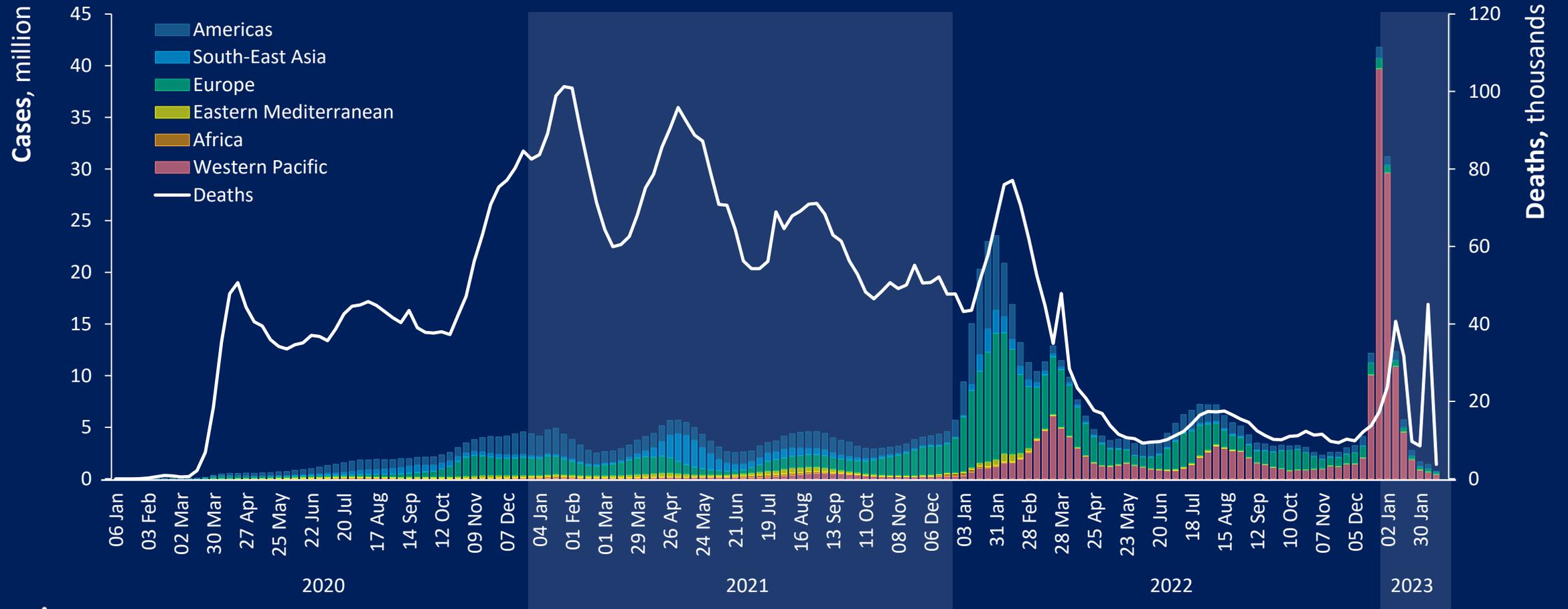


**Enable fast & robust**  
**decisions** during  
emergencies

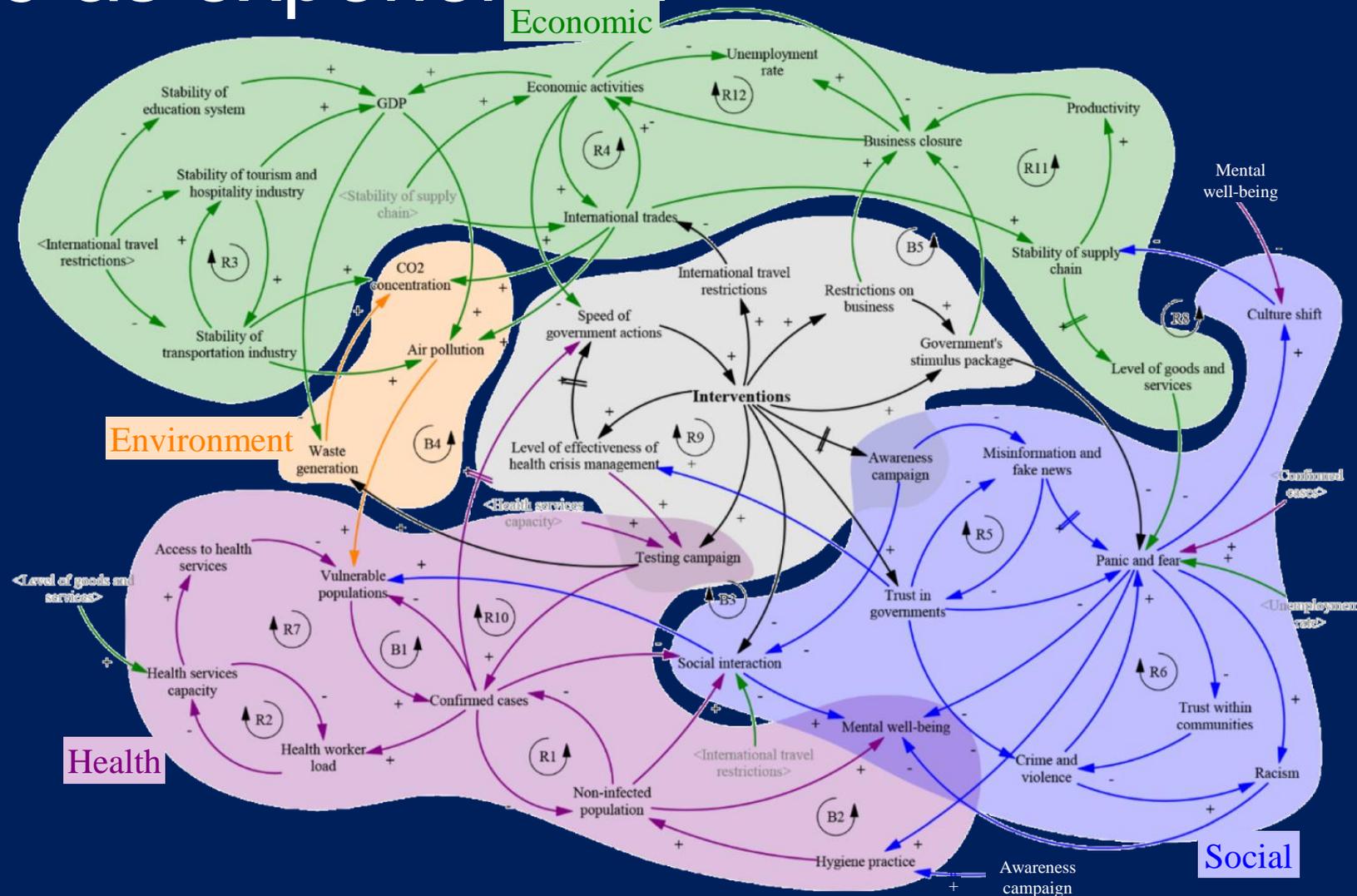


Avoiding 'wrong turns'  
during emergencies

# How we typically portray surveillance data



# COVID-19 as experienced



# Public health decisions must be informed by triangulation of many surveillance inputs

Every public health decision must flexibly draw from **multiple pieces of evidence...**

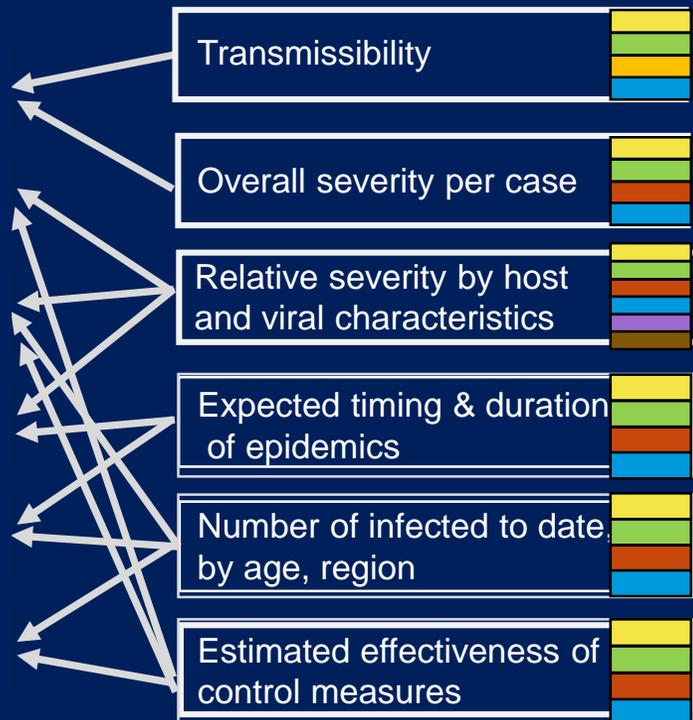
... by triangulating inputs from multiple **surveillance & other sources**

...requiring sophisticated **people, processes & technology**

## Decisions:

- ✓ Overall scale of response
- ✓ Selection & targeting of direct protection
- ✓ Selection & targeting of transmission reduction
- ✓ Balance of investments across types of measures
- ✓ Intervention timing & logistics; scale up plan
- ✓ Scale back plan

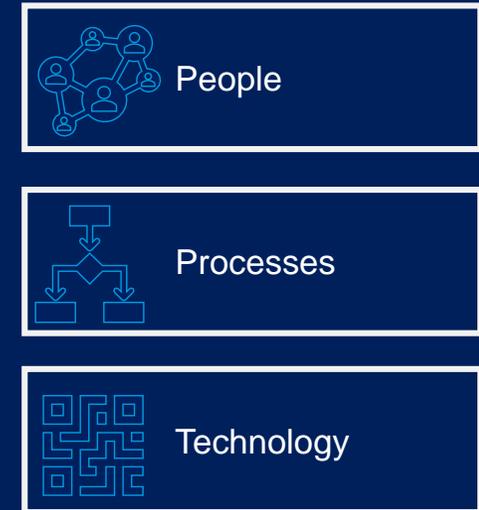
## Evidence



## Surveillance inputs



## Assets



# The complexity of the health risk environment



# Innovation in tools allows earlier and more comprehensive insights for decision making while increasing access to insights

## Outbreak analytics

- › data sharing and integration
- › disease modelling
- › AI adoption

## Genomics

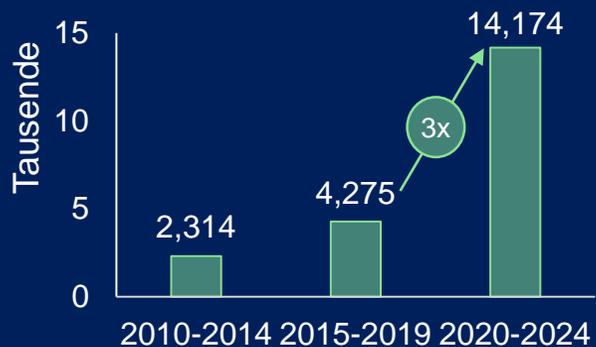
- › early detection of threats
- › inform response
- › develop countermeasures

## Open Source innovation

- › scale applications
- › enable collaboration
- › allow local specification

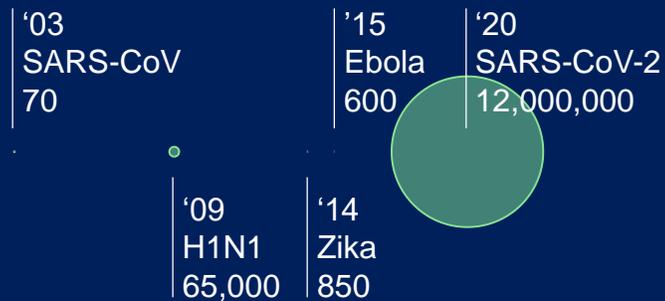
## Multiplication of research on public health intelligence

Number of publications



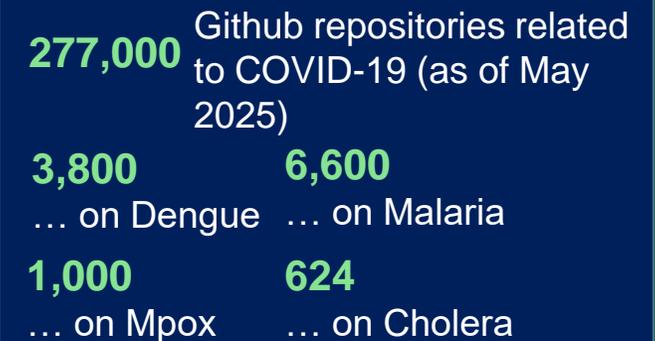
Pubmed ([link](#)), last updated 2 April 2025

## Increase in availability of whole genome sequences on public databases - Sep 2022



Mak TM et al. (2025). Pathogen genomics for surveillance and outbreak investigations. In: Fisher D, editor. Infectious Disease Emergencies: Preparedness and Response ([link](#))

## Expanded ease and openness to sharing work on digital tools



Estimates based on Github (May 2025)

# Collaborative Surveillance

## Building intentional collaboration across four dimensions



Connecting surveillance stakeholders for

- › Increasing capacity, tools, skill sets
- › Accessing new data sources
- › Improving technology and platforms

# Areas where the WHO Hub for pandemic works

## BETTER DATA



A GLOBAL INITIATIVE LED BY THE WORLD HEALTH ORGANIZATION

Providing timely information to Member States for the early detection of potential health threats



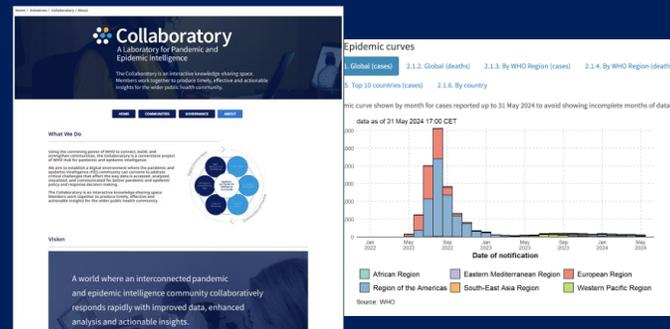
### Cholera outbreak

EIOS Dashboard showing detected signals of Cholera outbreaks

## BETTER ANALYTICS



Building a community & digital environment to enable faster data analysis during emergencies



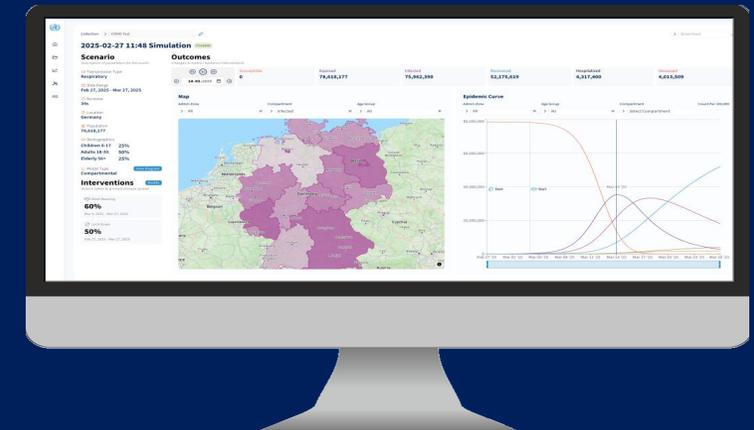
### Mpox outbreak

Community of Practice sharing of code, data and tools for real-time collaborative analytics

## BETTER DECISIONS

### Decision Support Pandemic Simulator

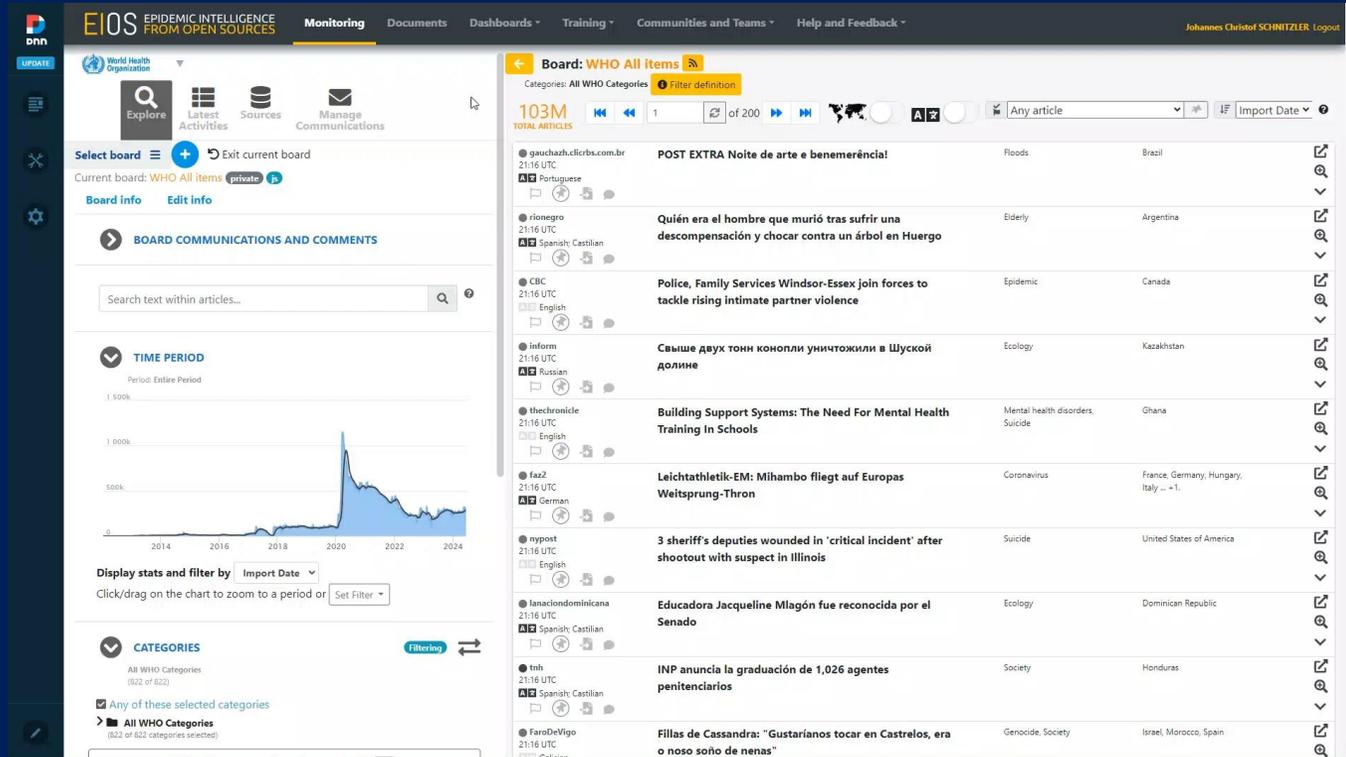
Supporting decision-making using real-world simulations of public health measures during emergencies



### Future outbreaks

Demo of the tool, currently in development

# Epidemic Intelligence from Open Sources - 2017



## EIOS Communities: Cumulative Growth\*



\* All communities have relevant training, enabling them to effectively use the EIOS system. Communities can be Member States, regional CDCs, as well as other organizations and networks. Relevant entities, including Member States, can join the initiative individually or as part of a network (e.g. GHSI).



A GLOBAL INITIATIVE LED BY THE  
WORLD HEALTH ORGANIZATION

# Speech to text – listening to radio stations online and local



News from rural communities



Unite-Wave EIOS Social listening platform

FM Radio signals transferred



Online Radios



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**EIOS**  
EPIDEMIC INTELLIGENCE FROM OPEN SOURCES



EIOS System

Real-time monitoring



World Health Organization



# Anomaly Detection and Semantic Search

**EIOS** EPIDEMIC INTELLIGENCE FROM OPEN SOURCES
EIOS Anomalies
Hello, jon.a@adappt.ai! [Log out](#) [About](#)

## Mpox Global Dashboard

Date Filter: 0  7 days

Search the knowledge bank

are mpox cases getting better or worse

Search

**Burundi** Approved

22 Nov 2024 | 09:15 AM UTC

Anomaly Score: 
93
42%

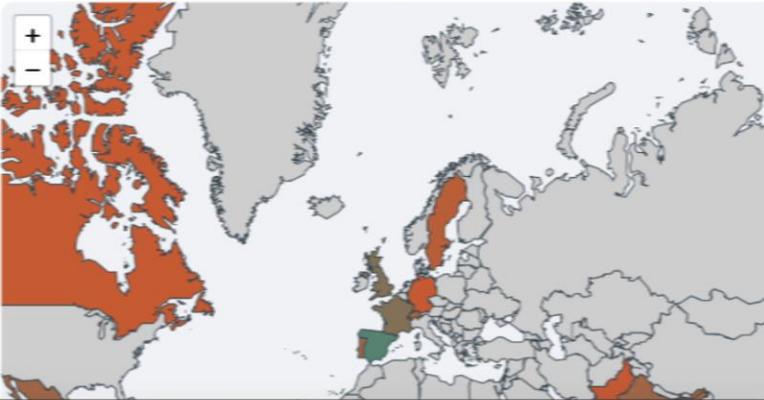
Health officials have reported elevated monkeypox (mpox) activity in multiple areas in Burundi, with an additional 763 confirmed cases reported Oct. 21-Nov. 17, bringing the total to 2,050 confirmed mpox ... is the first **outbreak of mpox** reported in Burundi; ... officials will likely **identify additional cases** in the ... in countries reporting **mpox transmission**. Seek medical ... WHO declared

**Angola** Approved

A case of Monkeypox reported in Angola, Namibians urged to...

Anomaly Score: 
83
16%

THE Ministry of Health and Social Services has received a report of one confirmed case of Monkeypox in the Angolan capital, Luanda. The patient is a Congolese national and is ... monitoring of the **Mpox outbreak** in the African ... recorded a confirmed **case of Mpox**. He reassured members





United Kingdom (GB)  
 Total Anomaly Score: 4367  
 Average Anomaly Score Per Article: 1456



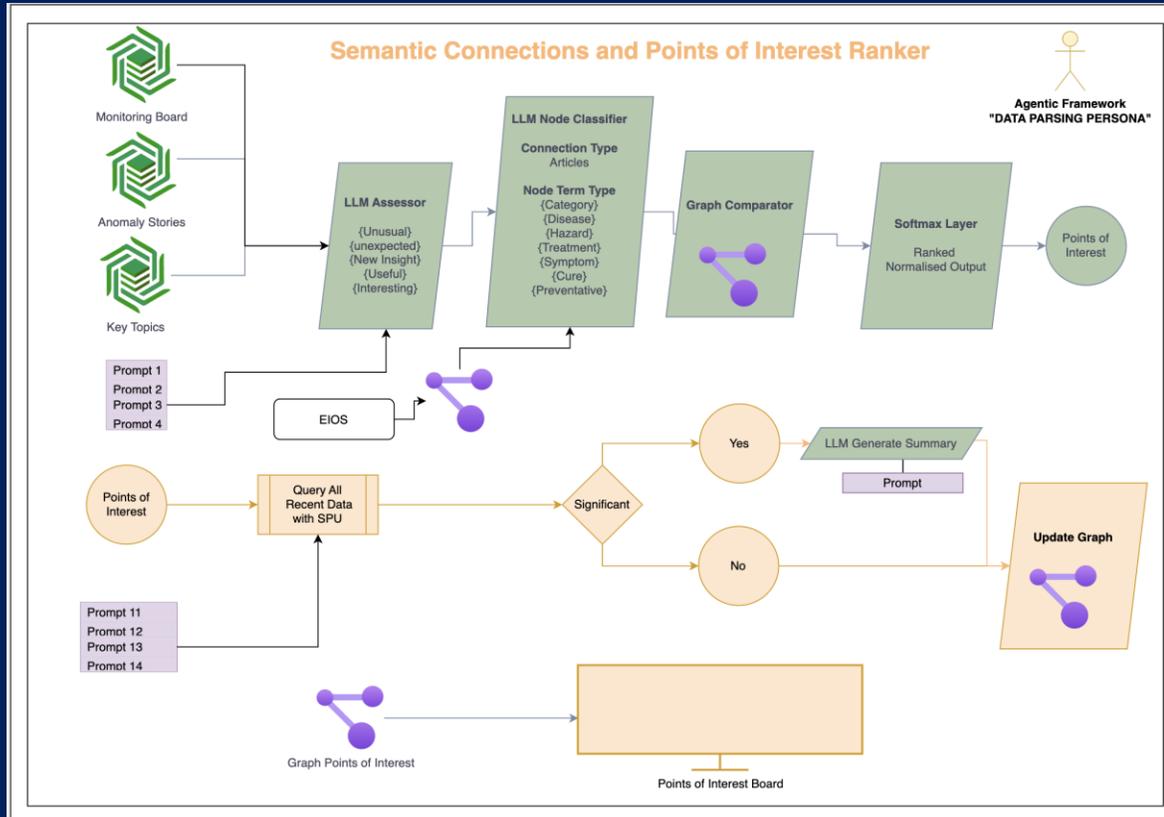
■ Article Count  
■ 7 Moving Average  
■ 60 Moving Average



**World Health Organization**

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# Creating a Living Knowledge Graph with Agentic AI



**EIOS**  
EPIDEMIC INTELLIGENCE  
FROM OPEN SOURCES

A GLOBAL INITIATIVE LED BY THE  
WORLD HEALTH ORGANIZATION

**Heart Disease** | Diseases | Symptoms | Treatments

This is the list of the Diseases with most articles related to heart disease

**Knowledge Graph:** A central node 'Heart disease' is connected to various related terms including Hemorrhagic fever with renal syndrome, Coronavirus pulmonary syndrome, Shortness of breath, Abdominal pain, Ventricular tachy, Dizziness, Coronary artery bypass grafting, Chest tightness, Muscle aches, Coughing, Premature coronary artery disease (CAD), Chills, Vomiting, Headache, Left main coronary artery, and Fever.

**News Articles:**

- What is hantavirus, infectio...**  
Betsy Arakawa, a classical pianist and wife of actor Gene Hackman, died from hantavirus pulmonary  
SCORE: 16  
08/03/2025
- Heart Disorders and Disease...**  
A recent report from Hebron University highlights the growing concern of premature coronary  
SCORE: 16  
04/03/2025

**Smoking** | Diseases | Symptoms | Treatments

**Anxiety** | Symptoms | Treatments

# Using Pathogen Genomics for Public Health Intelligence

International Pathogen Surveillance Network  
235 Partners in 85 Countries



Communities of Practice to solve common challenges



Country Scale-up Accelerator to enable exchange & amplify country voices



Catalytic grant fund to support member projects



PGS advocacy & communications



Convene partners to share progress and innovations



*Countries in which active IPSN partner organizations are located, \*excl. countries in which global/regional organizations are HQ*

# Data-driven decision making in health emergencies is difficult

Best available data    Appropriate analytics



## Operational teams

- ❖ Limited in-house analytics capacity
- ❖ Weak links to analytics community

## Analytics community

- ❖ Unaware of operational realities
- ❖ Develop tools in siloes

## Decision makers

- ❖ Removed from analytics process

# Collaboratory

Leverage WHO's position as a **globally networked** and **trusted** institution to convene communities and build a digital environment for communities of practice for **operationalizing analytics**



## Community

17 CoPs  
600+ members  
100+ organizations  
50+ countries

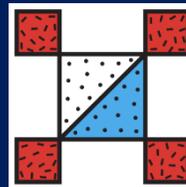
## Digital Platform

800+ posts  
250+ discussions



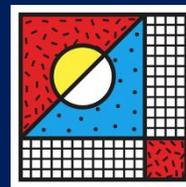
## Mpx Analytics

“How do we estimate the size of the mpx outbreak in DRC from cases detected abroad?”



## Dengue Analytics

“How do we predict the number of Dengue cases in three months from surveillance and climate data?”



## EpiParameters

“How do we report epidemiological parameter estimates in a standardized and centralized manner?”



# Example Global Repository of Epidemiological Parameters

## Problem Statement

There is currently no global repository of epidemiological parameters that the global modelling community can access, use, and contribute to.



## Future State

A global repository of epidemiological parameters that is publicly accessible by modellers, epidemiologists, subject matter experts, and decision makers to inform public health response.

**Proposed approach** (5 workstreams)- Collaborative approach-with currently, about 120 different collaborators- open to participate

Prioritization of diseases and parameters

Extraction of parameters

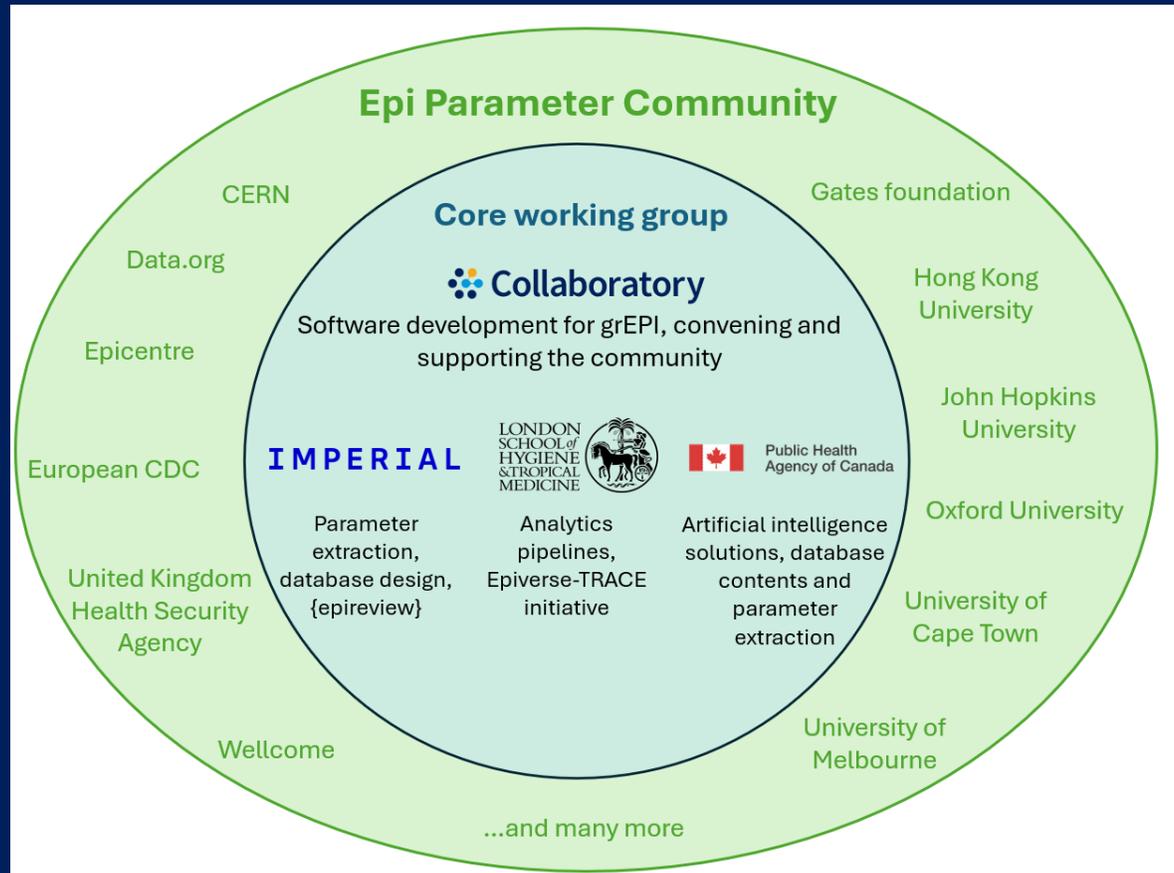
Storage and use of parameters

Maintenance and validation of parameters

Scientific recognition and other incentives

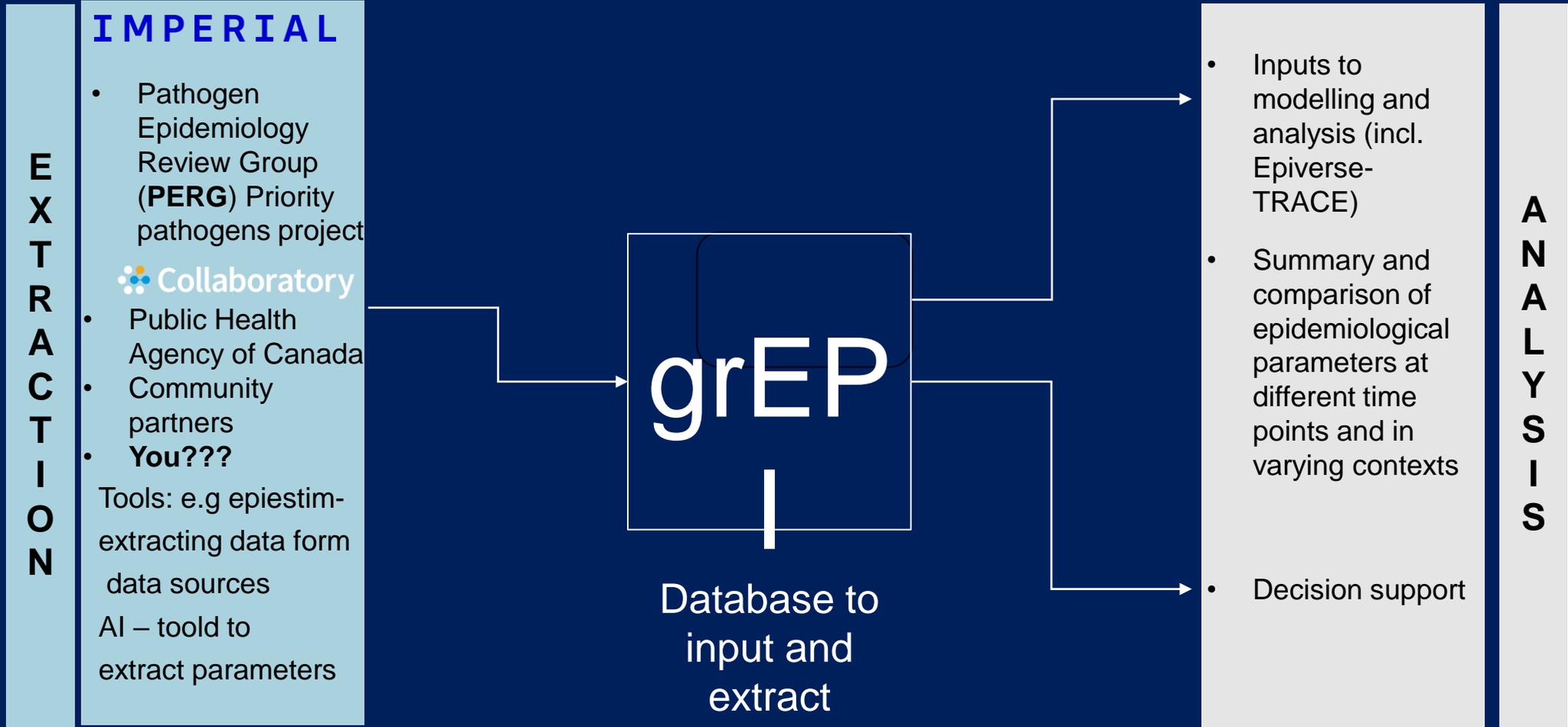


# Example Global Repository of Epidemiological Parameters



# Epidemiological Parameters

## Sources and pipelines



# Decision Support Pandemic Simulator

A data-driven decision-aid platform allowing public health officials and policy makers to conduct realistic simulations of the impact of multiple interventions before and during health emergencies on user-defined scenarios.



Democratize disease modeling access



Customizable pathogen characteristics

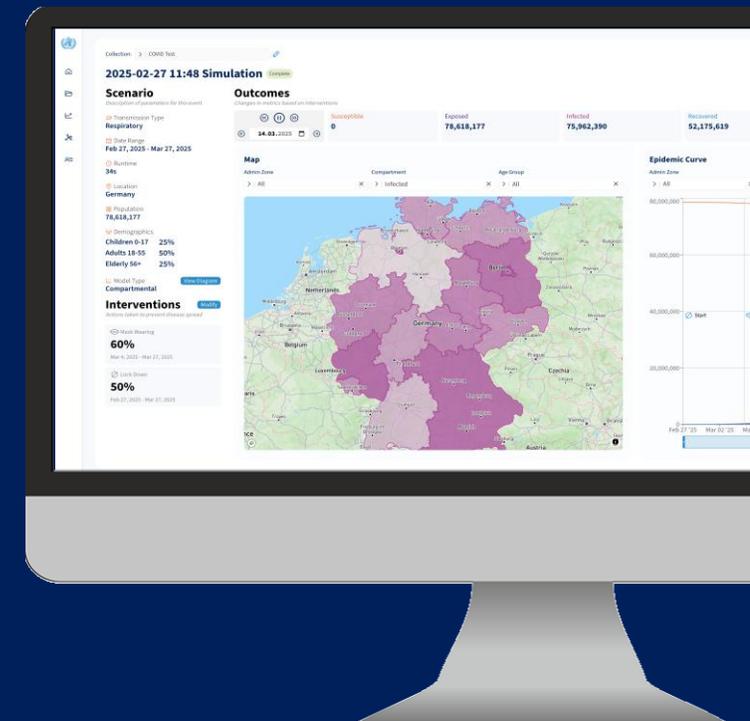


Rapid translation into policy-making

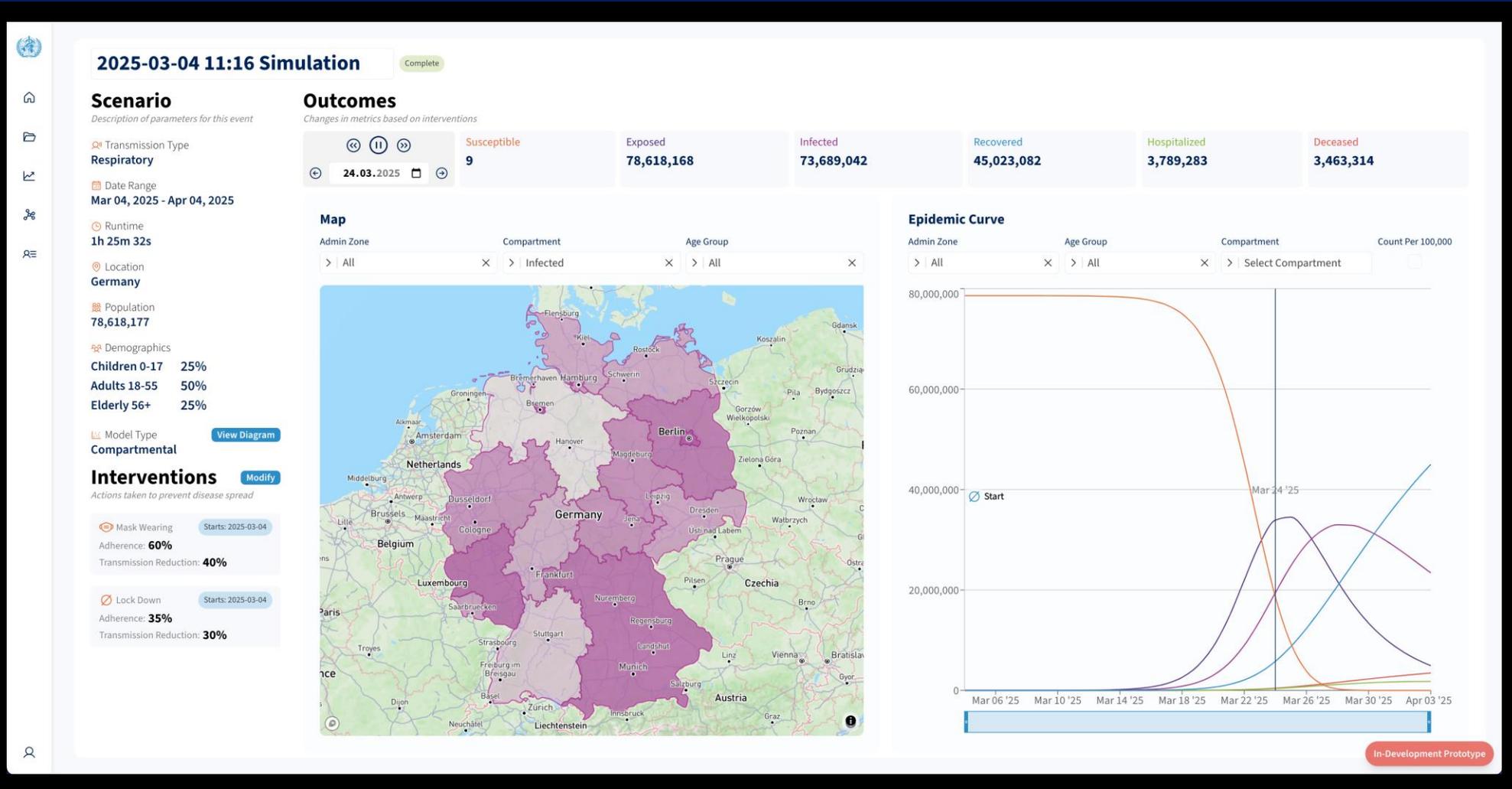


Model multiple diseases & compounding interventions

Next steps: AI – supported data input- model selection – model adaptation to the situation- and decision support



# Pandemic Simulator Prototype



# Verification and Epidemiological Understanding will always Require Field Investigation





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**Pandemic and Epidemic  
Intelligence**

# Thank you!

Acknowledgement for slides:

Dina Saulo

Patricia Ndumbi

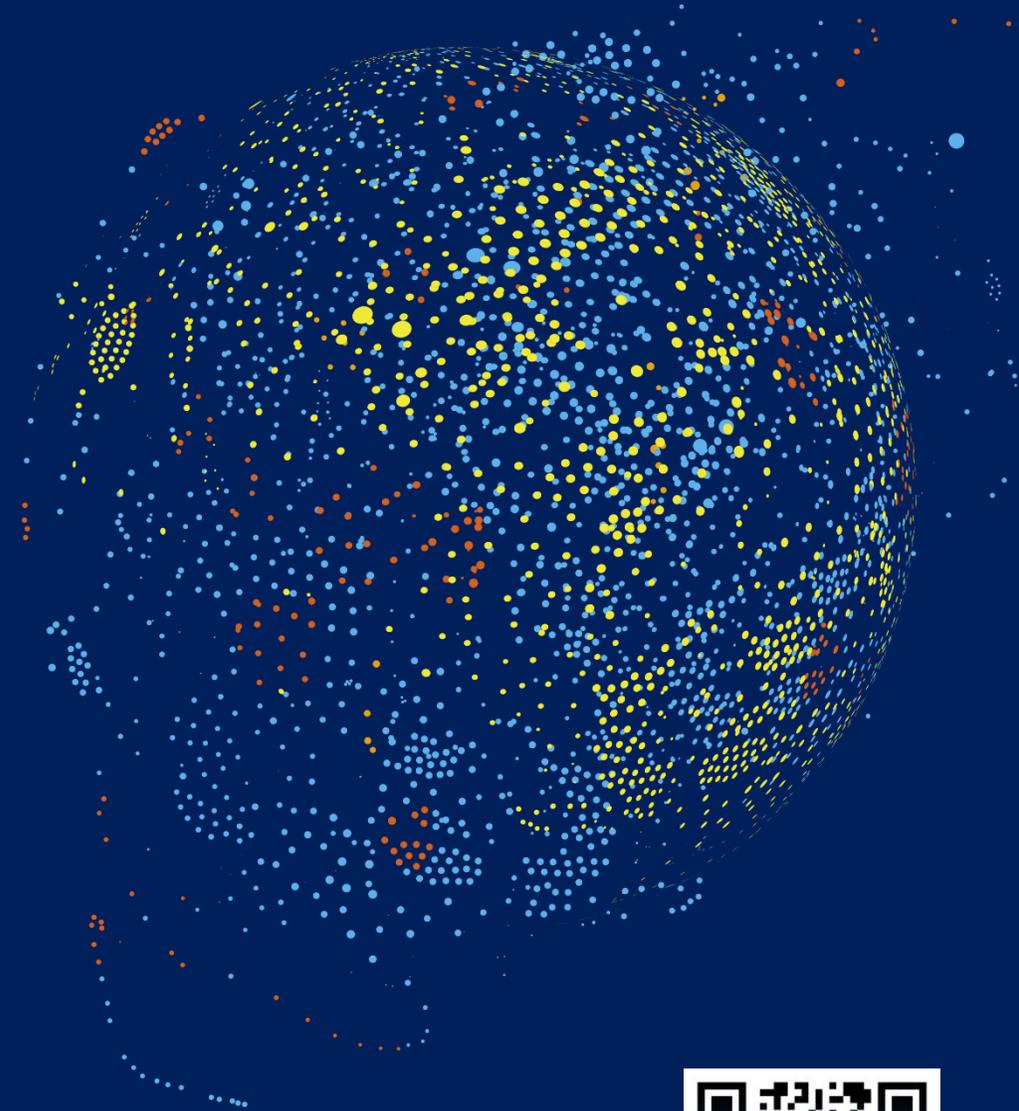
Christian Franz

Johannes Schnitzler

Philip Abelmalik

Chloe Rice

And ...



**Join the Collaboratory**  
*Scan this QR code to sign up*

