

## Global Health Resilience



Extreme climatic events, environmental degradation and socio-economic inequalities lead to excess mortality and morbidity and exacerbate the risk of infectious diseases. Climate change and biodiversity loss affect human interactions with other species, disease vectors and pathogens. This alters the distribution and spread of zoonoses and air-, water- and vector-borne infections and increases the risk of pandemics. Despite the wealth of data available to monitor these changing patterns, we lack analytical tools to understand interacting drivers at multiple scales and tailor multi-source information to predict and prepare for emerging global health threats.

The goal of the Global Health Resilience group at the Barcelona Supercomputing Center is to co-design policy-relevant decision-support tools to enhance surveillance, preparedness, and response to global health challenges, with a focus on climate-sensitive infectious diseases. The group applies a transdisciplinary approach, co-developing solutions at the interface of epidemiology, climate science, planetary health, biology, mathematical modelling, and data science. We conduct cutting-edge methodological research to understand the links between environmental change, socio-economic inequities, and infectious disease emergence and spread from global to local scales. This knowledge then feeds into the co-creation process to develop indicators, impact-based forecasting models and early warning systems at sub-seasonal to decadal time scales, which help to anticipate future risk in collaboration with public health, disaster risk management, and humanitarian agencies operating in Latin America and Caribbean, Europe, Asia and Africa.

We work closely with climate scientists, software engineers and knowledge integration experts from across the Earth Sciences department and international researchers specialising in disease intelligence data generation. These collaborations ensure integration with the latest technology and novel data streams to strengthen decision-support tools for public health decision-makers that ultimately build resilience to emerging health threats and protect the most at-risk communities. Our research contributes to global initiatives including the European and Brazilian Climate & Health Observatories, the Lancet Countdown and the Copernicus Health Hub, to ensure digital tools have a downstream policy impact to strengthen global health resilience to emerging health threats.

## Objectives

- Co-develop digital infrastructure and data harmonisation tools to allow researchers and practitioners to link, interrogate and use multi-scale spatiotemporal data to understand the links between environmental change, inequity and infectious disease outbreaks and emergence.
- Apply cutting-edge modelling techniques, including Bayesian modelling, machine learning and artificial intelligence to enhance disease surveillance and early warning and response systems.
- Tailor policy-relevant monitoring tools, indicators, impact-based forecasting models and early warning systems at sub-seasonal to decadal time scales to improve understanding, anticipation and forecasting of future risks of disease emergence and spread.
- Engage with local communities and decision-makers to understand the local context and perceptions around climate, environment and health and ensure digital tools meet the needs of the communities they intend to serve.
- Develop training materials in data harmonisation and disease risk modelling to enhance capacity sharing across disciplines and geographical regions.
- Ensure climate and health digital tools have a downstream impact on local, national, regional, and international policy.

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