

DZIF Bridging Topic: Global Health and Climate Change

Mission

This bridging topic group will collaborate across various fields within DZIF to develop effective strategies and translational solutions for infectious diseases, using approaches of global health and specifically addressing climate and environmental challenges.

Background

Global health has emerged as a field of research, teaching and practice focused primarily on health challenges that transcend borders, key amongst these are infectious diseases. Central research questions range from the development of technologies that address these challenges such as vaccines, diagnostics and therapeutics, to research focused on the kinds of interventions that ensure available and new solutions can be implemented and taken to scale. Research on contextual factors and on the causes of ill health, including social, cultural and environmental are a key part of this field of work. It is important to note that interdisciplinarity is a core aspect of the field and much of the research conducted in global health distinguishes itself by including intervention research and social science alongside more traditional biomedical research and development. It thereby drives the generation of knowledge that enables innovative thinking beyond the develop of a technical solution to include an explicit focus on implementation – making a practical difference to peoples’ health and lives. Understanding of why specific biomedical interventions work differently in different contexts, due to differences in the physical environment, different social and political contexts and differing community structures and belief systems is still limited and often neglected in development of innovation. Similarly, understanding risk of disease emergence, reemergence or spill over often is connected to changes in social and physical environments driven by the processes of globalization.

Global health extends to the kind of research that examines wider systemic factors that affect people’s health. Climate change, primarily driven by anthropogenic emissions of greenhouse gases into the atmosphere, has emerged as a critical determinant of global health. In fact, people in low- and middle-income settings are at higher risk for detrimental and large-scale impacts from climate change, through pathways of food and water security, the more frequent exposure to extreme climatic events, such as floods and droughts, but also changes in intensity and range of major infectious diseases. In total, climate change has been documented to impacts on over 150 infectious diseases, more than half of the known infectious disease of humans. The mechanisms are mediated through biological mechanisms and processes, but also through affecting the behavior of animals and human hosts. It is overall predicted to cause disease and fatalities to a much higher degree in already deprived population group suffering from worse health protection, with lower access to life saving vaccines, and limited access to health care. As such, climate change is widely recognized as one of the greatest global health challenges of the 21st century. Concurrently, much remains to be understood about the complex interactions between climate change, global health and infectious diseases, and how such impacts can be prepared for and prevented.

The Deutsche Zentrum für Infektionsforschung (DZIF) will be addressing such knowledge gaps by fostering interdisciplinary research at the interface of global health, infectious diseases and climate change. It will enable DZIF to facilitate innovation relevant worldwide, cognizant of the wider challenges causing infectious disease risks and that products and interventions can be implemented. For example, how can a new health care innovation, such as a therapeutic, diagnostic method, vaccine or behavioral intervention, be developed and implemented in such a way that it addresses the needs of communities in different settings, and contributes to protect vulnerable communities in the Global South from the impacts from infectious diseases and climate change? Which factors need to be considered to ensure uptake and implementation, and how can such innovations also benefit disadvantaged and vulnerable communities?

While efforts to mitigate greenhouse gas emissions are critical but unfortunately progress slowly, improved adaptation strategies at the clinical and public health interface are essential to prepare for the increased risk of emerging and re-emerging infectious diseases. Such adaptation action is crucial and does not always have to involve deploying new innovations but can also involve new strategies to coverage and deployment of well know remedies based on changes in the dynamic risk landscape informed by models. This includes the ability to better understand and predict and act on the risk of new or substantively more virulent pathogens emerging both in Europe and the Global South. It extends to the ability to design interventions, clinical and public health, to address the changing burden of disease, develop new surveillance and dynamic modeling methods to capture and project these changes, changes resulting from climate change and disease. There is also a lack of research infrastructures able to advance methods to continuous monitor and predict infection dynamics and the changing intervention needs in a One and Global Health Context.

DZIF's Contributions and longer-term Vision

To address global health and climate-change related challenges, DZIF has launched a dedicated initiative with following primary objectives:

- **Understanding implementation and uptake:** Conduct studies that focus on the factors affecting implementation and uptake of novel technologies, including in settings where infectious disease outbreaks are of greatest concern.
- **Understanding drivers:** research that focuses on how factors associated with global changes such as for example urbanization, migration and trade affect risk of spill over events, emergence of novel pathogens and disease dynamics. Research will also focus on interventions and strategies that seek to address these drivers.
- **Discovery of Climate-sensitive mechanisms:** Conducting studies to unravel the effects of climate variations on the replication, survival, and transmission of pathogens, as well as on the physiological responses of vectors and hosts, and the pathogen-insect-animal and human interactions.
- **Forecasting and Scenario-based Projections:** Engage in modelling of early warning of climate-driven emergence and outbreaks of infectious disease, as well and climate and development related scenario projections of infectious diseases

to inform infectious disease management, control, and the needs and effectiveness of adaptation with therapeutics and vaccines.

- **Intervention and Biomedical Innovation:** Developing and optimizing interventions, including vaccines, diagnostics and therapeutics, to meet the sometimes-higher demands of the global population, including arising from climate-driven disease dynamics.
- **Broadening Understanding:** Expanding research to encompass and describe changes in intervention needs across less studied groups of climate-sensitive infectious diseases, such as waterborne & foodborne diseases, pathogen spillover, and pathogen resistance to provide a more comprehensive understanding of climate change impacts on global health, and the need for strengthened interventions, including international teaching and capacity building initiatives.
- **Strengthening Surveillance and Adaptation Strategies:** Strengthening disease surveillance systems including fast-response diagnostics strategies and predictive modeling and promoting the development of adaptation strategies to mitigate the health impacts of climate change, particularly in regions most vulnerable to infectious disease outbreaks.

DZIF contribution to shorter-term Goals:

- Exchange of knowledge and establishment of an interdisciplinary “Global Health Climate Change” network within DZIF, its African Partner Institutions and beyond e.g. the social and natural sciences, to identify collaborative projects for FlexFund applications to make a progress in translational research in this field.
- Strengthening internal TTUs and TI collaboration as well as external collaboration with DZG and other networks/communities (such as the DNTD network, GLOHRA, One Health Platform).
- Facilitating access to platforms, hubs, networks, biobanking and data resources and platform of value for integrated surveillance systems, considering environment, human and animal health.
- Integration of the DZIF-Patient Advisory Board, RKI and diverse Societies and networks (e.g. MONID, GLOHRA, OHP) into the thematic to engage the public and responsible authorities to educate and gain acceptance for new strategies in translational research in this research field.
- Regular exchange at bridging topic meetings and workshops as well as participation in other relevant conferences to expand this thematic community.

Conclusion

The intersection of global health, climate change and infectious diseases represents a critical frontier in science. DZIF’s commitment to addressing this nexus through interdisciplinary research, capacity building and mainstreaming among health research professionals, innovation, and collaboration is essential for developing effective strategies to combat infectious diseases, to enable innovations that have an impact worldwide, and to address the global health impacts of climate change today and in the future. By advancing our understanding, refining and innovating interventions, DZIF aims

to strengthen global resilience against infectious disease threats, including the the growing threat posed by climate-driven infectious diseases.

Involved Partner Sites /Institutions / Associated DZIF Members

- Heidelberg University, Institute of Global Health (Heidelberg)
- Robert Koch Institute (Berlin)
- Bernhard Nocht Institute for Tropical Medicine (Hamburg)
- Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) (Ghana, Africa)
- Centre de Recherche Médicale de Lambaréné (Lambaréné, Africa)
- University Medical Center Hamburg-Eppendorf (Hamburg)
- Technical University of Munich (TUM), Institute of Medical Microbiology, Immunology and Hygiene & Center for Global Health (Munich)
- LMU University Hospital (Munich)
- Helmholtz Centre for Infection Research (Braunschweig)
- University Hospital Tübingen, Institute for Tropical Medicine (Tübingen)

Next Steps

- BT meetings with TTU topic representatives to discuss joint research interests.
- Organization of the DZIF bridging topic workshops.
- Identification of collaborative projects through the FlexFunds mechanism.