

Annex 3 Poster Exhibition - Book of Abstracts

Report on the High-level conference «Research Perspectives on the Health Impacts of Climate Change»

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Contact Rita ARAUJO

Email RTD-ENVIRONMENT-HEALTH@ec.europa.eu

Rita.ARAUJO@ec.europa.eu

RTD-PUBLICATIONS@ec.europa.eu

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EUROPEAN COMMISSION

Annex 3
Poster Exhibition - Book of Abstracts

Research Perspectives on **the Health Impacts of Climate Change**

Edited by
Rita ARAUJO and Alex MULET INDRAYANTI

Poster Exhibition

Book of Abstracts

The conference exhibition will consist of 52 posters which will be available for viewing in a dedicated space adjacent to the coffee/lunch tables.

Although participants will be able to visit this space throughout the event, posters will be divided into three groups each highlighted during a different timeslot:

- **BLUE posters:** highlighted during **Day 1 Coffee Break** (19 Feb. 15:15-15:45)
- **GREEN posters:** highlighted during **Day 2 Coffee Break** (20 Feb. 10:30-11:00)
- **ORANGE posters:** highlighted during **Day 2 Lunch Break** (20 Feb. 13:00-14:00)

During each of these timeslots, the authors of the highlighted posters will be available to answer questions on the content of their respective posters.

To vote for your favourite poster(s) from each group, please do so on Slido:

- **Vote for your favourite BLUE poster(s)** – link TBD
- **Vote for your favourite GREEN poster(s)** – link TBD
- **Vote for your favourite ORANGE poster(s)** – link TBD

Poster Exhibition

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Blue Posters

Poster 1

Local Climate Adaptation Tool: Working in co-design to develop decision-making tools on the health impacts of climate change

Emma Bland¹, Timothy J. Taylor¹, Jess Dicken¹, Phillipa Mina¹, Marissa Rice¹, Andrew Walton¹, Rhys Hobbs², Simon Kirby¹, Fliss Guest¹ and Peter Lefort¹

¹ University of Exeter, Exeter, United Kingdom

² Cornwall Council, Cornwall, United Kingdom

Abstract

What is LCAT?

The Local Climate Adaptation Tool (LCAT) brings together complex climate models, health impact evidence, vulnerability data & adaptations to help local areas understand the health implications of climate change & what action is needed. LCAT is being co-developed with, & for, local authorities & local service providers. It is a free, easy to use, online tool.

Why & how was LCAT developed?

An initial year was spent exploring how key stakeholders were adapting to climate change, what the barriers were to action & their understanding of the health impacts of climate change. Very little action on adaptation was taking place, in part due to barriers such as lack of capacity, funding, knowledge & usable data. A specification was subsequently co-designed for a tool which would provide accessible climate data, evidence and advice. They wanted a tool that supports multi-agency working & centres health & justice within decision-making. Cornwall & the Isles of Scilly,

UK, were the initial pilot site, before moving to a UK-wide tool. There is now an active & engaged National Stakeholder Group co-designing the tool, with over 100 members representing over 50 local UK areas. As it is developed further, updated iterations, with more data, content & evidence will be published.

Methods used include:

- Stakeholder engagement approaches including co-design
- Literature review
- mDPSEEA framework + causal loop diagrams

Why does LCAT focus on different sectors?

The health & wellbeing impacts of climate change are complex & wide ranging. They cross-cut multiple sectors from healthcare, to housing, to infrastructure & more. LCAT helps professionals take a multi-agency approach to build resilient and healthy communities. Additionally, those with least resilience to the effects of climate change are often vulnerable due to multiple factors including social & environmental factors. For example, quality of housing or access to greenspace. It

is therefore important that professionals across sectors & departments work together to reduce those inequalities.

Why is health the major focus?

The use of a health lens provides a common 'language', relevant to all service areas, and facilitates a multi-agency approach to adaptation planning. The tool identifies key, published evidence on health & wellbeing outcomes to support the recommendations it generates.

What next?

- Evaluation of the tool
- Further stakeholder engagement
- Development of a climate adaptation learning resource
- Internationalisation of the tool
- Further refinement of functionality & incorporation of new data sets

<https://www.ecehh.org/research/local-climate-adaptation-tool/>

Poster 2

Impacts of Heat Exposure in Utero on Long-Term Health and Social Outcomes: A Systematic Review

Nicholas Brink¹, Darshnika P Lakhoo¹, Ijeoma Solarin¹, Gloria Maimela¹, Peter von Dadelszen², Shane Norris³ and Matthew F Chersich¹ and Climate and Heat-Health Study Group

¹ Climate and Health Directorate, Wits RHI, University of Witwatersrand, Johannesburg, South Africa

² King's College, London, United Kingdom

³ MRC Developmental Pathways for Health Research Unit, University of the Witwatersrand, Johannesburg, South Africa

Abstract

Background:

Climate change, particularly global warming, is among the greatest threats to human health. While short-term effects of heat exposure in pregnancy, such as pre-term birth, are well documented, long-term effects receive less attention. This review aims to systematically assess evidence on the long-term impacts on the foetus of heat exposure in-utero.

Methods:

A search was conducted in August 2019 and updated in April 2023 in MedLine (PubMed). We included studies on the relationship of environmental heat exposure during pregnancy and any long-term outcomes. Risk of bias was assessed using tools developed by the Joanna-Briggs Institute, and the evidence was appraised using the GRADE approach. Synthesis without Meta-Analysis (SWiM) guidelines were used.

Results:

18,621 records were screened, with 29 studies included across six outcome groups. Studies were mostly conducted in high-income countries (n=16/25), in cooler climates. All studies were observational, with 17 cohort, 5 case-control and 8 cross-sectional studies. The timeline of the data is from 1913 to 2019, and individuals included

ranged in age from neonates to adults, and the elderly. Increasing heat exposure during pregnancy was associated with decreased earnings and lower educational attainment (n=4/6), as well as worsened cardiovascular (n=3/6), respiratory (n=3/3), psychiatric (n=7/12) and anthropometric (n=2/2) outcomes, likely culminating in increased overall mortality (n=2/3). The effect on female infants was greater than on males in 8 of 9 studies differentiating by sex. The quality of evidence was low in respiratory and longevity outcome groups to very low in all others.

Discussion:

Increasing heat exposure was associated with a multitude of detrimental outcomes across diverse body systems. The biological pathways involved are yet to be elucidated, but could include epigenetic, and developmental perturbations through interactions with the placenta and inflammation. This highlights the need for further research into the long-term effects of heat exposure, biological pathways, and possible adaptation strategies in studies with robust methodologies, particularly in neglected regions. Poor study design of the included studies constrains the conclusions of this review, with heterogeneous exposure measures and outcomes rendering comparisons across contexts/studies difficult.

Poster 3

Identifying climatically suitable European regions for leishmaniasis to guide public health interventions

Bruno M. Carvalho¹, Carla Maia², Orin Courtenay³, Alba Llabrés-Brustenga¹, Kim van Daalen¹, Jan C. Semenza⁴ and Rachel Lowe¹

¹ Barcelona Supercomputing Centre, Barcelona, Spain

² University Nova of Lisbon, Lisbon, Portugal

³ University of Warwick, Coventry, United Kingdom

⁴ Umeå University, Umeå, Sweden

Abstract

Leishmaniasis is a climate-sensitive zoonotic disease caused by *Leishmania* parasites and transmitted by female sand flies. Zoonotic visceral leishmaniasis (VL) and cutaneous leishmaniasis (CL) caused by *Leishmania infantum* are endemic in parts of Europe. However, notification is not compulsory in all endemic European countries, and underreporting and imported cases are common. Temperature is a main driver of sand fly distribution, which tends to be restricted to regions above 15°C. Optimum temperature and humidity conditions for vector activity and parasite development vary between species. As part of a collaboration between IDAlert and CLIMOS, projects of the European Climate-Health Cluster, we co-developed an indicator using a machine learning approach to track the climatic suitability for leishmaniasis at sub-national level across Europe over two decades (2001–2010 and 2011–2020). We compiled records of leishmaniasis cases caused by *Leishmania infantum* (ECDC) and linked them with the predicted suitability for its main vectors and with a set of nine bioclimatic indicators derived from monthly temperature and precipitation reanalysis data (ERA5-Land). Predicted suitability for the vectors *Phlebotomus perniciosus*, *P. ariasi*, *P. perfiliewi*, *P. neglectus*, and *P. tobbi* was estimated by associating their

occurrence data (from ECDC, EFSA VectorNet) with bioclimatic indicators, land cover (CORINE), and elevation (SRTM). A nested modelling approach based on the XGBoost algorithm was applied to fit the data summarised by decade to assess spatiotemporal changes in the climatic suitability for the disease. Climatic suitability for leishmaniasis has increased in Europe in the last two decades, with more noticeable changes in countries of the Southern and Eastern European regions. The number and spatial distribution of NUTS3 regions predicted to be suitable has changed within each country, between the two decades. The number of suitable NUTS3 regions has increased in the last decade in Southern, Western, and Eastern Europe, and in Western Asia, while remaining absent from Northern Europe. Italy, Bulgaria, North Macedonia and France were the countries with the most noticeable increase in the number of suitable NUTS3 regions in the last two decades. This indicator can be used as a guide to policy makers by detecting regions at higher risk of leishmaniasis occurrence, given suitable climatic conditions. Public health interventions in suitable areas include elimination of vector breeding and adult resting sites, use of repellents, and development of public awareness campaigns following a One Health approach to account for the complexity of its transmission cycle involving humans, domestic animals, wildlife, and sand fly vectors.

Poster 4

Early lessons and experiences from the Philippines for Europe in building climate-resilient local health systems in coastal municipalities

Karen C. Ceballos¹, Johannes Reiner Asio¹, Marianne K. Bongcac¹, Naomi Beyeler¹ and Renzo R. Guinto¹

¹ Planetary and Global Health Program, St. Luke's Medical Center College of Medicine-William H. Quasha Memorial, Manila, Philippines

Abstract

The Philippines is among the world's most vulnerable countries to climate change, experiencing wide-ranging climate-related impacts including more intense and more frequent typhoons and rapid sea level rise. As a threat multiplier, climate change exacerbates public health problems and strains local health systems. Numerous global initiatives and national declarations have been made to address climate-related health impacts. However, these aspirations for building climate resilience remain poorly operationalized within local health systems that are often already under-resourced to implement and innovate locally-appropriate strategies for climate-health resilience.

This implementation project aims to pilot an innovative, municipal-level intervention to build climate-resilient local health systems in two Philippine coastal towns - Alabat and Ajuy. The project aims to support municipal governments (1) build climate and health knowledge and capacity; (2) develop climate-health plans, budgets, and project proposals; and (3) foster collaboration within the municipal government and with local and national stakeholders to generate political will and financial support for climate-health action.

Some of the activities embedded in the intervention include (1) climate and health training for municipal staff; (2) iterative, collaborative, and participatory review of local climate change

action plans through a public health lens; (3) co-diagnosis of priority climate-related hazards and the interrelated climate-sensitive health conditions; and (4) co-design of climate-health measures, climate-considerate health budgets, and climate-health project proposals for submission to potential funders. Research and evaluation are also embedded through pre- and post-activity surveys, key informant interviews, and analysis of secondary data.

Local governments deal with a diverse range of concerns beyond climate and health, often with competing use of limited resources. Therefore, being strategic in resilience-building initiatives is key (such as by identifying focal points and champions and building on existing efforts). The local health sector is oftentimes neglected in climate-related planning and budgeting processes. Hence, this project helps connect the health sector with other climate-relevant sectors, which is critical for identifying locally-led climate-health resilience strategies and galvanizing collaborative climate-health action at the local level. Such lessons from a country in the Global South like the Philippines can be useful for Europe, as it begins to also experience more cyclones and flooding. This knowledge exchange can also present opportunities for Asia-Europe collaborations where such lessons can help inform priorities for adaptation-support that high-emitting regions like Europe can provide to low-emitting and climate-vulnerable countries like the Philippines.

Poster 5

Developing global and national indicators that track impacts and adaptation to climate change: attribution research in the HIGH Horizons and the HEAT Center projects

Matthew F. Chersich¹

¹ Wits RHI, University of the Witwatersrand, Johannesburg, South Africa

Abstract

A detailed understanding of the wide-ranging and complex threats that climate change poses to human health is a key step towards building effective responses to the climate crisis. Though harms of environmental exposures, such as extreme heat, are well known, traditional statistical approaches are limited in that they do not distinguish between harms from climate change and those from natural variations in climate. Attribution studies isolate health impacts specific to climate change, highlight the growing health consequences and costs of climate inaction, and provide a baseline for long-term surveillance through sensitive indicators. In turn, indicators that capture the impacts of climate change and trends in these impacts are critical for informing global priorities in climate change, developing and monitoring targets, advocacy and support for climate change litigation, and loss and damage initiatives.

In the HIGH Horizons project, funded by the European Union, we have begun to quantify impacts of high temperatures on maternal and newborn health using existing harmonised health and climate databases. Data are drawn from large population-based registries and related sources, including the Swedish birth cohort (all births in Sweden), the Lazio Region of Rome, several regions of Greece, and a district in South Africa and Kenya. This includes around 6 million birth records. The HEAT Center is an NIH-funded study which includes

data on maternal and child outcomes from around 200 cohorts or trials across sub-Saharan Africa, and mirrors activities in HIGH Horizons. Then, using modelling methods involving actual and counterfactual weather, we quantify the impacts from climate change alone. We will perform both event attribution (e.g., storyline analyses of heat waves) and probabilistic trend-to-trend analyses to understand how long-term trends in climate are impacting on health outcomes. Lastly, following a standardised protocol, we will select indicators to measure health impacts of climate change over time. We will also attempt to develop novel, integrated adaptation and emissions reduction indicators, which make explicit the benefits, costs and policy trade-offs involved in allocating resources between adaptation and mitigation.

Our approach focuses throughout on identifying the most vulnerable populations and potential protective factors – essential information for improving the agility of health sector decision-making and steering investment towards the climate-health nexus. Lastly, we aim to demonstrate the generalizability of our approach and understand climate changes risks in other key populations and settings. Ultimately, this work will develop indicators that track impacts of climate change on a key population, aiming for adoption of these measures in global instruments such as the Lancet Countdown and future WHO-led initiatives. The CHANCE network, founded by the EU-funded ENBEL project will facilitate research-to-policy shifts.

Poster 6

Ambient Temperature Exposure and Foetal Size and Growth in Three European Birth Cohorts

Esmée Essers^{1,2,3,4}, Laura Granés^{1,2}, Scott Delaney⁵, Joan Ballester¹, Susana Santos⁵, Sami Petricola^{1,2}, Tiffany C. Yang⁶, Ana Fernández-Somoano⁷, Ainhoa Bereziartua⁸, Ferran Ballester⁹, Adonina Tardón⁷, Martine Vrijheid^{1,2}, Aitana Lertxundi⁸, Rosemary McEachan⁶, Hanan El Marroun³, Henning Tiemeier³, Carmen Iñiguez¹⁰, Mònica Guxens^{1,2,3,4}

¹ Barcelona Institute for Global Health, Barcelona, Spain

² Universitat Pompeu Fabra, Barcelona, Spain

³ Department of Child & Adolescent Psychiatry/Psychology, Erasmus UMC, Rotterdam, The Netherlands

⁴ Generation R Study Group, Erasmus UMC, The Netherlands

⁵ Department of Environmental Health, Harvard T.H. Chan School of Public Health, Boston, MA, U.S.

⁶ Bradford Institute for Health Research, Bradford Teaching Hospitals NHS Foundation Trust, Bradford, United Kingdom

⁷ IUOPA – Department of Medicine, University of Oviedo, Oviedo, Spain

⁸ Health Research Institute, BIODONOSTIA, Donostia, Spain

⁹ Department of Nursing, Universitat de València, Valencia, Spain

¹⁰ Department of Statistics and Computational Research, University of Valencia, Valencia, Spain

Abstract

Introduction:

Extreme temperatures may affect birth outcomes adversely, but little is known about their impact on foetal growth throughout pregnancy. We evaluated the association between temperature exposure during pregnancy and foetal size and growth in three European birth cohorts.

Methods:

We studied 18,630 pregnant women from the English Born in Bradford cohort, Dutch Generation R Study, and Spanish INMA Project. We calculated weekly ambient air temperature at the mothers' residences during pregnancy using the 100-m resolution urban climate model UrbClimTM. Estimated foetal weight, head circumference, and femur length at mid and late pregnancy and weight, head circumference, and length at birth were converted into standard deviation scores

(SDS). Foetal growth from mid to late pregnancy was calculated (grams or centimetres/week). Cohort/region-specific distributed lag non-linear models were combined using a random-effects meta-analysis. Results were presented in reference to the median percentile of temperature exposure during the lag period of interest.

Results:

Weekly temperatures ranged from -5.5 (Bradford) to 30.9 °C (INMA-Valencia). Cold exposure during weeks 1-18 cumulated was associated with a smaller femur length in late pregnancy (e.g., for 8.0 °C (vs. 14.0 °C): -0.6 SDS [95% confidence interval -1.1; -0.2]). Heat exposure during weeks 1-18 cumulated was associated with a slower estimated foetal weight and faster femur length growth from mid to late pregnancy (e.g., for 22.5 °C (vs. 14.0 °C): -7.5 g/week [-12.9; -2.0] and 0.02 cm/week [0.01; 0.04], respectively), with two/three-week susceptibility periods during the first two pregnancy trimesters. Cold exposure was associated with a

slower head circumference growth (e.g., for 6.0 °C (vs. 14.0 °C): -0.1 cm/week [-0.2; -0.05]), with an eight-week susceptibility period during the first trimester. No associations were found for other foetal or any birth outcomes..

Conclusions:

Cumulative exposure to cold and heat during pregnancy was associated with changes in

foetal size and growth throughout gestation, with susceptibility periods during the first two pregnancy trimesters. No associations were found at birth, suggesting potential recovery of the identified changes. Future research should replicate this study across different climatic regions including varying temperature profiles.

Poster 7

ENDCast: A framework for El Niño driven disease forecasting in Latin America and the Caribbean

Chloe Fletcher^{1,2}, Martín Lotto Batista^{1,3}, Daniela Lührsen¹, Bruno M. Carvalho¹, Alba Llabrés-Brustenga¹, Gabriela Müller^{4,5}, Andrea Gómez^{4,5}, Soledad López^{4,5}, Paloma M. Carcamo^{6,7}, Gabriel Carrasco-Escobar^{7,8}, Juan D. Umaña⁹, Mauricio Santos-Vega^{9,10}, Renata Gracie^{11,12}, Christovam Barcellos^{11,12}, Leslie Rollock¹³, Avriel R. Diaz^{14,15}, Sadie J. Ryan^{16,17}, Anna M. Stewart-Ibarra¹⁸, Mercy Borbor-Cordova^{19,20}, Rachel Lowe^{1,21-23}

¹ Barcelona Supercomputing Center (BSC), Barcelona, Spain

² Universitat Pompeu Fabra, Barcelona, Spain

³ Helmholtz Centre for Infection Research, Brunswick, Germany

⁴ Center for Studies of Climate Variability & Climate Change, National University of Litoral (UNL), Sante Fe, Argentina

⁵ National Council for Scientific & Technical Research (CONICET), Santa Fe, Argentina

⁶ Yale School Of Public Health, New Haven, United States

⁷ Universidad Peruana Cayetano Heredia (UPCH), San Martin de Porres, Peru

⁸ University of California, San Diego, United States

⁹ Research Group in Mathematical & Computational Biology (BIOMAC), Universidad de los Andes, Bogotá, Colombia

¹⁰ Department of Biological Sciences, Universidad de Los Andes, Bogotá, Colombia

¹¹ Institute of Scientific & Technological Communication & Information in Health, Fdn. Oswaldo Cruz, Rio de Janeiro, Brazil

¹² Brazilian Climate & Health Observatory, Fdn. Oswaldo Cruz, Rio de Janeiro, Brazil

¹³ Ministry of Health & Wellness, St. Michael, Barbados

¹⁴ International Research Institute for Climate & Society (IRI), Columbia University, Lamont, United States

¹⁵ Department of Earth & Environmental Sciences, Columbia University, New York, United States

¹⁶ Department of Geography, University of Florida, Gainesville, United States

¹⁷ Emerging Pathogens Institute, University of Florida, Gainesville, United States

¹⁸ Inter-American Institute For Global Change Research (IAI), Montevideo, Uruguay

¹⁹ Faculty of Maritime Engineering & Marine Sciences, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador

²⁰ Pacific International Center for Disaster Risk Reduction, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador

²¹ Catalan Institution for Research & Advanced Studies (ICREA), Barcelona, Spain

²² Centre on Climate Change & Planetary Health, London School of Hygiene & Tropical Medicine, London, United Kingdom

²³ Centre for Mathematical Modelling of Infectious Diseases, London School of Hygiene & Tropical Medicine, London, United Kingdom

Abstract

El Niño influences extreme climatic events around the globe, such as floods, droughts and storms, which can impact the timing and intensity of climate-sensitive infectious disease outbreaks. Early warning systems and decision-support tools that integrate seasonal climate forecasts can predict the risk of outbreaks 1-6 months in advance, enabling sufficient time to implement actions for epidemic preparation. However, there

is currently a lack of accessible and reproducible prediction tools that can be implemented in response to emerging climatic events. To address this gap, we present a decision-support framework, ENDCast (El Niño Driven Disease Forecasting), that produces probabilistic predictions of infectious disease outbreaks in response to El Niño or La Niña events and associated seasonal climatic anomalies. We have opted to focus our initial prototype in the Latin American and Caribbean (LAC) region, an area experiencing multiple concurrent outbreaks

during the current 2023/24 El Niño. An operational platform that issues monthly disease forecasts with a 1-6 month outlook will be hosted via an R Shiny web application throughout the event. At present, we produce forecasts for two vector-borne diseases (dengue and malaria) and one water-borne zoonosis (leptospirosis) in LAC hotspots that are sensitive to El Niño, including Northeastern Argentina, Barbados, the Brazilian Amazon, Northeastern and Southern Brazil, Colombia, Ecuador and Peru. However, the ENDCast framework represents a simple, reproducible methodology that could be rapidly and flexibly deployed to any location or climate-sensitive disease during a future El Niño or La Niña. Using climate data obtained from open global products and locally provided epidemiological data, we undertake a comprehensive model fitting, selection and verification process to establish bespoke climate-integrated disease prediction models in each site. We employ a hierarchical Bayesian mixed modelling framework, where models

contain up to three climatic covariates including lagged El Niño-, temperature- and precipitation-based indicators. By integrating climate forecasts that have been individually calibrated through tailored post-processing techniques, we produce probabilistic 1-6 month forecasts for dengue, malaria and leptospirosis each month. These forecasts are hosted on a web application that has been co-produced with local collaborators. The platform includes visualisations, alerts and risk levels for predicted outbreaks at varying spatial and temporal scales, providing decision-makers with early warning of potential outbreaks to trigger early action. The ENDCast approach could be easily adapted to other endemic settings, including Asia or Africa, to predict the probability of outbreaks for a host of different climate-sensitive diseases, contributing to the Wellcome Trust funded projects (HARMONIZE and IDExtemes) and EU-funded projects (E4Warning and IDAlert).

Poster 8

West Nile virus: Tracking transmission suitability in Europe and beyond

Julian Heidecke¹, Marina Treskova¹ and Joacim Rocklöv¹

¹ Heidelberg University, Heidelberg, Germany

Abstract

Climate change is one of the major drivers of the transmission and geographic expansion of mosquito-borne infectious diseases. In Europe, one of the major concerns in this realm is the continuous expansion and increasing intensity of West Nile virus (WNV) transmission. WNV mainly circulates between birds and mosquitoes but can spillover into human populations via *Culex* bridge mosquitoes potentially resulting in rare but severe disease. Unprecedented European WNV outbreaks in 2010 and 2018 demonstrated that understanding of climate-driven risk changes and having tools to project them are key for adaptation and proactive outbreak management. To a large degree, the impact of climate change on mosquito-borne diseases results because changes in temperature can create more suitable conditions for mosquito populations to proliferate and their physical ability to transmit infectious diseases. Typically, mosquito-pathogen traits like mosquito lifespan or extrinsic incubation period respond in a unimodal manner to temperature. Therefore, it is often observed that transmission suitability is limited to a certain temperature range and optimized in between. These relationships can be tested experimentally which can in turn inform models to monitor changes in transmission suitability and assess impacts of warming. This information can be used to motivate climate change mitigation efforts and to focus adaptation efforts to areas experiencing most drastic increases of suitability for a specific disease.

In this work, we provide an updated analysis of data from over 40 laboratory studies investigating the response of various mosquito-pathogen traits to temperature. The dataset focuses mainly on species from the genus *Culex* and their potential to transmit West Nile virus but also includes information from other mosquito species which occur and transmit diseases mostly in temperate regions. A Bayesian hierarchical model is used to fit thermal response functions for each mosquito-pathogen trait and to account for differences in these responses between species and experiments. We demonstrate how these thermal response functions can be used to incorporate temperature sensitivity in mathematical models of mosquito population dynamics and transmission potential such as the basic reproduction number. Our recent results from the Lancet Countdown tracking progress on health and climate change, show how the approach can be used to monitor historical changes in WNV transmission suitability on a global scale. They reveal that the annual average temperature suitability of WNV transmission increased by 4.4% from 1951–60 to 2013–22, while Europe experienced a change of 36.6% in the same period, in line with the increase in transmission observed for this region. We discuss limitations of the approach and point out important paths for future research that could further enhance its value for an evidence-based assessment of climate change impacts on mosquito-borne diseases.

Poster 9

SPHERA Consortium: setting research priorities on environment, climate and health in Europe

Manolis Kogevinas¹, R. Barouki², J. Klanova³, R. Vermeulen⁴, A. Peters⁵, K. Katsouyanni⁶, F. Prenekert⁷, N. Pearce⁸, D. Sarigiannis^{9,12}, G. Bornette¹⁰, S. Netanyahu¹¹

¹ Barcelona Institute for Global Health, Barcelona, Spain

² French National Institute of Health and Medical Research (INSERM), France

³ Masaryk University, Brno, Czechia

⁴ Utrecht University, Utrecht, The Netherlands

⁵ Helmholtz Zentrum München - German Center for Environmental Health GmbH, Munich, Germany

⁶ Imperial College London, London, United Kingdom

⁷ Örebro University, Örebro, Sweden

⁸ London School of Hygiene & Tropical Medicine (LSHTM), London, United Kingdom

⁹ Aristotle University of Thessaloniki, Thessaloniki, Greece

¹⁰ The National Center for Scientific Research and Institut Écologie et Environnement (CNRS, INEE), France

¹¹ World Health Organization (WHO), Geneva, Switzerland

¹² National Hellenic Research Foundation, Athens, Greece

Abstract

The SPHERA (Single Planet Health and Environment Research Agenda) Consortium (<http://www.spheraresearch.org/>) is a development of the HERA Project (<https://www.heraresearch.eu/>), which was funded by the European Union (EU) Horizon2020 program to develop priorities for the EU in research on the environment, climate & health (grant agreement N° 825417). The final report by HERA, "The EU research agenda for the environment, climate & health, 2020-2030," has been highly successful and extensively utilized by the European Commission (EC) to develop the Horizon Europe program (<https://www.heraresearch.eu/hera-2030-agenda>).

The HERA project identified 6 major research goals, closely related to the topic of the meeting:

1. Climate change and biodiversity loss – reduce effects on health and the environment
2. Cities and communities – promote healthy lives in sustainable and inclusive societies

3. Chemicals and physical stressors – prevent and eliminate harmful chemical exposures to health
4. Improve health impact assessment of environmental factors and promote implementation research
5. Develop infrastructures, technologies and human resources for sustainable research on environment, climate change and health
6. Promote research on transformational change in environment, climate change and health

SPHERA is currently being deployed through a Consortium comprising major research institutions in the EU specialized in the area of environment, climate change, economics, social science, and health. It carries forward the HERA activities as a think-tank, regularly updating the research agenda, identifying emerging issues, setting-up disease specific priorities on environment and climate change, and advocating for new funding opportunities. By facilitating education

and training programs as well as research infrastructure networks, the Consortium actively fosters an environment to tackle the evolving challenges arising from the interplay of these interconnected domains. Through the promotion of a robust science-policy interface, SPHERA advocates for evidence-based decision-making and policy formulation.

The EC and Member States of the EU were the primary recipient of the HERA Agenda. SPHERA will expand its scope to the WHO European Region, encompassing 53 Member States. To foster a more holistic, multidisciplinary and impactful research environment, SPHERA will foster collaboration

with major international initiatives such as the Lancet Countdown on health and climate change, Ministerial Conferences on Environment and Health, European environment and health partnerships and the United Nations Environment Programme. Through collaboration and commitment to excellence in research and innovation, SPHERA aims at making substantial contributions to advancing research, shaping policy, and influencing practices at the intersection of society, environment, climate change and health in Europe and beyond, to address the triple planetary crises through science-policy panels.

Poster 10

Digital Health in the Heat: Lessons from COVID-19 for Thriving Through Heat Waves

Maria Daniel Loureiro¹, Henrique Vasconcelos¹ and Ana Luísa Neves²

¹ Center for Health Technology and Services Research (CINTESIS), University of Porto, Porto, Portugal

² Institute of Global Health Innovation, Imperial College London, London, United Kingdom

Abstract

Background:

Heatwaves significantly threaten public health in the European Union, as evidenced by the high heat-related mortality in the summer of 2022. Despite increasing occurrences of these events, European heat-health action plans largely exclude digital solutions. The COVID-19 pandemic, an unprecedented event in modern times, shifted perceptions and utilization of digital health tools from potential opportunities to necessities. This period demonstrated the effectiveness of digital interventions in rapidly responding to health crises, providing insights for heatwave challenges.

Aims:

This poster explores the potential of further including digital health interventions, which were pivotal during the COVID-19 pandemic, into European heat-health action plans. The objective is to identify adaptable digital strategies to mitigate heatwave health impacts.

Methods:

Framework Development: We started by analyzing WHO's guidance on the creation of heat-health action plans, as well as the European Observatory on Health Systems and Policies's assessment of the four main areas supported by digital health tools during the pandemic. Later, we proposed four main areas of heat-health action plans where digital health solutions could be efficiently integrated.

Literature Review and Critical Analysis: Each area underwent a rapid literature review to identify digital solutions used during COVID-19, followed by a critical analysis for applicability in heat-health action planning.

Results:

We found that the main areas where the implementation of digital health tools should be explored are: Communication and Information Dissemination (focusing on raising heat health impact awareness among the public, vulnerable groups, caregivers, and organizations); Modelling and Forecasting (developing precise, timely heatwave forecasts and their health impacts for proactive planning); Support for health services coordination (enhancing coordination among health authorities for optimized healthcare during heatwaves); Monitoring and Population Surveillance (implementing surveillance to identify and mitigate heat-related risks, especially in vulnerable populations).

Conclusions:

Preliminary research indicates that digital health solutions from COVID-19 can enhance national heat-health action plans. Tools developed for pandemic preparedness and response are applicable to extreme weather events. The pandemic's increased digital health usage resulted from policy changes, infrastructure investment, and health professional training. Leveraging these advancements could better prepare Europe for extreme heat threats.

Poster 11

GoGreenRoutes: Biodiversity Monitoring for Cities and Citizen Science

Tadhg MacIntyre¹, Kalyan Potter¹, Mario Balzan², Evelise Pereira Barboza³

¹Maynooth University, Maynooth, Ireland

²MCAST Institute of Applied Sciences, Paola, Malta

³Barcelona Institute for Global Health, Barcelona, Spain

Abstract

There is increasing recognition of the need to contribute to the transformative change needed to tackle the climate and biodiversity crises. The EU 2030 Biodiversity strategy, Green Deal and funding support for both Biodiversa+ and Horizon Europe fundings highlights the commitment to ensuring nature is central to our actions which support co-benefits for climate change and human health. Nature-based solutions projects are now firmly grounded in biodiversity and human and environmental health. The challenge for researchers is that while we conduct cutting edge science, the methodologies that are employed may build barriers for citizens, NGO's and municipalities to understand. Biodiversity in itself is complex, relating to types, structure and functions but to activate citizens and support the commitment of the 100CN cities, for example, GoGreenRoutes proposed to use tools which provide valid and reliable data across

our six target cities, but also are accessible and feasible for use by citizen scientists, community action groups and municipalities. The use of tools for the qualitative assessment of green space (Knobel et al., 2021), mobile applications to identify bird species and walking interviews to explore citizens perceptions of biodiversity can bridge this gap. GoGreenRoutes applied these methods and trained city personnel, local action groups and community leaders to ensure that their use would continue beyond the timeline of the project. Initial findings convey differences in biodiversity across our urban sites and link biodiversity to environmental quality including air quality and noise abatement. Phase two in 2024, will support their wider uptake by training citizens to interpret and share data and develop research questions which address local challenges. Nature-based solutions should primarily be about nature and this approach will ensure that biodiversity is integral to their implementation now and in the future.

Poster 12

Towards A Conceptual Framework Linking Climate Change-Induced Natural Disasters and Nutrition Outcomes

Lesley Macheka¹, Vimbainashe Dembedza¹, Prosper Chopera¹

¹ Marondera University of Agricultural Sciences and Technology, Marondera, Zimbabwe

Abstract

Extreme weather events and climate change can impact the nutrition status of individuals and pose major risks for long-term food and nutrition security. There are different pathways through which the climate induced natural disasters impact on nutrition. These pathways can either be direct or indirect. However, in literature, there is a paucity of information regarding how the different pathways interlink to impact on the nutrition outcomes. The available frameworks are not integrated and do not show the various interlinkages through with climate induced natural disasters impact on nutrition. Therefore, there is need for a conceptual framework that unravels the interlinkages and the different pathways can help in the designing of intervention strategies.

Our study presents conceptual framework that links climate induced natural disasters and nutrition

outcomes. The systems approach theory and contingency theory were used together with results from other studies to come up with this framework. The impact of climate induced natural disasters on nutrition outcomes is complex and not always direct. The framework presented in our study can be used in any climate induced natural disaster to understand the various pathways involved and the possible interventions. The framework we have put forward can also help to inform measures to put in place to mitigate against the effects of climate change natural disasters on the nutrition outcomes. However, it is important to note that the proposed framework should be tailored to the specific type of disaster and its impact. There is also a need to evaluate further the reliability, validity and applicability of the conceptual framework in different context settings.

Poster 13

Health Impacts of Climate Change: A Way Forward with the Climate-Health Cluster

Carla Maia¹, Ailish O'Sullivan², Alba Godfrey³, Anna Scolobig⁴, Annie Portela⁵, Antonio Parodi⁶, Birgit Kerstens⁷, Chloe Brimicombe⁸, Chloe Chavardes⁹, Chuansi Gao¹⁰, Claudia Di Napoli¹¹, Daniel Remondini¹², Daniel San Martin¹³, Dearbhaile Morris¹⁴, Debra Jackson², Diana Guardado¹⁵, Eline Boelee¹⁶, Elizabeth Robinson¹⁷, Enrico Scoccimarro¹⁸, Fortunate Machingura¹⁹, Francesco Pilla²⁰, Franz Prettenthaler²¹, Fredrik Wetterhall¹¹, Ian Hamilton²², Ilona Otto⁸, Jan C. Semenza²³, Jørn Toftum²⁴, Josep Maria Antó²⁵, Kerri Hall²⁶, Kevin Portune²⁷, Laurens Bouwer²⁸, Maria Maia²⁹, Mario Magana³⁰, Mireia Manent Blanch³⁰, Nathalie Roos³¹, Padraic Fleming³², Rachel Lowe³³, Raman Preet²³, Sandra Grano de Oro¹⁵, Sarah Williams²⁵, Sergio Natal¹³, Shouro Dasgupta¹⁸, Slava Jankin³⁴, Stefan Sieber²⁵, Suzana Blesic³⁵, Tim Taylor²⁶, Ulrike Falk¹¹, Cathryn Tonne²⁵, Joacim Rocklöv²³, Marc Neumann²⁷, Silvana Di Sabatino¹², Stanley Luchters^{7,19}

¹ University Nova of Lisbon, Lisbon, Portugal

² London School of Hygiene & Tropical Medicine, London, United Kingdom

³ EuroHealthNet, Brussels, Belgium

⁴ University of Geneva, Geneva, Switzerland

⁵ World Health Organization, Geneva, Switzerland

⁶ CIMA Research Foundation, Savona, Italy

⁷ Ghent University, Ghent, Belgium

⁸ University of Graz, Graz, Austria

⁹ Three O'clock, Paris, France

¹⁰ Lund University, Lund, Sweden

¹¹ European Centre for Medium-Range Weather Forecasts (ECMWF), Reading, United Kingdom

¹² University of Bologna, Bologna, Italy

¹³ Predictia, Santander, Spain

¹⁴ University of Galway, Galway, Ireland

¹⁵ F6S Network Ireland Limited, Dublin, Ireland

¹⁶ Deltares, Delft, Netherlands

¹⁷ London School of Economics and Political Science, London, United Kingdom

¹⁸ Euro-Mediterranean Centre for Climate Change, Lecce, Italy

¹⁹ Centre for Sexual Health and HIV AIDS Research Zimbabwe (CeSHHAR), Harare, Zimbabwe

²⁰ University College Dublin, Dublin, Ireland

²¹ Joanneum Research, Graz, Austria

²² University College London, London, United Kingdom

²³ Umeå University, Umeå, Sweden

²⁴ Technical University of Denmark, Kongens Lyngby, Denmark

²⁵ ISGlobal, Barcelona, Spain

²⁶ University of Exeter, Exeter, United Kingdom

²⁷ Basque Centre for Climate Change (BC3), Biscay, Spain

²⁸ Helmholtz-Zentrum hereon GmbH, Geesthacht, Germany

²⁹ Karlsruhe Institute of Technology, Karlsruhe, Germany

³⁰ WeDo, Barcelona, Spain

³¹ Karolinska Institute, Stockholm, Sweden

³² Trilateral Research, Waterford, Ireland

³³ Barcelona Supercomputing Centre, Barcelona, Spain

³⁴ University of Birmingham, Birmingham, United Kingdom

³⁵ Institute for Medical Research, University of Belgrade, Belgrade, Serbia

Abstract

The continuing challenge of global environmental change has triggered novel challenges for human health and one health. It is not only aggravating social inequalities and food- and water security, but also increasing the incidence of infectious, zoonotic and non-communicable diseases. Latest IPCC reports clearly show the expected increase of extreme temperatures over all Europe with expected exacerbated environmental conditions in cities where a large part of the population lives. As a consequence, it is expected that climate change will impact on citizens health by exacerbating the incidence of several diseases ranging from cardio-vascular to non-communicable diseases, but also increasing the risk of infectious diseases (vector borne and others). These rapidly increasing challenges require urgent actions at the European and Global level in view of increasing the preparedness of health systems.

The Climate-Health Cluster is the European Union's Horizon Europe cooperation of six research and innovation projects (BlueAdapt, CATALYSE, CLIMOS, HIGH Horizons, IDAlert and TRIGGER) that were funded under the same call, to respond to these challenges. The cluster collaborates to increase the societal and policy impact of EU-funded research linked to climate, human health and one health. The cluster specifically aims to promote and disseminate latest findings on climate change and health research from a OneHealth and Planetary Health perspective. Among the primary aims of the cluster is the raising of awareness on health impacts of climate change, costs and benefits of action and inaction. The cluster also functions as an instrument to maximise communication and dissemination of results emerging from each project's networks. By synergizing between all activities, the cluster addresses the challenge of producing the scientific background needed for

evidence-based decision-making. The final aim is to contribute to strengthen EU and global policies; and build capacity around climate change and health research.

The Climate-Health Cluster is coordinated by the six project coordinators and their deputies, while the cluster leadership rotates every nine months starting from October 2022. Five working groups respectively discuss topics such as science translation for policy and practice; data analysis and management; communication and dissemination; early warning systems and models; and indicator development. So far, the cluster has worked together in identifying priorities for the communication and policy strategies. At the same time the cluster is working on the identification of common numerical tools to harmonize findings from the six projects and deliver robust information at diverse interlocutors and policy makers.

Funding:

The projects that form the European Climate and Health Cluster have received funding from the European Union's Horizon Europe research and innovation programme, under grant agreement No. 101057764 (BlueAdapt), No. 101057131 (CATALYSE), No. 101057690 (CLIMOS), No. 101057843 (HIGH Horizons), No. 101057554 (IDAlert), and No. 101057739 (TRIGGER). BlueAdapt also receives funding from UKRI grants Nos. 10052955 and 10049774, CLIMOS from UKRI grants Nos. 10038150 and 10039289, and HIGH Horizons from UKRI grant No. 10038478.

Poster 14

Comparing changes in heat and cold-related mortality across Europe under climate change: a projection study covering 854 cities

Pierre Masselot¹, Malcolm Mistry¹, Shilpa Rao², Antonio Gasparrini¹, MCC Collaborative Research Network and other members of the EXHAUSTION project

¹ London School of Hygiene & Tropical Medicine, London, United Kingdom

² Norwegian institute of Public Health, Oslo, Norway

Abstract

Heat and cold have been established as major environmental stressors for human health. Historical analyses have suggested that the mortality attributed to cold could be around ten times higher than the mortality attributed to heat. In a world facing climate change, with a general shift of temperature distributions towards warmer temperatures, the natural question is whether warming could actually result in a decrease of cold-related mortality that would offset the expected increase in heat-related mortality. In this study, we performed projections of temperature-related mortality across the century under various climate change scenarios for 854 European urban areas. Our results show a dramatic increase in heat-related mortality across the century, outweighing a more limited decrease in cold-related mortality at the European scale. This results in a net increase of

temperature-related mortality across all considered scenarios and warming levels. Under the most extreme scenario, climate change could result in a 50% increase in all temperature-related deaths, cumulating more than 2 million deaths by the end of the century. We also observe important geographical differences, with the Mediterranean area facing the strongest increase in temperature-related mortality, while northern European countries could see a slight decrease overall. Eastern European countries with a more continental climate such as Bulgaria and Romania also seem particularly vulnerable to the effects of climate change. Our results highlight that mitigation policies could save a large part of the projected temperature-related deaths and that each passing year increases the death toll of climate change.

Poster 15

Systematically Assessing Environmental Impacts of Pharmaceutical Products – Lessons Learned

Lowik Pieters¹, Mila Garcia Valicente¹, Martijn van Bodegraven¹, Susanne Waaijers-van der Loop¹, Rosalie van Zelm^{1,2}

¹ RIVM Dutch National Institute for Public Health and the Environment, Bilthoven, The Netherlands

² Radboud University, Nijmegen, The Netherlands

Abstract

During the life cycle stages of healthcare processes and products, many emissions and resource extractions occur that can have negative health and environmental effects. If one person is cured today, at the expense of making other people sick tomorrow, healthcare becomes counter-productive. Safe and sustainable pharmaceuticals can contribute to a healthy healthcare system. To understand the environmental consequences of pharmaceuticals, Life Cycle Assessments (LCAs) can provide valuable input. However, it is not clear to what extent these studies are complete (i.e. covering all life cycle stages and important environmental impacts), representative for global pharmaceutical production and use, and accurate for impact prediction, accounting or monitoring.

Therefore, the goal of this work is to review scientifically published LCAs of pharmaceutical products, to come to recommendations for complete, representative, reliable, and accurate application of LCA to pharmaceutical products. We do this by presenting the current state of the science of LCAs of pharmaceutical products whereby methodological choices, knowledge gaps and challenges are identified. We conclude with recommending solutions on how to deal with challenges, strengths and limitations in pharmaceutical LCAs.

LCAs of 143 pharmaceutical products with a known active pharmaceutical ingredient (API) and 6 with an unknown API have been retrieved during literature screening. The LCAs on pharmaceutical products showed varying scopes, approaches and data quality. This limits comparisons and applications in broader environmental sustainability assessments.

Common inconsistencies in performing LCAs for pharmaceutical products are missing life cycle stages, unspecified inventories, a limited life cycle impact assessment, due to missing impact categories or characterization factors, and missing interpretation steps. To allow for complete and representative LCAs, comprehensive functional unit and system boundaries are needed. Transparent life cycle inventories lead to greater reliability, while complete impact assessments and interpretation contribute to representativeness of the LCA study. This presentation will show how identified solutions can be put into practice to aid decision-making.

This work is part of the Program on Sustainability and Health 2023-2026 funded by the Dutch Ministry of Health, Welfare and Sport (VWS) and is part of the TransPharm project that aims to move towards a sustainable pharmaceutical industry. TransPharm has received funding from the European Union's Horizon Europe research and innovation program under grant agreement N° 101057816.

Poster 16

Deepening the complex linkage between climate and human health: the HEU TRIGGER project

Silvana Di Sabatino¹, Elke Hertig¹, Antonio Parodi¹, Riccardo Biondi¹, Marina Neophytou¹, Petros Mouzourides¹, Maria Johansson¹, Hanna Andersson¹, Hanna Åberg¹, Simona Tondelli¹, Claudia De Luca¹, Milan Kalas¹, Joy Ommer¹, Franz Pretenthaler¹, Paolo Ruggieri¹, Carlo Cintolesi¹, Erika Brattich¹ with contribution of all TRIGGER partners

¹ University of Bologna, Bologna, Italy

Abstract

The Horizon Europe-funded project TRIGGER (soluTions foR mltiGatinG climate-induced hEalth thReats; GA 101057739; <https://project-trigger.eu/>) aims to deepen the current understanding of the linkage between climate, health and ecosystems (exposome framework) and use this knowledge to advance society uptake at personal and policy level. To this end and to prove on scientific ground the improvement in understanding of the potential pathologies and diseases (including the extent of those in vulnerable populations and across society) that may occur in response to a changing climate, the scientific research of TRIGGER is grounded on a set of demonstration Labs, the Climate-Health Connection Labs (CHCL). The 5 TRIGGER CHCL are strategically distributed to represent a widely different set of geographical and socio-economic conditions in Europe, from south Europe (Crete, Italy) to north Europe (Finland), including examples in central Europe (Germany, and Switzerland). As such, the CHCL represent regions impacted differently by climate change and thereby induced extreme events, but also by a different level of individual thermal tolerance, biodiversity, societal response and perceptions of risks and benefits of climate and environment-related issues. Grounded on the Living Lab concept, the CHCL and the scientific

knowledge generated in TRIGGER are rooted in the real contexts of the civil society; indeed, the CHCL involve local doctors, health practitioners, climatologists, policy makers as well as citizens in small, medium and large urban areas.

Within the first year of the project, the CHCLs have been setup and existing knowledge on climate change and human health linkage has been obtained. Specific indicators and proxies to best describe and assess direct and indirect relationships between climate, the social-economic system, and human health and well-being are identified. Simultaneously, an inventory of existing monitoring and modeling tools for historical analysis, future projections, and medium range forecasts of exposure to CC induced hazards is realized. At the same time, existing mitigation and adaptation policies at international and local levels are being mapped utilizing both conventional (desk research) and innovative search tools (text mining). A thorough review of the status of EU and local actions will give the opportunity to TRIGGER to construct evidence-based and solid policy making grounded on identified gaps.

The TRIGGER project has received funding from the European Union's Horizon Europe research and innovation programme, under grant agreement No. 101057739.

Poster 17

EU-OSHA's activities on the protection of workers in the context of climate change

Elke Schneider¹, Emmanuelle Brun¹, Annick Starren¹ and **Nadia Vilahur¹**

¹ European Agency for Safety and Health at Work, Bilbao, Spain

Abstract

The consequences of climate change on occupational safety and health (OSH) are already taking effect. Workers and workplaces are suffering from extreme and unpredictable weather events, such as droughts, heatwaves, heavy rain, floods and gales. Workers in nearly all sectors may be affected, although those in agriculture and forestry, transport, construction or emergency services (e.g., firefighters, health care workers and first responders) are particularly exposed and affected.

Some of the direct effects commonly described are related with heat stress, changes in air quality, increased occurrence of allergens or workplace accidents in extreme weather conditions. Mental health effects linked with climate change have been reported. Indirect effects have also been identified, as a consequence of changes in the ranges of disease vectors (e.g. mosquitoes), waterborne pathogens or an increased use of pesticides.

EU-OSHA has recently published guidance on how to manage heat stress at work. A series of its reports have considered climate change challenges in selected sectors, such as agriculture and forestry, or in emergency services, and related to specific risks, such as exposure to biological agents, as well as the possible effects of climate change-mitigating technologies on the health and safety of workers.

There are, however, considerable knowledge gaps on the climate change impacts on workers safety

and health, including on vulnerable groups (e.g. ageing workers, those with pre-existing diseases, women workers, migrant workers).

An in-depth overview into health-related impacts on workers and existing workplace interventions and good practices to mitigate and adapt to climate change related events in the EU will both be covered by EU-OSHA's forthcoming research activity on climate change and OSH (2025-2029). EU-OSHA has also launched a foresight project on "OSH implications of future climate change-related developments and crises", to identify new and emerging risks in occupational safety and health by building on a variety of future possible scenarios, provide a basis for priority-setting in OSH research and improve the timeliness of preventive measures. It also aims to anticipate how the world of work may react to climate change effects (e.g. adaptations in the agriculture/forestry, tourism, and energy sectors) and how this impacts on safety and health at work.

Research activities at EU-OSHA on climate change and OSH will substantially contribute to the key objectives of the 2021-2027 EU OSH Strategic Framework, to anticipate and manage change in the context of green, digital and demographic transitions and to increase preparedness to respond to future health crises. Knowledge gaps in research, risk assessment and practice will be identified.

Green Posters

Poster 18

Climate change and respiratory health: A European Respiratory Society position statement

Zorana Jovanovic Andersen¹, Erik Melén¹, Francesco Forastiere¹, Ulrike Gehring¹, Klea Katsouyanni¹, Arzu Yorgancioglu¹, Charlotte Suppli Ulrik¹, Kjeld Hansen¹, Pippa Powell¹, Brian Ward¹, Barbara Hoffmann¹, Ana Maria Vicedo-Cabrera¹

¹ University of Copenhagen, Copenhagen, Denmark

Abstract

The European Respiratory Society (ERS) is an international medical organization that brings together physicians, nurses, other healthcare professionals, epidemiologists, patient representatives, scientists and other experts working in respiratory medicine, with a mission is to promote lung health and alleviate suffering from respiratory diseases and drive standards for respiratory medicine globally. Science, education and advocacy are at the core of everything ERS does. ERS has published its first Climate Change Statement in 2009, realizing early connections between climate change and respiratory health, and seeking out to educate its members on this matter. In this Statement by the ERS, we aim to provide an overview of the state-of-the-art knowledge on the impact of climate change on respiratory health, and guidance to clinicians and other healthcare professionals and institutions, patients and patient organisations on how climate change and global warming can be addressed in clinical practice. In particular, we focus on how climate change mitigation and adaptation strategies synergise with other policies for respiratory health (i.e., clean air policies, sustainable urban development), how climate change impacts daily activities in clinical practice and patient behaviour, and how clinicians and patients can act as advocates for climate-friendly

policies from the clinical practice. This Statement is intended to be a reference resource on the impact of climate change on respiratory health and a call for action against this threat from the clinical and public health perspective and as members of today's society. The Statement also expresses the position of the ERS and European Lung Foundation in support of all policies that mitigate climate change impacts, which are imperative to improve the health of lung patients in Europe and prevent new climate-related lung diseases. Specifically, statement described the close links between climate change and air pollution, and expresses ERS support of the stricter air pollution standards fully aligned with the 2021 WHO Air Pollution Guidelines, as a part of the current EU revision of the Air Quality Directive. This statement has been developed by the Environment and Health Committee of the ERS and the European Lung Foundation, and approved by the Advocacy Council, Science Council and the Executive Committee of ERS. In conclusion, climate change is a major threat to lung patients, causing global warming, more frequent and extreme weather events, such as heatwaves, flooding, prolonged aeroallergen seasons, and poorer air quality from droughts, dust storms, and wildfires. ERS calls on the health community to help alleviate the health risks to the lung patients, and policymakers to act now and prepare for a complex future.

Poster 19

Association between short-term increases in ambient temperature and hospital admissions in Copenhagen, Denmark

Marie L. Bergmann¹, Yiyang Zhang¹, Zorana J. Andersen¹, Steffen Loft¹, Jiawei Zhang¹ and Youn-Hee Lim¹

¹ University of Copenhagen, Copenhagen, Denmark

Abstract

Background & Aim:

Global warming, which is a significant aspect of climate change, has direct and indirect effects on human health. Most available studies on the effects of increased ambient temperatures focus on mortality, but less on morbidity. This study aims to investigate the association between short-term increases in daily mean ambient temperature and cardio-pulmonary hospitalizations in Copenhagen, Denmark.

Methods:

Daily mean levels of meteorological factors, including temperature, relative humidity, and wind speed, were monitored at an urban background station in central Copenhagen during 2002-2018. Daily counts of hospital admissions (in-patients) due to respiratory or cardiovascular diseases were obtained from the Danish National Patient Register. Percentage increases and 95% confidence intervals (CI) in hospital admissions associated with temperature increases for up to 21 days preceding the admission were examined in a case-crossover study design. Additionally, we analyzed effect modification by sex and age.

Results:

We observed 110,746 respiratory and 130,176 cardiovascular hospital admissions between 2002 and 2018. A 1°C increase in the three-day average of daily mean temperature was significantly associated with a 0.71% (95% CI: 0.44, 0.98) and a 0.47% (0.26, 0.67) increase in respiratory and cardiovascular hospital admissions, respectively. Associations were stronger for older people (>65 years) and respiratory diseases (0.87% [0.56, 1.18]), and for men and cardiovascular diseases (0.7% [0.44, 0.97]).

Conclusions:

We found significant positive associations between short-term exposure to increased temperatures and cardio-pulmonary hospitalizations in Copenhagen, Denmark, with higher associations among elderly people and men.

Poster 20

Child mortality rates and climate change: an analysis of heat exposure and health data in 12 sub-Saharan African countries

Chloe Brimicombe¹, Katharina Wieser¹, Jeroen De Bont², Tobias Monthaler¹, Debra Jackson³ and Ilona M. Otto¹

¹ University of Graz, Graz, Austria

² Karolinska Institute, Stockholm, Sweden

³ London School of Hygiene & Tropical Medicine, London, United Kingdom

Abstract

Children in sub-Saharan continued to have the highest rates of mortality in the world at 74 deaths per 1000 live births in 2020. All but the Gambia of the sub-Saharan countries analyzed are projected to miss sustainable development goals for under-five mortality. Many of the leading causes of death in the under-fives have links to climate change and extreme heat. In this study, we evaluate the influence of heat exposure using the wet bulb globe temperature for under 5 mortality rates across 12 sub-Saharan African countries, from the INDEPTH network Health and Demographic Surveillance

Sites Consolidated dataset ranging from 1990 until 2019. We carry out pooled time series regression using for a whole year period and for the hottest season. Relative risk response of mortality rates to heat exposure differs for age groups, climate zones and seasons. For all-cause child mortality there is a positive association with extreme heat and a rise in mortality rates for the East and West African Monsoon regions. Our results show a need to assess the influence of heat on specific causes of mortality. In addition, prevention strategies for seasonal leading causes of death could reduce the influence of heat.

Poster 21

Review of Climate Change Adaptation Interventions for Health: Implications for Policy and Practice

Nicholas Brink¹, Kehkashan Mansoor², Ilona Otto², Joost Swiers², Kristin Aunan³ and Matthew Chersich¹

¹ Wits RHI, University of the Witwatersrand, Johannesburg, South Africa

² University of Graz, Graz, Austria

³ Centre for International Climate and Environmental Research, Oslo, Norway

Abstract

Background:

Climate change is the greatest threat to health in the 21st century, requiring urgent scale up of adaptation interventions. The optimal strategy for adaptations and their implementation, however, remains poorly understood. We aim to summarize the literature on adaptation interventions funded by the Belmont Forum and European Union (N=37), the largest global funders of climate change and health research.

Methods:

A systematic search was conducted to identify articles on adaptation interventions in studies funded by the Belmont Forum and Horizons EU. Data were extracted from the selected articles using a standardized data extraction form, which includes study characteristics, types of interventions, and study outcomes. The qualitative results were analysed thematically, and quantitative results summarised descriptively, with overall results synthesised narratively within the principles of the PRISMA guidelines. Articles published before February 2023 were included.

Results:

A total of 194 articles were screened, of which 37 reported on adaptation interventions. Twenty

studies reviewed interventions, and 17 reported empiric data on actual interventions. The majority of projects focused on the general population (n=17), using mixed-methods research and targeted interventions aimed at behaviour change (n=8) and health-systems strengthening (n=6). Few studies examined high-risk populations, such as pregnant women and children (n=4) or migrants (n=0), or adaptations with mitigation co-benefits such as the built environment (n=1) or nature-based solutions (n=0). The most studied climate change hazard was extreme heat (n=26), with fewer studies focusing on other extreme weather events (n=11). Several studies reported promising findings, principally on interventions to counter heat impacts in the workplace, among pregnant women, and improving risk awareness in communities.

Discussion:

This review highlights the substantial scope of research conducted by a large cohort of research groups across diverse specialities in the field. Importantly, the diverse interventions studied across multiple regions illustrates the broad base of potential projects for future investment. The lack of studies on air pollution, mental health, and the health of vulnerable groups such as migrants highlights important knowledge gaps. Future research on the cost-effectiveness

of adaptations help prioritise public health interventions. While there are gaps in evidence, there are several promising interventions that could be provided now. The health sector has a vital role to play in reducing carbon emissions, supporting adaptation efforts, and increasing public awareness. However, understanding the

health co-benefits and economic trade-offs of these interventions is crucial. The work conducted within the ENBEL consortium provides a platform on which to expand research and public health interventions towards safeguarding public health from the effects of climate change.

Poster 22

CARING NATURE: ClimAte neutRal INitiatives for GrowiNg heALTh and care Unmet Requirements

Chiara Cadeddu¹, Mattia Di Russo², Alessio Perilli², Doris Zjalic², Pasquale Mari², Sabina Magalini^{2,3} and Daniele Gui^{2,3}

¹ Erasmus School of Health Policy & Management, Rotterdam, The Netherlands

² Università Cattolica del Sacro Cuore, Rome, Italy

³ Fondazione Policlinico Universitario Agostino Gemelli, Rome, Italy

Abstract

The healthcare sector is responsible for 5% of global Greenhouse Gases (GHG) emissions and estimates to 2050 will dramatically increase if no action is taken. CARING NATURE (CN) is an international project funded from the European Union's Horizon Europe research and innovation programme, which includes partners from 11 European countries and is aimed at developing ten healthcare specific and sustainable solutions for carbon emissions and pollution reduction, demonstrating them in 33 use cases for the next 3 years.

To reduce environmental impact of building, waste and patient travel and to increase governance capability and staff engagement towards this reduction, 3 phases will be developed:

1. Collection of stakeholder requirements,
2. Development,
3. Piloting & validation.

A knowledge sharing system and a decision support system will allow healthcare providers to engage in collaborative co-creation activities related to their sustainability overall duties. Lifecycle multidimensional assessment model for healthcare professionals (HCPs) and sustainable finance evaluation model for HCPs will also be applied, together with a new Green Lean Six Sigma

methodology and telemedicine/AI solutions. Case studies applied to different healthcare settings will be finally conducted.

CN has started in January 2024. Seven "primary" solutions are expected to tackle main production sources on which HCPs are principal actors of transition:

- Building energy demand will be addressed through reduction of environmental impact of construction and renovation and utilizing AI-powered energy management;
- Reduction and valorization of medical, food and water waste through a HCP-tailored pyrolysis plant prototype and an on-site waste food digestion and drying system;
- Reduction of patient/visitors travel through next generation telemedicine.

Decision-makers and other stakeholders at the European level could benefit from the HCPs' specific eco-friendly approach to reengineering processes for enforcing sustainability in healthcare based on the CN findings. Opportunities for standardization will be also identified and reported, to export CN model in different European countries and health settings.

Poster 23

Assessing impact of forest fires on human health in Europe

Sourangsu Chowdhury¹, Risto Hänninen², Mikhail Sofiev² and Kristin Aunan¹

¹ CICERO Center for International Climate Research, Oslo, Norway

² Finnish Meteorological Institute, Helsinki, Finland

Abstract

Long term exposure to ambient PM_{2.5} (particulate matter less than 2.5 µm in diameter) is associated with multiple health outcomes and is the largest environmental health risk in Europe. While much attention globally has centred on reducing anthropogenic sources of ambient PM_{2.5} and other air pollutants, the significance of forest fires, capable of inducing extreme air pollution, was largely underestimated until recently, lacking credible mitigation strategies. Forest fires release various hazardous pollutants like black carbon and organic aerosols, potentially posing greater health risks compared to other sources of pollution. Our study delves into the escalating importance of forest fires as contributors to PM_{2.5} exposure in Europe across a thirty-year period (1990–2019) and also projecting them till end of the century under 3 climate change scenarios (SSP126, SSP245 and SSP370), utilizing simulations from a global meso-scale dispersion model. Additionally, we evaluate the health impact resulting from PM_{2.5} due to forest fires, examining how this burden shifts with changes in baseline mortality rates, demographics, forest fires, and PM_{2.5} exposure. Furthermore, we conduct sensitivity analyses considering recent evidence suggesting enhanced toxicity associated with forest fire-induced PM_{2.5}.

Our estimations reveal a decline in the excess death toll from exposure to ambient PM_{2.5} across Europe at a rate of 10,000 deaths per year, dropping from 0.57 million (95% confidence intervals: 0.44 - 0.75 million) in 1990 to 0.28 million (0.19 – 0.42 million) between 1990 and 2019 and is expected to decrease further until end of the century. Notably, we observed a consistent rise in fire-related excess deaths between 1990 and 2019 and expect this to increase even under the high mitigation, low emission scenarios. Eastern European nations have significantly higher excess deaths from forest fires, experiencing more pronounced increases compared to Western and Central Europe. Our sensitivity analyses, considering forest fire PM_{2.5} as more toxic than other sources, suggested an increased relative contribution of forest fires to excess deaths, reaching 2.5 - 13% by 2019.

These findings underscore the pressing need for enhanced mitigation and adaptation strategies and more sustainable forest management policies to curb the escalating health risks posed by forest fires.

Poster 24

Addressing climate change and environmental degradation, while improving health and financial resilience

Hans Dubois¹

¹ European Foundation for the Improvement of Living and Working Conditions (Eurofound), Dublin, Ireland

Abstract

Over the past years, Eurofound has conducted various research projects which are drawn-upon for this poster proposal, including its recent project with the European Environmental Agency (EEA) on exploring the socio-economic impacts of the transition to a climate neutral economy. This poster will highlight policies that have emerged from Eurofound's research that contribute to addressing climate change and environmental degradation, while simultaneously improving population health and household's financial resilience.

Three groups of such measures are identified, in order of availability of evidence (i.e. most for housing-related measures, least for consumption), while identifying research needs for each group:

1. One group of measures relates to housing. They include measures to facilitate better insulation, and installation of solar panels and more efficient heating systems. If designed properly, such policies potentially benefit the environment, population health (better air quality in the surroundings and home, and fewer heat/cold-related health problems) and household's resilience against utility costs increases. However, Eurofound's research highlights that there are challenges to reach low income groups with such measures which

would benefit most from them, a subject that requires more research.

2. A second group of measures relates to transport. Large-scale facilitation of access to high quality public transport, and cycling and walking infrastructure, can reduce environmental harm, while improving health and household finances. However, Eurofound research has mapped numerous barriers is achieving effective access to such modes of transport; it has also identified areas for further research needs in the area of cyclability & walkability in particular.
3. A third group of measures relates to adapting consumption patterns, such as facilitating shifts to more sustainable, possibly reduced, food -and other- consumption. While the potential for the environment, health, and household finances is clear, it is an area which needs more research in particular.

Poster 25

Contribution of climate change to the spatial expansion of West Nile virus in Europe

Diana Erazo¹, Luke Grant², Guillaume Ghisbain^{1,3}, Giovanni Marini⁴, Felipe J. Colón-González⁵, William Wint⁶, Annapaola Rizzoli⁴, Wim Van Bortel^{7,8}, Chantal B.F. Vogels⁹, Nathan D. Grubaugh^{9,10}, Matthias Mengel¹¹, Katja Frieler¹¹, Wim Thiery², Simon Dellicour^{1,12}

¹ Spatial Epidemiology Lab (SpELL), Université Libre de Bruxelles, Brussels, Belgium

² Department of Hydrology and Hydraulic Engineering, Vrije Universiteit Brussel, Brussels, Belgium

³ Laboratory of Zoology, Research Institute for Biosciences, University of Mons, Mons, Belgium

⁴ Research and Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige (TN), Italy

⁵ Data for Science and Health, Wellcome Trust, London, UK

⁶ Environmental Research Group Oxford Ltd, Department of Biology, Mansfield Road, Oxford, OX1 3SZ, UK

⁷ Unit Entomology, Department of Biomedical Sciences, Institute of Tropical Medicine, Antwerp, Belgium.

⁸ Outbreak Research team, Department of Biomedical Sciences, Institute of Tropical Medicine, Antwerp, Belgium.

⁹ Department of Epidemiology of Microbial Diseases, Yale School of Public Health, New Haven, CT, USA

¹⁰ Department of Ecology and Evolutionary Biology, Yale University, New Haven, CT, USA

¹¹ Department Transformation Pathways, Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany

¹² Department of Microbiology, Immunology and Transplantation, Rega Institute, Laboratory for Clinical and Epidemiological Virology, KU Leuven, Leuven, Belgium

Abstract

West Nile virus (WNV) is an important mosquito-borne pathogen in Europe and although the causal relationship between climate change and its emergence on the continent has been reported, it has not been formally evaluated. Here, we examine whether WNV establishment in Europe can be attributed to climate change. For this purpose, we train and project ecological niche models for WNV considering historical, future, and counterfactual climate data, the latter

corresponding to a hypothetical climate in a world without climate change. We show an increase in the ecologically suitable area for WNV under the historical climate evolution, whereas this area remains largely unchanged throughout the last century in a no-climate-change counterfactual. Our analyses therefore point towards climate change as one of the major drivers of the increased risk of WNV circulation in Europe, and further allows discussing potential scenarios for the future evolution of the areas at risk.

Poster 26

Making an Impact on Climate & Health in LMICs with DHIS2: An Action Research Project to Support Climate Resilience Strengthening for National Health Systems

Rebecca Potter¹, Elle Gallarano¹, Ernst Kristian Rødland² and Kristin Braa¹

¹ University of Oslo, Oslo, Norway

² Norwegian Institute of Public Health, Norway

Abstract

The effects of climate change and related ecosystem disruptions are dramatic and wide-ranging, touching every part of life on our planet, including human health. Action is needed to protect at-risk communities and prevent negative health effects, particularly in LMICs, whose populations are among the most vulnerable to the impacts of climate change. Planning and prioritizing that action requires accurate and actionable data on the specific correlations between climate and environmental factors and health outcomes. A recent landscaping report found that climate and health (C&H) data is particularly underrepresented in LMICs, and most do not have digital systems in place that facilitate analysis and quantification of these effects, making it challenging to plan effective local health interventions or create national climate change adaptation strategies to address them.

The research objective of this project explores how LMICs can close this data gap and deploy sustainable digital C&H systems that address local health priorities, provide evidence for national climate change adaptation and public health policies, and support effective health interventions to respond to climate-related health risks. To support LMICs in strengthening

the climate resilience of their national health systems, this action research project collaborates with LMIC ministries to enhance existing DHIS2 systems—which are already used to support public health program management in more than 80 LMICs—through the integration of climate data, the development of C&H analytical and modeling tools, and the design of data visualizations and dashboards to support effective and timely analysis and decision making in response to climate-sensitive health risks, such as better-targeted anti-malaria campaigns that reduce cost and increase prevention and treatment, climate-adapted local agriculture planning that decreases household malnutrition, and heat wave warning systems that help reduce mortality.

DHIS2 C&H pilot projects in Laos, Mozambique, and Malawi have demonstrated the potential for LMICs to build on existing systems and local capacity to respond to the threats posed by climate change and help fill the gaps in understanding of the effects of climate change and variation on human health. These free and open-source digital tools can help fill the gaps in understanding of the effects of climate change and variation on human health and help local and global stakeholders respond to emerging threats to public health with informed and timely action.

Poster 27

HIGH Horizons: Heat Indicators for Global Health – Monitoring, Early Warning Systems and health facility interventions for pregnant and postpartum women, infants and young children and health workers

Birgit Kerstens¹, Stanley Luchters^{1,9}, Gloria Maimela², Chuansi Gao³, Nathalie Roos⁴, Annie Portela⁵, Jørn Toftum⁶, Ilona Otto⁷, Sohail Baloch⁸, Fortunate Machingura⁹, Debra Jackson¹⁰, and Christos Hadjichristodoulou¹¹ on behalf of the HIGH Horizons consortium

¹ Ghent University, Ghent, Belgium

² Wits Reproductive Health and HIV Institute (Wits RHI), Johannesburg, South Africa

³ Lund University, Lund, Sweden

⁴ Karolinska Institute, Stockholm, Sweden

⁵ World Health Organization, Geneva, Switzerland

⁶ Technical University Denmark, Kongens Lyngby, Denmark

⁷ University of Graz, Graz, Austria

⁸ Aga Khan Health Services (AKHS), Mombasa, Kenya

⁹ Centre for Sexual Health and HIV AIDS Research Zimbabwe (CeSHHAR), Harare, Zimbabwe

¹⁰ London School of Hygiene and Tropical Medicine, London, United Kingdom

¹¹ University of Thessaly, Volos, Greece

Abstract

Background:

HIGH Horizons addresses key knowledge gaps around the quantification and monitoring of direct and indirect impacts of heat exposure on maternal, newborn and child health. Pregnant women, infants and health workers serve as sentinel populations for tracking climate change impacts, adaptations and co-benefits. Protecting these vulnerable populations is critical and ensures a healthy future for the next generations. HIGH Horizons includes 11 partners across 10 countries in Europe and Africa and encompasses activities in both the European Union (EU) and sub-Saharan Africa. Jointly our partners quantify and monitor direct and indirect health impacts of extreme heat; test a personalised

Early Warning System (EWS); and implement integrated adaptation-mitigation actions in health facilities. With heat adaptation interventions such as modifications to health facilities (e.g. passive cooling systems, reflective white paint on the roofs,...) and effective messaging through smartphones to accompany heat stress notifications to pregnant and postpartum women and mothers of infants, the burden of adverse health outcomes may be reduced.

Results:

HEAT-HEALTH DATA ANALYSES. Using data from Sweden, Italy, Greece, Kenya and South Africa, HIGH Horizons increases the understanding of the relationships between heat and maternal, newborn and child health outcomes. Specific biomarkers are measured during pregnancy and in infants in a prospective mother-child birth cohort

in Greece to explain the role of heat exposures on adverse health effects. These analyses and a thorough systematic review inform testing and selection of global, EU and national indicators as well as cut-off thresholds for the EWS, stratified by risk groups.

EARLY WARNING SYSTEM. Through a smartphone app (ClimApp-MCH) the EWS delivers notifications and setting-specific messages, co-designed locally. HIGH Horizons is currently developing the prototype of the early warning system application and the messages. The app will be evaluated among 600 mothers and infants in Sweden, South Africa and Zimbabwe, from antepartum through 12 months of infant age.

ADAPTATION. HIGH Horizons is also documenting the impact of heat exposure on health worker

wellbeing, health, productivity and on the quality of care provided in South Africa, Sweden and Zimbabwe, including through time-motion studies. These results support the co-design of modifications to health facilities which help to reduce heat exposure for health workers.

MITIGATION. Facility-generated carbon emissions have been measured in Kenya, South Africa and Zimbabwe and are inputted into our own tool, Carbomica, to optimize resources allocated to reduce carbon emissions in health facilities.

POLICY SUPPORT. Throughout we engage relevant stakeholders in both conduct of the research and dissemination of project findings, prioritising country partners, EU and global policy makers and leveraging existing networks.

Poster 28

How are national infectious disease surveillance systems taking climate change into account? Gap analysis of health adaptation in African countries (ENBEL project)

Sari Kovats¹, Julian Natukunda¹, Vincent Pagiwa², Caroline Muthoni³ and Francesca de Donato¹

¹ Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine, London, United Kingdom

² Okavango Research Institute, University of Botswana, Gaborone, Botswana

³ Institute for Human Development, Aga Khan University, Kenya

⁴ Department of Epidemiology, Lazio Regional Health Authority ASL ROMA 1, Rome, Italy

Abstract

A review of national adaptation plans in East and Southern Africa identified that strengthening infectious disease surveillance was a priority for health sector planning. This gap analysis aimed to determine the extent to which countries had address climate change in their national disease surveillance systems. Research was undertaken as part of the ENBEL project, funded by the European Commission under the H2020 program LC-CLA-22-2020. Research methods included document review of climate and surveillance strategies, evidence review of research literature; and key informant interviews. The research addressed the priority climate sensitive diseases as identified by national adaptation plans including malaria, RVF, dengue, cholera, and diarrhoeal diseases. The findings were then synthesised as priority gaps for action.

Key surveillance priorities from countries' policies and strategies documents focus on expanding surveillance (including digitalization and strengthening community and district surveillance); building robust information /evidence and research systems (integrated health information management systems, web observatories); and investing in

functional early warning systems. In addition, there is a need to build the capacity of healthcare professionals, and emergency and response teams, strengthen multi-sectoral collaboration and coordination, and implement efficient evaluation and assessment mechanisms including independent assessments of the epidemiological surveillance systems. Multi-disease epidemiological surveillance has been improved by the adoption of WHO IDSR guidelines, which standardized data collection. However, the integrated disease surveillance system does not capture climate/environmental to support adaptation. There remains limited engagement between National Meteorological Services and surveillance systems, with operational warning systems mostly linked to epidemic malaria. Climate services and disease surveillance and control are being advanced through collaborations, technical working groups, and the establishment of environmental health departments. Coordinating all stakeholders across sectors to streamline priorities and functions remains a challenge. While national adaptation planning and health policies support the establishment of integrated surveillance and early warning systems, implementation is slow.

Poster 29

Heat in cities: High-resolution assessments, impacts and adaptation planning using the UrbClim model

Filip Lefebre¹, Niels Souverijns¹, Dirk Lauwaet¹, Koen De Ridder¹, Sacha Takacs¹, Nele Veldeman¹, Raf Theunissen¹, Shu Yang¹ and Jente Broeckx¹

¹ Flemish Institute for Technological Research, Mol, Belgium

Abstract

In recent years, climate change has been causing increasingly frequent and intense heatwaves worldwide. Climate projections indicate that the population exposure to extreme heat will rise by more than an order of magnitude towards the end of the century. Cities are especially at risk because of the urban heat island phenomenon, which may cause a doubling in the annual number of heatwave days compared to rural areas.

The UrbClim model is a fast and accurate physical boundary layer model that simulates spatially highly detailed maps (up to the meter-scale) of basic climate variables and heat stress within cities. This level of detail offers many insights, ranging from the accurate depiction of hot spots in the city, but also the evolution of heat stress during a day or heatwave. The flexibility of the

model to change boundary conditions allows to simulate both present-day and future climate accurately using the latest state-of-the-art projections from RCMs or GCMs.

Heatwaves impact inhabitants of affected cities. Extreme heat decreases labour productivity, affects infrastructures, increases hospital admissions and even mortality. Impacts on several levels within society can be quantified at an unprecedented level, not only giving assessments at city-level, but also at community level. This detailed information offers options for adaptation modelling. Which measures at institutional, infrastructural and community level need to be taken to avoid the negative impacts of (future) heat waves in cities. Examples and direct quantifications from past projects within Belgium, Europe and worldwide will be presented.

Poster 30

GoGreenNext: A novel interactive survey to support climate mitigation, health and well-being

Tadhg MacIntyre¹, Andrew Coogan¹, Annalisa Setti¹, and Tabea Klumpe¹

¹ Maynooth University, Maynooth, Ireland

Abstract

GoGreenNext is a new Horizon Europe project that will future proof urban health across Europe and North America. The central aim of the project is to advance research and innovation to support the development of evidence-based policy at city, national, and global levels, to accelerate our efforts to address the challenges of climate change, biodiversity and environmental degradation and human health in the urban context.

A unique aspect of this project is the development and validation of a novel interactive survey on the challenges of biodiversity loss, climate anxiety and use of green space across both attitudinal and behavioural dimensions, the readiness of individuals to engage in behaviour change and engage in sustainable activities. Citizens awareness of their own attitudes, behaviours and potential future pathways to action will be heightened from the feedback on the interactive survey. Advancing the Yale global survey methodology, which provided a climate only profile (e.g. concerned, cautious etc.), GoGreenNext will create a dynamic profile

of the individual based on the dimensions of their relationship with nature: emotion, engagement; relatedness and access; and will include objective and subjective measures of health and wellbeing relevant to climate change and benefits of green environments. An evidence-based approach and aggregate score will highlight what actions citizens can engage in to enhance their health in the future. Their future health score will provide a compass to the individual citizens to direct them to positive action for their own health and planetary health starting from their own context. District and city level scores will enable decision makers both at community and city level to assess on a dashboard attitudes to climate mitigation initiatives including NBS and to evaluate readiness for new initiatives. The capacity for change across multiple levels will be enhanced and communication at key target audiences via social media, science galleries and living labs, will be used to amplify the adaptivity of the citizens for transformative change.

Poster 31

Key to Health and Well-being in Climate Adaptation through Nature-based Solutions

Maria Carmen Garcia Mateo¹, Thomas Andersson² and Nico Tillie³

¹ MCG Research & Innovation Sustainability Architecture / Urban Planning, Spain

² International Organisation for Knowledge Economy and Enterprise Development, Malmö, Sweden

³ Delft University of Technology, Delft, The Netherlands

Abstract

Health and Well-being in Climate Adaptation through Nature-based Solutions hinges on a systemic approach rooted in co-creation and co-governance. Climate Change brings dramatically rising consequences for human health and wellbeing. Nature-based Solutions offer a rich array of counter-responses which are presently under-valued. This contribution examines under what circumstances the potential benefits in this regard can be captured, spanning rising sea levels and flooding, heatwaves, fires, and also the linkages to biodiversity loss and pollution.

The latest empirical experience from regional, city and community level, in applying Nature-based solutions to cope with intensifying challenges of such sort, is reviewed and structured, bringing to

the forefront observations under what conditions the highest relevance and most effective responses to impending risks and be achieved. This is complemented by consideration to ongoing trends under way in regard to natural, social, and economic processes with a strong bearing on health and well-being. On this basis, we argue that a systemic approach focusing on nature-based design and nature-based regeneration, based on effective and inclusive co-creation and co-governance, is key.

Moreover, novel means of adaptation are required to manage divergent needs and challenges at the city or regional level. Pertinent scales need to be applied on terms that reflect thoroughly, spanning from a global to local perspective.

Poster 32

Enhancing Resilience: Finland's Climate Change Adaptation Plan for Health and Social Welfare

Päivi Meriläinen¹ and Jaana Halonen¹

¹ Finnish Institute for Health and Welfare, Helsinki, Finland

Abstract

Climate change poses a global threat to public health, with developing nations experiencing heightened risks. Even in traditionally less impacted regions like Northern Europe, including Finland, discernible effects on healthcare operations are emerging. Anticipated challenges stem from variables such as an aging population and urbanization linked to specific climate-related phenomena, such as heat-islands, collectively rendering populations more susceptible.

Moreover, the socio-economic consequences of climate change, including escalating inequality, are observable in the health and well-being of individuals, as evidenced in Finland and other countries. Mitigating these risks necessitates proactive measures by healthcare and social welfare systems to adapt and fortify resilience against imminent changes. The Climate Change Adaptation Plan for the healthcare and social welfare sector, extending until 2031, serves as a valuable resource in this regard.

Despite the gradual nature of climate change impacts, observable effects are already present. Consequently, alongside emission reduction efforts, it is imperative to implement adaptation measures promptly. Finland, as a developed society with a robust economic foundation, is well-positioned to undertake these measures. However, the execution of a successful systematic adaptation demands a comprehensive knowledge base.

The Adaptation Plan lays the basis for systematic adaptation, enhancing risk awareness, and ensuring the resilience of healthcare and social welfare systems in the long term. Emphasising health protection and healthcare adaptation, the plan assesses the current state of adaptation in Finland, identifies existing and potential measures, and outlines over 90 actions for climate change adaptation in the health and social care sector.

These actions encompass the establishment of a heatwave warning system, formulation of guidelines and action plans, in-depth examination of climate change effects on health and well-being, and intersectoral collaborations. Education, training, and communication strategies are integral components of the plan. As a practical tool, the Adaptation Plan contributes to the growing body of guidelines addressing climate change in the healthcare and social welfare sector.

Poster 33

Heat stress related physiological and pathophysiological shifts in a population cohort study in southern Denmark: the LOFUS Heat-stress Project

Nikolaj Nøhr¹, Randi Jepsen¹, Hanna Joersboe¹, Søren Lophaven^{1,2} and Susanne Koch^{3,4,5}

¹ Center for Health Research, Zealand University Hospital, Nykøbing F., Denmark

² Omicron APS, Roskilde, Denmark

³ University of Southern Denmark (SDU), Odense, Denmark

⁴ Department of Anesthesia and Intensive Care, Zealand University Hospital, Nykøbing F., Denmark

⁵ Department of Anesthesiology and Intensive Care Medicine, Charité – Universitätsmedizin Berlin, Berlin, Germany

Abstract

Introduction:

Rising global temperatures due to the climate crisis pose health risks, particularly during heatwaves. Mortality and morbidity increase during extreme heat events, affecting various organ systems. While warmer countries face higher risks, even colder regions, show elevated mortality during hot periods. This study aims to identify physiological shifts in different organ systems related to heat stress if exposed to temperatures $\geq 28^{\circ}\text{C}$ in a population cohort in southern Denmark.

Methods:

Health data were extracted from local citizens participating in the Lolland-Falster Health Study (LOFUS), a cross-sectional study with 18,949 participants (0-96 years of age), which took place from February 2016 until February 2019. We included participants from the LOFUS study, if they were ≥ 15 years and exam took place during the summer months (June, July, August) ($n=3,804$). During the exams, blood samples were taken and physiological exam took place. Physiological parameters were related different

organ systems as cardio-vascular, pulmonary, renal, inflammation, liver system. Meteorological data from the examination period were retrieved from the Danish Meteorological Institute. Heat-exposure was defined as apparent temperature $\geq 28^{\circ}\text{C}$ on the day before examination, using Heat Index calculated through the Rothfusz regression.

Results:

In the study period, we found an increasing number of days with heat index level $\geq 28^{\circ}\text{C}$ from 2016 until 2019 (2016: 9 days, 2017: 0 days, 2018 21 days, 2019 16 days). On the day before examination, 396 participants were exposed to heat stress (Exposure Group) and the remaining 3,408 served as controls (Control Group). Preliminary results indicate that for the cardio-vascular system, heat exposure was associated with lower systolic (mean dif. -3.4 , $p=0.00$) and diastolic blood pressure (mean dif. -1.1 , $P=0.02$), increased heart rate (mean dif. 2.2 , $p=0.00$), and decreased QT interval (mean dif. -5.2 , $p=0.00$). In the pulmonary system, a slight decrease in oxygen saturation (mean dif. -0.3 , $p=0.00$) was seen in participants exposed to heat. In the renal system, heat exposure indicated higher sodium (mean dif. 0.5 , $p=0.00$) and albumin levels (mean dif. 2.1 , $p=0.02$). There

were no significant differences in inflammatory and liver parameters.

Our results could potentially be biased, since citizens who feel affected by the heat might refuse to be examined on hot summer days.

Conclusion:

This study offer an overview of early physiological responses to heat stress in different organ

systems. In particular, the cardio-vascular, pulmonary and renal systems shift, highlight the complexity of physiological responses to rising temperatures, even in a temperate climate zone. As climate change continues, our study contributes valuable knowledge to guide effective and tailored strategies in mitigating the health risks associated with heat stress.

Poster 34

Predictiveness and Drivers of Avian Influenza Outbreaks in Europe

Michael Rogo Opata¹, Andrea Lavarello Schettini¹, Jan C. Semenza¹ and Joacim Rocklöv¹

¹ Heidelberg University, Heidelberg, Germany

Abstract

Avian Influenza virus (AIV) outbreaks are sporadic events marked by significant spikes in specific years. These outbreaks carry a substantial economic burden, resulting in considerable losses to farmers with profound impacts on economies. As the outbreaks continue in birds and other mammalian host species, further virus evolution and spillover to humans' risk is anticipated to grow and potentially involve into new pandemics. Despite this, the underlying drivers of AIV outbreaks remain elusive and difficult to track but hold the promise that such events can be anticipated through preventing spillover and early containment based on predictive modelling.

A climate environment sensitive models capable of predicting AIV events in Europe with high accuracy is hereby presented. We utilize high-resolution NUTS3-level data to construct machine learning models that dynamically uncover the critical determinants of AIV outbreaks. Our approach leverages XGBoost and SHAP for both model creation and result interpretation. When provided with diverse features, our models successfully

capture distinct disease phenomena, aligned with established AIV transmission dynamics among wild birds and poultry.

Specifically, we reveal that temperature, water index, and vegetation index play pivotal roles in propagating these events. The variables come into effect at different times of the year. Temperature emerges as a key factor in the second (mean temperature) and third (minimum temperature) quarters of the year while water and vegetation index are important in the first and second quarters of the year, respectively. Our models also reveal the interplay between wild bird-to-wild bird and wild bird-to-poultry transmission events as catalyzed by climate. This interplay is explored through various model scenarios, shedding light on the impact of infected wild birds on poultry outbreaks.

These insights lay a robust foundation for elucidating the intricate landscape of AIV outbreaks, offering valuable insights for proactive preventive interventions to mitigate spillover and integrated predictive modelling to early containment of outbreaks.

Orange Posters

Poster 35

Roadmap to Carbon Neutrality: Decarbonizing Healthcare in Finland

Saeed Ahmad¹

¹ Tampere University, Tampere, Finland

Abstract

This comprehensive study evaluates the environmental implications of Finland's healthcare and social welfare sector, which contributed a significant 6.5% to the nation's overall carbon footprint in 2019. Focused on critical emission sources encompassing district heating, fuel, electricity, transport services, expert services, and food and accommodation, the research underscores the pressing imperative for developing a meticulous and strategic roadmap to attain carbon neutrality within the healthcare sector.

Drawing on the significant findings, the study proposes a series of high-level recommendations with global applicability, establishing a robust framework for healthcare decarbonization. These recommendations advocate for a resolute commitment to achieving zero-emission healthcare by 2050, intricately integrating healthcare decarbonization into the Nationally Determined Contribution to the Paris Agreement. This commitment is fortified by the establishment of baselines, the formulation of national roadmaps, the development of detailed action plans, and strategic investments in implementation mechanisms.

Moreover, the study posits the necessity of aligning zero emissions with health equity and climate resilience, emphasizing the pivotal role of cost-effective, climate-smart healthcare in realizing

the broader Sustainable Development Goals. It advocates for addressing the challenges posed by the COVID-19 pandemic through a dual focus on response and recovery, intertwining these efforts with the strategic implementation of decarbonization and resilience strategies.

A notable aspect of the research highlights the integration of on-site renewable energy sources as a transformative approach to not only improve healthcare access but also to fortify facility, system, and community resilience against environmental challenges. This dual-purpose strategy signifies a paradigm shift towards sustainable healthcare practices.

The study further champions cross-sectoral collaboration by engaging the healthcare supply chain in championing zero-emission practices across energy, buildings, transport, pharmaceuticals, agriculture, and industry. Recommendations underscore the need for incentivizing innovation and embracing a circular economy approach, fostering a holistic and interconnected approach to sustainability within healthcare sector.

Finally, the study underscores the paramount importance of effective communication and activation within the healthcare sector, urging it to lead by example. It proposes the training of health professionals as climate leaders and implementers, leveraging the sector's ethical, economic, and political influence to catalyze the process.

Poster 36

SPRINGS: Supporting policy regulations and interventions to negate aggravated global diarrheal disease due to future climate shocks

Yemoh Ted Annang¹, Edvokia Bairampa¹, Rasmus W Benestad¹, Floor Biemans¹, Peter Borgen Sorensen¹, Cyril Caminade¹, Chloe Chavardes¹, Josh Colston¹, Ana Maria de Roda Husman¹, Ludovico Dipineto¹, Massimiliano Fabbicino¹, Christian Frolund Damgaard¹, Sujan Katuwal¹, Oskar Andreas Landgren¹, Chelcea Liviu¹, Jerome Lock-Wah-Hoon¹, Lazarica Marinescu¹, Shreedhar Maskey¹, Esto Mduma¹, Adelina Mensah¹, Eileen Moyer¹, Marloes Nijboer¹, Rik Oldenkamp¹, James Platts-Mills¹, Ioana Popescu¹, Laura Rinaldi¹, Debraj Roy¹, Francis Ruiz¹, Arlex Sanchez Torres¹, Jack Schijven¹, Charlotte Stark¹, Erica van der Sijpt¹, Anna Vassa¹, Lucie Vermeulen-Henstra¹, Wieger Voskuil¹ and **Vanessa Catherine Harris¹**

¹ Amsterdam University Medical Centres, University of Amsterdam, the Netherlands

Abstract

Background:

Climate change and the concomitant destruction of the natural world are threatening human and planetary health now. Global climate projections of increased precipitation, flooding and drought threaten decades of progress achieved in reducing diarrheal disease burden. Diarrheal disease is currently the third leading cause of death in children under 5 years of age globally with sequelae extending to undernutrition, cognitive decline, and costs to human productivity at individual and collective scales. This immense disease burden means even small changes in diarrheal risk will impact vulnerable populations worldwide. Alteration of diarrheal disease burden will depend on dynamic interactions between local climate hazards, vulnerabilities, pathogen exposures and risks. Key knowledge gaps in these dynamics hinder effective policy responses and prioritisation of mitigation and adaptation strategies to tackle diarrheal threats in Europe and globally.

Project Overview:

The SPRINGS consortium brings together scientists from climate, environment, health and the social sciences to collaborate with communities, private sector, public authorities, and policy makers in a transdisciplinary project to address these knowledge gaps and needs. The project builds 4 case studies in Italy, Ghana, Romania, and Tanzania with contrasting vulnerabilities to predict and measure local climate, water quality, and pathogen-specific diarrheal disease burden in order to inform and prioritise effective policy responses. SPRINGS will use climate modelling with global-to-local downscaling methods to study climate-health interactions, informing local adaptation. We will evaluate the effects of climate extremes on local flooding and drought, on how diarrheal pathogens spread via the environment and alter microbial water quality, and on risks of several waterborne diarrheal diseases in the past, present, and future. As such, SPRINGS will lay the foundations for improved, integrated surveillance systems with climate-sensitive diarrheal disease indicators and risk

assessment tools. Participatory ethnography will improve risk communication through active participation of citizens and stakeholders, providing insights into understandings of climate change, water and diarrheal risk and existing mitigation and adaptation measures. We will explore opportunities to adapt to climate-driven increases in diarrheal disease burden by implementing local water safety planning across case study settings and modelling the impact of adaptation strategies under varying climate

scenarios. We will improve preparedness by using health technology assessments of interventions to reduce climate-associated diarrheal disease risks. Working with stakeholders and policy makers across sectors we will identify, appraise and prioritize evidence-based interventions, conduct health & value impact assessments, helping policy makers implement sustainable planetary health policies with robust evidence.

Poster 37

Evidence Based Imperatives for Protecting Human Health from Climate Change in Africa

Deoraj Caussy¹ and Jacqueline Kado²

¹ The Interacademy Partnership, Mauritius

² Network of African Science Academies, Nairobi, Kenya

Abstract

The African continent is disproportionately affected by the adverse effects of climate change in proportion to the amount of greenhouse gases it produces. According to WHO, Africa ranks as the continent with the highest disease burden due to climate change since it has one third of the total global DALY. The resulting mortality can be as high as 80-20 deaths per 1 million inhabitants in some countries. Some 56% of public health events recorded between 2001 and 2021 were climate related. Yellow fever, accounted for 28% of the climate-related health emergencies, while water-borne diseases including food-borne diseases accounted for 40% over the past two decade. Much of Africa's agriculture is rain-fed and rising heat will adversely impact food security through crop failure putting some 25 million persons at risk for NCD and heat-related strokes.

These health problems are further compounded by the presence of the following factors, 1) a harsh geography comprised of nearly 60% arid land and 38% of desert, 2) high prevalence of climate-sensitive diseases like cholera, malaria, 3) low resilience of the health system and), 4 inadequate adaptative capacity of the population. However, evidence-based information for climate actions is not available for policy makers, yet climate change continues to result in loss of lives and livelihood, exacerbation of poverty, and leading to civil unrest.

Therefore, our report sought to bridge this knowledge gap by 1) reviewing the existing evidence for climate change and health, 2) identifying the tipping points for actions and 3) generating recommendations for coherent coping strategies using a system approach to identify synergies and avoiding disconnect or inadvertent health-consequences. The regional work from Africa forms an integral part of the InterAcademy (IAP) regional and global reports for producing evidence-based policy brief to engage with policy makers in reducing the inequity and gender gaps for coping strategies.

Our main findings are: 1) intersectoral policy and actions on climate change and health are limited at the regional and national levels, 2) climate change is approaching a tipping point in many parts of Africa necessitating urgent health adaptation and mitigation measures, 3) there is inadequate human capacity and expertise to tackle climate change and health, 4) there is insufficient evidence base for initiating climate actions, 5) partnership needs to be forged to combat adverse health impacts in Africa. Based on the assessed evidence, our recommendations can be grouped into 1) imperative for institutional policy development, 2) health adaptation through public health package, 3) mitigation for reducing the GHGs, and 4) strengthening the evidence base by research. Our poster contains specific details of our recommendations and other imperatives for actions.

Poster 38

Presentation of the BCOMING project

Julien Cappelle¹, Diego Rodriguez¹ and Gabriella Lovasz¹

¹ The Interacademy Partnership, Mauritius

² Network of African Science Academies, Nairobi, Kenya

Abstract

The drastic reduction of biodiversity in the last decades, has contributed to an equally drastic growth and transmission of infectious diseases. BCOMING started as a post-pandemic project that aims to understand how biodiversity loss is linked to the spread of zoonotic diseases and limit their emergence by means of biodiversity conservation strategies and disease surveillance systems. The project comprises substantial amount of sampling and data collection in three hotspots of biodiversity that will be used in modelling and risk mapping. BCOMING also counts with a participatory process to engage all stakeholders in the implementation and scale up of our findings.

Poster 39

One health clinical studies to unravel the TRIGGER climate-health connections

Maria Carelli¹, Erika Brattich², Igor Diemberger², Patrizia Brigidi², Valerio Carelli², Sylvain Sebert³, Silvana Di Sabatino², on behalf of TRIGGER partners

¹ IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

² University of Bologna, Bologna, Italy

³ University of Oulu, Oulu, Finland

Abstract

Emerging literature is promoting the development of exposome-related studies, typically limited to selected geographical areas, based on mortality registries and discharge databases or administrative data, different in the spatial resolution, the time-period covered, and the reference baseline used for the definition of extreme events. SoluTions foR mltiGatinG climate-induced hEalth tReaths (TRIGGER, ga n. 101057739) Project aims to overcome these limitations to deepen current understanding of the complex linkage between climate, human health and ecosystems (exposome framework) through the implementation of two large clinical studies: a cross-sectional study (Cross-sectional multicentric European observational CLimate-heAlth adVanced Interconnection Study in patients with acute cardiac or respiratory events, CrossCLAVIS) and an observational longitudinal study (Longitudinal multicentric European observational CLimate-heAlth adVanced Interconnection Study in healthy volunteers, LongCLAVIS).

The two concomitant studies are performed in the same geographical areas, with data collection in similar domains, but focusing either on patients hospitalized for acute events (CrossCLAVIS) or on general population (LongCLAVIS). Enrolling centres are distributed across Europe with a north-south gradient location with renowned clinical and scientific expertise, allowing the investigation of different weather-extreme conditions peculiar to Europe.

CrossCLAVIS is designed as a cross-sectional, multicenter, international study involving patients admitted to the hospital or the emergency room for acute cardiovascular and respiratory events throughout one year. We hypothesized that a sudden change, exposure of extreme intensity, or prolonged period of exposure related to temperature and/or air climatic or pollution-related factors is associated with changes in patients' characteristics. To reach this aim, we are collecting exposure-related samples and health data, to ultimately identify a risk profile of patients that develop acutely cardiovascular and pulmonary complications in extreme weather conditions, including analysis of molecular and microbiological pathways, i.e. respiratory microbiome and human mitochondrial DNA, involved in the protection from or predisposition to developing severe clinical conditions. Same information will be collected in the LongCLAVIS, that is designed as a prospective, international study with a prolonged longitudinal collection of exposure-related samples and health data. Moreover, enrolled subjects will be monitored through a multi-layered approach mostly based on wearables (for continuous monitoring) with low-cost and sensors for both health parameters and climate readouts, integrated with serial sampling of biological materials. The combination of these studies results will help in better understanding the genotype environment interaction effect both in the acute pathological setting and the preclinical/occasional setting.

Poster 40

Advancing Sector Footprint Monitoring: Integrating Bottom-Up Data into Top-Down Approaches for Estimating the Environmental Impacts of Healthcare

Tinia De Bruycker¹, Michelle Steenmeijer¹, Lowik Pieters¹, **Martijn van Bodegraven**¹ and Susanne Waaijers-van der Loop¹

¹ RIVM Dutch National Institute for Public Health and the Environment, Bilthoven, The Netherlands

Abstract

In the transition towards more sustainable economies, monitoring national footprints is becoming important to track climate and sustainability targets. In the Netherlands, these targets have been set on a sectoral level to drive action and to improve decision-making, since different sectors contribute to national climate and sustainability goals in distinctive ways. In this line, the healthcare sector has pledged to monitor its own environmental footprint to better understand its contribution and track its progress.

Several methodologies exist to measure environmental impacts. One valuable tool to do so on national and sectoral levels is environmentally-extended input-output analysis (EEIOA), which applies a top-down approach to compile environmental footprints and to identify hotspots across production and consumption chains. However, EEIOA databases are currently too aggregated to report sufficiently on specific sectoral mitigation efforts and are not suitable to monitor mid- to long-term developments. For the healthcare sector in particular, previous research has shown that EEIOA fails to provide detailed insights into the product group which contributes the most to the sector's environmental impacts: pharmaceuticals and other chemicals. This is due to the product group encompassing a diversity of products, from simple soap to process-intensive pharmaceuticals.

Environmental impacts can also be measured using a bottom-up approach. Referring to the Dutch healthcare sector, this would ideally lead to life cycle assessments (LCA) being performed for each specific product within the aggregated groups. This approach is, however, time- and labor-intensive as life cycle inventories are often missing, incorrect or incomplete.

In our research, we aim to examine how the two methodologies can be combined for better monitoring, using bottom-up data (LCA and sector or industry data) to increase the resolution of top-down sectoral footprints. While it is common to see EEIOA integrated into LCA, the reverse is under-explored. We delve into the different hybridization approaches and their respective drawbacks regarding data requirements and complexity. We also discuss the different types of data sources available in literature and practice, and their current discrepancies for integration. We further outline guidelines that would prevent future issues, contributing to the harmonization and standardization of both LCA and EEIOA data for healthcare, and hence to a more effective monitoring of its environmental footprint. The improvement of monitoring methods supports better decision-making in the mitigation of environmental impacts from the healthcare sector, which, in turn, benefits our health.

Poster 41

The project OneAquaHealth and the interplay between urban freshwater ecosystems, human health and climate changes

Maria João Feio¹ and the OneAquaHealth consortium

¹ Department of Life Sciences, Marine and Environmental Sciences Centre, University of Coimbra, Coimbra, Portugal

Abstract

The Horizon Europe project OneAquaHealth – Protecting urban aquatic ecosystems to promote OneHealth (2023–2026) is focused on the challenges that growing global urbanization and climate changes poses to the preservation of nature, and to human health. More specifically, it will test if the health of freshwater ecosystems and human health and wellbeing in urban contexts are interconnected, and thus, if improving one results in the improvement of the other, reestablishing the balance between nature and humans.

OneAquaHealth will also deliver and test an Environmental Surveillance System composed of predictive models, a Decision-Support System and other connected tools (Citizen app and dashboards) that will produce early warnings for potential human health and well-being, including epidemiological risks, based on new environmental indicators. OneAquaHealth uses: satellite Earth observations; climatic data; biodiversity and health data from existing databases; and new data collected in 5 Research cities: Coimbra (Portugal), Benevento (Italy), Toulouse (France), Gent (Belgium), and Oslo (Norway).

Among other environmental conditions, climatic conditions (air temperature, humidity, and their variations) affects the aquatic biodiversity and the ecosystem functioning but also humans.

On the other hand, healthy aquatic ecosystems, supporting diverse biological communities and ecosystem processes, have the potential to mitigate climate change effects (e.g., by buffering extreme air temperatures and low air humidity; draining the surface runoff from impervious urban surfaces during extreme precipitation events preventing floods), which is highly relevant in temperate and dry regions.

Thus, in OneAquaHealth, predictive modelling is used to forecast modifications in the aquatic ecosystems' health and in its resilience to alterations in environmental (e.g., water quality, vegetation, hydromorphology) and climatic conditions that are relevant for human health. By using those models, we will simulate scenarios of: a) restoration measures, b) anthropogenic pressures, and c) climate changes. When established, these models constitute a strong basis for the early warning surveillance system to be used by relevant decision-makers. Maps in the OneAquaHealth Hub will highlight options to integrate climate changes in the management of urban stream ecosystems with reflex in human health. The projections will also be taken in account in the OneAquaHealth toolkit of nature-based measures to recover and maintain aquatic ecosystems health (and thus, human, animals and plants health).

Poster 42

Official Statistics for Climate and Health Interactions

Megan Green¹, Vijendra Ingole¹ and Myer Glickman¹

¹ Office For National Statistics, United Kingdom

Abstract

Vulnerability to health risks from climate change varies with socioeconomic, demographic, and geographical factors. Disadvantaged groups are likely to be most immediately affected by climate change and least able to adopt effective mitigation actions.

Research in this area is under-developed, individual health risks are often studied in isolation from each other and approaches have mostly been articulated at a high level, with a lack of detailed knowledge of risks to inform local government and health sector planning. Furthermore, statistical guidance does not amount to a complete or coherent set of standards suitable for Official Statistics production.

A four-year project launched in February 2022, led by the UK Office for National Statistics and funded by Wellcome. The project aims to advance global research on climate and health, help to address gaps in the knowledge base and support national monitoring and evidence-based policy. It will produce a detailed, harmonised framework of standards and methods, led by official statisticians, incorporating multidisciplinary and multilateral input.

There are three project outcomes:

- Develop a transparent and globally generalisable framework for official statistics on climate change and health.
- Develop a global reporting and knowledge-sharing platform and open-source toolset to build capacity and reduce the resource

burden on low- and middle-income countries of developing climate-health statistics.

- Explore and develop statistical methods to better estimate climate-related health risk, through generalisable and reproducible methodologies, and exploration of ‘thin’ models for application to data-poor settings.

The framework is being developed jointly with the African Institute for Mathematical Sciences, Rwanda, and the Regional Institute for Population Studies at the University of Ghana. It will integrate the framework with national contexts and promote long-term capacity development. Our approach aims to be collaborative at all stages, for instance, by ensuring realism on the implementation of methods in resource-limited settings. Other partners include the UK Health Security Agency and the Cochrane Climate-Health Working Group (University of Alberta, Canada) who provide specialist input.

Throughout the project, we will engage with international and regional bodies and national governments to promote awareness of the work, join up with related initiatives, seek collaborative input, disseminate the outputs, and build sustainable, long-term engagement.

As a result of the project, users and producers of official statistics in low- and middle-income countries will have an increased ability to monitor the effects of climate change by having access to practical, coherent standards and open-source tools. Ultimately, this will translate into a better-informed international community and more effective, evidence-based climate change interventions.

Poster 43

LIFE RESYSTAL - A Climate change Resilience framework for health Systems and hospitals

Stelios Karozis¹

¹ National Centre for Scientific Research "Demokritos", Athens, Greece

Abstract

The LIFE RESYSTAL project's main objective is to increase climate adaptation capacities and resilience of the European Health Infrastructure (EHI) and systems and related dependent critical infrastructures. This 4-year project will develop, demonstrate, evaluate and disseminate a framework for climate-resilient health systems with seven pilot hospitals (site-level) and two pilot regional health systems (system-level). It is a close-to-market project, aiming to introduce innovative solutions to the market. Four main outputs will result from the project, all of them composing the framework for climate-resilient health systems.

1. The Upscaling Adaptation Starting Package – UASP is the first product that could be used by a hospital willing to work on its resilience to climate change.
2. The Toolbox would be used by a hospital as the next step for its increase in climate resilience capacities. The solutions is for site-level climate adaptation of health facilities and operations.
3. Health System Level guidance for health systems to design and implement a climate resilience strategy and enhance the resilience of regional and national health infrastructures in Europe.
4. Climate resilient strategies will be designed for two pilot health systems (Groupement Hospitalier de Territoire de Coordination et de Mutualisation Est-Hérault et du Sud-Aveyron, France, and Galician Health Service, Spain.) The strategies will assess CC risks to the health system, map out the country/regional health profile and policy environment and define CCA objectives and targets and policy recommendations at the health system level.
5. Blue and green infrastructure interventions will be carried out at the seven pilot hospitals. Hospitals have identified a number of infrastructure works for enhancing the resilience of their facilities: green corridors and walls, rewilding and tree planting. Some pilots will also implement grey infrastructure works to improve their heating and cooling systems, adapting them to the changing climate.
6. The Facilitation Board, composed of advisors and experts on climate change adaptation, the healthcare sector, the resilience of infrastructure, investors and policy makers at the national and European scales. The board will be sustained once the project ends.
7. The Scaling Network, gathering representatives of the health sector, federations or hospitals that are interested in using the above-mentioned outputs to improve their resilience to climate change. The network will be sustained once the project ends.

Poster 44

New tools for quantifying vulnerability to heat stress in cities

Iulia Marginean¹

¹ CICERO Center for International Climate Research, Oslo, Norway

Abstract

Heat stress, associated with the warming climate has severe impacts on human health, manifesting through increasing disease and premature death rates. These effects are most visible in cities, where more people are exposed to hot temperatures that are significantly higher than in their surrounding rural areas. Additionally, public health assessments anticipate an increase in overall vulnerability due to projected urbanization and aging of urban populations. Without appropriate adaptation strategies, the already notable heat-related impacts will intensify rapidly in the future urban environments.

Despite evidence highlighting the increased vulnerability of specific population subgroups, existing research has predominantly focused on the hazard and exposure components of heat stress risk, leaving a pressing need for further investigations into the vulnerability aspects. Furthermore, research on the impacts of heat on human health consists mostly of studies carried out at the regional, national or city level, with a focus on total population mortality and morbidity outcomes. Decision makers require detailed, granular information to develop and implement adaptation solutions targeting those most vulnerable. Findings from coarse resolution data on aggregated (total) population may mask differences in vulnerabilities of certain population subgroups and thus may not provide the information that is needed.

Underlying vulnerability factors such as the demographic (age, sex, education) and socioeconomic (income, wealth) structure of populations and characteristics of urban planning are useful for quantifying vulnerability dynamics and identifying vulnerable areas within cities. However, the effects of individual vulnerability factors, such as age for instance, are not well understood. This research aims to quantify the effect of different socioeconomic factors on the excess mortality rates due to heat stress and assess how well these factors describe vulnerability in a case study for Madrid. First, we use high-resolution demographic data to project vulnerability to heat stress under alternative scenarios that align with the narratives of the Shared Socioeconomic Pathways. We then employ meteorological data generated by the urban climate model UrbClim, together with district-specific mortality data to derive detailed exposure-response functions and the associated relative risk (RR) for the 21 districts in Madrid. We analyze the effect modification of heat-mortality relationship by a set of socioeconomic indicators that could account for the excess mortality.

The resulting indicator-specific coefficients inform about the potential of different vulnerability factors to increase heat-related mortality. The spatiotemporal distributions of vulnerable population groups, and their projected changes enables spatial mapping of vulnerable areas at the intra-urban level and projected changes of vulnerability patterns and their associated health outcomes.

Poster 45

Fostering a better understanding of climate and environmental drivers of sand fly-borne diseases in Europe – the CLIMOS project

Maria Maia¹, Ünal Altuğ², Manos Athanatos³, Eduardo Berriatua⁴, Suzana Blesic⁵, Gioia Bongiorno⁶, Remi Charrel⁷, Orin Courtenay⁸, Maya Davidovich-Cohen⁹, Jerome Depaquit¹⁰, Vit Dvorak¹¹, Ozge Erisoz¹², Federica Ferraro¹³, Padraic Fleming¹⁴, Valentina Foglia-Manzillo¹⁵, Nenad Gligoric¹⁶, Vladan Gligorijevic¹⁷, Diana Guardado¹⁸, Gordon Hamilton¹⁹, Nils Hempelmann²⁰, Tally Hatzakis¹⁴, Vladimir Ivovic²¹, Oscar Kirstein⁹, Edwin Kniha²², Iva Kolarova¹¹, Yusuf Ozbel²³, Shlomit Paz²⁴, Florence Robert-Gangneux²⁵, Jovana Sadlova¹¹, Luis Samaniego²⁶, Daniel San Martin²⁷, Frank Van Langevelde²⁸, Petr Volf¹¹, David Wright¹⁴, Carla Maia²⁹

¹ Karlsruhe Institute of Technology, Karlsruhe, Germany

² Turkish Ministry of Health, Ankara, Turkey

³ Telecommunications Systems Institute, Chania, Greece

⁴ University of Murcia, Murcia, Spain

⁵ Institute for Medical Research, University of Belgrade, Belgrade, Serbia

⁶ Istituto Superiore di Sanità, Rome, Italy

⁷ Aix-Marseille University, Marseille, France

⁸ University of Warwick, Coventry, United Kingdom

⁹ Israeli Ministry of Health, Jerusalem, Israel

¹⁰ University of Reims Champagne-Ardenne, Reims, France

¹¹ Charles University, Prague, Czech Republic

¹² Hacettepe University, Ankara, Turkey

¹³ Ministry of Health, Italy

¹⁴ Trilateral Research, Waterford, Ireland

¹⁵ University of Naples Federico II, Naples, Italy

¹⁶ Zentrix Lab, Pancevo, Serbia

¹⁷ CubexLab, Amsterdam, Netherlands

¹⁸ F6S Network, Ireland Limited, Dublin, Ireland

¹⁹ Lancaster University, Lancaster, United Kingdom

²⁰ Open Geospatial Consortium, Leuven, Belgium

²¹ University of Primorska, Koper, Slovenia

²² Medical University of Vienna, Vienna, Austria

²³ Ege University, Izmir, Turkey

²⁴ University of Haifa, Haifa, Israel

²⁵ University of Rennes 1, Rennes, France

²⁶ Helmholtz Centre for Environmental Research, Leipzig, Germany

²⁷ Predictia, Santander, Spain

²⁸ Wageningen University, Wageningen, Netherlands

²⁹ University NOVA of Lisbon, Lisbon, Portugal

Abstract

Sand fly-borne diseases, including leishmaniasis and phleboviruses, represent a major public health and veterinary concern. The spread of sand fly vector populations and the pathogens they transmit has induced in recent decades several research consortia (EDEN, EDENext and Vectornet) to improve knowledge, surveillance and control in Europe and neighbouring countries.

CLIMOS stands for Climate Monitoring and Decision Support Framework for the Detection and Mitigation of Sand Fly Diseases with Cost-Benefit and Climate Policy Measures (<http://www.climos-project.eu>). The project brings together 30 partners, including universities, institutes, research centers and ministries of health from 16 countries within and outside Europe.

It aims to characterize the climatic, environmental, demographic and epidemiological characteristics associated with the presence and abundance of sand flies and domestic animal infection rates at different geographic scales across Europe and neighbouring countries.

The collected data will be used in mathematical epidemiological-climate prediction models of realistic human-induced climate change scenarios to help develop an early warning system for infection and disease designed for public use seeking to

better prepare for current and future impacts of climate and environmental change on human and animal health.

In a nutshell, CLIMOS will:

- Develop a general public health risk assessment method for SFBDs through integration of climate, environmental and One Health disciplines and data sciences;
- Utilize big data from Earth-observing satellites and ground-level surveillance records, to map the locations of disease-carrying insects and provide health, climate and environmental services to keep communities safe;
- Integrate economic and social sciences, to enable socio-economic assessments of impacts of the incidence and spread of SFBDs on individuals and societies;
- Engage with key stakeholders and citizens to stimulate discussion and co-develop future scenarios for health and other impacts.

The CLIMOS consortium is co-funded by the European Commission grant 101057690 and UKRI grants 10038150 and 10039289.

The six Horizon Europe projects, BlueAdapt, CATALYSE, CLIMOS, HIGH Horizons, IDAlert, and TRIGGER, form the climate change and health cluster.

Uncovering the hidden toll: exploring 130 years of temperature-related mortality in Madrid

Dariya Ordanovich¹, Diego Ramiro¹ and Aurelio Tobías²

¹ Institute of Economy, Geography and Demography, Spanish National Research Council, Madrid, Spain

² Institute of Environmental Assessment and Water Research, Spanish National Research Council, Barcelona, Spain

Abstract

The association between ambient temperatures and health outcomes was extensively studied in the past decades, especially in the light of exacerbating climate change. The warming of the air temperatures in Spain affected the entire national territory since the turn of the XX century. Yet the number of studies exploring the evolution of adaptation to heat and relying on multidecadal time-series data in Spain at any administrative level is very limited. To our knowledge, the present research is the first one to leverage daily mortality and temperature data in the city of Madrid since the end of the XIX century until today.

We examined the patterns of adaptation to extreme and moderate heat and cold in the city of Madrid in the period from 1890 until 2019 using daily data on air temperature from the meteorological stations and all-cause mortality from yearly books and civil registers. Using a distributed-lag nonlinear modelling framework, we explored complex temperature-mortality relations and estimated the changes in the adaptation metrics by decade. In total, we analyzed 1 915 534 deaths registered in the municipality of Madrid since 1890. The temperature-mortality relationship exhibited a similar pattern throughout the entire period of the observation. The cold-related burden of mortality in Madrid experienced a drastic 12-fold reduction over time, mostly associated with the drops in moderate cold exposure. The heat-attributable

mortality fraction diminished less significantly and remained at similar levels throughout time. The temperature effect was most pronounced in the oldest (60+) age group during most of the observational window. The cold effect dropped drastically since 1990s for all ages and both sexes; however, the heat effect consistently increased in elderly females throughout the period of study.

Overall, the excess mortality decreased by 3 times in the period of 130 years, which indicates a progressive adaptation to warmer air temperatures in the city of Madrid. However, this overall reduction was mostly due to the drop of cold-related mortality attributed to fast improvement of the urban infrastructure and socio-sanitary system in the beginning of the 20th century. Mortality related to the exposure to moderate heat has declined over time, especially since the 1990s, when the prevalence of air-conditioning use started to sharply increase. Nonetheless, the extreme heat remained at the similar levels throughout most of the study period and increased in the last decade of observation.

This research marks a pioneering investigation into the effects of daily temperature on health in Spain during such an extended timeframe. The results hold considerable potential significance for predicting the future mortality impact of climate change, as well as informing the formulation of adaptation strategies in developing nations mirroring Madrid's historical trajectory.

Poster 47

Climate change induced health impacts facing Malaysia: gaps in urgent research

Raksha Pandya-Wood¹, Azliyana Azhari¹, Hamimatunnisa Johar², Adeline Johns-Putra¹, Nurfashareena Muhamad³, and Tin Tin Su²

¹ School of Arts and Social Sciences, Monash University Malaysia

² South East Asia Community Observatory (SEACO), Jeffrey Cheah School of Medicine and Health Sciences, Monash University Malaysia

³ University Kebangsaan Malaysia Institut Alam Sekitar & Pembangunan (LESTARI)

Abstract

In Malaysia, climate change typically manifests as frequent and extreme catastrophic weather events. The effects of climate change on human health are multiple and diverse. This Systematic Review (SR) adopted PRISMA guidelines, and identified and assessed a broad range of empirical research in this area.

Using the search engines Scopus, Pubmed, Ovid EMBASE, Web of Science, and EBSCO Host Medline, n=374 results were yielded. Three climatic themes emerged (Exposure: heat stress n=4, air pollution n=2, Outcomes: infectious diseases (including vector borne diseases) n=9, food security n=2, and Planning: disaster preparedness n=4, and community involvement n=2).

Our review confirms that urgent funding and investment is needed for larger scale intervention studies in Malaysia. We observed a scarcity of high-quality empirical research and a preponderance of modelling studies to project and simulate scenarios, and a limited number of qualitative research in high-quality international peer-reviewed journals. Particular gaps in knowledge were noted on climate change impacts on health in population groups in terms of demographic intersections to support these epidemiological data and simulation pathways. Furthermore, there was an absence of data on the effects of climate change on mental health, women or the effects of displacement.

Poster 48

The unequal impacts due to climate change

Paloma Rodríguez Martínez*

* University of Alcalá, Alcalá de Henares, Madrid, Spain

Abstract

Climate change does not affect all people in the same way, because depending on the geographical area in which we live and our economic capacity, our situation is different with respect to climate change. On the other hand, climate change does not affect men in the same way as it does women, which is why different international organizations explain the relationship between climate change and gender equality, such as the ILO (Climate change and extreme weather phenomena have a unequal impact on men and women¹), UN Women (How gender inequality and climate change are related to each other²), The European Parliament (Gender and climate change: a question of life and death. MEPs affirm that women face greater risks in natural disasters than men and call for measures to tackle this problem that mainly affects the poorest³), the EIGE (It has a section dedicated to the European Green Deal and gender equality, with seminars and different publications that relate climate change

and gender equality, highlighting that at COP28 there was a day dedicated to gender equality to highlight the impact that women suffer due to climate change⁴).

Thus, this relationship between gender equality and climate change has been analyzed by different international organizations of great impact, however, at a regulatory level we do not find this relationship in a clear and evident way either at the national and/or European level, leading to a lack of protection for women and girls. For all these reasons, it would be advisable to create a Directive or other regulatory Act that makes visible this inequality that is suffered in terms of climate change and that proposes the pertinent measures to protect women and girls from the adverse effects of climate change, giving the margin of transposition to each country so that it adjusts to its social, economic and geographical situation, always respecting a minimum content that does not lose the basic purpose of the norm, which is to reduce the gender inequality suffered due to climate change.

¹ https://www.ilo.org/americas/sala-de-prensa/WCMS_870976/lang--es/index.htm

² <https://www.unwomen.org/es/noticias/articulo-explicativo/2022/03/articulo-explicativo-como-la-desigualdad-de-genero-y-el-cambio-climatico-estan-relacionados-entre-si>

³ <https://www.europarl.europa.eu/news/es/headlines/society/20171201ST089304/genero-y-cambio-climatico-una-question-de-vida-o-muerte>

⁴ <https://eige.europa.eu/newsroom/news/gender-equality-cop28-newsfeed>

Poster 49

Belgian Climate and Environment Risk Assessment Governance

Stijn Segers* and Aurore Brunson*

* Climate and Environment Risk Assessment Center (CERAC), Brussels, Belgium

Abstract

The creation of a Belgian Climate and environment Risk Assessment Center (CERAC) was decided by the Council of Ministers following devastating floods in the Vesder Valley, July 2021 . The center specifically is housed in the Belgian Federal Public Service Health, Safety of the Food chain, and Environment and is independent in its operation.

CERAC reports to the National Security Council and, in addition to its coordinating role, its mandate also includes providing objective risk assessments of the impact of not only climate change but on the crossing of all nine planetary boundaries on all relevant sectors. Within this assignment, the center participates already as a transversal actor in the Belgian National Resilience Plan. Here, CERAC contributes from its role to the content of NATO baseline requirement 5 for Belgium: resilient civil health systems, which can withstand future risks caused by climate and the environment, including cascading risks and transition risks.

The poster presentation shows the steps taken from 2021 till now, where the center currently

is heading, and its future workprogram and risk assessments, which includes an overview of the Planetary Boundaries for Belgium and a first risk assessment on predefined impacted sectors. It also focusses on current Belgian Health system structures, systems and actors related with current and future crises that recently were put in place in the Belgian Federal state. The Belgian state structure is characterized by a delegation -from among others- health related authorities from the federal to the federated level, whereas the Federal Government had residual authorities, including in timing of crisis and to fulfill international obligations (DG SANTE, DG CLIMA, SENDAI-Framework, ...)

The center cooperates with the National Crisiscenter but has, apart from advising experts in specific domains, an advisory board that includes other significant Belgian institutions to fulfill its mission to provide Belgium. This advisory board also includes the Belgian Chief Medical Office, part of Public Health Emergencies and other actors such as the Belgian Climate Center, The Belgian National Bank.

Poster 50

A generalized modelling framework for dengue early warning systems in South and Southeast Asia

Remy Hoek Spaans¹, Sophie Belman¹, **Chloe Fletcher**¹, Quillon Harpham¹, Gina Tsarouchi¹ and Rachel Lowe¹

¹ Barcelona Supercomputing Center, Barcelona, Spain

Abstract

Dengue is a climate-sensitive disease affecting many countries in Asia, the Americas, and parts of Africa. Anthropogenic climate change is expected to increase the spatial extent of the global disease distribution and with increased intensity and frequency of extreme weather events the likelihood of large dengue outbreaks is also expected to increase. It is therefore essential for governments of endemic countries and those at risk of disease (re-) emergence to invest in robust early-warning systems. This work builds on the successful implementation of the Dengue forecasting MOdel Satellite-based System (D-MOSS) in Vietnam, which can provide lead-times of up to six months. In E4Warning we extend this work by developing a generalised modelling framework to produce dengue forecasts

across country settings, able to accommodate for differences in spatial and temporal scales of reporting. This framework will initially be applied to Vietnam, Sri Lanka and Malaysia. A Bayesian modelling approach will be taken and compared to standard practice for monitoring dengue outbreaks in each country. It will increase our understanding of which predictors of dengue are most consistent or unique across settings and provide a template for the development of dengue early warning systems that can be applied more widely, given a live stream of remotely sensed data and dengue reporting. The online platform implementing the forecasting system is hosted by HR Wallingford. We will work closely with in-country partners to provide actionable data visualisations and summaries to facilitate a data-driven dengue control response.

Poster 51

Community-Based Engagement and Interventions to Stem the Tide of Antimicrobial Resistance Spread in the Aquatic Environments Catalysed by Climate Change and Plastic Pollution Interactions (TULIP)

Marina Treskova¹, Eline Boelee², Alex Greenwood³, Hans-Peter Grossart⁴, Shannon McMahon¹, Mark Donald Reñosa⁵, Joana Mira Veiga², Jonas Wallin⁶, Joacim Rocklöv¹

¹ Heidelberg University, Heidelberg, Germany

² Stichting Deltares, HV Delft, The Netherlands

³ Leibniz Institute for Zoo and Wildlife Research, Berlin, Germany

⁴ Leibniz Institute for Freshwater Ecology and Inland Fisheries, Berlin, Germany

⁵ Research Institute of Tropical Medicine, Manila, The Philippines

⁶ Lund University, Lund, Sweden

Abstract

Interconnections between ecological and societal systems facilitate compounding impacts of climate change, environmental plastic pollution and proliferation of antimicrobial resistance (AMR) on the health of people, animals and ecosystems on a planetary scale. Current knowledge on interactions between these three crises in the Earth's natural systems and their impact on health is highly restricted. This poster will present a concept of an EU-Horizon project that focuses on plastic-AMR-climate change interactions in aquatic environments - TULIP.

TULIP will apply a transdisciplinary socio-ecological systems thinking approach, robust environmental science methods, epidemiology, modelling, sampling design and state-of-the-art molecular tools to generate scientific evidence on plastic-AMR interactions. It will describe spatio-temporal dynamics and patterns of plastic-associated AMR under a changing climate and the compounding health and ecological impacts. It will employ the methodology of intervention and social sciences to

explore social driving factors and current policies and design and evaluate community-based interventions and nature-based solutions.

TULIP will convert created evidence to modelling-based decision-supporting tools that approximate co-benefits to human and ecosystem health, indicators and environmental policy recommendations highlighting triple-win solutions and foster the science-policy translation using an integrated knowledge translation framework. Aiming to ignite a lasting societal change toward health-promoting environments, TULIP will engage communities, citizen scientists, policymakers and experts from multiple sectors in research, co-design, co-implementation, communication and dissemination processes.

TULIP will focus on aquatic environments as they create a milieu for interactions, transport pathways and exposure interface and showcase its approach in the Philippines and Italy and translate to a pan-European scale.

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