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PROGRESS ON THE STATISTICAL FRAMEWORK FOR CLIMATE AND HEALTH IMPACTS

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Abstract

We report progress of the project Standards for Official Statistics on Climate-Health Interactions (SOSCHI) and reflect on successes and opportunities, but also on challenges encountered in areas such as data availability and governance. We will outline needs for further development of methodologies and obstacles to implementation.

The project is developing a framework of recommended indicators for monitoring the impacts of climate change on population health and health services, to better inform policy on adaptation, public health measures and healthcare delivery. The framework will cover a wide range of health-related topics, namely heat- and cold-related mortality, mental and psycho-social health, effects of extreme weather events (wildfire and floods), exposure to chemical contaminants, water-borne diseases, impact on non-communicable diseases, air pollution and respiratory illnesses, malnutrition and food-borne diseases, vector-borne diseases.

Understanding impacts on health and who is most vulnerable to them is essential to effective adaptation to reduce the human cost of climate change in mortality and illness. The project aims to enhance the role of NSOs in systematic monitoring of climate change outcomes and help to build relevant expert capacity in LMIC statistical institutions. The indicators will inform climate change adaptation policies (particularly measuring climate-related risks, vulnerability, hazards, impacts and adaptation). The work is being carried out collaboratively between partners in Ghana, Rwanda and the UK so that experience and priorities in Africa, where some of the worst climate change impacts are already evident, are central to the development.

Importantly, we will introduce a consultation and collaboration process by which members of the Expert Forum are invited to review and test the proposed indicators as drafts are released.

I. PURPOSE OF THIS DOCUMENT

A. Aims

The Standards for Official Statistics on Climate-Health Interactions (SOSCHI) project aims to advance global research on climate and health, helping to address gaps in the knowledge base and support national monitoring and evidence-based policy. This project includes development of a statistical framework and online platform of recommended indicators (topics presented to Expert Forum for Producers and Users of Climate Change-related Statistics in 2023).

The aim is to reach wider audiences, to encourage the use and application of the framework and platform. This will be achieved through by working with the UNSD, WHO and other key stakeholders and by reaching out to NSOs across the globe including in the UNECE Expert Forum.

We are seeking user feedback (using an online survey) from members of the Expert Forum, who are invited to review and user-test one of the proposed indicators (heat and cold related mortality).

B. Background

Rising temperatures, wildfires, extreme weather events and increasing air pollution due to climate change, and the impact of these on human health, are recognised as a major global concern. The most significant hazards and their impacts are different between countries and regions, as are the possibilities and priorities for adaptation. Governments and other stakeholders need to have regular, reliable and comparable data to monitor climate impacts and inform adaptation strategies, thereby requiring a transparent and globally generalisable statistical framework.

The framework will include a range of indicators based on state-of-the-art statistical methods which estimate climate-related health risks. To support global reporting and monitoring and we are also developing a knowledge-sharing platform and open-source toolsets to facilitate high quality research and official statistics in line with the agreed framework.

C. Actions

Invitation for collaboration and user testing with UNECE Expert Forum

The primary users of the framework and platform will be analysts responsible for producing official statistics on climate and health for their country/region. These users will not necessarily be experts in climate/epidemiological methods/approaches but will have at least a basic statistical understanding of health and climate data and statistical methods. They would be looking to produce statistical outputs on a regular basis, often with limited resources, so require straightforward and reproducible methods.

We are seeking feedback on the first iteration of our open-source tool and platform (currently in the development stage), which will be hosted on the UN Global Platform (UNGP) for wide accessibility and reach. The platform currently includes a tool to calculate an indicator of the impacts of ambient temperature (heat and cold) on health outcomes (all-cause mortality) which is the first indicator within our framework to be completed.

Please use this [link](#) for the online platform feedback questionnaire (Microsoft Forms).

Please contact us by email at climate.health@ons.gov.uk if you would like to:

- offer specialist expertise on one of the indicator topics
- collaborate in the project by testing proposed indicators with your own data
- comment in any other way

II. PROGRESS OF THE SOSCHI PROJECT

A. Review of aims and objectives, partnerships and governance

Aims and objectives:

The SOSCHI [project](#) aims to advance global research and statistics on climate and health, helping to address gaps in the knowledge base and support national monitoring and evidence-based policy.

Partnerships:

SOSCHI is a four-year project, established in February 2022, led by the UK [Office for National Statistics](#) (ONS) and financially supported by [Wellcome](#) (grant no. 224682/Z/21/Z). This project is being developed collaboratively with [African Institute for Mathematical Sciences \(AIMS\)](#) and [Regional Institute for Population Studies \(RIPS\) at the University of Ghana](#). The [UK Health Security Agency](#), [Cochrane Climate-Health Working Group](#) (University of Alberta, Canada) and [UN Global Platform](#) are also actively involved.

Governance:

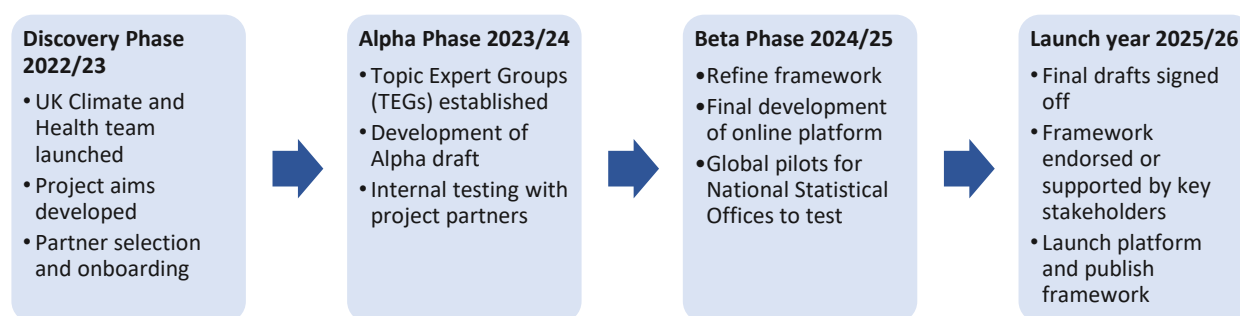
The project is overseen by a **Project Board** chaired by a senior manager in ONS and with representation from all the project partners. An **Expert Advisory Group** was established consisting of leading global experts and

representatives of key organisations involved with climate policy and data, chaired by Professor Sir Andy Haines, Professor of Environmental Change and Public Health at the London School of Hygiene and Tropical Medicine. To ensure coordination with national stakeholders, a **Ghana Steering Committee, Rwanda Project Advisory Committee** and **UK Cross-Government Group** have been set up.

B. Project timelines and update on activities

The project phases are outlined below. The Discovery phase included scoping and literature reviews, consultations and focus groups to establish user needs and priorities. We are currently in the Alpha development phase and aim to produce the first overall draft framework in September 2024.

Figure 1. Overview of SOSCHI project timeline



C. Update on planned outputs

We are developing a comprehensive communication and publications plan. For each health topic area (see Table 3 below) accompanying documents and resources are being developed as part of the Alpha phase as described in Table 1. These materials will be published on our website hosted by the UN Global Platform, and also communicated through the participating institutions' websites, academic journal articles and other means.

Table 1. Planned framework resources

Resource	Description and purpose
Introduction to the health topic area	This document introduces the health topic and its relationship with climate change. It summarises why the topic is included in the framework, the pathways between climate change and the health outcomes, the framework's chosen indicators for the topic and the reasons for their inclusion, key points on interpretation, recommended disaggregations, and important data issues.
Indicator metadata sheet	Each indicator within the topic will have a metadata sheet which gives users an overview of key general information necessary to understand and produce each indicator. This will include clear definitions behind each indicator, key references, and links to essential reading such as the UNDRR hazards framework, and ICD-10 codes.
Indicator methodology paper	There will be a methodological sheet accompanying each indicator, giving a more in-depth technical description of the data sources and statistical methodology to complement the high-level description of methodology in the metadata sheet. This paper will also give details of how certain methodological decisions were made for the indicator developer's country of origin so that other countries can make their own adjustments to the method with similar considerations.
R code library	A repository of the R code in GitLab which allows users to use the indicator and its methods for their own country/region/locality.
Online calculator	For selected indicators, we will provide an online interface for calculation which allows uploading of data and downloading of visualisations and reports. Subject to technical constraints, similar functionality should also be available through an API for integration into other websites.

D. Quality assurance and Indicator maturity scoring

Quality assurance of the framework and indicator methodologies is through the input of the Expert Advisory Group, discussion and review by topic expert groups, and review of models and code by specialists in relevant statistical standards. User testing and consultation will help to refine design and ensure fitness for purpose.

We have developed an approach to indicator maturity scoring which aims to make users aware of the methodological robustness and data quality of each indicator, support a fuller picture of the relationships between climate and health by supporting the inclusion of less well-established data sources and methods, and help raise awareness of data gaps and encourage future plans to bridge them.

We have also developed a three-tier classification following well-recognised principles, comparable to the tiers used by (for example) [the SDG indicators](#). Tier classification will be based on quality criteria informed by [international standards](#), indicator maturity scoring and expert review.

E. Challenges and solutions

As part of the project, a variety of challenges with data availability, statistical capacity and other issues have been identified. Table 2 summarises the key challenges and our approaches.

Table 2. Selected data challenges

Challenges and limitations	Consequences	Mitigations
Data availability or quality (e.g. completeness, timeliness)	Data to measure climate events or health impacts may not be available to develop or test indicators based on methods recommended in the literature	Variations of methods may be recommended to allow for different data availability. Metadata for each topic will include guidance on adjustments for data limitations, and the methodology paper will include information on data requirements to support future data collection. Where methods have been developed based on limited data, this will be reflected in the indicator maturity scoring. Beta phase partner testing (where data is not currently available) will be used to verify this approach.
Data granularity	Many environmental epidemiological methods require highly granular outcome data (e.g. daily mortality) to link to climate event data with sufficient resolution. Without this information, there is a risk of under or over-estimating the exposure-response relationship.	Variations of methods may be recommended to allow for different data availability. For example, variants of temperature-mortality DLNM models are being explored that use weekly death numbers. Where methods have been developed based on limited data, this will be reflected in the indicator maturity scoring.
Data disaggregation	Where climate-health impacts on the population are relatively small or events are rare, low counts mean there is not enough statistical power to identify impacts on sub-groups of the population. This may limit the opportunity to provide insights to support policy and adaptation strategies aimed at specific vulnerable groups or local areas.	Guidance on disaggregation will be included in each topic methodology paper with guidance to only include this where relevant or feasible. This is also reflected in criteria for the indicator maturity scoring.

III. OVERVIEW OF THE SOSCHI STATISTICAL FRAMEWORK PROPOSALS

SOSCHI will provide a transparent and globally generalisable framework developed for official statistics on climate change, environment, and health, that is explicitly relevant to low- and middle-income, data-poor

countries as well as high-income, more data-rich countries. Where appropriate, different methodological options depending on data availability will be highlighted.

The topic areas are based on the [WHO list of climate change impacts on health](#). Selected indicators are proposed for each topic area, based on consultation with experts and development by the project teams. Table 2 gives an overview of the topics and proposed indicators covered by the framework (Alpha version). Initial indicator proposals are being developed by ONS, AIMS and RIPS (each covering different topics areas) and will then be refined and user tested.

Table 3. Topic areas and indicators

Topic	Indicators
1. Air pollution and respiratory illnesses	Severe acute respiratory illness mortality and hospital admissions attributable to non-optimal air quality Cardiovascular mortality and hospital admissions attributable to non-optimal air quality Number of cerebrospinal meningitis (CSM) cases
2. Exposure to chemical contaminants	Health impacts of contaminated food and water from water toxicity (Harmful Algal Blooms) Health impacts of exposure to agriculture/veterinary antibiotic uses, through food and run-off into waterways/sewage
3. Healthcare systems and facilities	Impact of climate-related events on access to and operation of health facilities (and potentially vulnerability) General service readiness score for health facilities (essential services, medical equipment, medicines, and trained personnel)
4. Heat and cold mortality and morbidity	Temperature-related mortality and hospital admissions based on DLNM
5a. Injury and mortality from extreme weather events - Flooding	Mortality rate attributed to floods (flash and riverine) Number of hospitalized injuries attributed to floods Mortality rate attributed to landslides Number of hospitalized injuries attributed to landslides
5b. Injury and mortality from extreme weather (wildfires)	Number of respiratory mortality and hospitalisations related to wildfire smoke (fine particulate matter, PM _{2.5})
6. Malnutrition and food-borne diseases	Health outcomes associated with temperature and rainfall: Diarrhoea among children under age five Stunting, wasting and underweight Anaemia
7. Mental and psychosocial health	Suicides and hospital admissions related to temperature and extreme weather events (wildfires, storms, drought and floods)
8. Non-communicable diseases	Number of deaths and hospital admissions from cardiovascular disease, diabetes and cancer associated with extreme temperature, humidity and rainfall
9. Vector-borne diseases - Malaria	Malaria cases/mortality attributable to extreme temperature, extreme cumulative precipitation, sunshine duration, extreme relative humidity, wind speed, and flood exposure
10. Water-borne diseases and other water-related health impacts	Diarrheal morbidity and mortality attributable to extreme precipitation/rainfall Drought-associated diarrhea mortality and hospital admission estimated attribution number and fraction Flood-associated diarrhoea mortality and hospital admission estimated attribution number and fraction Water Sanitation and Hygiene (WASH) burden diseases attributable to drought/flood exposure

IV. OVERVIEW OF THE ONLINE PLATFORM AND DIGITAL TOOLS (IN DEVELOPMENT)

The aim for the online knowledge sharing platform is to develop a globally accessible open-source technical platform to disseminate the framework and methods and to facilitate analysis of climate and health data, especially for users with limited specialist expertise. The tools will consist of sets of open-source R packages and online calculators, along with detailed documentation and instructions. The UN Global Platform provides a widely recognisable, sustainable and technically sound base for the project's online presence.

The UNECE Expert Forum will include a short (video) demonstration of the platform, with a focus on a few main functionalities which have been completed as a pilot stage. The core functionalities of the platform include:

- 1.** Access to the statistical framework and methods
- 2.** Ability to upload and explore data
- 3.** Indicator calculators and visualisations
- 4.** Ability to download and share code/statistical package