Demonstration of a climate service to address the resilience needs of the UK health sector

Why this is important: Weather and climate can have significant impacts on human health. One aspect is heat and cold exposure, with health consequences being increased risks of heart attacks, strokes, and respiratory diseases. In the UK, around 9% of deaths are associated with high or low outdoor temperatures, with the majority currently relating to cold weather. However, as the climate warms, an estimated 7000 additional deaths per year by the 2050s associated with heat exposure are predicted without sufficient adaptation. An aging population compounds the problem, as the elderly are particularly at risk due to their increased vulnerability. With these increasing health risks there is a growing incentive to develop a UK climate service for health.

What the UKCR programme is doing: A suite of new datasets and statistical models of regional mortality attributed to non-optimal temperatures have been developed and have been made available through the EPHSS portal as well as the CEDA archive (instructions how to access here and register here) to allow as broad a community as possible to engage and to interact with the data. A series of webinars and workshops have been held with Public Health England to explain the science of the project and how to make use of these outputs. By combining up-to-date mortality, hospital admissions and weather and climate data, they provide the best current estimate of how climate variability has affected mortality in the past and how it could potentially change into the future. These can be used by many other projects and end-users to anticipate the impact of climate variability on the health and social care sectors and help prepare end-users in these sectors to adapt to climate change.

Model fits of exposure-response relationships and temperature-attributable mortality/hospital admission time series: These are based on the new observational dataset HadUK-Grid, and recent mortality data obtained from the Official for National Statistics, NHS Scotland and the Northern Ireland Public Records office. They cover the observed record (1981/1991-2018), including a list of the 10 highest mortality days from 1991 to 2018 based on UK-total temperature-related mortality and are;

- Temperature-attributable mortality/hospital admission time series observed record (1981/1991-2018)
- List of 10 highest mortality days from 1991 to 2018 based on UK-total temperature-related mortality
- Regional and national temperature-mortality/emergency hospital admission relationships

Weather regime and pattern classification for the observed record (1850/1979-2019): The relationship between weather regimes and mortality in the UK has been assessed, using a statistical model to provide a greater understanding of the link between recurrent, typical weather patterns in the North Atlantic and the UK and mortality. This has allowed the identification of weather regimes that lead to high mortality in the UK and pattern classification for the observed record (1850/1979-2019).

Attributable mortality time series for UKCP18 climate projections (1900-2099): Statistical models have been applied to the UKCP18 climate projections for the UK (28-member, 60km for 1900-2099) to assess relationships between mortality and changes in global mean temperature, providing an attributable mortality time series.

London Specific Data: The urban climate model Surface Urban Energy and Water Balance Scheme (SUEWS), driven by ERA5 reanalysis data and combined with an epidemiological modelling approach, was used to simulate temperatures in London boroughs and hospital admissions during recent hot and cold events between October 2015 to 2019. The data sets are;

- Average daily temperature by London boroughs simulated with an urban model, Oct 2015 - 2019
- Attributable hospital admission by London boroughs based on the above temperature time series

Effect Modifiers: Work has also been undertaken to understand which factors or characteristics are important for determining the mortality risk posed by heat and cold to a given population. Relevant epidemiological evidence regarding community and individual level measures affecting mortality risk

from heat and cold in the UK context have been identified and synthesised (effect modifiers), covering both factors affecting vulnerability (understood as susceptibility) and exposure.

Results so far: The study on weather regimes has found that both winter cold events and summer hot and cold events leading to significant mortality are strongly determined by weather regime. In particular, the negative phase of North Atlantic Oscillation and Scandinavian Blocking regimes in driving mortality during winter and the importance of the Blocking regime in summer. During winter, patterns with easterly or south-easterly flow from Europe are most clearly associated with excess mortality across all regions of the UK. In summer, hot days with high mortality are associated with the presence of a strong anticyclone over Scandinavia with little flow and warm temperatures over the UK. An unexpected finding was that there are some periods in summer of relatively high cold mortality, typically cyclonic westerly or south-westerly. There were no clear conclusive results that showed changing risks to health from changes to particular weather regimes or to changes in their frequency, but the datasets available through the EPHSS include this information so that future research can explore this issue in more detail. This approach could also allow the development of new applications of longer-range forecasts on seasonal to decadal timescales for the health sector.

Results using UKCP18 to assess future changes to UK mortality associated with the changing climate show that temperature attributed mortality in the UK is strongly linked to changes in global mean temperature, particularly in summer. When global mean temperature exceeds 2°C above pre-industrial the number of deaths due to hot weather accelerates rapidly without significant adaptation. The difference between a 3°C and 4°C world is stark, with an estimated 1181 additional deaths per year in summer in a 3°C world and 4183 additional deaths in a 4°C world.

Results from the London specific data were not conclusive, with many confounding and co-varying factors influencing mortality in London during recent heatwave and cold extremes. Further investigations with more detailed health data could help to develop a climate service for urban health. The project is working with the Met Office urban climate services team and on a new project with Reading Borough Council and the Royal Berkshire Foundation Trust to advance these ideas.

A small number of effect modifiers have been identified which have the strongest multiple lines of evidence for an effect relevant for the UK. These should be included in a future climate service for the health sector and could potentially contribute to the construction of a health risk map.

An overall conclusion from the work is that different public health bodies, by their different nature, have different capacities to make use of a future climate service. Therefore, a range of services covering current risk should be developed to encourage greater use of the suite of available forecast products and longer-term projections data available.

What is next: Research papers have been published, providing a means of communicating health impacts from UKCP18 to a wide audience. These will be followed up through presentation of the work in national meetings and future collaborations with public health bodies. One such collaboration is the Health Protection Research Unit (HPRU) that the Met Office is a partner of and that provides research capacity on Environmental Change and Health to Public Health England. A clear gap in engagement at the local level was identified in the project and two new projects aim to rectify this, one with Reading Borough Council with collaboration from the Met Office Urban Climate services team and one with the Royal Berkshire Foundation Trust. A future aim is to join this work together to understand where may benefit from enhanced climate-health services.

Reference:

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