

12 October 2017

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Professor Inder M Verma
Editor-in-Chief, *PNAS*

Dear Professor Verma:

My colleagues and I would like to submit the enclosed manuscript titled "Seasonal dynamics of mortality in the United States from 1982 to 2013" for consideration as a Research Report in *PNAS*. The paper makes novel and important contributions to our knowledge of how weather and climate impacts health in the United States, and to methodologies for studying these impacts across the world.

Whether a warmer world will be associated with an overall reduction in deaths in temperate climates by reducing so-called excess winter deaths remains a common but empirically unresolved hypothesis. This debate persists at least partly because there is no formal analytical framework for studying seasonality of mortality, and probe how it varies over space and time. Yet methods for studying periodicity, and its long-term dynamics, have been utilised in other areas of weather and climate, e.g., for El Nino-Southern Oscillation.

We use geo-coded data and novel methods to analyse seasonality of mortality over three decades in the USA, nationally as well as in subnational climatic regions. We find that seasonality of death rates in older middle- and older ages, when most deaths occur, is remarkably robust over time and climatic zone. In contrast, seasonality of deaths has largely disappeared in young children and weakened in adolescents and young adults. Deaths in young men have the largely-overlooked feature of peaking in summer.

The findings are important both for selecting environmental and health sector interventions that can reduce weather-related deaths today, and for understanding how changes in weather regimes may influence different population subgroups. Our approach to studying seasonality also harmonises methodologies used for analysing weather and climate, and their consequences for human health. Therefore, the paper will be of interest to scientists and policy makers in a range of disciplines with interest in the human consequences of global environmental change.

This manuscript is the original work of the authors. It has not been previously published and is not under review in any other journal. All authors have contributed to the paper, have approved its submission, and take responsibility for its contents. The author contributions were: research design (RP, RT, ME), methods development (RP, JEB, ME), data analysis (RP, KF), and writing of the manuscript (RP, JEB, KF, RT, ME). None of the authors has a

conflict of interest with the manuscript and its findings. The paper and its figures currently add up to fewer than 49,000 characters.

Among *PNAS* Editorial Board members, Professors Simon Levine and Stephen Polasky are highly qualified to assess the manuscript from a methodological and substantive perspective. NAS members who are experts in the paper's scientific areas and can act as editors include: Professors Burton Singer, Samuel Preston, and William Chameides.

The following people are qualified to assess its contents and their implications, and are independent of this work:

1) Professor Marcia Castro (climate change health effects; statistical methods; population health and environmental health)

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E-mail: mcastro@hsph.harvard.edu

2) Professor C Jessica Metcalf (mathematical biology; statistical methods; population health)

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4) Professor Deborah Balk (demography and population health; human/social dimensions of climate change)

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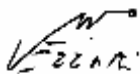
5) Professor C Arden Pope (environmental health; statistical methods)

Brigham Young University

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We look forward to your response and would be happy to answer any questions that you may have on this paper.

Sincerely,

A handwritten signature in black ink, appearing to read 'Majid Ezzati', with a stylized flourish at the end.

Majid Ezzati