

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Clarifying life lost due to cold and heat: a new approach using annual time series.
AUTHORS	Rehill, Nirandeeep; Armstrong, Ben; Wilkinson, Paul

VERSION 1 - REVIEW

REVIEWER	Adrian Barnett Queensland University of Technology, Australia I have met Ben and Paul a couple of times, but I feel confident that my review is fair and free from bias
REVIEW RETURNED	24-May-2014

GENERAL COMMENTS	<p>This paper takes a different look at the association between temperature and health by examining associations based on years rather than days. This means the results are resistant to short-term harvesting and that some of the confounders that apply to a daily analysis are avoided.</p> <p>The results provide further important evidence on the health effects of cold in the UK. The heat results are also interesting and indicate that heat-related deaths may be predominantly in relatively frail people (although the authors are more cautious in their interpretation).</p> <p>One disadvantage of using yearly data is that to get a reasonable sample size we need to go back in time many years. Hence there is a generalisability question for whether the slopes are fully applicable to the current population. Interestingly a recent paper from Sweden showed no change over the 20th century in the effect of cold: Åström et al, <i>Epidemiology</i> 2013;24: 820–829.</p> <p>Minor comments</p> <ul style="list-style-type: none">- Introduction. It might be worth citing the Rocklov et al paper showing long-term displacement in deaths between seasons. <i>ERJ</i> February 1, 2009 vol. 33 no. 2 245-251- it would be useful if the 'mortality data' section opened with a statement on what years were used- the opening sentence of the "statistical analysis" section should give the time period for the dependent data (i.e. annual).- it was good to see a check of the residuals- "There have to our knowledge been no other studies looking at long term mortality in relation to long term temperature." I agree, but the issue of longer-term associations is touched on in the book by Peng and Dominici.- Limitations section, influenza might be partly on the causal pathway, but there is clear evidence for the direct effects of cold via
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	<p>pathways such as increased blood pressure.</p> <ul style="list-style-type: none"> - The appendices are useful, and in particular I applaud the sharing of the data and the code. Appendix C ends with a colon which implies there's something missing. - Table 2, why is the AIC divided by the sample size? That's not the formula I am familiar with. - A statement about not needing to get consent would be useful, I imagine this is true as the data are highly aggregated.
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REVIEWER	Carina Gronlund Center for Social Epidemiology and Population Health University of Michigan School of Public Health USA
REVIEW RETURNED	07-Jul-2014

GENERAL COMMENTS	<p>This paper addresses an important issue in the field of climate change and health. Previous evidence of mortality associated with short-term changes in temperature has been translated into years-of-life-lost (YLLs) for the purposes of assessing the present and future burden of extreme heat. However, there is evidence, varying from location to location, that many of these deaths represent no more than a few days of life lost, the deaths having been advanced, "displaced," or "harvested," by only a few days. These authors have a very long time series of mortality, which provides the opportunity to use this particular study design, a times series study of annual mortality and annual temperatures, which is insensitive to short-term displacement. The drawback of this study design is that it uses a very crude measure of cold and warm temperature exposure, annual mean cold degrees and annual mean heat degrees. Despite this limitation, the authors find a significant cold effect and acknowledge the limitations regarding the null heat effect.</p> <ol style="list-style-type: none"> 1. In the partial autocorrelation function in Appendix D Residual Analysis iii, there's no obvious correlation at the shortest lags, but it looks like there is a lot of negative autocorrelation among the residuals. This might be inflating the confidence intervals, and if possible, it might be better to present a model with a different number of degrees of freedom in the spline for time with a better PACF. 2. In the abstract, "were displaced by at least six months" is confusing to readers not familiar with mortality displacement. Perhaps change this to something like, "were among individuals who would not have died in the next 6 months," which echoes the language in the Objective. 3. The term "harvesting" is used in the Article Summary, but this term may be unknown to readers. 4. In the Discussion, there is, in fact, another study looking at long-term mortality in relation to temperature, but the temperature metric is annual summer "temperature variance" rather than annual heat degrees and cold degrees. Zanobetti, A.; O'Neill, M.S.; Gronlund, C.J.; Schwartz, J.D. 2012. Summer temperature variability and long-term survival among elderly people with chronic disease. Proc Natl Acad Sci U S A. 109:6608-6613.
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	<p>5. In Limitations: if there's a negative correlation between mean annual cold and black smoke for the years for which this data are available, including black smoke in the model would be more likely to increase, not depress, the estimate of the cold effect.</p> <p>6. Should there be a red line in Figure 1 at 1964, as well as a step in the Appendix C model? I'm confused about where the steps took place. The text says "going into 1964-1965 and 1965-1966."</p> <p>7. Appendix C: need closing parenthesis in main model.</p> <p>8. In Appendix C, the source of the proportion of deaths due to influenza from 1949-1974 is confusing—were all "other death counts" presumed to be influenza?</p> <p>9. In Appendix C, spell out the "ONS."</p> <p>10. In Appendix D, this description looks like someone's comments. Please remove these and include titles for the figures in this Appendix.</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1 Reviewer Name Adrian Barnett Institution and Country Queensland University of Technology, Australia

Minor comments

1. Introduction. It might be worth citing the Rocklov et al paper showing long-term displacement in deaths between seasons. ERJ February 1, 2009 vol. 33 no. 2 245-251
 - We agree that the Rocklov paper throws light indirectly on the harvesting issue, though given it focus on DAILY mortality do not agree that the paper identifies long term displacement between seasons. We have however, added a reference to it in the second paragraph of the Introduction section acknowledging that by identifying that winters of high mortality decreased acute response to heat the following summer this suggests displacement of excess winter deaths by at least several months. Staffoglia (Epidemiol 2009) has a similar result.
2. it would be useful if the 'mortality data' section opened with a statement on what years were used
 - We have revised the text in accordance with this
3. the opening sentence of the "statistical analysis" section should give the time period for the dependent data (i.e. annual).
 - We have revised the text in accordance with this
4. it was good to see a check of the residuals
5. "There have to our knowledge been no other studies looking at long term mortality in relation to long term temperature." I agree, but the issue of longer-term associations is touched on in the book by Peng and Dominici.
 - Unfortunately we do not have ready access to this book
6. Limitations section, influenza might be partly on the causal pathway, but there is clear evidence for the direct effects of cold via pathways such as increased blood pressure.
 - We agree. However, we have opted not to enter into a discussion of plausibility of various casual

pathways between cold and mortality, which could be long. Because the adjustment of influenza changes the cold coefficient little, the issue is not crucial.

7. The appendices are useful, and in particular I applaud the sharing of the data and the code. Appendix C ends with a colon which implies there's something missing.

- A typographical error – the colon is now a full stop.

8. Table 2, why is the AIC divided by the sample size? That's not the formula I am familiar with.

- We agree this is not the commonly used formula, although it was the one used by our statistical software. We have recalculated the AIC in Table 2 by removing this step in the calculation.

9. A statement about not needing to get consent would be useful, I imagine this is true as the data are highly aggregated.

- We have added a statement regarding consent.

Reviewer: 2

Reviewer Name Carina Gronlund

Institution and Country Center for Social Epidemiology and Population Health University of Michigan School of Public Health USA

1. In the partial autocorrelation function in Appendix D Residual Analysis iii, there's no obvious correlation at the shortest lags, but it looks like there is a lot of negative autocorrelation among the residuals. This might be inflating the confidence intervals, and if possible, it might be better to present a model with a different number of degrees of freedom in the spline for time with a better PACF.

- While we acknowledge that reducing the df for the time spine sometimes increases precision, we were primarily concerned here to adequately control confounding, which will be more stringently controlled by using more df in the time spline than would minimise negative autocorrelation. Whether negative correlations in residuals represents a problem is controversial, with simulation evidence that minimising it leaves residual confounding in some circumstances¹.

We do show results for less and more df per year in the sensitivity analyses.

2. In the abstract, “were displaced by at least six months” is confusing to readers not familiar with mortality displacement. Perhaps change this to something like, “were among individuals who would not have died in the next 6 months,” which echoes the language in the Objective

- We have revised the text in accordance with this

3. The term “harvesting” is used in the Article Summary, but this term may be unknown to readers.

– We have added a definition to assist readers

4. In the Discussion, there is, in fact, another study looking at long-term mortality in relation to temperature, but the temperature metric is annual summer “temperature variance” rather than annual heat degrees and cold degrees. Zanobetti, A.; O'Neill, M.S.; Gronlund, C.J.; Schwartz, J.D. 2012. Summer temperature variability and long-term survival among elderly people with chronic disease. Proc Natl Acad Sci U S A. 109:6608-6613.

- We agree that this reference is relevant and have added reference to it in the second paragraph of the Introduction.

5. In Limitations: if there's a negative correlation between mean annual cold and black smoke for the years for which this data are available, including black smoke in the model would be more likely to increase, not depress, the estimate of the cold effect.

- We agree with the reviewer's statement and our intention was to communicate the same. However

we note that our version was misunderstood so for clarity we have reworded the relevant sentence in the Limitations section.

6. Should there be a red line in Figure 1 at 1964, as well as a step in the Appendix C model? I'm confused about where the steps took place. The text says "going into 1964-1965 and 1965-1966."
 - We thank the reviewer for close attention to detail, which revealed an error in our description of years substantially affected by boundary changes, which were 1965-6 and 1966-7, not 1964-5 and 1965-6. We have corrected the text accordingly.

7. Appendix C: need closing parenthesis in main mode
 - We agree and have inserted the missing parenthesis.

8. In Appendix C, the source of the proportion of deaths due to influenza from 1949-1974 is confusing—were all "other death counts" presumed to be influenza?
 - We have modified the text to make this clearer.

9. In Appendix C, spell out the "ONS."
 - We have now written this in full.

10. In Appendix D, this description looks like someone's comments. Please remove these and include titles for the figures in this Appendix.
 - The text is intended as explanatory notes to the figures, we have now made this clearer. Titles have also been added.

VERSION 2 – REVIEW

REVIEWER	Adrian Barnett Queensland University of Technology, Australia
REVIEW RETURNED	25-Aug-2014

GENERAL COMMENTS	<p>This is an interesting question and a novel analysis. The results are important and show that there is more certainty about the long-term effects of cold than heat. The authors have answered my previous questions well.</p> <p>Minor comments</p> <ul style="list-style-type: none"> - Page 5, line 41, 'This is reasonably resistant to' missing space. Also on line 48, perhaps this is a Word version issue? - Page 5, line 47, 'Given the limited evidence on the extent' added 'the' - Page 9, line 52, 'Our findings were generally robust' added 'generally' - Page 9, line 57, full-stop instead of comma - Figure 1, I would recommend reducing the spaces between panels to give more room to the line plots
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REVIEWER	Carina Gronlund Center for Social Epidemiology and Population Health, Department of Epidemiology, University of Michigan School of Public Health, USA
REVIEW RETURNED	04-Sep-2014

- The reviewer completed the checklist but made no further comments.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

Reviewer Name Adrian Barnett

Institution and Country Queensland University of Technology, Australia

Minor comments

- Page 5, line 41, 'This isreasonably resistant to' missing space. Also on line 48, perhaps this is a Word version issue?

- Page 5, line 47, 'Given the limited evidence on the extent' added 'the'

- Page 9, line 52, 'Our findings were generally robust' added 'generally'

- Page 9, line 57, full-stop instead of comma

- Figure 1, I would recommend reducing the spaces between panels to give more room to the line plots

- These are all very reasonable suggestions and I have amended the formatting and language of the manuscript in line with these.