Author’s response to reviews

Title: Associations between climate variability, unemployment and suicide in Australia: a multicity study

Authors:

Xin Qi (chestertsee@outlook.com)
Wenbiao Hu (w2.hu@qut.edu.au)
Andrew Page (a.page@uws.edu.au)
Shilu Tong (s.tong@qut.edu.au)

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Author’s response to reviews: see over
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Alice Murray
Executive Editor
BMC Psychiatry

Dear Dr. Murray,

Re: “Associations between climate variability, unemployment and suicide in Australia: A multicity study” (MS: 1265008305153727)

Thank you very much for your letter of 11 February 2015 and the attached reviews’ comments. We have revised our manuscript according to the two reviewers’ suggestions/comments, with some changes illustrated below:

**In response to Reviewer 1** (Benjamin Vyssoki)

Major Points:

1) Is it possible for the authors to divide suicide into violent and non-violent suicides? Associations between meteorological data and suicide have been found mostly only for violent suicides

*Reply: We have divided suicide into violent and non-violent suicide and examined the associations of meteorological variables, unemployment and suicide by methods. We found associations between meteorological variables and suicide was only significant for violent suicide.*

2) The Introduction is well written and gives a good overview on the research-field, however the Results and especially the Discussion are rather confusing. The text here would benefit a lot from restructuring! Also some important aspects are not discussed sufficiently (gender aspect, seasonality).

*Reply: We have added the subtitles (headlines) in the Discussion part to make it more clearly. Considering the sequence of variables (meteorological variables then unemployment) and significance of each meteorological variable (ΔT then others like rainfall and sunshine), we decided to keep the original sequence of each paragraph. The seasonality of suicide was summarized in line 207-209, page 9. Gender aspect were discussed in line 257-262, page 11.*

3) Is it possible to merge the capitals in 2 or 3 groups (according to climate for example) instead of discussing the results for all 8 cities?
Reply: We have indicated the climate zones of each city in the Methods part (line 92-97, page 4). In the results section, we found that there are dramatic differences of association between particular variable (e.g., rainfall) and suicide across cities in temperate climate zones (e.g., Melbourne vs other cities). Thus we decide to keep the original discussion of results.

4) Please use headlines in the Results section to divide. Further it is not necessary to describe all results in details when there are Figures and Tables with the results.

Reply: We have added the headlines in the Results section. As the headlines have made the Results section more clearly, we have also slightly revised the details of this section.

5) The authors write in the Discussion that there is evidence for an association between temperature and suicidal behaviour in humans, however the references given (references 26-29) are not supporting this hypothesis.

Reply: We have rewritten this part and the literature were also replaced (line 196-201, page 9).

Reviewer: Nicole Praschak-Rieder

Reviewer's report:

Major Compulsory Revisions

1) In most temperate areas of the world, there is a seasonal component in unemployment rates. Usually, seasonality in unemployment rates is to a great extent caused by meteorological changes, and seasonality in unemployment rates and the meteorological situation are inter-correlated (e.g. reduced construction activity in winter etc.). Does unemployment vary seasonally in the investigated areas, and if yes, how did the authors deal with this problem?

Reply: Thank you for your precise comment. The original data of unemployment rate in the study areas has been adjusted for seasonality (lines 98-100, page 5) before we collected them, thus the inter-correlation of temperature and suicide has been reduced. The seasonality of unemployment data in this study is not obvious. Then we used the original unemployment data directly.

2) Possible inter-correlations between unemployment rates and meteorological variables should be indicated.

Reply: Please check with above reply. The inter-correlations between unemployment and meteorological variables were low (correlation<|0.10|).

3) How were monthly sunshine hours measured? Why did the authors calculate the changes in monthly temperature, but not the changes in amount of monthly sunshine hours or other meteorological variables?
Reply: Monthly sunshine hours were calculated by using the mean value of daily sunshine hours (line 105, page 5). Actually we have also examined the changes of other monthly meteorological variables (besides temperature) and their associations with suicide, however, the significance were less than that of temperature change (line 162-164, page 7).

4) Methods, page 4: how was ‘seasonal adjustment’ done? Were data differentiated for seasonal variation in suicide rates and seasonal variation in temperature and delta temperature?

Reply: The unemployment data were seasonally adjusted from ABS and thus we obtained it and applied it in this study. In the data analysis, all the meteorological variables were seasonally adjusted as well as suicide rates (line 127-128, page 5).

Minor essential revisions.

Introduction, page 3: The authors state, that recent studies have found that meteorological factors are associated with suicide risk. This phenomenon has been repeatedly described since the nineteenth century. Please cite the respective literature (like Durkheim etc.).

Reply: We have cited these literature.

Introduction, page 4, line 81. ‘extend’ should read ‘extent’

Reply: We have revised it (line 80, page 4).

An important citation is missing. Vyssoki et al.: Direct effect of sunshine on suicide, JAMA Psychiatry 2014. Please discuss your findings in the light of findings of the Vyssoki et al. study.

Reply: We have added this literature and replaced an old one. The study by Vyssoki et al has been discussed (line 225-227, page 10).

Other papers are incorrectly cited, e.g. studies by Lambert et al. and Praschak-Rieder et al. measured more specific parameters of serotonin metabolism suggesting that extracellular serotonin is low (and not high) during winter.

Reply: We have revised the mistakes (line 228-230, page 10).

Discussion, line 174ff: ‘lower levels in the action of serotonin in human body associated with increased temperature’. I don’t know what the authors intended to say here. Please explain.

Reply: We have revised and rewritten this part (line 196-201, page 9).

Line 206 ff ‘The seasonal pattern of sunshine hours is similar as Melbourne and its association with suicide is also similar as that in Melbourne’. This sentence makes no sense. Please rephrase

Reply: After careful consideration, we have deleted this sentence.

Figure 2: Mortality rates: Please indicate exactly what the units on the x-axis are.
Reply: We have indicated the units on the x-axis (month, using 1-12 to indicate January to December)

Reviewer: Eberhard A. Deisenhammer

Reviewer's report:

The authors report on the associations between a variety of monthly mean meteorological variables, unemployment and suicide numbers in 8 Australian cities and find several (inter-) relations. The topic in general has been studied before, but results are inconclusive and thus further studies are warranted.

Reply: We have revised the manuscript as follows.

Major issues:

• There are many discrepancies between the Results section and Tab. 2: Delta T- female suicide rate relation for Canberra; humidity in Darwin; rainfall in Melbourne; Results section: "to a lesser extent for females" in Sydney (line 141) is not true according to Tab. 2. The sentences in lines 160 and 164 appear to be incorrect. Also, lines 168/169 would suggest a clear relationship of Delta T and suicide rate in Melbourne which, however, exists for males only. Line 198 – also for males only. I recommend to recheck the data profoundly and match the discussion with actual results!

Reply: The part of “to a lesser extent for females” in Sydney has been deleted. A significant association between humidity and suicide was only found among males in Darwin (line 151-153, page 7). Rainfall had a negative association with total and female suicide in Melbourne (line 155-156, page 7). In general, the association between ΔT and suicide is more significant in males compared with that in females in Sydney, Melbourne and Brisbane (line 193-194, page 9). The association between sunshine and suicide was only significant among males in Melbourne (line 223-225, page 10). We have rechecked the original data profoundly and the data has matched the discussion with actual results.

• In general, when studying meteorological effects on suicide risk the use of daily data may be a better choice than monthly means. If such a calculation is not possible (even when combining the data from all cities) this should be explained and listed as a limitation.

Reply: There are some limitations of suicide data in the original suicide database, especially for suicide in 2004, and this has been elaborated in the method part (page 4, line 87-91) and the limitation of use monthly data is also mentioned in the limitation part (line 274-276, page 12).

• A combined presentation would also reduce the likelihood that readers may be irritated by the so greatly varying patterns of associations which obviously cannot be explained sufficiently. Lines 222-224 indicate the way...
Reply: We have added the sub-titles in the Discussion part and it looks more clearly now. As the meteorological variables are need to discuss, we decide to keep the original order of each paragraph with some revisions of words.

- It is not clear throughout the paper whether suicide rates or numbers have been used. If numbers ("cases" in Tab. 1), the potential change in population numbers (over 20 years!) should be accounted for in some way. If rates (much more appropriate), the calculation method should be made clear in the Methods section (per 100,000 per month?). "Cases" in Tab. 1 then should be replaced by rates. In the Abstract, Tab. 2 and other sections it only says "suicide" or "s. data".

Reply: We interpolated the population size of each year using 5 terms of census population data (line 98-101, page 5). For suicide, we have calculated age-adjusted mortality rate by sex in each city. The Table 1 and 2 have been revised.

Minor issues:

- Abstract: "higher" temperature should probably read "increasing". Even if there is a conflict with a potential word limit, the meteorological variables studied should all be mentioned (probably best in the results section instead of "other m. v.").

Reply: We have revised them in the Abstract part.

- In Tab. 1 information on the significance of differences between the cities may be added (if authors choose to stay with the separated presentation).

Reply: We have highlighted the lowest and highest mean value of suicide rate and other variables in Table 1, e.g., mortality rate in Sydney (lowest) and Darwin (highest).

- Lines 206/207: Data from which city are similar to Melbourne?

Reply: After careful consideration, we have deleted this sentence.

- Since the direction of the interaction of Delta T and unemployment cannot be determined, lines 228-229 should read "... effect between..." (not on). An explanation for and/or discussion of this interaction is lacking.

Reply: We have corrected the errors (247-248, page 11). The explanation for the interaction has been addressed in line 250-254, page 11.

- Some recent studies on the topic are missing, e.g. Yang et al. (JAD 2011), Tsai and Cho (JAD 2011), Dixon et al. (Int J Biometeorology 2007). An overview on previous research is given in Deisenhammer (Acta Psychiatr Scand 2003). The Vyssoki et al. 2012 study may be replaced by the more recent and detailed one from 2014 (JAMA Psychiatry).

Reply: Thanks you’re your comment and we have added the missing literature in our study.

We have made some language corrections as suggested by reviewers.
Thanks for all the positive comments from the reviewers.

We have all read and approved the contents of the revision, and have no conflict of interest associated with this manuscript.

We look forward to your decision.

Yours sincerely,

Xin Qi*, Wenbiao Hu, Andrew Page, Shilu Tong