

## Response to Reviewer 1 Comments

**Point 1:** The abstract, and to a lesser extent the manuscript, contains sweeping statements eg 'The combined effects of climate change and air pollution have led to the complexity of mental health problems'. Whilst I can agree that during the period in which these environmental issues have arisen globally there has been an epidemiological rise in mental health issues, there are a multitude of contributing factors both social and medical (eg rising awareness leading to more diagnoses, more treatment available hence more reason to make a formal diagnosis). More nuanced argument would strengthen the paper, and need not override the opinion the piece wishes to make that climate and pollution are important factors.

**Response 1:** Thank you for your kind comments. Based on your helpful suggestion, we have revised the content to include the impacts of social and medical factors on mental health.

*The impact of global climate change and air pollution on mental health has become a crucial public health issue. Increased public awareness of health, advancements in medical diagnosis and treatment, the way media outlets report environmental changes and the variation in social resources affect psychological responses and adaptation methods to climate change and air pollution. In the context of climate change, extreme weather events seriously disrupt people's living environments, and unstable educational environments lead to an increase in mental health issues for students.*

**Point 2:** At times there is an over-reliance on review articles in the citations - for example references 9 and 10 are cited to support statements about climate and rising diagnoses, but are other reviews/opinion pieces. It would be better to cite original research making these findings.

**Response 2:** Thank you for your kind comments. We have added the original findings from these studies as follows:

*Global climate change, characterized by extreme weather events such as floods, droughts, hurricanes, and blizzards, leads to the destruction of living environments and poses threats to physical and mental health. Events such as injuries, deaths of loved ones, and illness increase the likelihood of mental disorders<sup>[9,10]</sup>. "Ecological anxiety" and "ecological grief" also affect people's mental health<sup>[11,12]</sup>.*

9 Hayes K, Blashki G, Wiseman J, Burke S, Reifels L. Climate change and mental health: risks, impacts and priority actions. *Int J Ment Health Syst* 2018; **12**: 28 [PMID: 29881451 DOI: 10.1186/s13033-018-0210-6]

10 Ebi KL, Vanos J, Baldwin JW, Bell JE, Hondula DM, Errett NA, Hayes K, Reid CE, Saha S, Spector J, Berry P. Extreme Weather and Climate Change: Population Health and Health System Implications. *Annu Rev Public Health* 2021; **42**: 293-315. [PMID: 33406378 DOI:

10.1146/annurev-publhealth-012420-105026]

11 **Cunsolo A**, Ellis N R. Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change* 2018; 8: 275-281 [DOI: 10.1038/s41558-018-0092-2]

12 **Palinkas LA**, Wong M. Global climate change and mental health. *Curr Opin Psychol* 2020; 32: 12-16 [PMID: 31349129 DOI: 10.1016/j.copsyc.2019.06.023]

**Point 3:** I would also appreciate some context as to the clinical relevance of some statements - for example reference 16 talks about risks associated with a 10 degree rise in temperature - are the authors implying that there has (or will be) rises of this magnitude due to climate change? Or is this just reflective of changes in season? The latter may come with other factors influencing mental health, such as light exposure, as well as other social factors of potential relevance.

**Response 3:** Thank you for your professional input. Based on your feedback, we have carefully reviewed the references and found that the mental health issues associated with rising temperatures mentioned in the references are within the context of global warming. We have also made revisions to the manuscript as follows:

*Increasing environmental temperatures may lead to an increase in the incidence of personal attacks, homicides<sup>[15,16]</sup>, and suicide<sup>[17]</sup>. In Bern, Switzerland, for every 10 ° C increase in the average daily temperature due to global warming, the risk of mental health disorders increases linearly by 4%<sup>[18]</sup>.*

**Point 4:** Reference 17 is cited to refer to hormonal changes in the context of temperature, but is about foundry workers, where temperatures are presumably much more than in the day to day outdoor environment. Is the finding relevant to the degrees we see with climate change? Addition of a section (or just balancing sentences) about confounders, together with one or two figures to illustrate points would be helpful. A figure would be particularly useful where talking about pollution impacts on mental health, to illustrate pathogenesis.

**Response 4:** Thank you very much for your helpful suggestions. We have added specific data to the manuscript to illustrate the impact of temperature on mental health, as follows:

*When the average Wet Bulb Globe Temperature (WBGT) index reaches 35 ° C, overheating can occur in temperature-sensitive areas of the brain and thyroid hormones are inhibited, leading to functional hypothyroidism, which affects psychological functions and emotional regulation<sup>[19]</sup>. When temperatures exceed 26.7 ° C, the number of hospitalizations for mental health disorders increases<sup>[20]</sup>. For people with existing mental health issues, heatwaves can exacerbate underlying psychiatric and*

*behavioral disorders, increasing their risk of death by more than three times*<sup>[21,22]</sup>.

19 **Norloei S**, Jafari MJ, Omid L, Khodakarim S, Bashash D, Abdollahi MB, Jafari M. The effects of heat stress on a number of hematological parameters and levels of thyroid hormones in foundry workers. *Int J Occup Saf Ergon* 2017; **23**: 481-490 [PMID: 27882829 DOI: 10.1080/10803548.2016.1246122]

20 **Hansen A**, Bi P, Nitschke M, Ryan P, Pisaniello D, Tucker G. The effect of heat waves on mental health in a temperate Australian city. *Environ Health Perspect* 2008; **116**: 1369-1375 [PMID: 18941580 DOI: 10.1289/ehp.11339]

21 **Bouchama A**, Dehbi M, Mohamed G, Matthies F, Shoukri M, Menne B. Prognostic factors in heat wave related deaths: a meta-analysis. *Arch Intern Med* 2007; **167**: 2170-2176 [PMID: 17698676 DOI: 10.1001/archinte.167.20.ira70009]

22 **Schmeltz MT**, Gamble JL. Risk characterization of hospitalizations for mental illness and/or behavioral disorders with concurrent heat-related illness. *PLoS One* 2017; **12**: e0186509 [PMID: 29036206 DOI: 10.1371/journal.pone.0186509]