Review of: "Human health effects of volcanic eruptions – a systematic review"

Carol Stewart[1]

1 Massey University

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This article is seriously flawed and misleading. While I have not comprehensively reviewed the whole article, there are sufficient problems identified in the introduction and methods alone to undermine the credibility of the whole.

An immediately obvious problem is the authors' lack of understanding of the volcanological context. It is notable that the author team does not include anyone with expertise in volcanology, nor anyone with a publication record in the topic area. While this need not have been an insurmountable problem for this review, in practice it means that their understanding of the volcanological context and knowledge base in this area is very limited and leads to many erroneous claims and misrepresentations.

In the second sentence of the introduction, it's incorrect to state that 500 million people are "at high risk" of exposure to volcanic ash and gas; what the original reference says is that 500 million people live within 100 km of an active volcano, which is within range of ash and gas emissions. This is quite different to being at high risk. Furthermore, the original reference is now outdated, and Freire et al. 2019 have estimated that over a billion people globally now live within 100 km of a Holocene volcano. But here it is important to understand the distinction between proximal, life safety hazards that generally occur close to the volcano, and distal (far-reaching) hazards that can affect people further away. More generally, there needs to be a discussion of the multiplicity of volcanic hazards. There are also no distinctions between explosive and effusive volcanic activity, or between eruptive and non-eruptive (such as quiescent degassing) hazards.

The authors also appear unaware of comprehensive overviews and reviews about health hazards and impacts of volcanic activity, such as:

Horwell et al. (2015) Health impacts of volcanic eruptions.https://www.cambridge.org/core/books/global-volcanic-hazards-and-risk/health-impacts-of-volcanic-eruptions/0D52DBFF187A22837EC443C20D23F9EA

Horwell and Baxter (2006) the respiratory hazards of volcanic ash: a review for volcanic risk mitigation. https://link.springer.com/article/10.1007/s00445-006-0052-y

Hansell and Oppenheimer (2004) Health hazards from volcanic gases: a systematic literature review. https://www.tandfonline.com/doi/abs/10.1080/00039890409602947

Hansell, Horwell and Oppenheimer (2006) The health hazards of volcanoes and geothermal areas. https://oem.bmj.com/content/63/2/149

Stewart et al (2021) Volcanic air pollution and human health: recent advances and future directions. https://link.springer.com/article/10.1007/s00445-021-01513-9

This last paper includes a review of clinical and epidemiological studies conducted on communities affected by volcanic emissions, published since 2000.

A lack of awareness of the International Volcanic Health Hazards Network and its resources and activities is also evident: www.ivhhn.org This includes a reference database.

In the final line of the first paragraph, 'caldera' is incorrect here as not all volcanoes are caldera volcanoes or have calderas. Just 'from the volcano'. And the reference supporting this statement is very inappropriate as it refers to a super-eruption 18 million years ago. These extremely large events are extremely infrequent compared to smaller events, and it would be far more relevant to characterize the risks for timescales of years to decades from the present time.

Deconstructing the following sub-paragraph from the introduction gives a further example of the authors' poor understanding of the context: *"In addition, volcanoes could be affected by climate change. Apparently, volcanoes could be reactivated due to the increase in temperatures caused by climate change. The impact of climate change, therefore, endangers human health [5]. The problems caused by volcanic eruptions must be addressed, but not only since climate change, as mentioned before, is one of the precipitants."*

The first sentence should read: "volcanic activity could be affected by climate change". The second sentence, stating that volcanoes could be reactivated due to the increase in temperatures caused by climate change is highly speculative and is not referenced. The sentence "The impact of climate change, therefore, endangers human health" implies that climate change is going to cause increased volcanic activity which is therefore going to endanger human health. This is highly speculative and misleading. It is uncontentious to state that a wide range of adverse human health impacts are anticipated as the world warms, but this is unrelated (or at best, very loosely related) to the present study, and it is misleading to conflate the two.

It then states that "the problems caused by volcanic eruptions must be addressed". This is a throwaway comment. For a start, you have not demonstrated that these problems warrant this level of urgent response, and nor do you make any suggestions about how this might be done, either here or in the discussion. Volcanic risk reduction is a whole subject in itself and includes aspects such as volcano monitoring and surveillance, land-use planning, warning systems, hazard maps, public education campaigns and so on. Here I refer the authors to this UNDRR resource on global volcanic hazards and risk: https://www.undrr.org/publication/global-volcanic-hazards-and-risk-summary-background-paper

Moving on to the third paragraph, it is good that the authors have familiarized themselves with the Global Volcanism Program resources. However, there is no scientific point in listing the 'most famous' volcanoes in the world and this is strongly subjective – what about Vesuvius? Krakatoa? Pinatubo?

The main problem with the fourth paragraph is that it is based on the assumption that health consequences of volcanic

activity are not well characterized. In fact there is quite an extensive literature on this subject, some of which is listed above. Considering the recent Cumbre Vieja eruption which is used as an example, there could have been a more informative discussion here on the health hazards it caused, of which impacts on air quality are important, e.g. https://www.sciencedirect.com/science/article/pii/S004896972300267X?via%3Dihub

And an article proposing a study design to analyse the short, medium and long-term respiratory health effects of exposure to the emissions from the eruption: https://www.sciencedirect.com/science/article/abs/pii/S0013935122018138

Their argument also doesn't follow. They note that preventive measures can help prevent injuries and loss of life, which is true, and go on to state that the health consequences of 'these' (presumably meaning injuries and loss of life) must be known. But that is not what they did in this study. They didn't include 'fatalities', 'death' or 'injuries' as search terms. If they did, they would have found highly influential articles such as Baxter and Gresham (1997) 'Deaths and injuries in the eruption of Galeras volcano, Colombia, 14 January 1993) and Baxter, Jenkins, Seswandhana et al. (2017) 'Human survival in volcanic eruptions: thermal injuries in pyroclastic surges, their causes, prognosis and emergency management.' Important work has also been led by Sarah Brown and co-authors on studying trends in volcanic fatalities: https://appliedvolc.biomedcentral.com/articles/10.1186/s13617-017-0067-4

Other reviewers have noted problems with the methodology, analysis and conclusions. I'll just note an additional one that jumped out at me: ref 18 in Table 2 gives the impression that the health effects of the 2019 Whakaari eruption, New Zealand, were primarily respiratory. For the information of the authors, this was a devastating event in which 22 of 47 people visiting the island lost their lives, and the majority of the survivors had extensive, life-changing thermal and chemical burns. https://academic.oup.com/jbcr/article-abstract/43/5/1105/6488940

In summary, I have not attempted a comprehensive review of the whole article here, but I hope that these comments illustrate the fundamental problems stemming from the authors' lack of familiarity with the volcanic risk context and the existing knowledge base of volcanic health hazards and risks.

Finally, a disclaimer: I am a co-director of the International Volcanic Health Hazard Network (www.ivhhn.org). However I offer this review as an individual and not on behalf of IVHHN.