

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

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I am disappointed by the paper. Volcanic soils are rich in nutrients and therefore provide for good harvests. Therefore, volcanic areas are usually densely populated. These dense populations faced repeated dangers due to volcanic eruptions throughout history. Even religions have been developed to pacify the angry gods hidden under these dangerous mountains. Therefore, the statement that volcanoes endanger health is not a novel finding.

The authors must have had a precise idea which effects of volcanoes they wanted to study. They did not study mechanical trauma due to falling rocks, suffocation by ashes, or structural damage because of earthquakes that also come with volcanic eruptions. Neither did they study tsunamis or fires. Still, the more indirect pathways of effect they selected according to their search strategy are still very diverse. They range from the impact of air pollution caused by volcanic eruptions (but not on toxic gases emitted from volcanoes even without an ongoing eruption) to water borne diseases. These might stem from damage to the water infrastructure due to an earthquake or from poor conditions at refugee camps.

The main message of their paper simply is: we looked for these diverse effects and we found these effects. And they report their findings only in a very crude way: x studies investigated outcome y and of these x studies a did find an effect and (x-a) did not. This is the most boring way of reporting results of a review.

Generally speaking, we might be interested why a certain study did not find an effect. Maybe that effect really did not occur? In that case: What might be the cause? Is it the type of the volcano or the distance of the populated / investigated area to the volcano? Or maybe there was an effect, but the study was not powerful enough or the exposure assessment was not precise enough? If risks differ between settings, what can we learn from it? Which factors could be influenced by human preparation?

It does not come as a surprise that volcanic eruptions emit air pollutants. And it is well known that air pollution is bad for health. But there is still uncertainty if the indicators of air quality currently in use are really the best predictors of health outcome. For example, does source and composition of particle mass affect its toxicity? Volcanic eruptions could be seen as a natural experiment where during a defined time and place particulate pollution is dominated by a very special source and composition. Is the effect of 10 µg/m<sup>3</sup> change in PM<sub>2.5</sub> different when it is derived from volcanic eruptions or, e.g., from road traffic or coal fired power plants? This would be an interesting research question. But for that, it is not sufficient just to count positive and negative findings!

Besides that, I found some smaller mistakes.

In the search term, there are redundancies: ("volcanic ash") ... OR ("volcanic ash"), ("volcanic air pollution") OR ("volcanic air pollution")

This statement is not entirely clear: "We divided health effects into short- and long-term if the volcanic eruption occurred less or more than a year ago." A year before the health effect or before the study? Often, short term effects are analyzed on a much shorter scale, usually in a time-series analysis where days with high exposure are compared to days (often during the same season or even month) with lower exposure. "One year" is therefore not only a rather long period to define "short term", it might also be difficult to pin down: if water borne disease occurs in a refugee camp, would it matter if this disease occurs 11 or 13 months after the eruption? Yes, cancer could only be a long-term consequence of pollution caused by an eruption. But to me it is absolutely not clear how cancer risks were assessed in the studies found by the authors.

Table 2, ID 1: Saint Vincent and the Grenadines is an independent island state with British colonial history. It is not part of France!

"Vog" (used several times, including table 2) is a very specific term (short for volcanic smog, where "smog" is already an artificial word constructed from "smoke" and "fog"). That term is so unusual for readers not involved in volcanic theory that it should be explained!

Table 2, ID 13 (and others): what is a "transversal" study?

The authors claimed: "However, to limit this bias we used a specific tool for quality evaluation." This might be laudable. But I do not find the results of their evaluation. Neither is it reported in table 2 nor is it used to explain differences between effect estimates of different studies. Maybe studies not finding an effect were of less quality? And even studies that found an effect might have found very different effect sizes.