

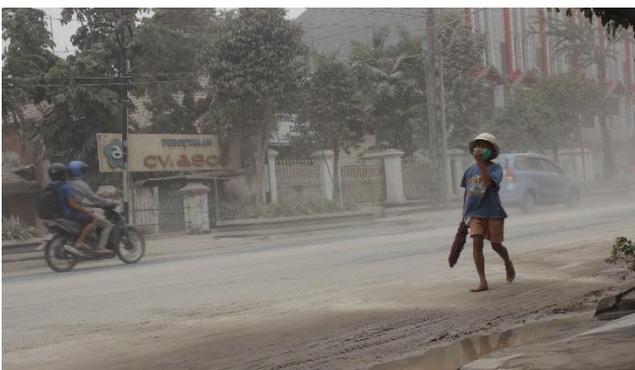
## Which facemasks are best to protect from breathing volcanic ash?

When a volcano erupts, humanitarian agencies often distribute surgical masks by the million. These are mostly from existing stockpiles for viral pandemics. But do these interventions protect people's health?

### Not all masks are effective

Governmental and humanitarian agencies recommend and distribute a variety of facemasks, most commonly surgical masks, in responses to volcanic risk. However, this research study found these masks are not always effective at protecting people from inhaling volcanic ash. Wearing ineffective masks can also give people a false sense of security, potentially increasing their exposure.

The Health Interventions in Volcanic Eruptions (HIVE) study provides a new evidence-base to inform humanitarian interventions, looking at both the effectiveness (protection from ash) and acceptability/'wearability' of different facemasks to communities. The outputs provide both evidence and practical guidance to inform more effective public health and humanitarian interventions in response to volcanic, and other air pollution, risks.



**Street children were given free masks during the 2014 Kelud eruption.** Photo credit: Tri Wahyudi, Yogyakarta, Indonesia, February 2014.

## Background

Inhaling fine ash particles during and after volcanic eruptions is unpleasant, uncomfortable and carries health risks. Some vulnerable groups (like children, and people with existing respiratory or cardiovascular disease) are particularly at risk of developing health problems. While agencies often distribute a wide variety of masks to protect communities at risk of breathing ash, little was known about how effective these are, nor on how best to design messaging around interventions to ensure people understand how to protect themselves.

The HIVE study investigated respiratory protection (facemasks and other cloth materials), to establish whether some forms of protection against volcanic ash were better than others, and if some protection is better than none. The research also explored behavioural factors influencing mask use in different societies to inform humanitarian decision-making and engagement.

## How the research was conducted

The study completed laboratory testing of different facemasks and undertook wearability trials amongst communities affected by volcanic ash. Social surveys were completed in three country settings – Indonesia, Mexico and Japan – alongside anthropological research to explore behavioural factors and how to tailor effective messages around protection.

## Key findings

- The facemasks which are most effective at filtering ash and protecting respiratory health are 'N95' industrial masks. Light-weight surgical masks often provided by responders are not the most effective at filtering ash.
- There is often little information or communication provided by agencies about the effectiveness of provided protection, or how to best wear it.
- All the facemasks studied provided some protection from ash, but this varied depending on materials.
- Societal and cultural context factors, such as how risk is perceived in communities, influence people's motivation to use facemasks.

## Implications for humanitarian practitioners and policymakers

- Humanitarian agencies and governments involved in preparedness planning for volcanic eruptions (and other air pollution crises) should consider the effectiveness of various types of facemasks before procurement and distribution.
- The most effective respiratory protection for adults is a well-fitting, industry-certified facemask such as an N95 mask (also called P2, FFP2 or DS2 in different parts of the world). Certifications are printed on the mask.
- Surgical masks are less effective protection, especially when not well-fitted to the face. People wearing surgical masks may feel safe, and reduce other protective measures, potentially increasing their health risks from breathing ash.
- If masks are recommended or provided, it should be alongside information on likely effectiveness and how to maximize fit. The HIVE project has co-produced informational products, with communities, for this purpose.
- Perception of risk from volcanic eruptions varies across cultural and social contexts. When designing interventions, it is important to develop targeted approaches for communities, considering what will motivate people to protect themselves.

## Recommendations for future research:

- Implementation research to explore the effectiveness of the informational products and epidemiological protocols developed by the study team.
- Research on ethical decision making in volcanic crises, evaluating a decision-making framework (developed as part of this study) designed for use by humanitarian agencies.
- Investigation into the suitability of interventions for people at greatest risk from breathing ash, particularly children.

## About the study team

The Principal Investigator was Prof Claire Horwell of Durham University, UK.

The partner organisations in the study were Kagoshima University, Japan; University of Indonesia; Institute of Occupational Medicine, Edinburgh; University of Mexico (UNAM); Pan American Health Organization (PAHO); Save the Children Indonesia; Red Cross Indonesia; and the International Society for Respiratory Protection.

## Keywords

Respiratory protection; volcanic crises; volcano; facemasks; respiratory disease; emergency response; volcanic hazards; humanitarian response



**A woman wears a mask during the 2010 eruption of Merapi volcano.** Photo credit: Boy Harjanto, Yogyakarta, Indonesia, 2010.

## Articles and further reading

- Guidelines on facemask use, and informational products such as videos, leaflets and posters for use by humanitarian agencies (English, Spanish, Filipino, Japanese and Bahasa Indonesia) available at: <https://www.ivhhn.org>
- Peer-reviewed journal articles linked here <https://www.elrha.org/project/hive-durham-call2/>
- Durham University's Health Interventions in Volcanic Eruptions (HIVE) site hosts information about ongoing research <http://community.dur.ac.uk/hive.consortium/>



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