

## Submission to the Royal Commission into National Natural Disaster Arrangements

By Ana Porta Cubas, Michael Abramson (Monash University) and Guy Marks (UNSW) on behalf of the Centre for Air pollution, energy and health Research (CAR)

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Thank you for the opportunity to comment on the Bushfires Royal Commission.

Although this inquiry is primarily investigating bushfire preparedness and response, it is critical to understand that a by-product of the fires —bushfire smoke—likely led to significant levels of morbidity and mortality in Australian communities. This knowledge will help preparedness for the next bushfire season by informing public health campaigns around the impacts of bushfire smoke and ways to minimise smoke exposure.

### Key points

- The indirect health effects of bushfires on the community are significant. Smoke from the 2019-20 bushfire season on the east coast is estimated to have resulted in over 400 premature deaths and over 3,000 hospital admissions for respiratory and cardiovascular conditions
- The short-term health impacts of bushfire smoke are wide-ranging and lead to increased illness and death. The long-term impacts of exposure to bushfire smoke are unclear
- Clear air quality information and public health advice should now be a focus to prepare for the 2020-21 bushfire season
- Tackling climate change is essential to reduce the frequency and ferocity of bushfires and in turn protect the health of our communities

### Short-term health impacts of bushfire smoke are wide-ranging

Bushfire smoke is an irritant that in most people leads to irritation of the airways, nose and eyes via an inflammatory response. Bushfire smoke is made up of a complex mix of hundreds of different components. The most important for health is suspended fine particulate matter (PM<sub>2.5</sub>) [1]. These fine particles, less than 2.5 thousandths of a millimetre in size, are able to penetrate deep into the lungs and cause inflammation. They are also able to directly enter the blood stream to affect different body organs. PM<sub>2.5</sub> typically affects the

respiratory, cardiovascular and immune systems and changes some metabolic functions [2]. Studies of large cohorts of people have found that exposure to smoke from bushfire events in Australia have led to increased number of deaths [3-5]. Studies have also found that bushfire smoke exposure leads to short-term increases in respiratory symptoms and hospital admissions for cardiac and respiratory diseases [3, 5-9].

Some groups are particularly vulnerable to the effects of bushfire smoke including pregnant women, older people and those living with respiratory or heart disease or Type 2 Diabetes [10, 11]. See CAR's Bushfire factsheet from December 2019 for further details on these vulnerable groups ([www.car-cre.org.au/factsheets](http://www.car-cre.org.au/factsheets)).

Importantly a recent study involving CAR researchers used computer modelling to estimate that exposure to smoke during the 2019-20 bushfire season caused 417 premature deaths in the eastern states [12]. This is more than 10 times the number of deaths caused directly by the bushfires. Additionally it was estimated that smoke exposure led to around 1,000 extra hospital admissions for cardiovascular conditions, around 2,000 admissions for respiratory conditions and 1,300 hospital attendances for asthma [12].

To establish a more comprehensive picture of the health impacts, CAR has proposed a comprehensive suite of work to further investigate the acute and delayed effects of smoke from the 2019-20 bushfire season. We propose to investigate premature deaths, hospitalisations, visits to Emergency Departments and respiratory exacerbations resulting from exposure to bushfire smoke. There will also be a focus on vulnerable groups such as pregnant women and first respondents. This proposal is currently subject to funding.

### Long-term health impacts are unclear

The long-term effects of bushfire smoke exposure are largely unknown. Most studies focus on the immediate effect of bushfire smoke (same day of exposure or a lag of some days) rather than longer-term effects, months or years after exposure. Additionally, most research on bushfire smoke exposure in Australia is limited to bushfire incidents which last days rather than weeks or months.

The only comparable research is the Hazelwood Health Study, an ongoing study which includes several CAR researchers ([www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)). It is investigating the long-term health outcomes of populations exposed to six weeks of smoke from the 2014 Hazelwood coal mine fire in Victoria. The duration and level of PM<sub>2.5</sub> exposure was comparable to the recent 2019-20 bushfire season.

Findings from the Hazelwood Health Study have found evidence of longer-term health impacts both in adults and children. Effects were typically on the respiratory system and lasted years after the Hazelwood coal mine fire was extinguished.

It is likely that the health effects of the recent 2019-20 bushfire season will likewise extend for several years, but this needs to be further researched.

## Public air quality and health information needs to improve

Clear public messaging in any disaster is key. During high smoke events as was seen in the 2019-20 bushfire season, clear warnings around air quality and strategies to prevent smoke exposure are essential. Focusing now on constructing clear public health messaging will allow agencies to be prepared for the 2020-21 and other future bushfire seasons.

Currently there is no single approach to reporting air quality between jurisdictions. We recommend that there be consistency in reporting of PM<sub>2.5</sub> and PM<sub>10</sub> levels (particles 10 thousandths of a millimetre in size) as part of a coordinated health response and to streamline public messaging. Some jurisdictions report a 24-hour rolling average of air quality while others report real-time, hourly readings. The latter is preferable because air quality can vary rapidly with changes in temperature and wind conditions. Additionally, real-time air quality readings allow people to alter their behaviour to avoid exposure to smoky conditions.

Some jurisdictions also provide an Air Quality Index (AQI). The AQI is an agglomerate measure meant to represent a single, easily understood measure of air quality to the public. However, the AQI includes criteria, such as visibility, which are not directly relevant to health outcomes. Instead for the purposes of health, a focus should be on reporting on individual pollutants relevant to the nature of the pollution event. For example, PM<sub>2.5</sub> and PM<sub>10</sub> levels during bushfires, dust storms, and general pollution events, ozone levels during summer ozone events, and nitrogen dioxide levels where appropriate.

These data should also be provided in a user-friendly format (such as a dashboard) that connects air quality readings with public health messages. Further, this messaging should be nuanced for different groups in the community, in particular those groups vulnerable to bushfire smoke (pregnant women, those with a respiratory or cardiovascular condition etc).

An example of a successful measure to communicate air quality conditions is the AirRater app ([www.airrater.org](http://www.airrater.org)). AirRater is a mobile phone app which provides location specific, hourly PM<sub>2.5</sub> and PM<sub>10</sub> readings. It allows users to input their symptoms and is useful for those with respiratory conditions. Its large user base of over 50,000 suggests that those in the community are seeking information not readily available or sufficiently user-friendly from government agencies. AirRater is currently funded to operate in Tasmania, ACT and Northern Territory.

Clear messaging should also extend to different strategies that reduce exposure to bushfire smoke. During the 2019-20 bushfire season, the community was provided with inconsistent messages on ways to protect themselves from bushfire smoke. The use of facemasks is an example. This is largely because their effectiveness, particularly in real-world settings is still unknown. All mitigation strategies have advantages, disadvantages and unknowns. We recommend that these be clearly communicated to the public to allow for informed decision-making [13]. See CAR's Bushfire Smoke factsheet ([www.car-cre.org.au/factsheets](http://www.car-cre.org.au/factsheets)) and [13] for further discussion of mitigation strategies.

## Addressing climate change is critical

One of the principal strategies to minimise poor air quality from bushfire smoke is to reduce the number and ferocity of bushfires themselves.

In Australia, the last 30 years have seen an increase in the number of high Forest Fire Danger Index (FDI) days [14]. FDI is an indicator of conditions associated with dangerous bushfires [14].

While most studies linking bushfire risk to climate change have come from North America, the scientific consensus is that climate change will lead to an increase in fire risk around the world [15, 16]. In south-east Australia, it is estimated that the number of fire danger days will increase strongly by 2100 and the fire season is expected to start earlier, leading to longer fire seasons [15]. Specifically, modelling suggests that the days conducive to extreme bushfires will increase by 20 to 50 per cent in western United States and south-east Australia [17].

Therefore, governments must act now on climate change to curtail the increasing risk of extreme bushfires and therefore air pollution events. By maintaining 'business as usual', extreme bushfire events and associated health impacts will continue to accelerate.

## About the Centre for Air pollution, energy and health Research (CAR)

[CAR](#) is a Centre of Research Excellence funded by the National Health and Medical Research Council (NHMRC). The centre brings together more than 30 researchers at the forefront of their fields, investigating the health impacts of air pollution and new forms of energy.

We have a dedicated bushfire research theme and a strong track record on understanding the health effects of bushfire smoke and wood burning and mitigation strategies.

Our centre's vision for a healthier community is the driving force behind our research.

### References

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### For more information

This submission has been produced by the Centre for Air pollution, energy and health Research (CAR).

For more information about CAR and our work on the health impacts of bushfires as well wood heaters: contact us at [car@sydney.edu.au](mailto:car@sydney.edu.au) or visit our website [www.car-cre.org.au](http://www.car-cre.org.au)

