Centre for Air pollution, energy and health Research

Submission to the NSW Independent Bushfire Inquiry

By Ana Porta Cubas on behalf of the Centre for Air pollution, energy and health Research (CAR)

27 March 2020

Thank you for the opportunity to comment on the NSW Independent Bushfire Inquiry. CAR is an NHMRC Centre of Research Excellence which brings together more than 30 researchers at the forefront of their fields. We are well placed to respond to the inquiry, having a dedicated bushfire theme which aims to understand the effects of bushfire smoke on human health.

Although this inquiry is investigating bushfires themselves, it is critical to understand that a by-product of the fires —bushfire smoke— has likely led to significant levels of morbidity and mortality in Australian communities.

Key points

- The indirect health effects of bushfires on Australians are just as important as the direct ones. Smoke from the 2019-20 bushfire season on the east coast is estimated to have resulted in 400 deaths and over 3,000 hospital admissions for respiratory and cardiovascular conditions.
- Climate change will lead to an increase in fire risk around the world. Tackling climate change is essential to reduce the frequency and ferocity of bushfires.
- The short-term health impacts of bushfire smoke are wide-ranging and lead to increased morbidity and mortality. The long-term impacts of exposure to bushfire smoke are unclear.
- Australian houses are typically leaky to outdoor smoke and building standards may need to change
- The effect of bushfire smoke on the health and safety of firefighters as first respondents needs to be further investigated
- Public communication and advice systems around air quality and public health advice should be improved
- CAR is hosting a two-day forum in October 2020 to showcase the latest scientific research on the health and economic impacts of bushfire smoke and to discuss policy challenges and ways forward. We welcome attendance by members of the committee or relevant staff

Factors contributing to the frequency, intensity and timing of bushfires

In Australia, the last 30 years have seen an increase in the number of high Forest Fire Danger Index (FDI) days [1, 2]. FDI is an indicator of conditions associated with dangerous bushfires and combines temperature, humidity, wind and drought information [1].

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 [3, 4]. 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 a longer fire season [3]. 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 [5].

Governments therefore must act now on climate change to curtail the increasing risk of extreme bushfires and their impacts on our communities. Although there are claims that tackling climate change is too expensive, with the increasing severity and duration of bushfires, the price of climate inaction will be even higher [6].

Health impacts of bushfire smoke are wide-ranging, and lead to increased morbidity and mortality

The 2019-20 bushfire season saw many communities affected by bushfire smoke and shone a spotlight on the need to further understand how smoke impacts the body both in the short and long-term. The importance of this is reinforced when considering that such extreme bushfire events are likely to become more common as a consequence of climate change.

Short-term impacts include increased deaths and illness

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 ($PM_{2.5}$), which is made up of particles less than 2.5 micrometres in size [7]. The 24-hour average concentration of $PM_{2.5}$ in most areas of Sydney during December 2019 was 100 micrograms per cubic meter (and sometimes reached 500 micrograms per cubic meter) [6]. This is four-times the $PM_{2.5}$ ‘safe’ level set out by the World Health Organisation of 25 micrograms per cubic meter [6]

Because of their small size, $PM_{2.5}$ particles can penetrate deeply into the lungs and cause inflammation. They are also able to directly enter the blood stream to affect different body organs. $PM_{2.5}$ typically affects the respiratory, cardiovascular and immune systems and changes some metabolic functions [8]. Studies of large cohorts of people have found that exposure to smoke from bushfire events in Australia leads to increased mortality rates [9-11]. Studies have also found that bushfire smoke exposure leads to short-term increases in

respiratory symptoms and hospital admissions for cardiac and respiratory diseases [9, 11-15].

Some groups are particularly vulnerable to the effects of bushfire smoke and include pregnant women, older people and those living with respiratory or heart disease or with Type 2 Diabetes [16, 17]. See CAR's Bushfire factsheet from December 2019 for further details on these vulnerable groups www.car-cre.org.au/factsheets

Importantly a very recent study led by CAR's Fay Johnston has used computer modelling to estimate that exposure to smoke during the 2019-20 bushfire season resulted in approximately 400 premature deaths in the eastern states [18]. Additionally it is 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 [18]. It is estimated that NSW had the highest proportion of deaths and hospitalisations of all eastern states. The 400 deaths are more than 10 times the number of official deaths (34) from the bushfires themselves.

Long-term impacts are less known

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 (as was seen in the 2019-20 bushfire season).

The most relevant Australian research is the Hazelwood Health Study (www.hazelwoodhealthstudy.org.au) an ongoing study which includes several CAR researchers. It is investigating the long-term health outcomes of communities exposed to six weeks of smoke from the 2014 Hazelwood coal mines in Victoria. The duration and level of $PM_{2.5}$ exposure is comparable to the recent 2019-20 bushfire season. Note however, the source of smoke was coal compared to vegetation from bushfires.

Results from the Hazelwood Health Study have found evidence of long-term health impacts from the smoke both in adults and children. Effects are typically on the respiratory system. In adults this includes chronic cough and in children respiratory infections and changes in lung function [19-22]. All these results were found years after the Hazelwood mine fires ocurred.

To establish a more comprehensive picture of the impacts of smoke from the 2019-20 bushfire season, CAR has proposed a comprehensive suite of work to further investigate the short and long-term health effects on various populations. We propose to investigate additional deaths, hospitalisations, visits to Emergency Departments and respiratory exacerbations resulting from exposure to the bushfire smoke. We will also investigate the effect on physiological outcomes at least 12 months after the bushfires to determine long-term effects. This proposal is currently subject to funding.

CAR is also hosting a two-day forum on 8 and 9 October 2020 to showcase the latest scientific research on the health impacts of bushfire smoke and to discuss policy challenges and key next steps (see Attachment A). We very much welcome attendance by members of this committee or relevant staff.

Australian building standards may to need change

During the 2019-20 bushfire season, one of the main recommendations provided to the community to avoid smoke exposure was to remain indoors. However, there are questions as to its effectiveness when many Australian houses are very leaky, allowing outdoor air to enter easily. The Hazelwood Health Study showed that some of the adults most affected by the mine fire smoke were those who lived in non-brick houses and those with tin roofs (e.g. weatherboard houses) [19]. This suggests those homes were particularly prone to penetration from outdoor $PM_{2.5}$.

To address this concern, CAR is planning to undertake a systematic review to establish new policy guidance to governments. The aim of this guidance will be to change building standards to make buildings more airtight and therefore more resistant to the entry of outdoor smoke.

Health and safety of firefighters as first respondents

There are concerns about the health of first respondents both because of the duration and intensity of $PM_{2.5}$ exposure at the fire frontline.

There have been very few studies investigating the health effects of smoke on fire fighters, and of those, most have come from other countries. Some studies have found smoke exposure in firefighters to be associated with systemic inflammation [23]. For example, a US study showed that in 52 firefighters, 65 per cent reported respiratory symptoms after smoke exposure and had evidence of lung and general inflammation [24]. Additionally, studies suggest that continuous occupational exposure to smoke could have a cumulative effect on lung function in fire fighters [23]. That is, lung function declines for each additional day or season of fighting fires [23]. However, no studies have investigated the effect of smoke on firefighters over the long-term.

One concern is that findings from international studies may not be applicable to Australian firefighters because of differences in the two countries' vegetation and fire conditions which would, in turn, affect smoke composition [25].

CAR is therefore proposing to undertake research specifically on volunteer fire fighters engaged in combating bushfires during the 2019-20 bushfire season. We plan to investigate the long-term effects of exposure on the respiratory system as well as track signs of general inflammation. We would recruit RFS volunteers with varying levels of smoke exposure and assess lung function, take biospecimens and collect questionnaires on symptoms at least 12 months after the 2019-20 bushfire season. The results of these studies will help drive policy

to ensure that firefighters remain as safe as possible on the frontline through personal protective equipment or changes in work practices.

Public communication and advice systems can be improved

Clear public messaging in any disaster is key. During high smoke events as was seen in the 2019-20 bushfire sea, clear warnings around air quality and mitigation strategies to prevent smoke exposure are essential.

Currently there is no single approach to reporting air quality amongst jurisdictions. We recommend that there be consistency in reporting of $PM_{2.5}$ and PM_{10} levels 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. We welcome developments that NSW now provides hourly PM_{10} and $PM_{2.5}$ averages.

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 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, $PM_{2.5}$ and PM_{10} levels during bushfires, dust storms, and general pollution events, ozone levels during 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).

This should also extend to different mitigation strategies to 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 the effectiveness, particularly in real-world settings, of these mitigations is still unknown. All mitigations strategies have advantages, disadvantages and unknowns. We recommend that these be clearly communicated to the public to allow for informed decision making [21]. See CAR's Bushfire Smoke factsheet for further discussion of mitigation strategies (www.car-cre.org.au/factsheets).

An example of a successful measure to communicate air quality conditions is the AirRater app (www.airrater.org). AirRater is a mobile phone app which provides location specific, hourly PM_{10} and $PM_{2.5}$ 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.

As part of our research, we are proposing to investigate the effectiveness of the public health response during the 2019-20 bushfire season. We plan to do this via an embedded journalism approach, with the results being in-depth articles in the media and synthesis of evidence into policy advice to government partners.

In addition, we will be discussing air quality reporting and public health messaging on Day 2 of our bushfire forum in October 2020. Specifically, we will discuss questions such as:

- Do current systems for describing air quality and health risk make sense in an era of escalating fire smoke risk?
- Do our current systems for communicating air quality and health risk work?
- How do we best communicate evidence-based health messages to the community?

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 are well placed to respond to the inquiry, having 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.

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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 in the health impacts of bushfires as well wood heaters: contact us at car@sydney.edu.au or visit our website www.car-cre.org.au

Attachment A

Join us as we host a two-day workshop to discuss the latest evidence and policy implications around the effects of smoke from bushfires and planned burns.
Attend one or both days

8 & 9 October 2020
Woolcock Institute of Medical Research, Glebe, Sydney

Day 1 Research Workshop

Share and learn about the latest evidence on the health and economic impacts of bushfire and planned burn smoke and the effectiveness of interventions to reduce these impacts

Call for abstracts now open


Keynote: Prof David Bowman

Day 2 Policy Forum

Attend an interactive policy forum to discuss challenges and future policy directions with air quality and fire scientists, land managers, regulatory authorities and health professionals


Keynote: Prof Carmen Lawrence

Register via car-cre.org.au

W: car-cre.org.au E: car@sydney.edu.au

Draft Program

Day 1 Research Workshop

Keynote: Professor David Bowman | "The Anthropocene global fire crisis"

Professor of Professor of Pyrogeography and Fire Science, Director of Fire Centre Research Hub, Univeristy of Tasmania

Research Presentations

****Call for abstracts now open****

CAR Invites submissions for research abstracts addressing one of the following themes

(1) Health and economic impacts of smoke from bushfires and planned burns

(2) The effectiveness of interventions to protect health from smoke from bushfires and planned burns

(3) Public risk communication and risk trade-offs in managing landscape fire smoke

Abstracts will be peer-reviewed prior to acceptance. Authors of accepted abstracts will have the opportunity to prepare a full paper for submission to a special edition of the International Journal of Environmental Research and Public Health (IJEHR).

Submissions due: 5pm, 5th April 2020
Email abstracts to: car@sydney.edu.au

Day 2 Policy Forum

Keynote: Professor Carmen Lawrence | "What do we need to know to develop good public policy on prescribed burning?"

Former Minister for Health and Human Services and Minister assisting the Prime Minister on the Status of Women
Senior Honorary Research Fellow, Faculty of Science, School of Psychological Science, Uni of Western Australia

A parliament of ideas | an interactive forum to discuss key policy questions

Session 1: Discussing bushfire risk, fuel management and smoke

- Is prescribed burning the solution to reducing bushfire disasters?
- What is the impact of smoke from prescribed burning on human health and the environment?
- What are acceptable trade-offs?

Session 2: Protecting health and policy future directions

- How useful are the standard interventions recommended for protecting our health?
- What other approaches should we consider?
- How do we protect outdoor workers?
- Do our current systems for communicating air quality and health risk work?