



Centre for Air pollution, energy and health Research

## Factsheet

# Bushfire smoke

What are the health impacts and what can we do to minimise exposure?

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# Bushfire smoke: what are the health impacts and what can we do to minimise exposure?

A factsheet from the Centre for Air pollution, energy and health Research (CAR)

December 2019

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## Key points

- As bushfires continue to burn on the Australian east coast, the exposure of communities to bushfire smoke is unprecedented.
- The health effects of bushfire smoke are mainly mediated by suspended fine particulate matter (PM<sub>2.5</sub>) which affects our respiratory, cardiovascular and immune systems when inhaled.
- People with existing medical conditions or vulnerable populations, such as children, women who are pregnant and older people, are most at risk of being affected by bushfire smoke.
- There are steps that can be taken to reduce exposure to bushfire smoke. These include staying indoors, seeking air-conditioned environments, or using indoor HEPA air cleaners. Face masks are only useful in limited circumstances and are not routinely recommended.
- Weather conditions caused by climate change will likely increase the frequency of extreme bushfires around the world. Tackling climate change is crucial to minimise health effects of bushfire smoke.

## How does bushfire smoke affect our health?

Air pollution from bushfires affects the health and well-being of thousands of Australians.<sup>1</sup>

Bushfire smoke contains hundreds of different components. The most important for health is suspended fine particulate matter (PM<sub>2.5</sub>).<sup>2</sup> These particles, 2.5 micrometres and below in size, are able to go deep into the lungs and cause inflammation. They are also able to enter the blood stream to affect different body systems. PM<sub>2.5</sub> typically affects the respiratory, cardiovascular and immune systems and changes some metabolic functions.<sup>3</sup>

Anyone can be affected by bushfire smoke, resulting in irritated airways, nose and eyes. But some groups are more vulnerable than others. Pregnant women, infants and children, older people and those living with respiratory conditions such as asthma, emphysema and chronic obstructive pulmonary disease (COPD), diabetes or cardiovascular diseases like angina or heart failure are at higher risk.<sup>4,5,6,7,8</sup> Box 1 outlines these groups and the special precautions they should take in the event of bushfire smoke.

## Box 1:

### Vulnerable groups

**Asthma and other lung diseases:** exposure to increased air pollution might worsen your symptoms. Use your action plan for managing worsening symptoms. If you don't have an up to date plan, see your GP to make one. Take steps to reduce the amount of smoke that you breathe (see below).

**Cardiovascular (heart) disease:** exposure to air pollution might worsen your condition and lead to symptoms such as palpitations, chest pain or shortness of breath. Pay attention to your symptoms and take steps to reduce the amount of smoke that you breathe (see below). If you are having symptoms of a heart attack you should call 000 for an ambulance.

**Diabetes:** air pollution can be associated with increases in blood glucose levels. Take steps to reduce the amount of smoke that you breathe (see below) and pay closer attention to your blood glucose control.

**Older people:** are at higher risk because they are more likely to suffer from chronic medical conditions and are less able to manage severe heat or other stresses that often occur during bushfire episodes. If you are in an older age group, actively look after any medical conditions you have and take steps to reduce the smoke that you breathe (see below).

**Infants and children:** are more susceptible because they breathe faster than adults and have actively developing lungs, blood vessels and immune systems. Air pollution is one of many risk factors that can affect the development of children. While the likely impacts are very small it is sensible to take steps to reduce the overall amount of smoke that children breathe, especially those who are aged less than five.

**Pregnant women:** Air pollution is one of many risk factors that can influence the development of children. Take steps to reduce your overall exposure to smoke from all sources, including tobacco, during pregnancy.

Research has shown that increases in PM<sub>2.5</sub> from bushfire smoke are associated with increased intensity and frequency of disease symptoms, increased use of asthma medication, increased healthcare attendances, respiratory hospital emergency admissions and cardiovascular problems including cardiac arrest, and mortality.<sup>1</sup>

CAR researchers estimated that in Sydney over the period of 2001-2013, smoke from 184 bushfire incidents was associated with 197 premature deaths, 436 cardiovascular hospitalisations, and 787 respiratory hospitalisations.<sup>9</sup>

CAR researchers have also shown that bushfire smoke particles have a greater association with worsening asthma symptoms than particulate matter from mixed urban sources, such as vehicle emissions.<sup>10</sup>

## What do we know about the impacts of smoke pollution that lasts more than just a few days?

Research on the health effects of medium-term exposure to fire smoke (weeks and months rather than days) is limited. However, CAR researchers involved in the Hazelwood Health Study ([hazelwoodhealthstudy.org.au](http://hazelwoodhealthstudy.org.au)), are investigating the health outcomes of populations exposed to 6 weeks of smoke from the 2014 Hazelwood coal mines in Victoria. They found more than a year after the fire occurred adults had increased rates of respiratory symptoms. Children who were exposed to the mine fire smoke either in the womb or in their first two years of life had more respiratory tract infections as reported by their parents. Additionally, they found a link between higher mine fire smoke exposure and small increases in lung stiffness in children who were aged up to two at the time of the fire. These impacts were relatively small but warrant further investigation.

In terms of the longer-term health effects of exposure to bushfire smoke, there have been comparisons made with cigarette smoking. Although these comparisons draw attention to the negative health effects of bushfire smoke, translating from one to the other is difficult to do in a scientifically robust way.

## How can people protect themselves from bushfire smoke?

There are various measures that can be taken to reduce exposure to bushfire smoke. See Box 2 for a summary.

The most important step is to seek cleaner air. Where possible, stay indoors with the doors and windows shut as this slows the movement of smoke indoors. When conditions clear, take the opportunity to open doors and windows and ventilate your home. If you have an air conditioner, set it to recirculate to avoid bringing in smoke from outdoors. Many large public spaces such as libraries and shopping centres are airconditioned and can provide some improvement over the outside smoky conditions.

The only measure to improve indoor air quality with scientific backing is the use of indoor air cleaners. If you choose to use these, ensure that they contain a high efficiency particle air (HEPA) filter. Note that humidifiers, negative ion generator and odour absorbers do not reduce air pollution.<sup>3</sup> For an indoor air cleaner to work well, the room where it is used should be relatively well sealed and match the size specified by the manufacturer.<sup>3</sup>

## Box 2:

### Minimising exposure to bushfire smoke

**Stay indoors:** close the doors and windows. Use the air conditioner on recirculate. Open doors and windows to ventilate the house during periods of smoke clearing.

**Avoid outdoor exercise:** especially for vulnerable groups.

**Stay informed:** use real-time, local air quality data.

**Indoor air cleaners:** Ensure the cleaner has a HEPA filter and make sure the room is the right size for the air cleaner. If the room is open to the outside the air cleaner will not work.

**Make sure you are well informed before using face masks:** Many cloth and paper masks do not work well to filter out particles associated with bushfire smoke. P2/N95 masks are effective if fitted properly but make it harder to breathe.

Avoid outdoor physical activity when conditions are poor. Indoor physical activity is fine as long as indoor air quality is good.

It is also important to stay informed about the air quality around you. Use real-time or hourly (rather than 24 hour rolling average) local air quality data if it is available in your area. Knowing the current air quality and if it is rising or falling helps with the best timing for when to seal, or to open and ventilate your home and enables the planning of activities and travel to avoid places severe affected by smoke. Each state has their own air quality reporting website. For example the NSW air quality data can be found at [dpie.nsw.gov.au/air-quality/current-air-quality](http://dpie.nsw.gov.au/air-quality/current-air-quality). The free AirRater app, developed in collaboration with CAR researchers, captures and shares publicly available hourly air quality data. However, it is not yet supported in every jurisdiction. See [airrater.org](http://airrater.org) for more information.

Masks require the correct filter and fitting to work well. Surgical or patient care masks or dust masks do not protect the wearer from particles (PM<sub>2.5</sub>) that are associated with bushfire smoke. The material in P2/N95 masks do filter out PM<sub>2.5</sub>. However, the seal around the mouth and nose must be perfect for them to work well. This can be difficult to achieve, especially for those with facial hair or sideburns, or those who have a small face.<sup>11</sup> Where a good seal is achieved, it is usually hot and uncomfortable for long periods of time, and breathing may be more difficult. Additionally, wearing a face mask may provide a false sense of security, so that people stay outdoors for longer than what is safe.<sup>12</sup> View the advice from the British Columbia Center for Disease control on the advantages and disadvantages of face masks and how to use them in Reference 12.

### How is this related to climate change?

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.<sup>13,14</sup>

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.<sup>13</sup> 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.<sup>15</sup>

The mechanisms that drive bushfires in Australia are complex and so is the likely link between climate change and bushfire risk. Bushfire activity in Australia is influenced by a variety of climate phenomena including El Niño and the Indian Ocean Dipole which affects rain patterns and in turn bushfire potential.<sup>14</sup> According to the Bureau of Meteorology the behaviour of the Indian Ocean Dipole is changing in response to climate change, leading to lower rainfall in central and Southern Australia.<sup>16</sup> Research suggests that as global temperatures rise, these events will become more frequent<sup>16</sup> leading to lower rainfall and creating a drier feedstock for extreme bushfires. In turn our communities' risk to bushfire smoke and associated health effects is likely to increase.

### **What can we do to minimise our communities' exposure to bushfire smoke?**

There are a variety of strategies that should be used to minimise bushfire risk and in turn population exposure to bushfire smoke.

First and foremost, we must act now on climate change to curtail the increasing risk of extreme bushfires and pollution events. By maintaining the *status quo*, extreme bushfire events and associated impacts on society will continue to accelerate.

Secondly, we must increase efforts for public safety and bushfire protection through urban design and landscaping, vegetation modification and the management of fuel loads. Hazard reduction burning is a central fuel management strategy. However, it is not practical in all settings and vegetation types and has a limited time window for safe implementation.<sup>17,18</sup> A range of approaches is therefore needed. Also, the associated risks of air pollution need to be well managed and communicated to enable those at higher risk to take action, such as closing their doors and windows, or using preventive medication before they are affected by the smoke.<sup>19</sup>

Thirdly, we need to further understand the health effects of such severe and prolonged bushfire smoke events. Because of the historically brief and episodic nature of past bushfire events, research has focused on the health effects of short-term exposure to smoke (days). But with the observed trend towards longer and more severe bushfire smoke episodes (weeks or months), it will be important to understand the effect that this medium-term smoke exposure has on health.

And lastly, we need to investigate the best way to provide timely public health advice to people when bushfire smoke exposure does occur. After all, the health of our communities is of utmost importance.



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

The Centre for Air pollution, energy and health Research (CAR) is a National Health and Medical Research Council Centre for Research Excellence in Australia. It is the only group of its kind nationally to bring together researchers focusing on the impacts of air pollution and new versus traditional forms of energy on our health. Our vision for a healthier community is the driving force behind our research.

CAR has a specific research theme focusing on the impacts of bushfire and other landscape fire smoke on health.

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### For more information

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