BUSHFIRES AND HEALTH IN A CHANGING ENVIRONMENT

FACT SHEET

Bushfires have always been a part of the Australian ecology, but now that ecology is changing.

BACKGROUND

Extreme fire weather has increased in Australia over the last 30 years. Our fire-prone continent is at particular risk from the impacts of climate change, and we are experiencing more extreme heat events, an increase in severe fire danger days and a longer fire season *(Hughes & Fenwick 2015; CSIRO 2016)*.

The south-east and south-west of the country is especially vulnerable to bush fires *(IPPC 2014; Hughes & Fenwick 2015)*. Modelling of weather projections across these areas show increasingly hot and dry conditions for longer periods over the coming decades *(IPPC 2014; Hughes & Alexander 2017)*.

Destructive fires generally occur when a period of hot dry weather with strong winds follows a season of high rainfall that has created a large fuel load. Accidental ignition, lightning or arson can start a fire which spreads rapidly, becomes fast moving and difficult to control *(BOM 2009)*.

The health impacts of bushfires can be severe and long lasting, but can be reduced through bushfire prevention, preparation and education.

HOW BUSHFIRES HARM HEALTH

Bushfires are accompanied by a range of acute health impacts, and an increase in the number of patients seeking emergency services.

Adverse health impacts include:

- Respiratory conditions
- Heart problems
- Burns
- Heat stress
- Trauma
- Longer term impacts on mental health
- Death

BUSHFIRE SMOKE AND ITS EFFECTS

The smoke from bushfires consists of a complex mix of particles and gases, and has a significant and measurable impact on human health.

- Smoke can cause itchy or watering eyes and a runny nose
- Smoke mainly affects the respiratory system. It can
  - irritate the throat
  - cause coughing
  - cause shortness of breath
  - aggravate existing lung conditions such as asthma or bronchitis
- fine particles in smoke can affect the heart

Pollutants from bush fires can affect air quality many hundreds or thousands of kilometres away *(Sastry 2002; Sapkota 2005; Glover 2006)*.

Particulate matter

Particulate matter (PM) is an air pollutant made up of very small particles, some of which can penetrate deeply into the lungs. It can exacerbate lung disease such as asthma and chronic obstructive pulmonary disease (COPD).

High concentrations of $PM_{2.5}$ and PM_{10} (particulate matter less than 2.5 and 10 micrometres diameter respectively) in bushfire smoke cause a range of health impacts.

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Healthy planet, healthy people

Raised $PM_{2.5}$ and PM_{10} concentrations from bushfires are associated with increased presentations to hospital emergency departments with respiratory illnesses *(Martin 2013; Tham 2009; Chen 2006; Johnston 2002; Reid 2016; Alman 2016; Broome 2016)*.

As well as respiratory problems, the smaller particles $PM_{2.5}$ can be absorbed into the bloodstream, triggering adverse cardiovascular effects and even death *(Brook 2010; Haikarwal 2015; Dennekamp 2015)*.

Australian studies show a 5% increase in non-accidental deaths on days of high air pollution from bushfire smoke *(Johnston 2011; Finlay 2012)*. Increased rates of disease and death with increased ambient concentrations of $PM_{2.5}$ are well documented in other studies *(Dennekamp 2011; Johnston 2002; Reisen 2010; Pope 2002)*.

Increased cardiovascular mortality rates, and increased out-of-hospital cardiac arrests were reported in both Melbourne and Sydney on high bushfire smoke days *(Haikarwal 2015; Morgan 2010; Dennekamp 2015)*. Increased hospital admissions due to cardiovascular complaints were also observed *(Johnston 2007; Johnston 2011; Delfino 2003)*.

Other important pollutants

Bushfire smoke also includes carbon monoxide, polyaromatic hydrocarbons, oxides of nitrogen and volatile organic compounds - specifically formaldehyde, acetaldehyde, acrolein, benzene and toluene. Some of these substances can act as respiratory irritants and some are potentially cancer-causing. *(Bernstein and Rice 2013; Dennekamp 2011; Spracklen 2009)*.

These compounds can significantly contribute to acute and chronic illnesses of the respiratory system such as asthma and COPD *(Finlay 2012; Reisen 2007)*.

While exposure to pollutants from a single bushfire episode may be limited to short-term health impacts, the risks of repeated exposure to air pollution can be cumulative *(Pope 2002; Beelen 2014)*. Long-term health effects from low-level exposure to PM and toxic compounds remain a cause for concern.

Projections of more regular seasonal bushfires driven by climate change and an increased frequency and duration of controlled burns in an attempt to reduce forest fuel loads is likely to continue frequent exposure to bushfire smoke, even in urban areas of Sydney and Melbourne.

HEAT STRESS

Radiant heat is the biggest killer in a fire *(CFA)*.

People exposed to radiant heat while fighting fires are vulnerable to heat stress from very hot and dry conditions, potentially compounded by the necessary use of heavy protective clothing.

Heat stress occurs when the body is unable to reduce its temperature adequately. Heat related illness can be mild to severe. Early signs of heat stress may include dizziness, weakness or fatigue. More severe illness may progress to include confusion, altered behaviour, hot dry skin, vomiting or rapid breathing. The most severe form of heat stress is heat stroke, which can be fatal *(Kilbourne 1997; Better Health Channel)*.

Those fighting fires must ensure adequate hydration and rest frequently to allow cooling.

BURNS

People in close proximity to bushfires risk burns from direct and/or radiant heat. The rate at which a fire releases energy is measured in Watts or Kilowatts (equal to 1,000 Watts) *(NIST)*. Radiant heat from the sun that we feel at midday on a summer's day is about 1 kW/m^2. The pain threshold for most people is about 2 kW/m^2 and at this rate, bare skin will undergo a partial thickness burn in about 40 seconds *(Sullivan 2015)*. Bushfires can reach 100 kW/m^2 or more.

Deep or widespread burns can be life threatening, and multiple casualties can overload medical resources unless sufficient capacity exists *(Seifman 2011; Cameron 2009)*.

Severe burns can become a chronic disability spanning years of treatment and requiring multiple medical procedures.

OTHER HEALTH IMPACTS

Fire fighters or residents very close to the fire front are at risk of breathing carbon monoxide (CO) and other toxic products of combustion, and of asphyxiation from breathing oxygen-depleted air. Any or all of these can lead to unconsciousness and death *(CFA; Johnston 2009)*.

Those in close proximity are also at risk of trauma from falling trees or debris.

Vehicle accidents are more common in poor visibility caused by smoke and fatalities have occurred *(Haynes 2010)*.

Fire fighting involves intense and prolonged physical activity, and heart attacks can occur in those with pre-existing cardiac disease *(Stefanos 2007)*.

LONG-TERM EFFECTS

MENTAL HEALTH

The stress of experiencing a bushfire can affect people psychologically, socially and economically.

As well as the risk to human life, loved ones and property may be lost, pets and livestock killed, and home environments and livelihoods destroyed.

These compounding impacts can contribute to mental health disorders, including:

- Depression
- Anxiety
- Post-traumatic stress disorder (PTSD)
- Anger
- Substance abuse, particularly tobacco and alcohol

Serious mental health problems in residents and fire fighters have been observed at least four years after the event *(McFarlane 1997)*.

Children and youths are particularly vulnerable to PTSD as well as behavioural and emotional disorders *(Yelland 2010; McDermott 2005)*.

Public health

Cleaning up after fires can expose workers to hazardous materials including asbestos, lead, copper, chromium and arsenic, or ash containing those substances.

Water catchments, land and soil can be contaminated by particulate matter, alkaline ash, asbestos, arsenic and other hazardous chemicals and important ecosystems can be destroyed *(Johnston 2009; WA DOH; Hughes and Alexander 2017)*.

WHO IS VULNERABLE?

While anyone can be affected by bushfires, some population groups may be more at risk from bushfires than others.

Of the 173 deaths in the 2009 Victorian Black Saturday bushfires, 44% were children less than 12 years, people greater than 70 years, or people with a disability *(O'Neill 2012)*.

The following groups are more likely to suffer the effects of bushfire smoke *(Morgan 2010; Finlay 2012)*:

- Children
- Pregnant women
- Those with pre-existing medical conditions, especially chronic respiratory diseases and asthma
- Smokers
- Older people

THE ECONOMIC BURDEN OF BUSHFIRES

Bushfires can have profound and devastating consequences. They can also place significant pressure on communities that will only worsen with climate change.

An estimation of bushfire costs to Sydney health services was $8.2 million in 2011 *(Deloitte 2014)*, and there will be increased demands on health resources in the future *(Hughes & Fenwick 2015)*.

The number of professional fire fighters required in Victoria and Western Australia between 2010 and 2030 is projected to double *(NIEIR)*.

Victoria experiences more deadly fires and a higher economic burden from bushfires than any other Australian state or territory *(Hughes & Alexander 2017)*. The conservative estimated cost of the 2009 Victorian Black Saturday fires is $4.4 billion *(Victorian Bushfires Royal Commission 2009)*.

The annual cost of bushfires in Australia is estimated to be $375 million, with a forecast growth in costs of 2.2% per year. These projections do not account for climate change, so the total cost is likely to be much higher *(Hughes and Alexander 2016)*.

WHAT CAN BE DONE?

Climate change is increasing the severity and frequency of bushfires in Australia, exposing more people, especially the most vulnerable, to sickness and death. There will be increasing demands on our communities, fire fighting resources and health services. An urgent response is required to protect communities and human health.

Doctors for the Environment Australia calls for:

- Urgent action to mitigate climate change, by reducing Australia's greenhouse gas (GHG) emissions, including our usage and reliance on fossil fuels. Australia's GHG mitigation policies are currently inadequate to limit warming to less than 2°C above pre-industrial levels, and need to be revised.
- A nationally coordinated approach to the health impacts of climate change, including preventing and managing the health impacts of bushfires. This could include strengthening community and health care capacity to cope with bushfires, including improved education and training of health care workers, and raising public awareness of the acute and long-term health effects of bushfire smoke.
- For those affected by bushfires, recovery plans and adequate funding should be put in place to cope with long- term health effects.

MORE INFORMATION

DEA publications

- **https://www.dea.org.au/air-pollution-policy-healthy-planet-healthy-people-dea/**
- **https://www.dea.org.au/heatwave-fact-sheet/**

Weather and climate

- **http://www.bom.gov.au/weather-services/bushfire/about-bushfire-weather.shtml**

Government health websites

- **https://www.asthmaaustralia.org.au/sa/about-asthma/manage-your-asthma/triggers/asthma-bushfire-smoke**
- **https://www.betterhealth.vic.gov.au/health/healthyliving/bushfire-smoke**
- **https://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/bushfires-and-public-health**
- **http://www.health.nsw.gov.au/emergency_preparedness/weather/Pages/bushfire.aspx**
- **https://www3.epa.gov/airnow/wildfire_may2016.pdf**
- **http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Health-Environment/WFSG_BC_guidance_2014_09_03trs.pdf**

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