Bushfire advice:

Smoke hazard during a bushfire event

Dr Monika Nitschke
Department of Health – South Australia
This presentation is **not** about acute lung injury due to acute burn and smoke inhalation.

- Impaired oxygenation
- Burns in the respiratory system
- CO poisoning

This presentation is about short term **public health impacts** from bush fire smoke.

- Higher exposure to particulate matter (PM) than during days of normal air pollution
- Eg. vehicles, power generating, manufacturing, wood heating
What is the issue?

Bushfires are likely to increase with global warming.
• Interface between bushland and urban/rural development.

• Bushfires and prescribed burning can produce copious quantities of smoke.

• Disperses over long distances depending on the climatic conditions, topography and vegetation sources and as a result, smoke may affect communities not directly threatened by fire.

• Smoke persists for days
Incomplete Combustion Products: gases and fine particles suspended in air

- Inhalable particulate matter (mainly PM2.5... soot loaded with inorganic and organic substances)
- Carbon Monoxide
- Volatile organic gases (*toluene, formaldehyde, xylenes, benzene...* >100)
- Nitrogen oxides
- Polycyclic-aromatic hydrocarbons
- Ozone: secondary formation
Health effects in relation to urban air pollution in Adelaide

- **Respiratory** hospital admissions in the 15-64 age-group (per increase in 10 µg/m$^3$ PM10/24 h) in winter: 3%

- **Cardiovascular**-related hospitalisation, all age (per increase in 10 µg/m$^3$ PM2.5)
  - All season: 2.7%
  - In winter: 4.5%

Normal PM10: 10-40
During bush fire PM10: >50-150

PM2.5: 5-15 µg/m$^3$
PM2.5: 15-25 µg/m$^3$
Bush Fire Population Studies – association between bushfire smoke PM exposure and health outcomes

<table>
<thead>
<tr>
<th>Hospital admissions</th>
<th>Mortality</th>
<th>Toxicological research</th>
</tr>
</thead>
<tbody>
<tr>
<td>for COPD</td>
<td>Asthma</td>
<td>General respiratory</td>
</tr>
<tr>
<td></td>
<td>General respiratory</td>
<td>Cardiovascular</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Respiratory health effects were greater during bush fires than during general urban air pollution.

- Worldwide, urban air pollution studies including those from wood combustion pollution indicate cardio-vascular-related hospital admissions and mortality.
- There is no threshold of fine PM-levels that is safe.
- No clear info about what happens at very high concentrations.
Bush fire smoke-related Health Effects

- Acute lower or upper respiratory symptoms
- Impacts on quality of life: itchy eyes, runny nose, scratchy throat, cough, headaches, unpleasant smell
- Exacerbation of Asthma
- Increased medication use, GP visits
- Hospital and Emergency admissions:
  - Asthma
  - COPD (chronic bronchitis, emphysema)
  - Other respiratory
  - Cardio-vascular
- Respiratory
- Cardio-vascular
- Deaths
Relevant Pathway for Particulate matter (PM)

PM2.5 and UFP adsorb and carry other toxic chemicals deep into the alveolar regions of the lung.

Fine PM stays airborne and travels easily indoors.
Potential Mechanisms for the Respiratory and Cardiovascular Effects

1. **Inflammation**
   Activation of inflammatory processes on the epithelium.
   Increase in inflammatory cells, fibrinogen and clotting factors, plaques formation, dislocation or rupture, myocardial infarction (clotting hypothesis).

2. **Neural pathway**
   Autonomic nervous system, altered heart rate variability, sudden acute coronary effect.

3. **Translocation**
   Ultra-fine particles may directly enter into the bloodstream.

Who is vulnerable?

- Older people as they tend to have pre-existing respiratory (COPD, chronic bronchitis, asthma, emphysema) and cardiovascular diseases and reduced immune defence systems against particulate matter.

- People with asthma, particularly children
Preventive measures

- People with pre-existing illnesses (respiratory, cardio-vascular, diabetes) should be vigilant with taking their medication and adhere to their action/treatment plan.

- Have relieving and preventing medication in stock (e.g. for asthmatics relieving puffers; oxygen supply for emphysema sufferers.

- No physical exertion, exercise (less intake of particles)

- If symptoms (shortness of breath, heart palpitations, wheeze, phlegm, cough) occur and persist, seek urgent medical advice.

- Stay indoors, close windows, doors to reduce smoke entry.

- Stay in air-conditioned places where the air – conditioner is switched to recirculate or recycle – this mode filters particles from the air (no intake of fresh air from outside).

- No extra polluting sources (dust from cleaning, candles, smoking)

- Assist, advice, observe people at risk

- If it is hot: be aware of heat stress and keep fluids up and wear lightweight appropriate clothes.
Websites: WHO, DHS Victoria, NSW, SA, WA; CDC

> bushfires and other vegetative fires WA: public health guide to bushfires
> http://www.bt.cdc.gov/disasters/wildfires/
Estimated mean annual PM$_{2.5}$ from landscape fire smoke, 1997-2006

PM$_{2.5}$ (ug/m$^3$)
- 0 - 1
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50

Forest fires

Tropical deforestation fires

Savanna fires
Thank you for listening