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Cardiovascular and Respiratory Health Effects of 2006/2007 Bushfire Smoke in Victoria

Anjali Haikerwal, Martine Dennekamp, Michael Abramson, Malcolm Sim
School of Public Health & Preventive Medicine (SPHPM), Monash University, Victoria

Mick Meyer
CSIRO Marine and Atmospheric Research, Aspendale, Victoria



STRUCTURE OF MY PRESENTATION



1. Introduction & Background
2. Research Plan including progress and next stage
Data Linkage stage/Retrospective Study
3. Significance & Conclusion



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INTRODUCTION

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“Climate change is the biggest global health threat of the 21st century” Lancet 2009¹

More frequent and severe extreme events such as bushfires are predicted to get intense².

Exposure to smoke from bushfires is a serious public health problem

¹Costello A et al. Lancet &UCL.2009

²Westerling AL et al. Science 2006

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PREDICTIONS

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- **Increase in number of severe fire weather days in SE Australia**
- **More days with temperatures over 35°C**
- **Frequent droughts**
- **Increased risk of bushfires and heat waves**


	2020		2050	
	Low global warming (0.4°C)	High global warming (1°C)	Low global warming (0.7°C)	High global warming (2.9°C)
Very high	+2-13%	+10-30%	+5-23%	+20-100%
Extreme	+5-25%	+15-65%	+10-50%	+100-300%

Percentage change in the number of days with very high and extreme fire weather

Lucas H et al. Consultancy Report 2008

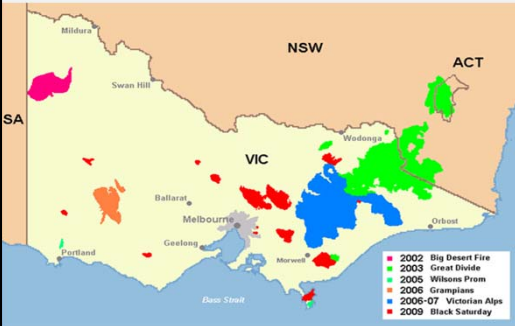
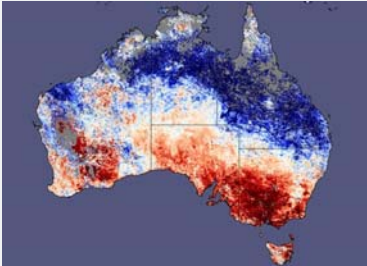
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BUSHFIRES IN VICTORIA



Victoria is one of the most fire prone regions in the world and bushfires are an inherent part of the Victorian environment


Victoria has had a number of severe bushfires during the past 100 years

www.epa.vic.gov.au/air/bushfires

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PARTICULATE MATTER

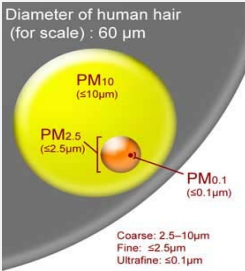


Bushfire smoke consists of pollutants which can affect health

PM (particulate matter) is the pollutant of most concern and is associated with most of the adverse health effects.

PM concentrations can reach extreme levels, travel vast distances, and affect densely populated areas far from their source

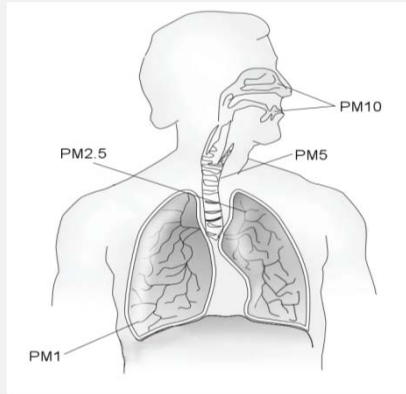
Diameter of human hair
(for scale) : 60 μm



Particulate Matter classified according to their aerodynamic diameter into size fractions

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PM DEPOSITION IN THE RESPIRATORY SYSTEM



With ease of inhalation deep into the respiratory tract, particulates can readily exacerbate respiratory conditions including asthma, chronic respiratory disease

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PM AND CARDIOVASCULAR HEALTH



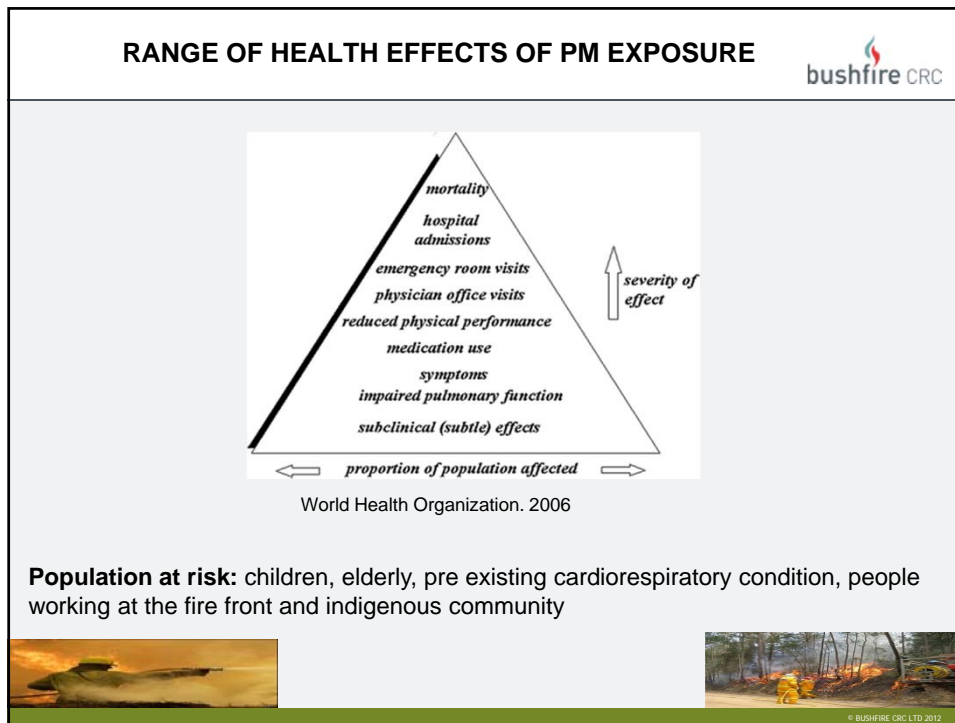
PM inhaled into the lungs may affect CV health in a number of ways



- Promote ischemic events/acute events
- Hypertension
- MI
- Heart failure
- Arrhythmias
- Cardiac arrest
- Chronic events: Atherosclerosis



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CHALLENGES & GAPS

- Challenges associated with **exposure assessment** : e.g. exposure is unpredictable and rarely constant, pollutants are diverse and complex
- **Limited** number of studies evaluating the health impact of air pollution from bushfire smoke in the community as compared to studies in urban air pollution
- Studies investigating the impact of bushfire smoke on **subtle health effects** are sparse
- Little is known regarding susceptibility of **subgroups** in the community

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RATIONALE



This study is important for two main reasons:

1. The results will provide an insight into the health effects on communities living in regional and peri-urban areas of Victoria
2. This study will allow for more accurate exposure assessment including areas with no air quality monitors



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RESEARCH PLAN



AIM

To assess the *cardiovascular and respiratory health* effects from exposure to air pollutants emitted from bushfire smoke in the rural and urban communities in Victoria

Hypothesis

Exposure to particulate matter air pollutants due to bushfire smoke increases the risk of adverse cardio respiratory health outcomes in the affected communities

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DATA LINKAGE STAGE / RETROSPECTIVE STUDY

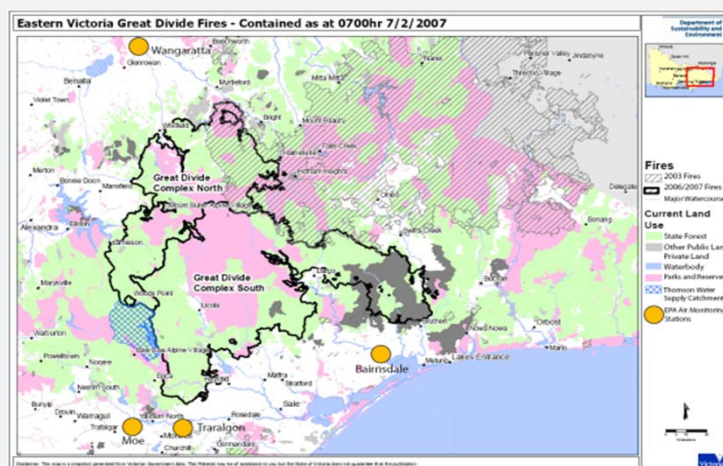


This stage will focus on the *cardiorespiratory* health effects from 2006/2007 Victorian bushfires

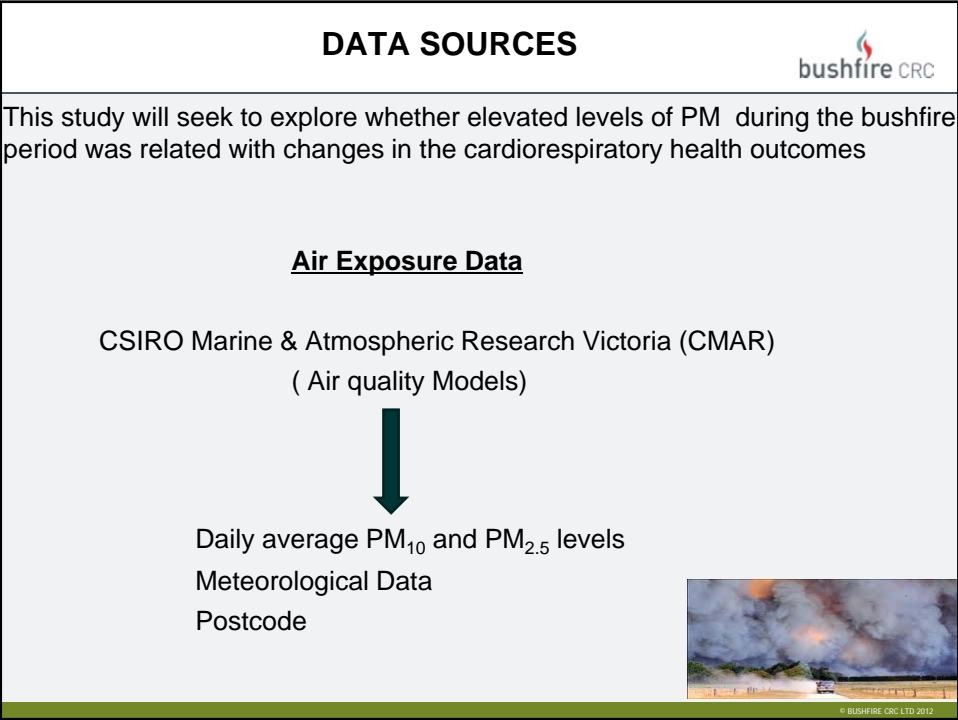
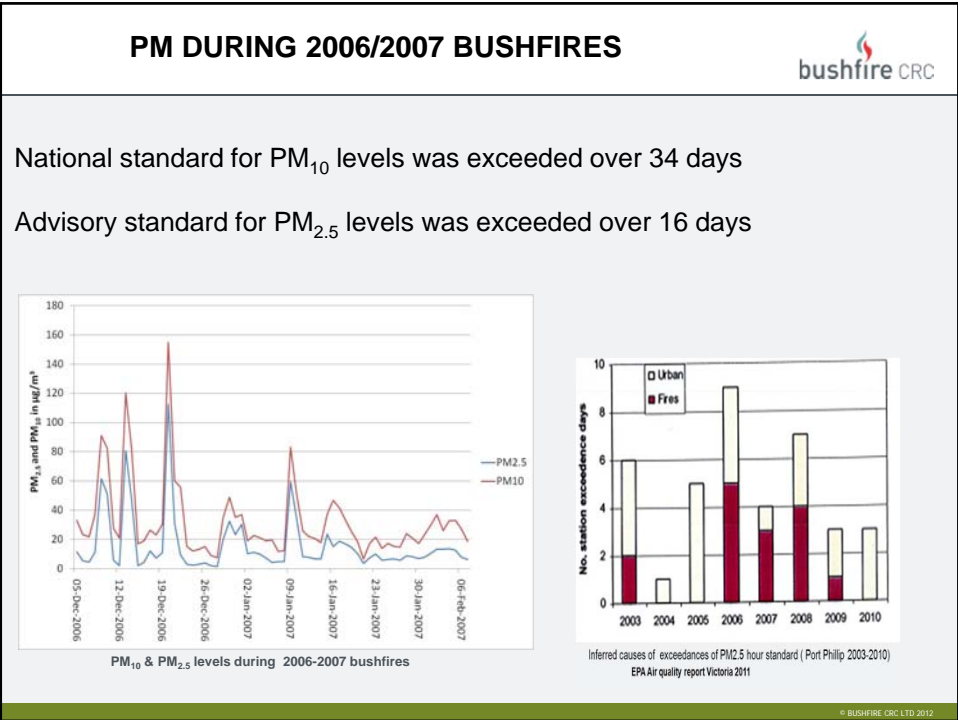
- Large population based epidemiological study
- Data collected retrospectively for the entire state of Victoria
- Health outcome data: Large health registries and hospital databases
- Air exposure data : Air quality models


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2006/2007 VICTORIAN BUSHFIRES WHY THIS PERIOD?



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DATA SOURCES

Health Outcome Data

Department of Health

VAED (Admission episodes)

VEMD (Emergency attendance)

Ambulance Victoria



VACAR (Out of hospital cardiac arrest: cardiac etiology)

De identified data has been received (event code, postcode, date of the event, gender, age etc.)


ICD-10 AM code

Cardiovascular Disease

Respiratory Disease

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Melbourne : 2006-2007 Bushfires. Out of hospital cardiac arrest

Association between daily air pollutant concentrations and out-of-hospital cardiac arrests: Percent increases of risk associated with an interquartile range

	%	95% CI	IQR
PM10	6.58	.42, 13.11	11.67µg/m ³
PM_{2.5}	4.51	.48, 8.70	6.01µg/m ³

Dennekamp M et al 2011

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STUDY DESIGN AND ANALYSIS



A time stratified *case cross over study design* will be used adjusted for temperature and humidity.

Time stratified into months and day of week. Reference days - the same day of week within the same month. → Elimination of confounding by day of week and monthly trends, elimination of selection bias

Association between health outcomes and PM levels analysed using conditional logistic regression models

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DESCRIPTIVE ANALYSIS

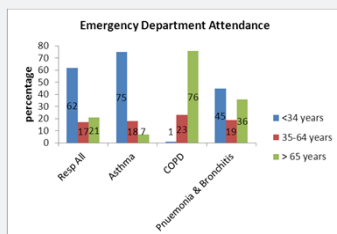
VEMD



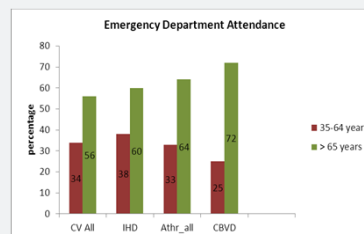
Percentage of emergency department attendance for cardiorespiratory condition Victoria (January 2006-December 2007)

Of all the ED attendances for CR conditions **65%** diagnosed as having a respiratory disease and **35%** as having a cardiovascular disease

Of all the ED attendances for CR conditions **53%** were males and **47%** females



Percentage of ED attendance by age group for Resp condition



Percentage of ED attendance by age group for CV condition

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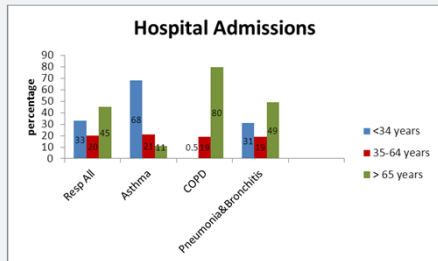
DESCRIPTIVE ANALYSIS VAED



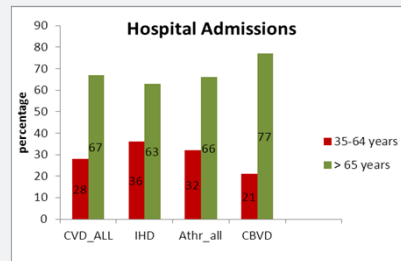
Percentage of Hospital admissions for cardiorespiratory(CR) conditions Victoria (January 2006-December 2007)

Of all the hospital admissions for CR conditions **47%** diagnosed as having a respiratory disease and **53%** as having a cardiovascular disease

Of all the hospital admissions for CR conditions **54%** were males and **46%** females



Percentage of hospital admission by age group and resp condition



Percentage of hospital admission by age group and CV condition

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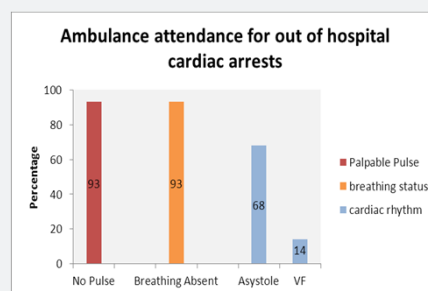
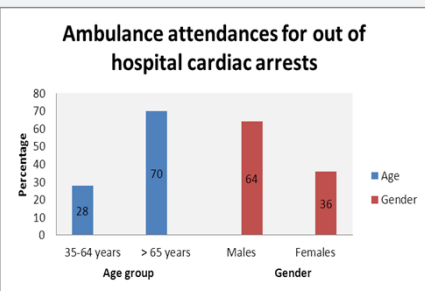
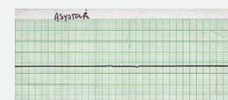
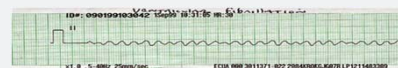
DESCRIPTIVE ANALYSIS VACAR



Percentage of ambulance attendances for out of hospital cardiac arrests Victoria (January 2006-December 2007)

There were **6356** ambulance attendances for cardiac arrests

72% were attended by MAS and 28% were attended by RAV



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SIGNIFICANCE



This study has **major public health** implications:

- It will advance the understanding of the health impacts of smoke from bushfires in the rural and urban communities
- Allow for targeted evidence based advice to the clinicians and policy makers of the measures required to implement appropriate preventive strategies



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ACKNOWLEDGEMENT



Supervisors

Dr Martine Dennekamp
 Professor Michael Abramson
 Professor Malcolm Sim
 Dr Mick Meyer (CMAR)

Bushfire CRC

Dr Richard Thornton
 Ms Lyndsey Wright

CMAR



Dr Martin Cope
 Dr Fabienne Reisen
 Ms Jennifer Powell
 Mr Jason Ward

Centre Data Manager
 Mr Anthony Del Monaco

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