

Climate Change- Battling the conditions in the emergency department

Dr Mark Monaghan MBBS FACEM AFRACMA

Emergency Physician and Medical administrator

Member of Doctors for the Environment Australia

We cannot talk about the microcosm without the macrocosm

- WHO – 'Climate change is the greatest threat to global health in the 21st century'
- It is the poor and vulnerable people, and those at the extremes of age, both at a global level and a local level in our community that are at greatest risk.

The global health impact of climate change - WHO

- Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter, disease patterns, extreme weather events.
- Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress.
- The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between USD 2-4 billion/year by 2030.
- Areas with weak health infrastructure – mostly in developing countries – will be the least able to cope without assistance to prepare and respond.

Climate change and Australia

- Heat – extreme heat, bushfires, infrastructure
- Extreme weather events
- Environmental degradation, including marine
- Water supply
- Air Quality
- Vector borne illness
- Financial cost

Heat

What is a heatwave?

- Three or more days of increased relative average temperature (maximum and minimum) for particular region and time of year.
- For example, a heatwave in metro Perth is defined as 3 days > average temp of 32 deg C per day.
- Excess heat factor (predicted average temp for next 3 days totalled and divided by three) used to initiate heat wave response (see below). This predicted 3 day period is compared to 'normal' temperatures for location and year and the 30 days prior to allow for acclimatisation.

-

BOM Heatwave classification

- Standard- low intensity- generally people and infrastructure cope well.
- Severe- less frequent and pose risk to vulnerable people
- Extreme – rare- dangerous for anyone and are threat to infrastructure
- Calculation to distinguish between them is a calculation based on degree of excess heat factor.

Global heat waves

- 2003- hottest period Europe had experienced since at least 1500 AD
- 70,000 excess deaths attributed to that period.
- 2010- Russian heatwave, 56,000 deaths.
- Europe and North America have all had major heatwaves over the past decade.
- Globally, regions with more heatwave days experience more bushfire activity.
- IPCC project with virtual certainty (99% probability) that heat extremes will increase.

Heat in Australia

- 2017 was worlds hottest year on record. 2018 was third hottest year on record with annual national Temp 1.14 deg. C > average.
- High temperature records have again been broken this year in SE Australia (Adelaide 46.6 deg C on 24 Jan) .
- We have seen a doubling of record breaking summer temperatures and 'hot days' (>35 deg. C) in the past 50 years.
- Since 1950s each decade has been hotter than the previous one.
- The probability of extreme heat in Australia is now about five times greater than 50 years ago.
- Heat waves are longer, hotter and more frequent, with almost all of Australia demonstrating lengthening heat wave seasons. These conditions increase the bush fire risk.

Heat in Australia

- In the last decade, hot weather records have occurred 3 times more frequently than cold
- Prediction is for hot days to increase across globe during 21st century.
- 1 in 20 year extreme hot days are expected to occur every 2-5 years.
- Record breaking hot days will become commonplace, occurring every summer if current trends continue.
- SE Australia stands out at being of increased risk.
- In the past 100 years, heat waves have caused more deaths than the sum of all other natural hazards.

Excellent summary of extreme heat and heat related deaths in Australia

- [Environmental Science & Policy](#)
- [Volume 42](#), October 2014, Pages 33-44
- **Exploring 167 years of vulnerability: An examination of extreme heat events in Australia 1844–2010**
- Author links open overlay panel [Lucinda Coates^{ab}Katharine Haynes^{ab}James O'Brien^{ab}John McAneney^{ab}Felipe Dimerde Oliveira^{ab}](#)

Western Australian heat and Rainfall

- SW WA and Pilbara/ Interior average temperatures increased 1.1 and 1.0 degree respectively between 1910 and 2013.
- Kimberley temperatures have increased in winter (0.9 deg.c) and decreased in summer (increased summer rainfall and cloud cover).
- Southwest rainfall already significantly reduced (approx 20%) and rainfall zones have effectively shifted west by 100kms in some areas.
- In contrast rainfall in Kimberley and Pilbara have increased over past 60 years.

Effects of heat and heat waves

- **Health effects-**
- direct morbidity and mortality (discussed below)
- **Non- directly related health effects (all of which have secondary health impacts)**
- Bushfires
- Infrastructure damage (electricity/transport)
- Decreased work capacity
- Drought exacerbation and decreased productivity / reduced crop yields and livestock productivity

Effect of heat and heat waves

- Marine - (1-2 deg C > average T) -coral bleaching, Ningaloo 2011 (sea surface temps 2-2.5 deg above average), Great Barrier Reef repeatedly.
- Triggering of mass deaths of heat sensitive species- eg 2011 heat waves Carnaby's Black Cockatoos population , SW little penguins breeding success, mass tree deaths in WA's northern Jarrah Forest
- Urban 'heat islands'- loss of city's ability to cool with several days of high average ambient temperatures. Many of our most vulnerable people live in these urban environments without the financial resources to adequately protect themselves

.

Impact of heat on health

- Susceptibility of an individual or a community depends on several factors:
- Acclimatisation
- Age and existing disease burden of the population
- Local environmental factors

How does extreme heat manifest in the Emergency department

- Direct heat related illness- heat stress, renal failure, heat stroke
- Indirect heat related illness- increase in all cause mortality.
- Ambulance and health resource utilisation.

At risk groups

Mortality rates increase markedly during heat waves, mainly in the 'at risk' groups-

- the extremes of age,
- comorbidities esp cardiovascular and respiratory,
- cognitive burden,
- the socially deprived,
- chronic psychiatric burden,
- outdoor workers
- athletes who exercise in extreme temperatures.

Direct heat related illness

- Sunburn, dehydration, pre-renal acute renal failure.
- Heat stress- rising core temperature in an environment where it is difficult to thermoregulate effectively. Non specific symptoms- headache, fatigue, presyncope. Thirst may not be present.
- Heat stroke- 'medical emergency' may be exertional eg athletes, or classic- seen in at risk group as above. >40.5 , denaturation of proteins, multiorgan failure, CNS depression, seizures, death.

Indirect heat related illness

- All cause mortality – increased rate of out of hospital cardiac arrest presentations. Primarily in older patients with comorbidities. (By 2031 one in four Australians will be >65 years of age).
- Individual physiological factors –age, chronic disease, manifest risk in multiple ways:
- Diminished cardiovascular reserve
- Decreased mobility
- Decreased capacity to seek cooler environments or adequate hydration
- Medications-
- anticholinergics, b Blockers, neurolepts, vasodilators/vasoconstrictors, diuretics, lithium act by reduced sweating, altering central thermoregulation, reducing cardiac output, reducing peripheral blood flow, increasing diuresis

Vector Borne illness

- Globally there are examples of disease pattern shift with regional warming, eg:
- Mosquitos:
- Malaria, which requires warm humid conditions with good rainfall, has shifted to highlands of eastern Africa with regional warming.
- Malaria was endemic in northern Australia prior to 1960s. Modelling suggests that climatic conditions are currently suitable for survival of parasite and mosquito vector in very north of continent. With warmer and wetter conditions, the malaria receptive zone could spread to southern Queensland by 2050.(Australian Academy of Science)

Vector borne illness

- Dengue fever: patterns are also predicted to shift.
- *Aedes albopictus* can thrive in urban areas and require similar conditions to malaria. Australia does not have endemic *Aedes albopictus* but does have other *Aedes* mosquitos (eg *A. aegypti*) that can spread dengue virus and causes dengue fever outbreaks in northern Queensland every year.
- Marine- eg. *Irukandji*. Tropical marine species moving into subtropical regions. Jan this year, found in Hervey bay and Fraser island on Queensland coast. In WA they currently reach as far south as Geraldton.
-

Air quality

- Fossil fuel burning generates ground level ozone plus fine particulate matter.
- Lung tissue particularly susceptible, pathophysiology appears to be free radical production and oxidation-cell damage.
- Ozone is linked to reduced lung function and increased respiratory and CVS mortality. This relationship is most prominent during warm seasons and there appears to be a rapid and direct relationship between exposure and sudden cardiac death.
- Bushfires- smoke effect leading to increased presentations with bronchospasm and exacerbations of COPD.

Allergen induced bronchospasm- 'thunderstorm asthma'

- High concentration of pollen stirred up by thunderstorm, absorb moisture and swell, burst into v small allergen granules which reach lower respiratory tract leading to bronchospasm in asthmatic and previously non asthmatic people.
- .
- Victoria Nov 21, 2016- 8,500 people presented to hospital, 8 died.
- health.vic now release an epidemic thunderstorm asthma forecast –grass pollen season (October-December 2019)
- Link with climate change – extreme weather events and increased pollen production in higher CO2 environment

Climate change impact on health system

- Heat impact most but not exclusively concentrated in large urban environments.
- As this situation worsens the demand on already pressured public emergency departments and inpatient beds only increases.
- There is no current strategy for capacity generation to take this into account.
- It is to be managed within business as usual approach.

Extreme heat waves

- **SE Australia 2009-**
- Melbourne had 3 consecutive days >43 deg C, Adelaide had max T's reaching 45.7 deg C.
- Melbourne 374 excess deaths in 1 week, plus 180 'Black Saturday' bushfire deaths with 414 injured.
- Almost threefold increase in patients dead on arrival at EDs

- **Victoria 2014.**
- 167 excess deaths in 4 days (14-17 jan)
- 25% increase in emergency ambulance call outs (new record for calls received in a day)

- In 2009 and 2014:
- 64% and 60% respective increase in ED patients requiring immediate resuscitation.
- 26 and 27% increase in emergency presentations
- 25 and 16% increase in urgent presentations to the ED.
- Increase in overall deaths ranging from 13% to 24% across SE Australia during that period.

- Following 2009, Victoria established a heat health surveillance system.
- Data showed heat related health service activity increased within first 24 hours of an extreme heat event
- And people >65 years were four times more likely to present to an ED with heat related effects compared to other age groups.

WA Heatwaves

- Limited research and therefore data available for WA based health effect of heatwaves
- 2011 paper Williams et al in Environment International demonstrated:
 - An 8.9% increase in mortality seen on heat wave days.
 - Total ED presentations increased by 4.4% and renal related ED presentations by 10.2% per 10 degree C increase in maximum threshold.

What can we do?

Mitigate and Adapt

- Primarily this means effective policy on climate change to reduce greenhouse gas emissions.
- However with current level and predicted warming, we need better adaptation:
- Heatwave warning systems – BOM very active in this area.
- Systematic response to extreme heat to protect the vulnerable
- Urban planning- energy efficient structures, tree cover, green spaces, improved public transport, lower air pollution

WA health heat wave response plan

- Initiated in response to predicted excess heat factor. Triggers are currently being reviewed.
- Identifies roles of various agencies.
- Endeavours to provide and manage communication of health messages to the public before and during a heatwave emergency.
- Has no capacity to increase provision of health care services to cope with demand.

Public health measures during heatwaves

- Public warnings- avoid exposure, maintain hydration, check on your elderly relatives etc
- Limitations on outdoor activities/professions/sporting events.
- Various layers of public services focused on vulnerable people within the local community, welfare checking systems. This includes local health networks and GPs.
- Well coordinated community support systems have been shown to make a difference internationally.

Role of GPs and local health services

- Potential role in:
- identifying at risk patients
- Educate them and their carers re heat illness and prevention
- Pre summer medical assessment for those with chronic disease
- Coordinating with local services to check on patients during extreme heat events.

Nationally

- Matters of prime national importance are domain of the commonwealth.
- There is thusfar no nationally coordinated heat response plan or framework.
- National Climate Resilience and Adaptation strategy 2015 –states:
- ‘Australia is well positioned to meet the challenges of climate change’
- Australia is ‘responding to the health effects of climate change within the overall context of existing health services’
- Also acknowledges there are ‘no national programs specifically targeting the health effects of climate change’.
- None of this is adequate.

- A nationally coordinated framework could provide:
- consistency and best practice sharing across jurisdictions
- Opportunities for research
- Improved funding and long term capacity building.

Final comment- mitigation

- It appears to me that we are at a tipping point from the perspective of public awareness, acceptance that the issue is real, and activism.
- However it is the nature of our political system that our politicians will remain locked to their political survival rather than long term policy to ensure ours.
- Therefore, the only thing that will influence the political conversation is public support for long term good policy on greenhouse gas emissions rather than short term financial arguments.
- I would encourage all of you to watch this u tube link of Greta Thunberg's speech at the UN climate change COP 24 conference: <https://www.youtube.com/watch?v=VFkQSGyeCWg>
-



