

Overview of Climate Change Impact: Public Health Issues

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Discipline of Public Health

Effects of climate change

- Temperature rise
 - Warmer climate
 - More frequent and more severe heatwaves
- Sea level rise
- More severe weather events
 - Floods
 - Storms
- Droughts
- Air pollution
 - dust, bushfires



Health effects of climate change

Direct effects

- Heat stress
 - increase in hospital admissions and ED visits
 - increase in mortalities
 - increase in ambulance callouts
- Skin cancer, eye cataracts
- Cardiovascular disease
- Renal disease
- Mental illness

Indirect effects

- Deaths related to flooding
- Respiratory and cardiovascular conditions due to air pollution
- Many infectious diseases are known to be sensitive to changes in climatic conditions
 - foodborne
 - waterborne
 - vector-borne diseases

Effects of heat

- During extreme heat the body tries to maintain normal temperature
 - This can exacerbate previous chronic conditions
- Failure to thermoregulate can lead to
 - Heat stress
 - Hyperthermia, dehydration
 - Heat exhaustion
 - Heat stroke → multi-organ failure → death
- Vulnerable subpopulations:
 - Elderly
 - Very young
 - Socio-economically disadvantaged
 - Persons
 - With chronic illnesses
 - With poor mental health
 - Living in social isolation



Nitschke M, Tucker G, Bi P. Morbidity and mortality during heatwaves in metropolitan Adelaide. *Medical Journal of Australia* 2007; 187 (11/12): 662-665

Effects of heat on renal disease

- Background
 - Exposure to extreme heat can lead to dehydration, placing strain on kidneys and renal system. Persons with diabetes at risk.
- Aim
 - To determine if heatwaves are associated with an increase in renal admissions
- Method
 - Study period: 1 Jan 1995 – 31 Dec 2006
 - Hospital admissions data from the SA Department of Health
 - Renal disease, acute renal failure, dialysis admissions
 - Comorbidities: diabetes, exposure to heat, effects of heat
 - Regression analysis used to compare daily counts of admissions during heatwaves (≥ 3 days when max temp $\geq 35^{\circ}\text{C}$) compared to non-heatwave periods

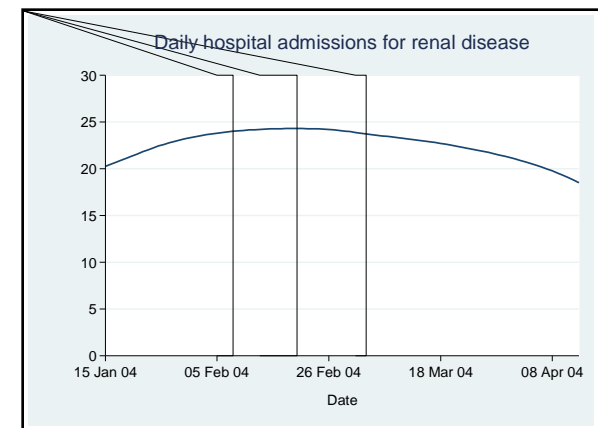
Effects of heat on renal disease - Results

- During heatwaves

- Renal disease admissions increased by 10%
- Acute renal failure admissions increased by 25.5%
- Almost 11-fold increase in renal admissions for persons with co-existing effects of heat
- No increase in renal admissions for persons with diabetes
- No increase in dialysis admissions

- Conclusion

- Our results suggest the burden of renal morbidity may increase as periods of hot weather become frequent



Hansen A, Bi P, Ryan P, Nitschke M, Pisaniello D, Tucker G. The Effect of Heatwaves on Hospital Admissions for Renal Disease in a Temperate City of Australia. *International Journal of Epidemiology* 2008; 37:1359-65

Effects of heat on mental health

- Background
 - Persons with poor mental health are susceptible to extreme heat
 - Physiological and behavioral reasons
 - Medications that interfere with thermoregulation
- Aim
 - To determine if hospital admissions and mortalities for mental and cognitive disorders increase during heatwaves
- Method
 - Study period 1 July 1993 to 30 June 2006
 - Hospital admission and mortality data for a range of mental, behavioural and cognitive disorders from SA Dept of Health
 - Regression models used for analysis as in previous studies

Effects of heat on mental health - Results

- During heatwaves compared to non-heatwaves periods there were increases in
 - Hospital admissions for persons with
 - **All mental and behavioural disorders**
 - **Organic, symptomatic disorders**
 - **Mood disorders**
 - **Stress related disorders**
 - **Disorders of psychological development**
 - **Dementia**
 - **Senility**
 - Deaths for persons with
 - **All mental and behavioural disorders (aged 65-74 years)**
 - **Dementia (early onset)**
 - **Disorders due to psychoactive substance use (females)**
 - **Schizophrenia and delusional disorders**
- Conclusion
 - Warmer weather may pose a risk for those with mental illnesses

Hansen A, Bi P, Ryan P, Nitschke M, Pisaniello D, Tucker G. The effect of heat waves on mental health in a temperate Australian City *Environmental Health Perspectives* 2008; 116 (10):1369-

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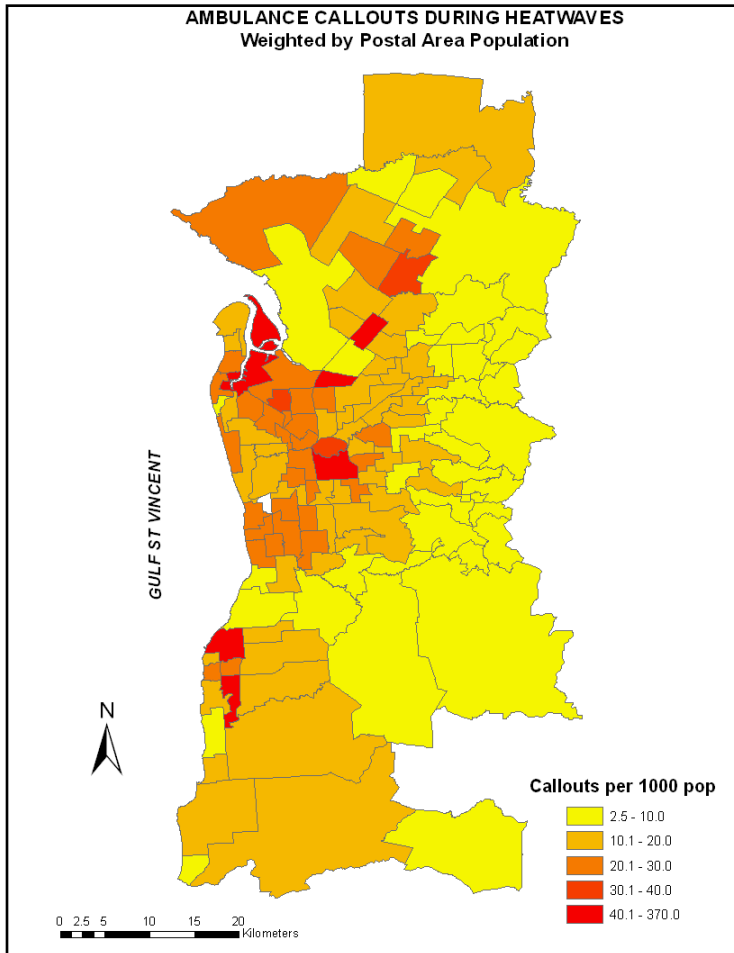
Ambulance callouts

- Aim
 - to identify heat-sensitive areas of Adelaide
- Method:
 - Study period
 - 1 July 1993 to 30 June 2005
 - Details of ambulance callouts in metropolitan Adelaide obtained from SA Department of Health
 - Meteorological data - Bureau of Meteorology
 - Callouts during heatwave periods compared to non-heatwave periods using regression models as in previous studies and mapping techniques

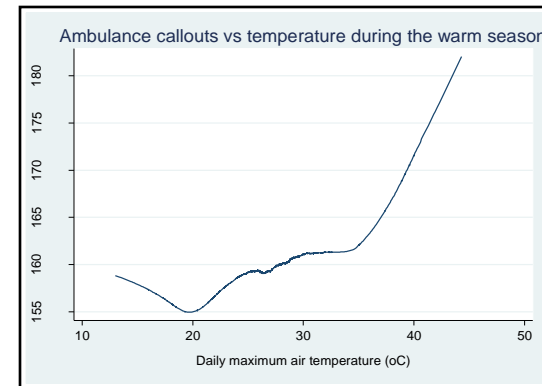


Ambulance callouts - Results

Areas with most callouts during heatwaves



3.6% increase in ambulance callouts during heatwaves compared to non-heatwave periods



Areas with highest risks (hw to non-h/w)

- Angle Pk, Mansfield Pk
- Pt Adelaide, Birkenhead
- Colonel Light Gdns, Daw Pk
- Gawler
- Glenelg

Foodborne disease

- Threat of diarrhoeal diseases increases as weather gets warmer
- Incidence of foodborne diseases significantly increases in summer
- Estimated that there could be an additional 179,000 cases of food-poisoning by 2050 as a result of climate change if adaptive measures not taken

Pittock B. 2003. Climate change. An Australian guide to the science and potential. Australian Greenhouse Office, Canberra

- Microbial contamination can arise during processing, handling, storage or cooking of food
- Examples:
 - *Salmonella*
 - *Campylobacter*
 - *Shigella*



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Foodborne disease

- **Climate change may affect foodborne diseases:**
 - **Rise in temperature increases proliferation rate of microorganisms**
 - **Temperature danger zone 5°C to 60°C**
 - **Our recent study has shown that temperature and rainfall affect the transmission of Salmonella and Campylobacter infections**

Zhang Y, Bi P, Hiller J. 2008. Climate variations and salmonellosis transmission in Adelaide, South Australia: a comparison between regression models. *Int J Biometeorol* 52:179-87.

Bi P, Cameron AS, Zhang Y, Parton KA. Weather and notified *Campylobacter* infections in temperate and sub-tropical regions of Australia: An ecological study. *Journal of Infection* 2008, 57(4):317-23

- **Implications for food production, handling and storage**

Vector-borne diseases



- **Spread by vectors**
 - Flies, ticks, cockroaches, mites, water-snails, mosquitoes
 - Change in temp or rainfall patterns can affect transmission patterns
- **Viruses**
 - Yellow fever
 - West Nile virus
 - Hantavirus
 - Dengue fever *
 - Ross River Virus *
 - Murray Valley Encephalitis *
- **Bacteria**
 - Plague
 - Lyme disease
- **Protozoa**
 - Malaria
- **Helminths (worms)**
 - Lymphatic filariasis
 - Onchocerciasis

* Most relevant to Australia

Ross River Virus

- Australia's most prevalent vector-borne disease
- Widely distributed
- Causes fever, rash, sore joints, fatigue
- No treatment, can linger for years
- Significant public health issue in Australia
- Animal reservoir (kangaroos, wallabies)
 - More than 30 mosquito vectors
- Rainfall, temperature and tidal levels are environmental determinants in the transmission cycles: A potential 1°C increase in maximum or minimum temperature may cause 18% RRV cases in the temperate region

Bi P, Hiller J, Cameron S, Zhang Y. Climate variability and Ross River infections in the Riverland, South Australia, 1992-2004. *Epidemiology*

Infection, 2009: in press

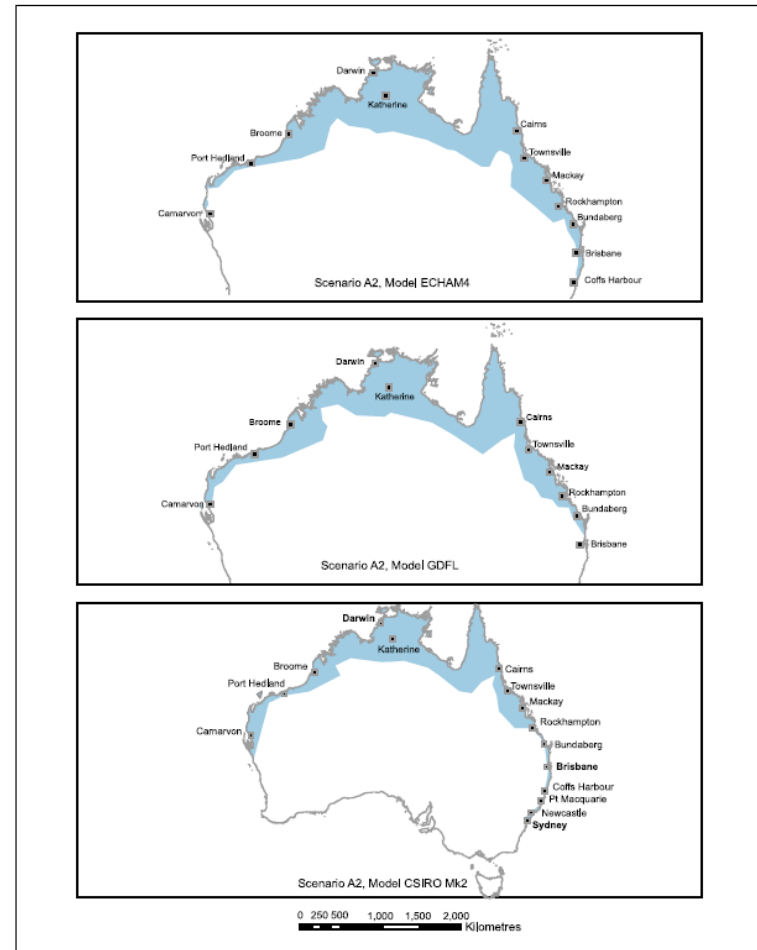
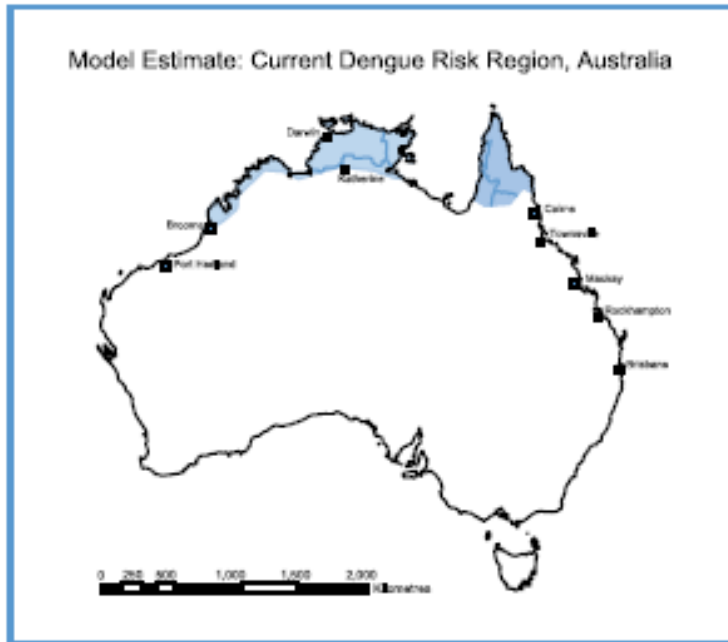


Dengue fever

- Estimated 2.5 billion people live in areas at risk for transmission
- In Australia, epidemics occur in northern Qld during summer
- Weather a major determinant of incidence
 - Climate change will increase geographic area for mosquito breeding exposing more people to risk of infection
- Prevention strategies may curb an increase in incidence

Dengue fever

Regions suitable for transmission: 2002 and 2100



Woodruff R, Hales S, Butler C, McMichael A. 2007. Climate change health impacts in Australia. Effects of dramatic CO₂ emission reductions.. Available: http://www.acfonline.org.au/uploads/res/res_ama_acf_full_report.pdf Accessed 2 April 2008

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Heatwaves and ageing population

What are the causes of heat related morbidity and mortality

- Lifestyle of older people,
- Isolation,
- Lack of knowledge about heat waves,
- The anxiety of home invasion,
- Water shortages, and
- High costs for living (such as high power bills) and public health (such as ambulance transport).

What is major problem?

- Four of the nine stakeholders mentioned the overload on hospitals and a drain on capacity of electricity service during heatwaves as the major problem during heatwaves
- Others mentioned lifestyle of patients, lack of leadership, high costs of living (such as high electricity bills), isolation, lack of knowledge among elderly people, and poverty as the major problem during heat waves.

What can stakeholders do?

Stakeholders all agree that an education campaign (through media) should be set up to educate the elderly population about the health risks/effects of heat waves

van Iersel R, Bi P. The impact of heatwaves on the elderly living in SA: How should a Heat Health Warning System be developed to protect them? The Rangeland Journal, 2009 in press

Increased services in 2009 Heatwaves

- Hospitals
 - Average of 2,370 beds in use each day (173 above the winter average)
- Extended Care Paramedic Pilot Program
 - 112 admission averted from 208 patients attended
- 13,533 clients called/attended by HSS Metro Homelink
 - 16 Ambulance calls
 - 5 Police calls
 - 214 Emergency Response Pt Management
 - 178 Additional road team visits
 - 1724 Escalation Action Resolved
- RDNS
 - 2777 calls to clients
 - 148 visits
 - 59 > hospital
 - 6 deceased (cause yet to be determined)