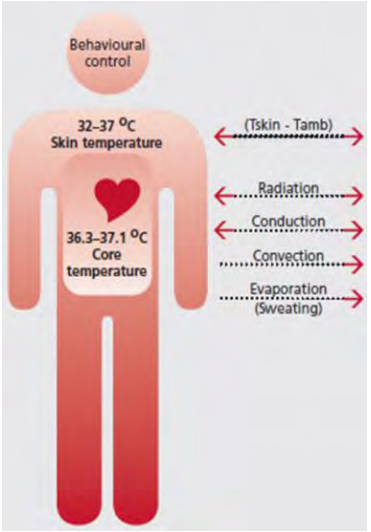
Dr Alana Hansen

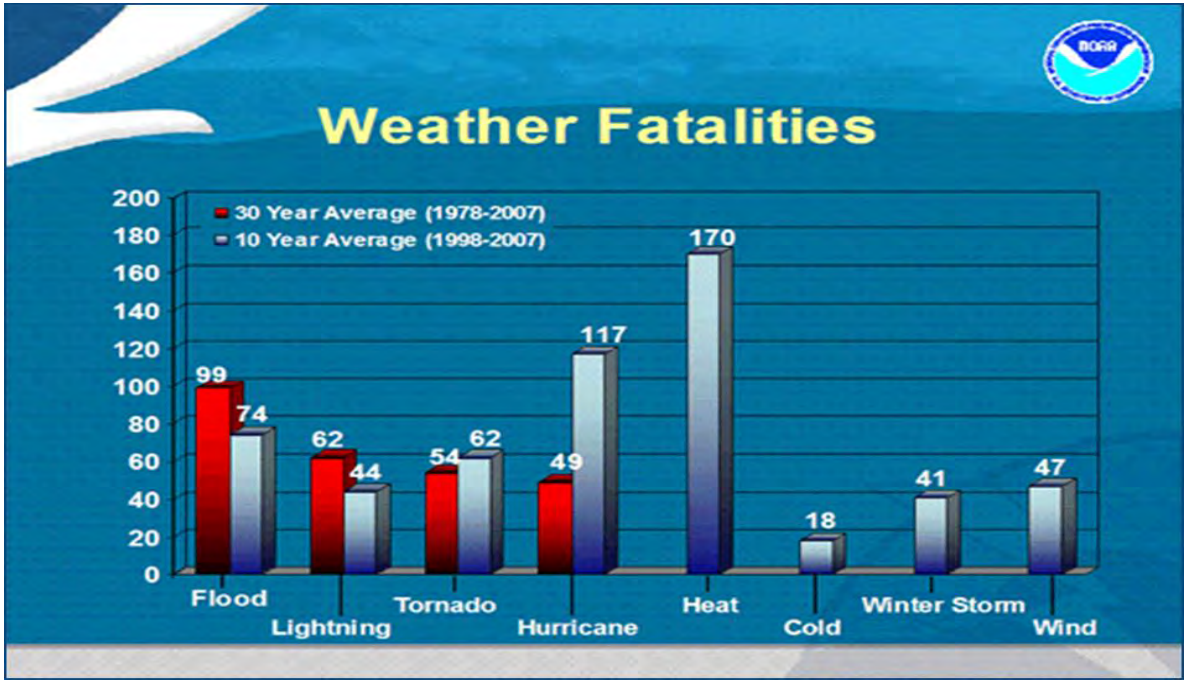
Too hot to handle - Working safely in hot conditions

Background



- The body *gains* heat from the environment, and internally generates heat from metabolic activity
- Body temperature remains stable if we *lose* heat accordingly
- This is due to *physiological* thermoregulation
  - Radiation, convection, conduction, evaporation of sweat
- Also *behavioural* thermoregulation
  - Protective mechanisms
  - E.g. seeking shade, reducing physical activities
- Failure to adequately thermoregulate when temperatures are high can lead to the onset of heat-related conditions

Heat kills more people than any other weather-related hazard



Office of Climate Water and Weather Services http://www.nws.noaa.gov/om/hazstats.shtml

(1) Our research on heatwaves in SA

Published SA evidence

Nitschke M, Tucker G, Bi P. *Morbidity and mortality during heatwaves in metropolitan Adelaide*. Med J Aust. 187[11/12], 662-665. 2007.

Hansen AL, Bi P, Ryan P, Nitschke M, Pisaniello D, Tucker G. *The effect of heat waves on hospital admissions for renal disease in a temperate city of Australia*. Int J Epidemiol 2008.

Hansen AL, Bi P, Nitschke M, Ryan P, Pisaniello DL, Tucker G. *The Effect of heat waves on mental health in a temperate Australian City*. Environ Health Perspect 116, 1369-1375. 2008.

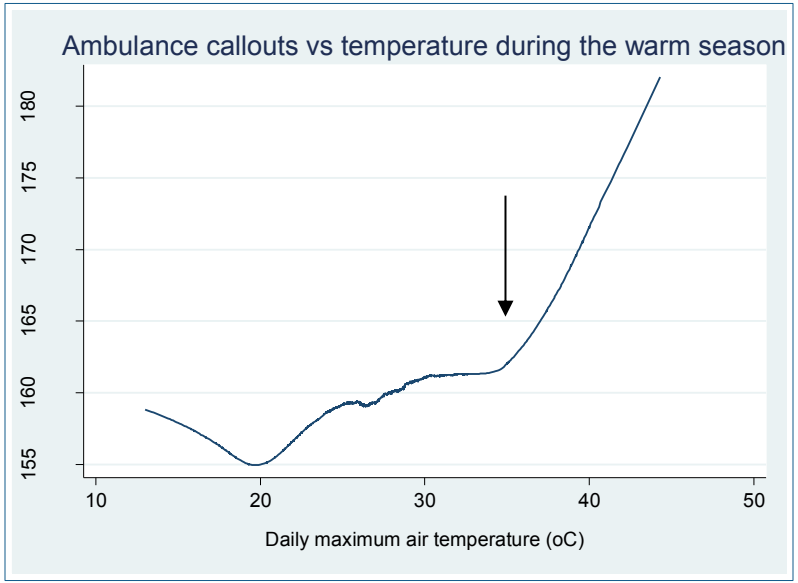
"Heatwaves" = 35°c for ≥ 3 consecutive days

Metro Adelaide

- Increase in ambulance call-outs 4% (6 extra cases daily)
- Increase in daily hospital admissions 7% (86)
  - Mental disorders 7%
  - Renal disorders 13%
  - Ischemic heart disease 8% (65-74 years old)
- Increase in emergency admissions 4% (38)
  - Mental disorders 6%
- No overall increase in mortality
  - But increase in mental disorder related mortality 2.6 times

Source: Dr. Monika Nitschke, SA Health

(2) Ambulance callouts during heatwaves 1993-2005



Suburb	IRR*	
Adelaide CBD	1.0[illegible]	0.99-1.31
Mansfield Park	1.23	
Port Adelaide	1.21	1.04-1.40
Panorama	1.20	1.05-1.37
Glenelg	1.10	1.00-1.21
Gawler	1.14	1.01-1.29

Work–related ↑ >3x;

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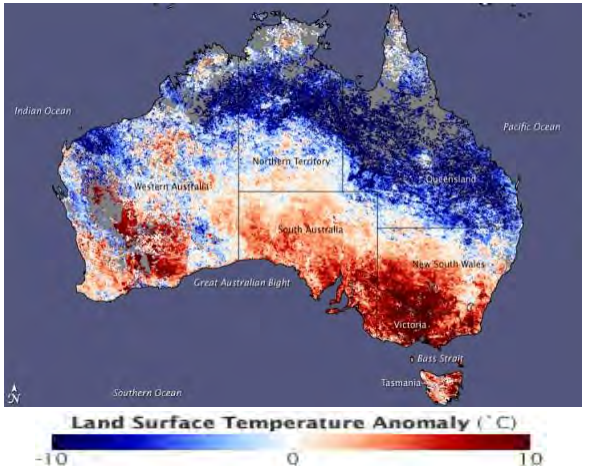
(3) 2008/2009 heatwaves in SA

- We found direct heat-related hospital admissions increased:
  - 3-fold in 2008
  - 14-fold in 2009
- There was increased mortality in **15-64** year age group in 2009
- Ambulance callouts increased by:
  - 10% in 2008 heatwave
  - 16% in 2009 heatwave
    - 37% in **15-64** year age group



Workplace heat exposure

Can affect:

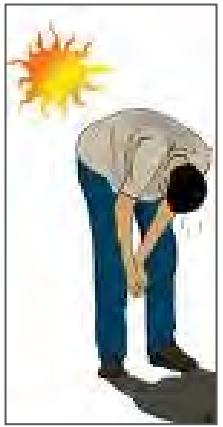
- Indoor workers
  - Foundries, furnaces, factories, welding, confined spaces etc.
- Outdoor workers
  - Agriculture, construction, road workers, emergency services etc.

Due to:

- High heat exposure
- Personal protective equipment
- Physical work

Potential health impacts of heat exposure on workers

- Heat-related illnesses can occur when over exposed to heat, or due to overexertion in hot conditions
  - Dehydration
  - Heat cramps
  - Heat oedema
  - Heat exhaustion
  - Heat stroke (can be fatal)
  - Exacerbation of existing chronic conditions
- Heat-related injuries



Why can injuries occur in hot conditions?

- A loss of concentration and decreased perceptual motor skills may be associated with increased incidence of workplace injuries in the heat:
  - Loss of grip due to sweating
  - Slips
  - Contact with hot surfaces
  - Impaired judgement due to heat fatigue
- Injuries can be in addition (or secondary) to heat induced illness
- The effects can be more prevalent amongst young workers, possibly due to:
  - Physically strenuous tasks
  - Lack of skill and experience

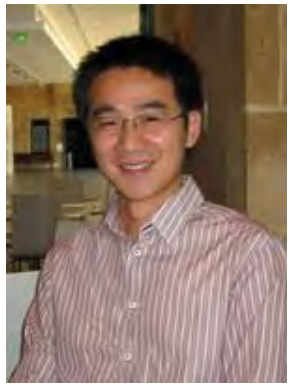
(4) Effects of heat on occupational injuries

Aims:

- To investigate the association between ambient temperature and work-related injuries
- To identify groups of workers at high risk

Methods:

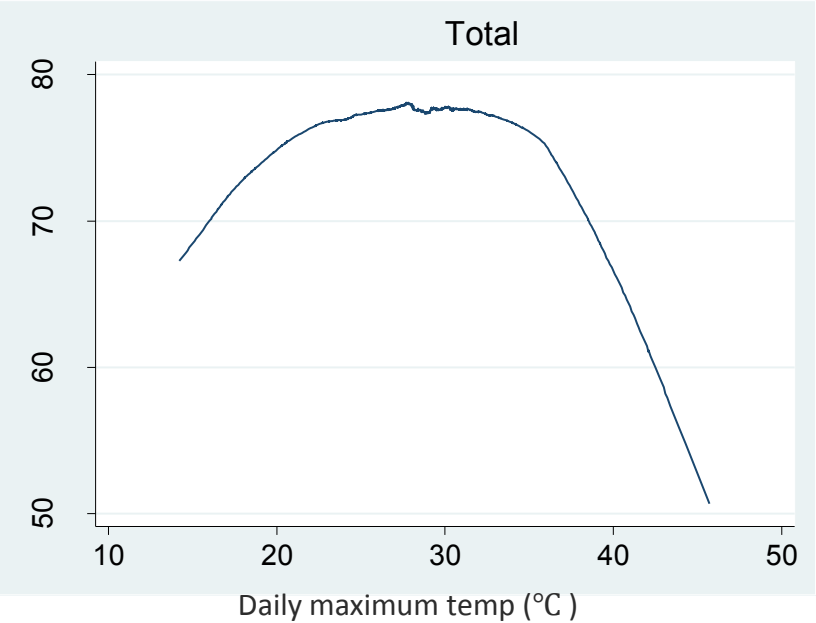
- SafeWork SA worker's compensation claim data 2001-10 and weather data from Bureau of Meteorology
- Time series analysis



Dr Jianjun Xiang

Results

The association between maximum temperature and total work-related injuries in Adelaide, SA, 2001-2010



- A reversed U-shaped exposure-response relationship
- 1 degree increase in temperature was associated with 0.2% increase work-related injuries
- Decline when temperature above 37.7℃
  - Due to prevention measures in place

Results

- More likely to make a claim in the heat are:
  - Males
  - Young workers (<=24 years)
  - Medium and small businesses (<200 employees)
- Industries:
  - Agriculture, forestry and fishing
  - Construction
  - Electricity, gas and water
- Occupations:
  - Intermediate production and transport workers
  - Labourers
  - Tradespersons

(5) Heatwaves (3+ days ≥ 35°C) and WHS

- For **total** claims there was no significant difference between heatwave and non-heatwave periods
- For **outdoor industries**, daily claims increased by 6.2% during heatwaves
  - Male labourers, tradespersons aged ≥ 55 years
- Types of injuries that increased:
  - 'Burns'
  - 'Wounds, lacerations, and amputations'
  - 'Heat stress'
- Mechanism of injury:
  - Increases in:
    - 'Hit by moving objects'
    - 'Chemicals and other substances'
    - 'Heat, electricity and other environmental factors'

(6) Survey at AIOH conference 2012

180 AIOH conference attendees' responses to survey questions

- **In your experience have workers ever expressed concern about heat in your workplace during very hot weather?**
  - Yes (91%)
- **Do you know of any organisations planning for increased frequency of extremely hot weather events?**
  - No (81%)
- **What do you foresee as potential barriers for the prevention of heat stress in workplaces?**
  - Lack of awareness (68%)
  - Lack of training (56%)
  - Lack of management commitment (52%)
  - Low compliance and implementation of heat stress prevention programs (40%)
  - Lack of financial resources (37%)
  - Lack of specific heat-related guidelines and regulations (37%)

(7) Workers' perceptions of heat exposure

Methods

- 1,471 questionnaires were distributed amongst workers and trades apprentices
  - 749 were returned

Results

- 51.2% of respondents were concerned about workplace heat exposure
- 43.4% claimed they had received heat-related training
- The most common heat prevention measure was the provision of cool drinking water
- 51.4% of respondents were satisfied with the current heat prevention measures
- 63.8% said that there should be more heat-related regulations and guidelines for working during very hot weather

(8) Perceptions of Council workers - a qualitative study

Methods

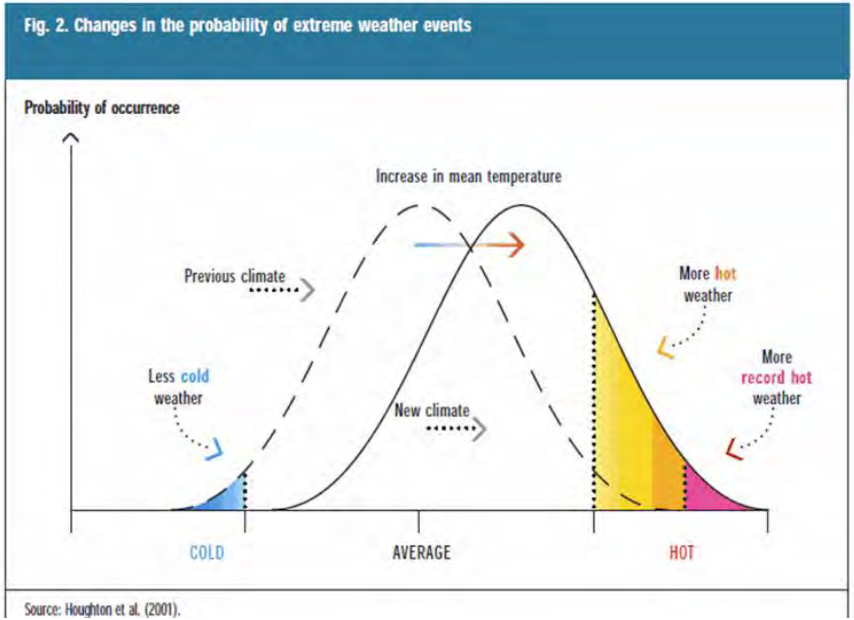
- 32 workers aged 27-67 years from a suburban council participated in 5 focus groups
- Thematic analysis

Results

- Even in a well regulated and safety conscious environment, workers are impacted by the heat in various ways:
  - health, work, tools, environment, loss of productivity
- Important factors:
  - workplace management, training, acclimatisation for workers, ability to self-pace

Why is this research important?

Temperatures are projected to increase by 0.4-1.3^{o}C by 2030; 0.8-4^{o}C by 2070.

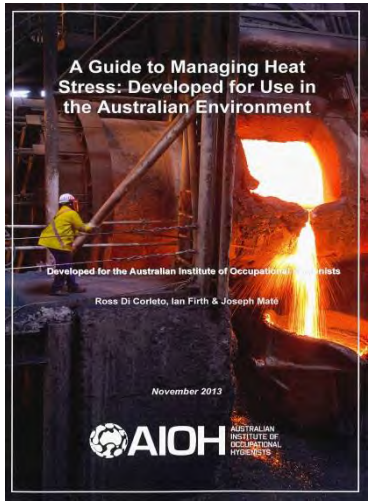


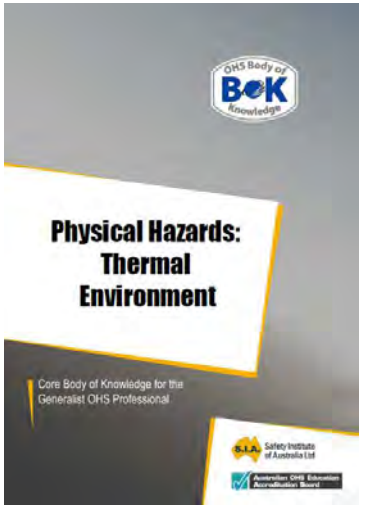
- Predicted that by 2070 “for un-acclimatised people, outdoor activity will not be possible on 33–45 days per year, compared to 4–6 days per year at present.”
- “For acclimatised people”… ‘manual labour will be dangerous to perform on 15–26 days per year compared to 1 day per year at present.”

Maloney SK & Forbes CF. 2011. *Int J Biometeorol* 55:147-160

Heat stress management practices

- Prevention:
  - Training and hazard awareness programs
  - Sufficient rest periods and ability to self-pace
  - Changed work schedule arrangements
  - Provision of cool micro-environments
  - Increased air movement
  - Acclimatisation
  - **Adequate hydration**
- Influencing factors:
  - Physical activity
  - Health & fitness, pre-existing conditions, age, medications
  - Clothing





Heat stress indices

Designed to measure the thermophysical effects of the environment

Examples include:

- Temperature
  - Maximum temperature
  - Apparent temperature/Humidex
- Wet Bulb Globe Temperature (WBGT)
- Predicted Heat Strain
- Thermal Work Limit
- Universal Thermal Climate Index
- Basic Thermal Risk Assessment (AIOH)
  - Thermal risk app

EuroWEATHER - Heat and discomfort index

HEAT AND DISCOMFORT INDEX

HUMIDEX INDEX OF APPARENT TEMPERATURE (degree C)

	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
42°	48	50	52	55	57	59	62	64	66	68	71	73	75	77	80	82
41°	46	48	51	53	55	57	60	61	64	66	68	70	72	74	76	78
40°	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75
39°	43	45	47	49	51	53	55	57	59	61	63	65	66	68	70	72
38°	42	44	45	47	49	51	53	55	56	58	60	62	64	66	67	69
37°	40	42	44	45	47	49	51	52	54	56	58	59	61	63	65	66
36°	39	40	42	44	45	47	49	50	52	54	55	57	59	60	62	63
35°	37	39	40	42	44	45	47	48	50	51	53	54	56	58	59	61
34°	36	37	39	40	42	43	45	46	48	49	51	52	54	55	57	58
33°	34	36	37	39	40	41	43	44	46	47	48	50	51	53	54	55
32°	33	34	36	37	38	40	41	42	44	45	46	48	49	50	52	53
31°	32	33	34	35	37	38	39	40	42	43	44	45	47	48	49	50
30°	30	32	33	34	35	36	37	39	40	41	42	43	45	46	47	48
29°	29	30	31	32	33	35	36	37	38	39	40	41	42	43	45	46
28°	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
27°	27	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
26°	26	26	27	28	29	30	31	32	33	34	34	35	36	37	38	39
25°	25	25	26	27	27	28	29	30	31	32	33	34	34	35	36	37
24°	24	24	24	25	26	27	28	28	29	30	31	32	33	33	34	35
23°	23	23	23	24	25	25	26	27	28	28	29	30	31	32	32	33
22°	22	22	22	22	23	24	25	25	26	27	27	28	29	30	30	31

Up to 29 C°	No discomfort
From 30 to 34 C°	Slight discomfort sensation
From 35 to 39 C°	Strong discomfort. Caution: limit the heaviest physical activities
From 40 to 45 C°	Strong indisposition sensation. Danger: avoid efforts
From 46 to 53 C°	Serious danger: stop all physical activities
Over 54 C°	Death danger: imminent heatstroke

Figure A modern wet bulb globe temperature (WBGT) instrument

Conclusion

- Our research supports international findings that heat can be a WHS hazard
- Can create potentially serious health effects for workers:
  - Injuries, exacerbation of health conditions, heat-related illnesses
    - Some sub-groups more at risk
- Food 4 Thought:
  - October is National Safe Work Month 2015
  - Summer is fast approaching
  - Need to strengthen awareness of heat as a WHS risk
  - Particularly with climate change predictions of warmer summers

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