The Importance of 'Place'

Victorian Climate Change Adaptation Program

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Overview

- 2 main aspects climate change
  - Heatwaves
  - Increase in average temperature and climate variability
  - What can we learn from others?
- Adaptation baseline
  - Threshold temperature
  - Measures of place
    - Health measures
    - Socioeconomic status

Heatwaves

- Definition (no formal definition).
  - BoM “prolonged period of excessive heat”
  - Largest cause of mortality from a natural hazard in Australia
  - Passive threat - unlike floods or cyclones (deaths often under reported as heat related)
- Examples from Europe and US
  - Australia smaller numbers
    - Brisbane 2000 **22** deaths **350** hospitalisations
      - 2001 **287** people hospitalised 2 days
      - 2004 **12** deaths **221** n hospitalisations
    - Sydney 2003 **15** excess deaths per 100,000 people 3 days
    - Adelaide 1997 **10** deaths, **250** hospitalisations Adelaide 2008 (will this be bigger?)
- Place specific
  - Features of the natural and built environments affect heat loads
  - Demography and underlying health status of resident population.
- One size fits all rule does NOT apply

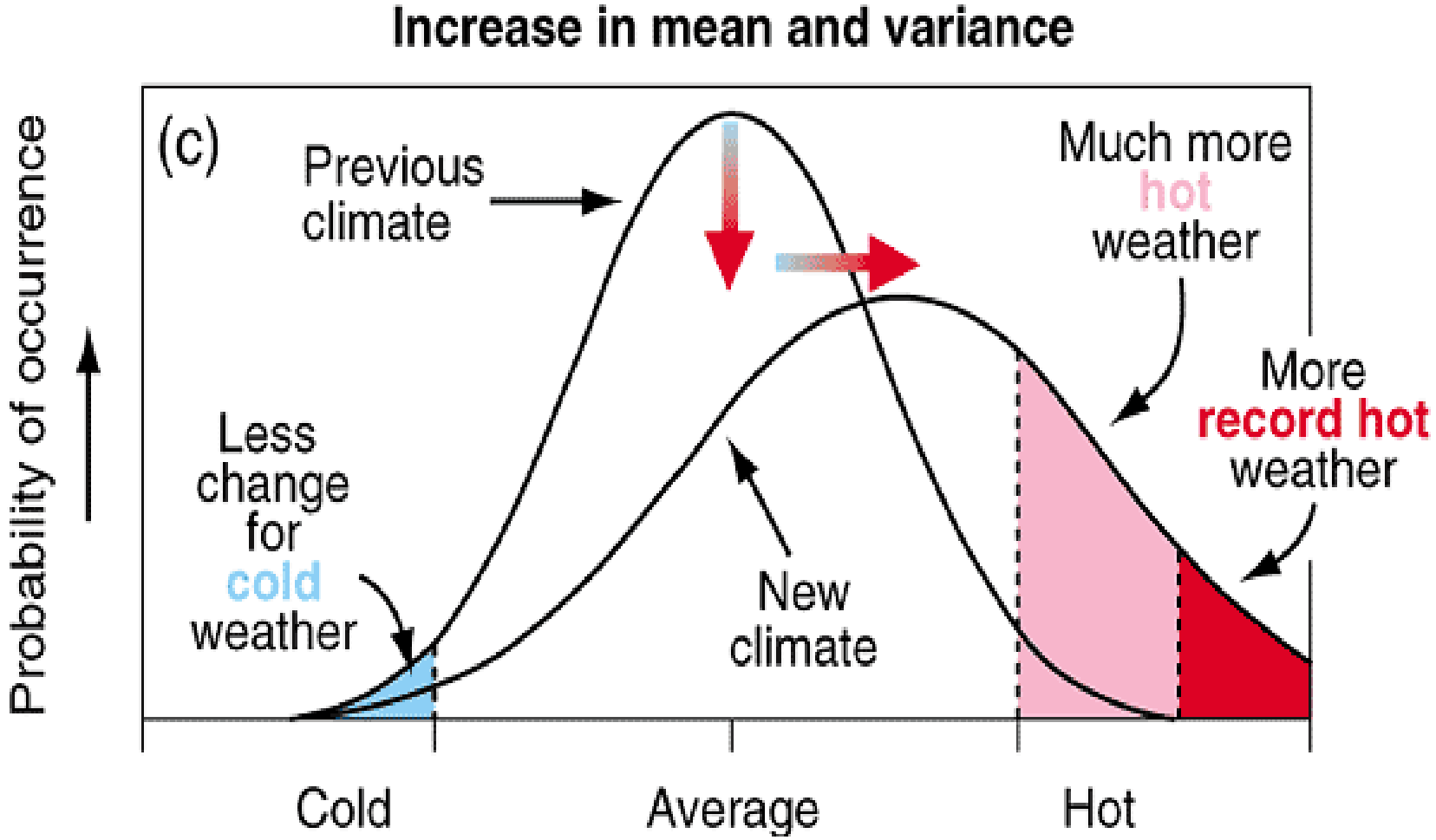
Media Representation Natural Hazards

heatwaves

tsunami

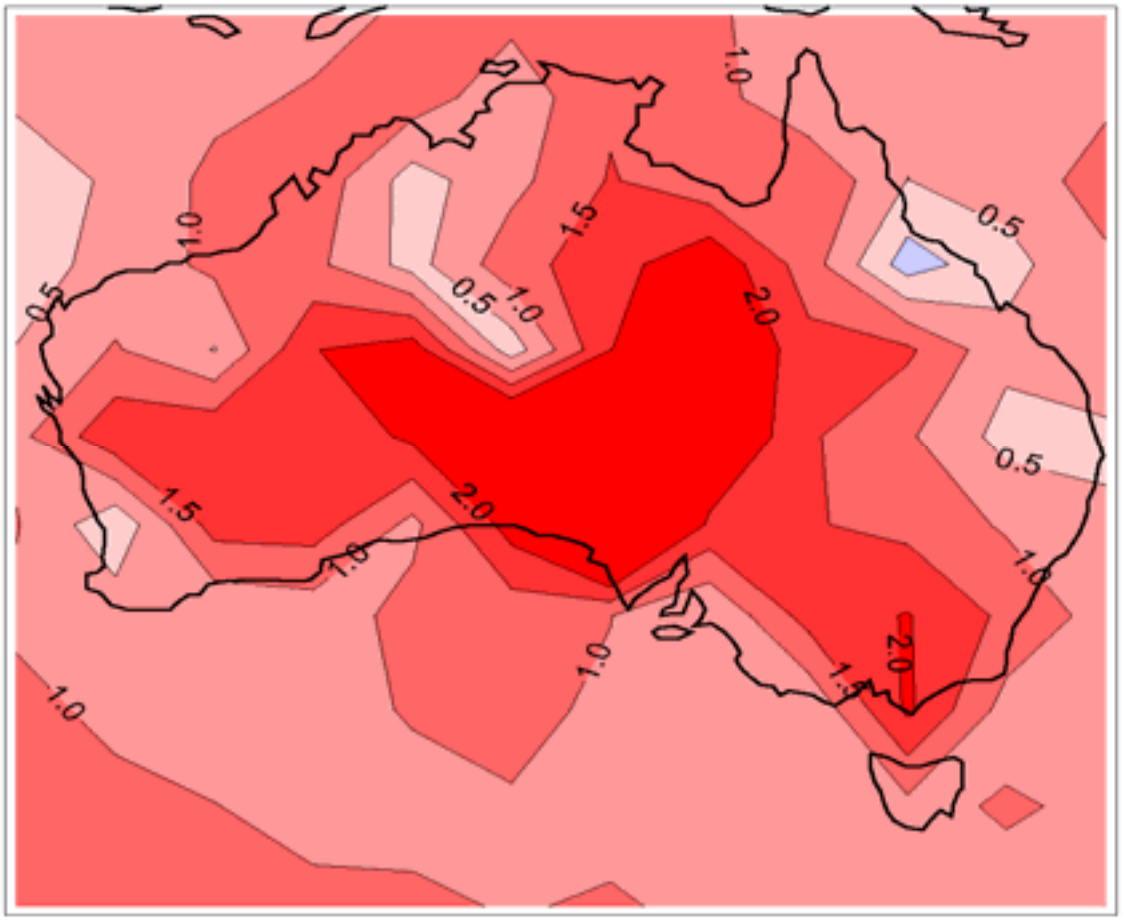
earthquake

cyclone



Changing extremes

Run length days of heat waves



Tryhorn and Risbey, 2006

Increased temperature and climate variability

- Less well defined at a regional level.
- Australia
  - South-eastern Australia
    - Increase in average temperature of 1.4^{o} – 5^{o} C
    - Increase in days <30^{o}C
      - Currently Wodonga – 67 days/year – 81 days/year by 2070
    - Increase in days <35^{o}C
      - Currently Wodonga - 19 days/year – 27 days/year 2070
- Heatwaves are extremes
  - evidence suggests increased mortality and morbidity occurs at more modest temperature that occur more frequently.
- Intensification of Urban heat islands
  - Socioeconomic circumstance and vulnerability

Heatwaves - What can we learn?

- **Effects** – France 2003
  - Most heat related deaths are preventable deaths
    - Mortality displacement (harvesting) = immediate
  - Environments
  - Vulnerable population
    - Elderly
    - Chronic disease
- What do we need to know?
- Threshold temperatures
  - Calculation
  - Applications of thresholds
  - Threshold temperature and inequality
    - Indexes (SEIFA)

- Identifying risk factors is an important public health priority
- France 2003
  - Contextual and compositional aspects of ‘place’
    - Health
    - Social factors
    - Housing conditions
    - Behavioural factors
    - Environmental factors
- Most deaths amongst community dwelling elderly
  - those living own homes
    - Alone or with others
- Cardiovascular (CVD) related deaths accounted for many of the cases (37%).

- Odds Ratio (OR)
- Health
  - Lack of mobility strongly associated with death (limited mobility OR 3.2 – confined to bed OR 7.5)
  - As were pre-existing medical conditions
    - Mental disorder OR 5.8 (Adelaide study)
    - Neurological disease OR 4.6
    - CVD OR 3.1
    - Cancer OR 2.7
    - Liver disease OR 2.0

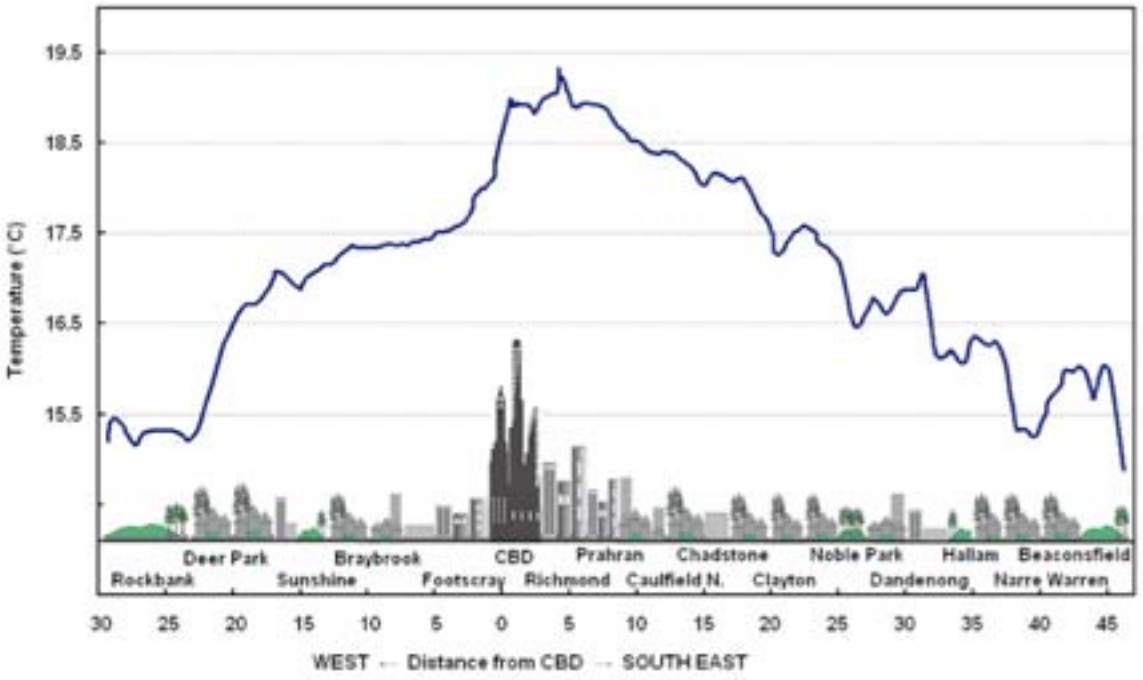
- Social factors
  - Lower social status was main risk factor
  - Social isolation OR 6.1
  - Occupation - highest manual workers OR 2.9
  - Use of ‘home help’ OR 3.8
  - Frequency of bathing
    - Once per day OR 3.1
    - Every second day OR 12.0
    - Once per week OR 15.6

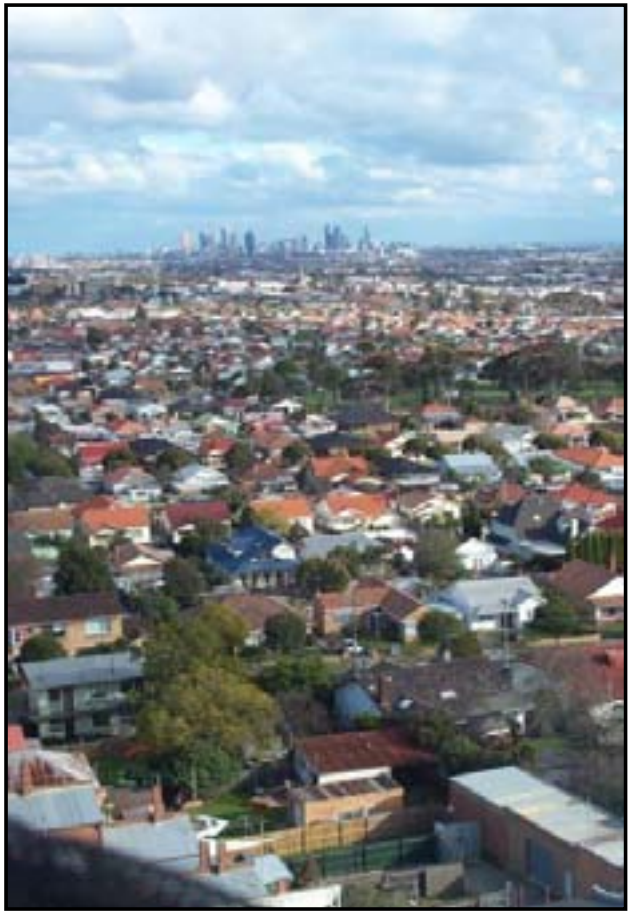
- Housing conditions
  - Construction date – pre 1975 increased risk OR 1.8
  - Lack thermal insulation OR 1.28
  - Living multi dwelling structure OR 1.2
  - Living on top floor OR 2.3
  - ↑ Number of rooms in house decreased risk
  - ↓ number of windows increased risk OR 1.25
    - the aspect of the home - number of hours of sunshine on the bedroom, bedrooms on top floor/under roof OR 2.1.
  - Vegetation around the home decreased risk

Behaviour can influence the likelihood of death

- Example
  - Maintaining hydration – access to potable water (this is a big problem for homeless people)
  - Opening windows in the afternoon heat ↑ OR 3.3 (preferable during evening/morning)
  - Visiting air-conditioned or cool places ↓ risk OR 0.5
  - Use cooling techniques/devices ↓ risk 0.5
  - Dressing lightly in non restrictive clothing ↓ risk OR 0.3

- Environmental factors
  - Urban Heat Islands ↑ risk





- Coutts, Beringer and Tapper *Urban Policy and Research*, 2008 in press
  - Heat Island Melbourne March 23rd 2006.

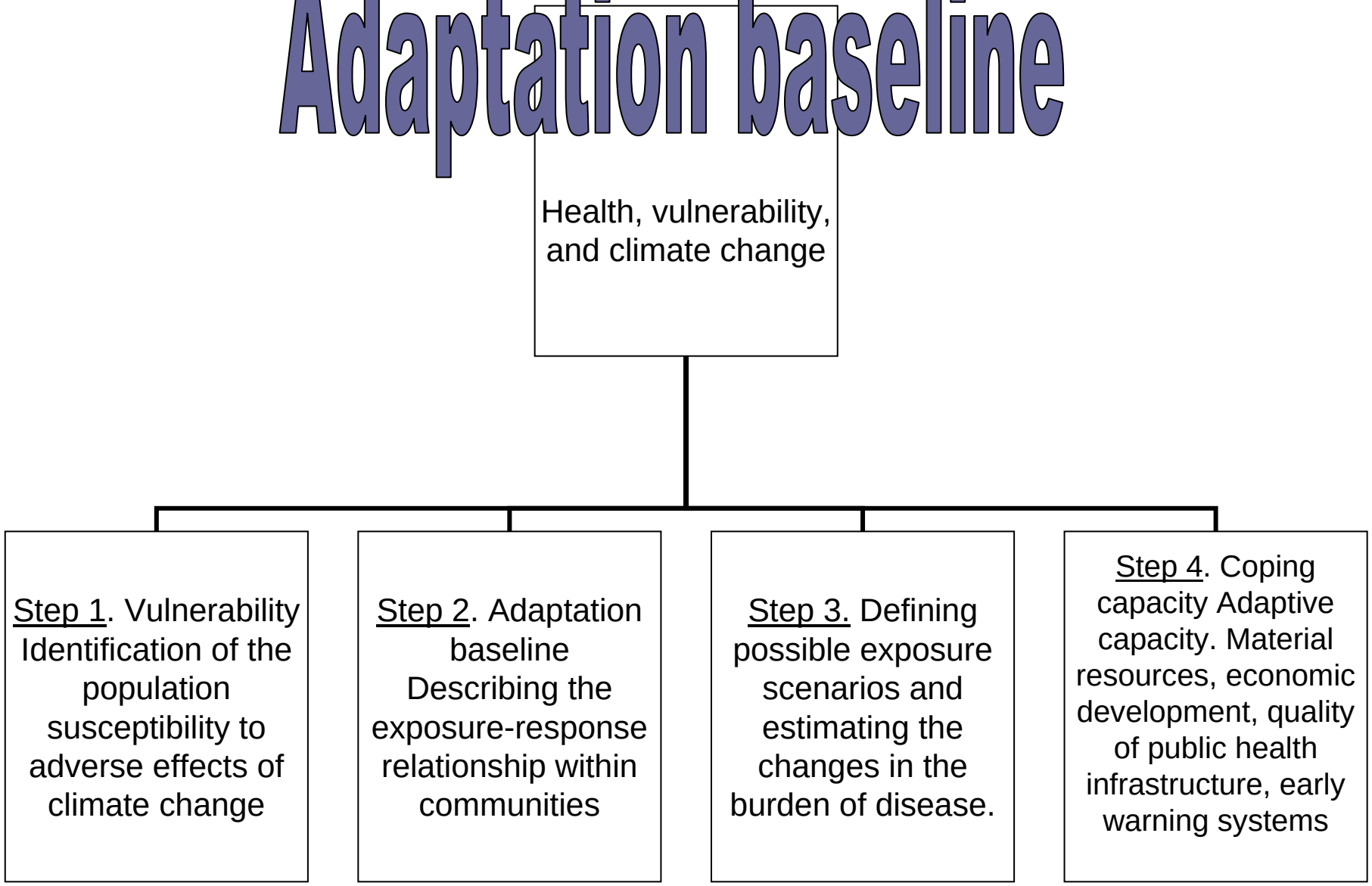
Summing up what we can learn

- The elderly and chronically living in the community are most vulnerable
- Where people live and the types of homes they live in can either increase or decrease risk
- Behavioural factors influence the likelihood of death
- Environmental factors - UHI enhance inequalities and increase risk
- ALL these are modifiable risk factors.

Develop an Adaptation baseline

- What do we know about risk in our communities?
- What is being done now to mitigate effects of vulnerability to health impacts of heat events?
- Place specificity
  - Threshold temperature
  - Measure socioeconomic circumstance
  - Demographic profile
  - Understanding of underlying population health

Adaptation baseline



Adapted from (Campbell-Lendrum and Woodruff 2006; Ebi, Kovats et al. 2006)

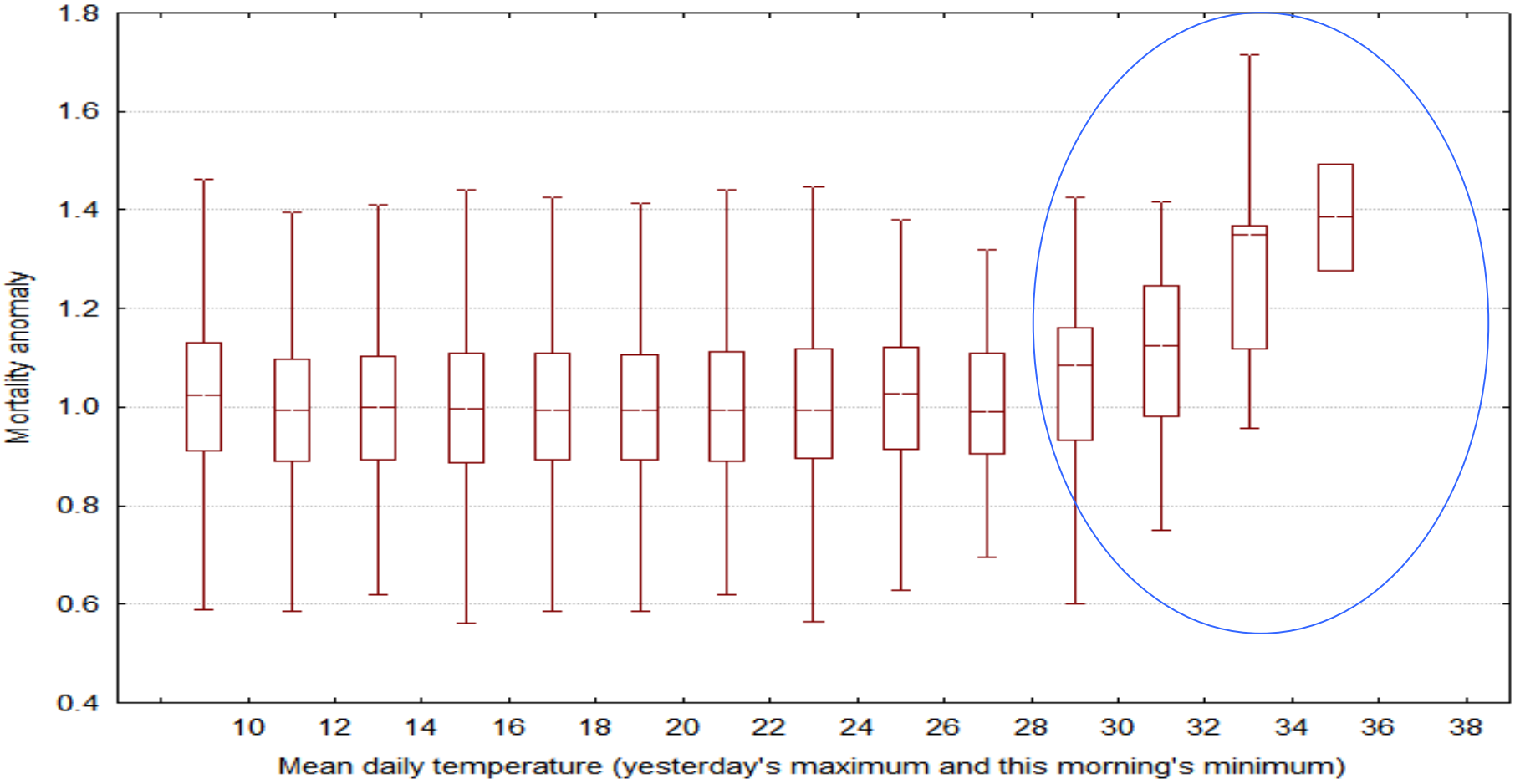
Threshold temperature

- Temperature above which mortality and morbidity increase from a baseline measure.
- Mortality in the elderly
- Cardiac disease largest cause mortality and morbidity in Australia
  - known sensitivity to weather
  - Largely preventable disease





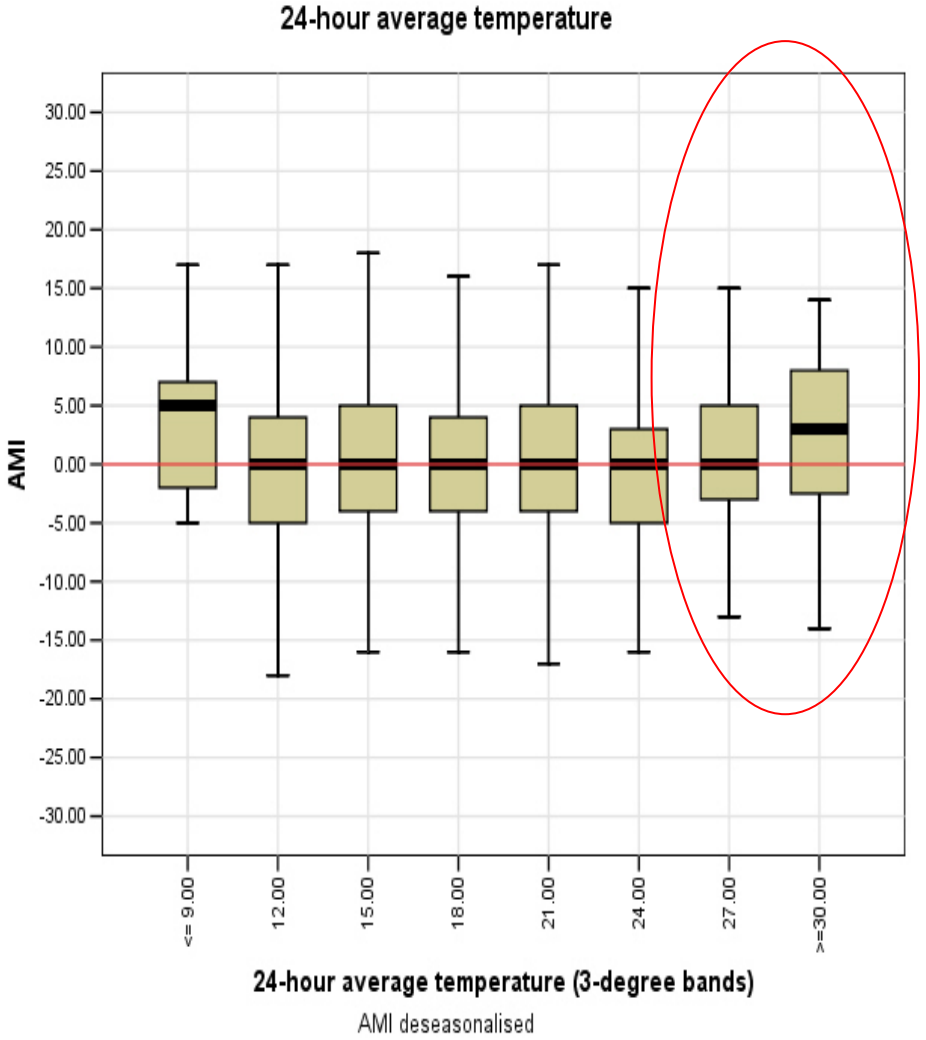

Mortality persons aged 64 years and older.



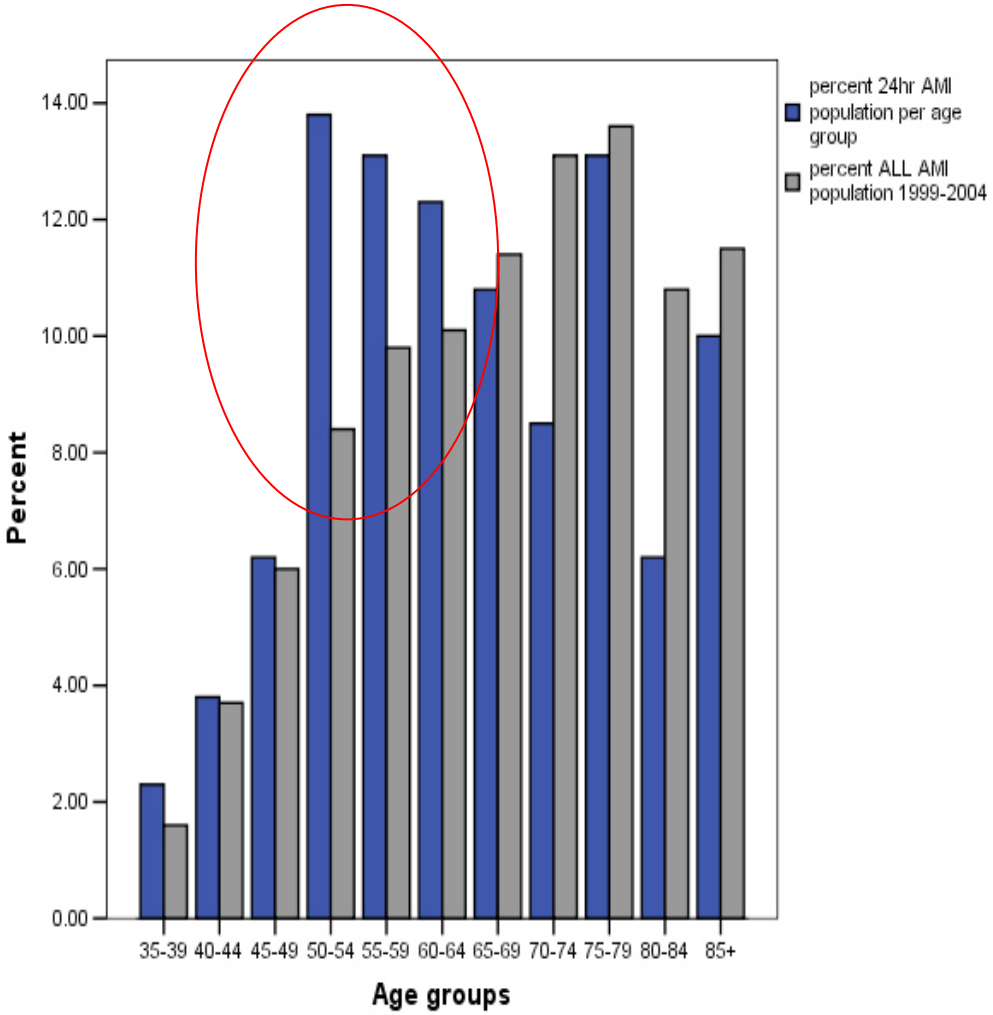
Nicholls,N. Skinner,C. Loughnan,M. Tapper,N. 2008. Int J Biometeorol

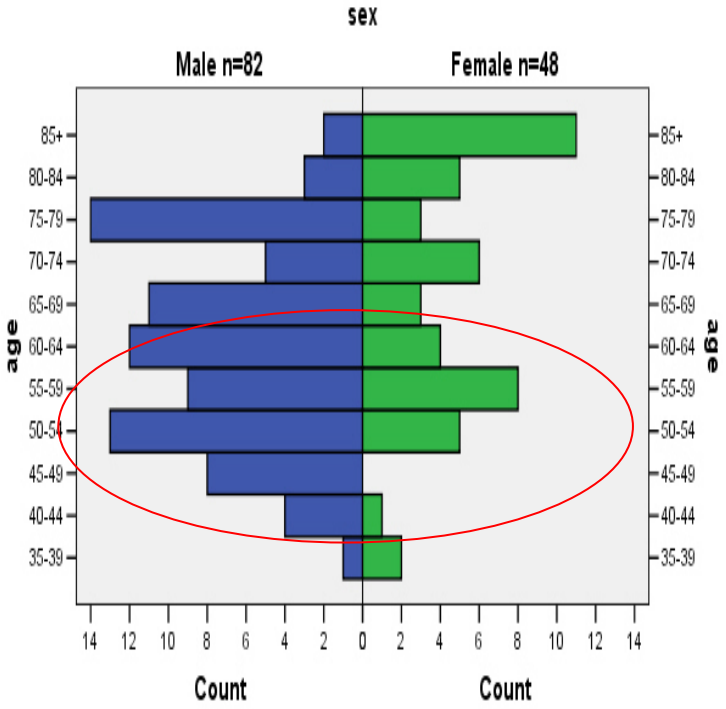
Temperature & AMI admissions

- 24-hour average temperature (9am-9am)
- Identified threshold temperatures
- Reference period 1999-2004
- Clear increase at temperatures above 30 ^{o}C
- 9 episodes (55% February)
- 130 admissions
  - 10% increase in AMI admissions



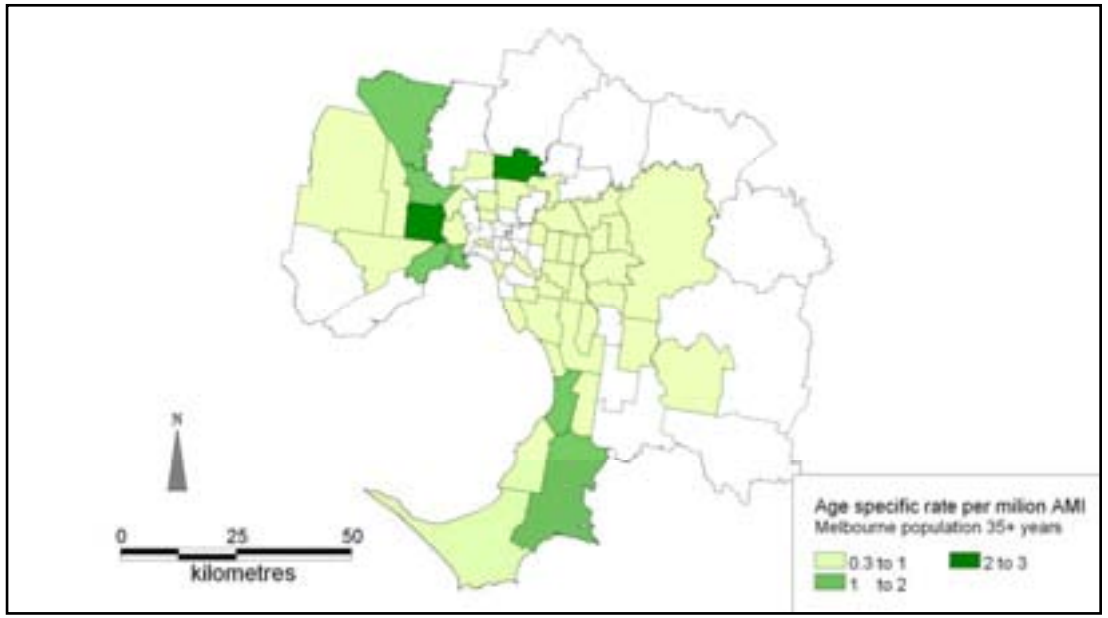
Age & sex distribution of AMI admissions ‘all other’ days in summer and ‘hot’ days





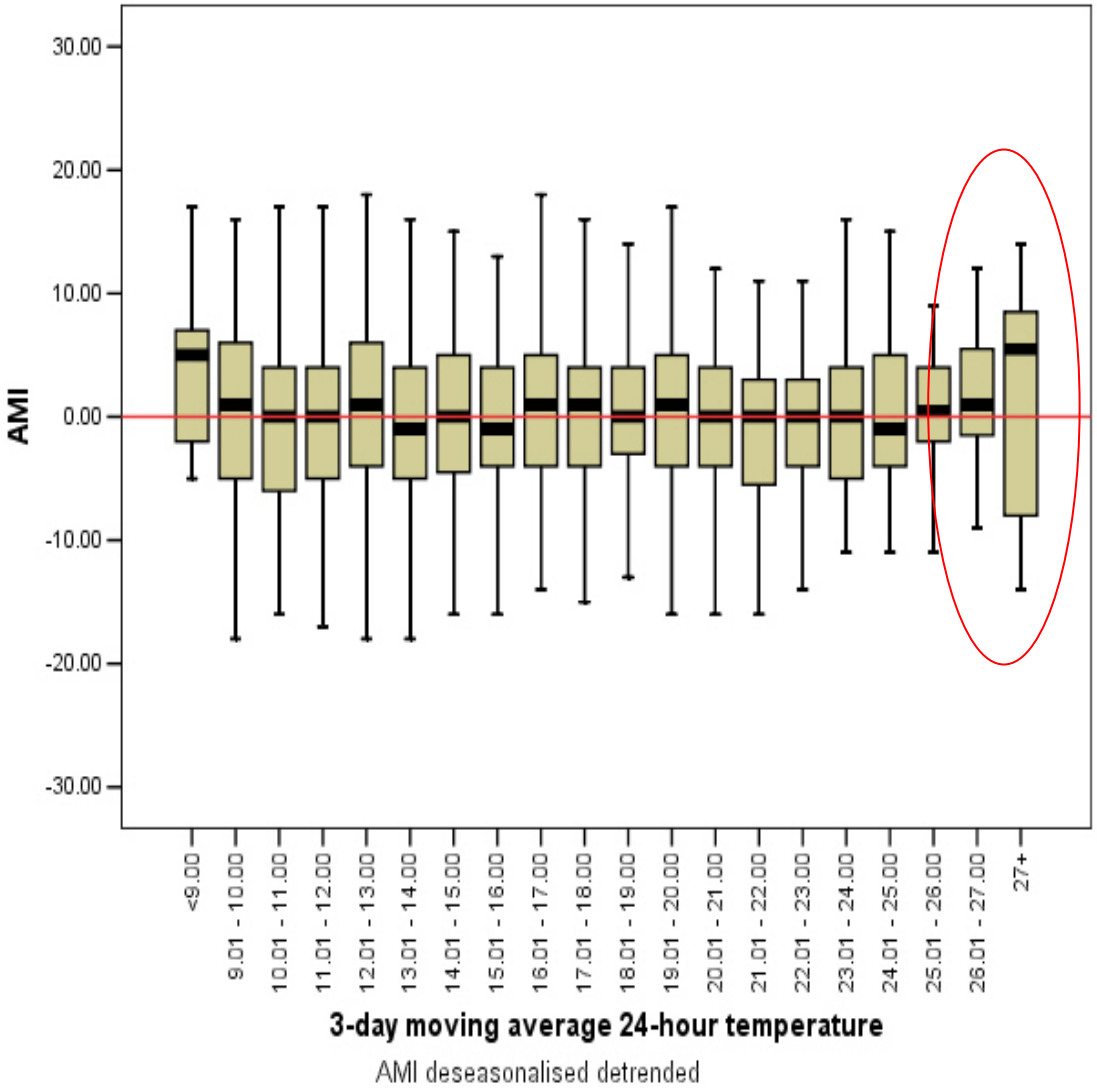
Patients admitted on ‘hot’ days 24-hour average temperature ≥ 30^{o} C

- 130 patients were admitted on days exceeding the threshold
- They represented 47 of the 75 SLA’s in Melbourne
- Control for age
  - *r* = -.298, p = 0.05
  - *SES* explains 9% variation in AMI admissions on ‘hot’ days.
- Control for SES (**SEIFA**)
  - age did not make a significant contribution to AMI admissions on ‘hot’ days.

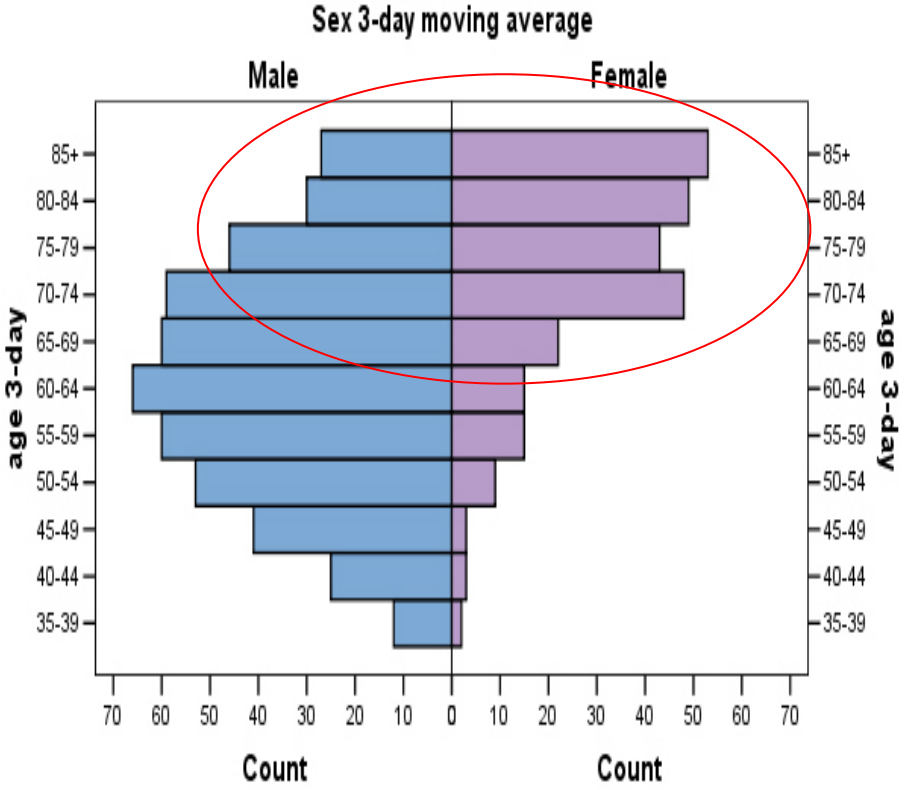


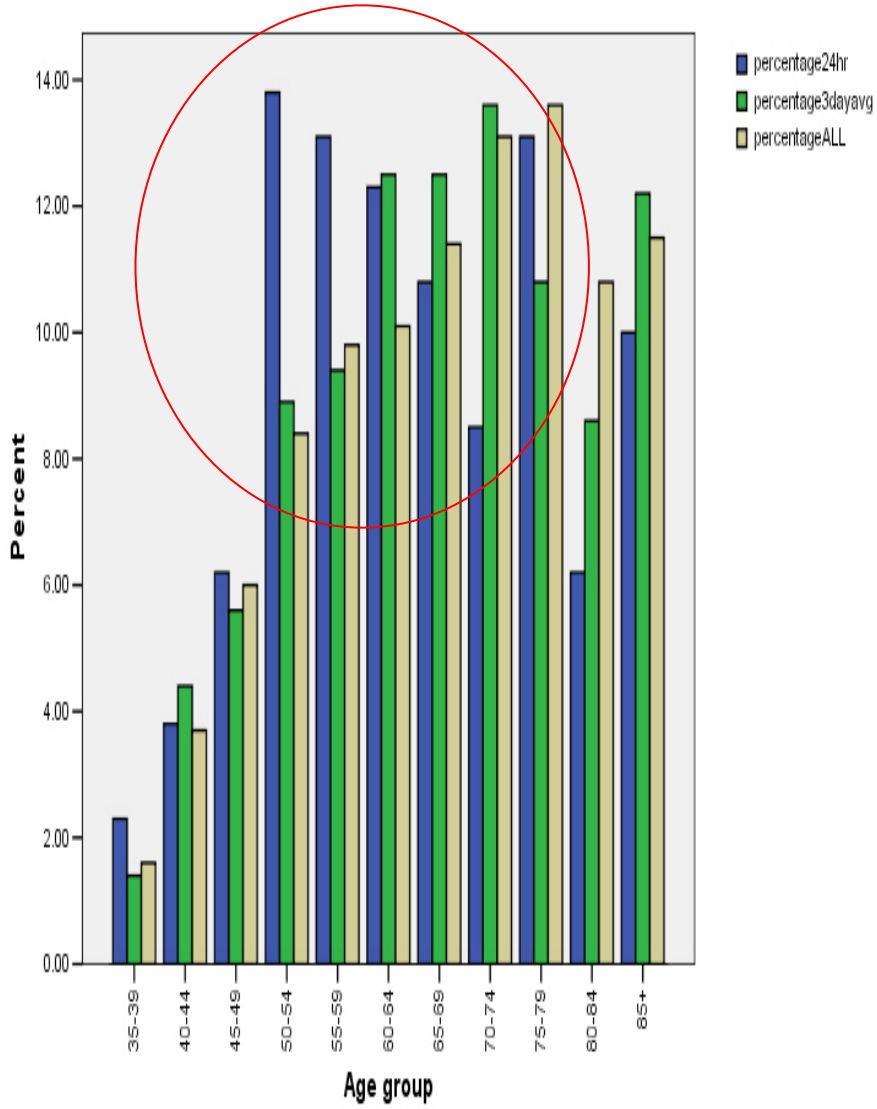
Consecutive ‘hot’ days

- 3-day moving average of 24-hour average temperature
- Clear increase at temperatures above 27 degrees
- 14 episodes or 42 days
  - (73% February)
- 741 admissions
  - 210 excess AMI admissions
  - 38% increase
- Day 1 = 31%
- Day 2 = 34%
- Day 3 = 35%



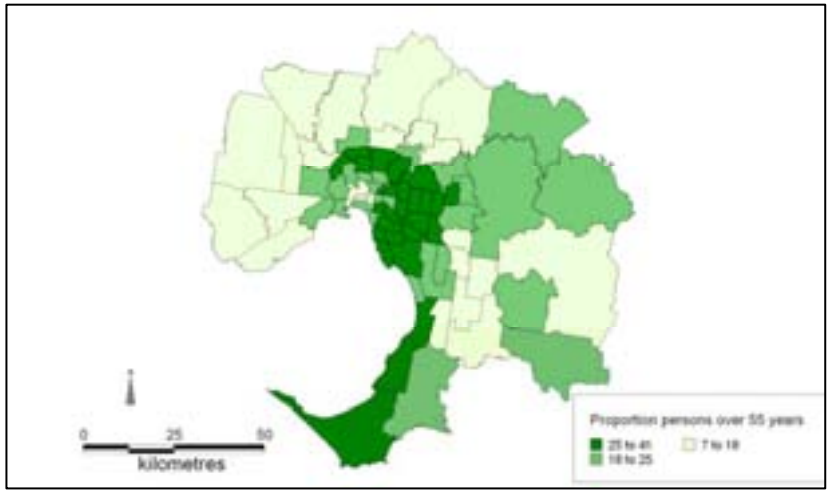
Age & sex distribution





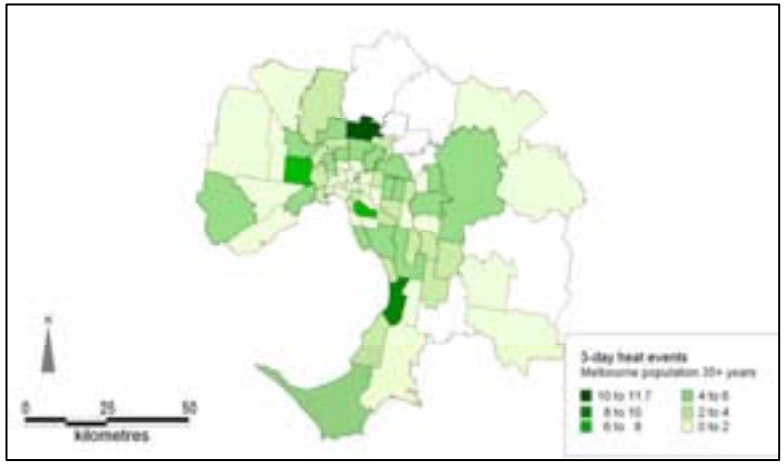
Spatial distribution 3-day heat events

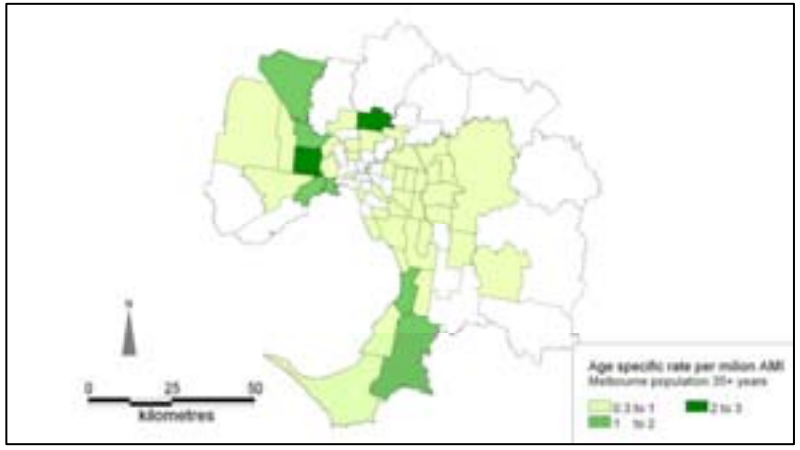
- 3-day heat events present a broader pattern
- Intensification of 24-hour events



Proportion population over 55 years

3-day heat event



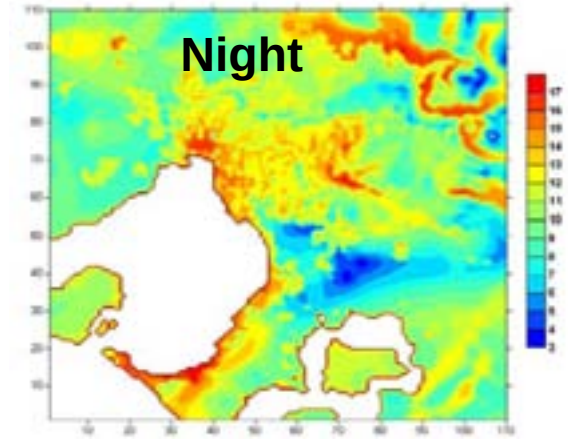


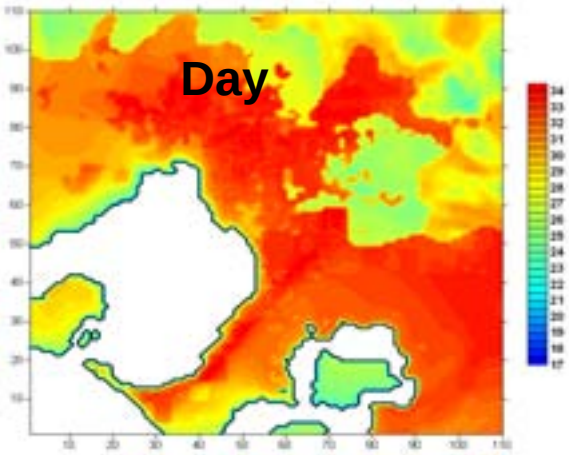
24-hour heat events

UHI & heat events in Melbourne

TAPM night-time model UHI (March 2006)

Coutts et.al. 2006





TAPM day-time model UHI (March 2006)

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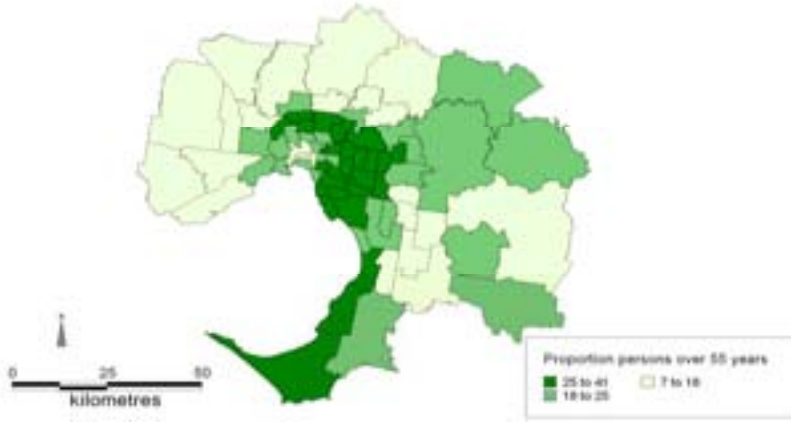
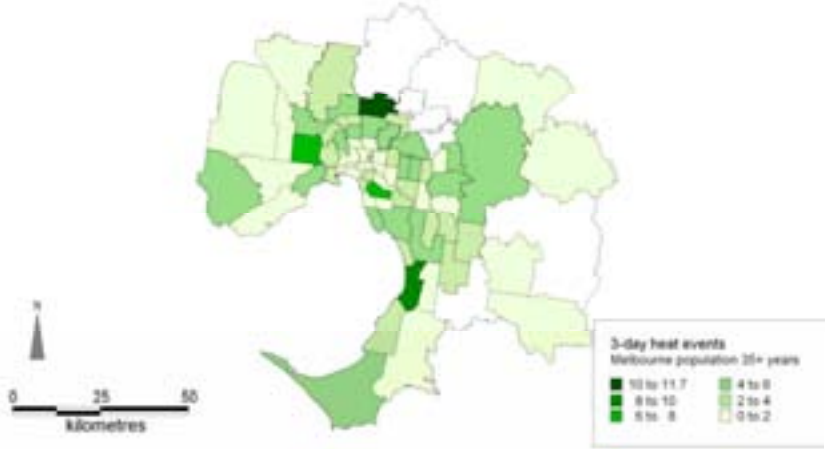




3-day heat events

Socioeconomic status

- 3-day heat events larger effect
  - AMI admissions from 63 out of 75 Melbourne SLA's
  - Controlled for age
    - SES explains 15.6% of the variability in AMI Admissions
      - r = -.395, p ≤0.001.
  - Controlled for SES
    - Age explains 10% of the variability in AMI Admissions
      - r = .331, p = .007.

Socioeconomic status overall

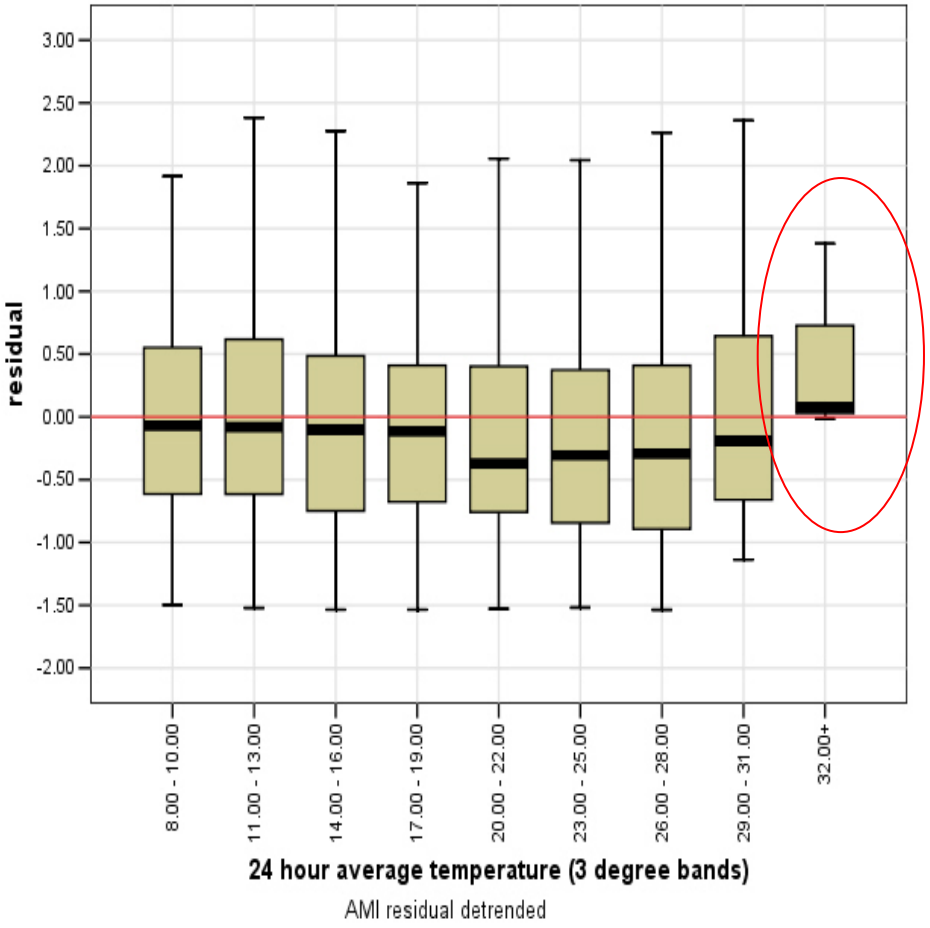
	SEIFA	Quintile of disadvantage 1	2	3	4	5
*ASR	Disadvantage	125	97	80	79	63
	Adv/disadvantage	126	104	83	75	57
	Eco-resources	135	91	78	77	58
	Education/occupation	108	107	92	72	63
Rate Ratio	Disadvantage	2	1.5	1.5	1.3	n/a
	Adv/disadvantage	2.2	1.8	1.5	1.3	
	Eco-resources	2.3	1.6	1.3	1.3	
	Education/occupation	1.7	1.5	1.5	1.1	
Rate difference	Disadvantage	62	34	17	16	n/a
	Adv/disadvantage	69	47	28	16	
	Eco-resources	77	33	20	19	
	Education/occupation	45	44	29	9	
Excess	Disadvantage	414	227	113	106	n/a
	Adv/disadvantage	841	695	555	501	
	Eco-resources	902	608	521	514	
	Education/occupation	303	294	194	60	
Percent excess	Disadvantage	49.6	27.2	13.6	12.8	n/a
	Adv/disadvantage	54.7	37.3	20.6	14.2	
	Eco-resources	57.4	24.4	14.9	14.1	
	Education/occupation	41.7	40.7	26.9	8.3	

*ASR (age standardised rate per 100,000 Melbourne population aged 35 years and older).

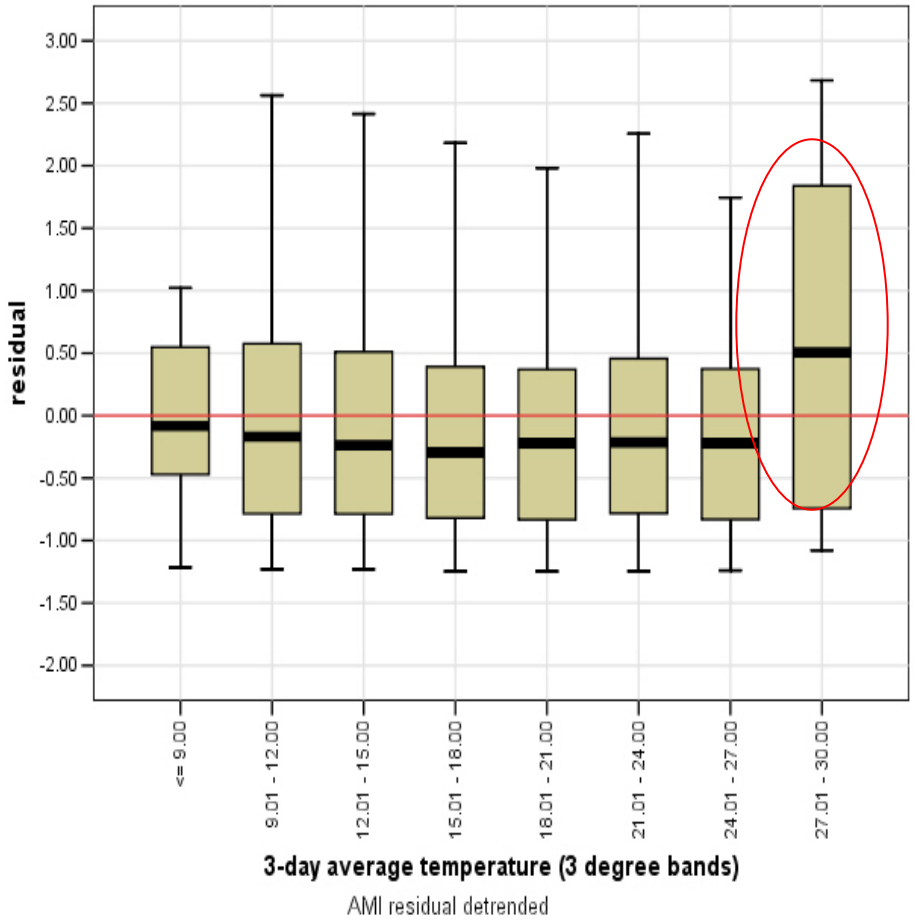
Calculation of the inequality AMI admissions per SEIFA quintile

Is socioeconomic status driving threshold temperature?

Quintile 1 threshold temperature



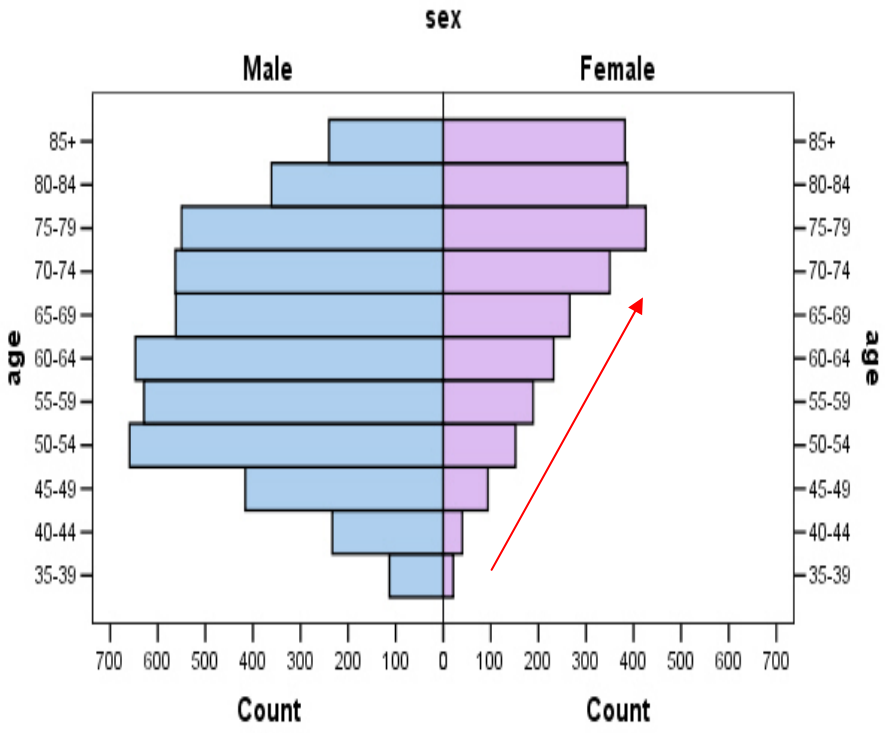
Quintile 5 threshold temperature



Population demography quintile 1

age

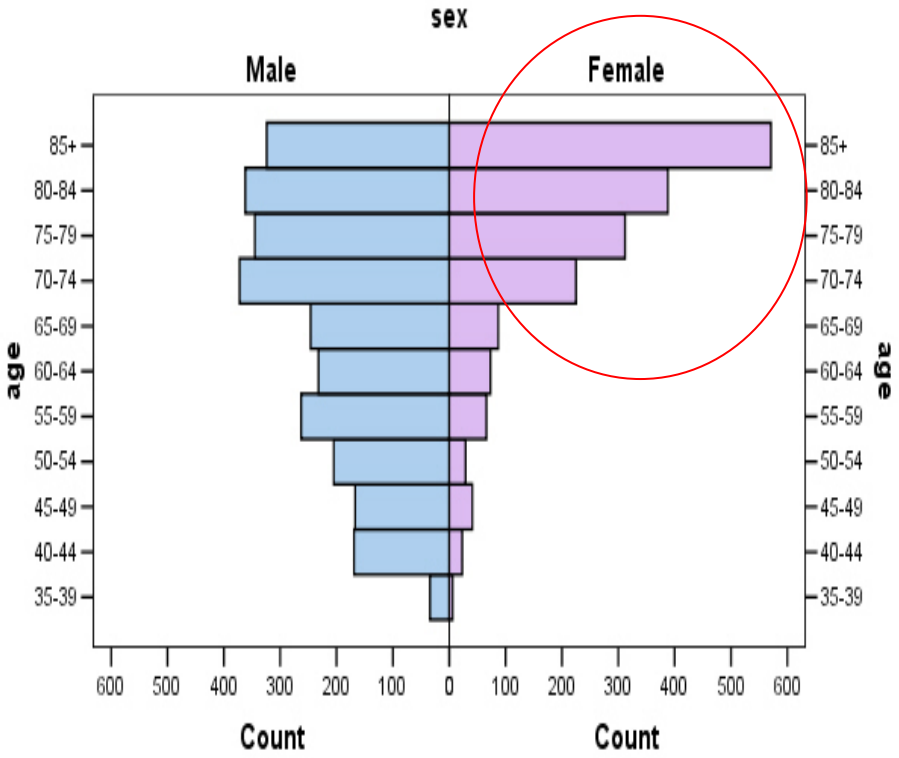
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	35-39	134	1.8	1.8	2.8
	40-44	273	3.6	3.6	6.4
	45-49	510	6.7	6.7	13.1
	50-54	811	10.7	10.7	23.8
	55-59	818	10.8	10.8	34.6
	60-64	879	11.6	11.6	46.1
	65-69	828	10.9	10.9	57.1
	70-74	913	12.0	12.0	69.1
	75-79	976	12.9	12.9	81.9
	80-84	748	9.9	9.9	91.8
	85+	622	8.2	8.2	100.0
	Total	7588	100.0	100.0	



Population demography quintile 5

age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	35-39	40	.9	.9	.9
	40-44	192	4.2	4.2	5.1
	45-49	208	4.6	4.6	9.7
	50-54	234	5.2	5.2	14.8
	55-59	329	7.2	7.2	22.1
	60-64	305	6.7	6.7	28.8
	65-69	333	7.3	7.3	36.1
	70-74	597	13.1	13.1	49.3
	75-79	657	14.5	14.5	63.8
	80-84	750	16.5	16.5	80.3
	85+	895	19.7	19.7	100.0
	Total	4540	100.0	100.0	



WHY Quintile 5 ?

- Synergistic effect of the UHI and an older population.
- Spatial scale of the analysis
  - The possible inclusion of pockets of disadvantage (Q1) in areas of least disadvantage (Q5)
  - Requires further investigation at a higher spatial resolution
    - Look for effects in smaller areas.

Where to now?

- Development of a ‘tool’ to determine the spatial vulnerability of elderly persons to extreme heat.
- This will include measures of socioeconomic status, urban environments, population health, population demography.
- The tool itself is being developed in Melbourne but it should be transferable to other cities within Victoria and Australia.

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