

# 2006 California Heat Wave Mortality Patterns: *Examining Vulnerable Subgroups*

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# California 2006 Heat Wave

- July 15<sup>th</sup> – 26<sup>th</sup>
- 3<sup>rd</sup> warmest July in 112 years

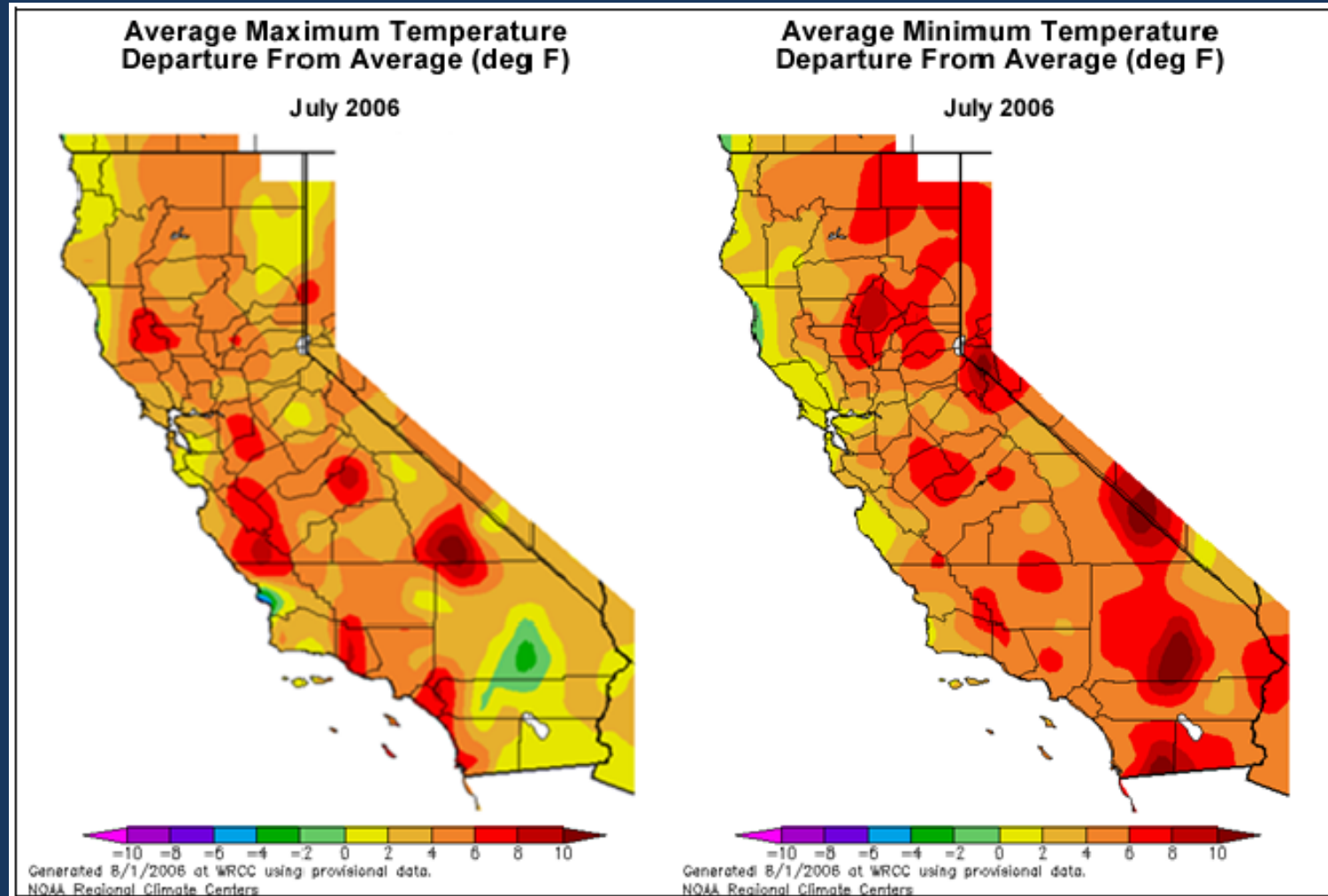


Image Source: Kozlowski and Edwards (2007)

# Study Goals

- Examine demographic & geographic patterns of mortality risk during the 2006 HW
  - Place of death, sex, age, race/ethnicity, underlying causes of death, Building Climate Zones (California Energy Commission, [http://www.energy.ca.gov/maps/renewable/building\\_climate\\_zones.html](http://www.energy.ca.gov/maps/renewable/building_climate_zones.html))
- Investigate unique vulnerabilities of Californians across the whole state
- Our paper is available online: <http://www.mdpi.com/1660-4601/13/3/299>

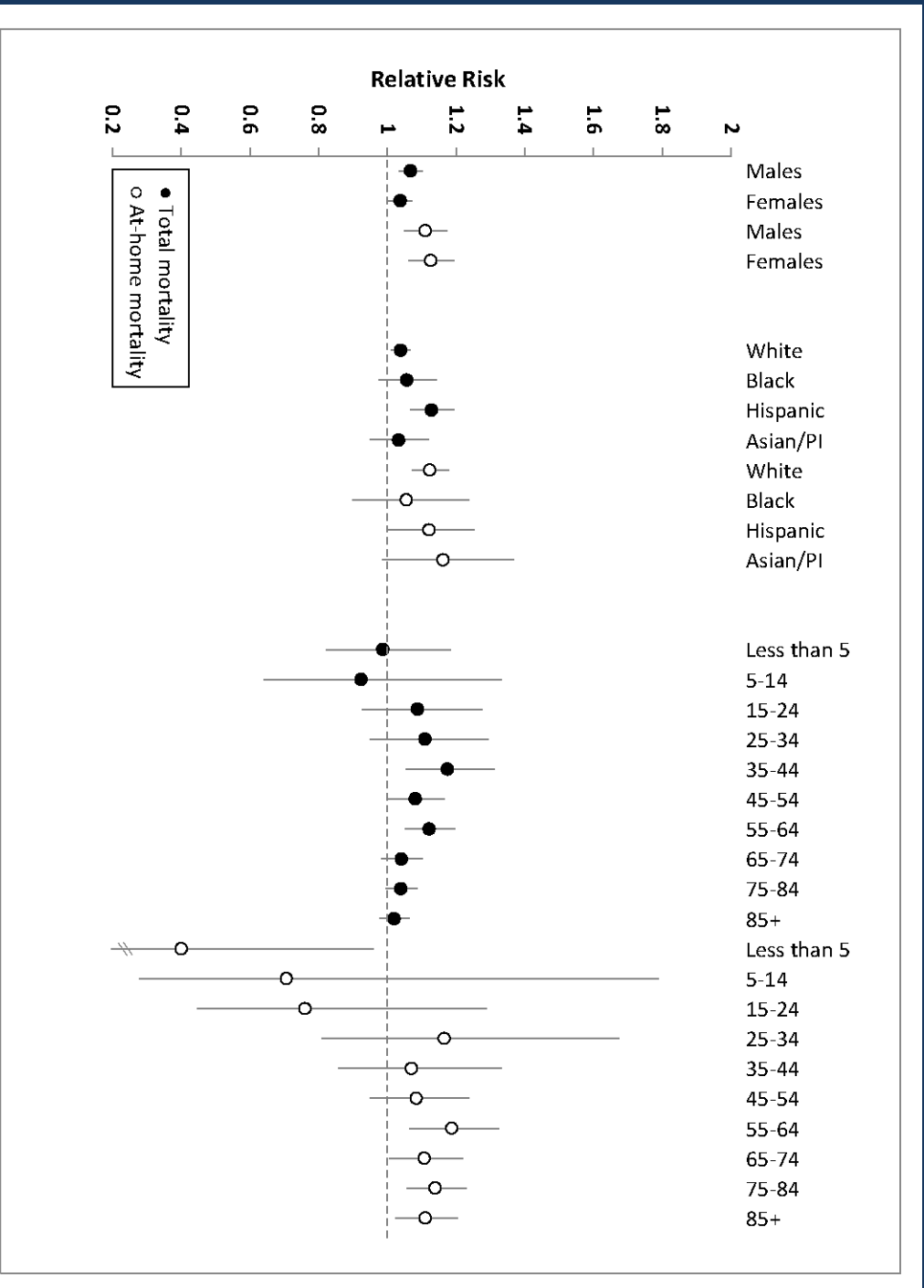
# Results: Place of Death

**Table 1.** Heat wave mortality relative risks (RR), 95% confidence intervals (CI), and excess deaths by place of death.

Place of Death	Heat Wave Deaths <sup>a</sup>	Reference Day Deaths/2 <sup>b</sup>	RR (CI)	Excess Deaths <sup>c</sup>
All deaths	11,727	11,144	1.05 (1.03–1.08)	582
Inside hospital <sup>d</sup>	4933	4820	1.02 (0.99–1.06)	113
Outside hospital	6670	6197	1.08 (1.05–1.11)	473
Decedent's home	3646	3262	1.12 (1.07–1.16)	384
Hospice or nursing home	2218	2156	1.03 (0.98–1.08)	62
Other	806	779	1.04 (0.95–1.13)	27
Unknown	124	127	0.97 (0.79–1.21)	–3

Notes: <sup>a</sup> Deaths that occurred between 15 July to 1 August, 2006. <sup>b</sup> Deaths that occurred on same-summer reference days divided by two and then rounded for presentation. <sup>c</sup> Heat wave deaths minus reference day deaths. <sup>d</sup> Includes in-patient, emergency room/outpatient, and dead-on-arrival deaths.

# Results: Sex, Race/Ethnicity, and Age



# Results: Causes of Death

Underlying Cause of Death (ICD-10 Codes)	Total Mortality		
	Heat Wave <sup>a</sup>	Reference/2 <sup>b</sup>	Relative Risk (CI)
Internal causes (A00–R94)	10,575	10,167	1.04 (1.02–1.07) *
Mental/nervous system (F00–H95)	935	841	1.11 (1.03–1.20) *
Endocrine Disease (E00–88)	483	448	1.08 (0.97–1.20)
Respiratory system (J00–99)	1042	973	1.07 (0.99–1.16)
Other internal diseases (L00–R99)	515	488	1.06 (0.95–1.17)
Cardiovascular (I00–99)	4169	4014	1.04 (1.00–1.08)
Digestive system (K00–92)	443	434	1.02 (0.91–1.14)
Neoplasms (C00–D48)	2769	2739	1.01 (0.97–1.06)
Infectious and parasitic (A00–B99)	219	230	0.95 (0.81–1.12)
External causes (V01–Y89.9)	1152	977	1.18 (1.10–1.27) *
External causes, excluding X30	1053	971	1.09 (1.01–1.17) *
Related to extreme heat (X30)	99	7	15.2 (8.54–27.1) *
Accidental drowning (W65–74)	57	43	1.33 (0.95–1.85)
Accidental poisoning (X40–49)	182	145	1.26 (1.04–1.51) *
Homicide (X85–Y09, Y87.1)	170	145	1.17 (0.97–1.42)
Falls (W00–19)	91	83	1.09 (0.84–1.41)
Transport accidents (V01–99, Y85)	292	278	1.05 (0.91–1.21)
Other external <sup>c</sup>	92	91	1.01 (0.79–1.30)
Suicide (X60–84, Y87.0)	169	185	0.91 (0.76–1.10)

# Results: Causes of Death, At-Home Mortality

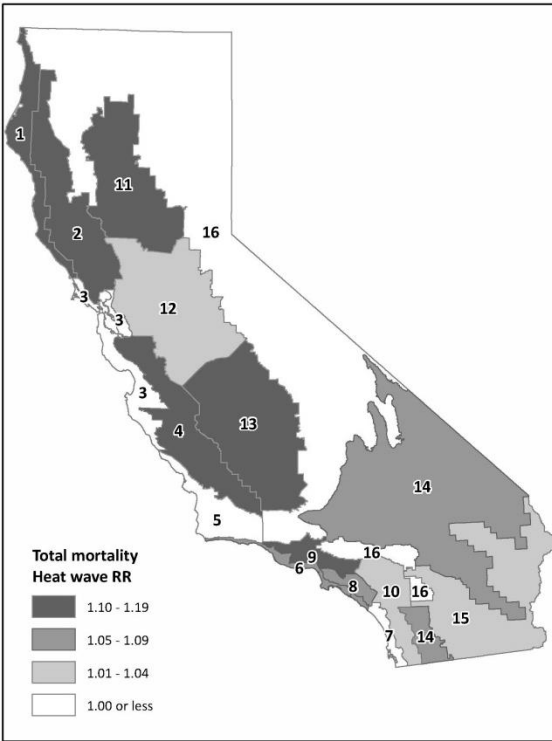
Underlying Cause of Death (ICD-10 Codes)	At-Home Mortality		
	Heat Wave	Reference/2	Relative Risk (CI)
Internal causes (A00–R94)	3382	3053	1.11 (1.06–1.16) *
Mental/nervous system (F00–H95)	259	212	1.22 (1.05–1.43) *
Endocrine Disease (E00–88)	163	119	1.38 (1.13–1.68) *
Respiratory system (J00–99)	243	217	1.12 (0.95–1.31)
Other internal diseases (L00–R99)	88	77	1.14 (0.87–1.48)
Cardiovascular (I00–99)	1292	1095	1.18 (1.10–1.26) *
Digestive system (K00–92)	67	71	0.94 (0.70–1.25)
Neoplasms (C00–D48)	1249	1231	1.01 (0.95–1.09)
Infectious and parasitic (A00–B99)	21	29	0.71 (0.43–1.17)
External causes (V01–Y89.9)	264	210	1.26 (1.08–1.47) *
External causes, excluding X30	221	209	1.05 (0.90–1.24)
Related to extreme heat (X30)	43	1	86.0 (11.8–624.5) *
Accidental drowning (W65–74)	8	1	8.00 (1.70–37.67) *
Accidental poisoning (X40–49)	88	69	1.28 (0.98–1.67)
Homicide (X85–Y09, Y87.1)	16	18	0.89 (0.49–1.60)
Falls (W00–19)	5	7	0.67 (0.24–1.83)
Transport accidents (V01–99, Y85)	1	1	0.67 (0.07–6.41)
Other external <sup>c</sup>	12	16	0.75 (0.39–1.46)
Suicide (X60–84, Y87.0)	91	97	0.94 (0.73–1.21)



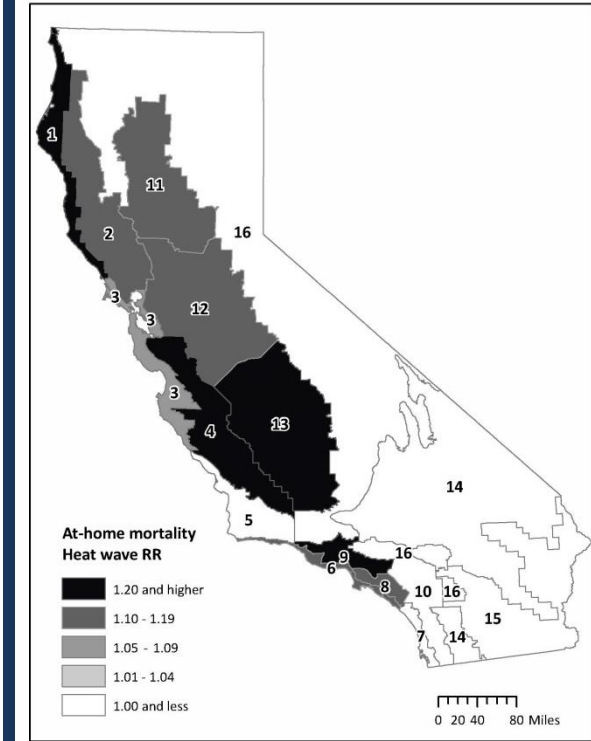
# Results: Building Climate Zones



A. California's sixteen building climate zones and topography.



B. Total mortality heat wave relative risk by building climate zone.



C. At-home mortality heat wave relative risk by building climate zone.



# Conclusions

- Elevated mortality risks were observed
  - 5% increase overall
  - 66% of excess deaths were at home
  - Risk varied by subgroups
    - 35-44 year olds higher compared to 65+
    - Hispanics higher compared to whites
    - External causes of deaths higher compared to internal
  - Risk varied by Building Climate Zones
    - At home risks were higher in some zones: northernmost zone (1) and the southernmost part of the Central Valley (13)

# Building Climate Zones and Counties

