

Effects of heat stress on human health outcomes



Julia Gohlke, PhD
Associate Professor
Population Health Sciences
Virginia Tech

Adverse health outcomes during heat waves

- Non-accidental mortality (NAD) and ED visits increase during heat waves.
- Previously identified important covariates include SES, age, chronic disease status, minority status, and geography (greater risk in northern 'less hot' cities).
- Numerous studies have reported a positive association between preterm birth (PTB) and heat waves.

Data gaps:

- A variety of heat wave definitions exist. Which one is the most predictive of adverse health outcomes?
- Does ambient temperature predict personal heat exposure across urban/rural areas and occupations?

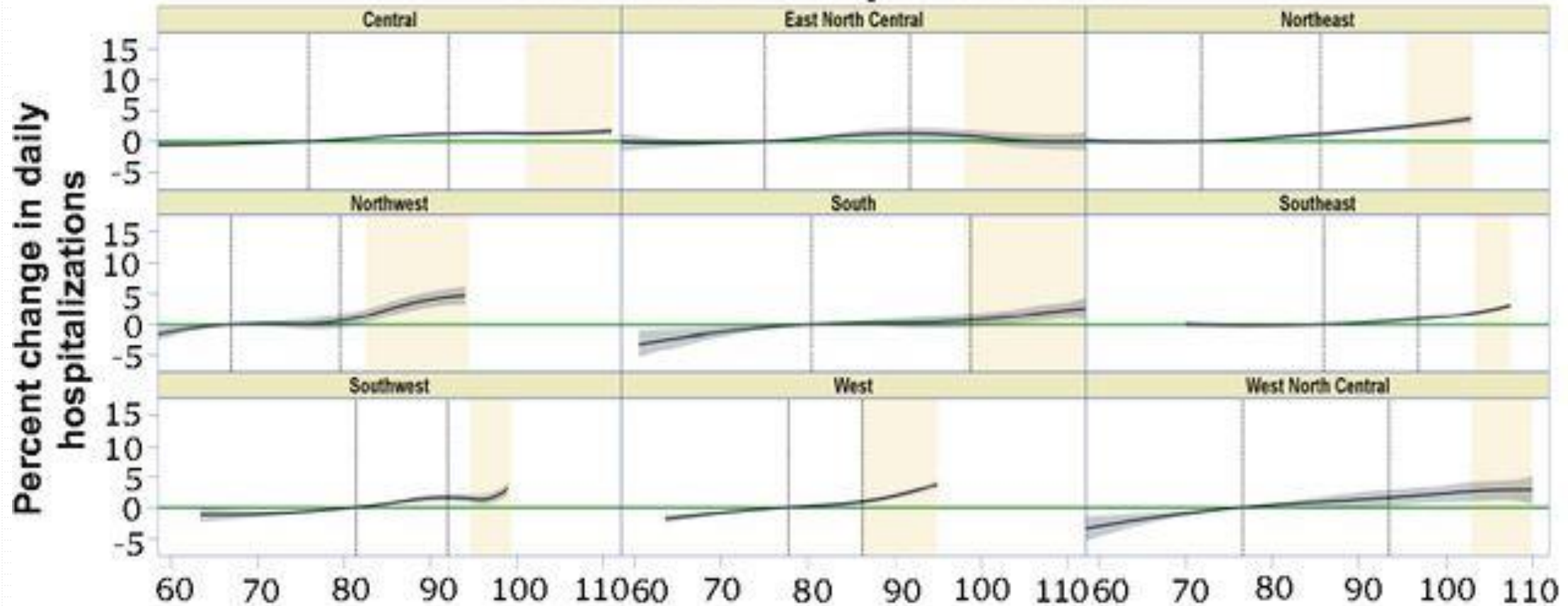
A map of the United States divided into climate regions. The regions are color-coded: Northwest (dark brown), West North Central (light orange), East North Central (orange), Northeast (dark red), West (medium brown), Central (grey), Southwest (dark grey), South (orange), and Southeast (light orange). States with hospitalizations data are indicated by a hatched pattern. The legend at the bottom shows a white box for 'U.S. Climate Region' and a hatched box for 'States with Hospitalizations Data'.

Climate Region	States with Hospitalizations Data
Northwest	WA, OR, ID
West North Central	MT, ND, SD, NE, WY
East North Central	MN, MI, WI, IL, IN, OH
Northeast	ME, VT, NH, MA, CT, RI, PA, NJ, NY
West	CA, NV, UT, CO, AZ, NM
Central	KS, MO, IL, IN, OH, WV, VA, NC, SC, GA, FL
Southwest	AZ, NM
South	TX, OK, AR, MS, AL
Southeast	VA, NC, SC, GA, FL

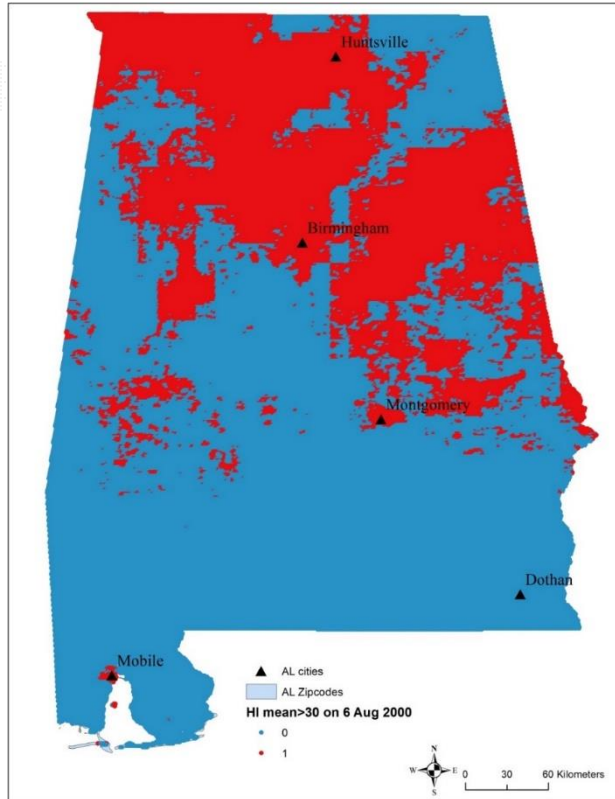


Exposure-response relationships between daily maximum heat index and hospitalizations across U.S. Regions

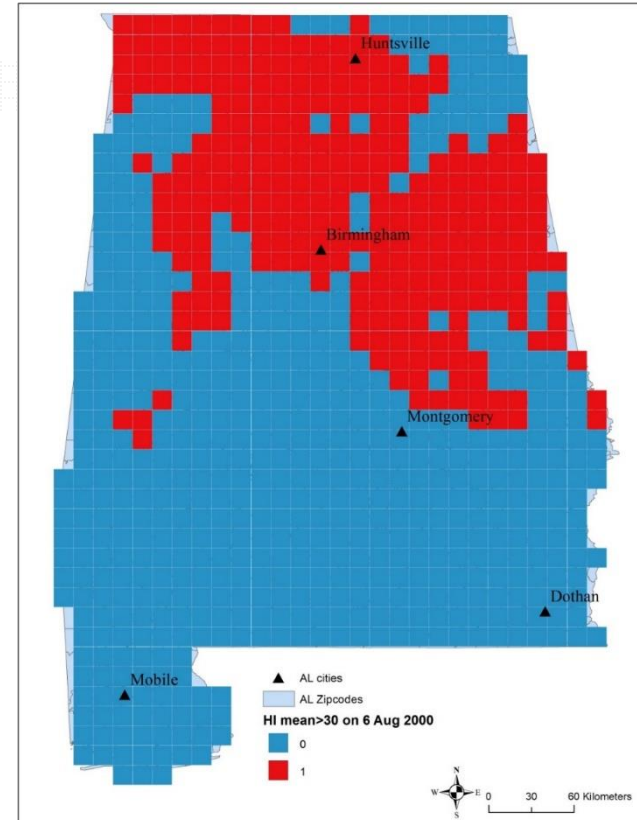
A All-Causes hospitalizations



Heatwaves in urban heat islands are detected with incorporation of satellite-derived data



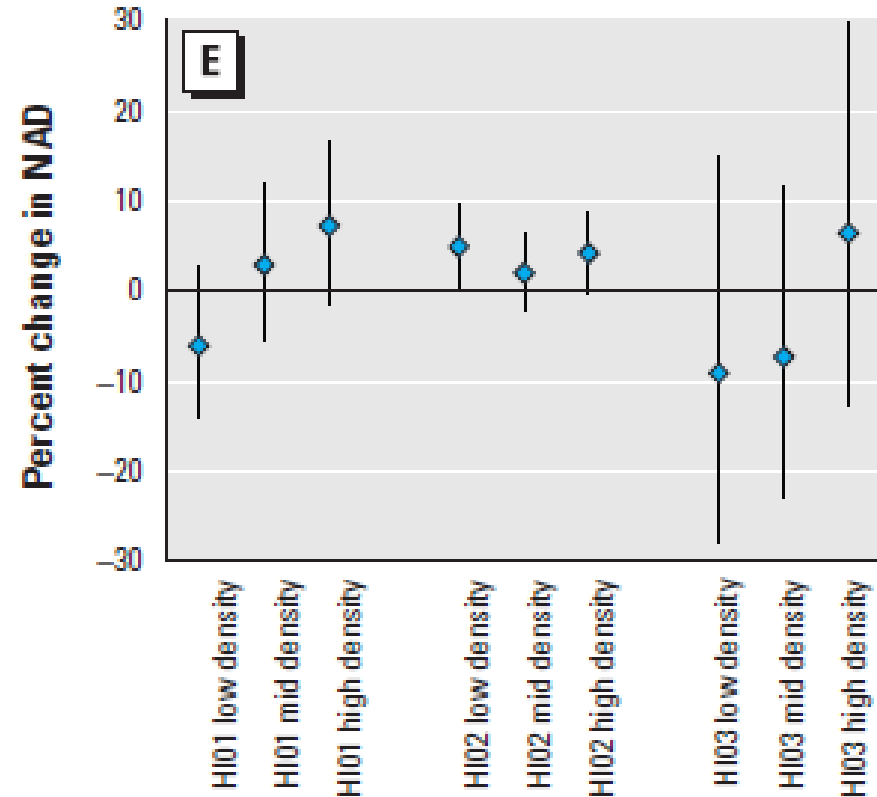
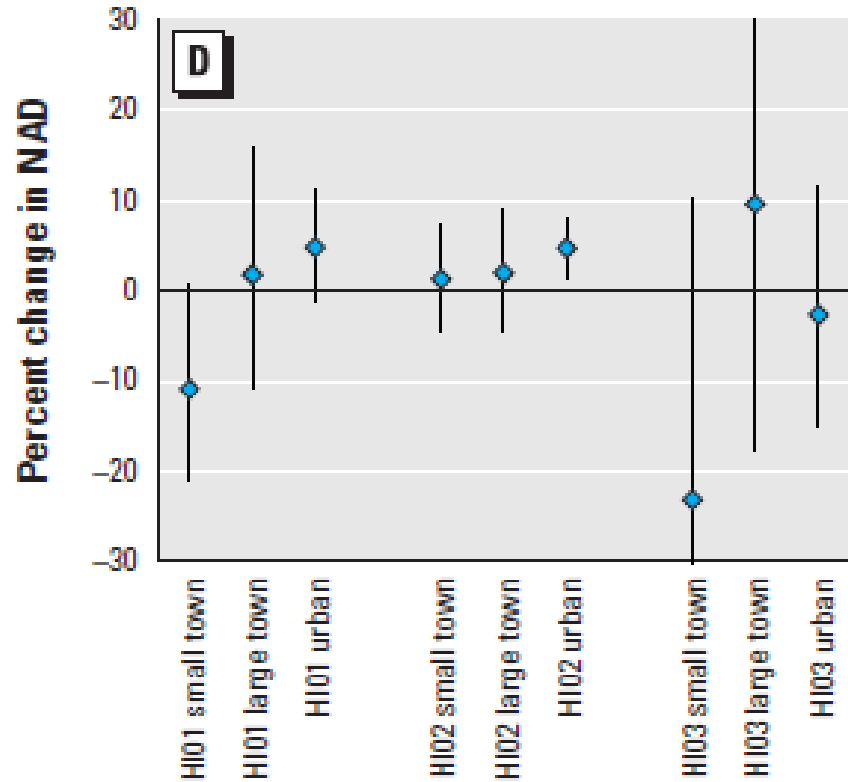
Downscaled data (1km)



NLDAS data (12.5km)

Wu et al. (2018) *Annals of Amer Assoc Geog*

Association between heat waves and non-accidental deaths are greater in urban areas

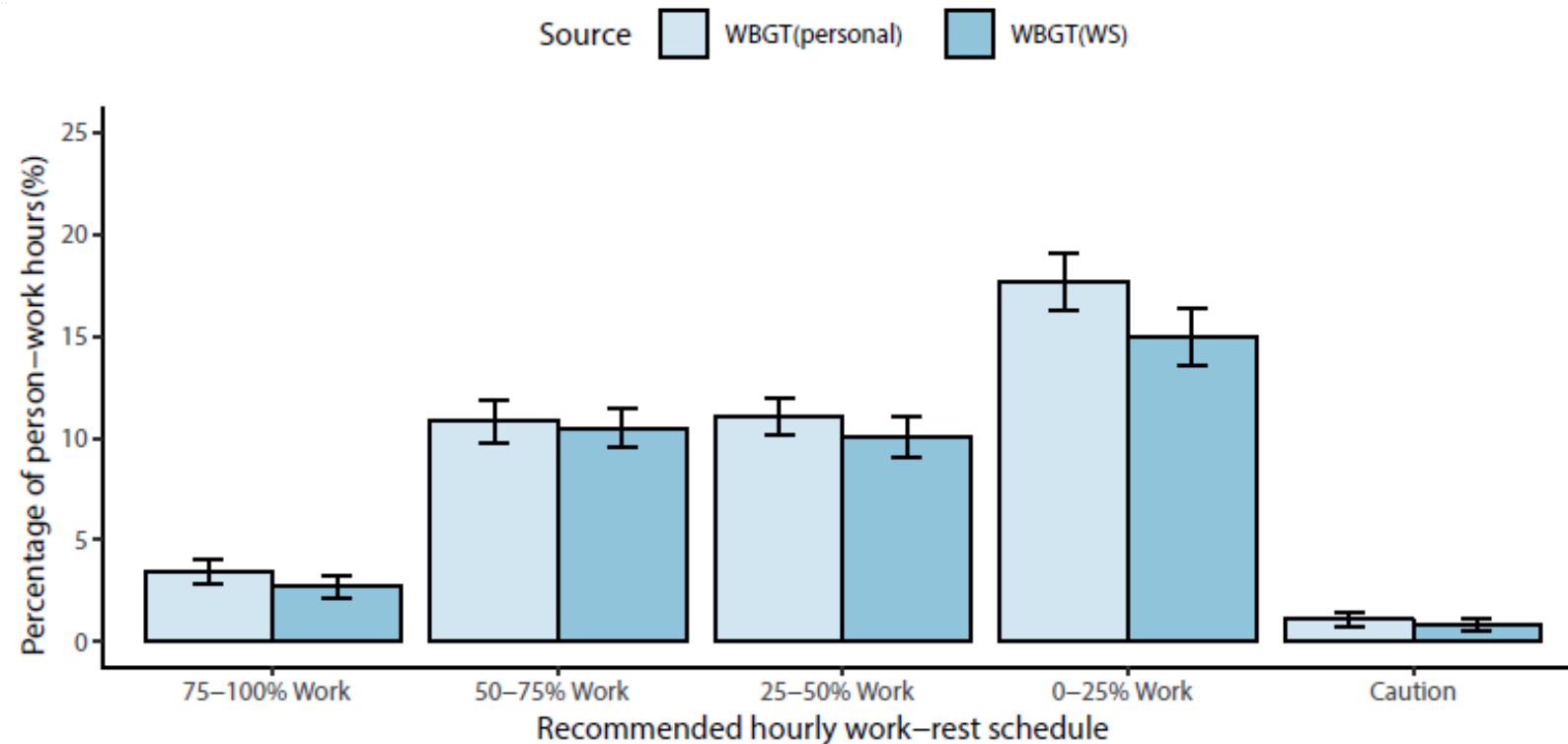


Kent et al. 2014 *Environ Health Persp.* 122 (2)

The iButton temperature sensor clipped to shoe

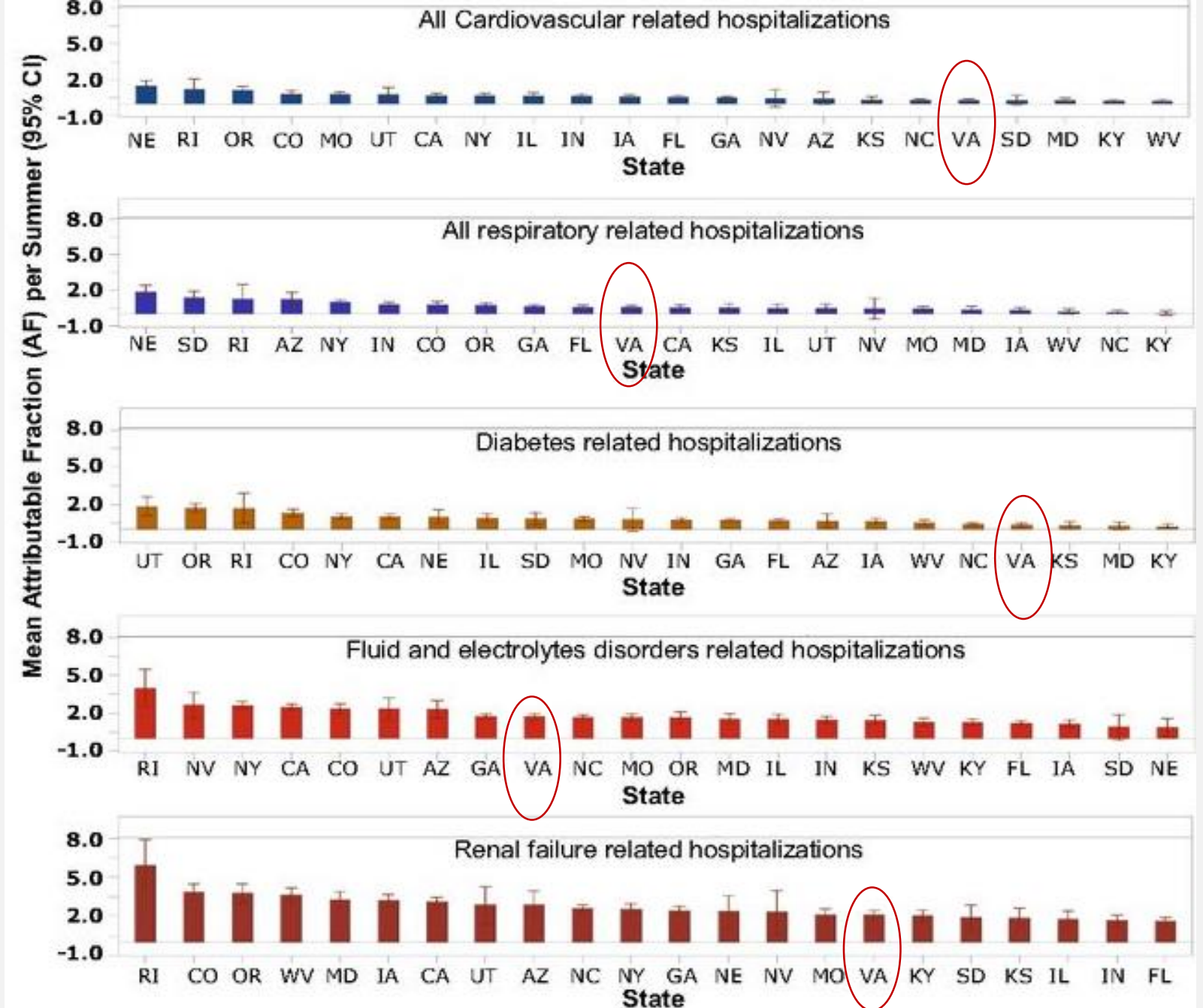


More hours in most protective work-rest schedule when using personal vs. weather station temperatures



Wang, S et al. (2019) *Jour Occup Envir Med*

Attributable fractions of hospitalizations to heat exposure



Actionable Solutions

- Remind patients in the late Spring about signs of heat stress, allow at least a 2 week period for physiological acclimation to hot weather.
- Hospital preparedness for more cases of diabetes complications and renal failure during hot periods of summer.
- Work with local employers of outdoor workers to implement appropriate monitoring and work-rest schedules.
- Remind obstetric patients to identify an air conditioned location that is available to them and be particularly aware of signs of heat stress, dehydration, and preterm labor during hot periods.

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