

Climate and Health Symposium
May 6, 2022

Heat Stress and Acute Cardiovascular Effects

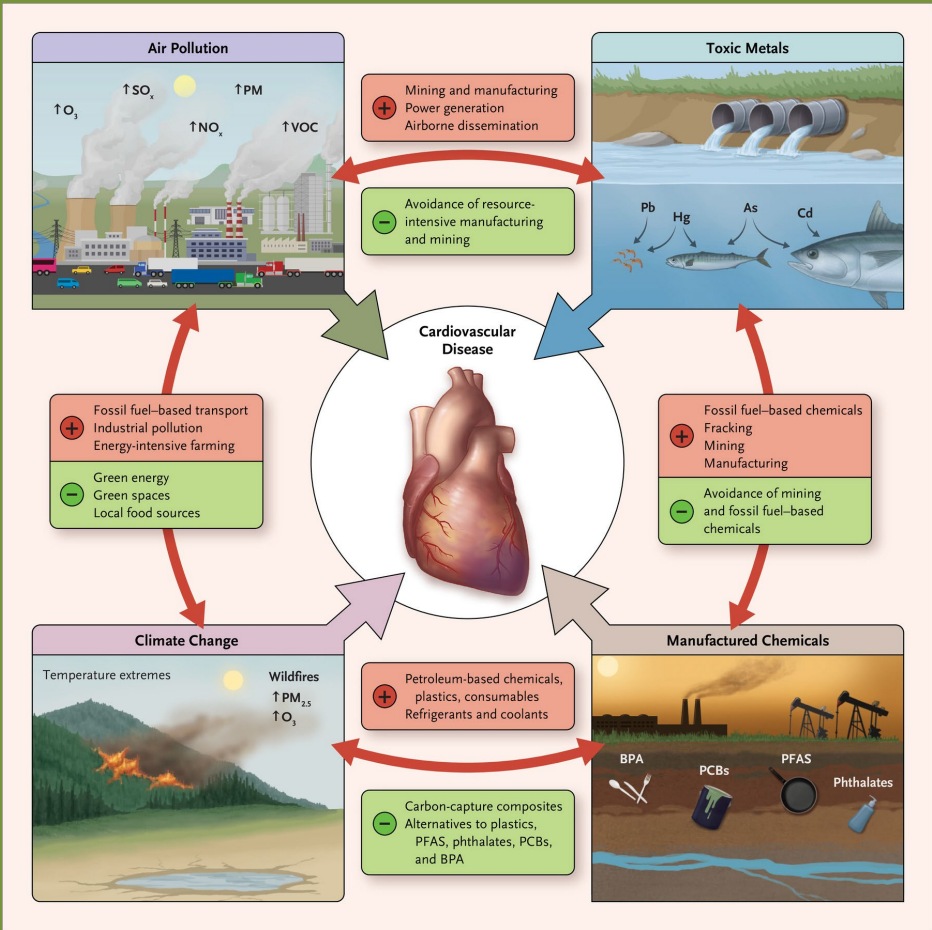
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Disclosures

None

Pollution, Climate and the Heart



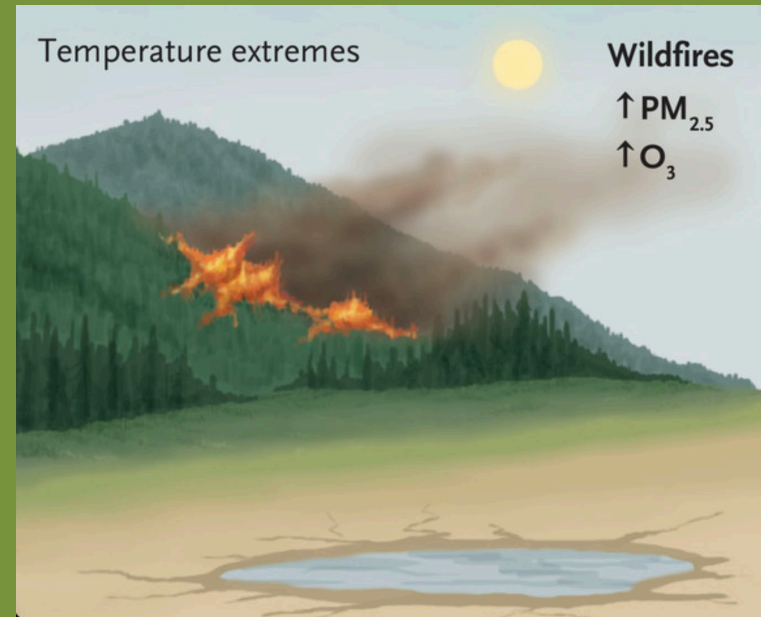
- 9 million deaths worldwide in 2019
- 62% cardiovascular disease
- Largely omitted from cardiovascular disease prevention guidelines

Rajagopalan S, Landrigan PJ. Pollution and the Heart. *N Engl J Med*. 2021 Nov 11;385(20):1881-1892.
 GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors. *Lancet* 2020; 396: 1223-49.

Heat Stress and CVD

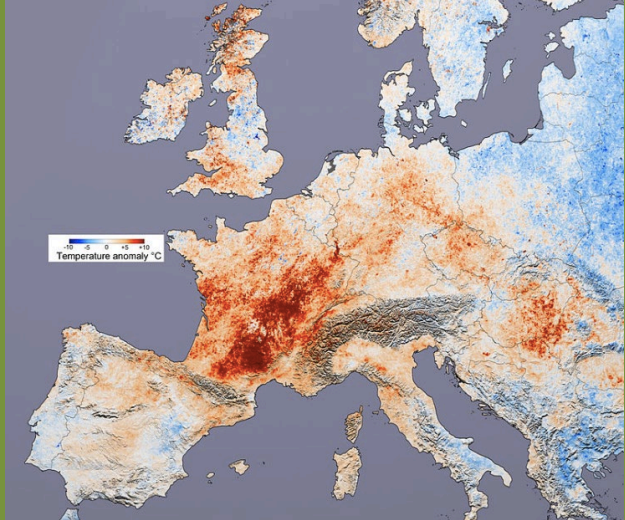
High temperatures increase:

- ground-level ozone
- risk of wildfires and dust storms (PM_{2.5})
- Demand for electricity (fossil-fuel combustion and pollution)
- mortality from CVD



DeFlorio-Barker S, et al. Cardiopulmonary effects of fine particulate matter. *Environ Health Perspect* 2019; 127: 37006.
Peters A, et al. Cardiovascular risks of climate change. *Nat Rev Cardiol* 2021;18:1-2.

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Heat Exposure and Cardiovascular Health (2020) Centers for Disease Control and Prevention.
 Peters A, Schneider A. Cardiovascular risks of climate change. Nat Rev Cardiol. 2021 Jan;18(1):1-2.

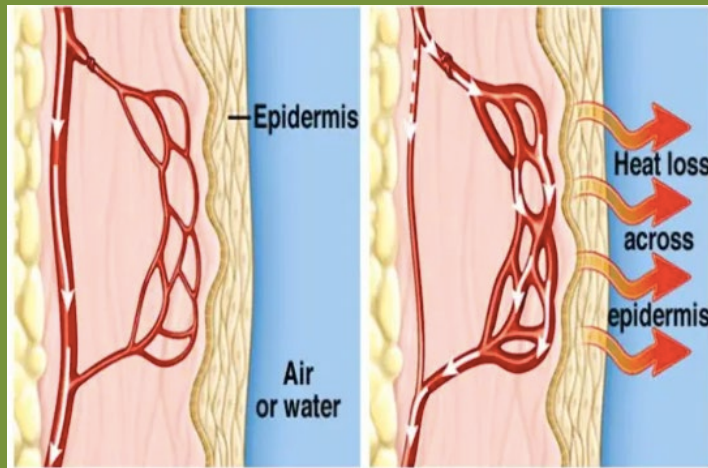


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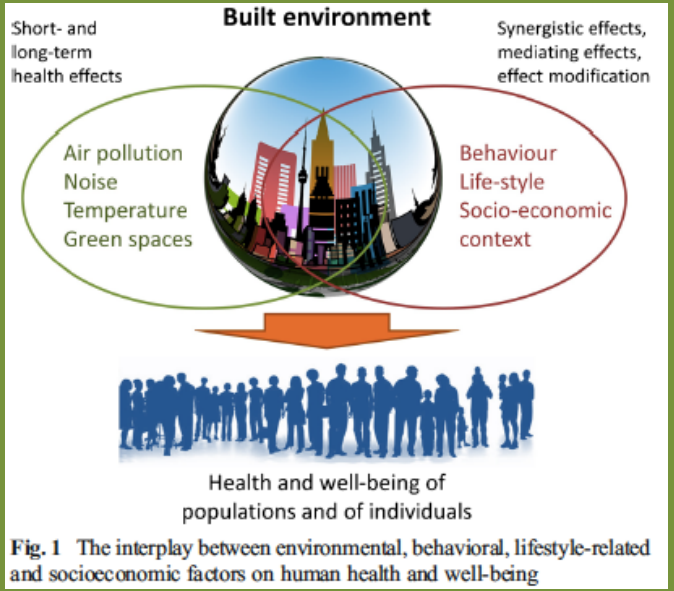
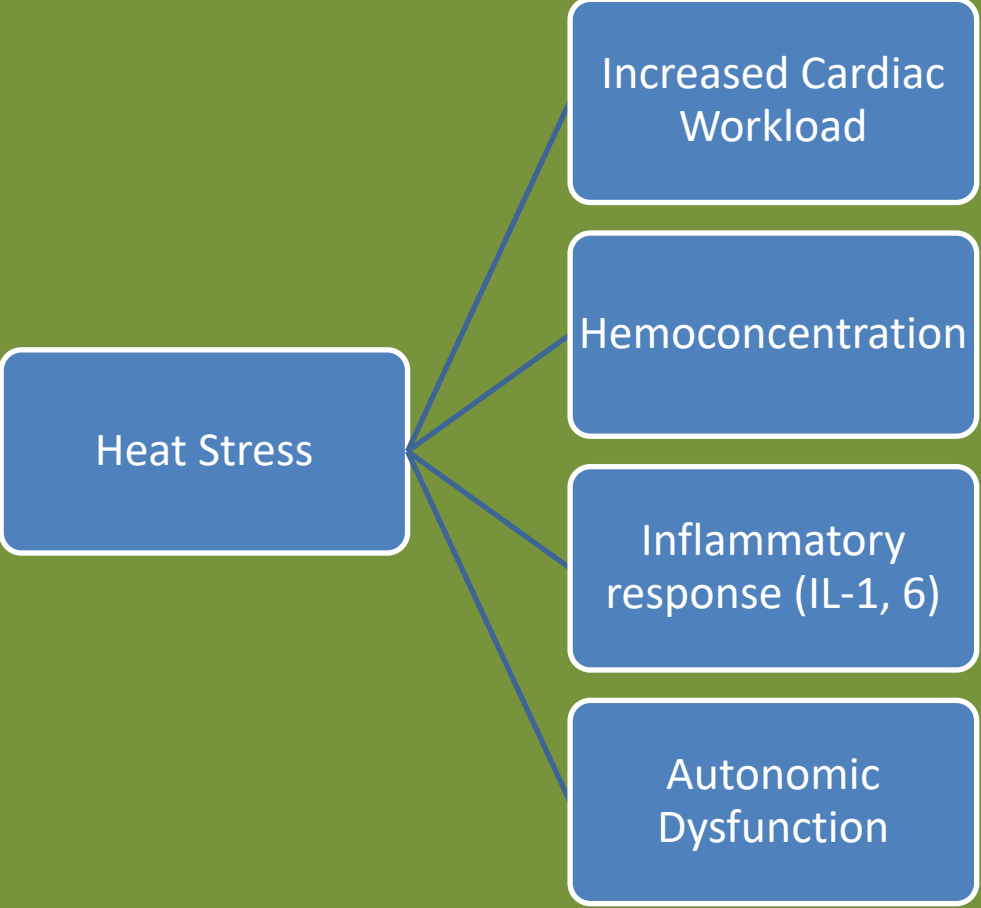
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Climate, Heat, and the Heart



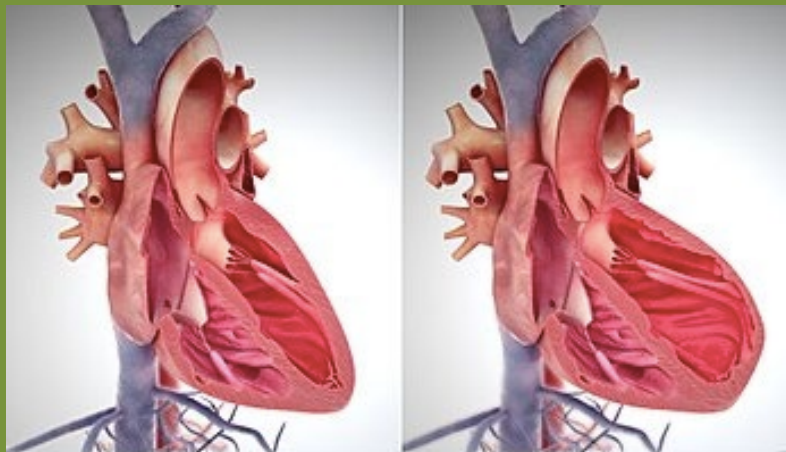
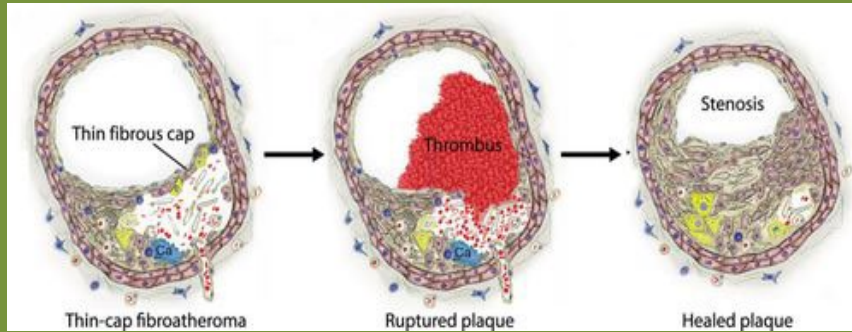
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Gillam, Paul. "Vasodilation." PMG Biology, <https://pmgbiology.com/tag/vasodilation/>.

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Schneider A, et al. Thermal Control, Weather, and Aging. Curr Environ Health Rep. 2017 Mar;4(1):21-29.

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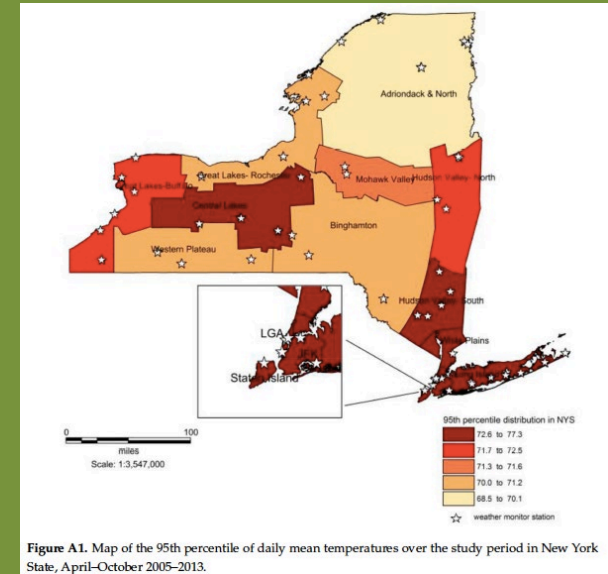
Bentzon, et al. Mechanisms of Plaque Formation and Rupture. *Circulation Research*. Volume: 114, Issue: 12, Pages: 1852-1866

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Among older adults in summer after controlling for PM2.5 concentration, relative humidity, and barometric pressure:

Extremely hot days (>95th% of monthly mean)

- CVD-related ED visits at lag day 5
 - OR: 1.02 (95% CI: 1.01–1.04)
 - 6% increase risk of cardiac dysrhythmias
 - 4% increased risks of hypertension
- 7% increased risk of ischemic heart disease on the day of extreme heat



Heat Exposure and Cardiovascular Health (2020) Centers for Disease Control and Prevention.

Li, et al. Impact of Extremely Hot Days on Emergency Department. Int J Environ Res Public Health. 2019 Jun 14;16(12):2119.

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Diagnosis	ICD-9-CM code	ED visits		
		Reference period	Heat-wave period	RR (95% CI)
All causes	All	485,785	501,951	1.03 (1.02–1.04)
Internal causes	0–799.9	386,229	399,699	1.03 (1.03–1.04)
Diabetes	250	37,321	38,315	1.03 (1.01–1.04)
Electrolyte imbalance	276	30,076	35,020	1.16 (1.15–1.18)
Cardiovascular diseases	390–398, 402, 404–429, 440–448	45,613	46,515	1.02 (1.01–1.03)
Acute MI	410	2,822	2,869	1.02 (0.96–1.07)
Cerebrovascular disease	430–438	7,397	7,250	0.98 (0.95–1.01)
Respiratory illnesses	460–519	64,051	64,213	1.00 (0.99–1.01)
Nephritis and nephrotic syndrome	580–589	12,185	12,935	1.06 (1.04–1.09)
Acute renal failure	584	5,085	5,839	1.15 (1.11–1.19)
Heat-related illnesses	992	403	2,537	6.30 (5.67–7.01)

ICD-9 principal diagnoses:

- hypertension (401–405)
- ischemic heart diseases (410–414)
- cardiac dysrhythmias (427)
- heart failure (428)
- cerebrovascular diseases (430–434, 436–438)



Heat Exposure and Cardiovascular Health (2020) Centers for Disease Control and Prevention.

Knowlton, et al. The 2006 California heat wave: impacts on hospitalizations. Environ Health Perspect. 2009 Jan;117(1):61-7.

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Time-series analysis in 184 cities in China between 2014 and 2017

At the national-average level, a 1-°C increase in temperature variability was associated with increase in hospital admissions for:

- cardiovascular disease 0.44% (0.32%-0.55%)
- ischemic heart disease 0.31% (0.20%-0.43%)
- heart failure 0.48% (0.01%-0.96%)
- heart rhythm disturbances 0.34% (0.01%-0.67%)
- and ischemic stroke 0.82% (0.59%-1.05%)



Heat Exposure and Cardiovascular Health (2020) Centers for Disease Control and Prevention.

Tian, et al. Association between temperature variability and daily hospital admission. PLoS Med. 2019 Jan 28;16(1):e1002738.

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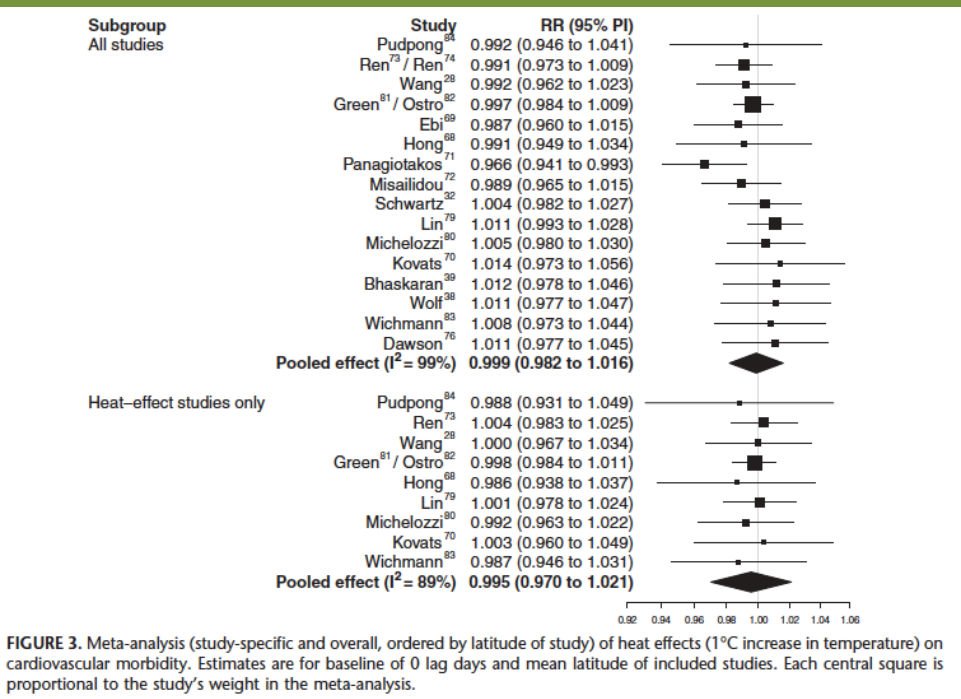
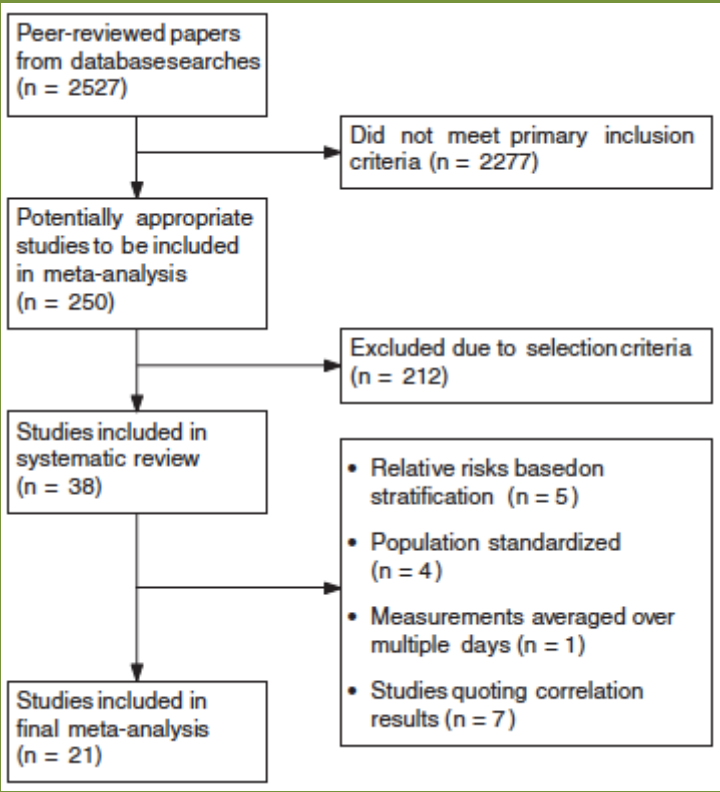
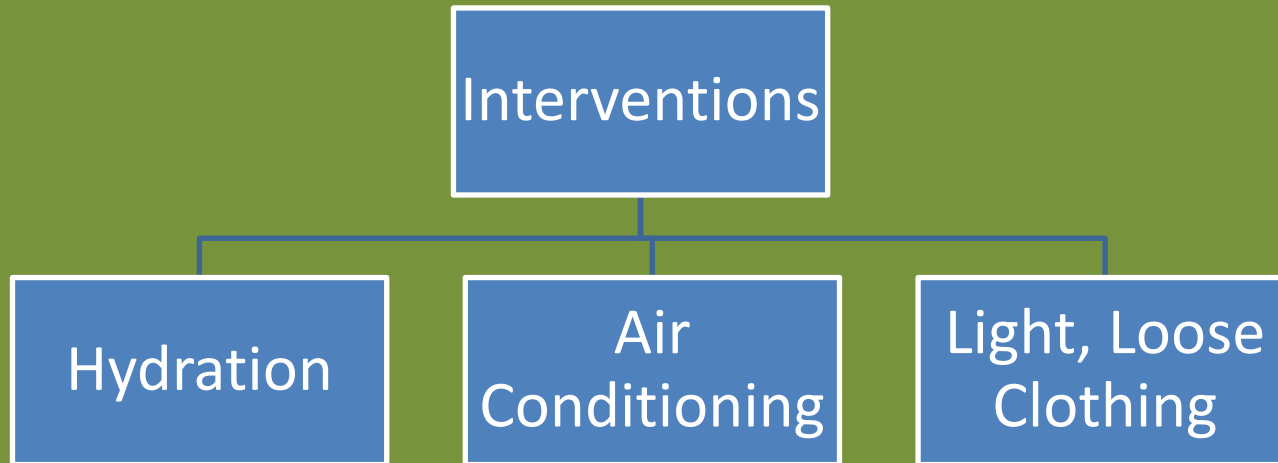


FIGURE 3. Meta-analysis (study-specific and overall, ordered by latitude of study) of heat effects (1°C increase in temperature) on cardiovascular morbidity. Estimates are for baseline of 0 lag days and mean latitude of included studies. Each central square is proportional to the study's weight in the meta-analysis.

Heat Exposure and Cardiovascular Health (2020) Centers for Disease Control and Prevention.

Turner LR, et al. Ambient temperature and cardiorespiratory morbidity. Epidemiology. 2012 Jul;23(4):594-606.

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Heat Exposure and Cardiovascular Health (2020) Centers for Disease Control and Prevention.
<https://www.nature.org/en-us/what-we-do/our-insights/perspectives/natural-solutions-to-climate-change/>

Thank you!

Contact: @williamaitken