Aging under Climate Stress:

How Extreme Temperatures Shape Multi-System Biological Aging

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Acknowledgement

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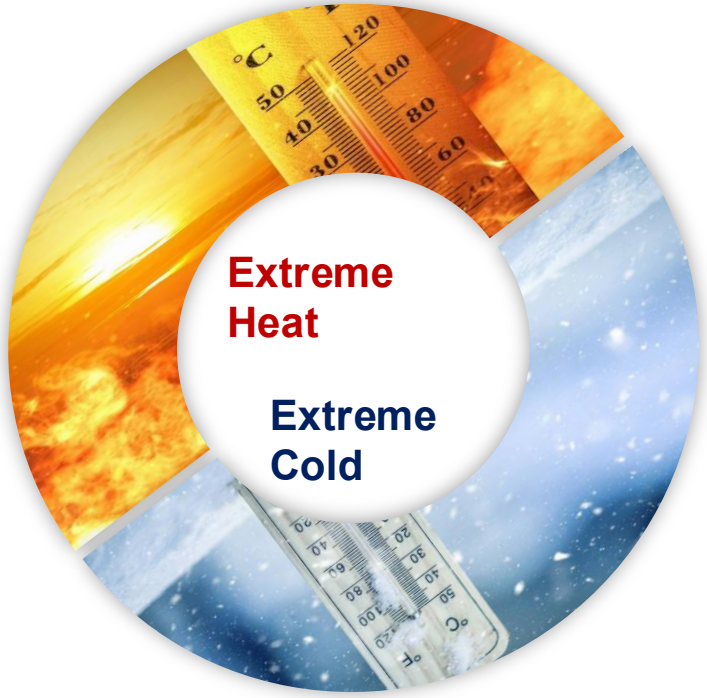
Data Availability

The data for this study incorporate several restricted data sources from the Health and Retirement Study (HRS). Due to privacy and confidentiality requirements, access to these datasets is regulated and requires a formal application process. Researchers interested in utilizing these datasets for their research must apply through the HRS website at https://hrs.isr.umich.edu

BACKGROUND

Extreme Temperature Events are Increasingly Known

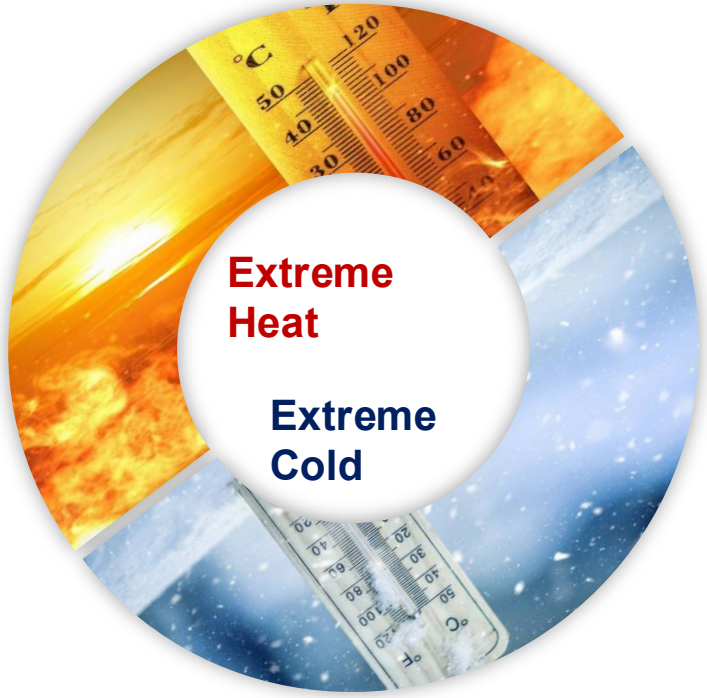


(1)(2)

- **Disease** (Cardiovascular, renal, infectious)
- **Injuries**
- **Mental & Neurological Disorders**
- **Mortality**

(1) Rocque RJ, Beaudoin C, Ndjaboue R, *et al* Health effects of climate change: an overview of systematic reviews *BMJ Open* 2021;**11:**e046333.
(2) Weilnhammer, Veronika, *et al*. Extreme weather events in Europe and their health consequences–A systematic review. *Int. J. Hyg. Environ 2021;***233**:13688.

Biological Mechanisms Underlying Clinical Outcomes Remain Poorly Understood



Biological Aging

- Molecular changes
- Cellular changes
- Decline in system integrity

Disease (Cardiovascular, renal, infectious)

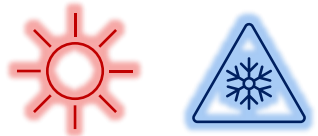
Injuries

Mental & Neurological Disorders

Mortality

Extreme Temperatures and Older Adults' Biological Aging

Aim 1. Determine if older adults living in areas with **more extreme heat or cold days have greater biological age acceleration** and **identify which physiological systems** are most affected



Biological Age

22 clinically relevant biomarkers capturing 8 physiological systems

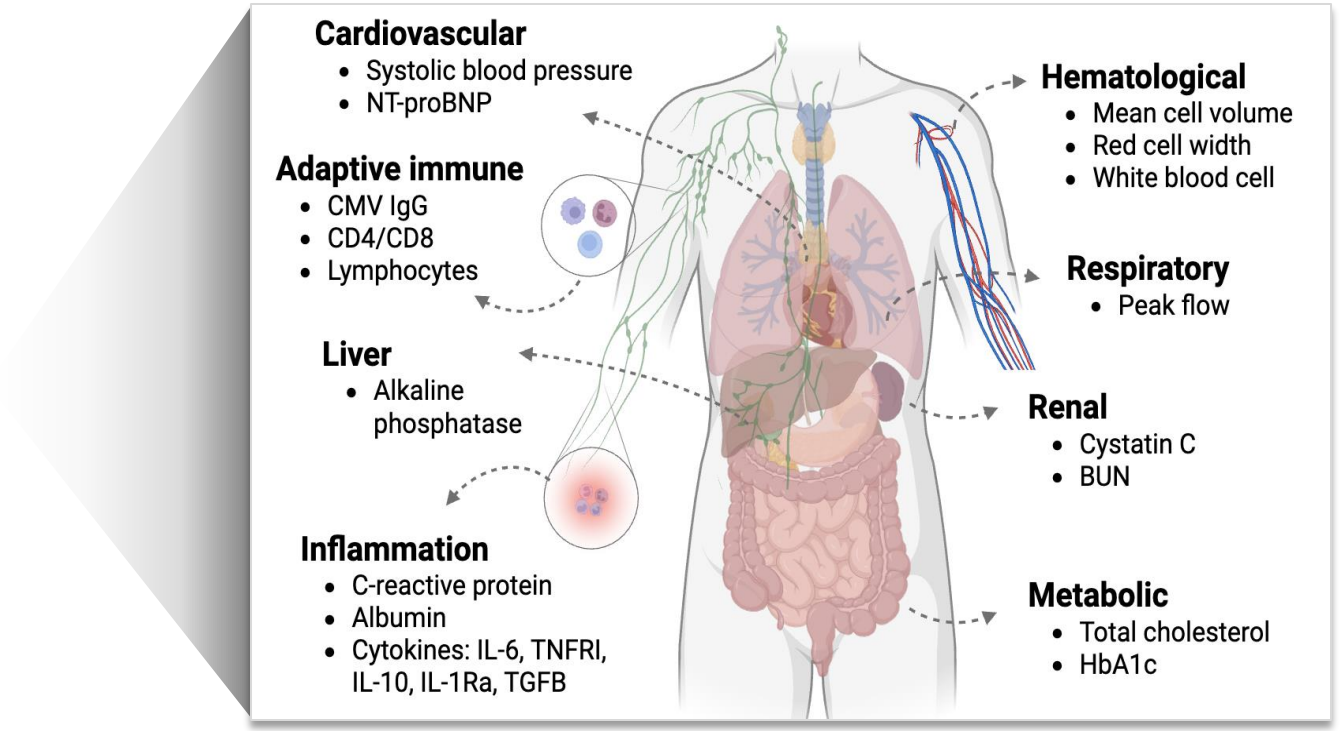
Deceleration

Lower than Chronological Age

Same with Chronological Age

Acceleration

Higher than Chronological Age



Extreme Temperatures and Older Adults'

Sample

~6,000 adults age 56+, 2016 Health and Retirement Study (HRS) Venous Blood Study sample

Outdoor Weather

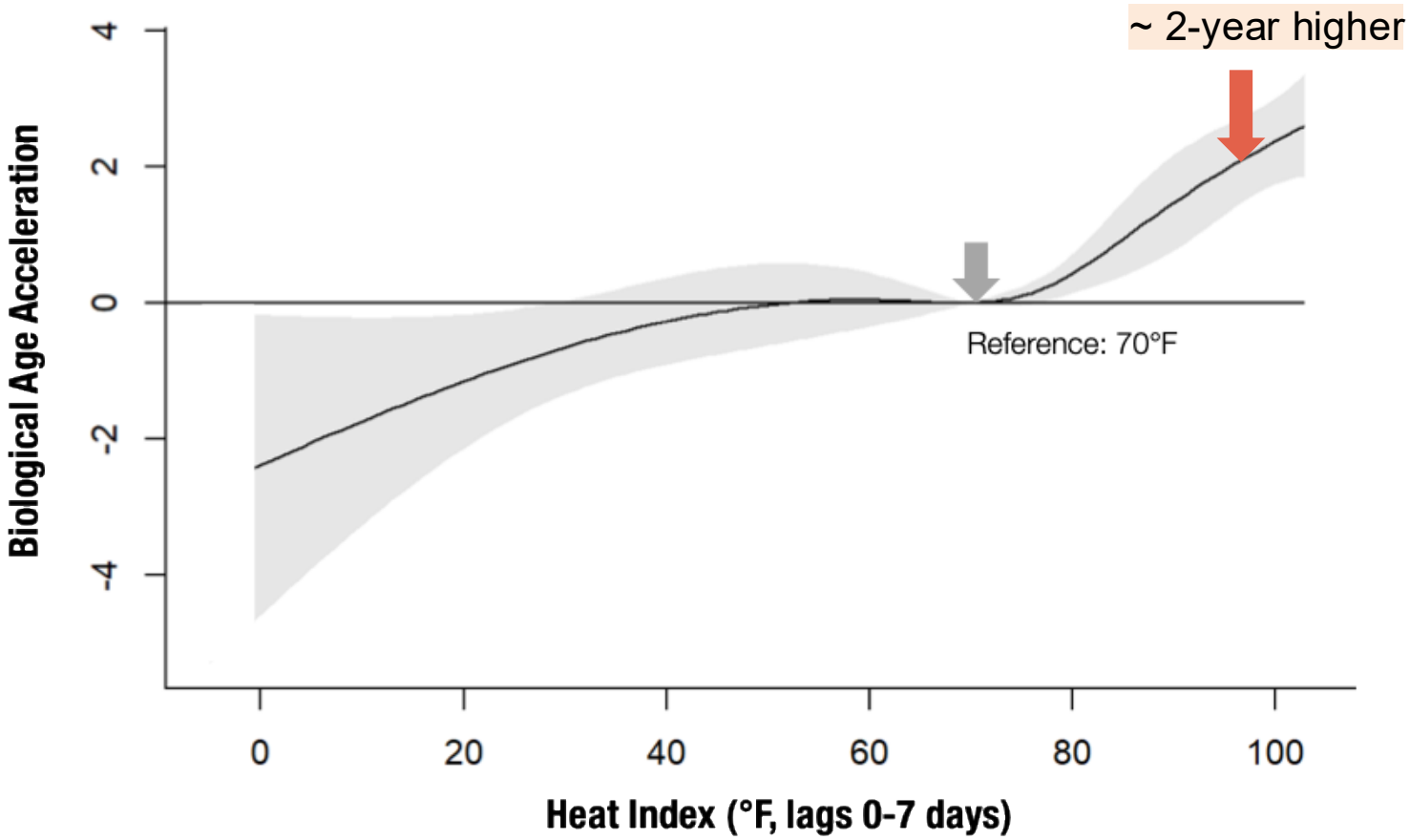
Heat? Heat Index (air temperature with an adjustment for relative humidity)
Cold? Wind Chill Index (air temperature with an adjustment for wind speed)
Time? Short-term (last 7 days) prior to the date of blood collection
Long-term (last 1-10 year) prior to the date of blood collection

Linkage

Weather data merged with HRS sample based on their geocoded addresses at the census tract (*HRS Contextual Data Resource)

PRELIMINARY FINDINGS

Overall Cumulative Exposure-Response

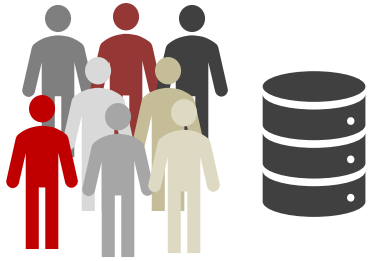


- Distributed lag nonlinear model controls for age, sex, race/ethnicity, education, wealth, $PM_{2.5}$, O_3, tract-level social vulnerability, urbanicity, smoking, drinking, physical activity, and obesity, with inverse probability weighting adjusted for exposure.

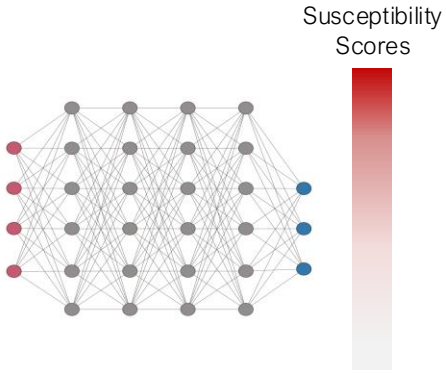
NEXT STEPS

Extreme Temperatures and Older Adults' Biological Aging

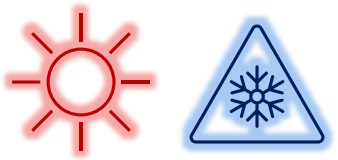
Aim 2. Identify **population subgroups most susceptible** to biological age acceleration in response to outdoor extreme temperatures



Different resources at personal, familial, community levels that can intensify the effects of outdoor extreme temperatures

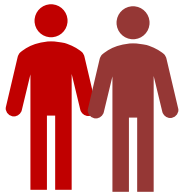


Generate susceptibility scores using regression-guided neural networks (ReGNN) model



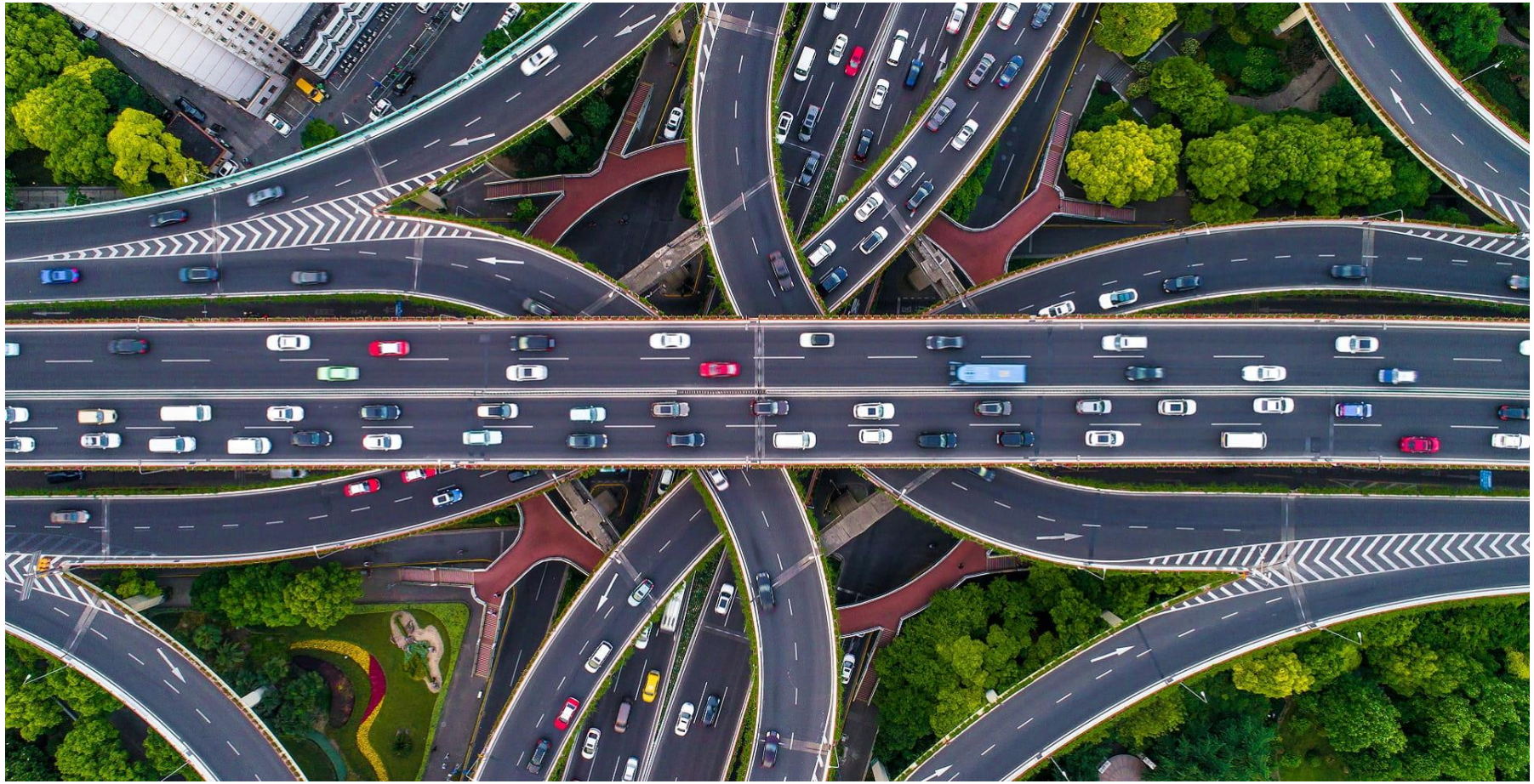
Greater Acceleration

Minimal to No Acceleration



Phenotypes of high-risk subgroups

Still Figuring It Out and Hoping We Can Do That



Thank You For Your Attention!

For More Details, Scan Here:

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