Assessment of Extreme Heat and Hospitalizations to Inform Early Warning Systems

September 19th, 2019

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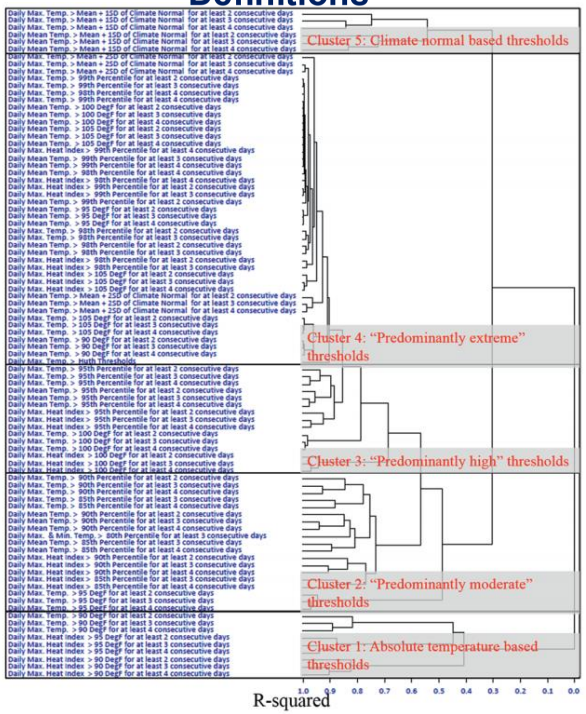
Centers for Disease Control and Prevention (CDC)

Heat-Health Activities: Background

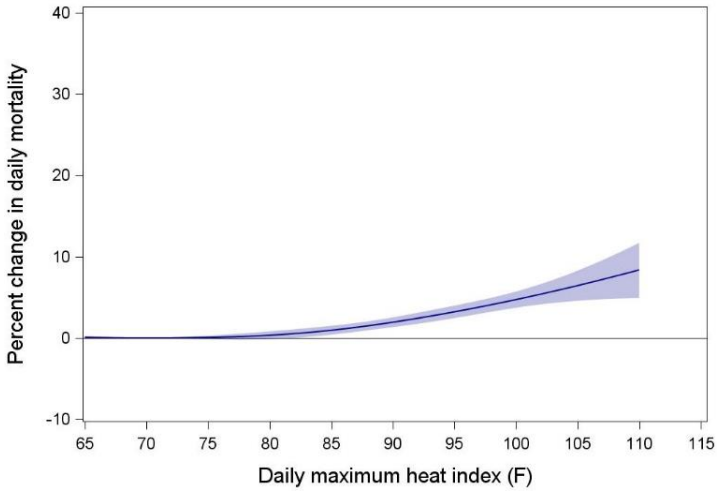
Evaluating Extreme Heat (EHE) Definitions



Vaidyanathan A, et al. A statistical framework to evaluate extreme weather definitions from a health perspective: a demonstration based on extreme heat events. Bulletin of the American Meteorological Society. 2016 Oct;97(10):1817-30.

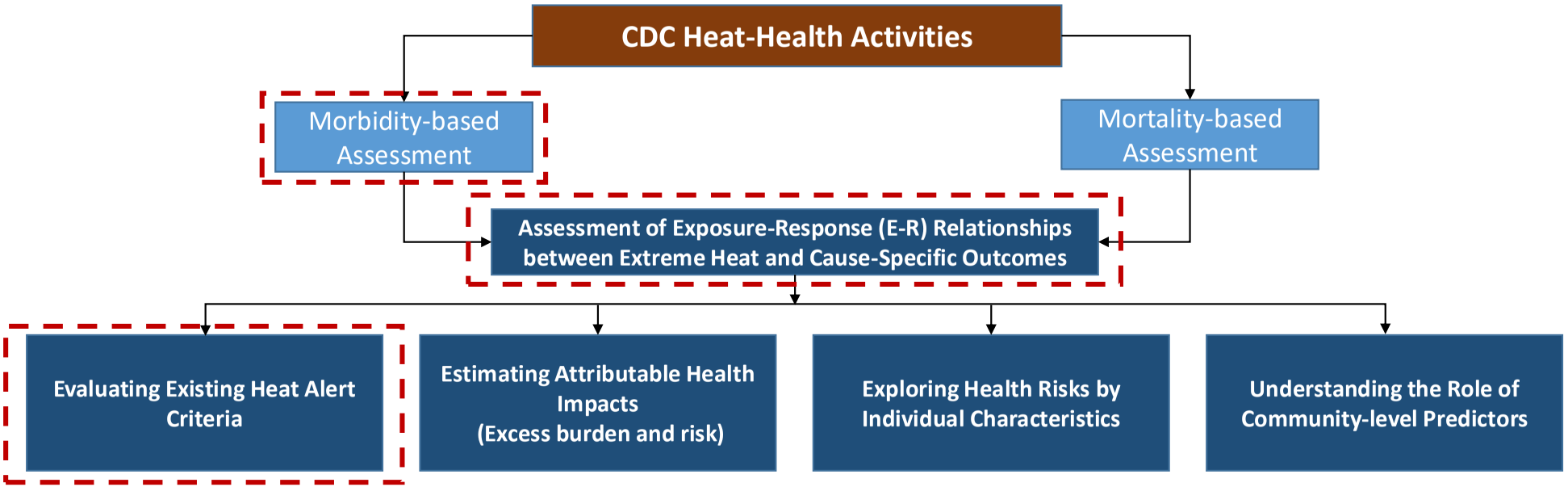
CDC-NOAA Joint Meeting (Silver Spring, MD)

Development of Exposure – Response (E-R) Profiles for Summertime Temperature Ranges

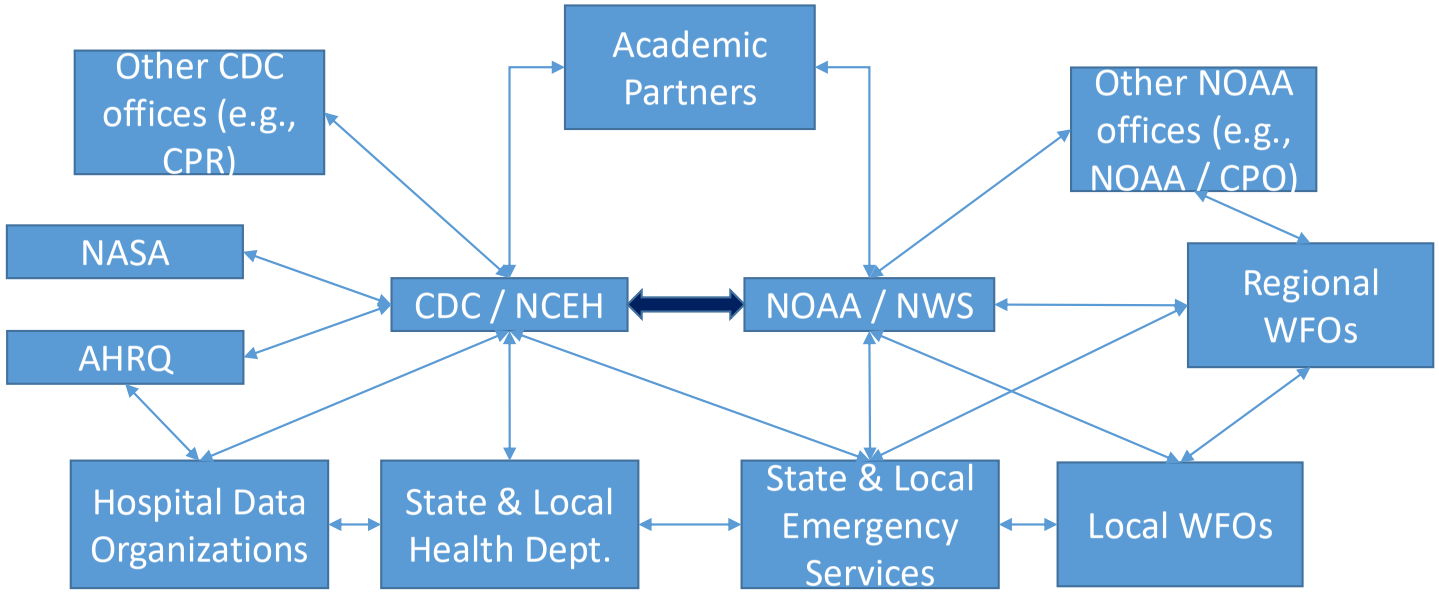


Heat-Health Activities: Background

- Conduct heat-health risk assessments to support public health interventions



Heat – Health Activities: Partnerships

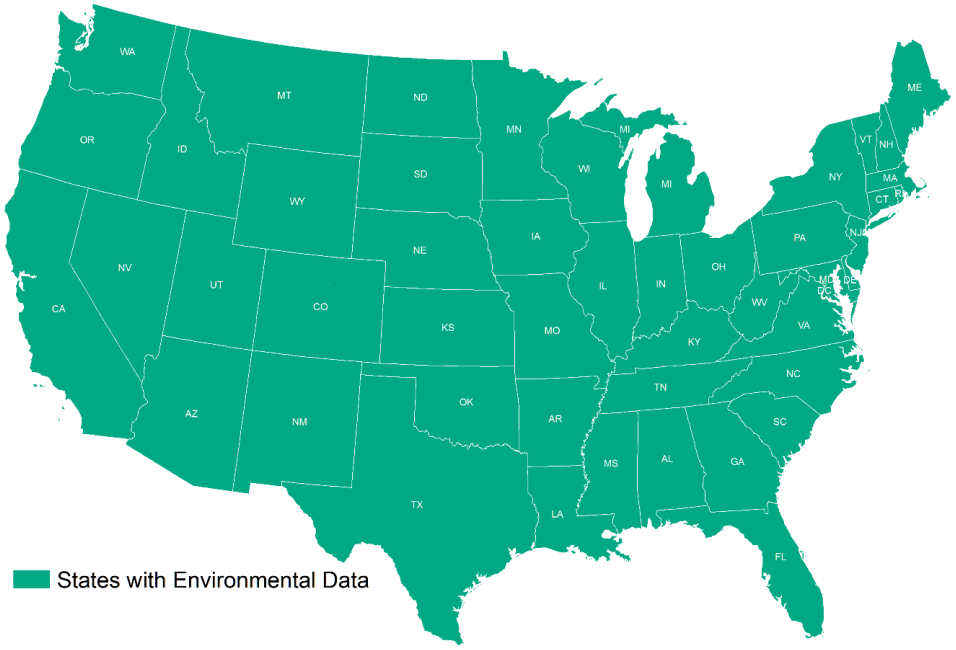


CDC: Centers for Disease Control and Prevention
NCEH: National Center for Environmental Health
AHRQ: Agency for Healthcare Research and Quality
NASA: National Aeronautics and Space Administration
CPR: Center for Preparedness and Response
LSHTM: London School of Hygiene and Tropical Medicine

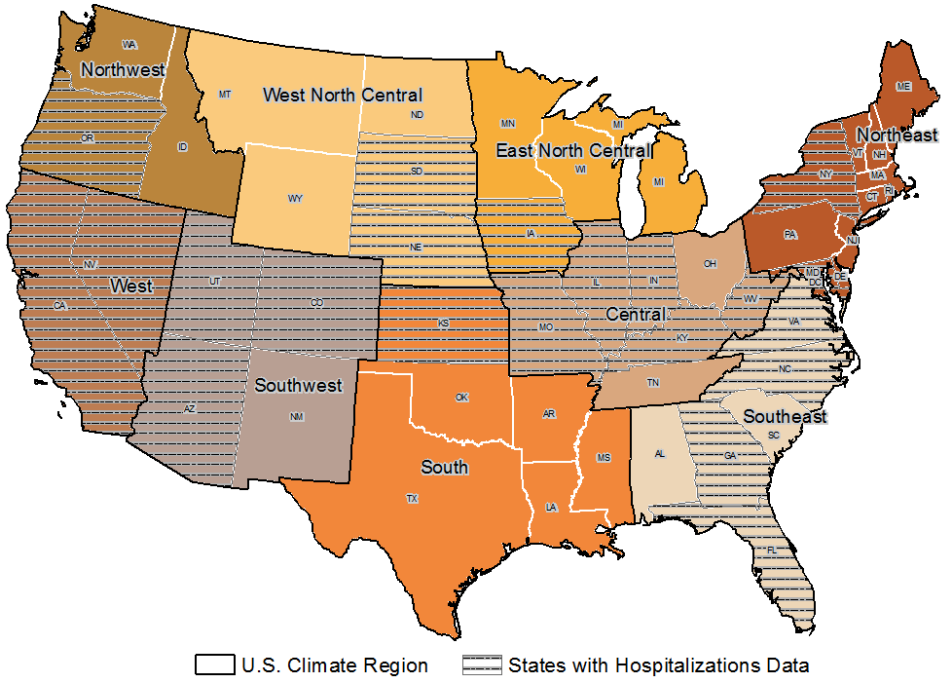
NOAA: National Oceanic and Atmospheric Administration
NWS: National Weather Service
CPO: Climate Program Office
WFO: Weather Forecast Office

Summary of Data Sources

Meteorological / Environmental Data

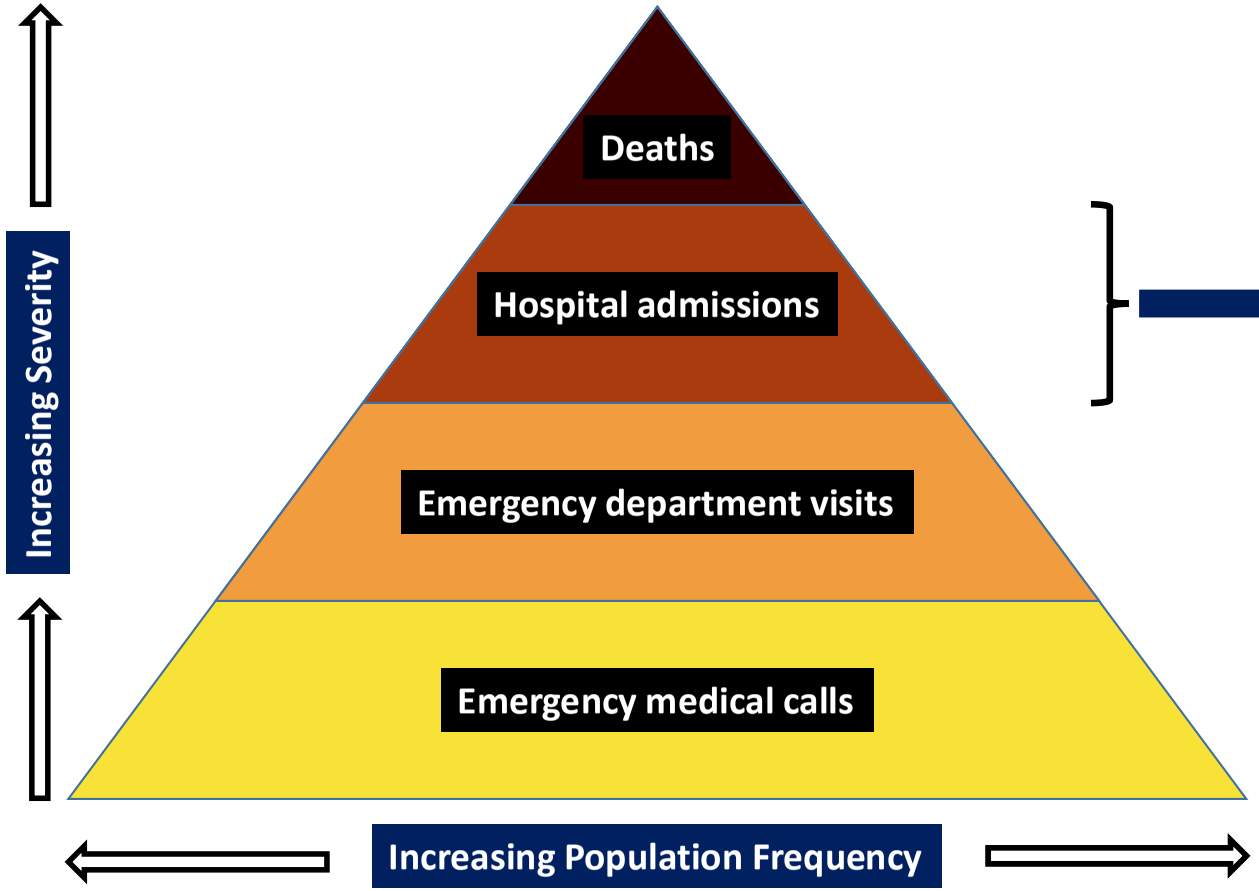


Health Data / Climate Regions



- Daily heat metrics and air pollutants (*1999 – 2016)*
- Hospital admissions data from 22 states *(2003 – 2012)*
- *Time period for this Study: 2003-2012*

Heat-Related Health Outcomes

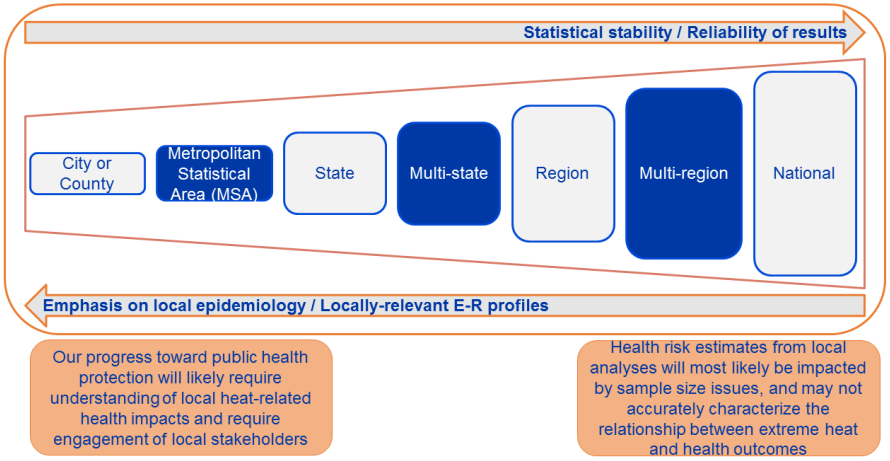


Cause-Specific Outcomes Identified for this Study

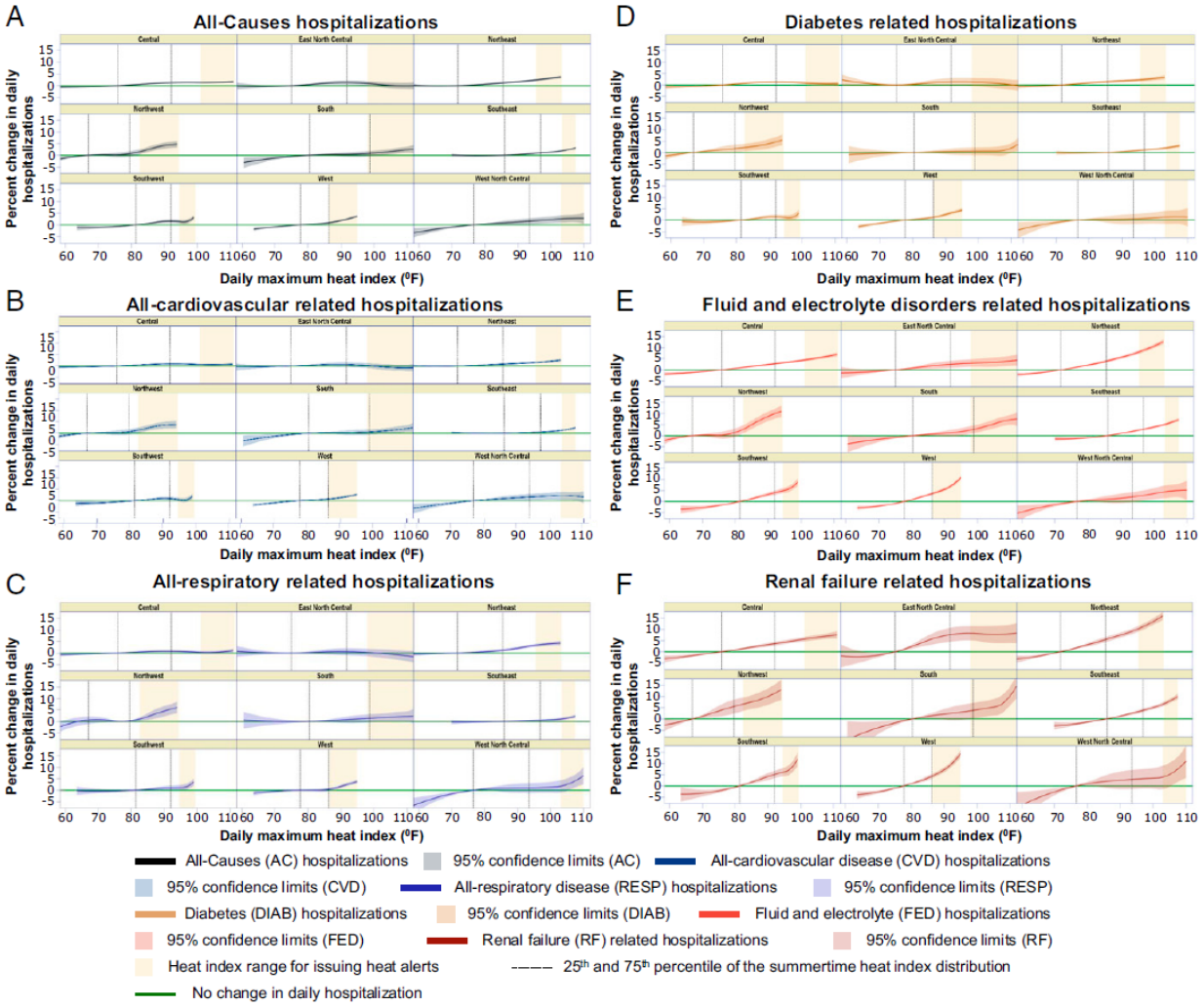
- All-causes
- All cardiovascular-related diseases
- All respiratory diseases
- Acute renal failure
- Fluid and electrolyte imbalance disorders
- Diabetes-related disorders

Analysis Framework

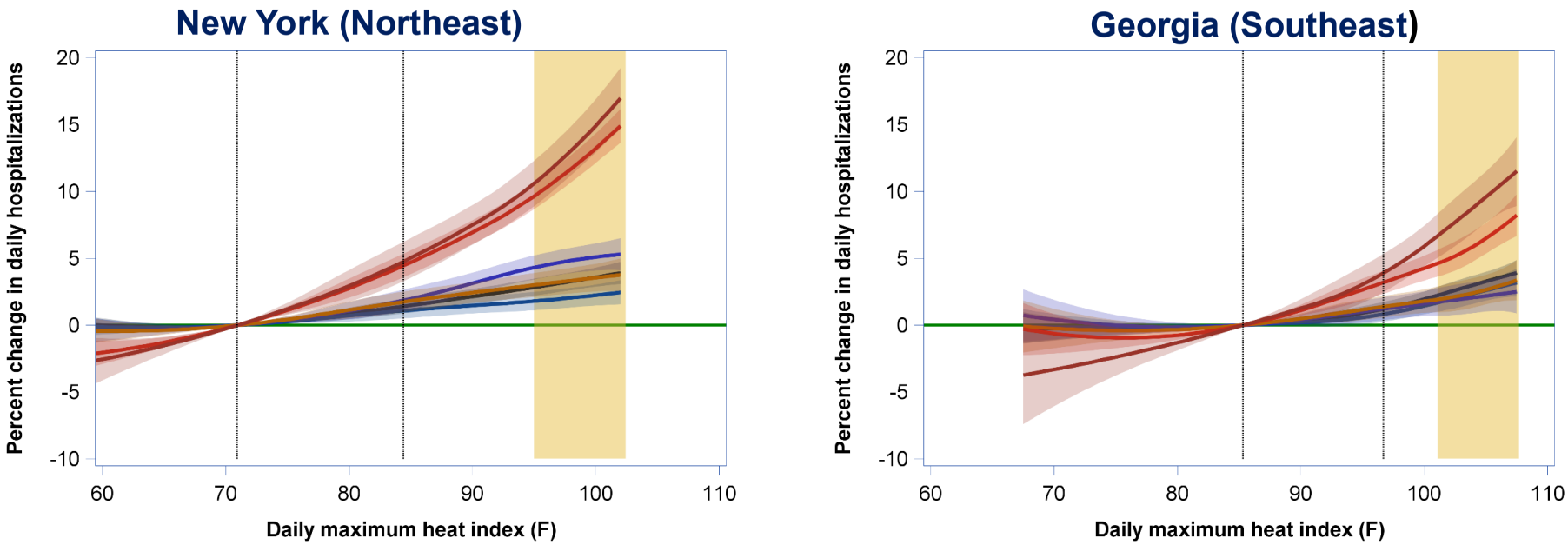
- Two-stage analysis to estimate heat-health risk relationships for hospitalizations
- The first stage involved a county-level time-series quasi-Poisson regression using a distributed lag nonlinear model for the summer months (May1 through September 30)
  - Controls for air pollution, seasonality, long-term trends, day of the week, etc.
  - Health risks estimated for a cumulative lag period of 2-3 days
- Second stage involves a pooled analysis to summarize county-specific risks across larger geographic scales
  - Pooled analysis conducted using standard meta-regression techniques



Results: E-R Relationships



Results: Evaluation of Existing Heat Alert Criteria



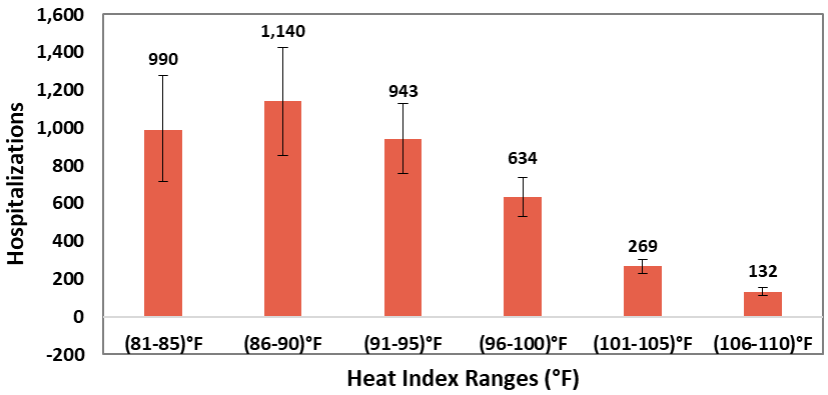
Legend

- All-Cause (AC) hospitalizations
- 95% confidence limits (CVD)
- Diabetes (DIAB) related hospitalizations
- 95% confidence limits (FED)
- 25th and 75th percentiles of the summertime heat index distribution
- 95% confidence limits (AC)
- All respiratory disease (RESP) related hospitalizations
- 95% confidence limits (DIAB)
- Renal failure (RF) related hospitalizations
- No change in daily hospitalizations
- All cardiovascular disease (CVD) related hospitalizations
- 95% confidence limits (RESP)
- Fluid and electrolyte disorders (FED) related hospitalizations
- 95% confidence limits (RF)
- Heat index range for issuing heat alerts

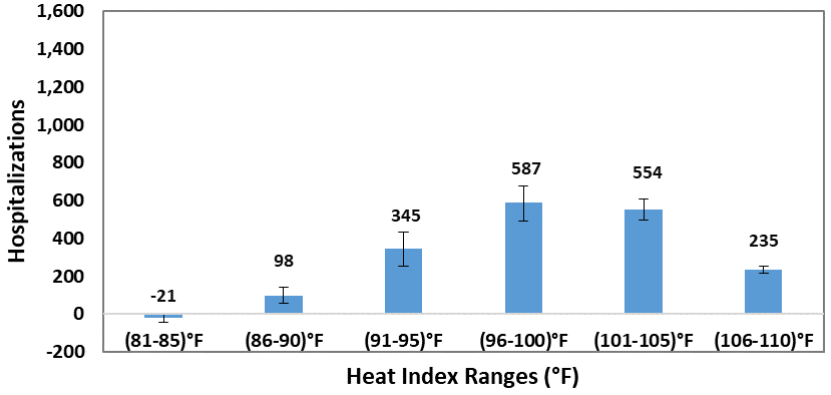
Results: Health Burden Associated with Heat Exposure

All-cause ED visits and hospitalizations associated with heat exposure, per summer (May – Sep)

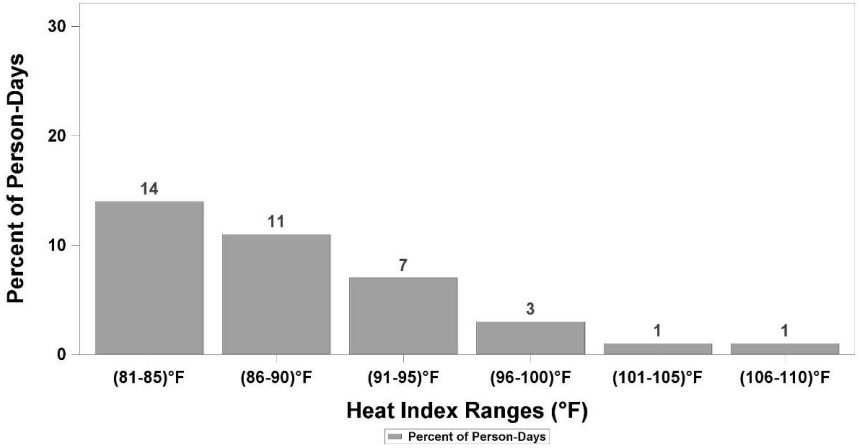
New York (Northeast)



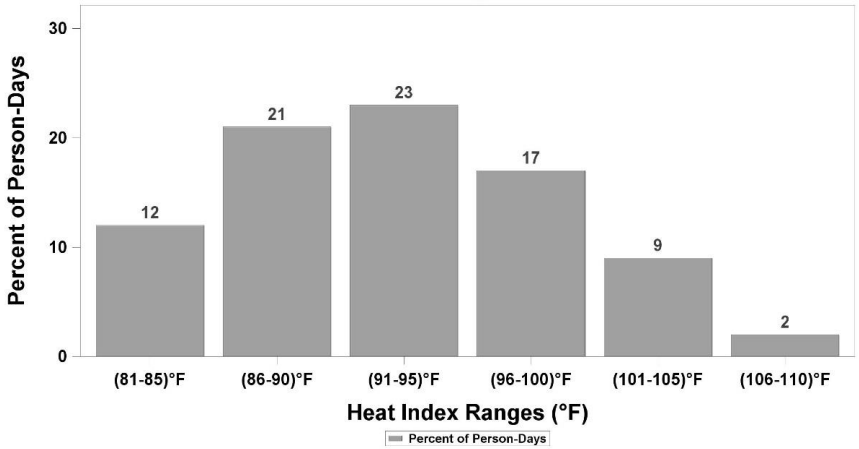
Georgia (Southeast)



Median Heat Alert Criteria: 100 °F

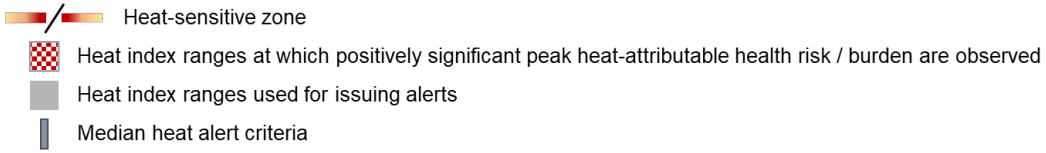


Median Heat Alert Criteria: 107 °F



Results: Region-Specific Heat-Sensitive Zones

Climate Region	Hospitalization Outcome	Heat-Sensitive Zones with Heat Alert Criteria, by Heat Index Ranges				
		<= 80 °F	81 – 90 °F	91 – 100 °F	101 – 110 °F	> 110 °F
Central	All-Causes					
	All cardiovascular					
	All respiratory					
	Diabetes					
	Fluid and electrolyte					
	Renal failure					



Vaidyanathan A et al. Assessment of Extreme Heat and Hospitalizations to Inform Early Warning Systems. Proceedings of National Academy of Sciences (Available online). (https://www.pnas.org/content/early/2019/02/26/1806393116)

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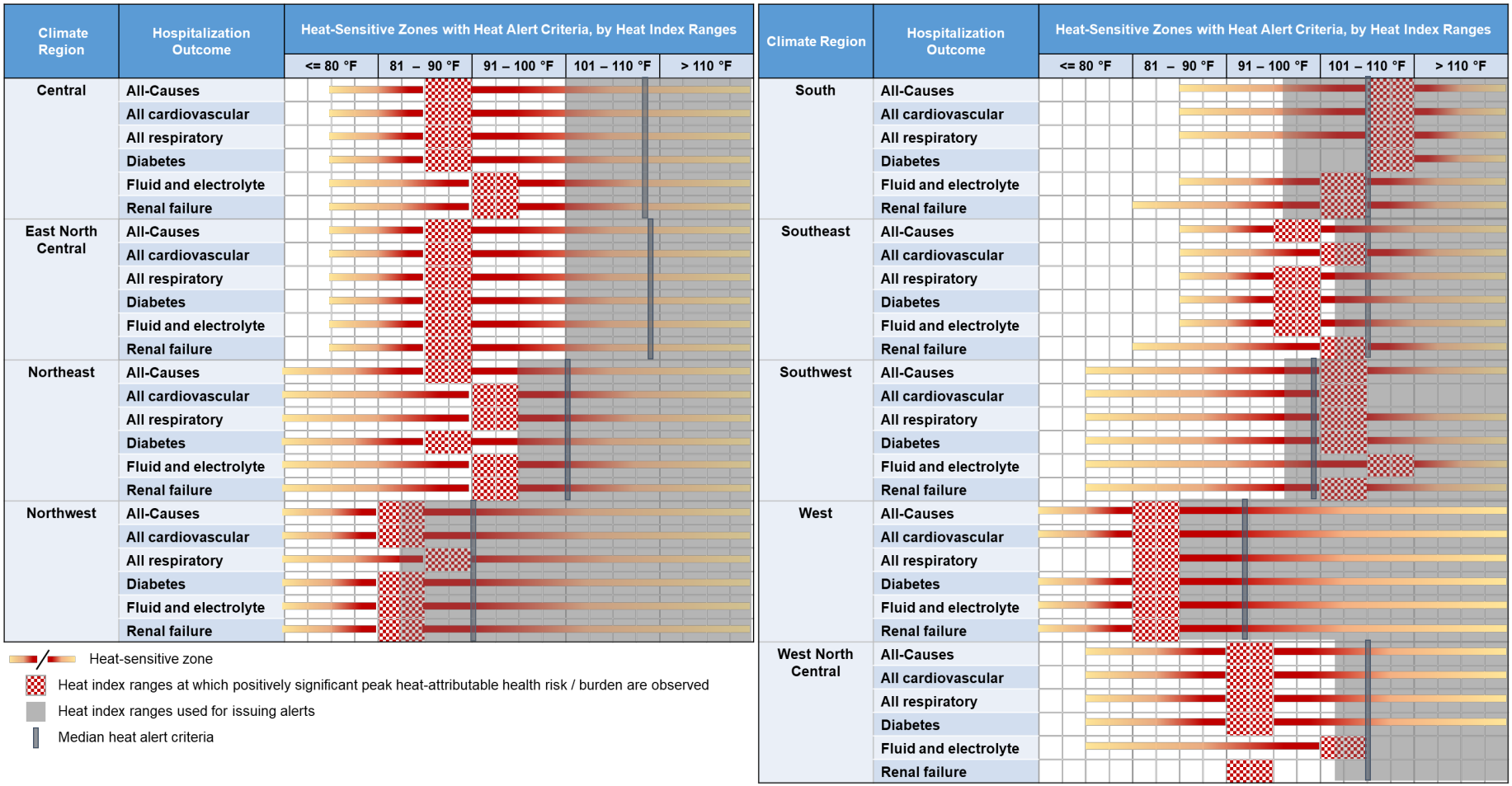

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Summary: Major Findings

- Risk sensitivity (slope) and magnitude of cause-specific E-R associations tend to differ across heat-related health outcomes chosen for this study

- Heat-related illnesses start to occur at moderate heat-index values, which in colder regions are well below the alert ranges used by the National Weather Service

- The findings highlight opportunities for using local epidemiological data to refine heat-alert criteria and to potentially reduce the substantial burden of disease associated with extreme heat

Acknowledgements: Coauthors and Contributors

Agency for Healthcare Research and Quality (AHRQ)
Dr. Anne Elixhauser
Mr. Rick Jordan

Centers for Disease Control and Prevention (CDC)
Dr. Shubhayu Saha
Mr. Nabil Abdurehman (ORISE)
Dr. Josephine Malilay
Mr. Paul Schramm
Dr. Fuyuen Yip
Dr. Dana Flanders
Dr. Scott Kegler
Dr. Judith Qualters
GRASP-ATSDR

London School of Hygiene and Tropical Medicine (LSHTM)
Dr. Antonio Gasparrini
Dr. Ana Vicedo-Cabrera
Mr. Francesco Sera

National Aeronautics and Space Administration (NASA)
Mr. John Haynes
Ms. Sue Estes
Dr. Maury Estes
Dr. Kevin Doty

NOAA / National Weather Service
Dr. Michelle Hawkins
Mr. Mike Staudenmaier
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State and Local Health Departments
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University of Washington
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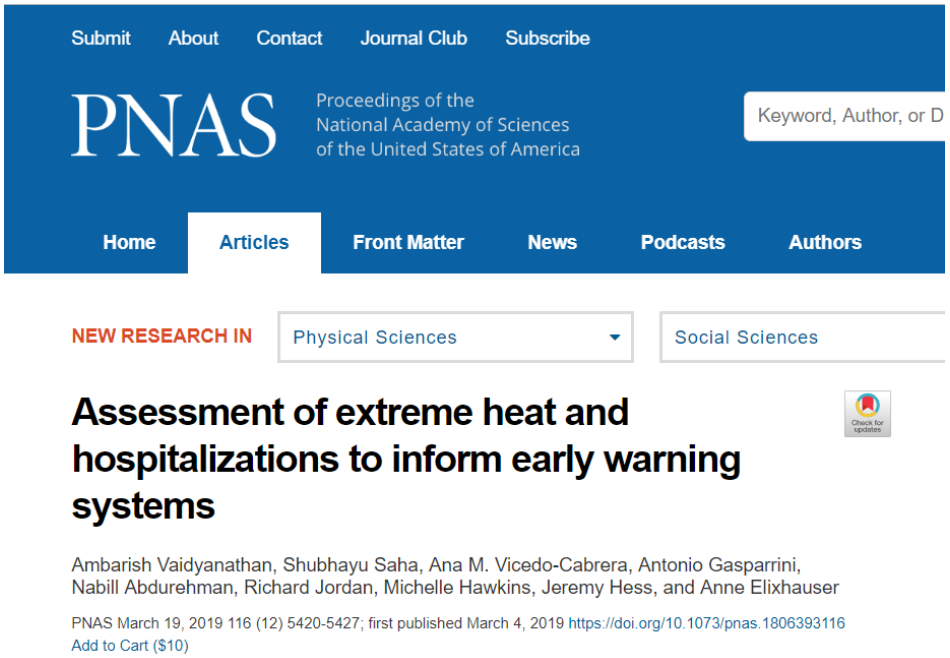

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Questions?

Thank You!

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