Extreme Heat and Clinical Practice

- Cecilia Sorensen, MD
- Director, Global Consortium on Climate and Health Education
- Associate Professor, Columbia Irving Medical Center
- Associate Professor, Mailman School of Public Health

The view from the Emergency Department

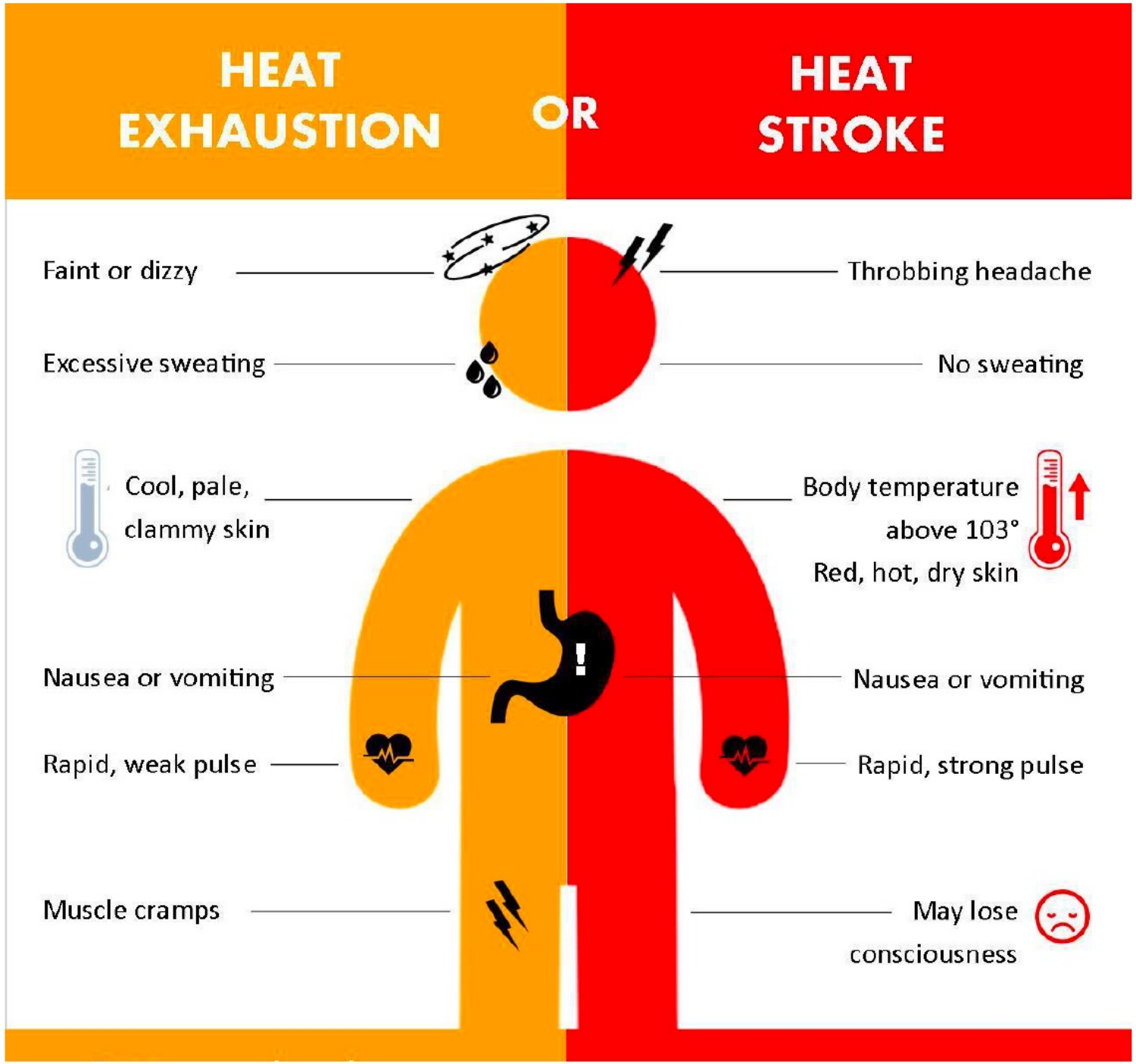
Case 1:

- 76-year-old male, history of cardiac arrhythmia, hypertension, takes multiple unknown medications
- Chief Complaint: lightheaded, passed out
- Brought to ER by family after he collapsed in the backyard
- Exam:
- Gen: Awake, alert
- Vital Signs:
  - Heart rate: 110
  - Blood Pressure: 178/80
  - Temperature: 100.1°F

The view from the Emergency Department

Case 2:

- 36-year-old male, previously healthy
- Chief Complaint: Confusion
- Had been driving enclosed tractor all day in summer temps, found confused at worksite
- Arrival via private vehicle to urgent care
- Exam:
- Gen: Ill appearing, arousable to voice, dry skin
- Vital Signs:
  - Heart rate: 130
  - Blood Pressure: 105/80
  - Temperature: 103.3°F


HEAT EXHAUSTION
OR
HEAT STROKE
Faint or dizzy
Throbbing headache
Excessive sweating
No sweating
Cool, pale, clammy skin
Body temperature above 103°
Red, hot, dry skin
Nausea or vomiting
Nausea or vomiting
Rapid, weak pulse
Rapid, strong pulse
Muscle cramps
May lose consciousness

Vulnerability to Heat

Exposure

Populations that will have increased exposure to heat during extreme heat events include

- Persons experiencing housing insecurity
- Outdoor workers
- Athletes
- Incarcerated individuals

Sensitivity

Populations that will have greater sensitivity during periods of extreme heat include

- Elderly persons (65 and older)
- Infants and young children
- Persons who are pregnant
- Persons who are bedridden
- Persons with mental illness/disability
- Persons with chronic medical conditions
- Persons taking life-saving medications
- Persons utilizing medical equipment
- Persons with substance or alcohol use disorder

Adaptive capacity

Populations who may be unable to adapt via behaviors or resources to periods of extreme heat include

- Persons using mobility devices or who are non-ambulatory
- Persons who are socially isolated
- Persons who do not speak local/prevailing language
- Persons who do not have air conditioning
- Persons living in areas unaccustomed to extreme heat

Patel et al., *NEJM Catalyst*, July 2022

Case 1 Analysis:

Context:

- Higher than average temperatures
- Elderly, on multiple medications, SSO
- Patient did not suspect he was vulnerable
- No air conditioning in home

Pre-hospital:

- Lack of community/family awareness as to signs and symptoms of heat-illness

Facility-based care:

- No chilled fluids available
- No social worker on duty to do home assessment of risks
- Lack of ability to communicate with medication prescribers/PCP/Cardiologist

Case 2 Analysis:

Context:

- Higher than average temperatures
- Workplace precautions in place?
- Patient did not suspect he was vulnerable
- Had (+) UDS

Pre-hospital:

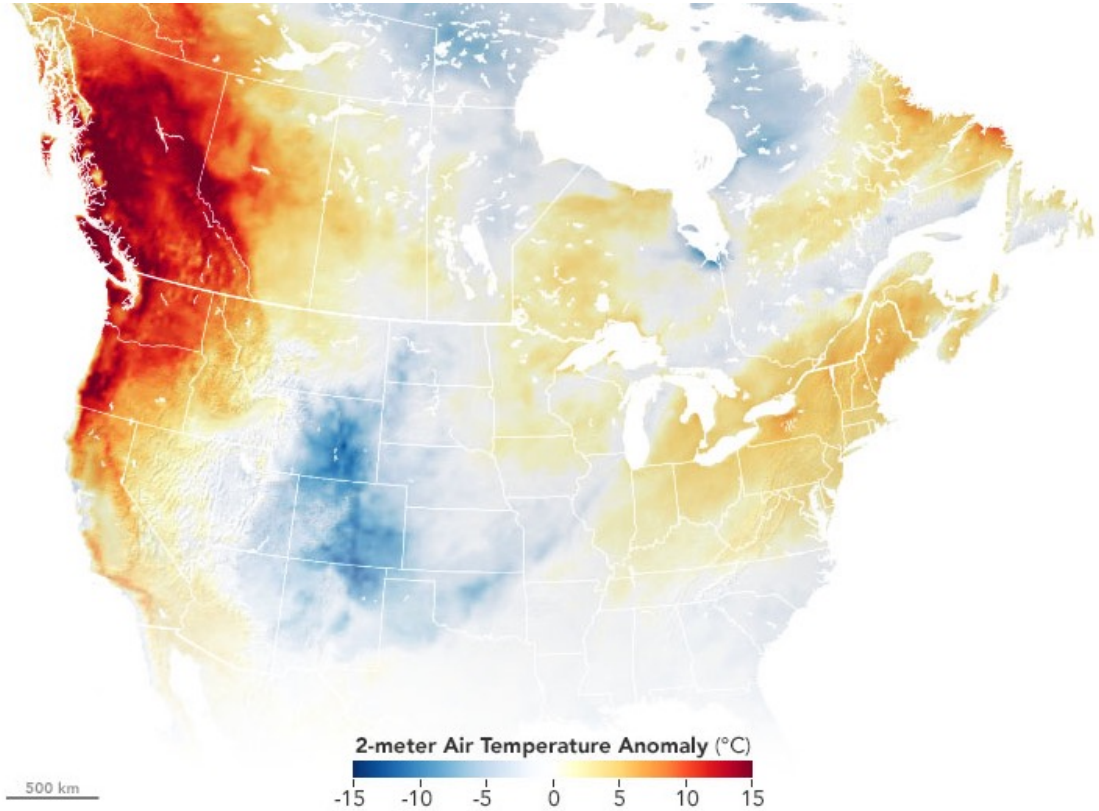
- No temperature taken in field, no cooling started
- Lack of community awareness (co-workers) as to signs and symptoms of heat-illness

Facility-based care:

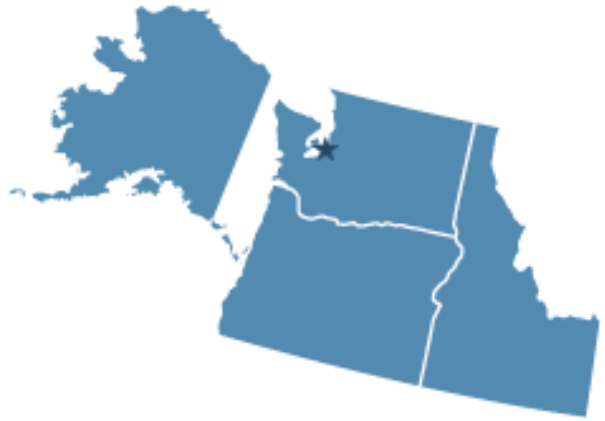
- No onsite ability for cold water immersion, ice-machine rapidly exhausted
- No ability to easily monitor core temperature
- Staff overall had no experience treating heat stroke/no protocols in place

Pacific Northwest Heatwave of 2021

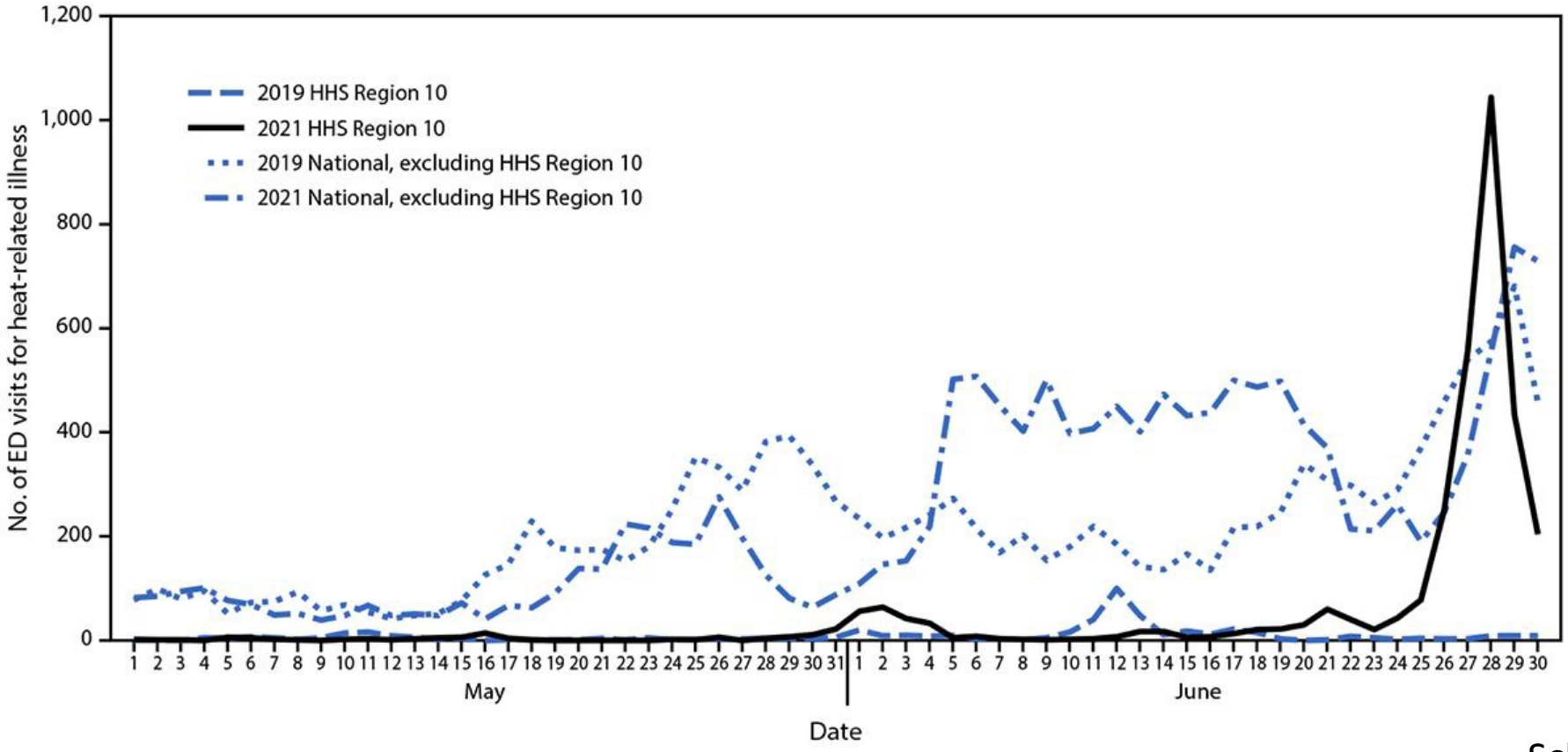
- Historically unprecedented extreme heat event
  - Near-surface air temperature anomalies reached up to 16–20 °C above normal over a wide region
- Relatively short advance warning
  - Little lived experience with heat
- Acute-on chronic capacity constraints
  - Population growing faster than health care capacity



Health Impacts



- **100-fold increase in heat-related ED visits**

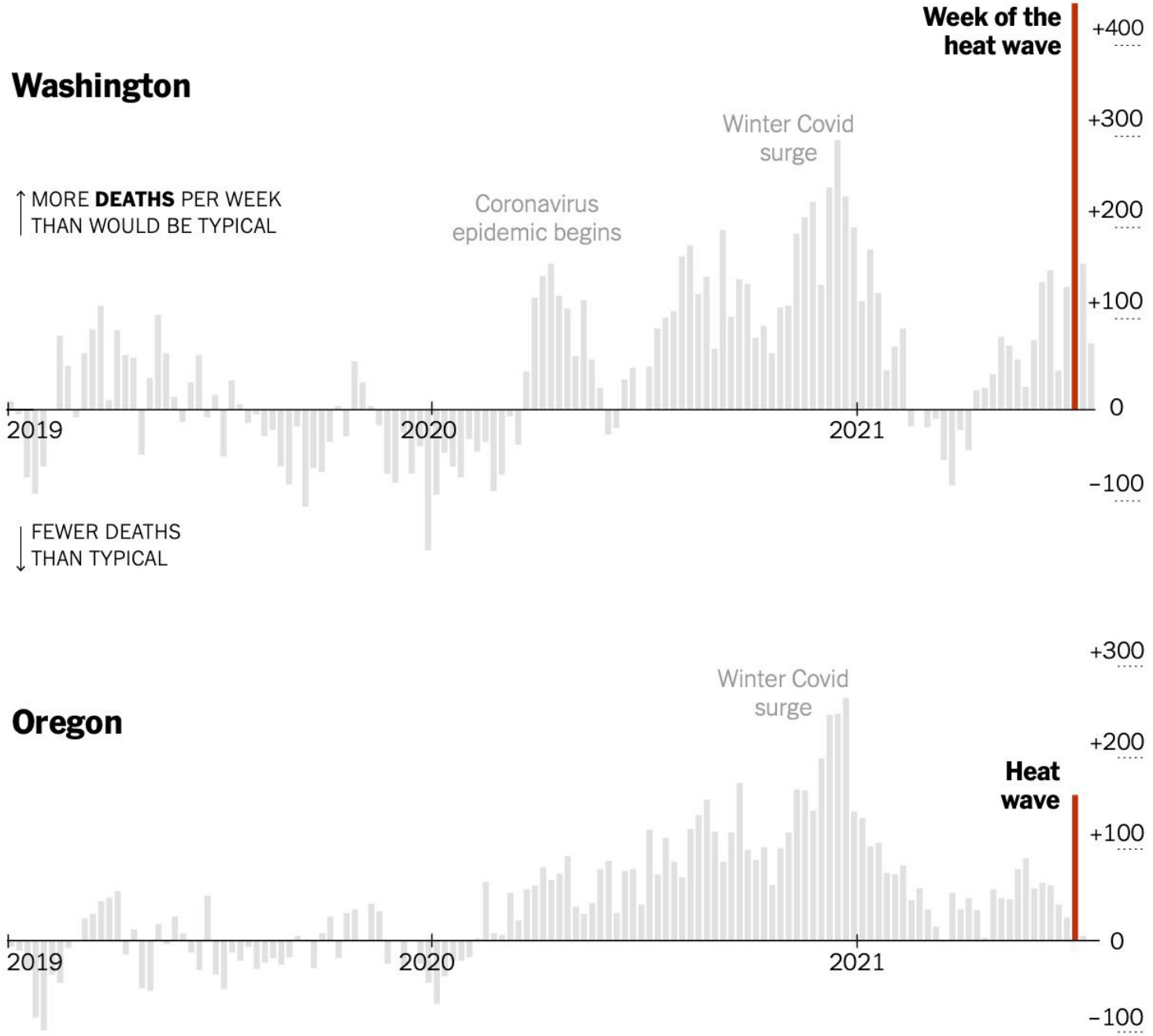


Schramm et al, 2021

- Community deaths higher in neighborhoods with material & social deprivation & lower levels of green space
- Mental illness & substance use disorder were significant risk factors
- Higher risk among those aged 65–84 years and among females

(White et al, *Nature*, 2023)

Figure: NYT



Healthcare system impacts:

- 911 call centers overwhelmed
- Patient surges in regional hospitals
- Several lost power
- No regional disaster plans for heat waves
- Hospitals ran out of ice/abilities to cool patients
- Ventilators in short supply

PACIFIC NORTHWEST

Doctors filled body bags with ice to save NW heat-wave patients from death

….a “never again” moment….

- Creation of heat action plans in affected cities in PNW
- Closer coordination of EMS/Healthcare systems with meteorologic services
- Engagement of communities most impacted by heat and environmental injustice, such as seniors, primary caregivers for children, and communities of color to improve extreme heat planning and response
- Greater outreach to homeless and mental health populations
- Healthcare system upgrades

Healthcare System Challenges

- **Clinical Challenges:**
  - Recognition and life saving care requires trained staff
  - Widespread access to cooling resources is limited
  - Whole of healthcare system approach is needed
  - Lack of research to guide evidence-based practices
- **Healthcare System Challenges:**
  - No wide-spread adoption of triage and treatment protocols for heat-related illnesses
  - No mandate to require heat (or other climate-related events) in hazard vulnerability assessments
  - Widespread need to upgrade infrastructure, back up power, etc for MULTIPLE climate hazards
  - Need for wide-spread training and capacity building of staff
- **Community Challenges:**
  - Patient/community awareness of vulnerability
  - Vulnerability maps with adequate response plans for heat are not widespread
  - Limited resources allocated for adaptation
  - Lack of coordination with healthcare systems