

Data and Surveillance:

*How can we measure and monitor
climate-related health effects?*



John E. Baldacci, Governor

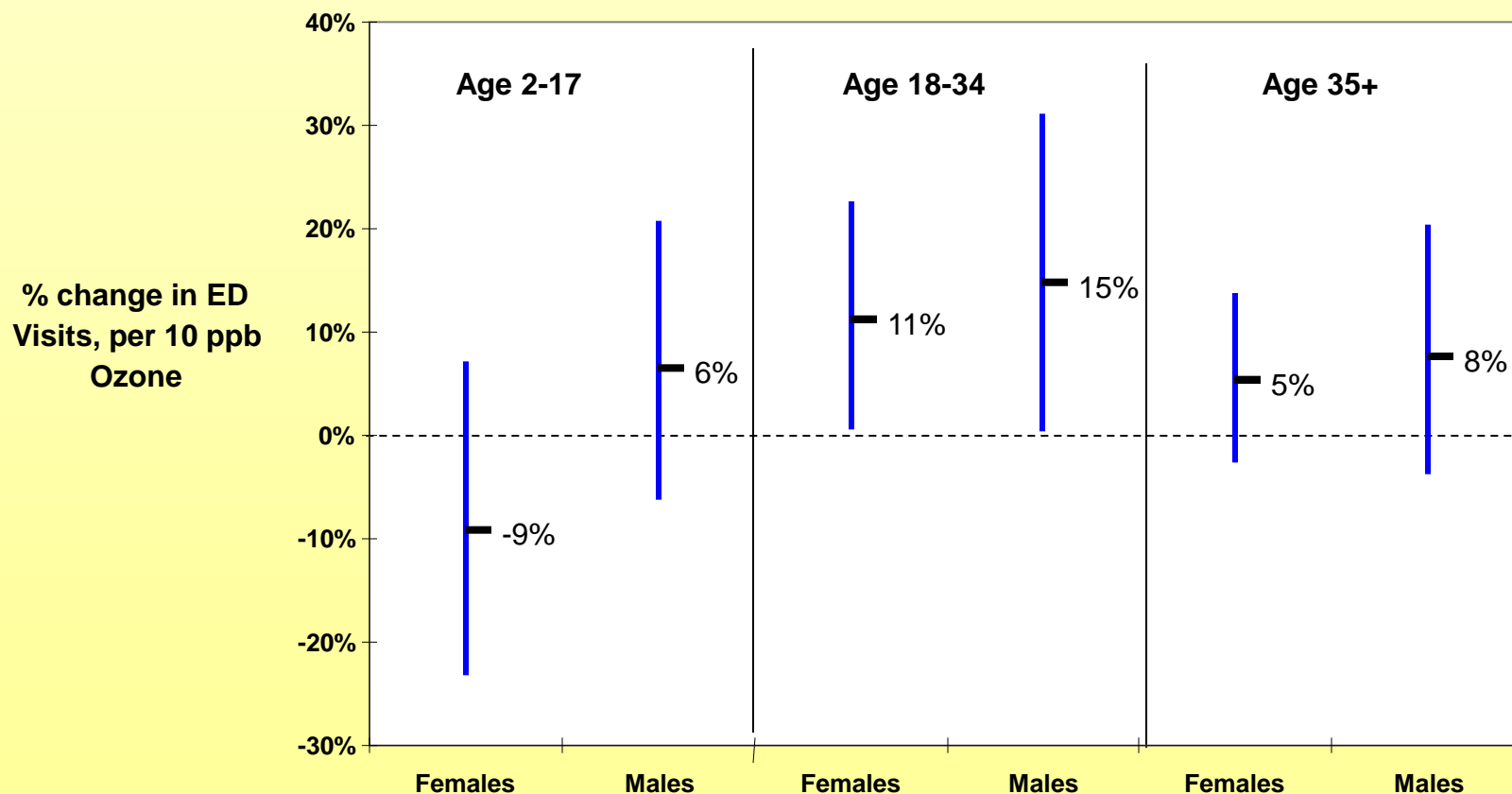
Brenda M. Harvey, Commissioner

**Andrew Smith, SM, ScD
State Toxicologist, Maine CDC**

**Rebecca Lincoln
Toxicologist, Maine CDC**

Why surveillance matters

Maine Asthma ED visits 2001: daily percent change associated with ozone
by age and sex groups, adjusted model



Surveillance Needs Nationally Consistent Indicators

Review

Environmental Health Indicators of Climate Change for the United States: Findings from the State Environmental Health Indicator Collaborative

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OBJECTIVE: To develop public health adaptation strategies and to project the impacts of climate change on human health, indicators of vulnerability and preparedness along with accurate surveillance data on climate-sensitive health outcomes are needed. We researched and developed environmental health indicators for inputs into human health vulnerability assessments for climate change and to propose public health preventative actions.

DATA SOURCES: We conducted a review of the scientific literature to identify outcomes and actions that were related to climate change. Data sources included governmental and nongovernmental agencies and the published literature.

DATA EXTRACTION: Sources were identified and assessed for completeness, usability, and accuracy. Priority was then given to identifying longitudinal data sets that were applicable at the state and community level.

DATA SYNTHESIS: We present a list of surveillance indicators for practitioners and policy makers that include climate-sensitive health outcomes and environmental and vulnerability indicators, as well as mitigation, adaptation, and policy indicators of climate change.

CONCLUSIONS: A review of environmental health indicators for climate change shows that data exist for many of these measures, but more evaluation of their sensitivity and usefulness is needed. Further attention is necessary to increase data quality and availability and to develop new surveillance databases, especially for climate-sensitive morbidity.

KEY WORDS: adaptation, air quality, climate change, environmental health, heat, indicators, vulnerability. *Environ Health Perspect* 117:1673–1681 (2009). doi:10.1289/ehp.0900708 available via <http://dx.doi.org/> [Online 18 May 2009]

established the State Environmental Health Indicators Collaborative (SEHIC) in 2004. SEHIC comprises a group of state-level environmental health practitioners interested in developing environmental public health indicators for use within environmental health surveillance and practice. The SEHIC first focused on developing indicators for air quality, asthma, and drinking water. Last year, it established a workgroup on climate change. This article presents the initial findings of that workgroup.

Materials and Methods

Indicators are quantitative summary measures that can be used to track changes in conditions by person, place, and time. The purpose of environmental health indicators as established by the SEHIC is to describe elements of environmental sources, hazards, exposures, health effects, and intervention and prevention activities. Indicators can be used to assess

CSTE SEHIC

Proposed indicators

- Environmental indicators
 - Greenhouse gases, temperature, etc.
- Morbidity/mortality indicators
 - Morbidity/mortality from heat, extreme weather, etc.
- Vulnerability indicators
 - Poverty, elderly living alone, vulnerability to sea level rise, etc.
- Mitigation indicators
 - Energy efficiencies, no. of vehicle miles traveled, etc.
- Adaptation indicators
 - Access to cooling centers, no. of heat wave warning systems, etc.
- Policy indicators
 - No. of states/cities participating in climate change initiatives, etc.

The Role of Environmental Public Health Tracking




CDC Home
CDC Centers for Disease Control and Prevention
Your Online Source for Credible Health Information

National Environmental Public Health Tracking Network

Home About Tracking Program State & Local Tracking Portals Indicators & Data Secure Portal

Tracking A-Z Index [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#) <#>


[GLOSSARY](#) [CDC A-Z](#) [TRACKING A-Z](#)



Environmental causes of chronic diseases are hard to identify. Measuring amounts of hazardous substances in our environment in a standard way, tracing the spread of these over time and area, seeing how they show up in human tissues, and understanding how they may cause illness is critical. The National Environmental Public Health Tracking Network is the start of that system.


The National Environmental Public Health Tracking Network is a system of integrated health, exposure, and hazard information and data from a variety of national, state, and city sources. On the Tracking Network, you can explore information and view maps, tables, and charts about health and environment across the country. [Learn more about tracking.](#)

Environments




- Outdoor Air
- Water
- Homes

Health Effects



- Asthma
- Cancer
- Childhood Lead Poisoning
- More Health Conditions

Info by Location



Select State:

[SEARCH](#)

Page Options

Text size:

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Tracking Hot Topics

- New data added for Cancer, Reproductive Health, Birth Defects and Air
- Listen to our Tracking podcasts


Resources

- Communication Features
- Join our List-serv
- Document Library
- Quick Reports
- Technical Notes

Contact Us

CDC Phone: 800-CDC-INFO
800-232-4636
888-232-6348 (TTY)

Tracking Program:
trackingsupport@cdc.gov
1-877-923-TRACK



The Role of Environmental Public Health Tracking

Maine.gov

Agencies | Online Services | Web Policies | Help

Maine Center for Disease Control & Prevention
An Office of the Department of Health and Human Services

Maine Tracking Network
A partner in the
National Environmental Public Health Tracking Network

NATIONAL
Environmental Public
Health Tracking Program

Welcome: GUEST [Sign In]

Environmental Exposures Health Effects Information By Location Tracking Toolbox

HOME

Welcome

Data and information for this site are still being added. We welcome your comments and feedback.

Contact Us

Maine Environmental Public Health Tracking Program
11 State House Station
Augusta, ME 04333

E-Mail Us

METracking@maine.gov

This effort has been supported by funding from the U.S. Centers for Disease Control and Prevention, Environmental Public Health Tracking Program.

The Maine Tracking Network: Improving Public Health with Better Information

The goal of the Maine Tracking Network is to improve public health by making data on environmental hazards and health effects easier to find and use.

These data can be used to help understand vulnerable Maine populations, target public health prevention efforts, and evaluate the success of these efforts.

What you can do here

- View pre-made data reports for selected environmental hazards and health effects
- Make your own customized data reports as tables, charts or maps
- Compare health and environmental data by public health districts or counties
- Link to other state and national resources and materials

Getting Started

1. Select a topic area from the top navigation bar.
2. Select a content area from the drop-down menu. You will be directed to a 'Quick Facts' page with more information, links, and resources.
3. Select 'View Data' to see pre-made reports or create your own customized data reports.
4. Let curiosity be your guide.

Repeat visitors may want to use the 'View All Maine Data' link under the Tracking Toolbox to access data.

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<https://tracking.publichealth.maine.gov>

The Role of Environmental Public Health Tracking

Maine.gov

Agencies | Online Services | Web Policies | Help

Maine Center for Disease Control & Prevention
An Office of the Department of Health and Human Services



Maine Tracking Network

A partner in the
National Environmental Public Health Tracking Network



Welcome: GUEST [\[Sign In\]](#)

Environmental Exposures

Health Effects

Information By Location

Tracking Toolbox

HOME > Health Effects > [Asthma](#)



"Maine has one of the highest rates of asthma in the U.S."

Quick Facts: Asthma

[What is asthma?](#)
[What can cause asthma or make it worse?](#)
[How is asthma tracked in Maine?](#)

What is asthma?
Asthma is a disease that affects the airways that carry oxygen in and out of the lungs. If you have asthma, the insides of these airways can be irritated and swollen. The airways for someone with asthma are sensitive and more likely to react strongly to infections, allergens like pollen in the air, or irritants, like smoke and air pollution.

What can cause asthma or make it worse?
What causes asthma is not well known. Asthma can be made worse by environmental triggers like air pollution, pollen and other allergens. Two key air pollutants can affect asthma. One is ozone (found in smog). The other is particle pollution (found in haze, smoke, and dust). When ozone and particle pollution are in the air at higher levels, adults and children with asthma are more likely to have asthma related health symptoms.

How is asthma tracked in Maine?
Asthma health symptoms can be serious enough to cause a person to seek medical care. In many cases, this is the hospital emergency room, but sometimes requiring a hospital stay. Tracking asthma hospital emergency room visits and hospital admissions allow for monitoring trends over time and identifying high risk groups. Tracking these measures can also inform prevention, evaluation and program planning efforts. To view tracked asthma data, use the "View Asthma Data" link under the Related Resources menu on the right.

View Data

[View Asthma Data](#)

[View All Data](#)

Related Web Pages

[Maine Asthma Prevention](#)

[US CDC Asthma Program](#)

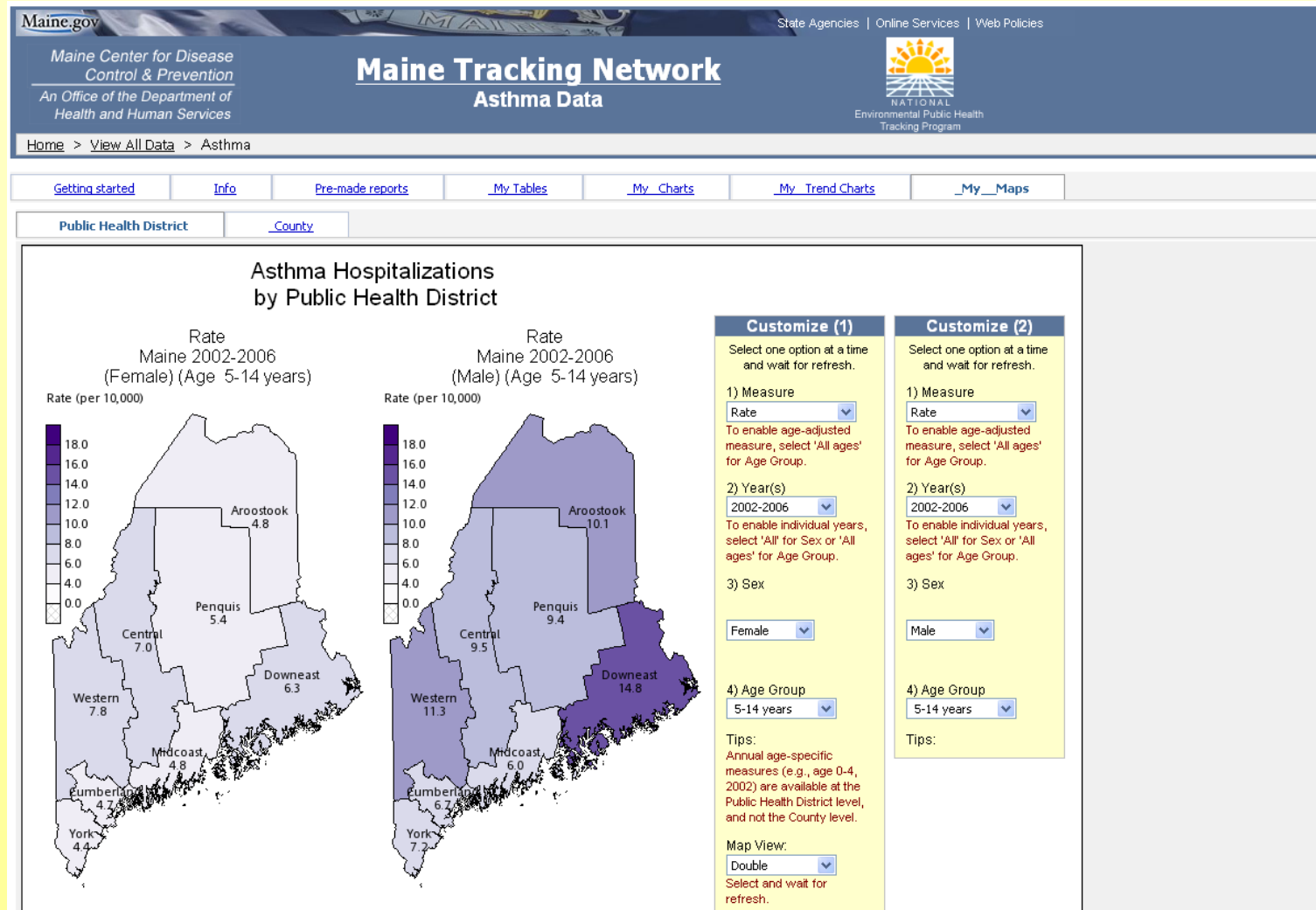
[American Lung Association](#)

[CDC Center for Health Statistics](#)

[US EPA Asthma](#)

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The Role of Environmental Public Health Tracking



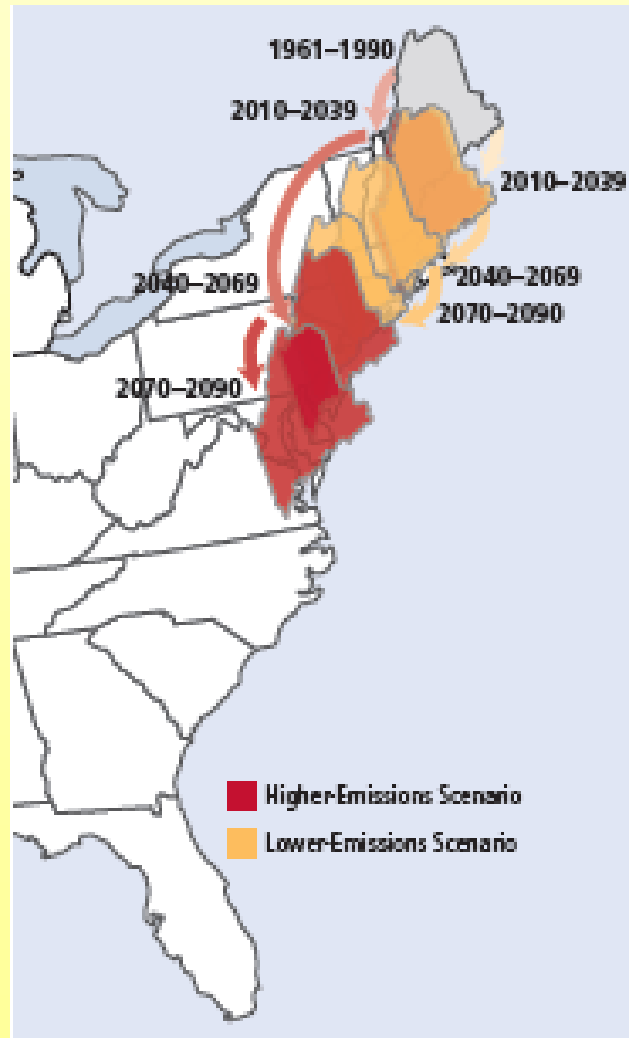
Surveillance of Heat Related Mortality

Why start with heat waves?

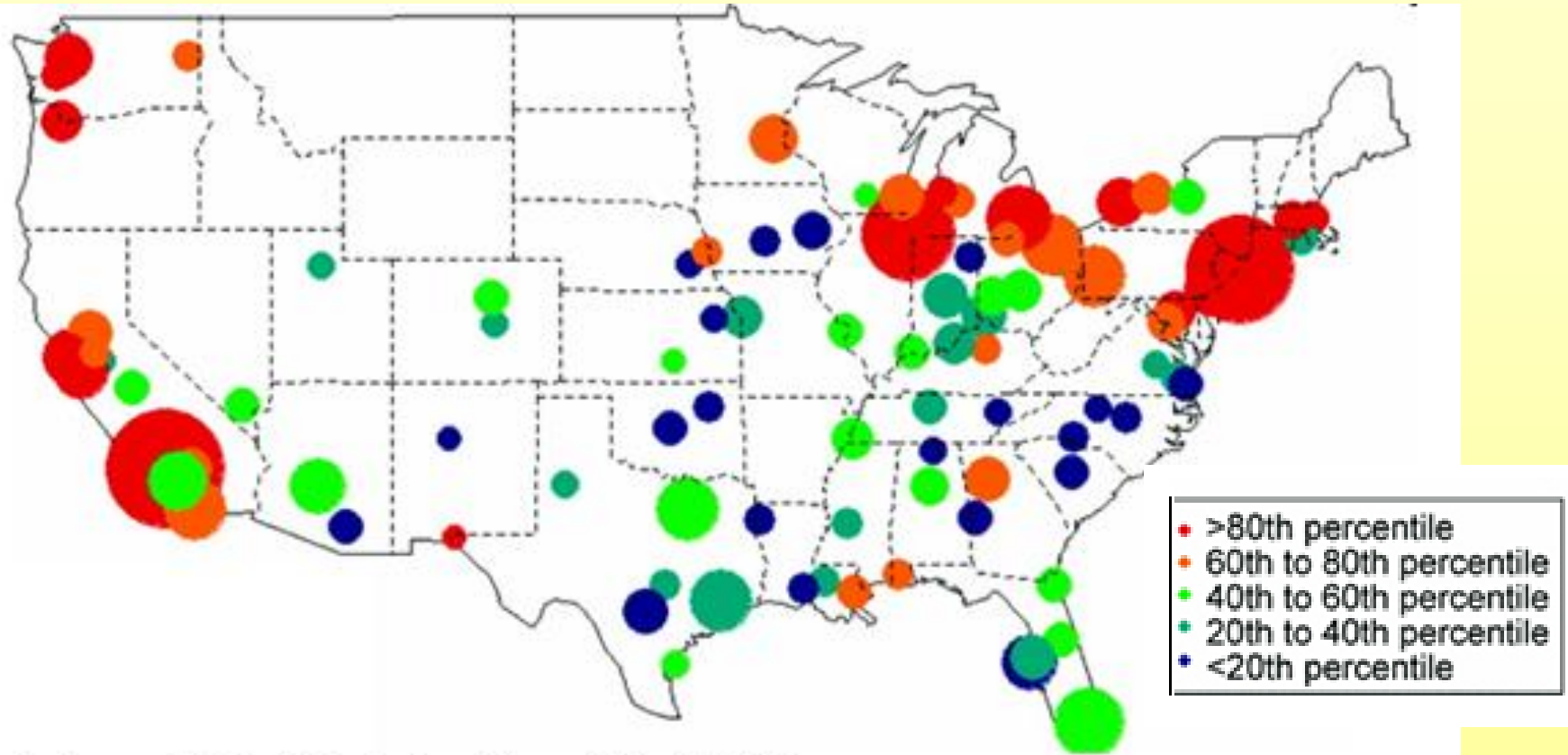
- More deaths from heat wave than all other weather events combined (CDC)
- Predicted to increase
- Currently ~700 U.S. heat-related deaths per year...
- If greenhouse gas emissions remain steady, estimated heat-related deaths in 2050 between 3,000 and 5,000 (CDC)



Heat waves in Maine??



Cooler climates are more vulnerable



Anderson & Bell, 2009. *Epidemiology*, 20(2):205-213)

Vulnerable Populations

Vulnerable to heat waves:

- Elderly living alone
- Those with chronic diseases
- Rural?



Maine is:

- 3rd nationwide for % of elderly residents living alone
- 5th nationwide for % of adults with asthma
- 2nd nationwide for % of population living outside urban areas

Example: Chicago heat wave of 1995

July 12-16, 1995

- Daily Max T: 93-106 F
- Record humidity
- Nightly Min T: high 70s/low 80s
- ~**700** excess deaths
 - 85% increase over the same time period in 1994



Characteristics of Heat-Related Mortality

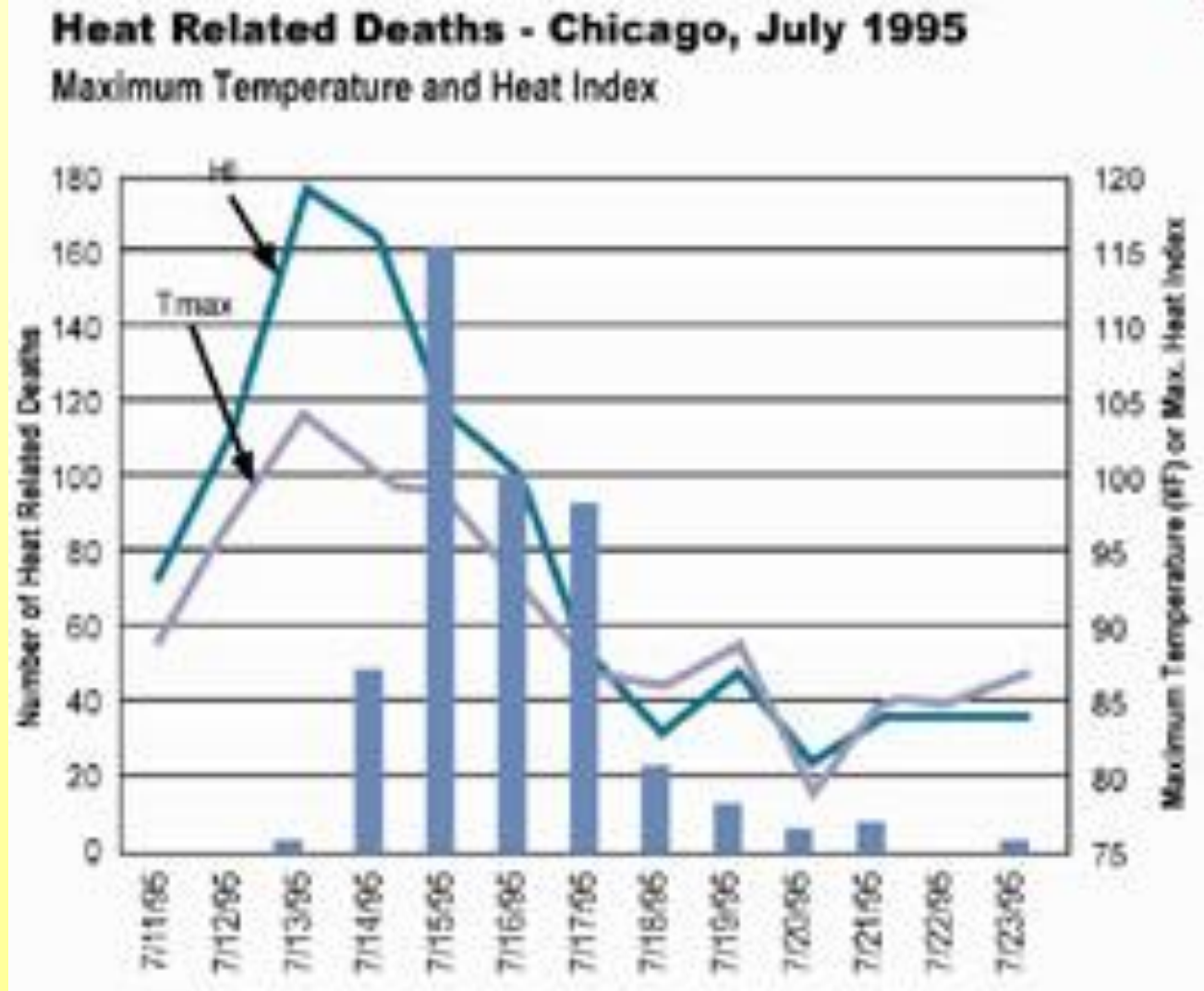


Figure: US Global Change Research Program

How to measure mortality?

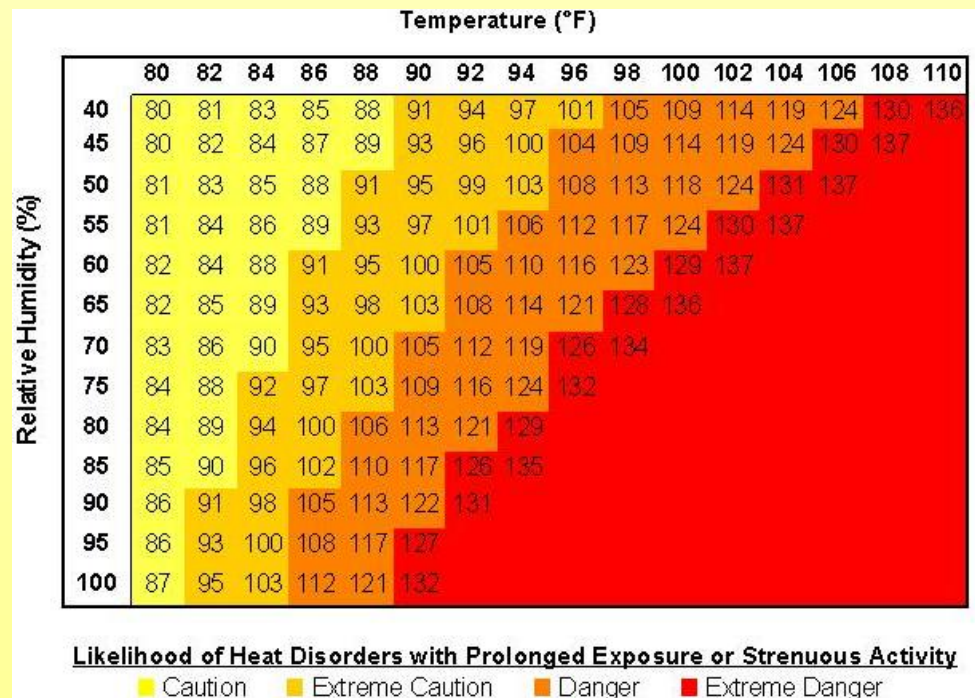
| CAUSE OF DEATH (See instructions and examples) | | | Approximate interval: Onset to death |
|---|--|--|---|
| <p>32. PART 1. Enter the chain of events—diseases, injuries, or complications—that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.</p> <p>IMMEDIATE CAUSE (Final disease or condition resulting in death)</p> <p>a. <u>Congestive heart failure</u> Due to (or as a consequence of):</p> <p>b. <u>Coronary heart disease</u> Due to (or as a consequence of):</p> <p>c. _____ Due to (or as a consequence of):</p> <p>d. _____ Due to (or as a consequence of):</p> <p>UNDERLYING CAUSE (Disease or injury that initiated the events resulting in death) LAST</p> | | | <p>7 years</p> <p>25 years</p> |
| <p>PART 2. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART 1.</p> <p>Hypertension, atrial fibrillation</p> | | <p>33. WAS AN AUTOPSY PERFORMED? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> | |
| <p>35. DID TOBACCO USE CONTRIBUTE TO DEATH? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Probably <input type="checkbox"/> Unknown</p> | <p>36. IF FEMALE:</p> <p><input checked="" type="checkbox"/> Not pregnant within past year</p> <p><input type="checkbox"/> Pregnant at time of death</p> <p><input type="checkbox"/> Not pregnant, but pregnant within 42 days of death</p> <p><input type="checkbox"/> Not pregnant, but pregnant 43 days to 1 year before death</p> <p><input type="checkbox"/> Unknown if pregnant within the past year</p> | <p>37. MANNER OF DEATH</p> <p><input checked="" type="checkbox"/> Natural <input type="checkbox"/> Homicide</p> <p><input type="checkbox"/> Accident <input type="checkbox"/> Pending investigation</p> <p><input type="checkbox"/> Suicide <input type="checkbox"/> Could not be determined</p> | |

Problem: How to determine whether a death is heat-related?

→ One solution: Count all-cause mortality during heat wave and compare to non-heat wave periods

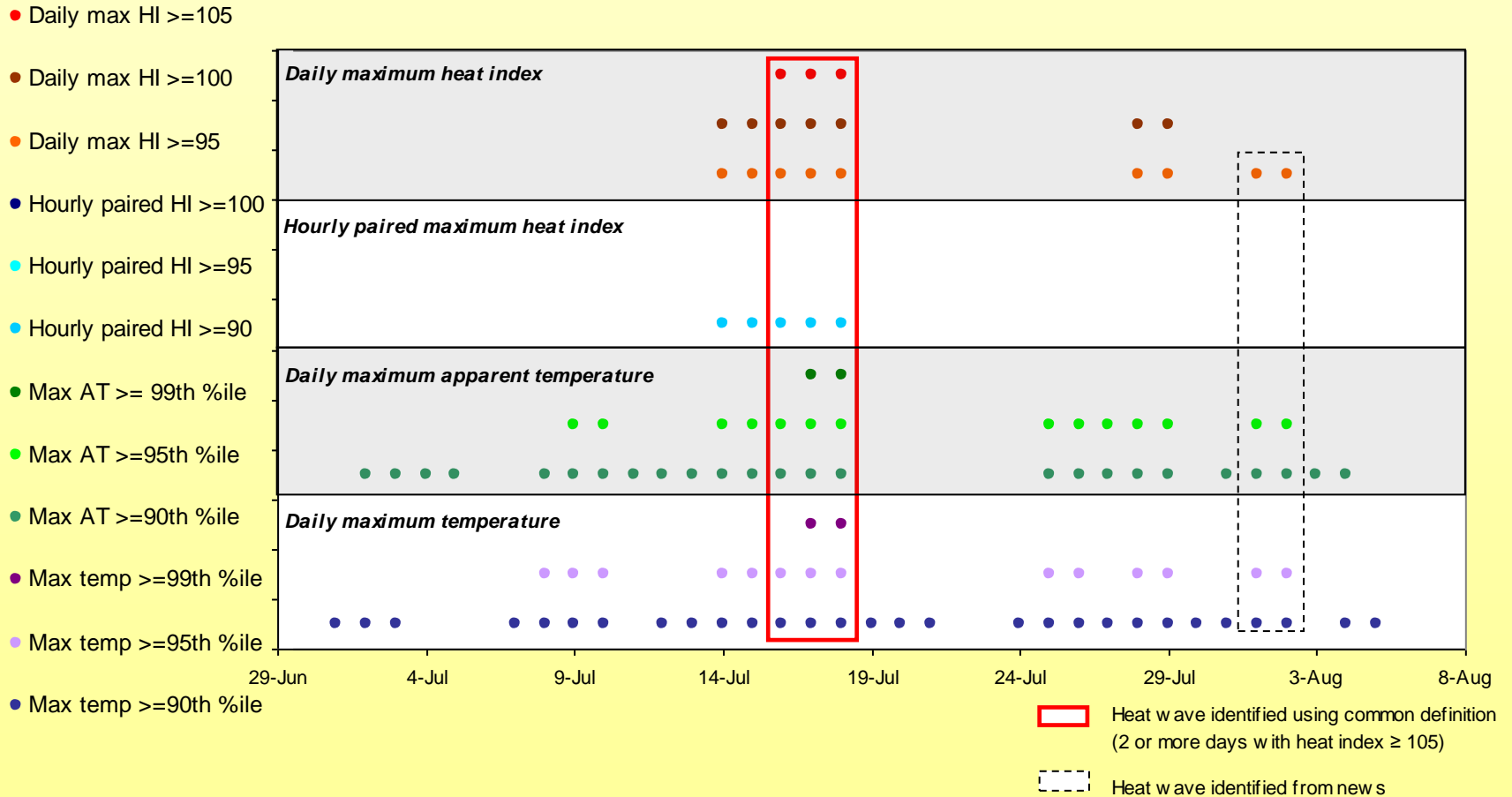
How to measure heat waves?

- Problem: There is no consistent, universal definition
 - Best working definition is a ‘prolonged period of excessively hot weather’ – but workgroup is still determining what this means
- Problem: Many different ways to measure *heat*



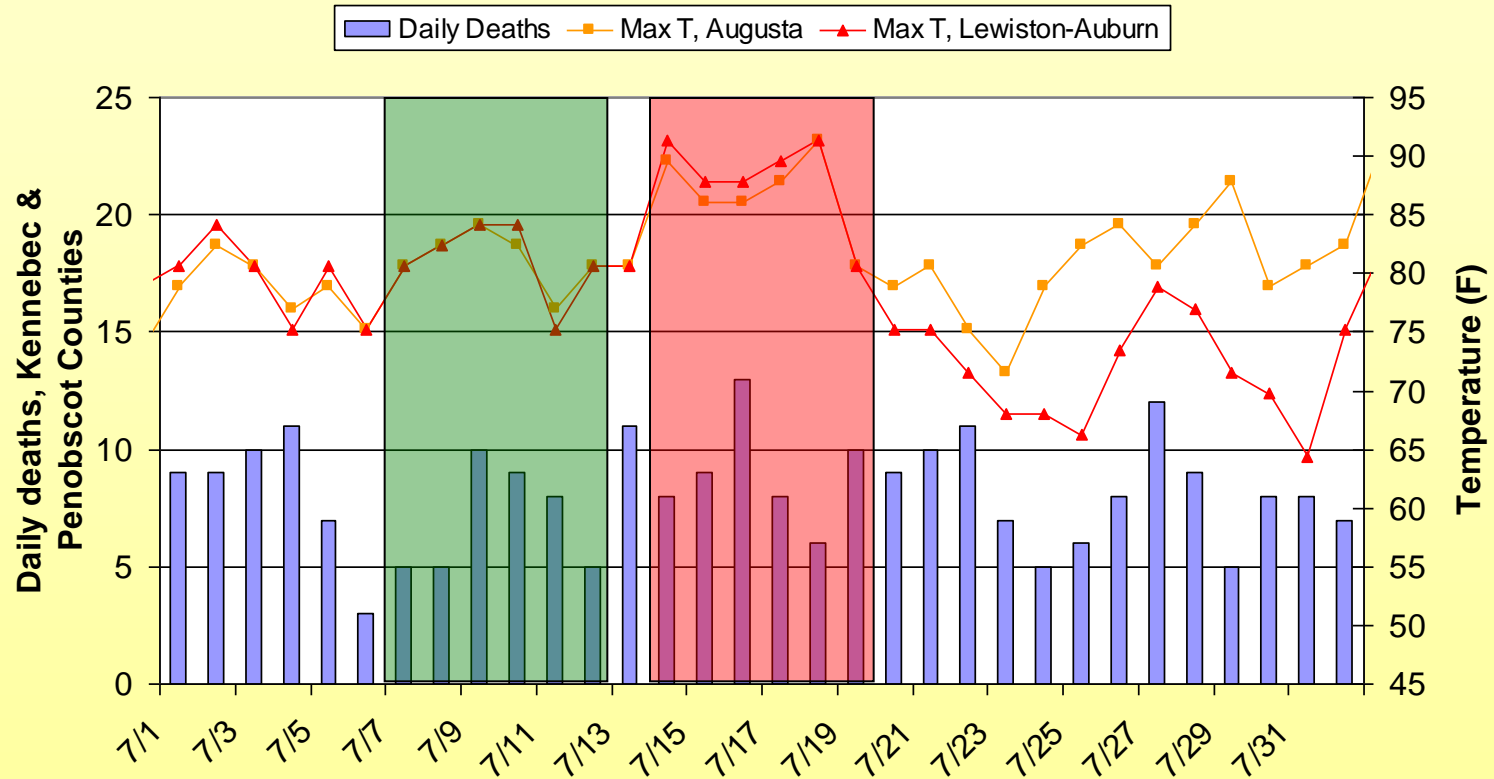
Heat Wave in Maine?

Heat Waves - Augusta, ME - 2006



Mortality rate ratio example

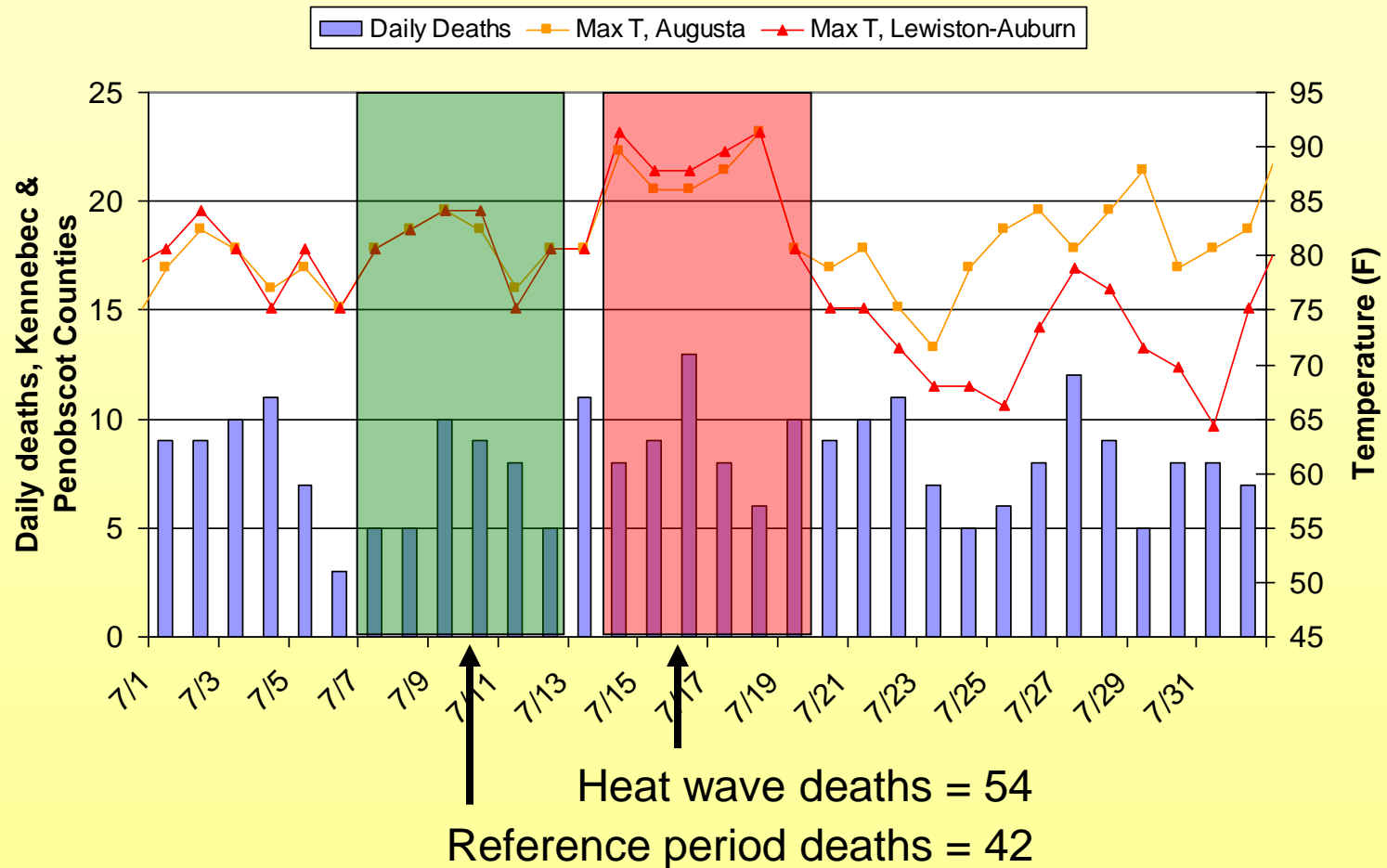
Temperature and Deaths, Central Maine, 2006



1. Define a 'heat wave' period
2. Define a 'reference' period
3. Calculate the ratio of deaths in the heat wave period to deaths in the reference period

Mortality rate ratio example

Temperature and Deaths, Central Maine, 2006

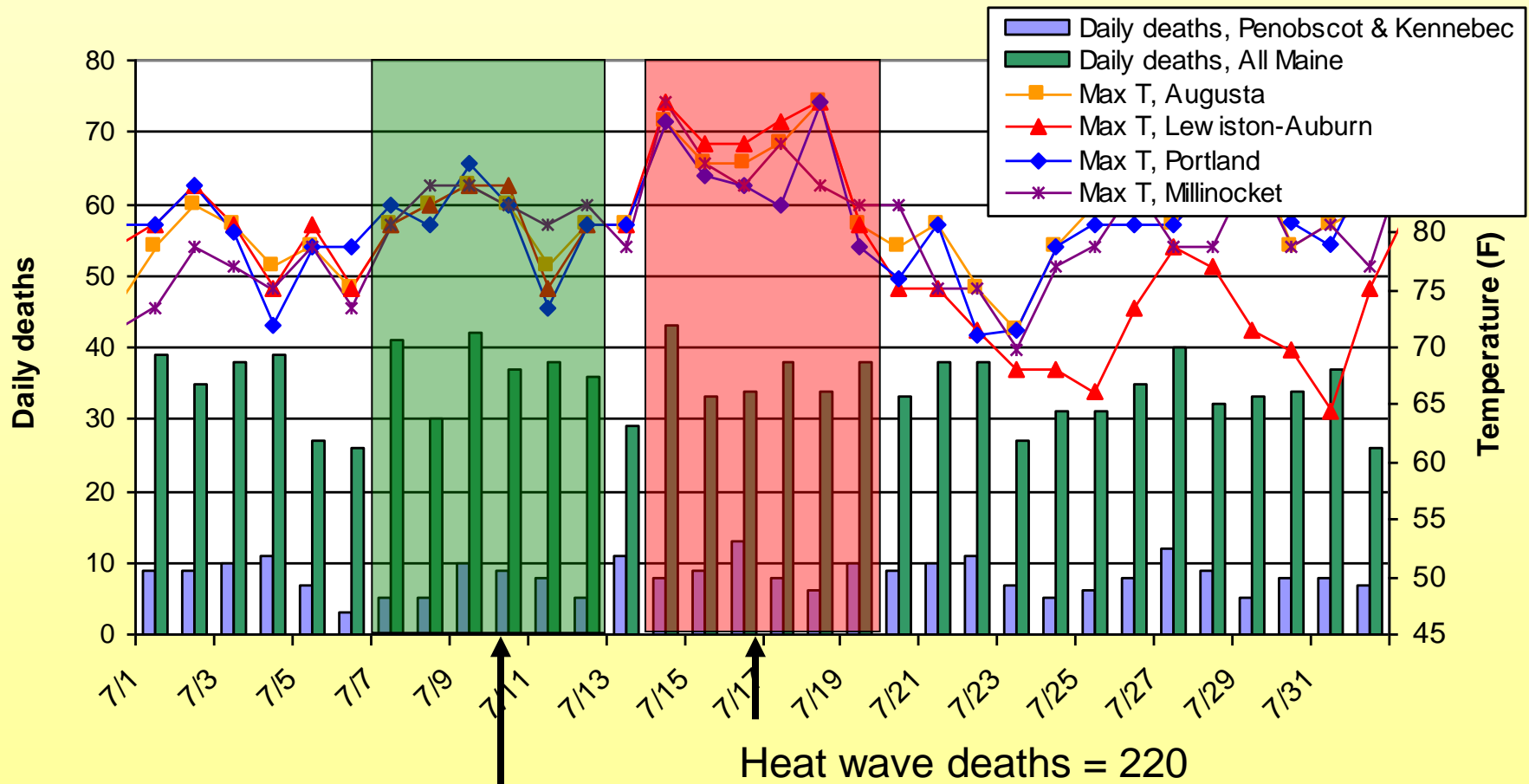


Rate ratio = $54/42 = 1.29 \rightarrow 29\%$ more deaths than expected
95% Confidence Interval = 0.86-1.93

What comes next



Mortality rate ratio example: All ME

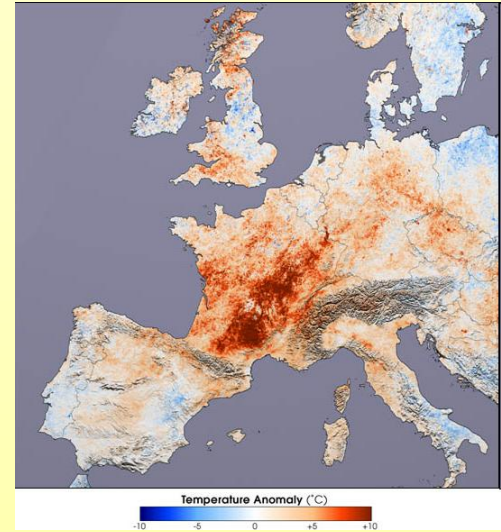


Rate ratio = $220/224 = 0.98 \rightarrow$ 2% fewer deaths than expected
95% Confidence Interval = 0.82-1.18

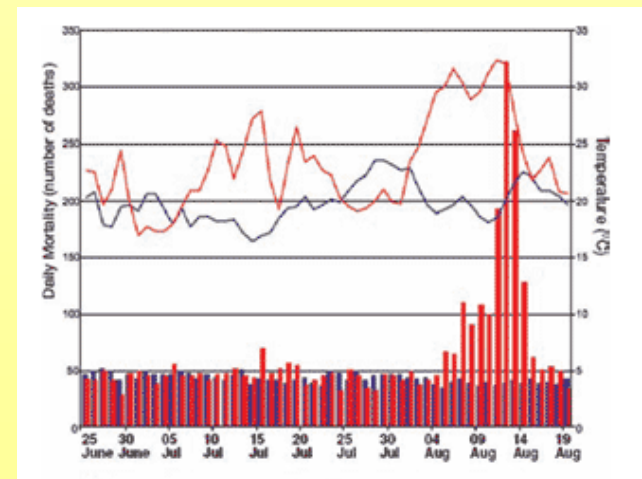
European heat wave of 2003

Late July-August, 2003

- Daily maximum temperatures 10 C (18 F) higher than average
- Nightly minimum temperatures also elevated
- Between **35,000 and 55,000** excess deaths (~**15,000** in France alone).

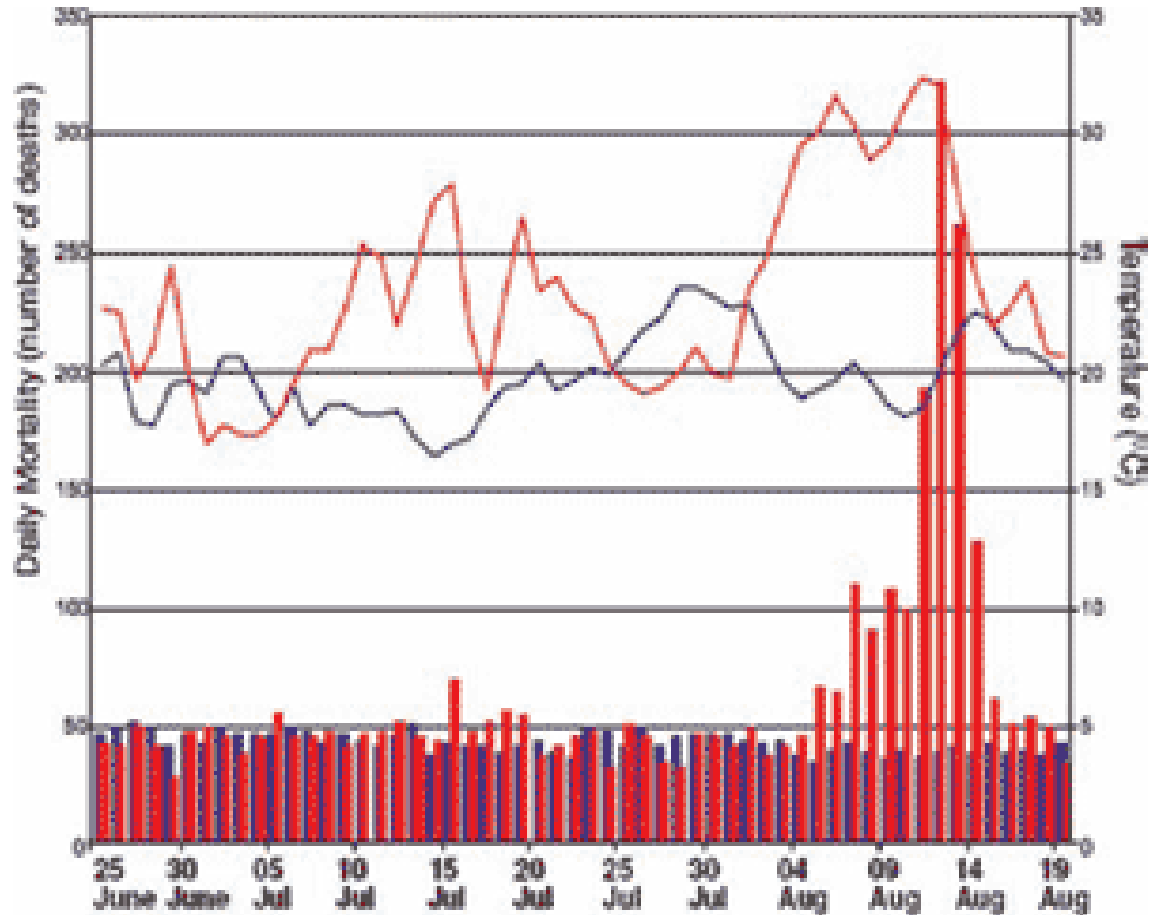


Temperature anomalies in southern Europe, 2003.
Image: NASA



Daily temperature and deaths, France, 2003. Figure:
Kalkstein et al., 2008. B Am Meteorol Soc, 89(1):75-85

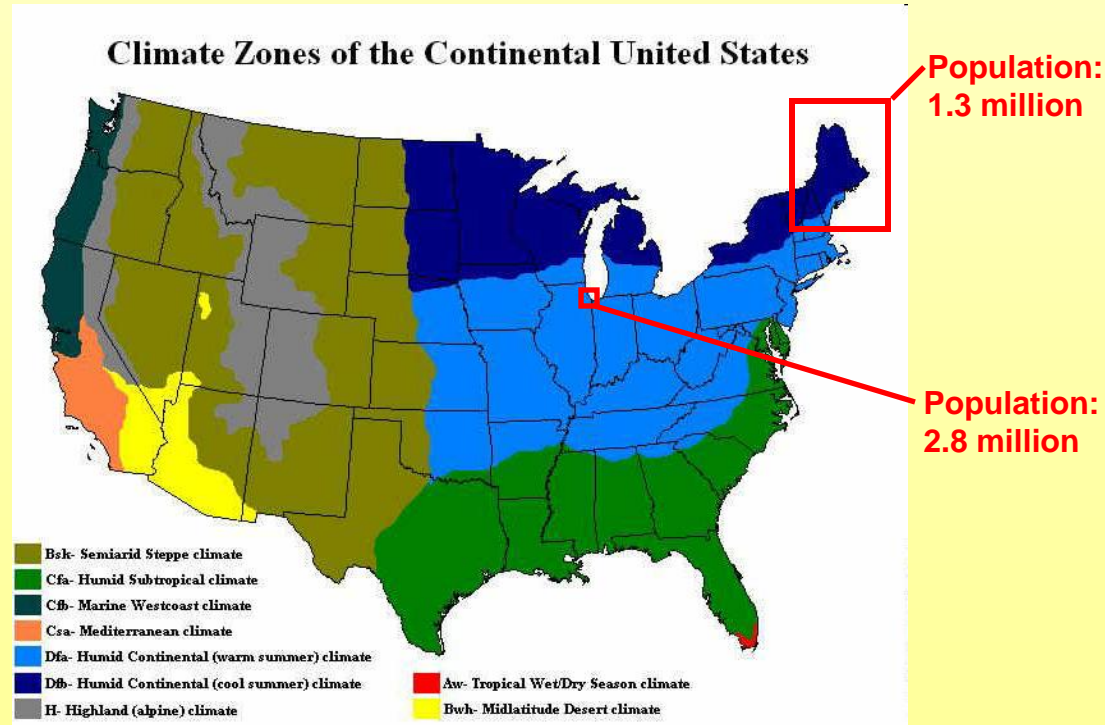
European heat wave of 2003



Daily temperature and deaths, France, 2003. Figure: Kalkstein et al., 2008. B Am Meteorol Soc, 89(1):75-85

Heat Waves in Maine?

- Cooler temperatures
- Smaller, more dispersed population



BUT...