Who, When, and Where: Using All-Cause Heat Data to Target Public Health Action in Greater Boston

Sharon Ron
Chad Milando
Alexis Arlak

LIVE POLL

Time for a Poll!

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The Context

Where and Why

The Setting

The **Lower Mystic Communities** of Chelsea, Malden, Revere, Everett, Winthrop

Environmental Justice

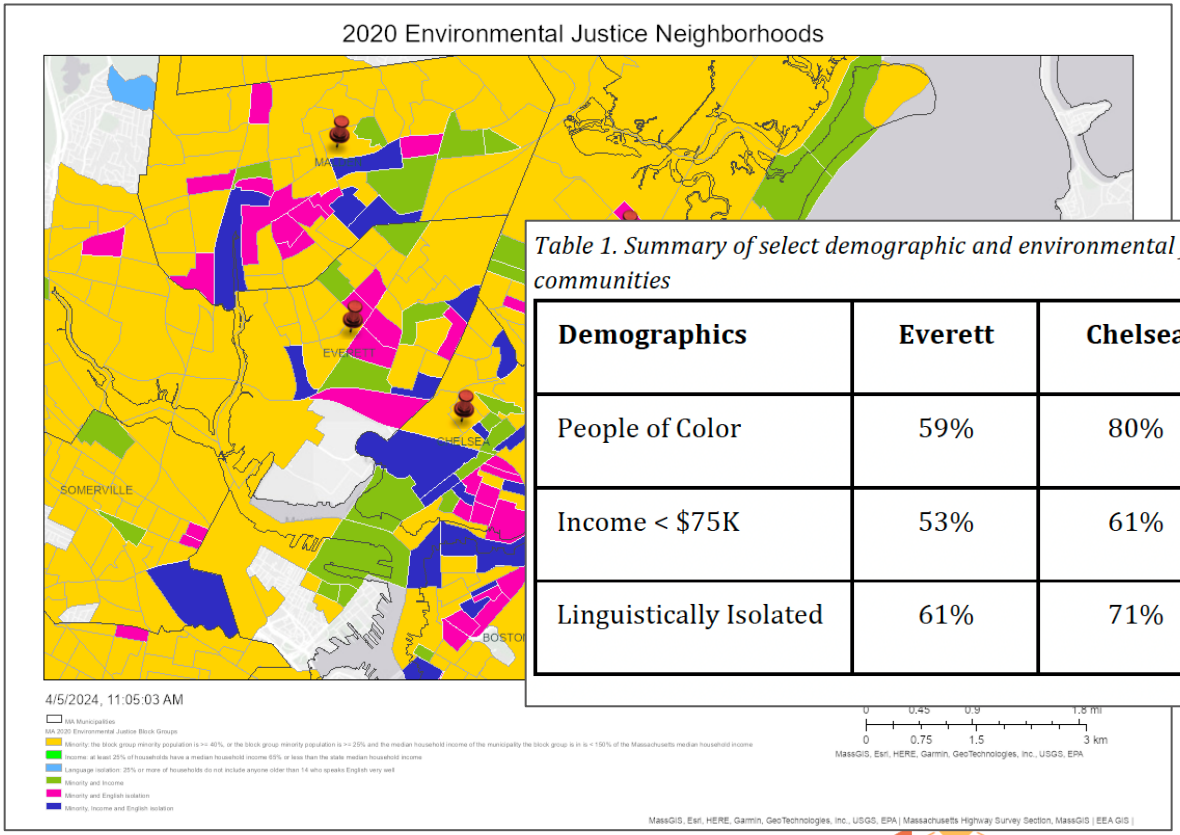
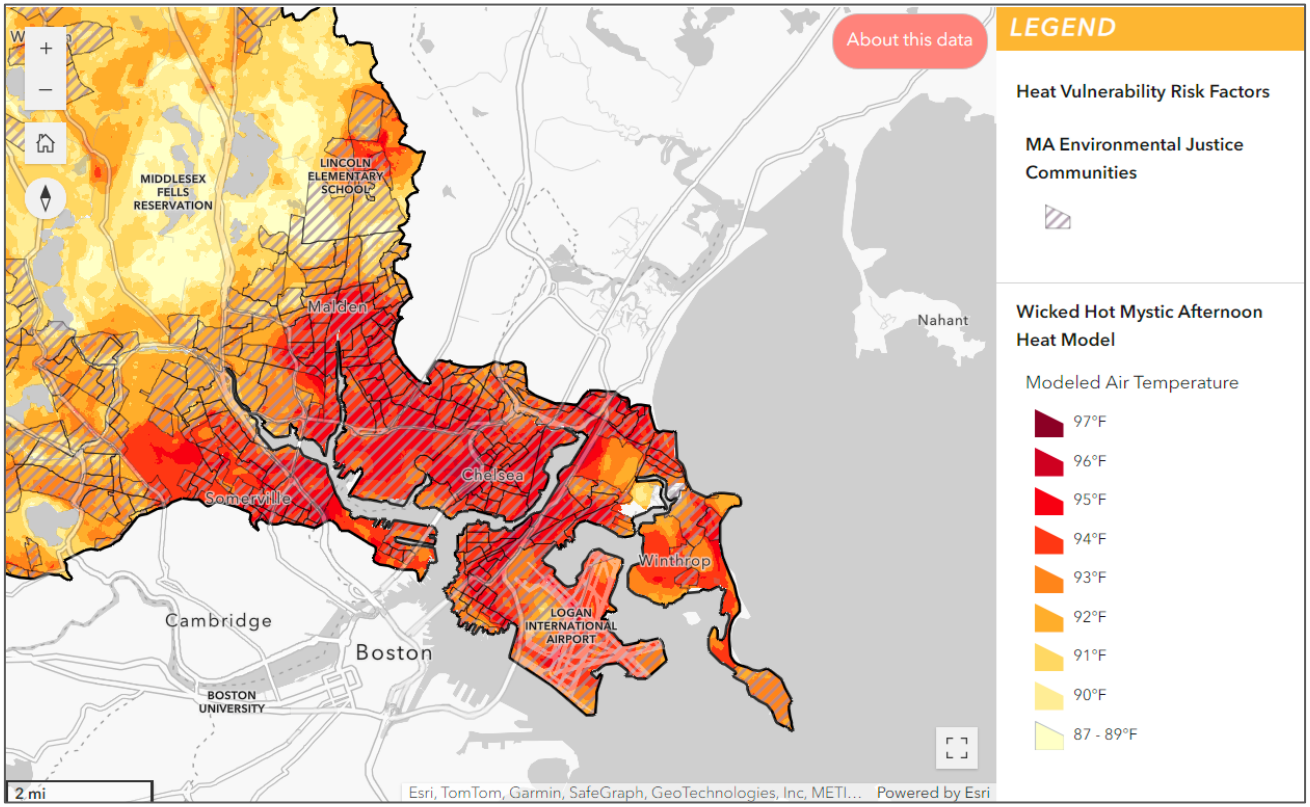


Table 1. Summary of select demographic and environmental justice indicators from EPA EJ Screen viewer for target communities

Demographics	Everett	Chelsea	Malden	Revere	Winthrop
People of Color	59%	80%	53%	30%	17%
Income < $75K	53%	61%	50%	58%	48%
Linguistically Isolated	61%	71%	52%	59%	23%

Future Risk



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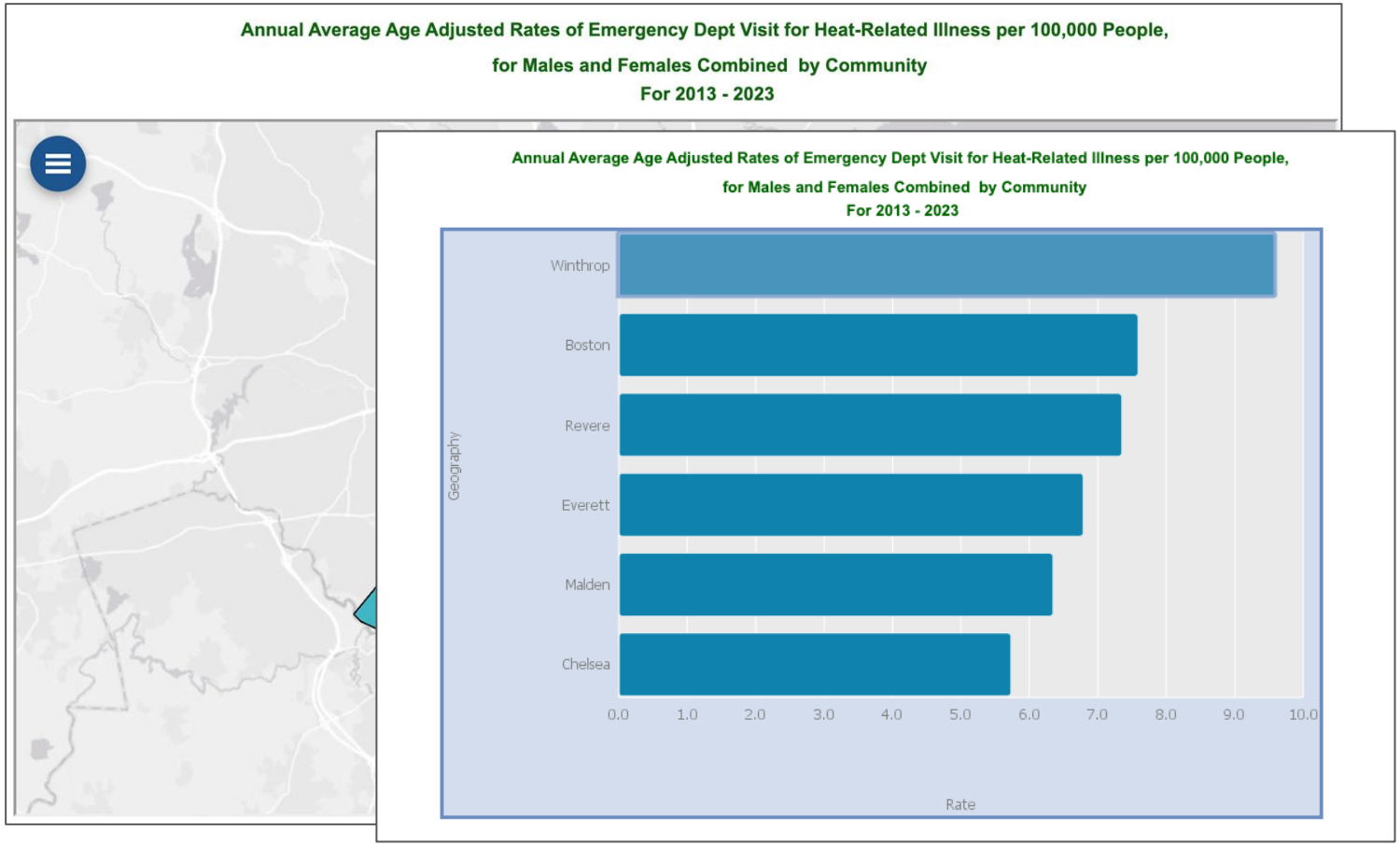
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The Problem

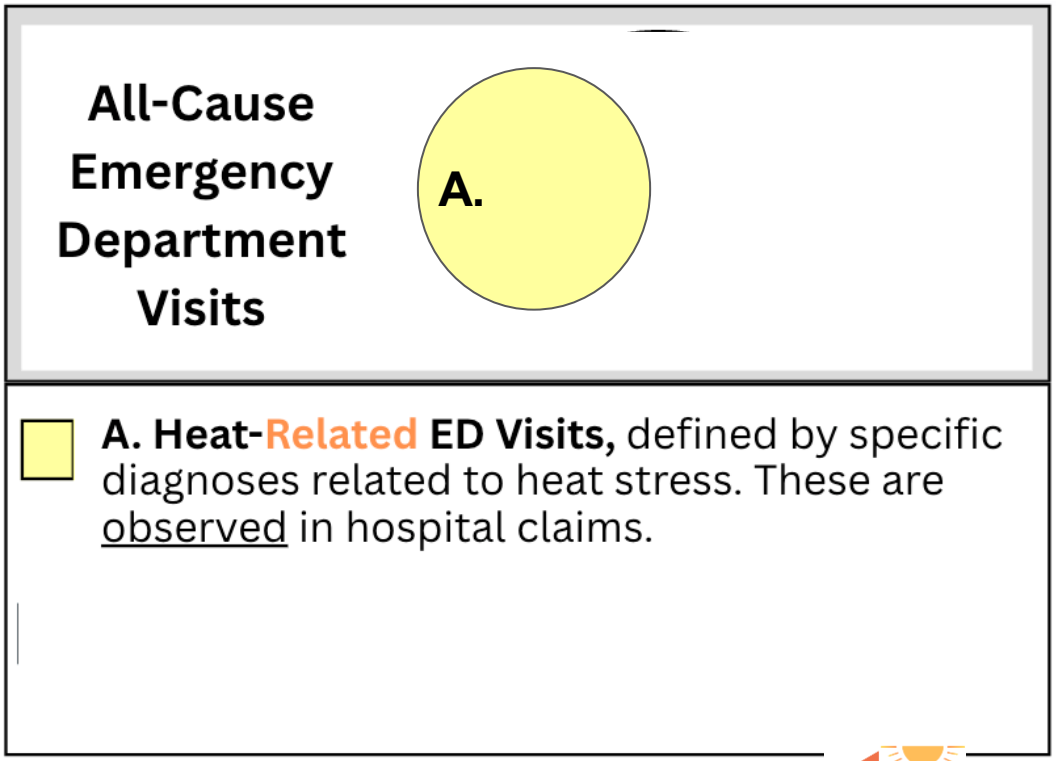
Heat Impacts are Currently **Undercounted**

Current Measurements are a Valuable Starting Point



Source: MA Environmental Public Health Tracking

Traditional **Methods Undercount the Health Burden of Heat**



Heat-attributable outcomes likely outnumber heat-related outcomes but are not typically tracked

Which limits the ability of municipal officials to translate current data into effective policies

The ICD Codes Considered

Traditional Estimation of Heat Impact

The Methods Developed Here

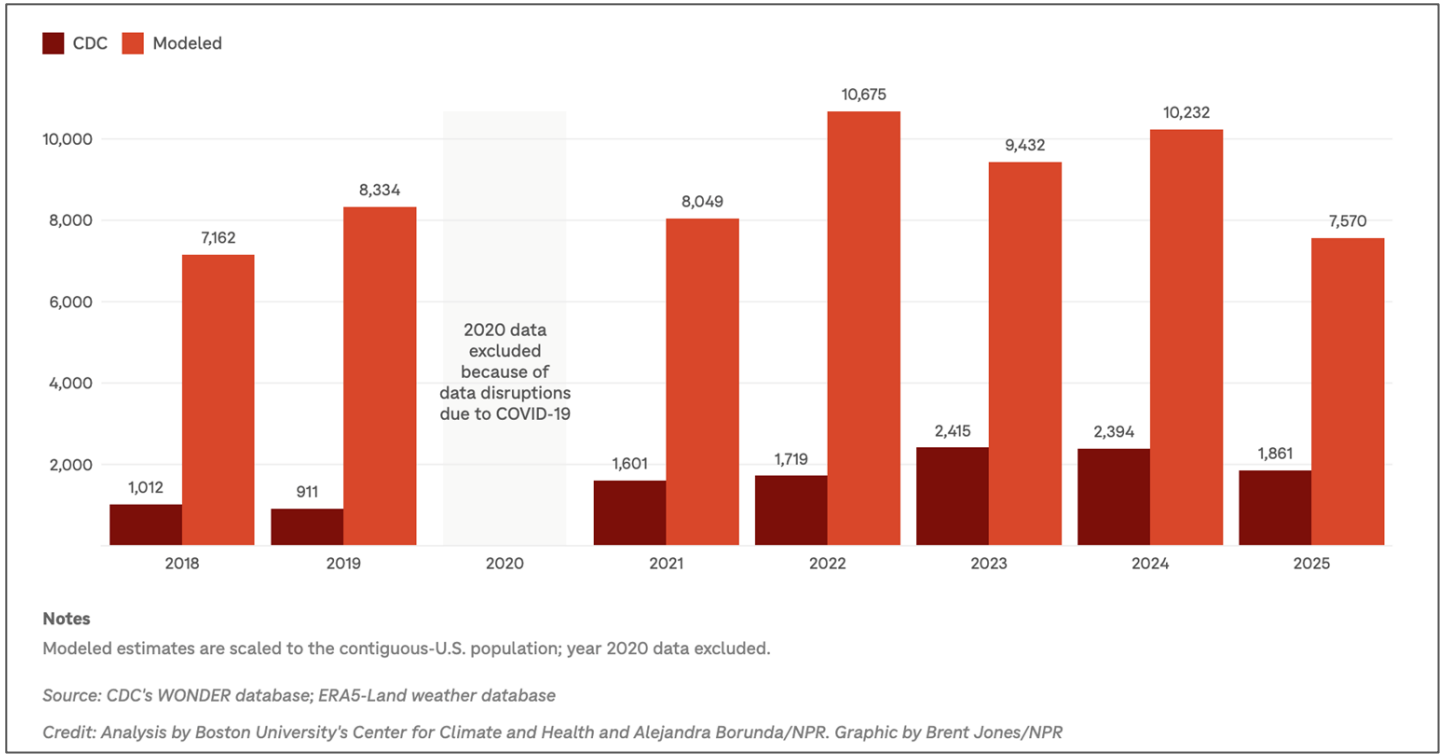
	Definition	ICD Codes	Description
Heat-Related	Outcomes identified as having been caused by exposure to excess heat, such as Hyperthermia (Sun Stroke), Heat Exhaustion, Heat Stroke, Heat Syncope, Heat Cramps, Heat Fatigue, Heat Edema, and other unspecified clinical effects	***ICD 9* (used prior to 10.1.2015)**	
		992	Effects of heat and light
		E900.0	Accident caused by excessive heat due to weather conditions
		E900.9	Accidents due to excessive heat of unspecified origin
		E900.1 (excluded)	Accidents due to excessive heat of man-made origin
		ICD 10 (used after 10.1.2015)	
		T67	Effects of heat and light
		X30	Exposure to excessive natural heat
		X32	Exposure to sunlight
		W92 (excluded)	Exposure to excessive heat of man-made origin
Heat-Attributable	Outcomes that occurred associated with warmer than average temperatures	Not Applicable (heat-attributable outcomes are the fraction of outcomes of all cause ED visits)	

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The Size of the Undercount Varies



Notes

Modeled estimates are scaled to the contiguous-U.S. population; year 2020 data excluded.

Source: CDC's WONDER database; ERA5-Land weather database

Credit: Analysis by Boston University's Center for Climate and Health and Alejandra Borunda/NPR. Graphic by Brent Jones/NPR

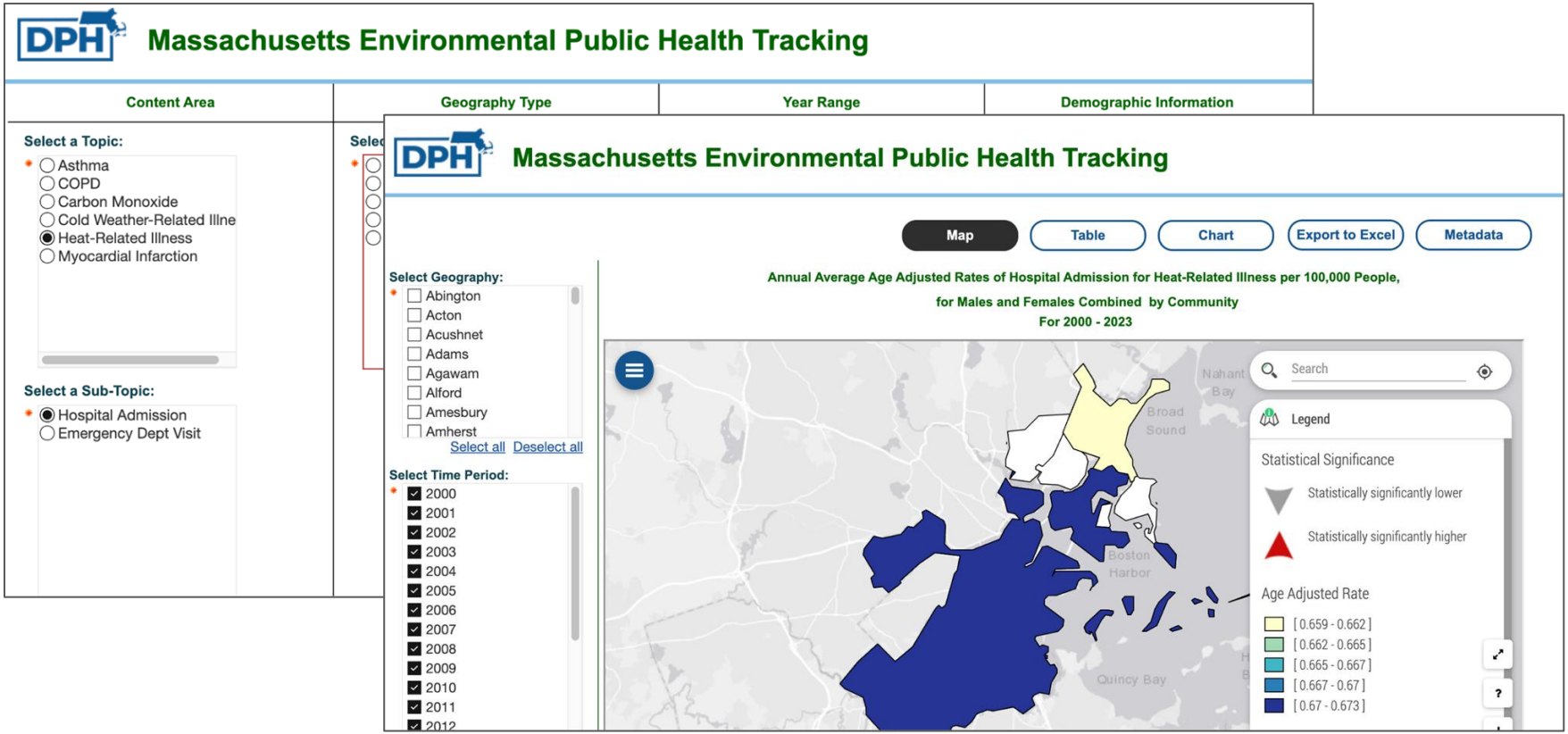
Figure Source: NPR and Boston University

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MassDPH Environmental Public Health Tracking



The true burden of heat:

In Boston, **about 800* people** per year visited the Emergency Department (ED) for a reason that could be attributed to heat.

About **50 people** had a diagnosis of heat stress.

*relative to a reference daily temperature of 77 F

The Cool Communication Project

Results

Lower Mystic Cool Communications Project Background

Funding: Municipal Vulnerability Preparedness (MVP) Action Grant from the MA Executive Office of Energy and Environmental Affairs (EEA); matching funds from DLTA-A, the Barr Foundation, and Public Health Excellence Grant Program

Timeline: 2 year grant 2024-2026, ends June 30th, 2026

Lead: MAPC, Mystic River Watershed Association (MyRWA), BU School of Public Health (BUSPH)

Partners: 5 cities, Community Based Organizations, 3 artist teams

Project Activities

1. **Use health data** to inform communication strategies that address who, when, and where people are most at risk.
2. **Pilot a coordinated, regional communications campaign** during summer 2025 & 2026.
3. **Integrate artists & community members** to increase cultural relevance, bring creativity, and build a culture of heat.

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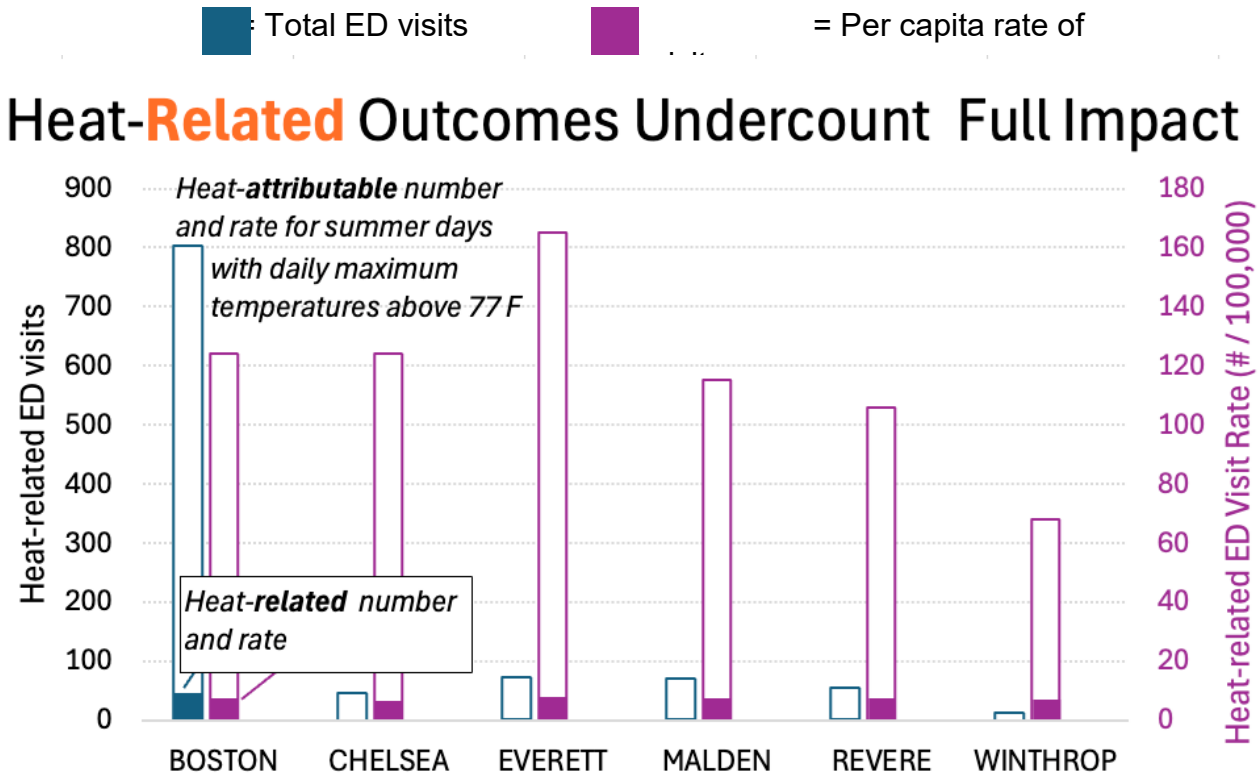
RESEARCH QUESTION:

How can we focus **heat** communication on **who**, **when**, and **where** people are most at risk?

Methods:

- distributed-lag non-linear modeling approach to estimate the association between temperature and ED visits
- ED data from 2010 to 2023 from the Massachusetts Center for Health Information and Analysis (CHIA)
- Reference point -> **77 Degrees Fahrenheit**
- relative risk, total attributable number, and per-capita rates of heat-attributable ED visits across demographic sub-groups (sex, age, race and ethnicity, payor status) and timing (month, day of the week)
- Feedback loop between MAPC and community org.

The true burden of heat in the Lower Mystic

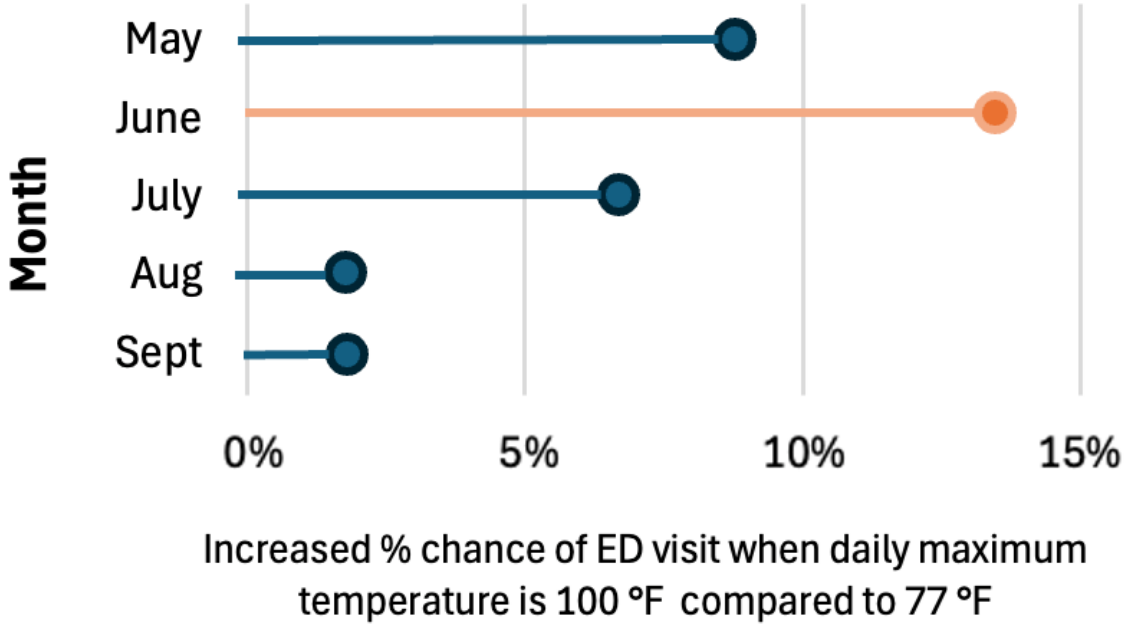


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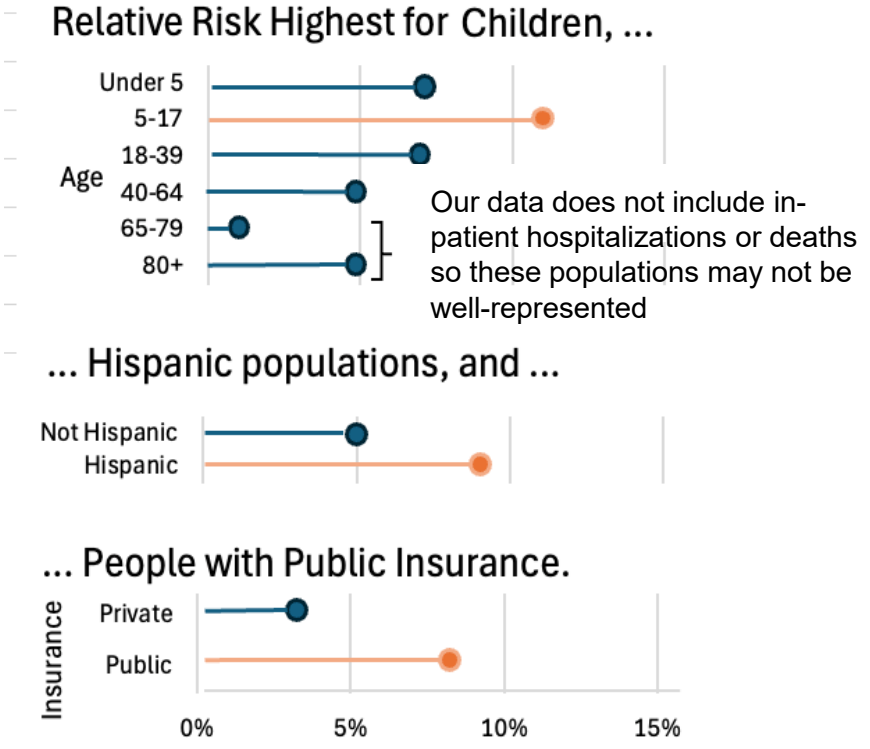
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First is the worst Compared to late summer, June was the riskiest season

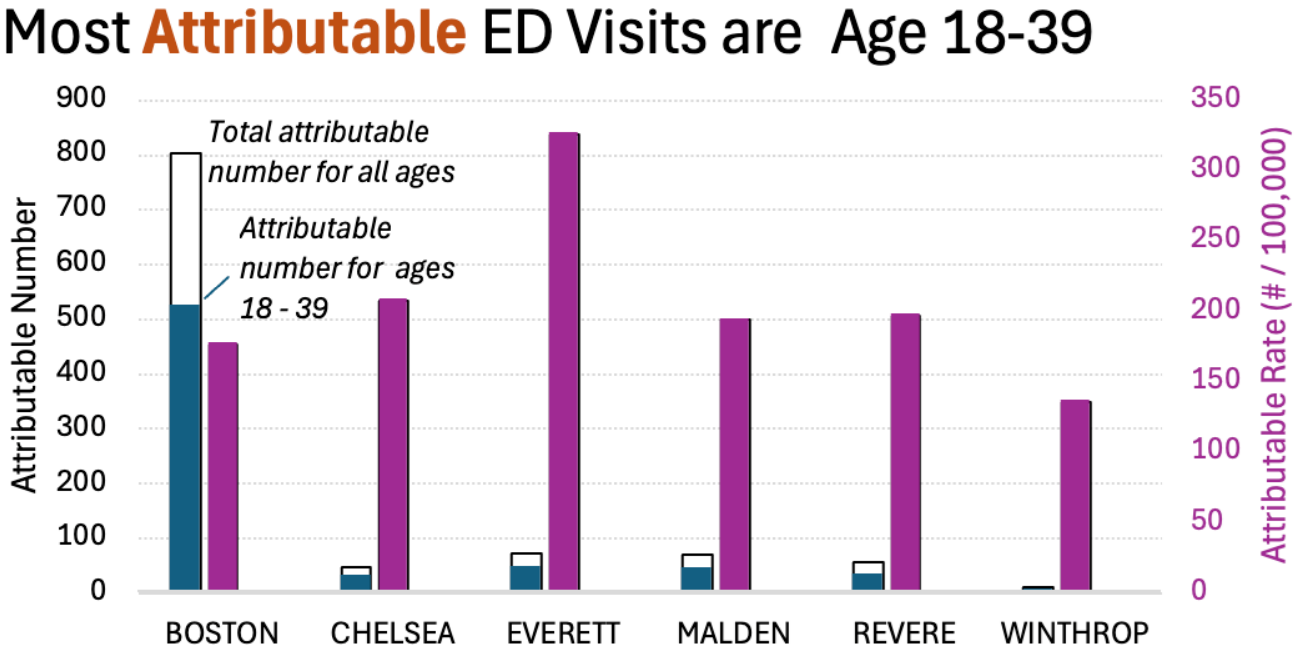


Some groups face greater risks

On a hot day, relative risk is higher for youth 5-17, hispanic residents, and people on public insurance



Greatest individual risk ≠ highest system demand



Although youth were at greater individual risk, most heat-attributable ED visits came from adults

Summary of Findings

1. **First is the "worst"-** in terms of individual risk, but more people visit the ER in July/August because there are more high-heat days.
2. **Some groups face greater risks** - youth ages 5-17, hispanic residents, and people on public health insurance.
3. **Greatest individual risk ≠ highest system demand -** strategies for preparing health systems should differ from those aimed at the public.

The Cool Communication Project

Impact

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Extreme Heat Webpage on Mass.gov

OFFERED BY Bureau of Climate and Environmental Health | Department of Public Health

Extreme heat

Explore guidance, tools, and resources to help you understand, prepare for, and stay safe during periods of extreme heat in Massachusetts.



This page is your central source for public health information and planning tools related to heat exposure and safety in Massachusetts. Here, you can download the Extreme Heat Resource Guide, access Extreme heat resources, and find links to local and statewide planning tools, including the Unhealthy Heat Forecast webpage. Whether you're a resident, healthcare provider, or local official, this page offers the guidance and support needed to respond effectively to heat waves.

Quick links



Unhealthy Heat Forecast →



Extreme heat resources →



Beach Water Quality Dashboard →



Prevent and treat heat-related illness →



Climate and health →

Mass.gov/extreme-heat

Community heat resources

Connecting community organizations with heat safety resources, shareable materials, and guidance to help prepare for and stay safe during periods of unhealthy heat.



Featured community heat resources

Community heat resource fact sheet →



Use this fact sheet to help your community learn simple ways to stay safe during very hot weather.

English | Cape Verdean Creole | Chinese, Simplified | Chinese, Traditional | Haitian Creole | Portuguese (Brazil) | Russian | Spanish | Vietnamese

Prevent and treat heat-related illness →



Understand heat-related symptoms to keep yourself and others safe during hot weather.

English | Cape Verdean Creole | Chinese, Simplified | Chinese, Traditional | Haitian Creole | Portuguese (Brazil) | Russian | Spanish | Vietnamese

Community heat alert signup →



Sign up for Community Heat Alerts to get timely email updates when unhealthy heat is forecasted, along with practical tips and shareable resources to help you protect your community.

Massachusetts Unhealthy Heat Forecast

Stay informed with real-time heat forecasts and community resources to help you plan, prepare, and respond to unhealthy heat in Massachusetts.



THERE IS AN UNHEALTHY HEAT ALERT FOR 8/11-8/14

Alert updated at 5:26am on 08/11/2025

TODAY'S FORECAST FOR
Massachusetts

91°F

Heat Threshold Red

HOTTEST 7-DAY TEMPERATURE IS FORECAST FOR
Tuesday, 8/12

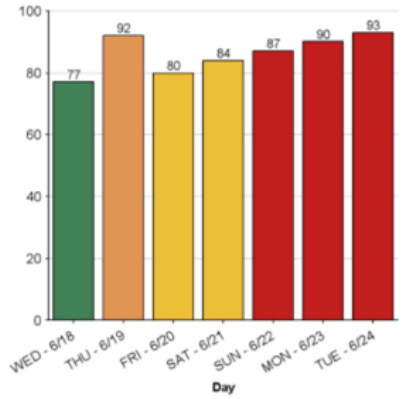
92°F

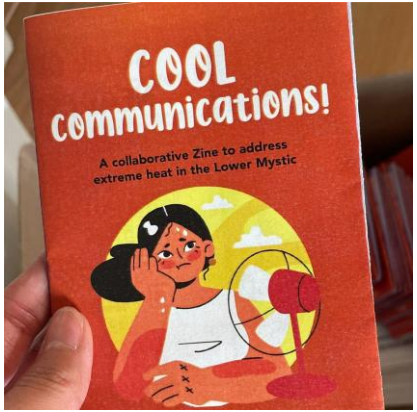
Heat Threshold Red

Cool Communications Campaign

What we did during Summer 2025

- Beginning 6/22, MAPC sent weekly emails to project partners with:
  - DPH Unhealthy Heat 7-Day forecast
  - Suggested heat communications materials and messages
  - Cities and CBOs posted on social media
- Climate leaders hosted 2 festivals, gave out Care Bags, and tabled at over 25 events to talk to residents about cooling solutions
- Artists hosted 4 Popups and 2 Workshops and created engagement toolkits and instructions









What did we learn from the 2025 Summer pilot?

1. **It's already HOT!** Data helped us understand who, when, and where heat risks are greatest so that partners can prioritize resources.
2. **Materials need to feel hyper-local:** Communication materials need to look like they're from Revere Beach not Miami.
3. **Message fatigue:** Too many emails & warnings about heat! Focus on fresh & seasonal messages rather than sending emails every time unhealthy heat is on the forecast.
4. **Accessibility:** Materials needed to be easier to customize. Partners wanted more access to the graphics and materials so they could make it their own.

Cool Communications Design Packets





Cool Communications Design Packets:

Animals Are Cool

A vibrant, illustrated style featuring animals and their heat-beating adaptations, developed in partnership with artist Hania Mariën.

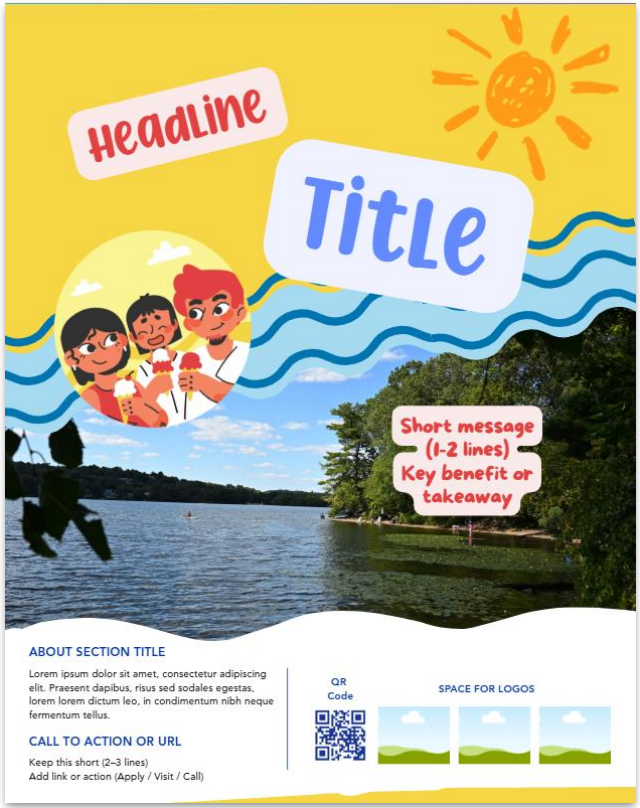


Includes:

- Canva Brand Kit
- Flyer Templates
- Social Post Templates

Cool Communications Design Packets:

Heat Design by Depict Brands



An expansive library of heat graphics, template and guidelines organized by heat season, with various layouts suited for graphic-, photo-, and text-based designs by Eileen Riestra

- Canva Brand Kit
- Flyer Templates
- Social Post Templates



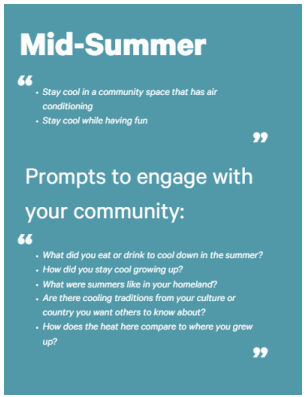
Cool Communications Design Packets:

Heat Message Library

A Heat Message Library with ready-to-use, pre-translated messages that follows the arc of the heat season — from pre-season preparedness and cooling tips to heat illness signs and high-risk groups — so users can quickly customize materials for their community.









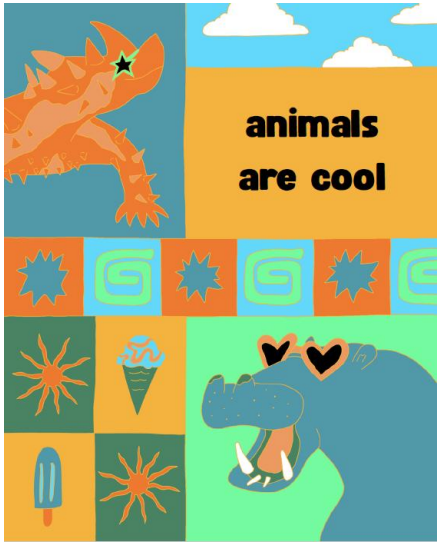


Cool Communications Lending Library

- **Heat Oral History Kit**
  - a deck of tarot-deck-inspired cards with conversation-starting questions about heat experiences
  - an oral history guidebook
  - Mini fans
- **Hot Takes Gumball Machines**
  - Collected heat stories
  - Heat-themed trinkets

Contact coolcommsart@mapc.org to submit a request for temporary use

Cool Communications Lending Library





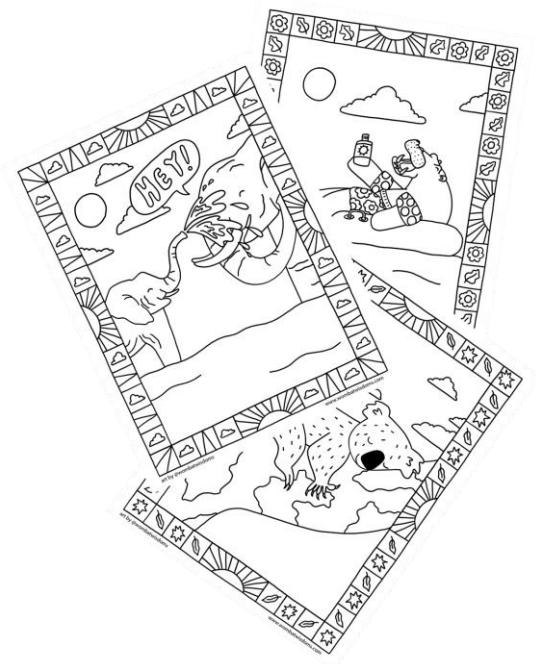


- Engagement activities guide
- Booklet with illustrations and poems

Go to https://artsandplanning.mapc.org/cool-communications-arts-toolbox/ to download

Cool Communications Lending Library

- **Downloadable coloring sheets**



- **Stickers**











Go to https://artsandplanning.mapc.org/cool-communications-arts-toolbox/ to download

Cool Communications Lending Library



Heat Resources Zine

Go to https://artsandplanning.mapc.org/cool-communications-arts-toolbox/ to download

Using the cityClimateHealth Tool

What Gaps Does This Tool Address

1. **Undercount:** Cities undercount the burden of heat
2. **Vulnerability:** Cities want to know who is most vulnerable to heat
3. **Scale:** Cities need data on the scale that they can act on
4. **Accessibility:** Confidentiality of health data can create analytical challenges

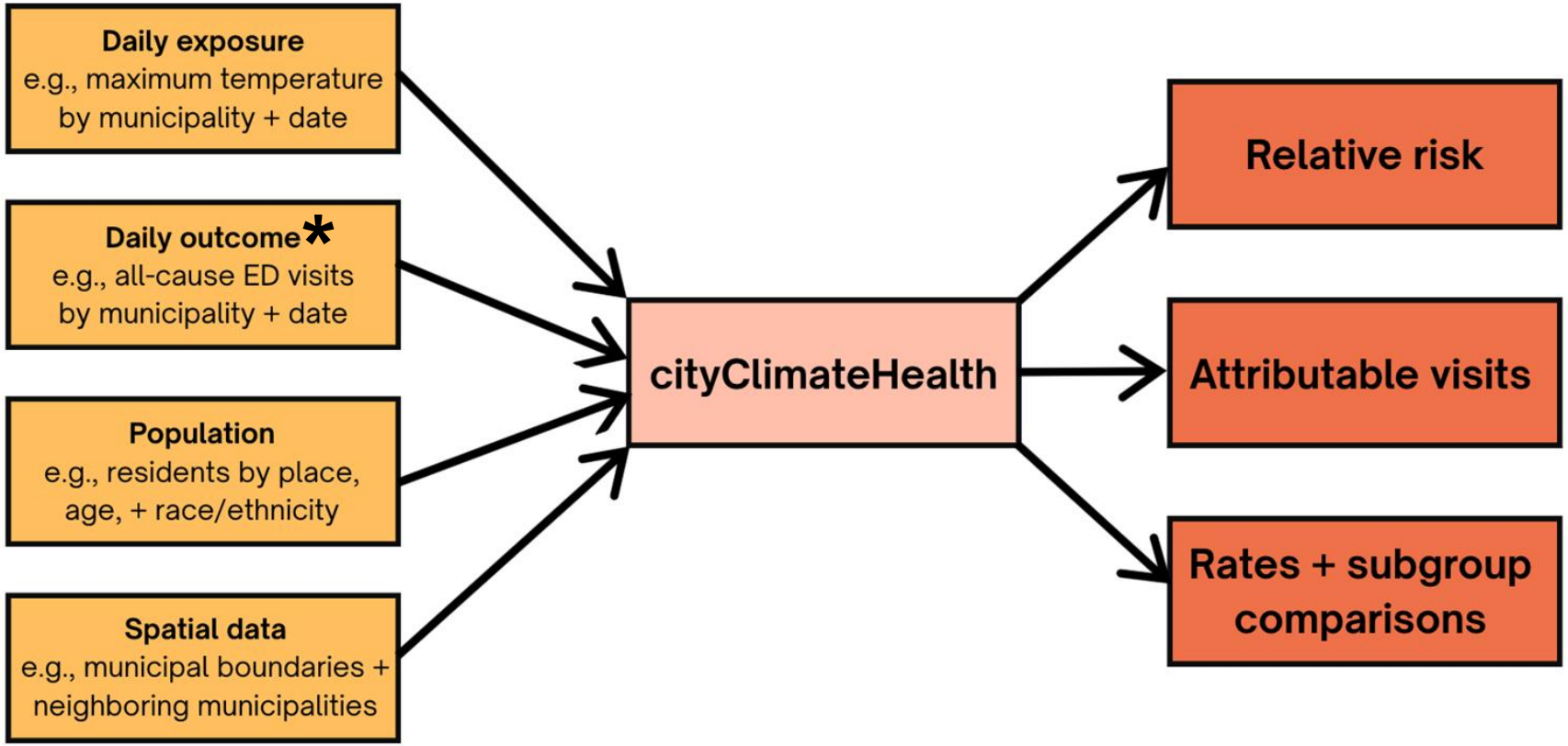
Expertise needed

- Familiarity with R
- Ability to manage sensitive health data
- Statistical background knowledge

Who can use it?

- Anyone familiar with R
- Public health departments
- Researchers with health data
- Analysts conducting local case studies

Clarifying Your Inputs and Outputs



*Confidentiality of health data can create analytical challenges, cityClimateHealth streamlines data sharing

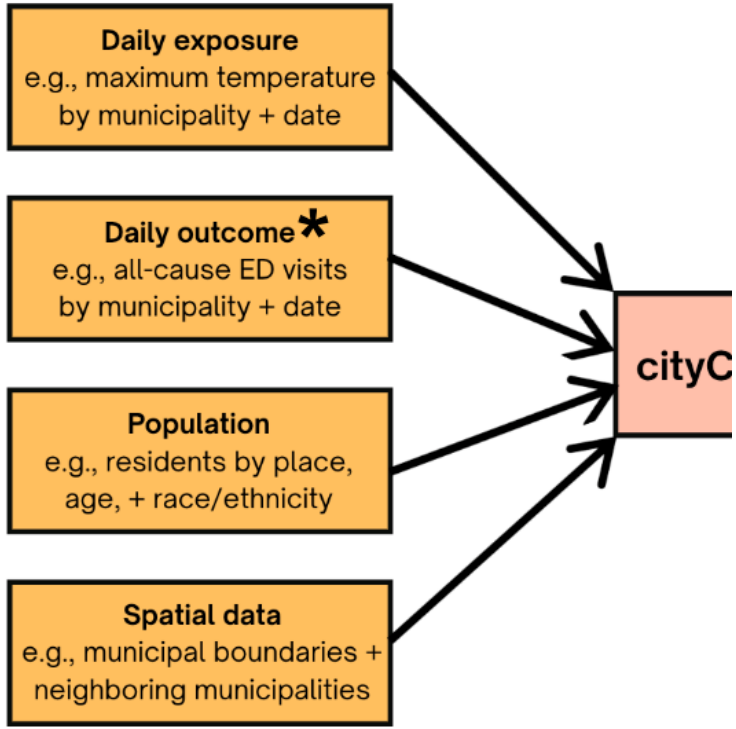
Inputs

Daily Exposure: heat, cold, floods, power outages, etc.

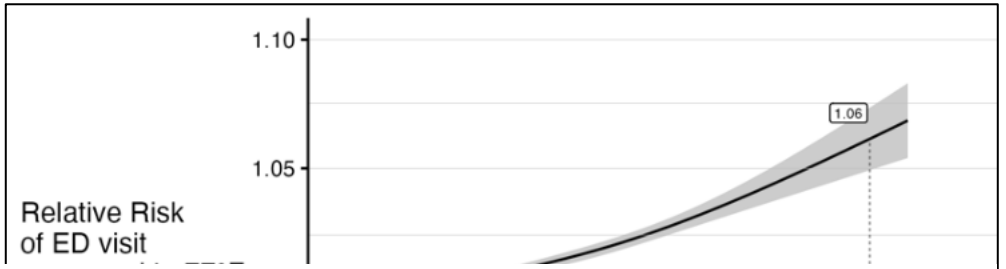
Daily Outcome: ED visits, hospitalization, mortality

Population: census data

Spatial Data: shapefiles at the state, county, city, tract, etc.

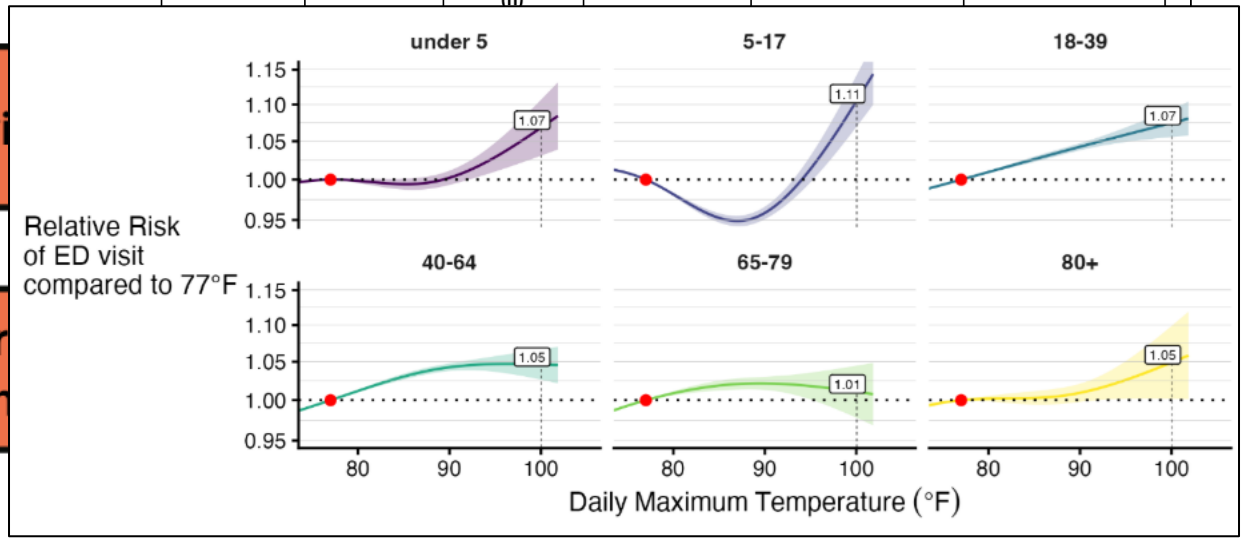


Outputs



Municipality	Population (2015)	Average annual warm season all-cause ED visits (n)	Average rate of warm season all-cause ED visits (n per 100,000)	Annual average number of heat-attributable ED visits* (n)	Average rate of heat-attributable ED visits* (n per 100,000)

- Relative risk
- ealth
- Attributable vi
- Rates + subgr comparison



Guided Examples

Getting started with `cityClimateHealth`

Here is code that shows the basic skeleton of how this package works. We can run the model and then calculate attributable numbers easily, and provide a number of outputs.

```
library(cityClimateHealth)
```

Run the model

Exposure

First, create the exposure object - you will need to define the `exposure_columns`.

```
library(data.table)

# load a built-in dataset and get a subset
data("ma_exposure")

exposure_sub <-
  subset(ma_exposure,
         COUNTY20 %in% c('MIDDLESEX', 'WORCESTER'))

# define columns of ma_exposure
exposure_columns <- list(
  "date" = "date",
  "exposure" = "tmax_C",
```

On this page

Getting started with cityClimateHealth

Run the model

Calculate attributable numbers

Running with factors

H.E.A.T. Community Heat Alert System

Bureau of Climate and Environmental Health

EXTREME HEAT ALERT

The HEAT EDUCATION and ALERT TOOLS (HEAT) RESPONSE

- **Daily heat forecasts from May 1st to September 30th**
- **Targeted alerts for unhealthy heat** – notifications for Community-Based Organizations (CBOs) and health equity partners.
- **Web Resources** – information to keep people and communities safer while enjoying the summer

SIGN UP COMMUNITY HEAT ALERT

Want to Know More? We'd Love to Work With You

Boston University

Alexis Arlak - aarlak@bu.edu

Chad Milando - cmilando@bu.edu

Metropolitan Area Planning Council

Sharon Ron - sron@mapc.org

cityClimateHealth

Cool Comms Proj.

Thank you! Questions?

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