



Department of  
**Public Health**  
CITY OF PHILADELPHIA  
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# CLIMATE CHANGE AND HEALTH IN PHILADELPHIA: PREPARING FOR A HOTTER, WETTER FUTURE

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**DVRPC Healthy Communities Task Force Meeting  
February 7, 2017**

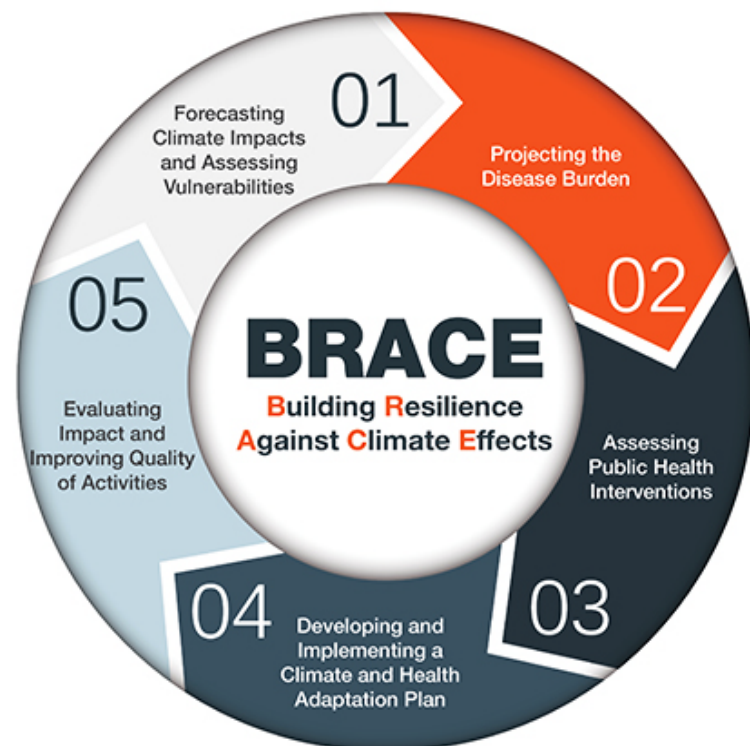
Presented by Jessica Caum, Assistant Program Manager,  
Public Health Preparedness, Philadelphia Department of Public Health

# Presentation Overview

- Project background and current status
- Climate change projections for Philadelphia, expected health outcomes, and PDPH Climate Change and Health Adaptation Plan
- Extreme heat planning in Philadelphia

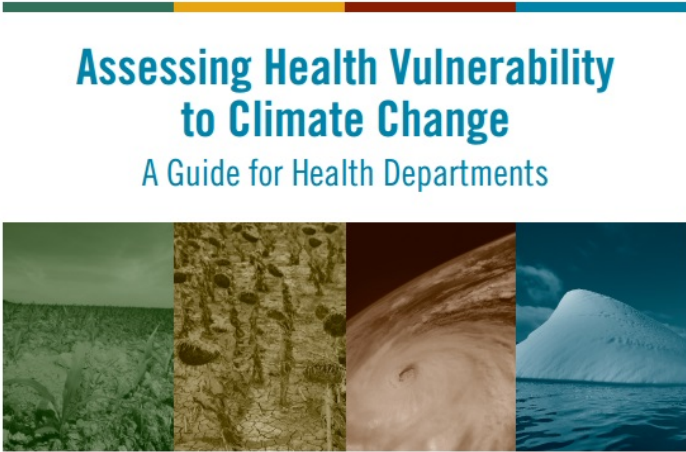
# Building Resistance Against Climate Effects (BRACE)

- PDPH is developing a Climate Change and Health Adaptation Plan using CDC's BRACE framework
- Office of Sustainability has documented the climate projections
- PDPH's role:
  - Identify likely health impacts based on climate projections
  - Identify vulnerable populations
  - Quantify and estimate disease burden
  - Develop and implement adaptation strategies to minimize health impacts



# Project Background

- Public Health Preparedness Program at PDPH received a small grant from the Public Health Institute to develop outreach materials about climate change and asthma
  - Led to broader thinking about climate change and health impacts in Philadelphia
  - Role of LHDs in preparing jurisdictions for health effects of climate change




**Assessing Health Vulnerability to Climate Change**  
A Guide for Health Departments

**Climate and Health Technical Report Series**  
Climate and Health Program, Centers for Disease Control and Prevention

Arie Ponce Manangan<sup>1</sup>, Christopher K. Uejio<sup>2</sup>, Shubhayu Saha<sup>1</sup>, Paul J. Schramm<sup>1</sup>, Gino D. Marinucci<sup>3</sup>, Claudia Langford Brown<sup>1</sup>, Jeremy J. Hess<sup>1,3,4</sup>, George Luber<sup>1</sup>

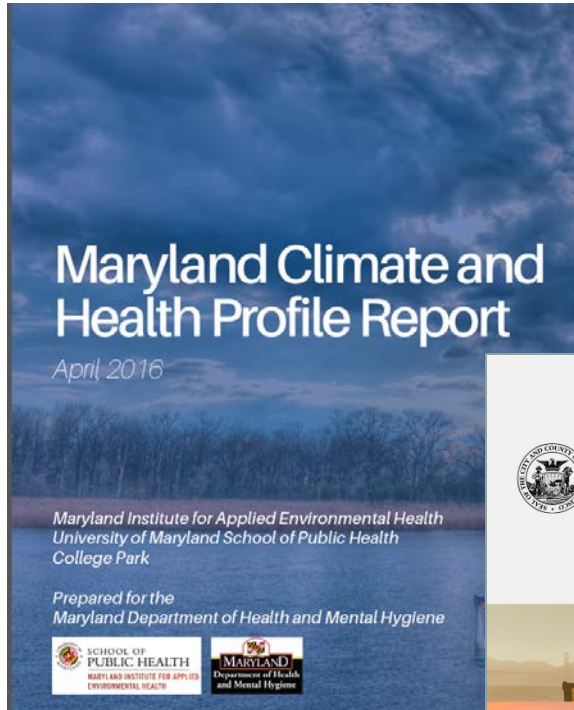
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National Center for Environmental Health  
Division of Environmental Hazards and Health Effects



CS249402-A


# State/Local Health Department Planning



**Maryland Climate and Health Profile Report**  
 April 2016

Maryland Institute for Applied Environmental Health  
 University of Maryland School of Public Health  
 College Park

Prepared for the  
 Maryland Department of Health and Mental Hygiene



Ann. N.Y. Acad. Sci. ISSN 0077-8923

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES  
*Issue: Building the Knowledge Base for Climate Resiliency*

**New York City Panel on Climate Change 2015 Report  
 Chapter 5: Public Health Impacts and Resiliency**

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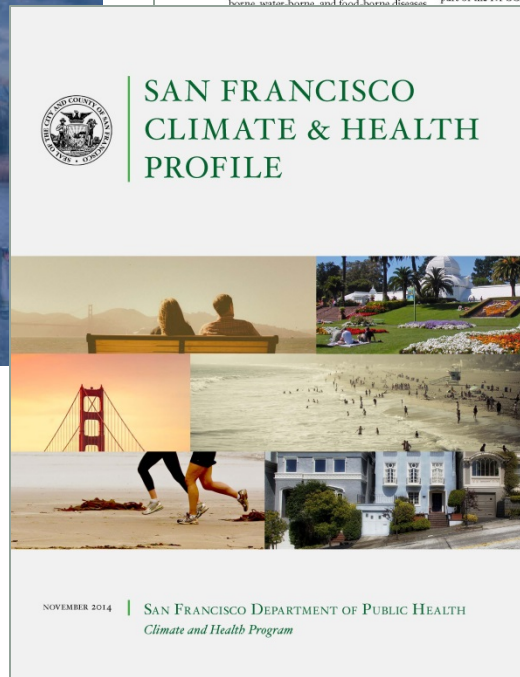
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**Contents**


- 5.1 Coastal storms and flooding
- 5.2 Extreme heat
- 5.3 Air pollution, aeroallergens, and vector-borne, zoonotic, and food-borne diseases

CLIMATE AND HEALTH SERIES - REPORT 1

**Your Health and Climate Change in Los Angeles County**

**SAN FRANCISCO CLIMATE & HEALTH PROFILE**



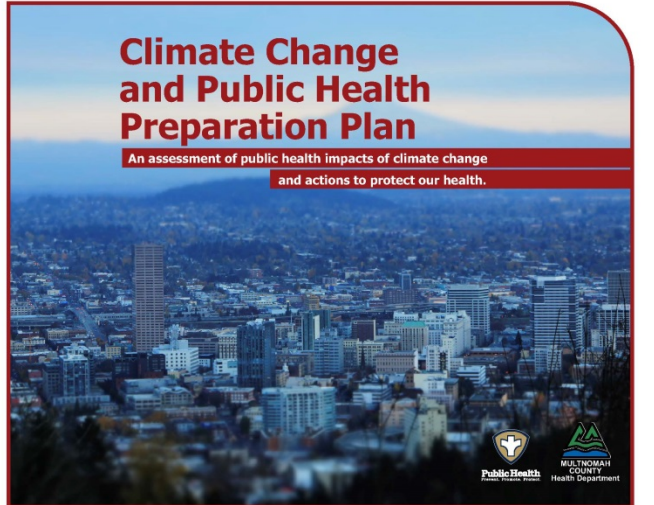

NOVEMBER 2014 | SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH  
 Climate and Health Program

Although New York City is one of the best-prepared and most climate-resilient cities in the world, there remain significant potential vulnerabilities related to climate variability and change. As part of the NPCC2 process, a team of local climate scientists was mobilized to assess current vulnerabilities and identify strategies that could help New York City to address climate events. The goal was the important climate-related information currently available in the future due to climate variability and change on emerging scientific information.

Figure 5.1. Health impacts of climate change when critical infrastructure, systems, and interdependencies are disrupted. These include threats, including delivery of essential services on a multi-faceted basis. These include, for example, delivery of essential services to black and brown communities. These, in turn, can lead to increased exposure to heat stress due to failure of cooling systems and predicting future events may have more careful analysis to enhance climate resilience. These have been released. (City of New York)

**Climate Change and Public Health Preparation Plan**

An assessment of public health impacts of climate change and actions to protect our health.

# Project Status

- 50+ person Advisory Group meets quarterly
- PDPH outreach materials
- Drexel/PDPH ozone and asthma study
- Revision of Citywide Excessive Heat Plan
- Development of PDPH Climate Change and Health Adaptation Plan

**NAME: Air Quality Arnold**



Air can be dirty even when it looks clean. Ground-level ozone is made when pollutants from factories, cars and trucks mix together in the hot summer sun. Climate change could make air pollution worse in Philadelphia.

**On ozone action days, try to limit your time outside.**

You can get Air Quality information from weather reports on the news and at [www.airnow.gov](http://www.airnow.gov).

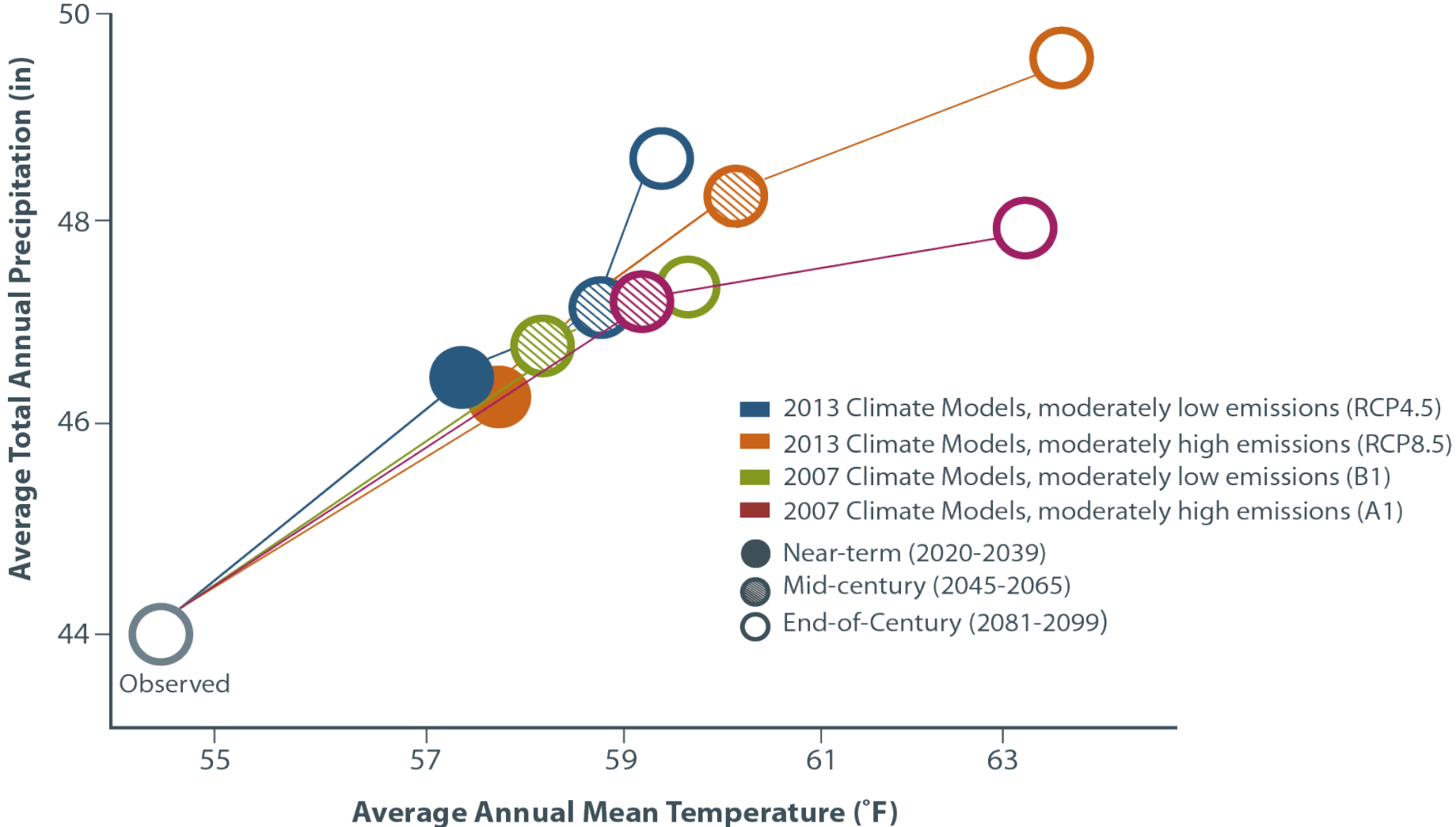
June Tip: Help **AIR QUALITY ARNOLD** stop coughing by taking public transportation, riding a bike or walking! This is good for the environment and will also help slow down climate change.



**June 2017**

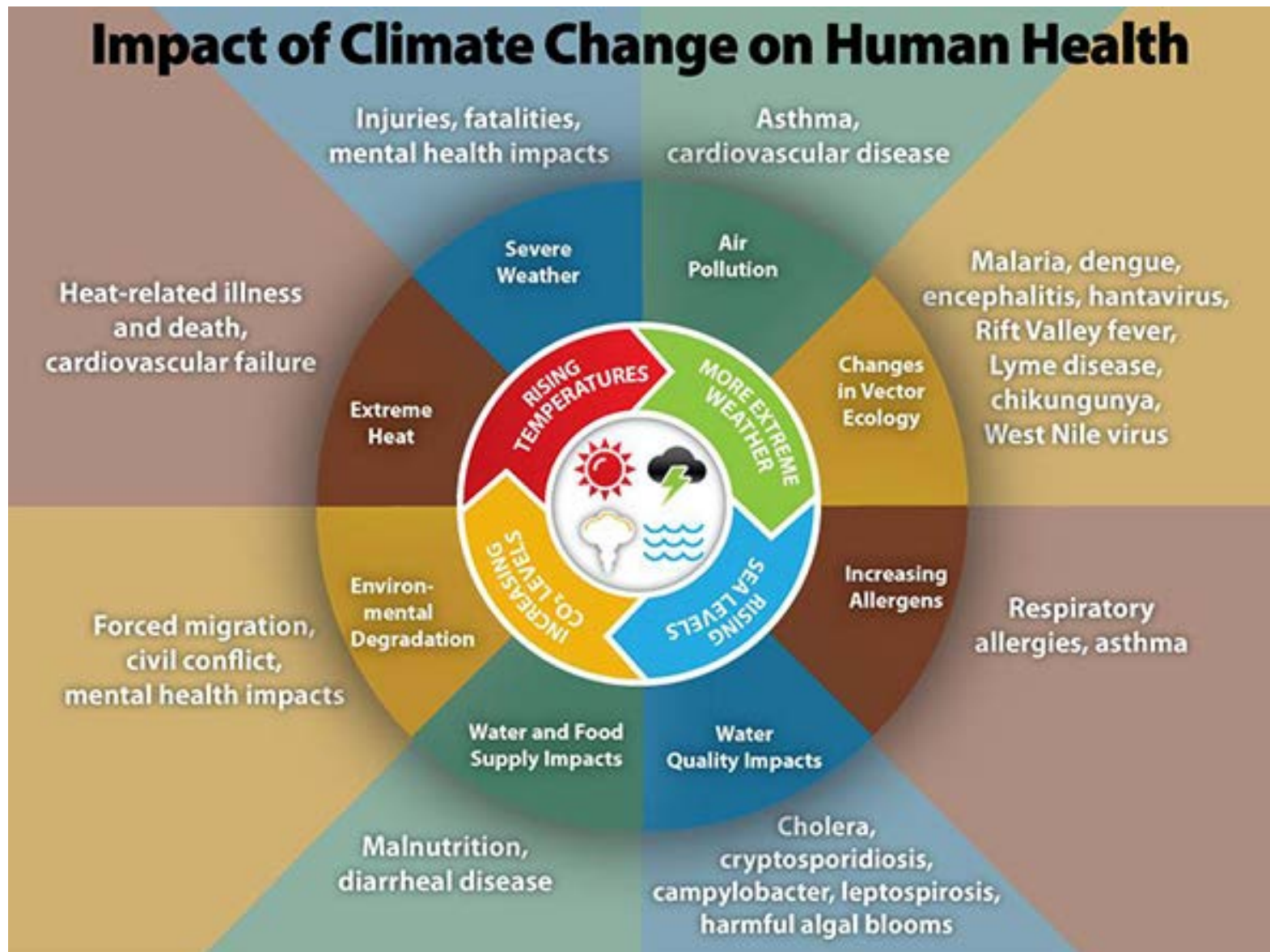
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5 	6	7	8	9	10
11	12	13	14	15	16	17
18 	19	20	21 	22	23	24
25	26	27	28	29	30 <b>FLIP THIS PAGE TOMORROW MORNING!</b>	

# Philadelphia Climate Projections



From Growing Stronger: Toward A Climate-Ready Philadelphia (p. 11), by the Mayor's Office of Sustainability and ICF International, 2015, Philadelphia.

# Impact of Climate Change on Human Health





# Health Impacts of Climate Change in Philadelphia

Hazard	Environmental Impact	Human Health Impact	Vulnerable Populations
More days of extreme heat; more consecutive "extremely hot" days per year	<ul style="list-style-type: none"> <li>Urban heat island effect</li> <li>Decreased air quality due to increases in ground-level ozone</li> </ul>	<ul style="list-style-type: none"> <li>Heat-related illness, including dehydration and heat stroke</li> <li>Heat-related mortality</li> <li>Respiratory disease exacerbations</li> </ul>	<ul style="list-style-type: none"> <li>Elderly</li> <li>Children</li> <li>People with chronic diseases, including diabetes, cardiovascular and respiratory conditions</li> <li>Low socioeconomic status</li> <li>Outdoor occupations</li> <li>Homeless</li> </ul>
Increased mean temperature; fewer days below freezing	<ul style="list-style-type: none"> <li>Increases in ground-level ozone, airborne allergens and other pollutants</li> </ul>	<ul style="list-style-type: none"> <li>Respiratory disease exacerbations (COPD, asthma, allergic rhinitis, bronchitis)</li> </ul>	<ul style="list-style-type: none"> <li>Elderly</li> <li>Children</li> <li>People with respiratory conditions</li> </ul>
	<ul style="list-style-type: none"> <li>Changes in vector ecology</li> </ul>	<ul style="list-style-type: none"> <li>Vector-borne disease increases/changes</li> </ul>	<ul style="list-style-type: none"> <li>Various</li> </ul>
Extreme weather events (e.g., hurricanes)	<ul style="list-style-type: none"> <li>Flooding                             <ul style="list-style-type: none"> <li>Damage to infrastructure and residences</li> <li>Mold and mildew</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Injuries</li> <li>Displacement</li> <li>Mental health</li> <li>Vector-and water-borne diseases</li> <li>Asthma exacerbations</li> </ul>	<ul style="list-style-type: none"> <li>Residents in low-lying areas</li> <li>Low socioeconomic status</li> <li>People with respiratory conditions</li> </ul>
Increased precipitation	<ul style="list-style-type: none"> <li>Flooding                             <ul style="list-style-type: none"> <li>Mold and mildew</li> </ul> </li> <li>Decreased drainage</li> </ul>	<ul style="list-style-type: none"> <li>Injuries</li> <li>Displacement</li> <li>Asthma exacerbations</li> </ul>	<ul style="list-style-type: none"> <li>Residents in low-lying areas</li> <li>Low socioeconomic status</li> </ul>
	<ul style="list-style-type: none"> <li>Changes in vector ecology</li> </ul>	<ul style="list-style-type: none"> <li>Vector-and water-borne diseases</li> </ul>	<ul style="list-style-type: none"> <li>Various</li> </ul>

# Climate and Health Vulnerability

- Vulnerability to climate change: “the degree to which geophysical, biological and socioeconomic systems are susceptible to, and unable to cope with, adverse impacts” (IPCC, 2007).
- Populations with an increased risk of poor health outcomes:
  - Seniors (Age 65+ in Philadelphia: 12.5%)
  - Children
  - Low SES (Persons below poverty level in Philadelphia: 26.5%)
  - Language other than English spoken at home: (21.5% in Philadelphia)
  - Pregnant women
  - Individuals with chronic health conditions, such as obesity and asthma
  - Individuals with outdoor occupations
  - Homeless persons
- Having multiple factors increases risk

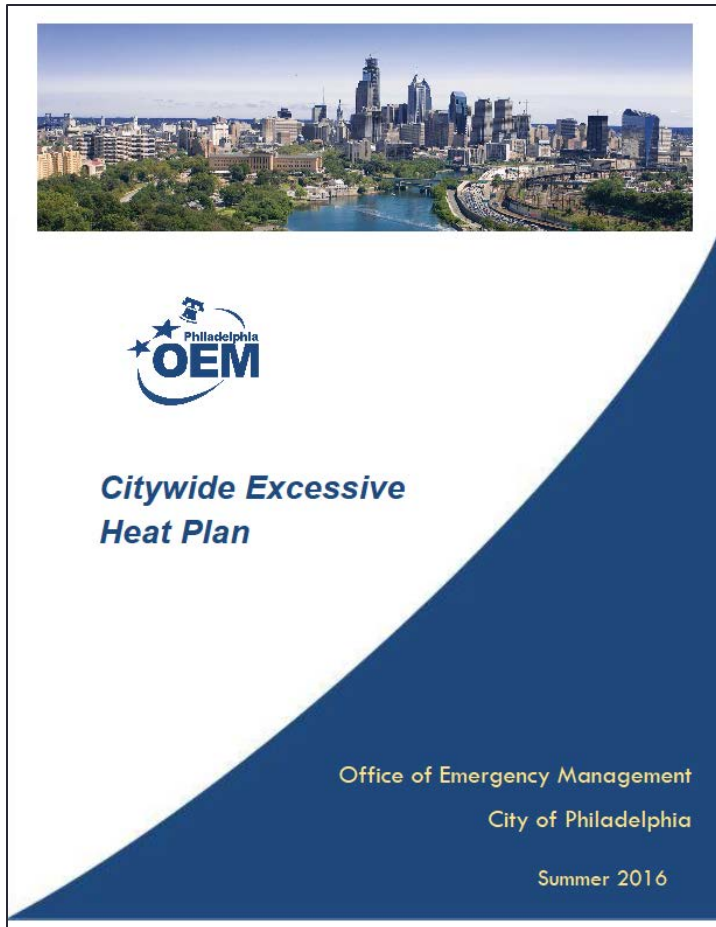
# PDPH Climate Change and Health Adaptation Plan: Key Sections

- Climate Change Projections for Philadelphia, Health Impacts, and Vulnerable Populations
  - Focus on extreme heat, air quality, severe storms, and vector-borne disease
- Adaptation Strategies
  - Specific, practical and achievable actions, interventions and/or policy changes to build resilience within the City's population to better cope with expected health effects
  - Most strategies will be actions that PDPH can implement/facilitate
  - Some will be individual/family actions or policy recommendations

# EXTREME HEAT PLANNING

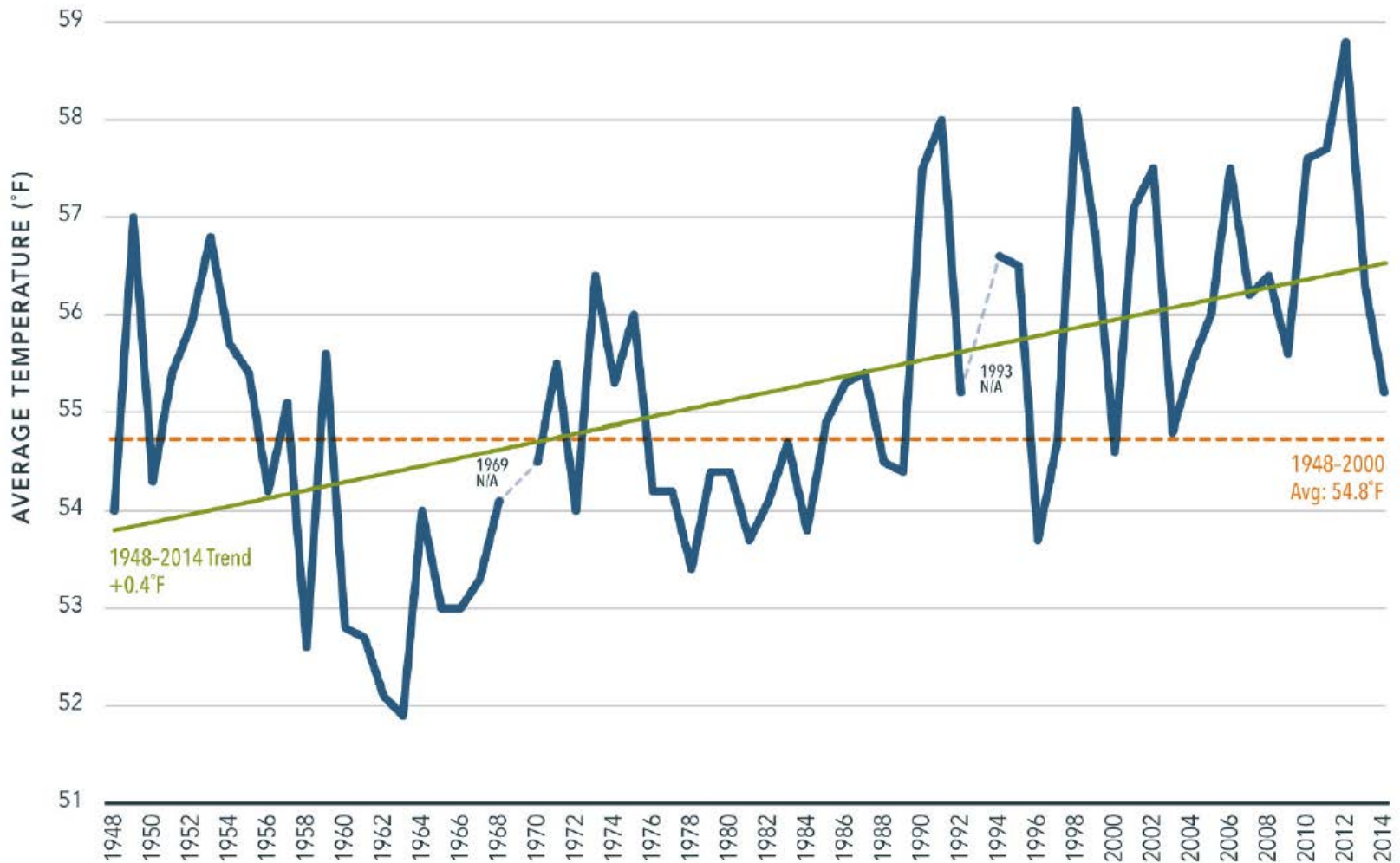
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# Citywide Excessive Heat Plan



- Citywide Response Actions
  - Internal notifications
  - Public notifications
  - Ozone and air action alerts
  - Excessive heat warning declaration and activation of mobile teams
    - PCA Heatline: refers callers to PDPH EHS/AHS assessment team
  - Outreach for homeless persons
  - Cooling centers

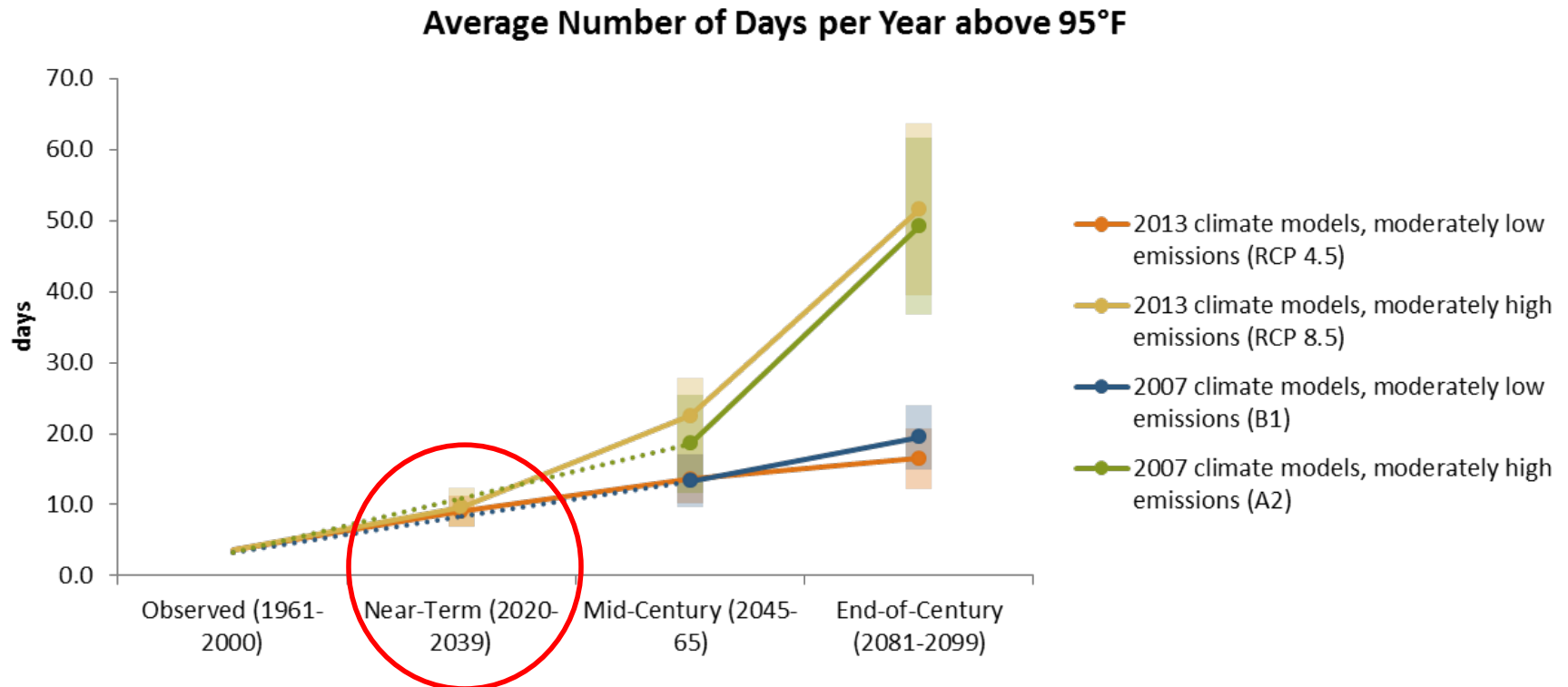
## ANNUAL TEMPERATURE TREND FOR PHILADELPHIA, 1948–2014



The horizontal line represents the average temperature in Philadelphia from 1948–2000.<sup>2</sup>

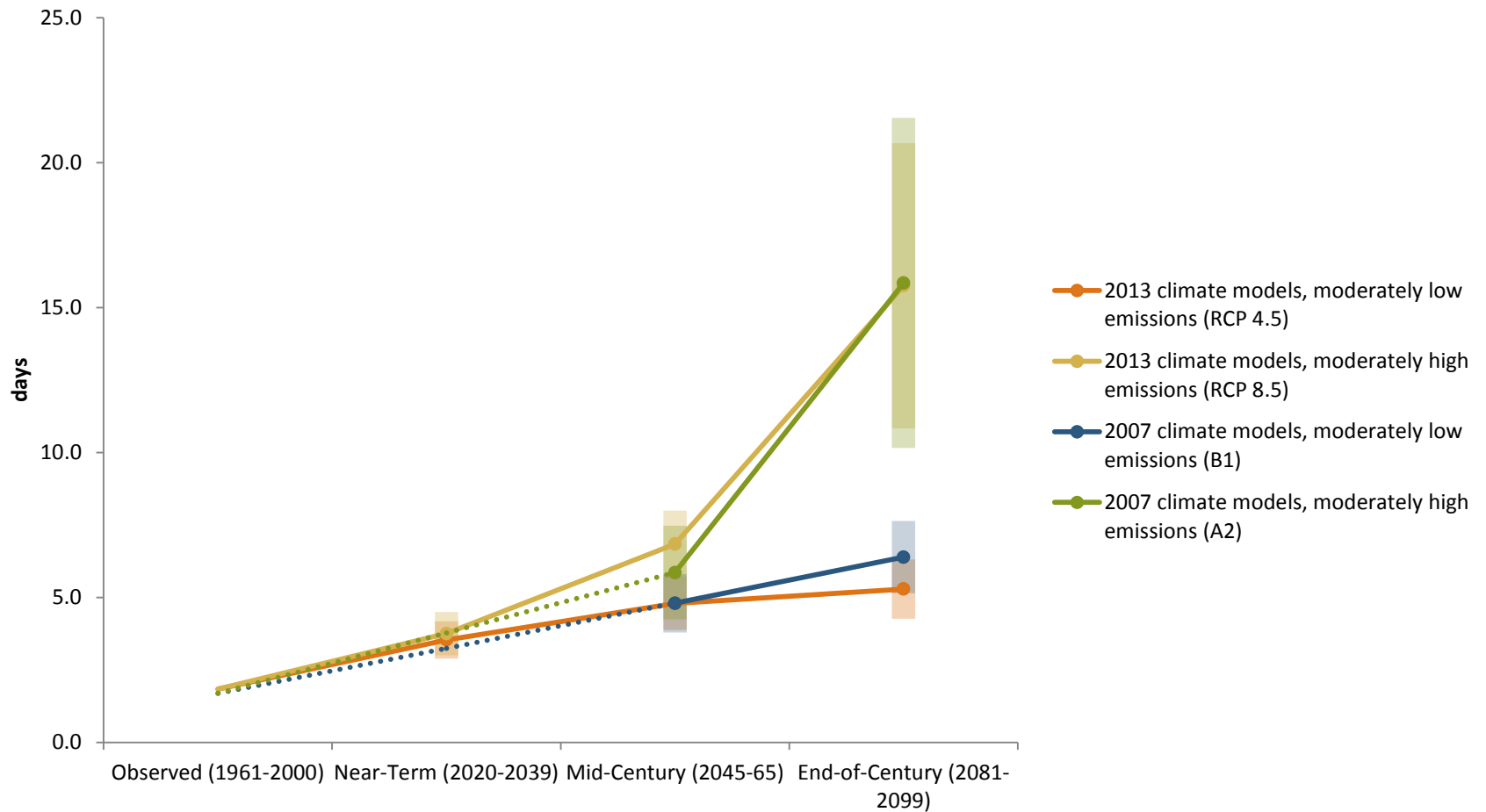
# 2016: A Record-breaking Year

- NOAA and NASA: 2016 was the hottest year on record globally
  - July 2016 was Earth's warmest month on record
- 2016 was hottest year on record in U.S.
  - In Philadelphia: 17 days with temperatures at or above 95°F



# More Consecutive Days of 95°F or Above

Maximum Number of Consecutive Days per Year above 95°F

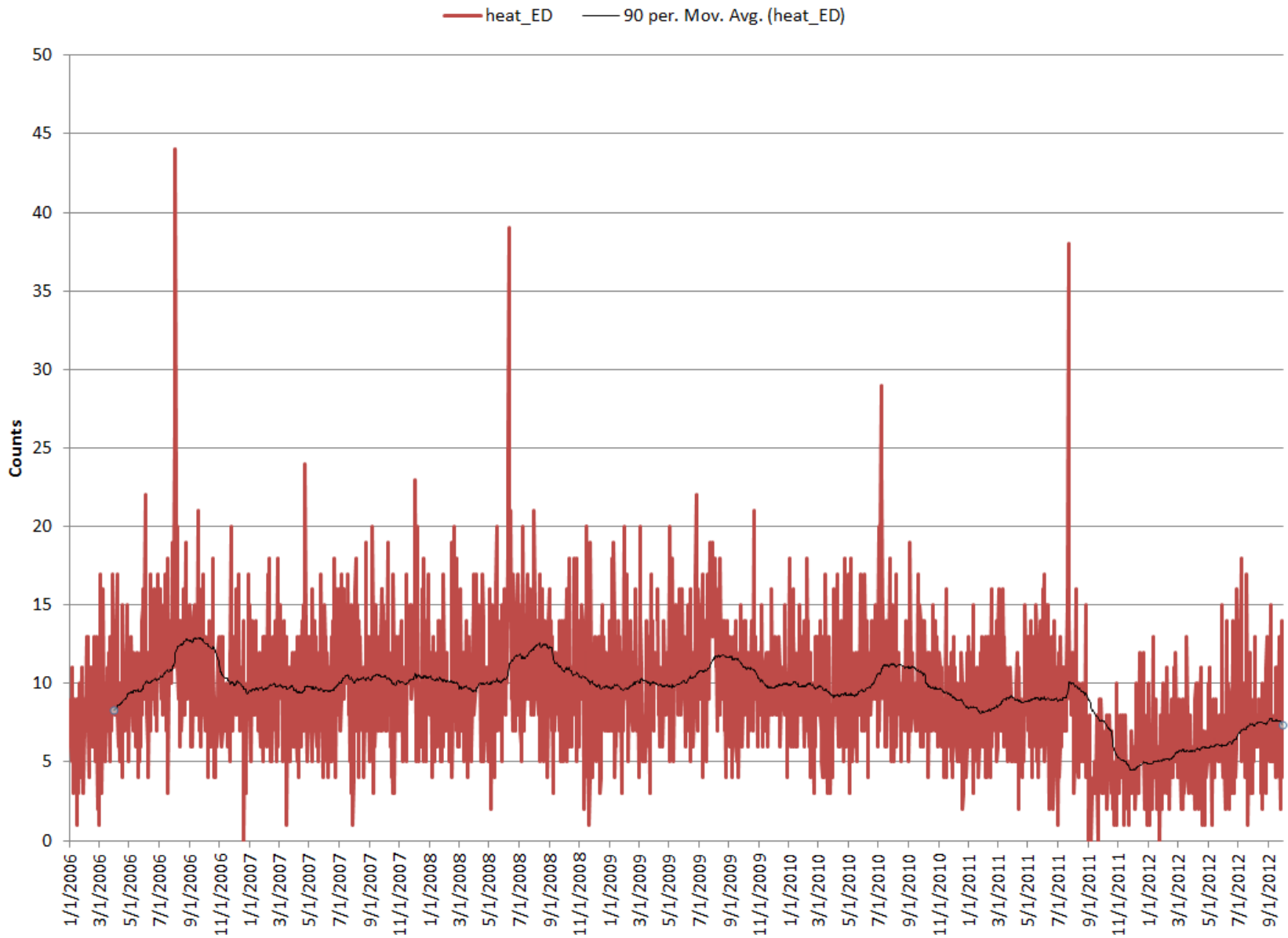




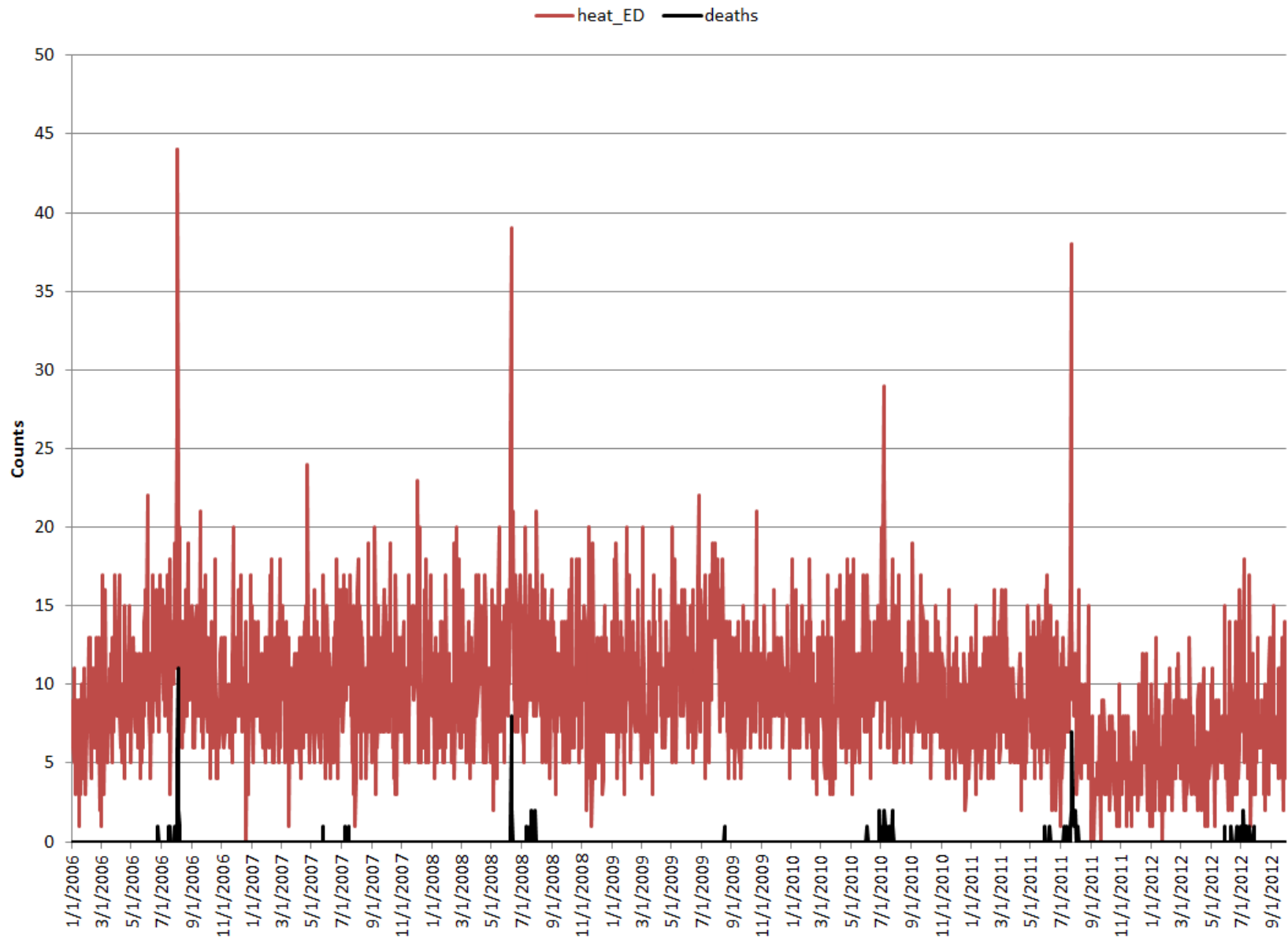
# Heat and Health

- Temperature extremes compromise the body's ability to thermo-regulate, which can result in:
  - Dehydration, heat cramps, heat exhaustion
  - Heat stroke
  - Exacerbation of existing conditions:
    - Cardiovascular disease
    - Diabetes
    - Respiratory conditions
      - High temps increase ground-level ozone and enhance formation of some pollutants
    - Kidney disease
    - Mental health conditions (e.g., mood disorders, substance abuse)
- Greater health impacts expected in places where temps are typically cooler

# Philadelphia Heat-related Morbidity



# Philadelphia Heat-related Mortality



# Future Heat-related Morbidity and Mortality in the Northeastern U.S.

## Study by Petkova, et al. (2013):

- Northeast region of U.S. expected to be particularly vulnerable to increased heat-related mortality as a result of climate change
- Study projected future heat-related mortality in New York City, Boston, and Philadelphia
  - By 2080s, three-fold increase in heat-related mortality in Philadelphia under RCP4.5 and six-fold increase under RCP8.5

## Study by Schwartz et al. (2015)

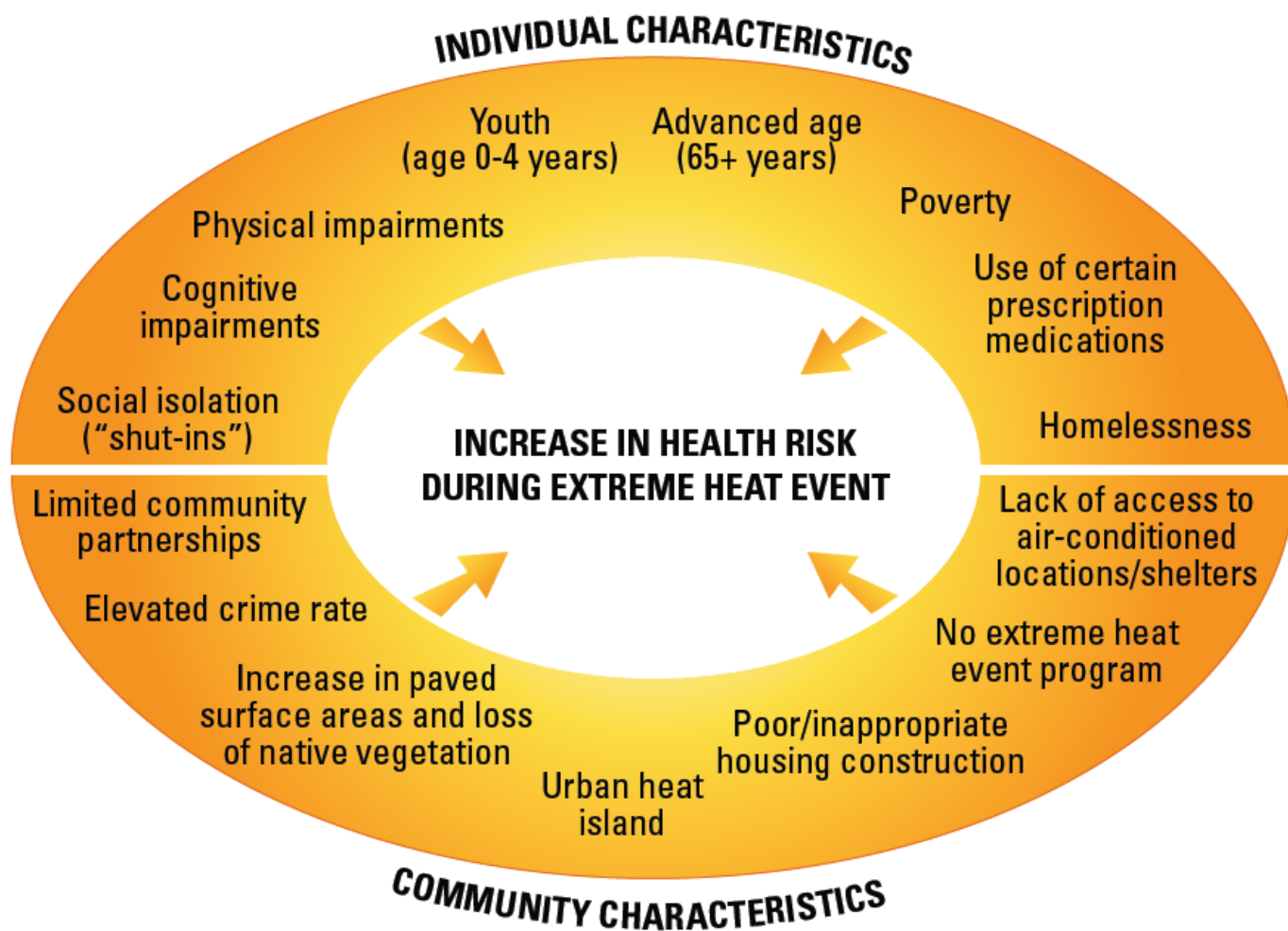
- Map shows projected increase in death rates due to warming in the warmer months



# Focus of 2017 Heat Planning

- Preparing for an extreme heat event greater than we have experienced previously
  - High intensity
  - Long duration
- Enhanced response strategies now will prepare us for future extreme heat events
- Update the Citywide Excessive Heat Plan
  - Goal date: Memorial Day weekend 2017
  - Emphasis on outreach to vulnerable populations, both pre-event and during event

# Individual and Community Risk Factors



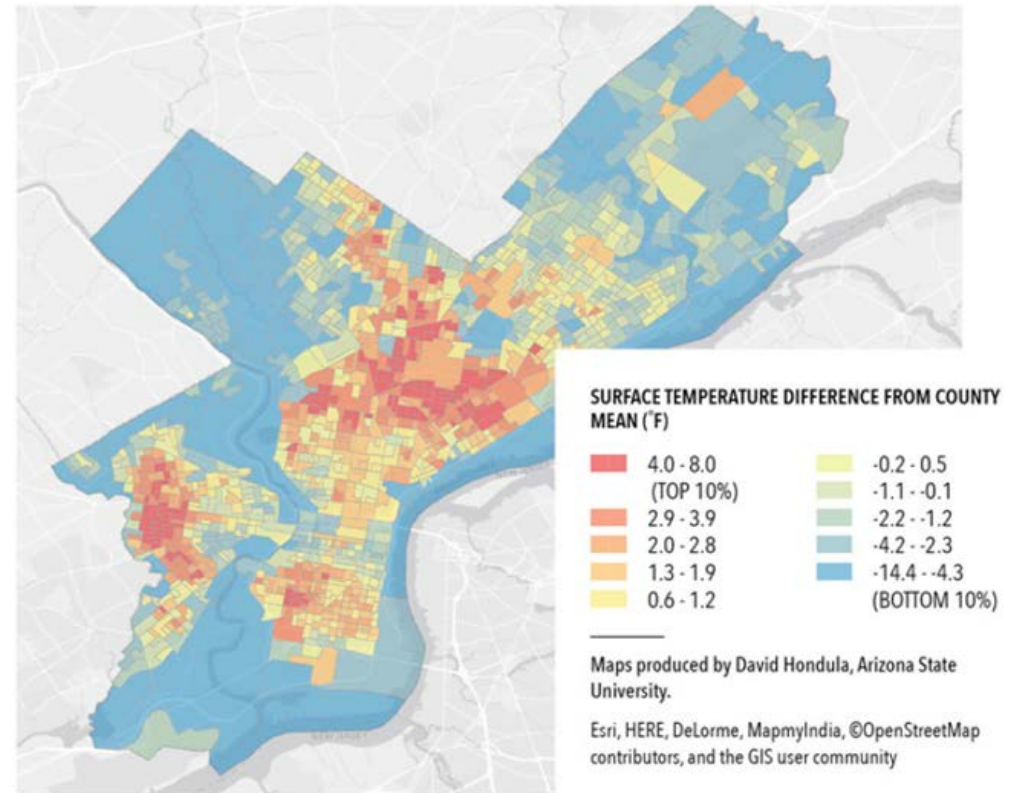
# Extreme Heat and Chronic Conditions

- Obesity
  - Overweight (33.4% of adult population in Philadelphia)
- Diabetes
  - Diabetes (15.5% of adult population in Philadelphia)
- Cardiovascular disease
  - Hypertension (38.3% of adult population in Philadelphia)
- Respiratory disease
  - PADOH estimated 2013 citywide pediatric asthma prevalence at 22% percent
- Renal disease
- Mental health conditions

# Urban Heat Island

- Difference between air and surface temps in urban area vs. temps in suburban/rural areas
  - Annual mean air temp of a city with 1 million people can be 1.8–5.4°F warmer than surrounding areas (EPA)
  - In the evening, the difference can be as high as 22°F (12°C)
    - Limits potential relief of cooler nighttime temps
- Heat islands can increase energy demand and costs, air pollution, heat-related illness and mortality

AVERAGE SURFACE TEMPERATURES BY CENSUS BLOCK, 2013-15



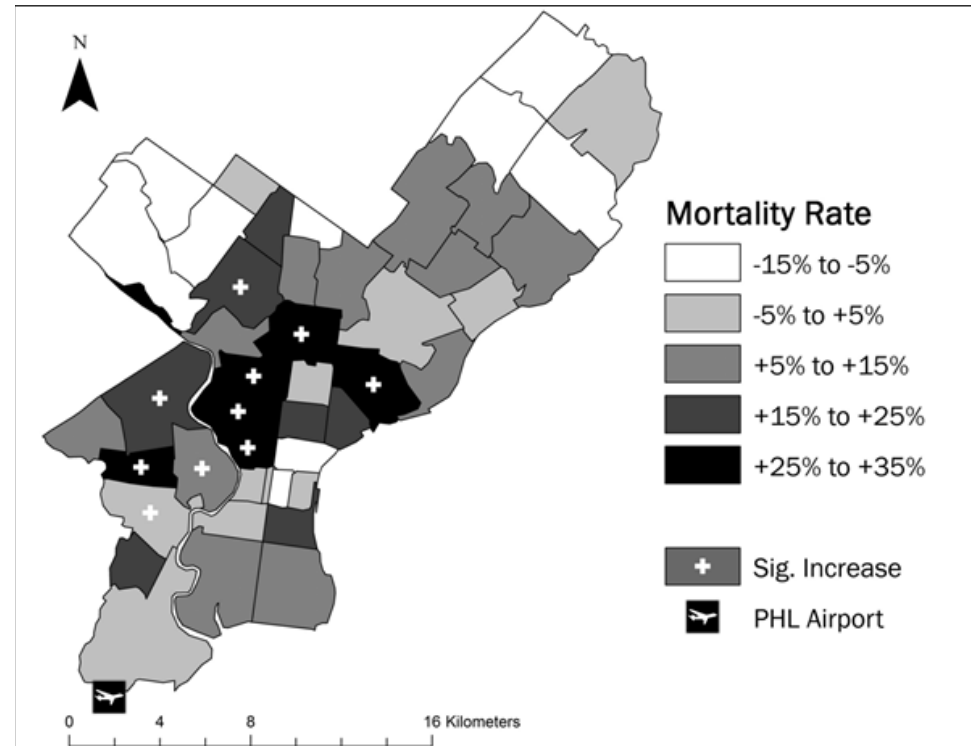
Data are for the seven hottest days on which mostly cloud-free Landsat imagery was available. *Image courtesy of David Hondula, Arizona State University*



# Heat-Related Mortality Risk

- Study by Hondula et al. (2012) of years 1983-2008 in Philadelphia:
  - Elevated mortality rates observed for some parts of city in response to high temperatures
  - Factors related to high heat mortality risk:
    - Proximity to high surface temperatures
    - Low socioeconomic status
    - High density residential zoning
    - Age

- Recommendation: Future interventions should target high-risk areas



# Social Environmental Approach for Mapping Heat Vulnerability in Philadelphia

- **Social Vulnerability Factors:**
  - Age 65 and over
  - Living alone
  - Age 65 and over + living alone
  - Low SES (Unable to afford air conditioning, poor housing conditions, lack of adequate health care)
  - Limited English proficiency
  - Low education (less than high school diploma)
- **Environmental Factors:**
  - High surface temps
  - Lack of nearby green space
  - Lack of cool spaces

# Considerations for Excessive Heat Plan Update

- Education and Pre-season Preparedness
  - Conduct targeted pre-season community workshops about extreme heat preparedness
  - Communicate with vulnerable populations about heat safety through healthcare and other service providers
- Excessive Heat Response
  - Neighborhood canvassing immediately prior to a heat event
  - Assess locations of cooling centers, ensure citywide accessibility
  - PCA Heatline, PDPH mobile teams
  - Block captains, buddy systems
  - Coordinated public information campaign



# PDPH Short-term Strategies for Extreme Heat Adaptation

- Continue to conduct heat-related morbidity and mortality surveillance
- Educate community members about extreme heat and adverse impacts on health, including distributing culturally competent outreach materials focused on preventing heat-related illness
- Educate healthcare providers about impacts of extreme heat on health and risks for patients with chronic health conditions

# Longer Term Strategies

- EPA'S Heat Island Cooling Strategies
  - **Trees and vegetation:** increasing tree and vegetation cover lowers surface and air temps
  - **Green roofs:** growing a vegetative layer (plants, trees, etc.) reduces temp of the roof surface
  - **Cool roofs:** installing a cool roof reduces roof temps and lowers energy demand
  - **Cool pavements:** more reflective paving materials cool the pavement surface and surrounding air
  - **Smart growth:** development and conservation strategies help protect the natural environment and make communities more livable



Roofs



Green Space



Trees

# Closing Thoughts

- Raise awareness about climate change and expected health impacts across all sectors:
  - Government agencies and officials
  - Community-based organizations
  - Healthcare providers
  - All communities, and especially vulnerable populations
  - Families and individuals
- Frame the issue in new ways
  - Health is a great focus because it's relatable
- Emphasize the importance of increasing resilience and other co-benefits of adaptation activities
  - Biking/walking have positive environmental and health benefits

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