CLIMATE CHANGE AND HEALTH IN PHILADELPHIA: PREPARING FOR A HOTTER, WETTER FUTURE

DVRPC Healthy Communities Task Force Meeting
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Presented by Jessica Caum, Assistant Program Manager,
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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
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New York City Panel on Climate Change 2015 Report
Chapter 5: Public Health Impacts and Resiliency

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5.1 Coastal storms and flooding
5.2 Extreme heat
5.3 Air pollution, aerosologenesis, and vector-human interactions and food-borne diseases

Although New York City is one of the best-prepared and most climate-minded cities in the world, there remain significant potential vulnerabilities related to climate variability and change. As part of the NYCC21 process, a team of local climate change experts was convened to assess current and future impacts and identify strategies that could be implemented to mitigate the risks of New York City to adverse climate events. The goal was to develop a strategy for New York City to ensure the safety of its citizens in the face of climate variability and change.

Figure 5.1. Health impacts when critical night-time interventions are made after an extreme heat wave event. Healthcare facilities report increased demand for hospital and emergency room admissions and more frequent hospitalizations. More people are transported to blacked-out hospitals. Those in hospitals are transported to other hospitals, which then have to transport others. As a result, more people are transported to other hospitals, which then have to transport others. This cycle continues until the healthcare system is overwhelmed.

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
Philadelphia Climate Projections

Impact of Climate Change on Human Health

- Injuries, fatalities, mental health impacts
- Asthma, cardiovascular disease
- Heat-related illness and death, cardiovascular failure
- Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus
- Forced migration, civil conflict, mental health impacts
- Respiratory allergies, asthma
- Extreme heat
- Air pollution
- Changes in vector ecology
- Increasing allergens
- Sea levels rising
- Water and food supply impacts
- Water quality impacts
- Increasing CO2 levels
- Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms
- Rises in extreme weather
- Severe weather
- Malnutrition, diarrheal disease
# Health Impacts of Climate Change in Philadelphia

<table>
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<tr>
<th>Hazard</th>
<th>Environmental Impact</th>
<th>Human Health Impact</th>
<th>Vulnerable Populations</th>
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| More days of extreme heat; more consecutive “extremely hot” days per year | • Urban heat island effect  
• Decreased air quality due to increases in ground-level ozone | • Heat-related illness, including dehydration and heat stroke  
• Heat-related mortality  
• Respiratory disease exacerbations | • Elderly  
• Children  
• People with chronic diseases, including diabetes, cardiovascular and respiratory conditions  
• Low socioeconomic status  
• Outdoor occupations  
• Homeless |
| Increased mean temperature; fewer days below freezing | • Increases in ground-level ozone, airborne allergens and other pollutants | • Respiratory disease exacerbations (COPD, asthma, allergic rhinitis, bronchitis) | • Elderly  
• Children  
• People with respiratory conditions |
|                                              | • Changes in vector ecology | • Vector-borne disease increases/changes | • Various |
| Extreme weather events (e.g., hurricanes)    | • Flooding  
  o Damage to infrastructure and residences  
  o Mold and mildew | • Injuries  
• Displacement  
• Mental health  
• Vector-and water-borne diseases  
• Asthma exacerbations | • Residents in low-lying areas  
• Low socioeconomic status  
• People with respiratory conditions |
| Increased precipitation | • Flooding  
  o Mold and mildew  
• Decreased drainage  
• Changes in vector ecology | • Injuries  
• Displacement  
• Asthma exacerbations  
• Vector-and water-borne diseases | • Residents in low-lying areas  
• Low socioeconomic status  
• Various |
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
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
The horizontal line represents the average temperature in Philadelphia from 1948–2000.²

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

- 2013 climate models, moderately low emissions (RCP 4.5)
- 2013 climate models, moderately high emissions (RCP 8.5)
- 2007 climate models, moderately low emissions (B1)
- 2007 climate models, moderately high emissions (A2)
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

The graph shows the heat-related morbidity trends in Philadelphia over time. The red line represents the number of heat-related ED visits, while the black line indicates the 90th percentile moving average of these visits. The data spans from January 2006 to July 2016, with a noticeable increase in morbidity during the summer months.
Philadelphia Heat-related Mortality

The graph shows the number of heat-related hospital visits (heat_ED) and deaths over a period from 2006 to 2012. The x-axis represents the dates, and the y-axis represents the counts. The graph includes several spikes, indicating weeks with a higher number of heat-related events.
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

**INCREASE IN HEALTH RISK DURING EXTREME HEAT EVENT**

**INDIVIDUAL CHARACTERISTICS**
- Youth (age 0-4 years)
- Advanced age (65+ years)
- Physical impairments
- Cognitive impairments
- Poverty
- Use of certain prescription medications
- Homelessness
- Lack of access to air-conditioned locations/shelters
- No extreme heat event program
- Poor/inappropriate housing construction
- Urban heat island
- Increased paved surface areas and loss of native vegetation
- Elevated crime rate
- Limited community partnerships
- Social isolation (“shut-ins”)
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
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

![Map showing mortality rate distribution]
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
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


References


Point of contact

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