Surviving Maricopa County’s Extreme Heat: Update on Mortality and Morbidity Associated with Environmental Heat

Vjollca Berisha, MD, MPH  National Energy & Utility Affordability Coalition, 2018 Annual Conference, Phoenix, Arizona
Outline

- Background Information

- Environmental Heat Injury/Death in Maricopa County

- Special Studies

- Results
Maricopa County, Arizona

One of the largest urban centers to experience the nation’s most extreme heat

<table>
<thead>
<tr>
<th>Typical year:</th>
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<tr>
<td>Environmental temperatures ≥ 100°F</td>
<td>Start: mid-May</td>
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<tr>
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<td>End: 1st week October</td>
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<tr>
<td>Days where max. temp ≥ 110°F (119°F)</td>
<td>26 days (average)</td>
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<tr>
<td>Days where min. temp ≥ 90°F (95°F)</td>
<td>13 days (average)</td>
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Excessive Heat Warnings in Maricopa County (2006-2017)

- Excessive Heat Warnings Events Issued: 56
- Days with Excessive Heat: 179
- Number of Deaths During Excessive Heat Warnings: 268
- Of Total Heat Related Deaths have occurred during Excessive Heat Warning Days: 25%

Months: May, June, July, August, September
Silent Killer

Lack of public recognition

- No damage to infrastructure (silent killer)
- Many deaths go unreported, unrecognized

Every heat associated death is preventable!
Enhanced Heat Surveillance

- Exceptionally high temperatures (July, 2005)

- Media Reports:
  - “Many heat deaths may go uncounted”
  - “Heat deaths catch officials off-guard”
  - “Heat wave claims 18 lives in 5 days”

- No surveillance system for heat-associated deaths in place

MCDPH IMPLEMENTED A SYSTEM FOR TRACKING HEAT-ASSOCIATED DEATHS IN 2006
Public Health: Vision and Mission

Vision:
“A healthy and safe community”

Mission:
“To protect and promote the health and well-being of Maricopa County residents and visitors”
Data Sources

- Traditional Data Sources
  - Death certificates
  - Medical examiner data (PRODs)
  - Hospital discharge data (HDD)
  - Syndromic Surveillance
    - Essence
Who is at Risk?

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

COMMUNITY CHARACTERISTICS
- Limited community partnerships
- Elevated crime rate
- Increase in paved surface areas and loss of native vegetation
- Urban heat island
- Poor/inappropriate housing construction
- No extreme heat event program
Help Create a Healthy Community...

Maricopa County Heat Statistics
Frequency of Heat Associated Deaths By Year, Maricopa County (2006-2017)

N= 1085
Environmental Heat Associated Emergency Department Visits, Maricopa County 2016

**Yellow bars indicate days with Excessive Heat Warning and Illness occurrence in these days**

Source of Data: National Syndromic Surveillance Program – BioSense Platform (12 Maricopa County Hospitals)

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Heat-Associated Deaths by Month, Maricopa County

- Jan: 1
- Feb: 0
- Mar: 4
- Apr: 4
- May: 19
- Jun: 143
- Jul: 344
- Aug: 186
- Sep: 62
- Oct: 10
- Nov: 4
- Dec: 0
Temperatures and Heat Deaths, Maricopa County

- **May**: 19 Heat Associated Deaths, Average Low Temperature 70°F, Average High Temperature 95°F
- **June**: 143 Heat Associated Deaths, Average Low Temperature 80°F, Average High Temperature 106°F
- **July**: 344 Heat Associated Deaths, Average Low Temperature 85°F, Average High Temperature 107°F
- **August**: 186 Heat Associated Deaths, Average Low Temperature 84°F, Average High Temperature 106°F
- **September**: 62 Heat Associated Deaths, Average Low Temperature 79°F
Heat Associated Deaths by Residency

8% not from Arizona

4%
Fifty-eight Percent of Heat-associated deaths since 2006 have been classified as Heat Caused
All People are at Risk of Heat Related Deaths Regardless How Long Have Been Living in Maricopa County
Heat Associated Deaths by Gender and Age Group, Maricopa County

<table>
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<tr>
<th>Age Group</th>
<th>Male</th>
<th>Female</th>
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<tr>
<td>0-4</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>5-19</td>
<td>12</td>
<td>1</td>
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<tr>
<td>20-34</td>
<td>50</td>
<td>5</td>
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<tr>
<td>35-49</td>
<td>129</td>
<td>28</td>
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<tr>
<td>50-64</td>
<td>205</td>
<td>44</td>
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<tr>
<td>65-74</td>
<td>80</td>
<td>32</td>
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<tr>
<td>75+</td>
<td>81</td>
<td>91</td>
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Death Rate by Age per 100,000 residents

- 75+: 7.3
- 65-74: 3.8
- 50-64: 2.9
- 35-49: 1.4
- 20-34: 0.3
- 5-19: 0
- 0-4: 0.4
Heat Death Rates by Race/Ethnicity

- White: 1.8
- Hispanic: 0.9
- African American: 2.8
- Native American: 4.0
- Asian/Pacific Islander: 0.5
Heat Associated Deaths by Place of Injury, Maricopa County
Air Conditioning Status for Indoor Heat Deaths

80% Died in “Non-Cooled Indoor Environment

20% AC Status was Unknown

12% AC Not Present

88% AC Present

Reasons Why AC was Present but Not Functioning

11% - No electricity
28% - AC was OFF
61% - AC was Not Working
Outdoor Heat Associated Deaths by Place of Injury, Maricopa County

[Cell Range] [Cell Range] [Cell Range] [Cell Range] [Cell Range]
[Cell Range] [Cell Range] [Cell Range] [Cell Range] [Cell Range]
[Cell Range] [Cell Range] [Cell Range] [Cell Range] [Cell Range]
[Cell Range] [Cell Range] [Cell Range] [Cell Range] [Cell Range]
[Cell Range] [Cell Range] [Cell Range] [Cell Range] [Cell Range]

Female

Male
A total of 53 people died in a car due to heat. 11 of these people were children between the ages of 0 and 4, and 31 were between the ages of 35 and 64.
Heat Deaths among Homeless, Maricopa County, 2006-2017
Evaluation of Cooling Centers in Maricopa County, 2014
Problem Statement

• For several years MCDPH explored the possibility of evaluating the HRN cooling centers
• In 2014, new collaborations were developed between to evaluate the cooling center program.
The purpose of this project was to further understand the utilization patterns of the Cooling Centers, services offered, and opportunities for optimizing locations.

Main Objectives:
1. Identify the main demographic characteristics of individuals visiting the cooling centers
2. Identify the geographic locations of under/over used cooling centers
3. Set up a framework that will allow for conducting similar evaluation projects (ex: energy assistance programs, etc.)
4. Identify the most effective methods in communicating important heat-related messages
Methodology

- Three surveys were designed and teams were deployed for distribution.
  - Visitor Survey: help to gain a better understanding of the role that the Heat Relief Network plays in supporting these at-risk individuals.
  - Facility Manager Interview: help to gain a better understanding of the Cooling Center capacity, utilization, costs, and best practices
  - Facility Data Collection (Observational): help to gain a better understanding of the facility layout, visibility, accessibility, etc.

- Qualitative and quantitative data collected

- Site visits were also used to distribute educational materials and any other relevant information.
Final Results: Managerial, Visitor and Observational Survey
Highlights from the Facility Manager Survey

- Total of 52 Facility Manager Surveys were completed.
  - 39% of Cooling Centers are open on Saturdays
  - 21% of Cooling Centers are open on Sundays
  - Only 6% of Cooling Centers are open 24/7
  - July and August tend to have the highest number of visitors
What motivated your facility to become a Cooling Center?

- **Sense of community**: 44%
- **Extreme heat**: 31%
- **Location**: 21%
- **City initiated**: 17%
- **Helping homeless**: 15%
- **Death**: 10%
- **Importance**: 10%
- **Company initiative**: 4%
- **Brand reputation**: 4%

"Caring about people and their situation, giving the community what it needs. Basic hospitality."

"Not sure, we were assigned to be a Cooling Center, but it is a great thing for this neighborhood."
How does your facility alert the public that services are available?

- Word of mouth: 54%
- Print materials: 33%
- Internet: 33%
- Hanging materials: 29%
- Targeted outreach efforts (off-site): 15%
- Media releases/PSAs: 8%
- Daily announcements on site: 8%
- Other government organizations: 8%
- Utility/water bill advertisement: 8%
- Heat Relief Network: 6%

"Local homeless population and families are aware of facility (word of mouth)"

"City of Phoenix website, PSAs, local neighborhood papers, water bills which advertise Cooling Center Services"
Highlights from the Visitor Survey

- There were a total of 658 final visitor surveys completed
  - Over 80% of Cooling Center visitors spoke English
  - ½ of Cooling Center visitors indicated it was their first time at a Cooling Center
  - Over 1/3 of Cooling Center visitors have visited a center three or more times
  - Almost ½ of all Cooling Center visitors stay for less than one hour
Demographics of Cooling Centers Visitors

- Over half, 59% of the Cooling Center visitors are identified as female.

- Majority of visitors are unemployed.
  - Over 85%

- Age Groups: Almost ¾ of the visitors were between the ages of 18-64.

- About 40% of visitors feel their health is at risk due to high temp.

- Visitors by Race:
  - Higher rates among Native Americans and African Americans.
Air Conditioning Status

Air Conditioning Status of Cooling Center Visitors who had a Permanent Residence

- Yes, I have air conditioning: 89%
- No, I do not have air conditioning: 11%

Air Conditioning Status of Cooling Center Visitors who did not have a Permanent Residence

- Yes, I have air conditioning: 36%
- No, I do not have air conditioning: 64%
Visitors who are able to use their Air Conditioner

- 73% Yes, I can use my air conditioner
- 16% Yes, I can use my air conditioner, but rarely because of costs
- 4% No, I cannot use my air conditioner because it is broken
- 7% No, other
Visitors who have used an Utility Assistance Program

- Yes, I have used an utility assistance program before (n=138)
- No, I have not used an utility assistance program before (n=355)
- I Don't Know (n=51)

- 25% of visitors have used a utility assistance program before.
- 65% of visitors have not used a utility assistance program before.
- 10% of visitors are unsure.
Knowledge of Visitors about Cooling Centers

- Means of travel to cooling centers
  - 32% of visitors indicated they walk
  - 33% of visitors use a personal vehicle
  - 23% of visitors use public transit

- Methods used by cooling center visitors to find out about Excessive Heat Warnings
  - Television, Radio, word of mouth

- Methods used by visitors to find cooling centers
  - Saw its location
  - Heard about cooling centers through someone they knew
Heat-Associated Illness in Maricopa County (n=6255*), 2008-2012

Point Density Map with Cooling Centers

*1502 cases excluded because residence address was unidentifiable.

*excludes 100 visitors who did not respond
53 Observational Surveys were completed

- Evaluators observed 89% of the Cooling Centers to be easily accessible
- Evaluators observed that 67% did not have an indicator or sign visible on the Cooling Center Exterior informing people that it was a Cooling Center
The Cooling Center Evaluation highlighted the following:

- The need for Cooling Centers during the chronic heat months: 50% of visitors were new.
- The importance of understanding the demographics of the people served.
- The need for community and governmental partnership.
- The need for opening facilities in high risk areas to eliminate extensive travel: 1/3 of visitors walk to Cooling Centers.
- More marketing and signage for the Cooling Centers.
- The opportunity for Cooling Center expansion.
Informational Gaps

- Still had informational gaps:
  - Not community-wide
  - Did not capture special populations
  - Needed context for what we saw in the cooling center evaluation and mortality investigations
  - How do we better understand these risk factors?
  - How do we start to develop effective risk communication strategies?

- What would be the best methodology for gathering this information?
  - Internet surveys
  - Focus groups
  - Additional targeted passive surveys
  - Active survey collection
CASPER

- CASPER is an epidemiologic technique designed to provide household-based information about a community in a timely and representative manner.

- CASPER is quick, inexpensive, flexible, and uses a simple reporting format

- Received technical assistance from the CDC National Center for Environmental Health, Disaster Epidemiology Response Team

- Due to differences in vulnerability MC decided on two sampling frames:
  - High incidence
  - Low incidence
Heat Illness Rates

High Incidence Area: with greater or equal to 100/100,000 HR hospitalizations

Low Incidence Area: with less than 100 HR hospitalization
Risk Perception and Preparedness Barriers
- Major risks, Disabilities or other barriers to evacuations, Access to assistance (family or friends), and Barriers to communication

Knowledge of Heat Stress
- Excessive heat warnings, Knowledge of heat illness symptoms, Heat illness episodes

Coping Mechanisms/Access to Resources
- Cooling of home, Barriers to cooling of home, Knowledge of assistance programs

Neighborhood/Access to Resources
- Access to community resources
- Knowledge of Cooling Centers

Demographics
 Ended up knocking on 1,026 doors

Surveys collected:

– 168 in High Incidence areas
  • Contact Rate 34.6%
  • Cooperation Rate 54.2%
  • Completion Rate 80.0%

– 169 in Low Incidence areas
  • Contact Rate 31.3%
  • Cooperation Rate 48.9%
  • Completion Rate 80.5%
Households that felt too hot in their homes during past summer, MC, CASPER 2015

Approximately 10% of households in both high and low incidence areas reported, “always” or “most of the time”, feeling hot inside their homes.
Vast majority (72%) indicated that there is nothing that prevents them from using their air conditioning day and night in both high and low incidence households.
One quarter of Maricopa households in low and high incidence areas reported that cost of electricity was a barrier to using air conditioning and properly cooling their homes.
Households Aware of Utility Assistance Programs, MC, CASPER

- Less than half of these households are aware of utility assistance programs.
- Of those that were aware of utility assistance programs, only 20% have ever applied.
- From those that have applied less than 30% in both areas reported to experience barriers such as: low funding, income too high, or it took too long.
- In both high and low Incidence sample frames, the majority reported not knowing about Heat Refuge Stations.
Summary

- Households in both high and low incidence communities perceive extreme heat as one of top three emergencies.
- Knowledge gaps exist among MC residents regarding symptoms associated with heat illness and heat messaging.
- 10% of household reported feeling too hot always.
- 28% reported experiencing limitations in using air conditioning.
- 25% reported cost of electricity being a barrier to using air conditioning.
- Awareness of utility and other assistance programs is low.
Assessing the Cooling Needs of Homebound Individuals in Maricopa County, 2016
Public Health Institute

The Climate Change and Public Health Learning Collaborative for Urban Health Departments
Objectives and Partnership

- The objectives of this project were to identify the needs of homebound individuals during extreme heat events.
- Determine whether the county’s existing services are accessible to this vulnerable population.
Project Rationale

- MC experiences an average of 100 heat associated deaths and over 1,500 heat-associated injuries per year
- Around 40% of heat-related deaths occur indoors
  - 83% of indoor heat-related deaths occurred in homes that did not have AC running at the time of death
- Homebound individuals are particularly susceptible to overheating for several reasons, including:
  - advanced age
  - inability to leave home if their cooling system stops working
  - lack of knowledge of utility assistance programs
  - difficulty applying to utility assistance programs
  - limited incomes
Methodology: Community Health Assessment Toolkit
Survey Instrument

- 15 - question paper survey
  - administered by Selrico staff during home meal delivery

Focus of the survey:
- perception of indoor temperatures
- types of cooling systems in the home and whether they were operational and/or in use
- reasons for not utilizing cooling systems, if applicable
- use of utility assistance programs and barriers to use
- Demographics (housing status, age, race/ethnicity)
1300 surveys were delivered to homebound individuals in Maricopa County

472 returned completed surveys to MCDH

Response rate of 36%

English (455) and Spanish (17)
Demographic Characteristics

- **64%** Female
- **36%** Male

- **7%** <54 years old
- **18%** 55 - 64
- **75%** 65 +

- **63%** Live ALONE
- **57%** Rent
At what temperature do you feel too hot in your home?

62% reported feeling too hot after the temperature reaches 80°F.

18% were unsure of the temperature that made them feel too hot in their home.
In the summer, how frequently do you feel too hot inside your home?

- Always: 14%
- Sometimes: 61%
- Rarely: 3%
- Never: 17%
- Not Sure: 5%

75% of respondents said sometimes or always feel hot inside their house.
Which cooling system is present and works in your home?
Limitations on Use of Cooling System

Does anything prevent you from using your cooling system?

85% of respondents that answered “yes” said they sometimes or always feel hot inside their house (75% for all respondents)
Reasons for Limitations on Use of Cooling System

- Cost of bills: 81%
- Cost of repairs: 27%
- Medical and/or mobility limitations: 17%
- Does not work: 12%
- Confusing technology: 4%
- Other: 9%
Are you aware of community programs or services to help you with...

- Cost of Utility Bills:
  - No: 48%
  - Yes, have NOT used the service: 29%
  - Yes, have used the service: 17%
  - Did not respond: 6%

- Cooling System Repairs:
  - No: 63%
  - Yes, have NOT used the service: 20%
  - Yes, have used the service: 8%
  - Did not respond: 9%

- Overheating Prevention:
  - No: 61%
  - Yes, have NOT used the service: 23%
  - Yes, have used the service: 3%
  - Did not respond: 12%
Reasons for Not Using Community Programs or Services

- Don't have contact information: 48%
- Difficulty hearing on the phone: 11%
- Not interested in the program: 3%
- Don't qualify: 9%
- Unable to complete application: 6%
- Complicated process: 11%
- Other: 11%
Summary

- Home bound individuals broadly represent the same demographics as our indoor heat related deaths
  - Female
  - Over 65 years of age
  - Limited resources
  - Live alone

- The majority of homebound individuals report feeling too hot at or above temperatures where adverse health effects are known to be seen
  - 21% report at 85° or above
  - 65% at 80° or above

- There is a lack of awareness of current assistance programs

- Awareness does not always lead to use:
  - Administrative or process barriers can be more easily addressed
  - Overall a lack of resources
Next Steps

- Framework next steps focus on intervention
  - Plan (step 6)
  - Implement (step 7)
  - Monitor (step 8)

- Working with Selrico to incorporate heat awareness training and screening for delivery personnel

- Utility assistance resources increases

- Utility assistance group led by Institute for Sustainable Communities looking and reforming assistance application and distribution process