

*MARICOPA COUNTY DEPARTMENT OF PUBLIC HEALTH  
DIVISION OF DISEASE CONTROL  
OFFICE OF EPIDEMIOLOGY*

# IMPACT OF EXTREME HEAT ON HUMAN MORTALITY AND MORBIDITY:

## SURVEILLANCE SYSTEMS IN MARICOPA COUNTY

Vjollca Berisha

[vjollcaberisha@mail.maricopa.gov](mailto:vjollcaberisha@mail.maricopa.gov)



# No financial disclosures to report

# Presentation Outline



- Background information on heat effects
- How heat affects health
- What Maricopa County Department of Public Health (MCDPH) does before and during the heat season
- Heat surveillance system for tracking heat-associated mortality and morbidity
- Data on heat-associated mortality and morbidity

# Exposure to Environmental Heat



- **Heat is the number ONE weather-related killer in the United States**
  - In the U.S., 3442 individuals died from excessive heat exposure from 1999-2003
  - ~400 deaths occur annually in the U.S.
  - Deaths related to heat were three to seven times greater in Arizona than in the U.S. (1993-2002)
  - 550 confirmed heat-associated deaths in Maricopa County (2006-2012)
  - 7757 patients have presented to the local Maricopa County hospitals due to heat related illness (2008-2012)

# Silent Killer

## Lack of public recognition

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

**Every death is preventable!**



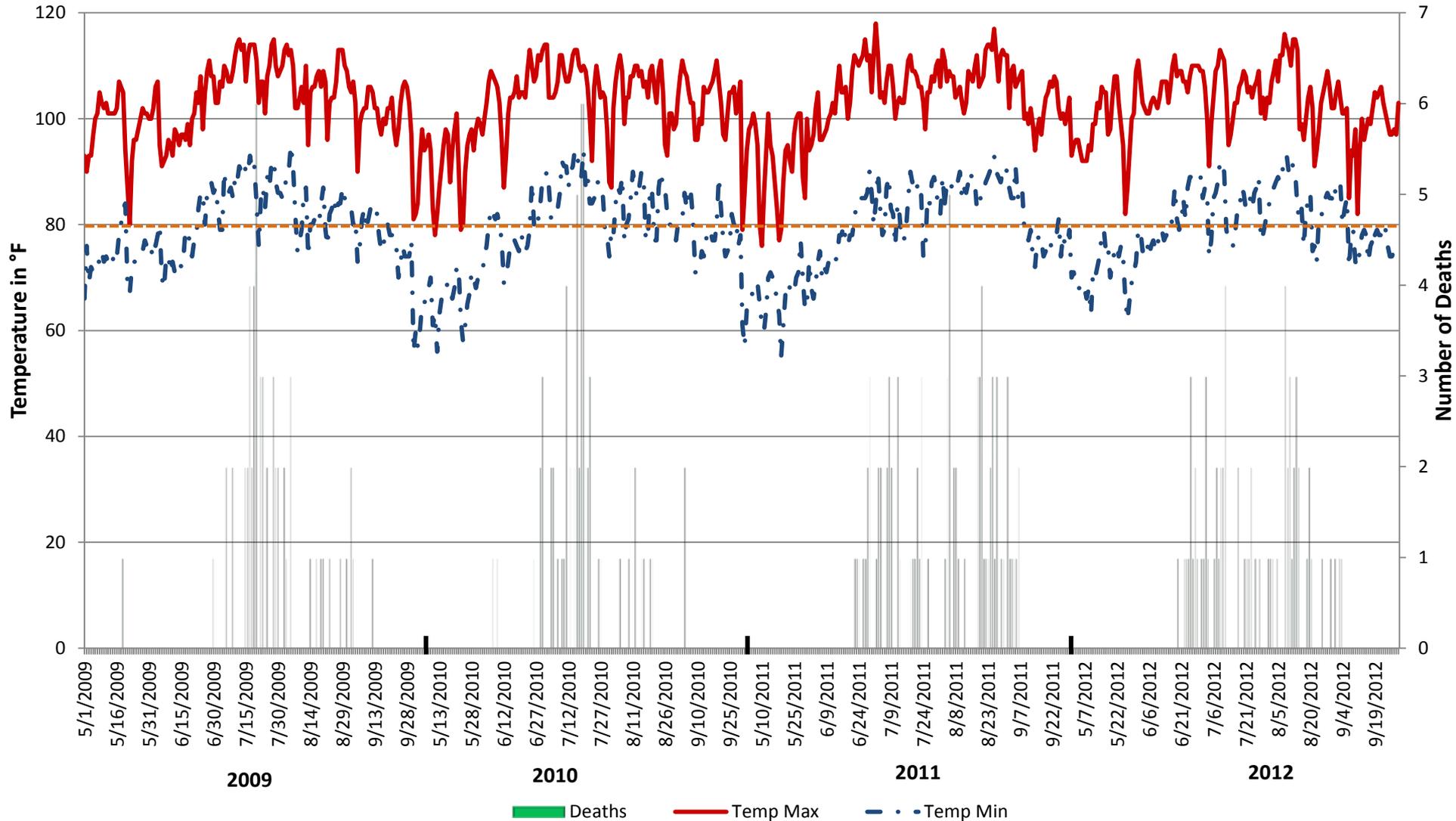
## Maricopa County 2008-2012

Average number of days  
with maximum temp.  
 $\geq 100$  °F :  
**109** days/year

Average number of days  
with maximum temp.  $\geq$   
100 °F and minimum  
temp.  $\geq 80$  °F:  
**71** days/year

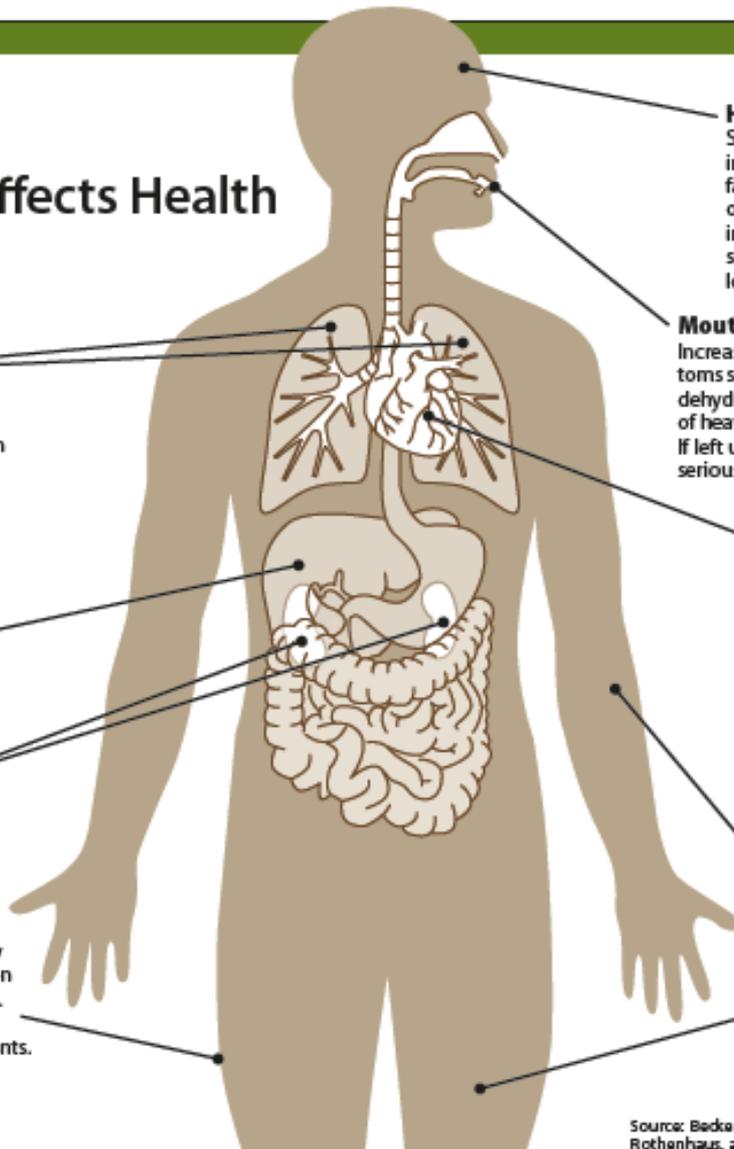
- The third most populous local public health jurisdiction in the U.S. (after NYC and LA)
  - Population of 3.8 Million (60% of Arizona)
- Chronically hot weather
- Environmental temperatures  $\geq 100$  °F start as early as mid May through first week of October

# Deaths Occurring in Maricopa County During Periods with Max Temps $\geq 100^{\circ}\text{F}$ and Min Temps $\geq 80^{\circ}\text{F}$





# How Heat Affects Health



**Head**  
Symptoms of heat exhaustion can include headache, dizziness, irritability, fatigue, and loss of coordination. Hallmarks of heatstroke—a medical emergency—include marked changes in mental status, such as confusion, delirium, irritability, loss of consciousness, and seizures.

**Mouth**  
Increased thirst, dry mouth, and other symptoms such as weakness and nausea often signal dehydration—a loss of water or salts because of heavy sweating or inadequate fluid intake. If left untreated, dehydration can lead to serious health effects.

**Heart**  
Your heart has to work harder to keep your body from overheating when outside temperatures rise. Tachycardia (rapid heartbeat) can occur with heat exhaustion, and cardiac arrhythmias (abnormal or irregular heart rhythms) can occur with heatstroke. Patients with a history of cardiovascular disease and high blood pressure are at greater risk of hospitalization during heat waves.

**Lungs**  
Asthma, chronic obstructive pulmonary disease, and other respiratory diseases can worsen when temperatures spike. People with pneumonia and influenza are also at greater risk of hospitalization during a heat wave.

**Liver**  
Heatstroke can injure the liver.

**Kidneys**  
Heatstroke can lead to kidney failure.

**Skin**  
Heat rash—also called prickly heat, or miliaria—occurs when sweat ducts become blocked. It is most common in babies, and in hot, humid environments. Flushed, pale, or clammy skin and profuse sweating can be signs of heat exhaustion.

**Arms and Legs**  
Heat cramps can cause painful muscle spasms and cramping in the arms, shoulders, and legs.

Source: Bednar and Steward 2011; Glazer 2005; Lugo-Amador, Rothenhaus, and Mouyer 2004; Semenza et al. 1999.

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Heat Illnesses (Edema, Rashes, Cramps, Exhaustion, Syncope, Stroke, Hyperpyrexia)

ILLUSTRATION: ANATOMY ONLINE; PHOTO: GETTY IMAGES/ISTOCKPHOTO.COM

# Risk Factors for Heat Mortality and Morbidity



## ■ Individual Characteristics

- Age (young and old)
- Underlying medical conditions/mental illness (obesity, cardiovascular disease, alcohol, drugs, disabled...)
- People that overexert during work or exercise
- Income and poverty status
- Homelessness
- Social isolation
- Access to health care and cooling facilities

## ■ Community Characteristics

- Land use/land cover
- Crime rate
- Housing type
- Urban heat island

# What do we do during the Heat Season?



- **Heat Season** –May through October
  - In 2006, MCDPH Implemented a surveillance system for tracking heat-associated deaths
  - Currently making efforts to expand the system to include heat morbidity tracking
- **Office of Medical Examiner (OME)**
  - Developed a partnership with OME
  - Receive suspect heat-associated death data from their office
- **National Weather Service (NWS)**
  - **Excessive heat warning** – issued when a life threatening heat emergency exists or is imminent
- **Notify Healthcare Providers**
  - We initiate an electronic Public Health Alert to healthcare providers
  - We advise providers to consider heat warning message upon discharging patients by providing them information on the locations of cooling centers
- **Respond to Data requests**
  - Share Heat related information with our stakeholders (Heat Relief Network, Infection Preventionists, etc.)

# Public Health Response



- **Initiate education campaign**
  - Press release and social media with information on dangers of excessive heat, signs and symptoms of heat-related illnesses
  - Emphasis on Spanish-speaking community
  - Where to call for help
  - Risks associated with medications
  - Pets
  - Look out for neighbors
- **Weekly Heat Reports and other resources on MCDPH website**
  - <http://www.maricopa.gov/publichealth/Services/EPI/Reports/heat.aspx>



# Heat-Associated Deaths in Maricopa County



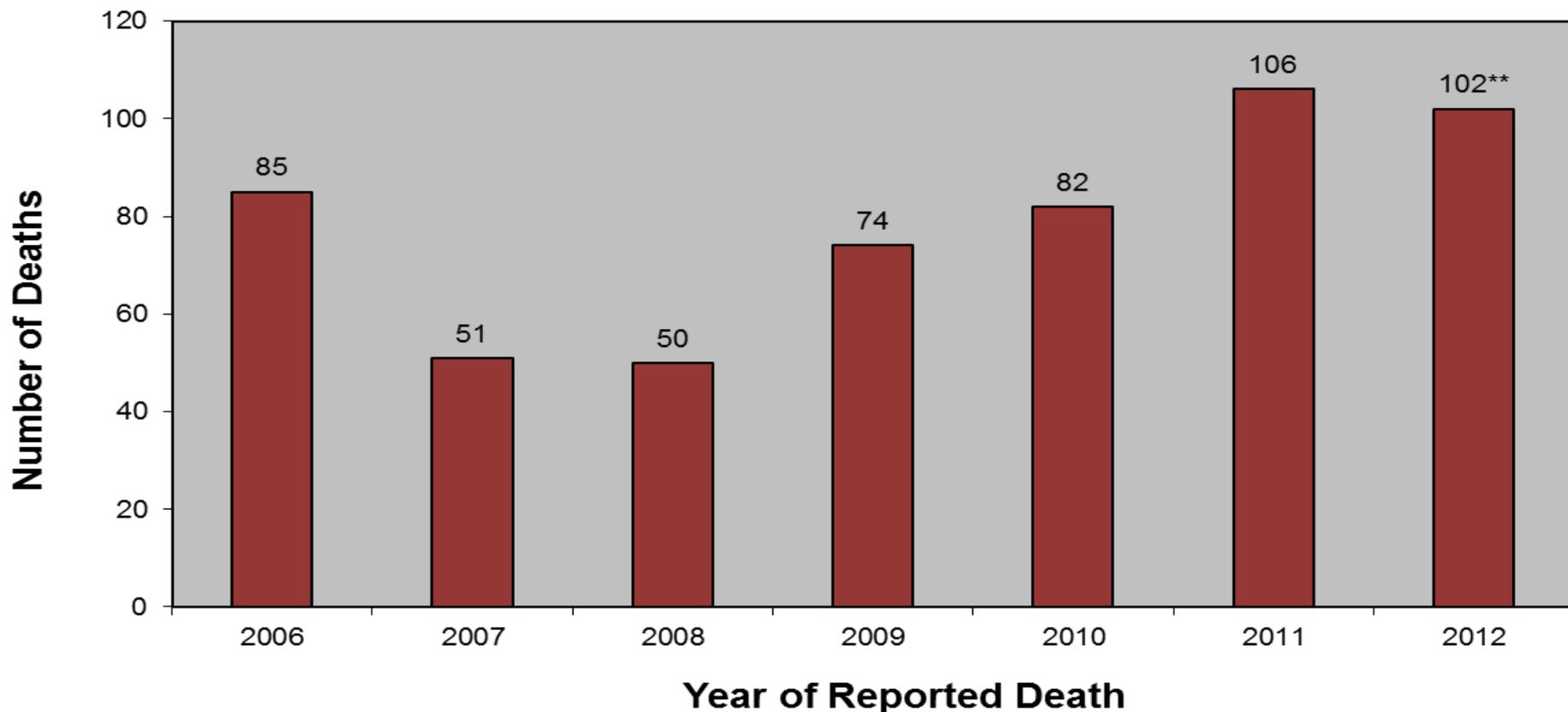
# Total Cases Reported by Case Type in Maricopa County for 2006-2012\*



Year	Total Reported	Confirmed	Ruled-Out	Pending
2006	104	85 (83%)	19 (17%)	0 (0%)
2007	131	51 (39%)	80 (61%)	0 (0%)
2008	97	50 (52%)	47 (48%)	0 (0%)
2009	114	74 (65%)	40 (35%)	0 (0%)
2010	142	82 (58%)	60 (42%)	0 (0%)
2011	144	106 (74%)	38 (26%)	0 (0%)
2012	172	102 (59%)	57 (33%)	13* (8%)
<b>Total</b>	<b>904</b>	<b>550 (61%)</b>	<b>341 (38%)</b>	<b>13* (1%)</b>

\*As of 3/29/2013, 13 cases are still pending a final cause of death. The numbers in this report are provisional and will be updated once these cases have been classified.

# Heat-Associated Deaths in Maricopa County for 2006-2012\*

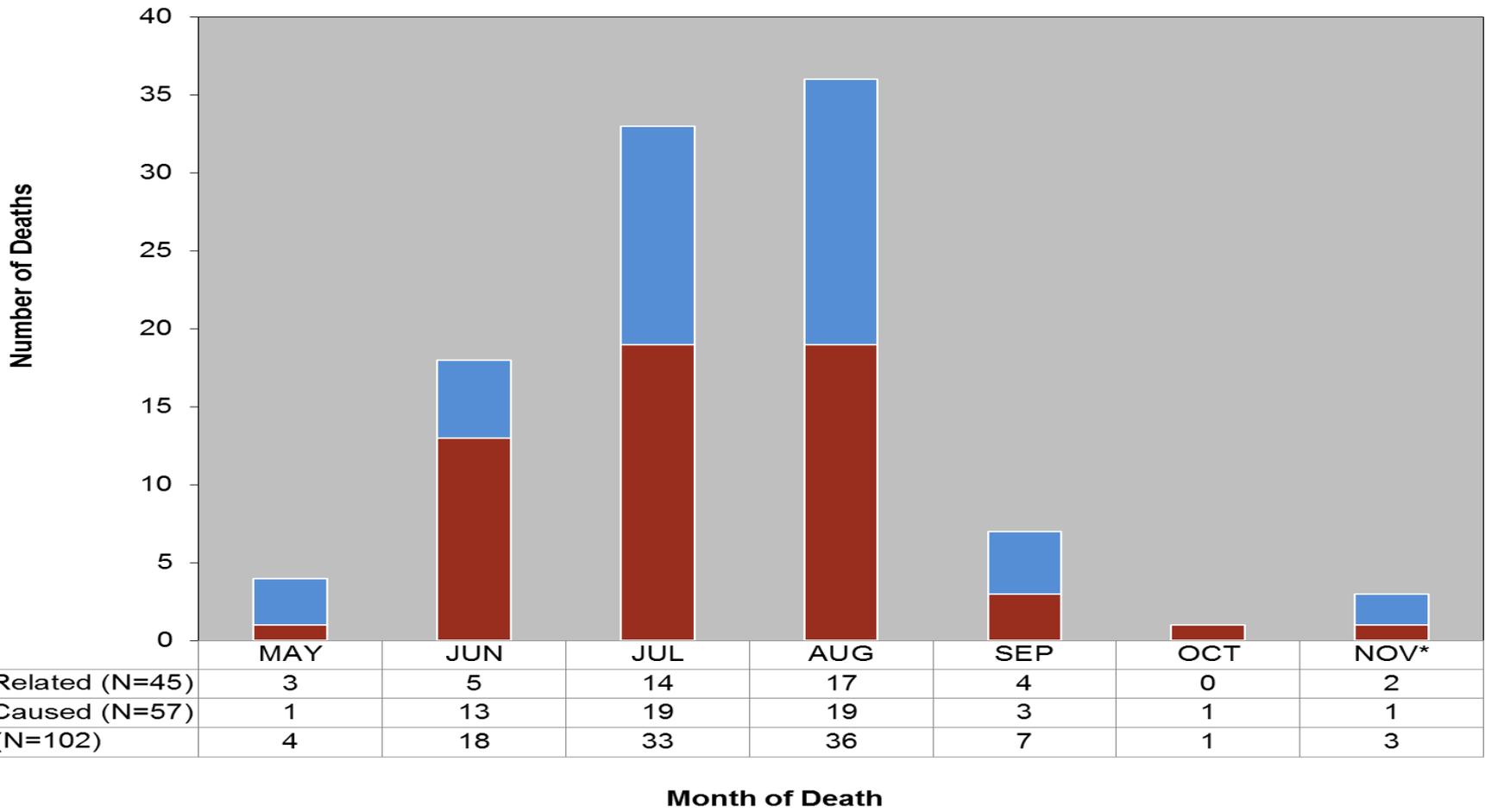


**Data Sources: Maricopa County, Office of Vital Registration and Office of Medical Examiner; Arizona Department of Health Services, Office of Vital Registration**

\*The numbers reported here are for heat-associated deaths reported to MCDPH as of 3/29/2013.

\*\*Thirteen cases still pending a final cause of death.

# Heat-Associated Deaths by Month in Maricopa County for 2012



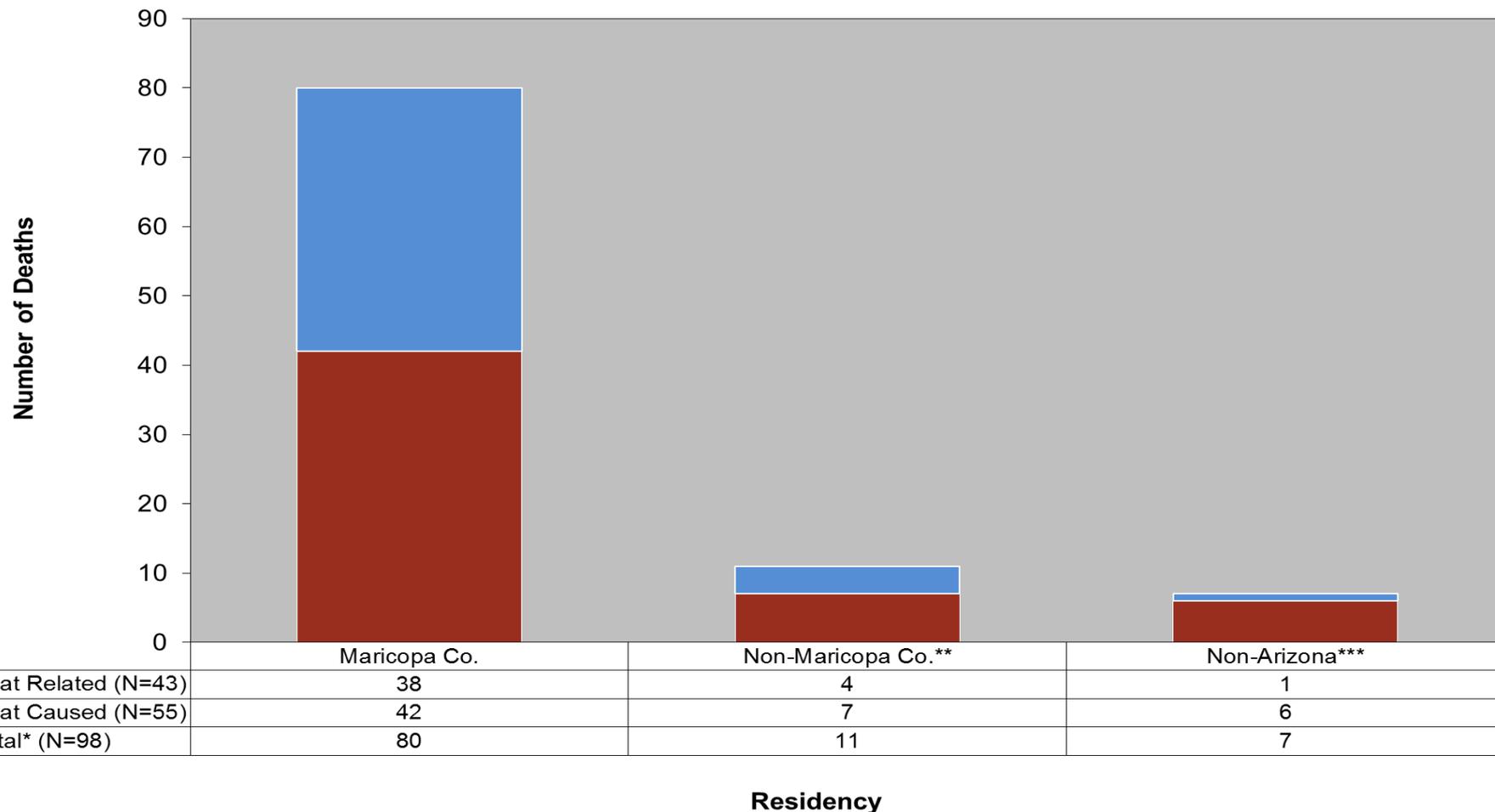
\*The three deaths that occurred in November were result of heat injuries that occurred over the summer.

# Heat-Associated Deaths in Maricopa County for 2012

## Demographics



# Heat-Associated Deaths by Residency in Maricopa County for 2012

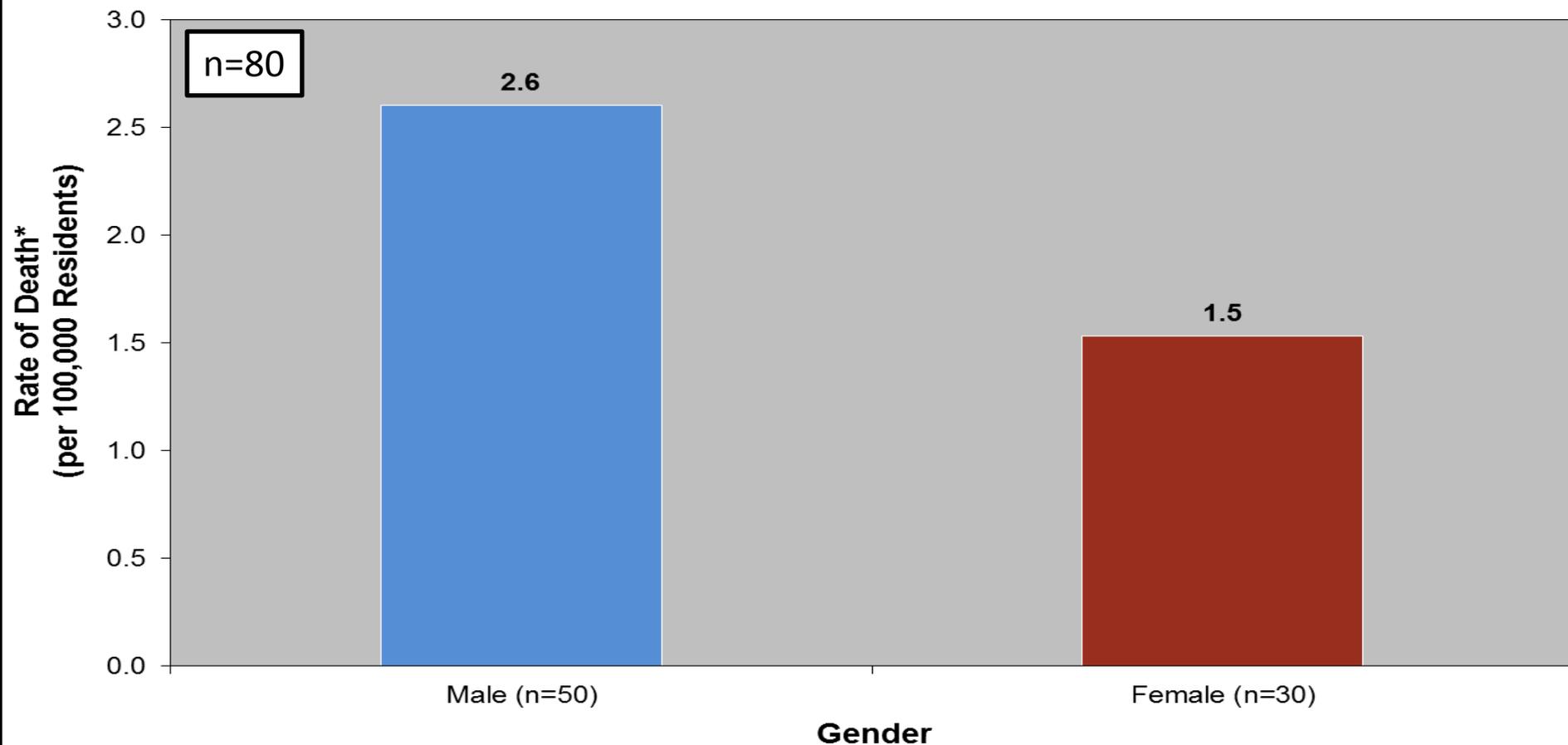


\*Excludes four cases where residency could not be established.

\*\*Non-Maricopa residents include Apache (1), Cochise (1), La Paz (1), Mohave (1), Pinal (1) and other unidentified AZ counties (6).

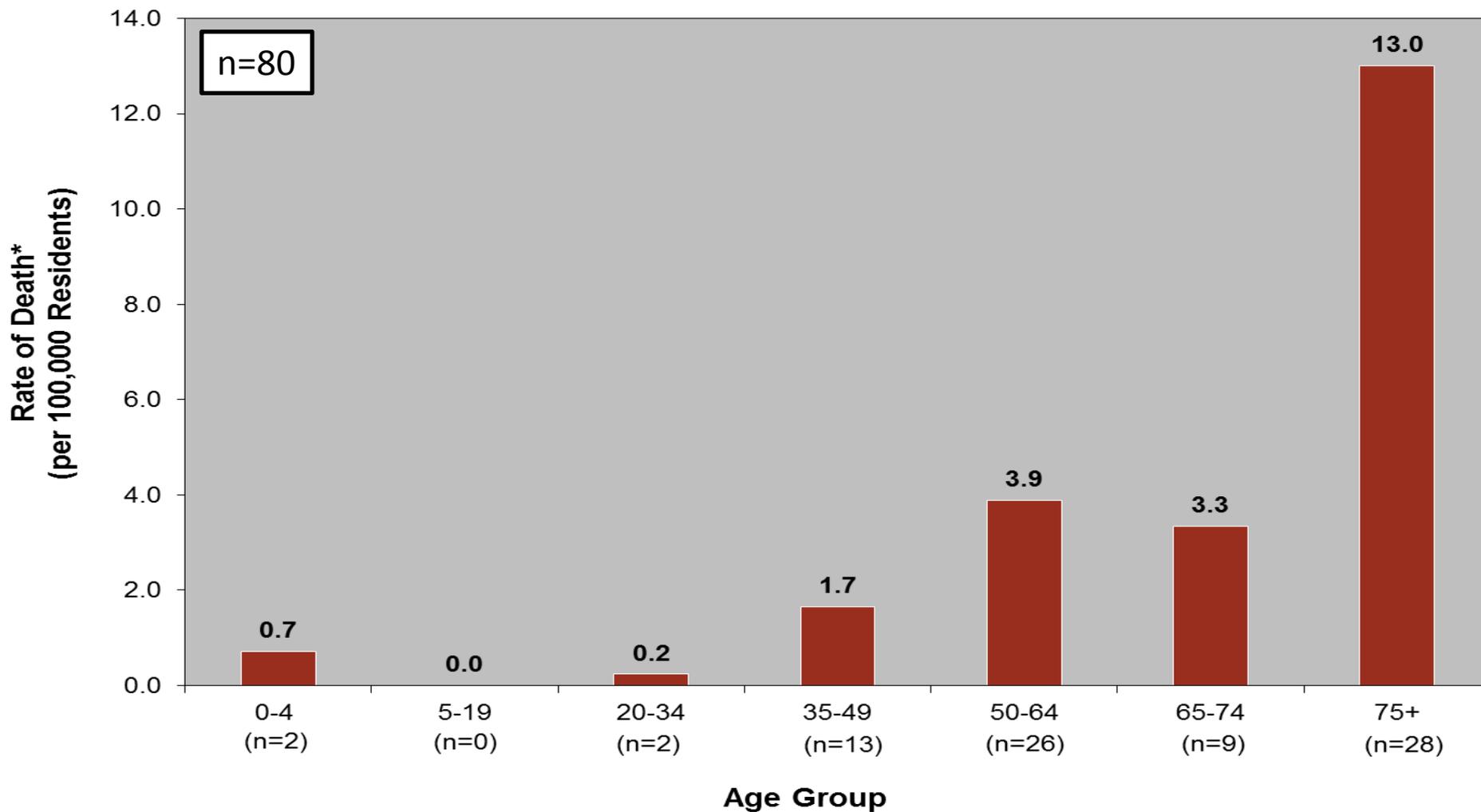
\*\*\*Non-Arizona residents include six US residents (AR, CA (3), IA, MN) and one non-US resident (Mexico).

# Heat-Associated Death Rates per 100,000 Maricopa County Residents\* by Gender for 2012



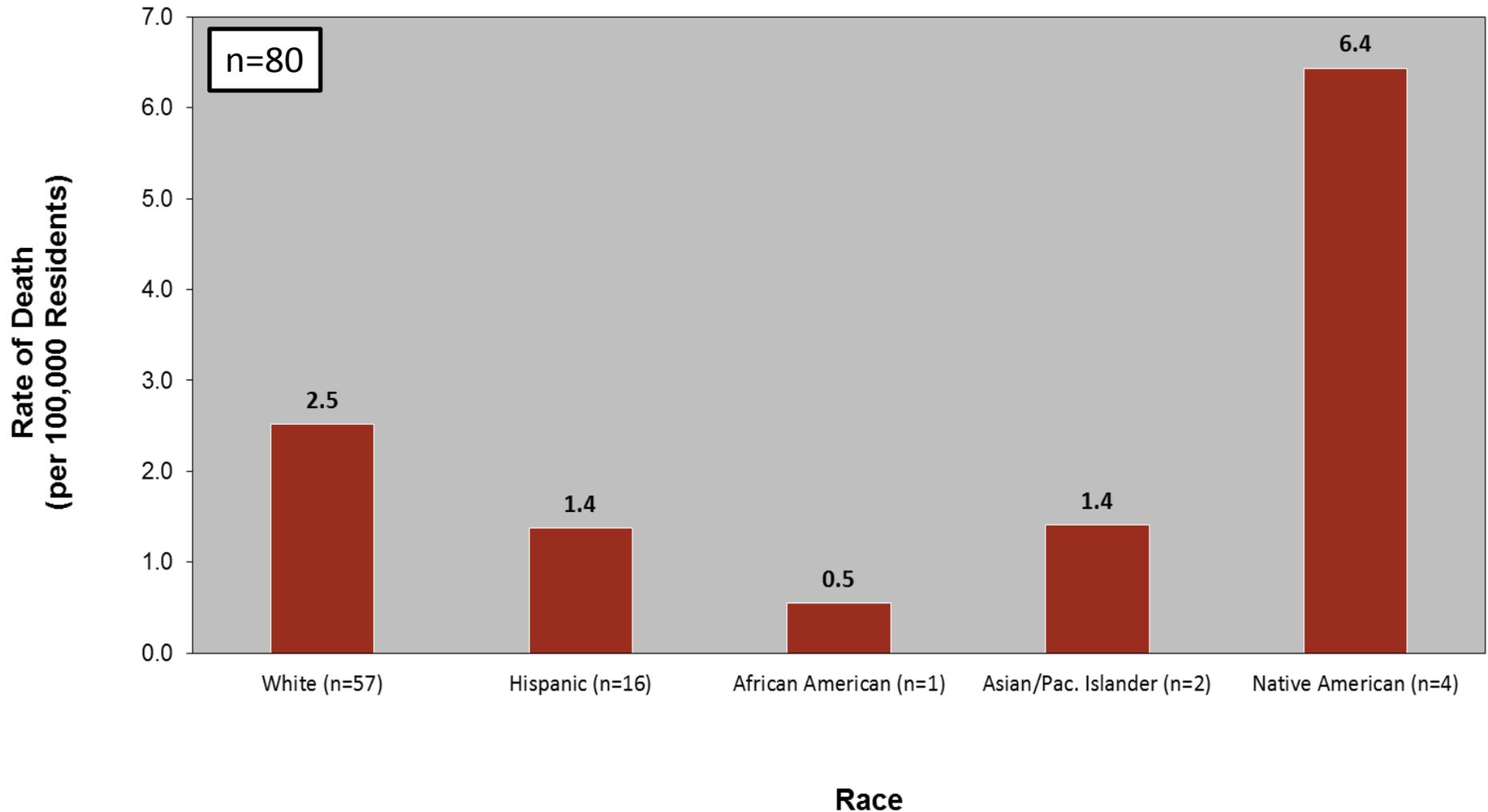
\*Based on 2011 Census population estimates for Maricopa County. Excludes twenty-two cases that were not Maricopa County residents.

# Heat-Associated Death Rates per 100,000 Maricopa County Residents\* by Age Group for 2012



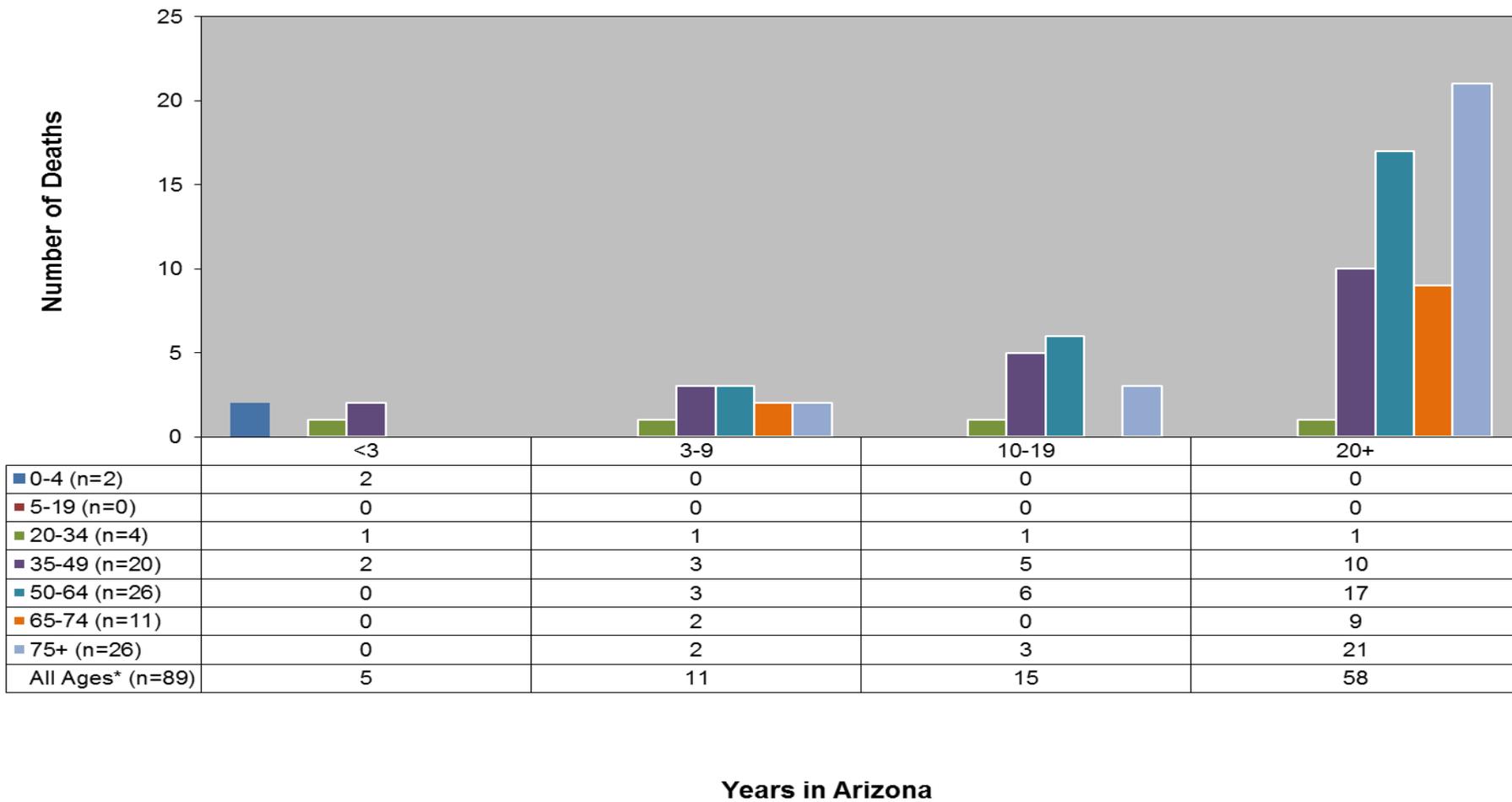
\*Based on 2011 Census population estimates for Maricopa County. Excludes twenty-two cases that were not Maricopa County residents.

# Heat-Associated Death Rates per 100,000 Maricopa County Residents\* by Race/Ethnicity for 2012



\*Based on 2011 Census population estimates for Maricopa County. Excludes twenty-two cases that were not Maricopa County residents.

# Heat-Associated Deaths by Years Lifetime Spent in Arizona and Age Group for 2012



\*Excludes thirteen cases for which time spent in Arizona was unknown at the time of analysis.

# Heat-Associated Deaths Maricopa County for 2012

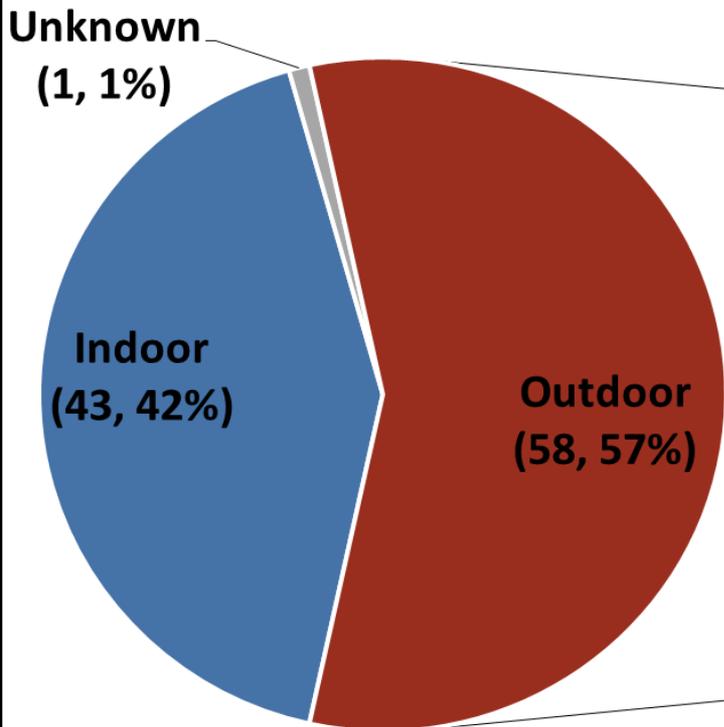


## Location of Injury

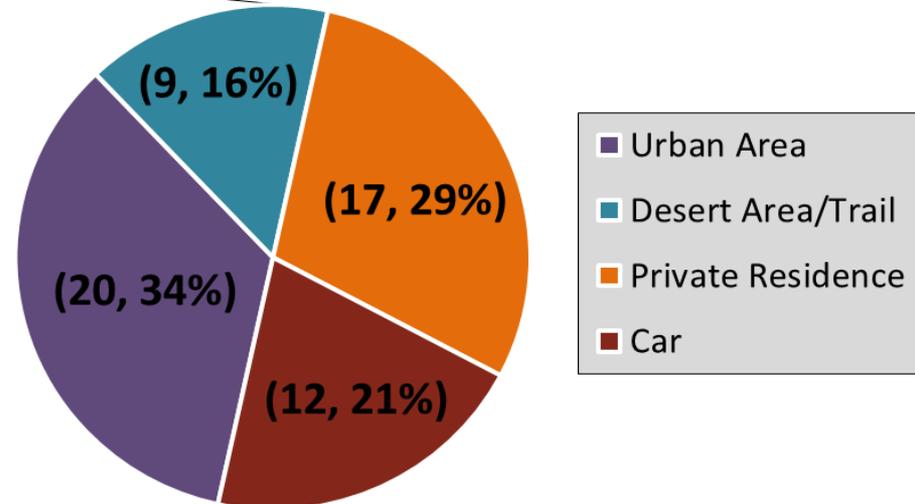
# Heat-Associated Deaths by Place of Injury Occurrence and Place of Outdoor Injury in Maricopa County for 2012



**Place of Injury Occurrence**  
(n=102)



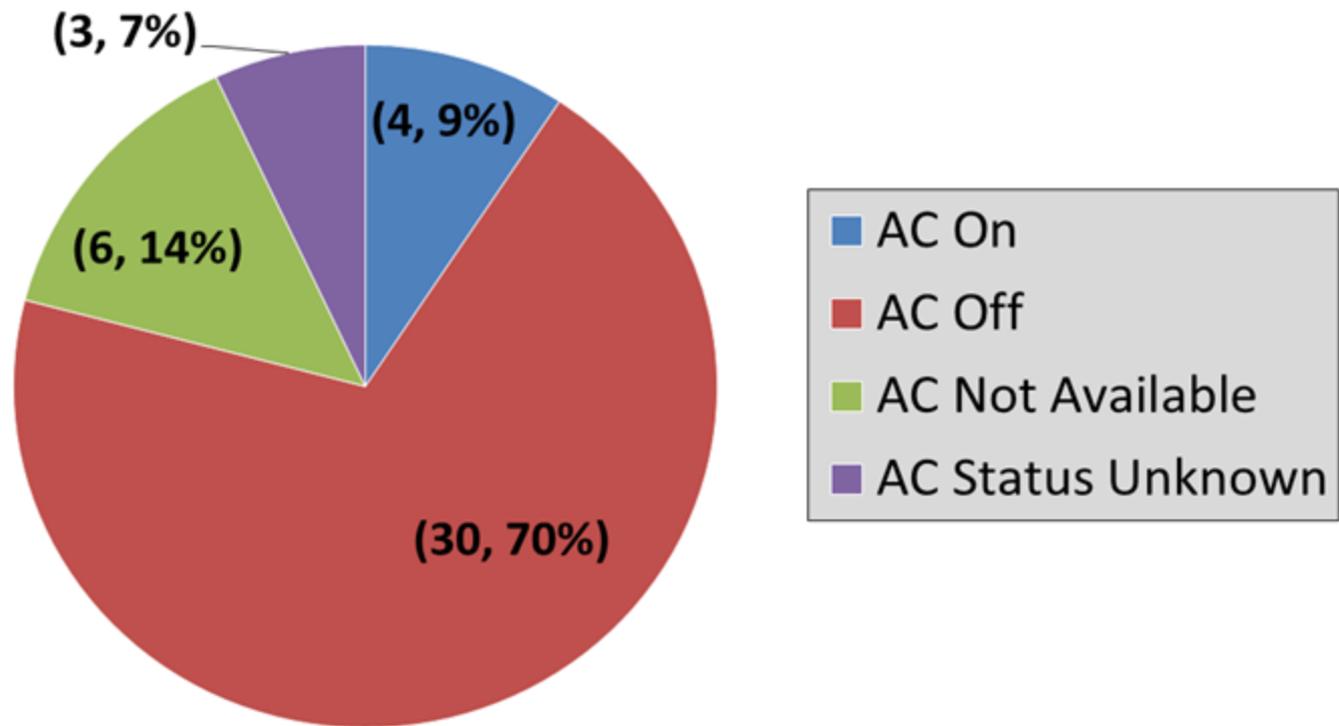
**Place of Outdoor Injury**  
(n=58)



# Heat-Associated Deaths (indoor occurring) by Use of Air Conditioning in Maricopa County for 2012



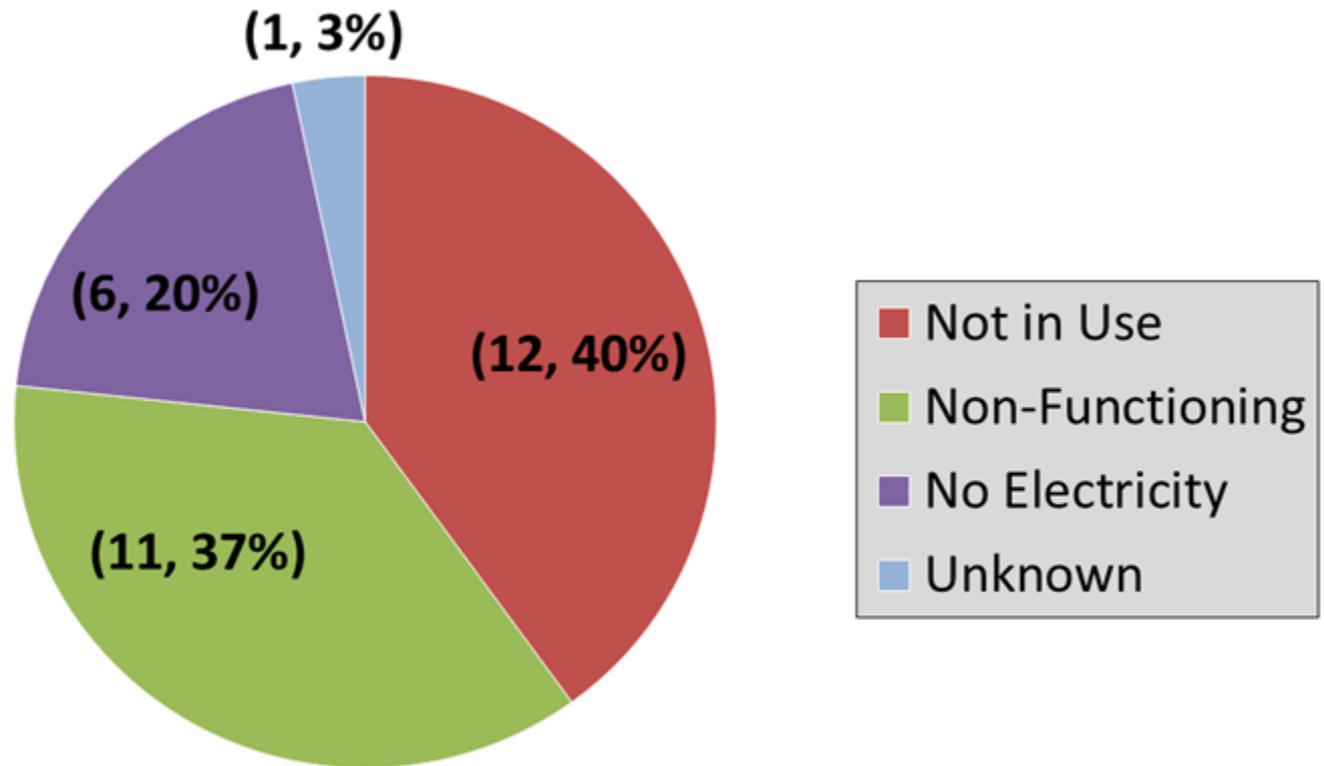
n=43

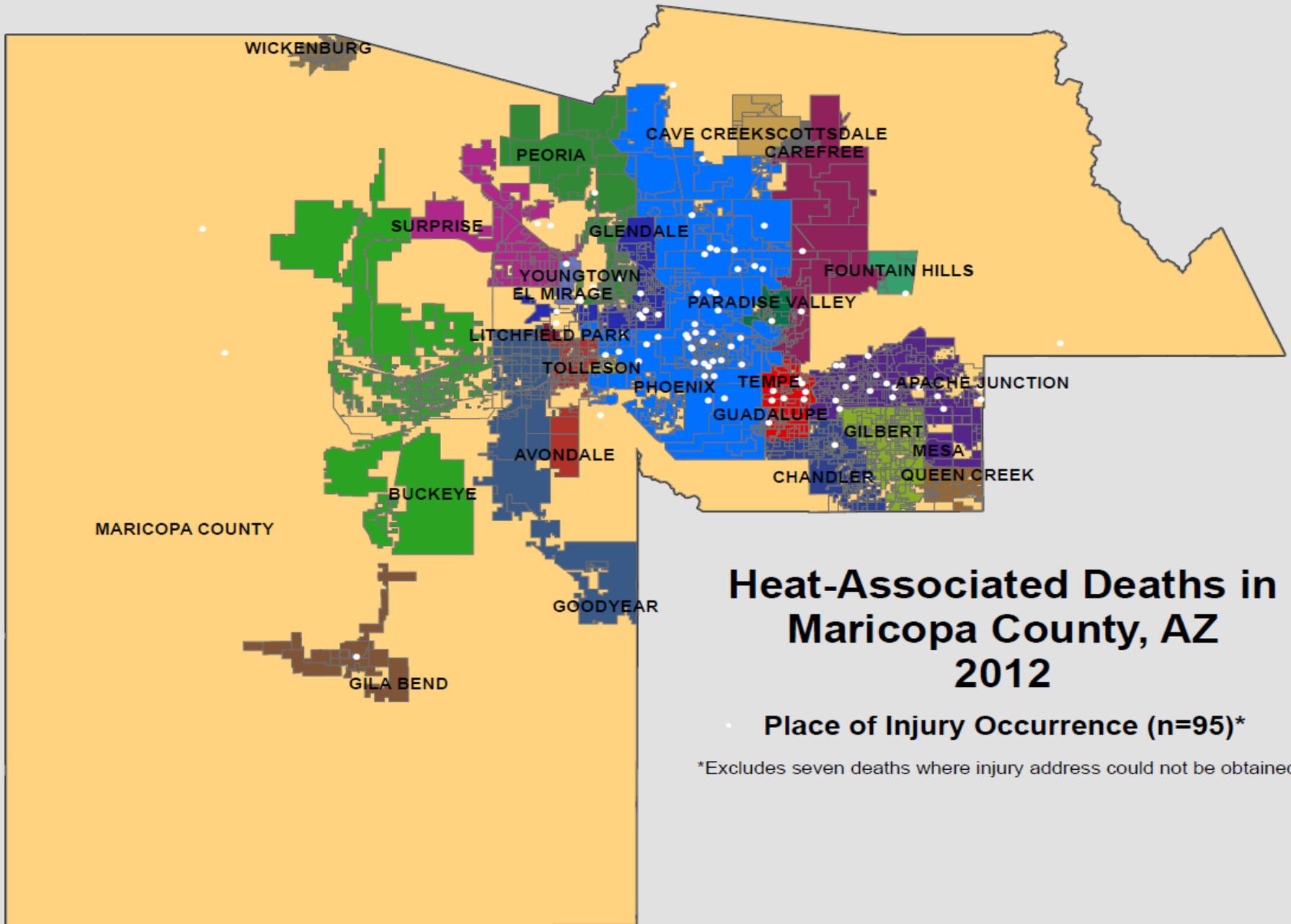


# Status for Cases with Air Conditioning Turned Off in Maricopa County for 2012



n=30



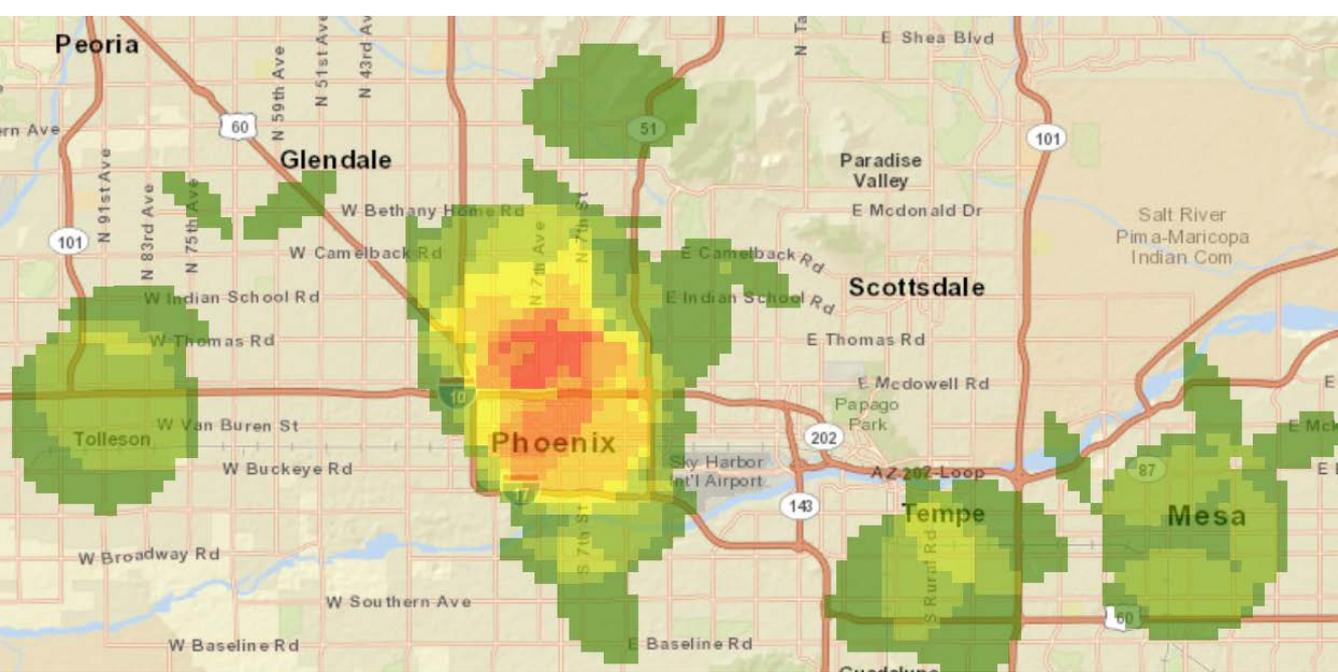


While every effort has been made to ensure the accuracy of this information, Maricopa County makes no warranty, expressed or implied, as to its accuracy and expressly disclaims any liability for the accuracy thereof. This data has been geographically masked to protect individual's privacy.

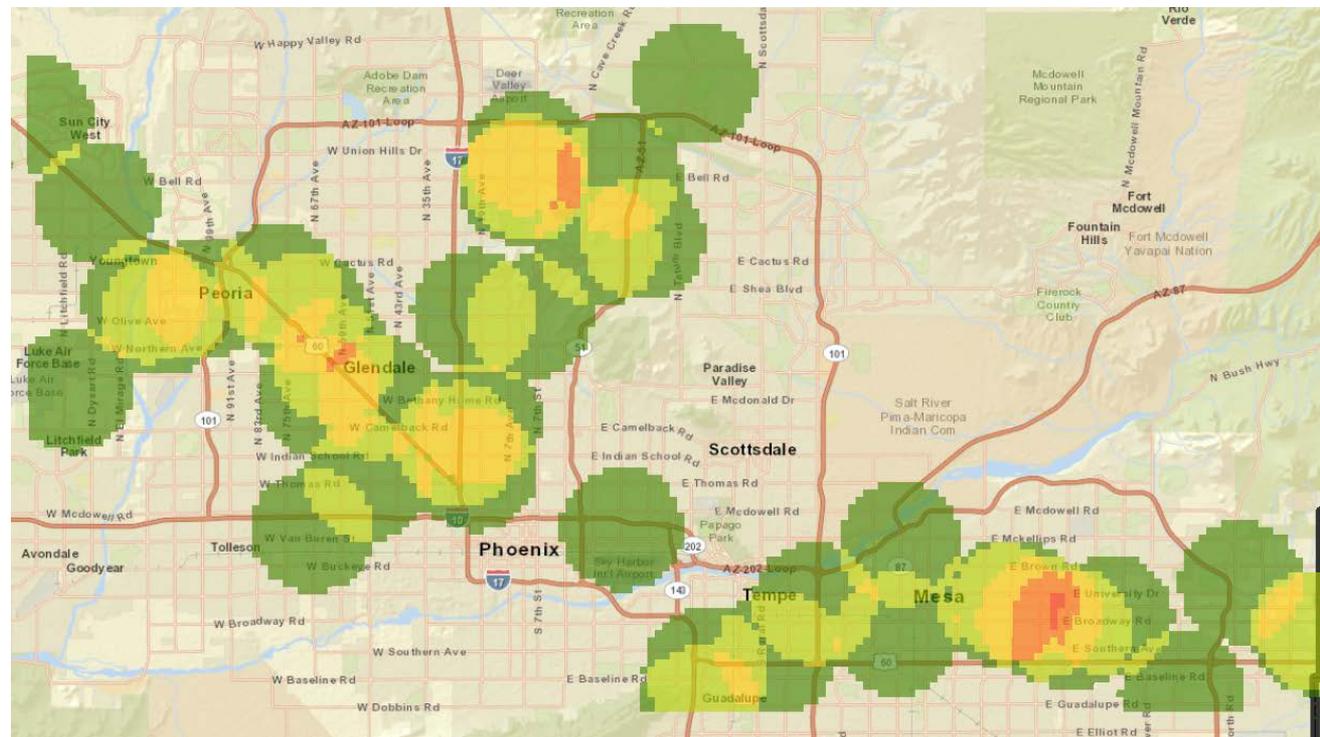
0 10 20 40 Miles



# Outdoor Point Density Maps



# Indoor Point Density Maps

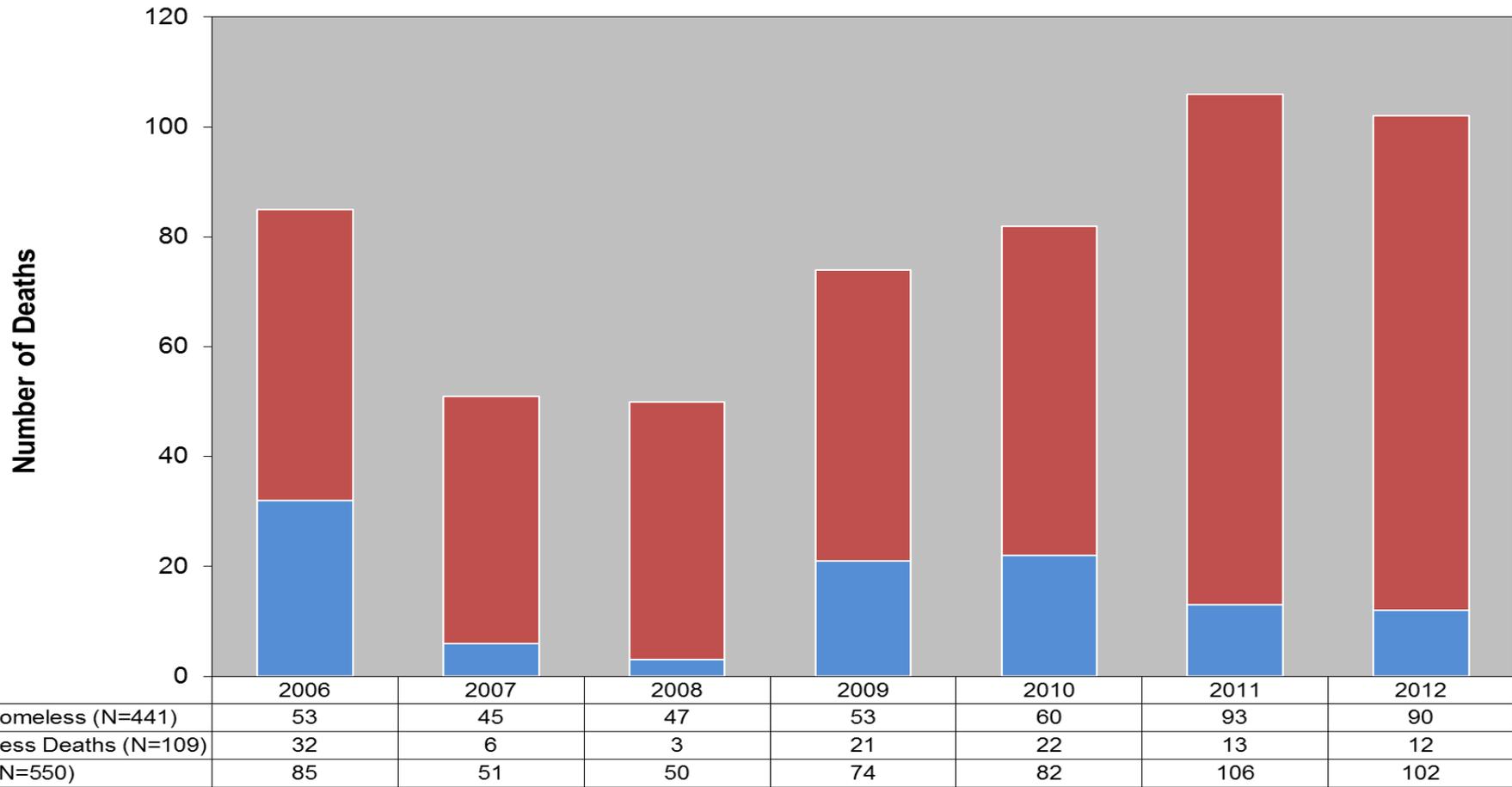


# Heat-Associated Deaths in Maricopa County for 2012



## Homeless Population

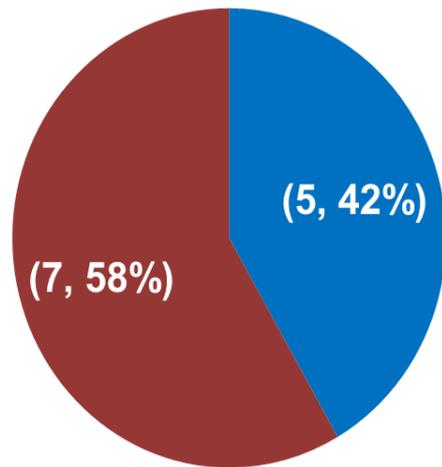
# Heat-Associated Deaths for the Homeless in Maricopa County for 2006-2012



# Heat-Associated Deaths for the Homeless with Drug and Alcohol Use as Mentioned on the Death Certificate for 2012

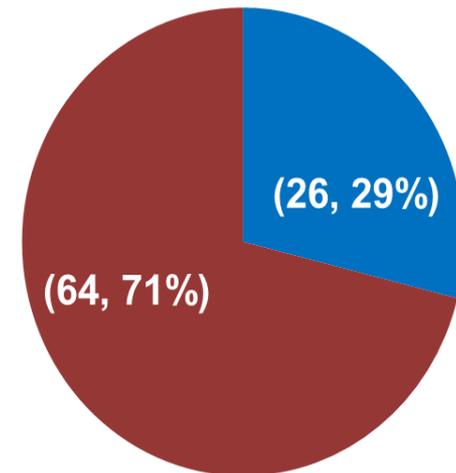


## Homeless (n=12)



- Drug and/or Alcohol Use
- No Drug or Alcohol Use

## Non-Homeless (n=90)



# Heat Morbidity Surveillance Maricopa County



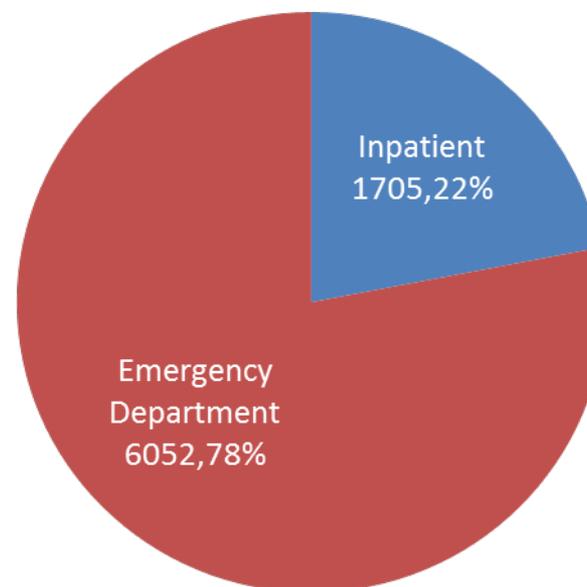
**Heat Related Illness (HRI) using  
Hospital Discharge Data (HDD)**

# HRI by Year and Type of Visit in Maricopa County for 2008-2012



YEAR	NUMBER OF HRI	PERCENT OF HRI
2008	1253	16.15
2009	1353	17.44
2010	1488	19.18
2011	1851	23.86
2012	1812	23.36
<b>TOTAL</b>	<b>7757</b>	<b>100.00</b>

Heat Related Illness Cases by Visit Type (2008-2012)

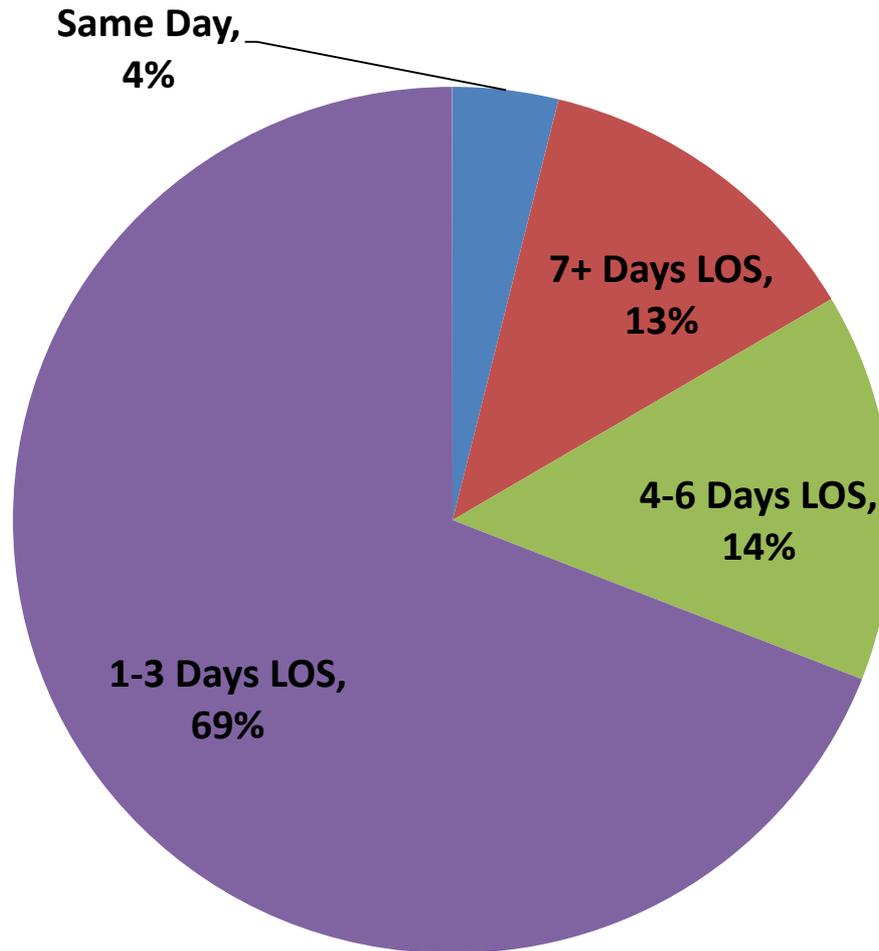


Source: Hospital Discharge Data (inpatient/outpatient)

# HRI by Length of Inpatient Stay in Maricopa County Healthcare Facility for 2008-2012



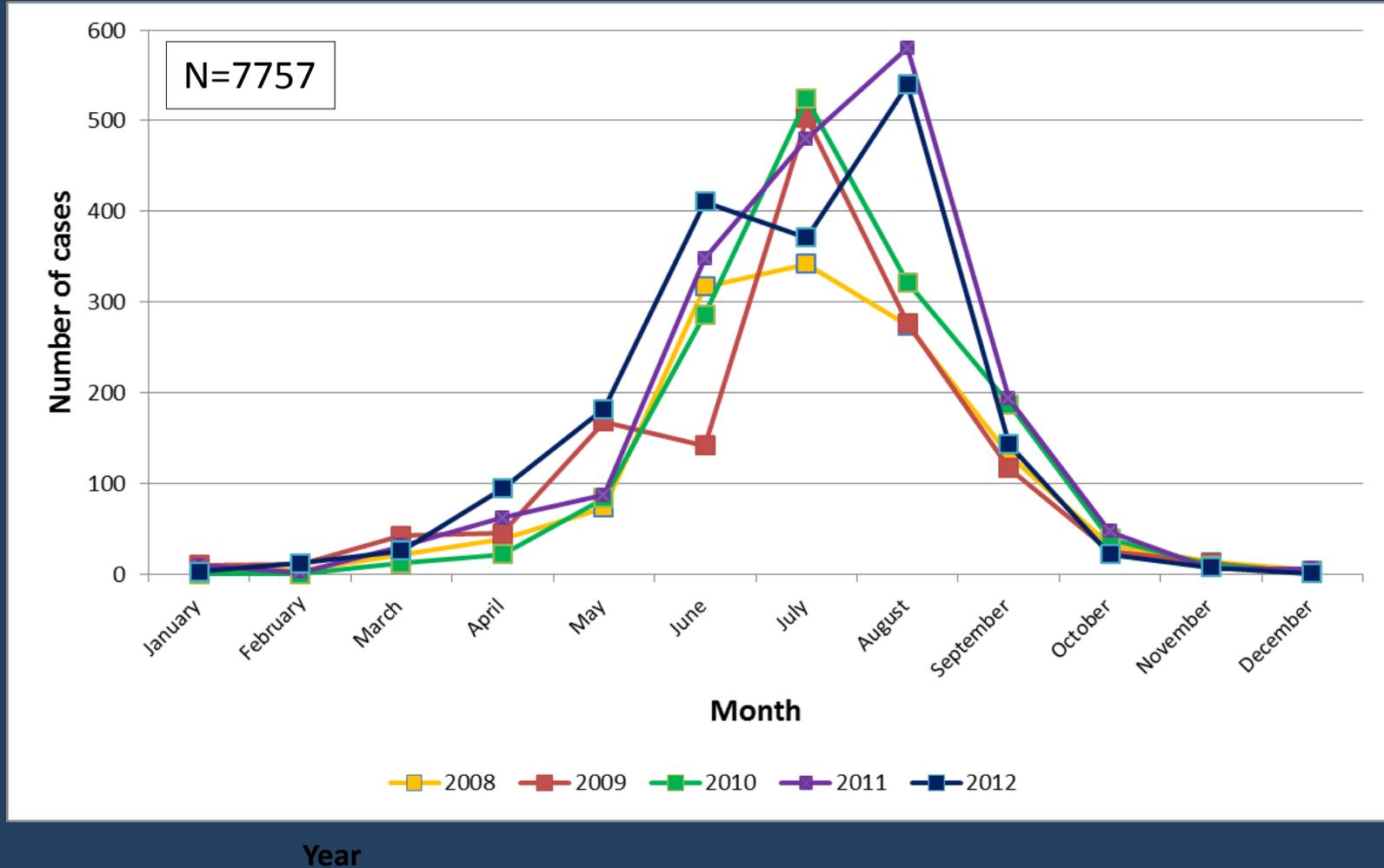
n=1705



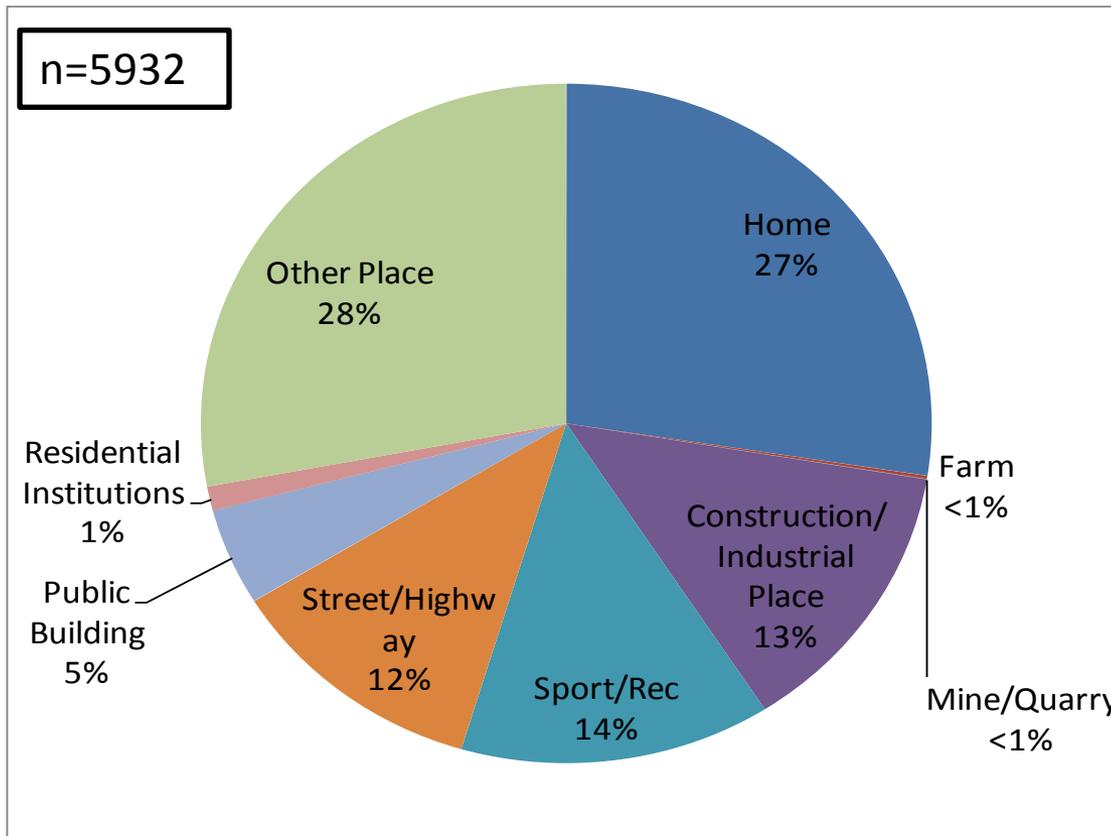
Median: 2 Days  
Mean: 3 days  
Range: 0-74 days



# HRI by Month in Maricopa County for 2008-2012



# HRI by Place of Injury\* in Maricopa County for 2008-2012

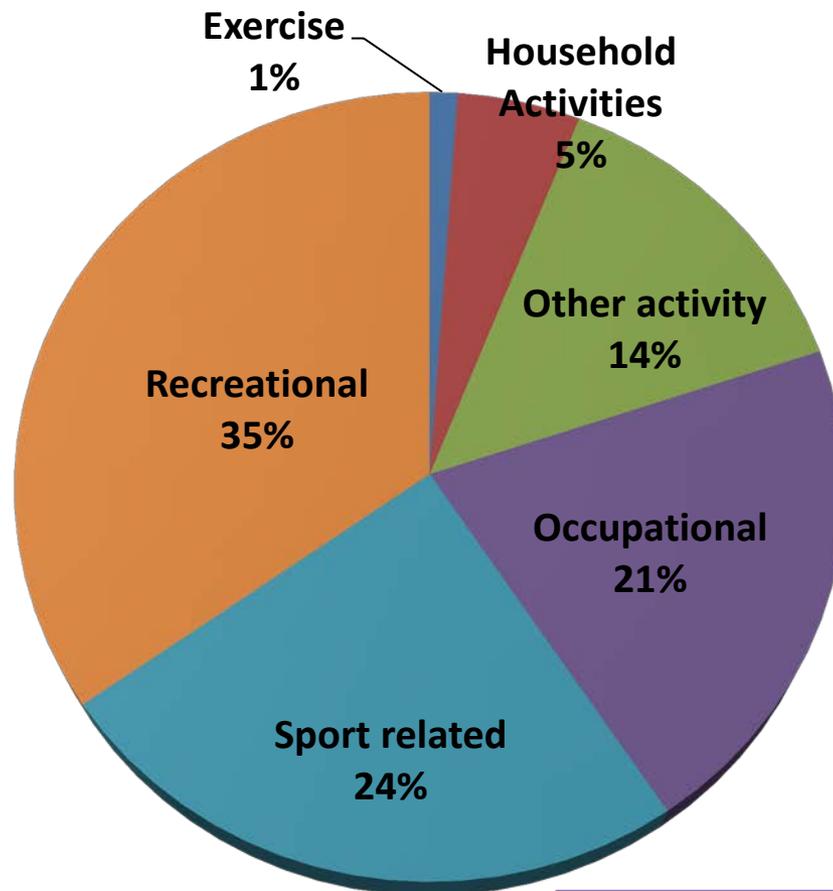


**\*Excluded:1825 (not specified place of injury)**

# HRI by Activity\* Maricopa County for 2008-2012

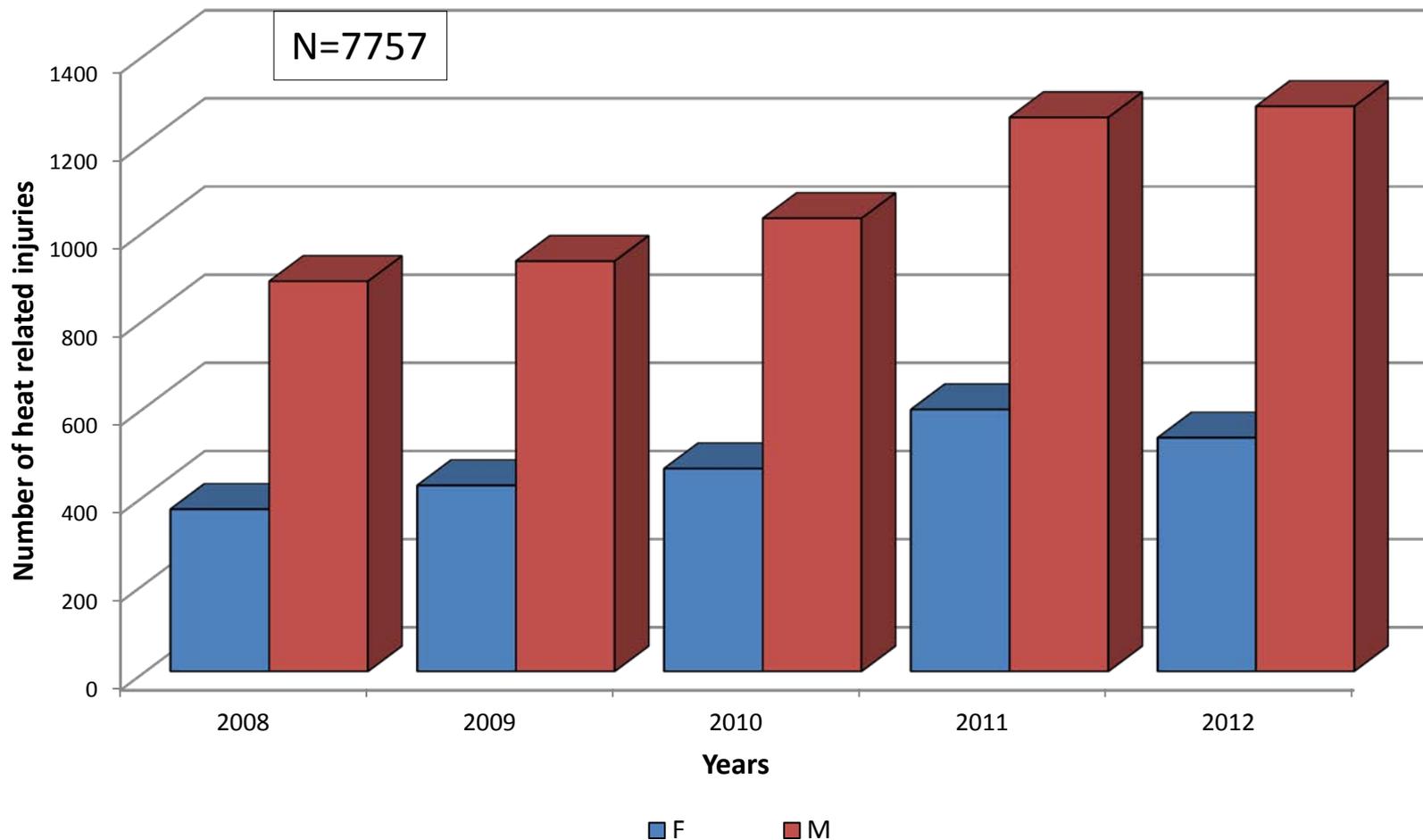


n=1009

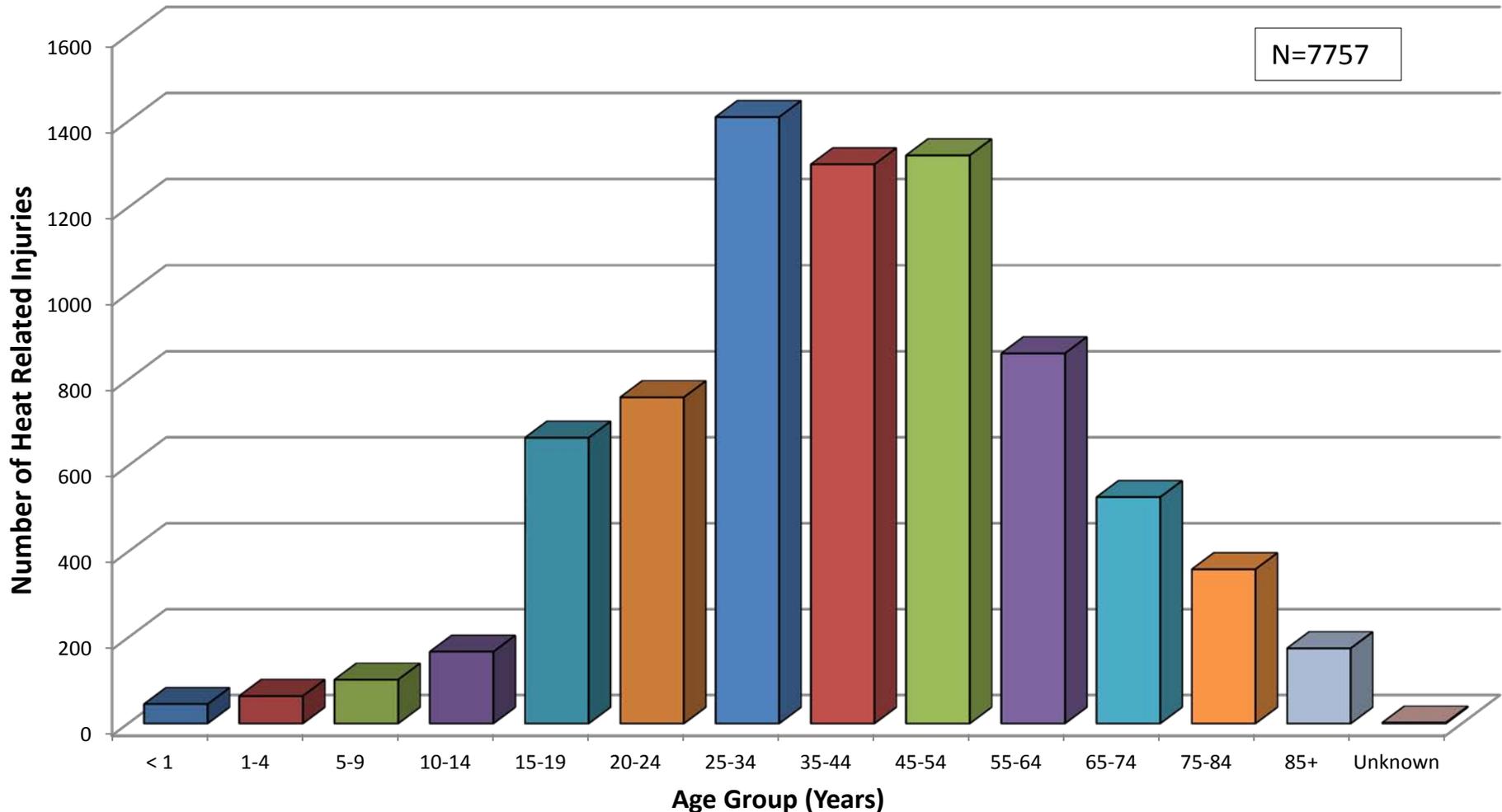


**\*Excluded: 6748 (no activity listed)**

# HRI by Gender in Maricopa County for 2008-2012



# HRI by Age Group in Maricopa County for 2008-2012



# Future Plans



- Continue heat-associated death surveillance
  - Obtain more detailed information pertaining to circumstances surrounding heat-associated mortality (A/C status, analysis on additional risk factors)
  - Cooling and hydration stations
- GIS mapping
- Continue to use Hospital Discharge Data to obtain more detailed information on heat morbidity
- Incorporate Biosense in heat morbidity as a real-time data resource

# Acknowledgements



- Maricopa County Office of the Medical Examiner (OME)staff
- Maricopa County Department of Public Health
  - Office of Epidemiology staff
    - Kirti Ghei
    - Bianca Salas
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    - Catherine Gouge
    - Kathryn Putman
    - Beverly Bradshaw
    - Greg Garcia
  - Office of Vital Registration
- National Weather Service staff
- Local hospital staff
- Arizona Department of Health Services (ADHS)

# Questions?



**I'm thirsty**

# Top 10 Tips for Staying Safe in the Arizona Heat



## 1. Drink plenty of WATER

Drink plenty of water EVERY DAY even when you are not thirsty.

## 2. Do NOT rely on a FAN as your primary source of air

A fan does NOT replace being in an air-conditioned location. It *dehydrates* your body.



## 3. Stay cool indoors

Stay in a cool, air-conditioned location. If you need help paying your electric bill, contact your utility company for possible special programs.

## 4. Take care of your pets

Make sure that your **pets** are provided with plenty of **water, shade and a cool place to rest**, since they can become dehydrated as well.



## 5. Cool down by taking a bath or shower

Taking a shower helps your body cool down. However, DO NOT take a shower immediately after becoming overheated, since your body may cool down too quickly and cause illness.

## 6. Wear LOOSE clothing

Allow your skin to **breathe** in the heat. Breathable fabrics like cotton are best.



## 7. Limit the use of your OVEN and STOVE

During the daytime, using the oven and stove **add heat to your home**. Limit the use of hot appliances to keep your home cool during the day.

## 8. Limit outdoor exercise

Exercise outside during morning hours; exercise inside in air conditioning the rest of the day.



## 9. Check on friends and neighbors

Open windows are a sign that a neighbor could be having an air conditioning problem. Check to make sure they are staying cool.

## 10. For more information

For cooling locations or additional resources, visit [HeatAZ.com](http://HeatAZ.com), [211arizona.com](http://211arizona.com) or dial 2-1-1

