IMPACT OF EXTREME HEAT ON HUMAN MORTALITY AND MORBIDITY:

SURVEILLANCE SYSTEMS IN MARICOPA COUNTY

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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. \( \geq 100 \, ^\circ\text{F} \):
109 days/year

Average number of days with maximum temp. \( \geq 100 \, ^\circ\text{F} \) and minimum temp. \( \geq 80 \, ^\circ\text{F} \):
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 \( \geq 100 \, ^\circ\text{F} \) start as early as mid May through first week of October

7/29/2013
Deaths Occurring in Maricopa County During Periods with Max Temps $\geq 100^\circ F$ and Min Temps $\geq 80^\circ F$
Heat Illnesses (Edema, Rashes, Cramps, Exhaustion, Syncope, Stroke, Hyperpyrexia)
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**
Heat-Associated Deaths in Maricopa County
<table>
<thead>
<tr>
<th>Year</th>
<th>Total Reported</th>
<th>Confirmed</th>
<th>Ruled-Out</th>
<th>Pending</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>104</td>
<td>85 (83%)</td>
<td>19 (17%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>2007</td>
<td>131</td>
<td>51 (39%)</td>
<td>80 (61%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>2008</td>
<td>97</td>
<td>50 (52%)</td>
<td>47 (48%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>2009</td>
<td>114</td>
<td>74 (65%)</td>
<td>40 (35%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>2010</td>
<td>142</td>
<td>82 (58%)</td>
<td>60 (42%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>2011</td>
<td>144</td>
<td>106 (74%)</td>
<td>38 (26%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>2012</td>
<td>172</td>
<td>102 (59%)</td>
<td>57 (33%)</td>
<td>13* (8%)</td>
</tr>
<tr>
<td>Total</td>
<td>904</td>
<td>550 (61%)</td>
<td>341 (38%)</td>
<td>13* (1%)</td>
</tr>
</tbody>
</table>

*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.

7/29/2013
Heat-Associated Deaths in Maricopa County for 2012
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).

<table>
<thead>
<tr>
<th>Residency</th>
<th>Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maricopa Co.</td>
<td>38</td>
</tr>
<tr>
<td>Non-Maricopa Co.**</td>
<td>4</td>
</tr>
<tr>
<td>Non-Arizona***</td>
<td>1</td>
</tr>
<tr>
<td>Total* (N=98)</td>
<td>80</td>
</tr>
</tbody>
</table>

| Heat Related (N=43)        | 43               |
| Heat Caused (N=55)         | 55               |

*Excludes four cases where residency could not be established.
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
Heat-Associated Deaths (indoor occurring) by Use of Air Conditioning in Maricopa County for 2012

- AC On: 3 cases, 7%
- AC Off: 30 cases, 70%
- AC Not Available: 6 cases, 14%
- AC Status Unknown: 4 cases, 9%

Total: 43 cases
Status for Cases with Air Conditioning Turned Off in Maricopa County for 2012

- 12 cases (40%) were not in use.
- 11 cases (37%) were non-functioning.
- 6 cases (20%) had no electricity.
- 1 case (3%) was unknown.

Total cases: 30
Heat-Associated Deaths in Maricopa County, AZ 2012

Place of Injury Occurrence (n=95)*

*Excludes seven deaths where injury address could not be obtained

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.
Heat-Associated Deaths in Maricopa County for 2012

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-Homeless (N=441)</th>
<th>Homeless Deaths (N=109)</th>
<th>Total (N=550)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>53</td>
<td>32</td>
<td>85</td>
</tr>
<tr>
<td>2007</td>
<td>45</td>
<td>6</td>
<td>51</td>
</tr>
<tr>
<td>2008</td>
<td>47</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>2009</td>
<td>53</td>
<td>21</td>
<td>74</td>
</tr>
<tr>
<td>2010</td>
<td>60</td>
<td>22</td>
<td>82</td>
</tr>
<tr>
<td>2011</td>
<td>93</td>
<td>13</td>
<td>106</td>
</tr>
<tr>
<td>2012</td>
<td>90</td>
<td>12</td>
<td>102</td>
</tr>
</tbody>
</table>
Heat-Associated Deaths for the Homeless with Drug and Alcohol Use as Mentioned on the Death Certificate for 2012

Homeless (n=12)  Non-Homeless (n=90)

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

(7, 58%)       (64, 71%)
(5, 42%)       (26, 29%)
Heat Morbidity Surveillance
Maricopa County

Heat Related Illness (HRI) using Hospital Discharge Data (HDD)
# Heat Related Illness Cases by Visit Type (2008-2012)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER OF HRI</th>
<th>PERCENT OF HRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1253</td>
<td>16.15</td>
</tr>
<tr>
<td>2009</td>
<td>1353</td>
<td>17.44</td>
</tr>
<tr>
<td>2010</td>
<td>1488</td>
<td>19.18</td>
</tr>
<tr>
<td>2011</td>
<td>1851</td>
<td>23.86</td>
</tr>
<tr>
<td>2012</td>
<td>1812</td>
<td>23.36</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7757</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Hospital Discharge Data (inpatient/outpatient)
HRI by Length of Inpatient Stay in Maricopa County Healthcare Facility for 2008-2012

n=1705

1-3 Days LOS, 69%

4-6 Days LOS, 14%

7+ Days LOS, 13%

Same Day, 4%

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

Source: Hospital Discharge Data (inpatient/outpatient)
HRI by Month in Maricopa County for 2008-2012

N=7757

Source: Hospital Discharge Data (Inpatient/Outpatient)
HRI by Place of Injury* in Maricopa County for 2008-2012

n=5932

Home 27%
Other Place 28%
Construction/Industrial Place 13%
Sport/Rec 14%
Street/Highway 12%
Mine/Quarry <1%
Residential Institutions 1%
Public Building 5%
Farm <1%
Other Place 28%

*Excluded: 1825 (not specified place of injury)
HRI by Activity* Maricopa County for 2008-2012

n=1009

- Recreational: 35%
- Sport related: 24%
- Occupational: 21%
- Other activity: 14%
- Household Activities: 5%
- Exercise: 1%

*Excluded: 6748 (no activity listed)
HRI by Gender in Maricopa County for 2008-2012

N=7757

Source: Hospital Discharge Data (inpatient/outpatient)
HRI by Age Group in Maricopa County for 2008-2012

Number of Heat Related Injuries

Age Group (Years)

N=7757

Source: Hospital Discharge Data (inpatient/outpatient)
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

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    - Kathryn Putman
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    - 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, 211arizona.com or dial 2-1-1.