

June 2023

# **2022 Heat Deaths Report**

**Maricopa County**

**Department of Public Health**

**Division of Epidemiology and Informatics**

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# Acknowledgements

The Maricopa County Department of Public Health (MCDPH), Office of Epidemiology would like to thank the following agencies for their contributions to this report:

- Maricopa County Office of the Medical Examiner (OME)
- Maricopa County Office of Vital Registration (OVR)
- Arizona Department of Health Services (ADHS), Office of Vital Registration
- National Weather Service (NWS)
- Maricopa Association of Governments (MAG)
- Local hospitals (infection preventionists, emergency departments, social worker staff)
- City of Phoenix Heat Relief Network

To receive additional data, please submit a data request form through the Maricopa County Public Health website [here](#). A staff member from the Climate and Health team will contact you to discuss your request.

You may also contact the Climate and Health Team through email:

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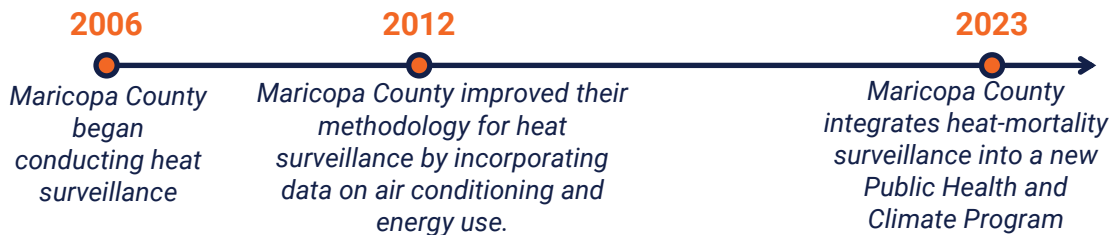
Primary Author: Meaghan Calendo, Climate and Health Epidemiologist

# Introduction

Mortality from environmental heat is a significant public health problem in Maricopa County, especially because it is largely preventable. Sharing this information helps community stakeholders to design interventions to prevent heat-associated deaths among vulnerable populations.

## TIMELINE OF HEAT SURVEILLANCE IN MARICOPA COUNTY

Maricopa County has conducted heat surveillance each year since 2006. The enhanced heat surveillance season usually begins in May and ends in October



## HEAT DEATHS CLASSIFICATION

Heat-associated deaths are classified as heat-caused or heat-related:

### Heat-Caused:

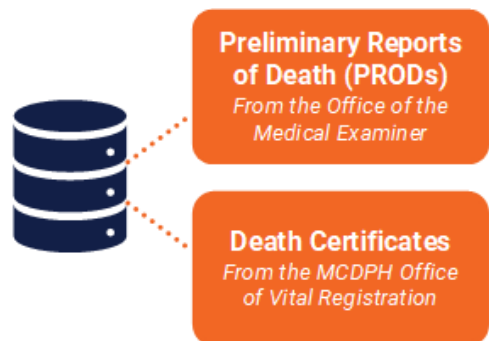
Environmental heat was directly involved in the sequence of events causing deaths.

### Heat-Related:

Environmental heat contributed to the deaths but was not in the sequence of events causing these deaths.

## HEAT SURVEILLANCE DATA SOURCES

Maricopa County uses two main sources of data for heat surveillance:



## HEAT SURVEILLANCE OBJECTIVES

The main goals of heat surveillance are to identify the demographic characteristics of heat-associated deaths (e.g., age and gender) and the risk factors for mortality (e.g., homelessness or lack of air conditioning).

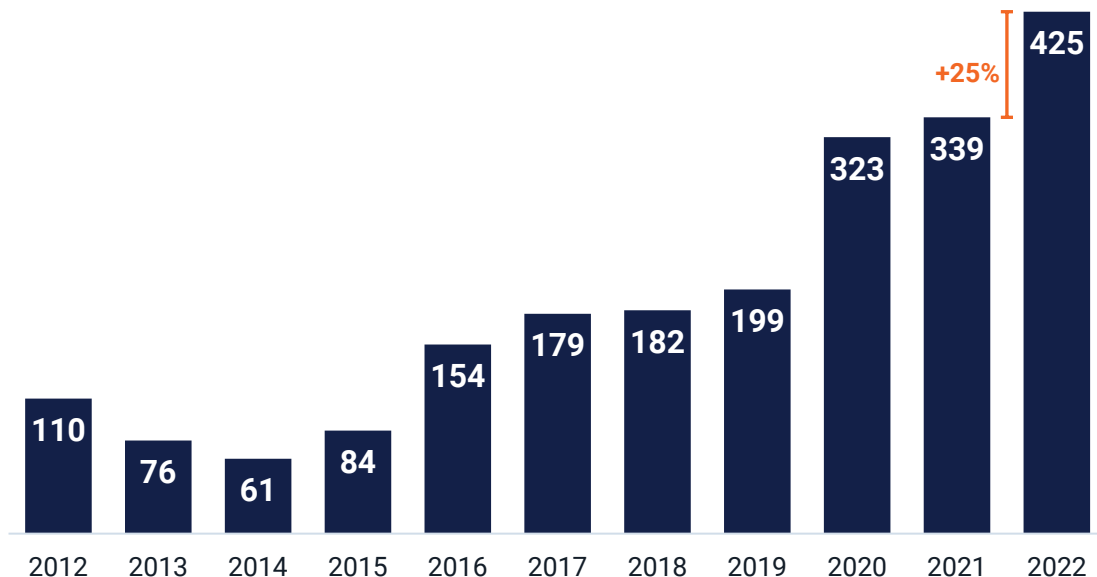
For more information on how heat-associated deaths are classified, see the definitions in Appendix. For more information on MCDPH's surveillance system, see Background and Methodology.

# Heat-Associated Deaths Over Time

Deaths by Year

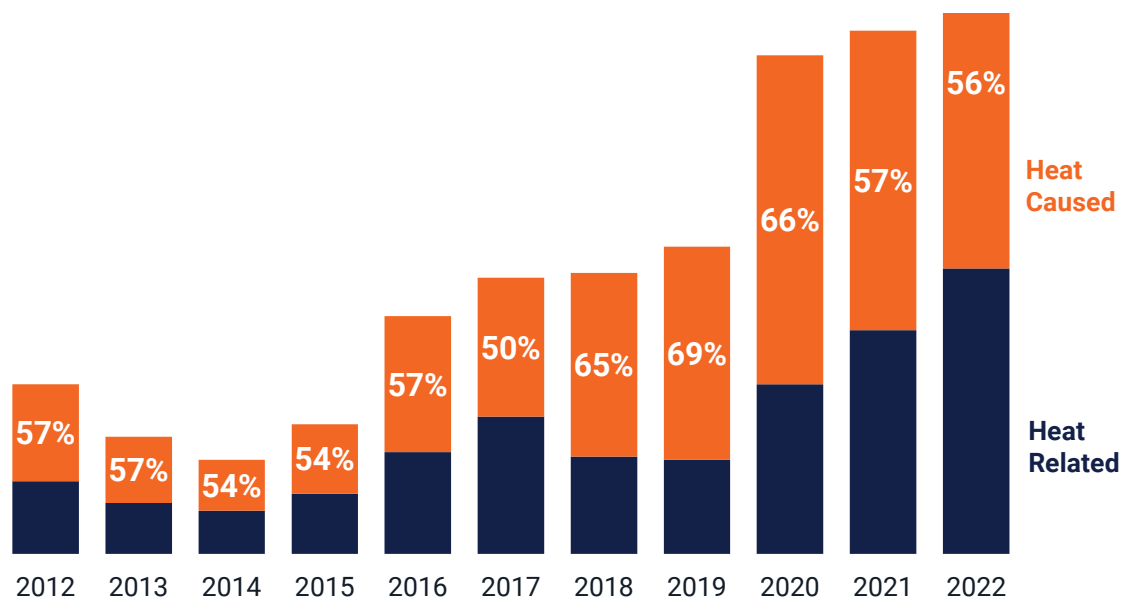
Maricopa County identified a total of 425 heat-associated deaths occurring in 2022.

This represents a twenty-five percent increase from last year



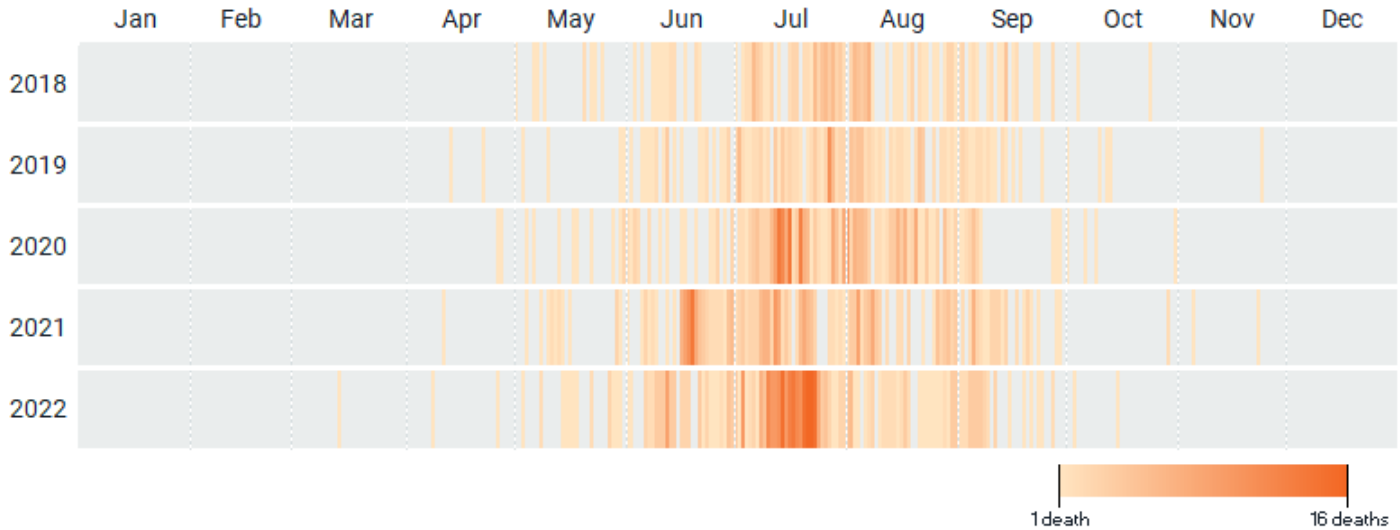
In recent years, most deaths have been classified as **heat-caused**.

This year, environmental heat was directly involved in the sequence of events causing death in more than half of all heat-associated death cases.

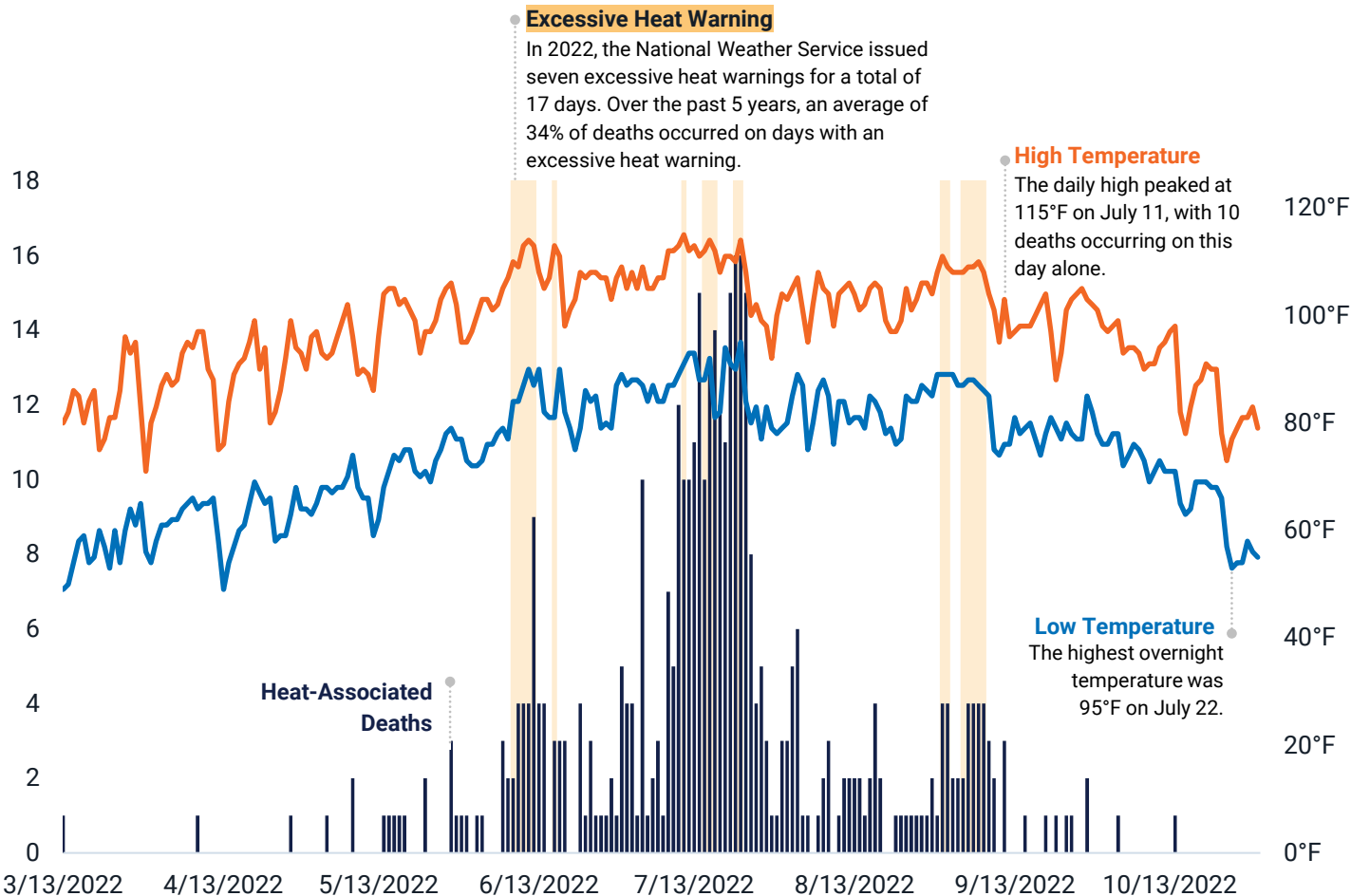


## Deaths by Day and Temperature

In 2022, more than half of all heat-associated deaths occurred during the month of **July**. Compared with previous years, a higher proportion of deaths occurred in July (58%) and fewer deaths occurred in August (11%).

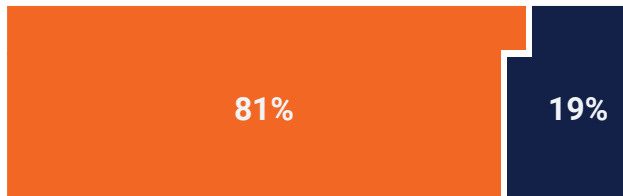


In 2022, 107 heat-associated deaths occurred on days with an **excessive heat warning**.



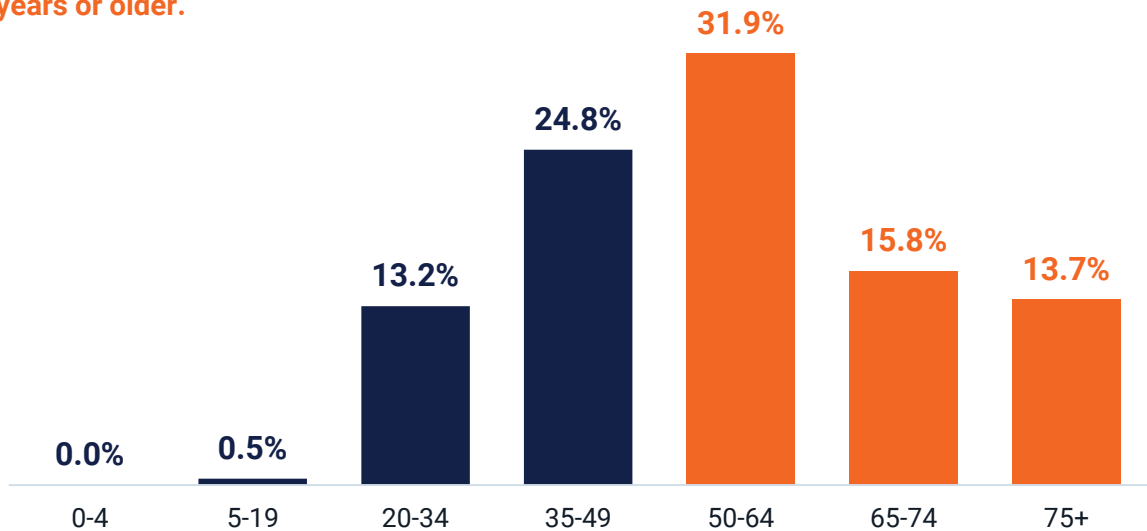
# Demographics Overview

Age, Sex, Race, and Ethnicity

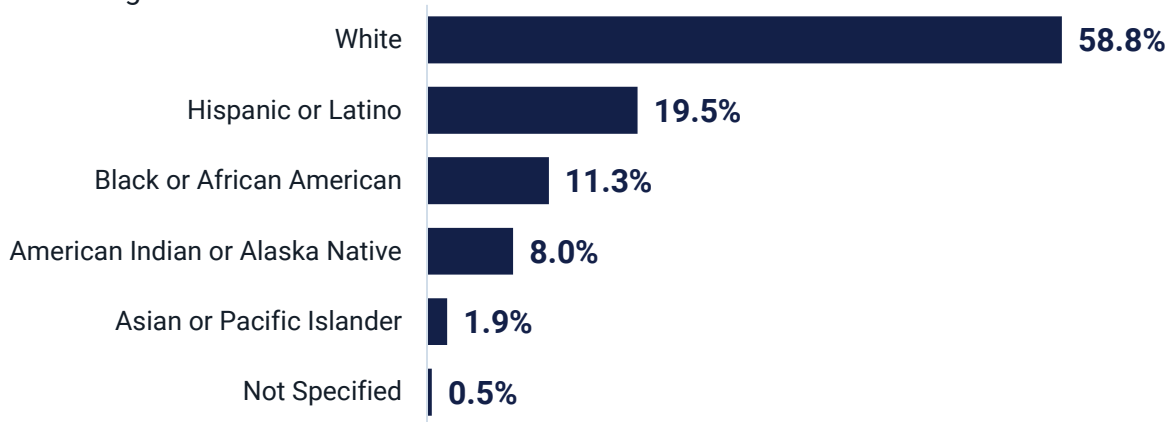


**Males** accounted for more than 80% of heat-associated deaths in 2022.

Nearly two-thirds of all heat-associated deaths occurred among individuals aged 50 years or older.



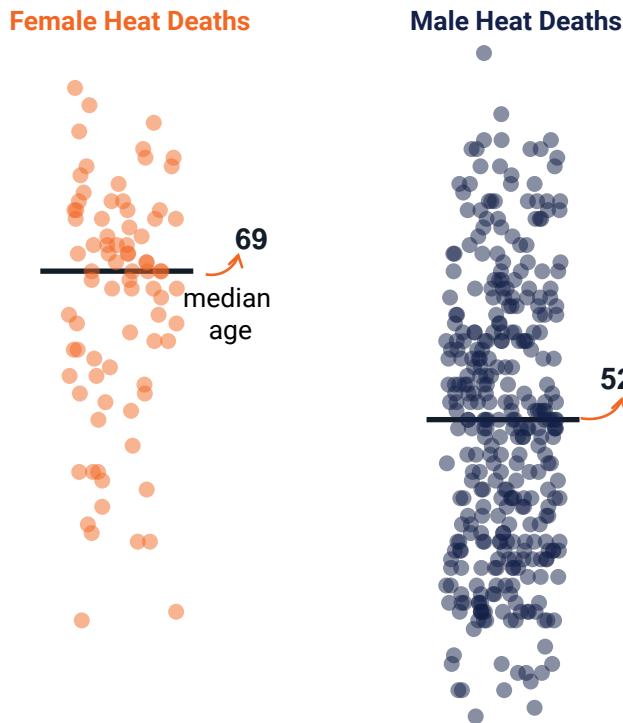
Nearly 60% of heat-associated deaths occurred among non-Hispanic White individuals. Compared to the proportion in which they make up Maricopa County's population, African Americans (7.4%) and American Indians (3.6%) are overrepresented among heat deaths.



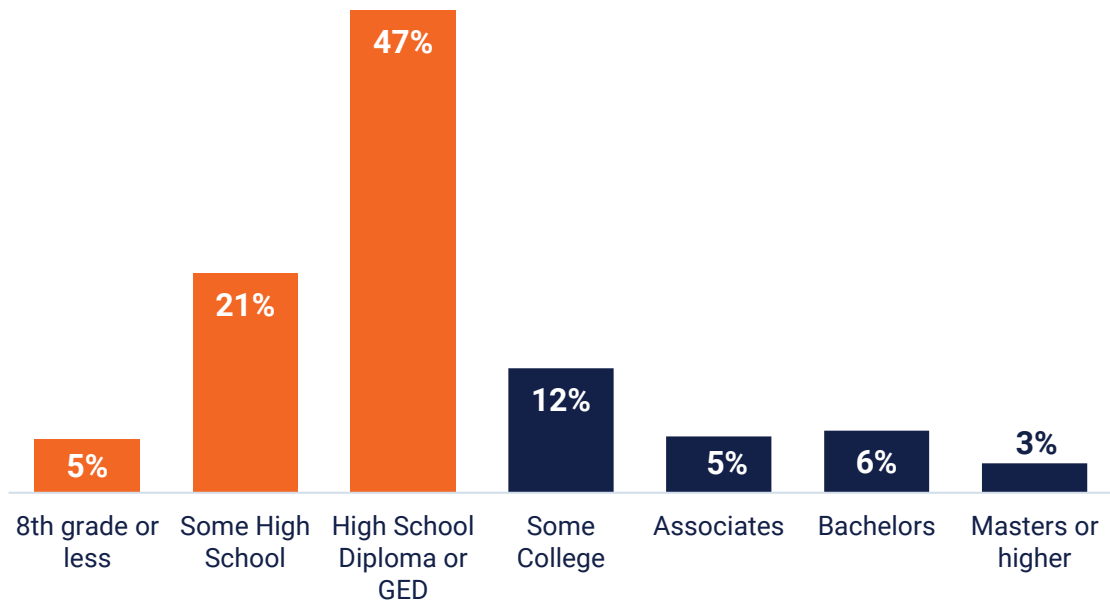
\* Percentages exclude 1 case where sex is unknown and 2 cases where age is unknown.

## Sex, Age, and Education

The median age of heat-associated deaths was younger among males than females in 2022.



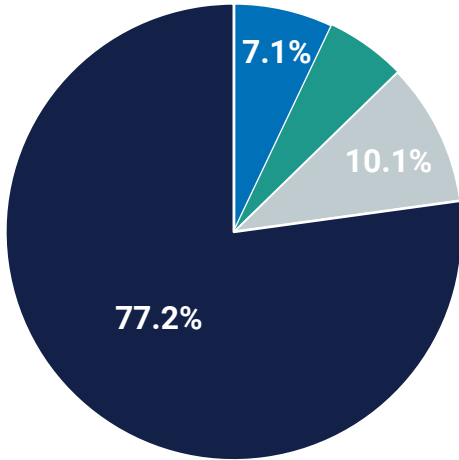
More than two-thirds of adult decedents did not attend any **post-secondary schooling**, among all heat-associated deaths with known educational background.



\* Percentages exclude 2 cases where age is unknown and 78 cases where education is unknown.

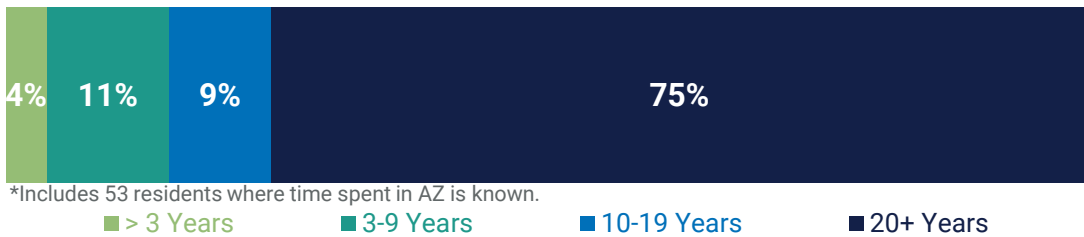


Local residents account for the majority of heat-associated deaths in Maricopa County.

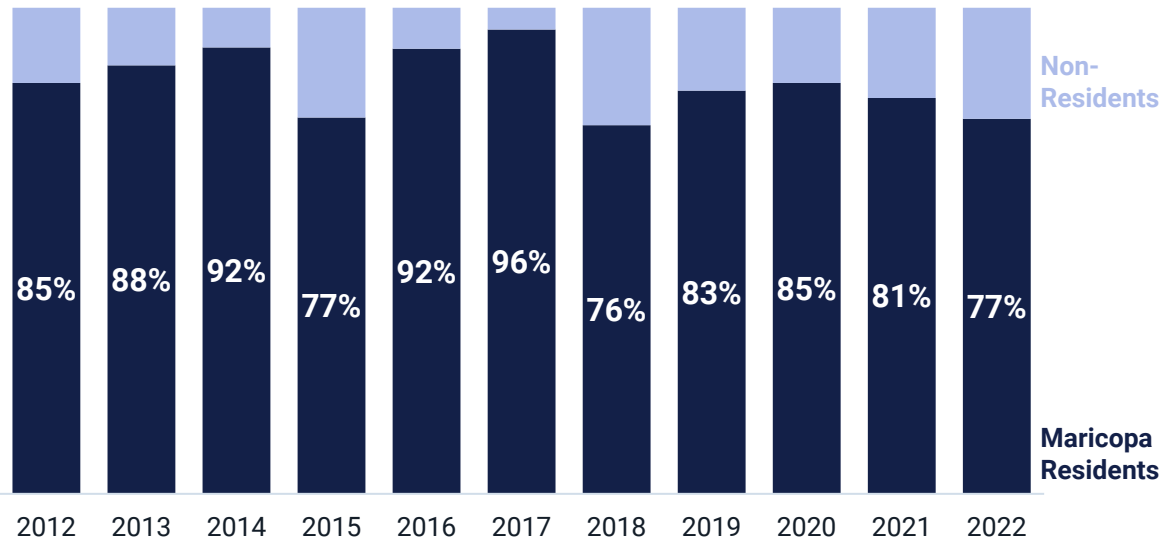


- **77.2% Maricopa County Residents**
- **7.1% In-State Residents**  
Includes residents of nine other Arizona counties.
- **5.6% Out-of-State Residents**  
Includes residents of 18 other states.
- **10.1% Residency Unknown**  
Includes 43 cases where residency state, county, or both are unknown.

Among local residents for whom length of residency is known, three-fourths had lived in Maricopa County for twenty years or more.



The percentage of heat-associated deaths that are Maricopa County residents has decreased in recent years, despite an increase in overall heat-associated deaths.



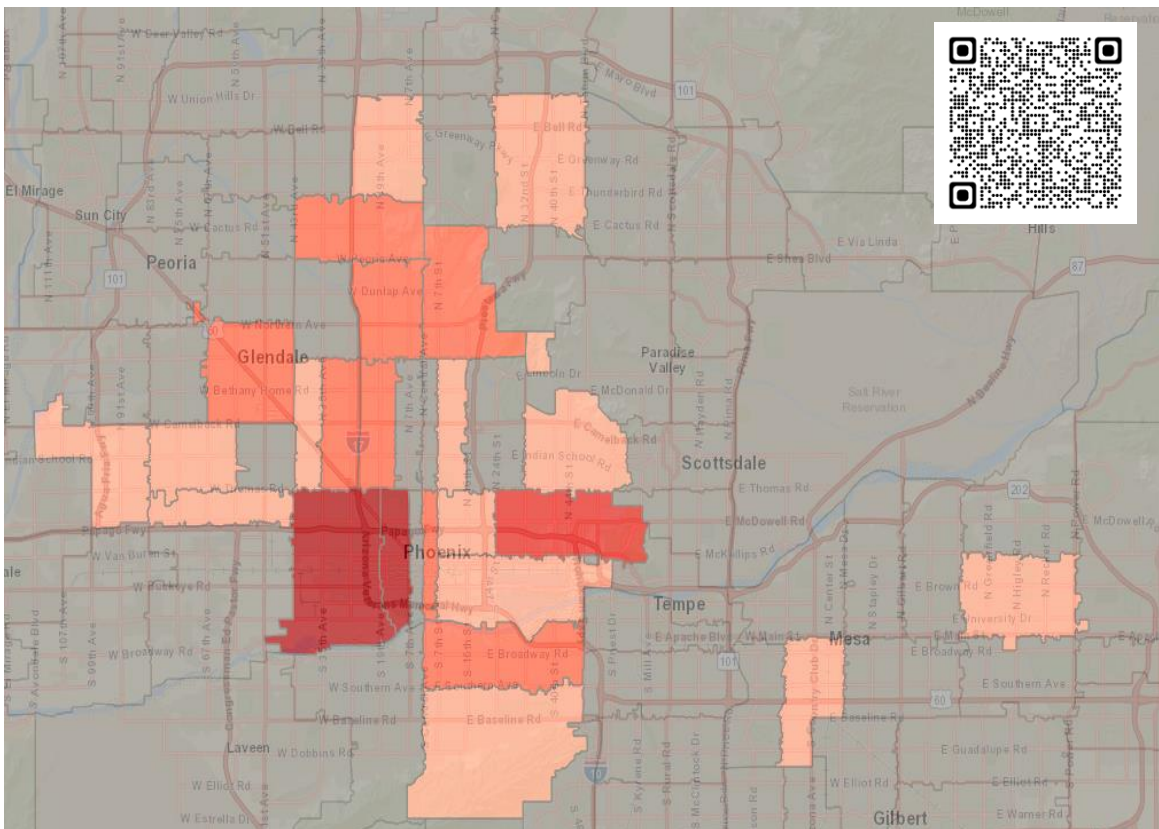
# Circumstances of Death

## Location of Injury

Cities with less than 5 heat-associated deaths have been excluded from the table.

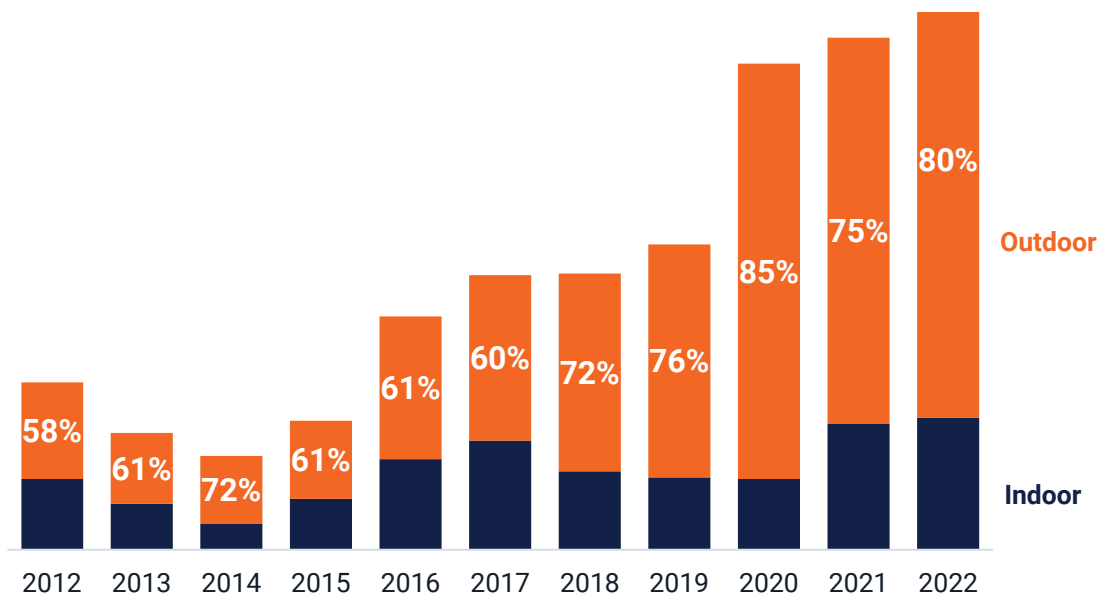
PLACE OF INJURY CITY	HEAT DEATHS
Phoenix	245
Mesa	36
Glendale	22
Scottsdale	10
Tempe	10
Avondale	8
Peoria	8
Chandler	7
Gilbert	6

To view an interactive map of 2022 heat-associated deaths in Maricopa County, click the QR code on the map or scan it with your smartphone camera.

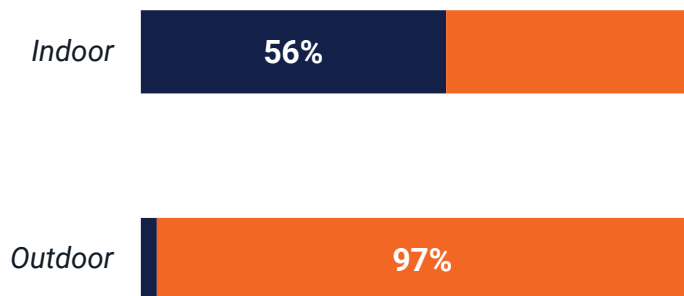


## Place of Injury

**Deaths in outdoor settings** have driven the increase in total number of heat-associated deaths in recent years

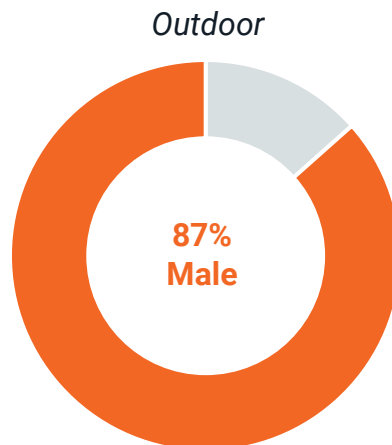
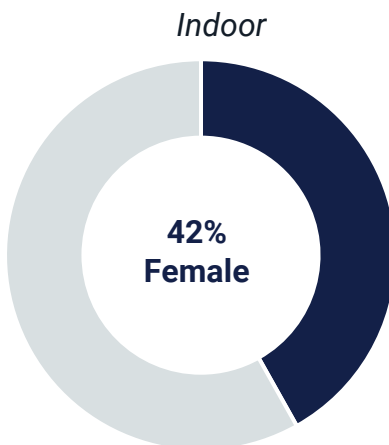


### Welfare Check ◀▶ None



**More than half of all indoor deaths were found during a welfare check.** Welfare checks identified less than three percent of outdoor deaths.

**In 2022, 42% of indoor deaths were among females,** despite females comprising less than 20% of the overall heat deaths for the year.

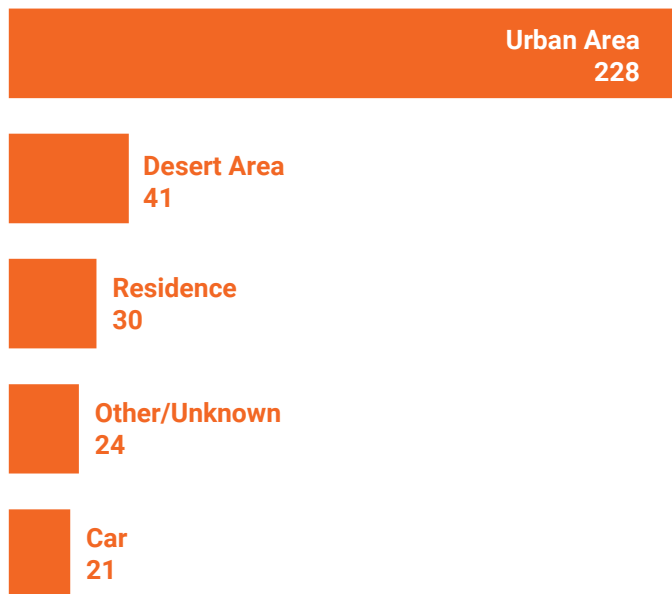


\* Percentages exclude 3 cases with unknown injury location and 1 with unknown sex

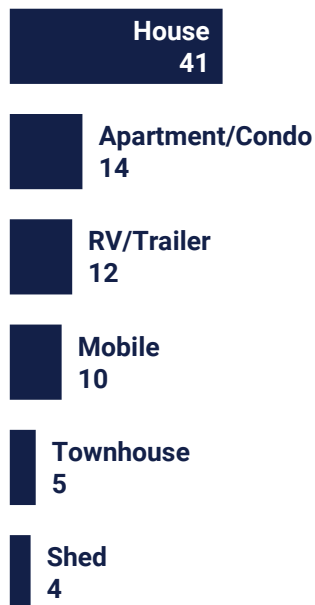
**The majority of outdoor heat-associated deaths occurred in an Urban Area in 2022.**

Nearly 70% of outdoor heat deaths and over half of all overall heat-associated deaths occurred in an Urban Area within Maricopa County throughout the year.

**Outdoor Heat Injury Sites**

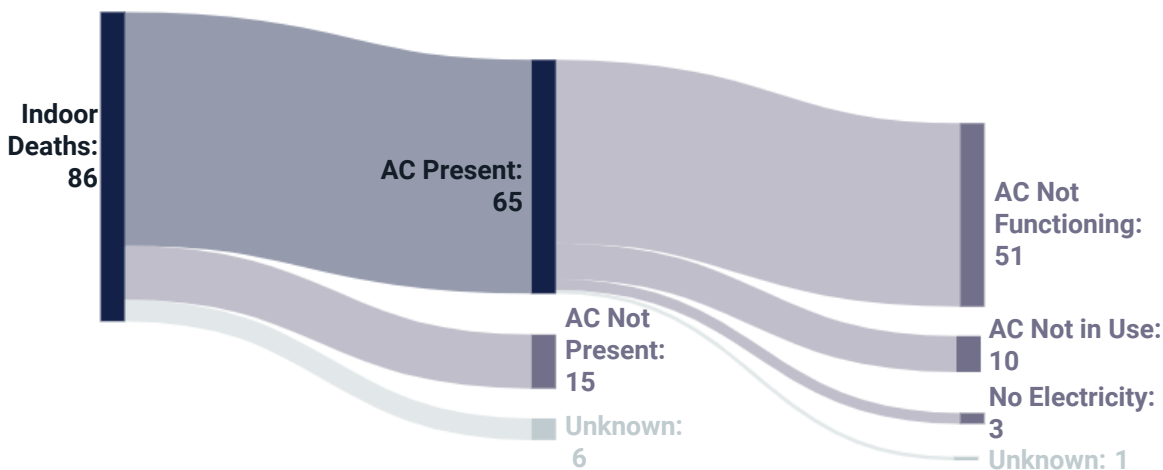


**Indoor Heat Injury Sites**



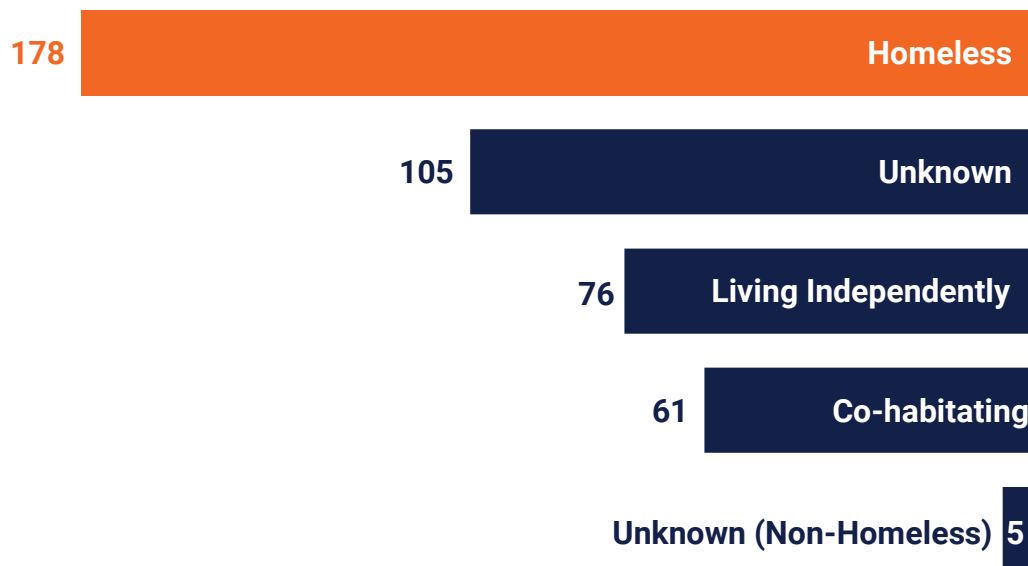
**All indoor heat-associated deaths in 2022 occurred in uncooled environments.**

In most indoor death cases, an air conditioning (AC) unit was present on-site. Among indoor deaths where an AC unit was present, the unit was non-functioning in 78% of cases.

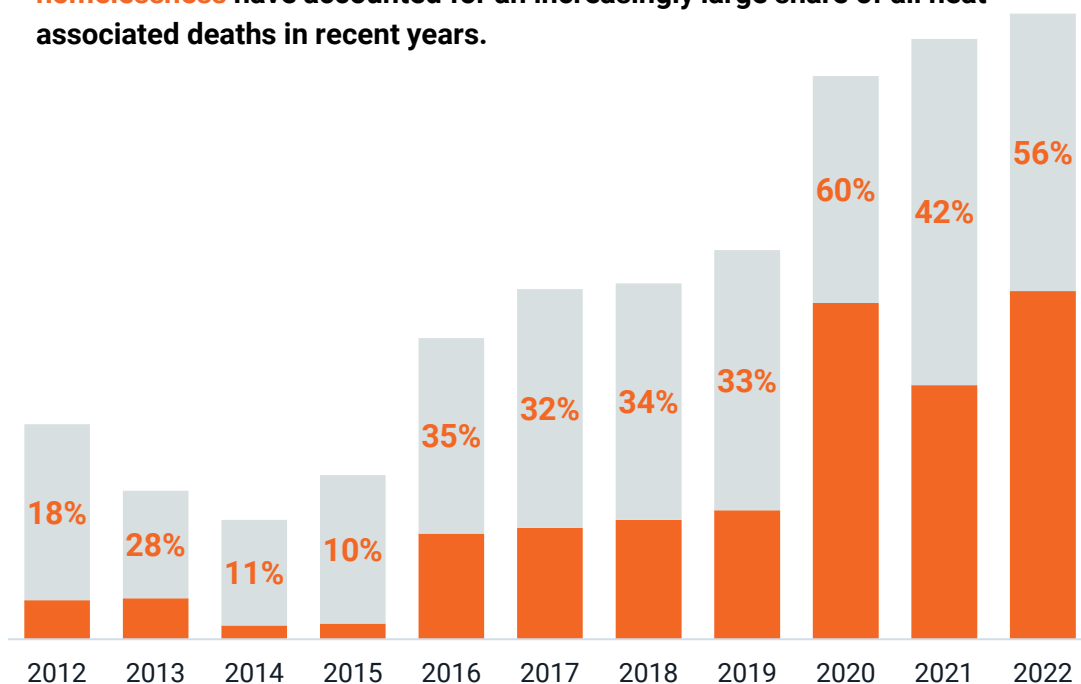


## Living Situation

Individuals experiencing **homelessness** make up the largest proportion of heat-associated deaths in 2022.



Among deaths where the living situation is known, people experiencing **homelessness** have accounted for an increasingly large share of all heat-associated deaths in recent years.

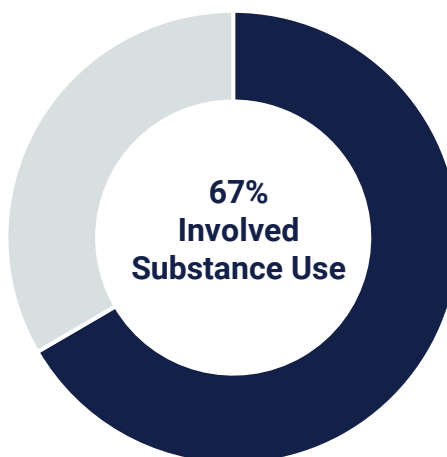


\* Percentages exclude cases where living situation is unknown

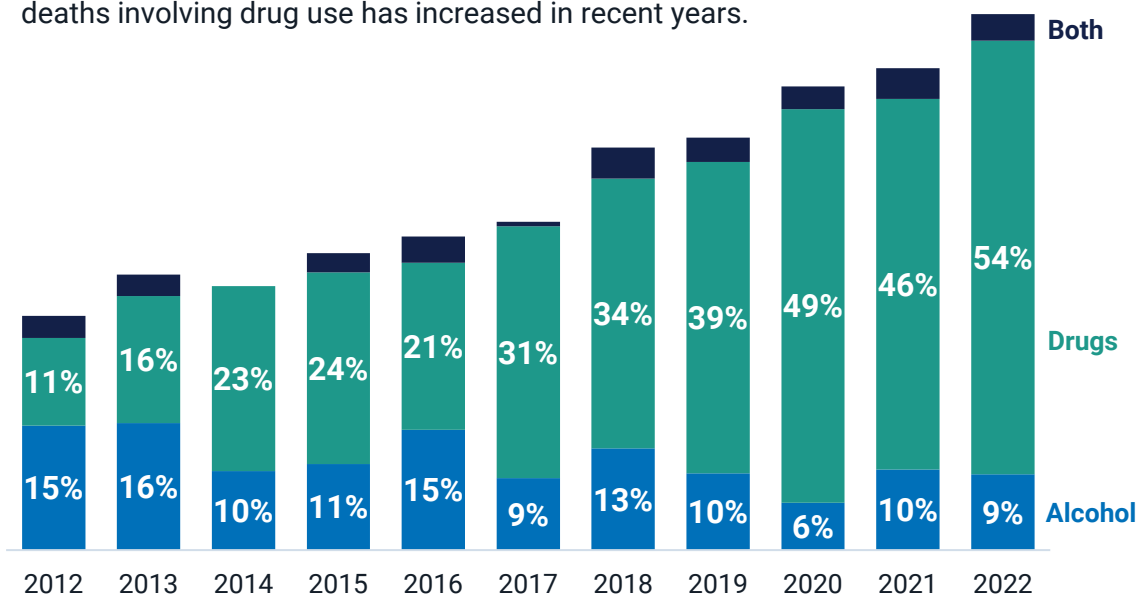
\* According to the [Maricopa Association of Governments Point-in-Time Count](#), there was a 36% increase in homeless individuals overall in Maricopa County from 2019-2022.

## Substance Use

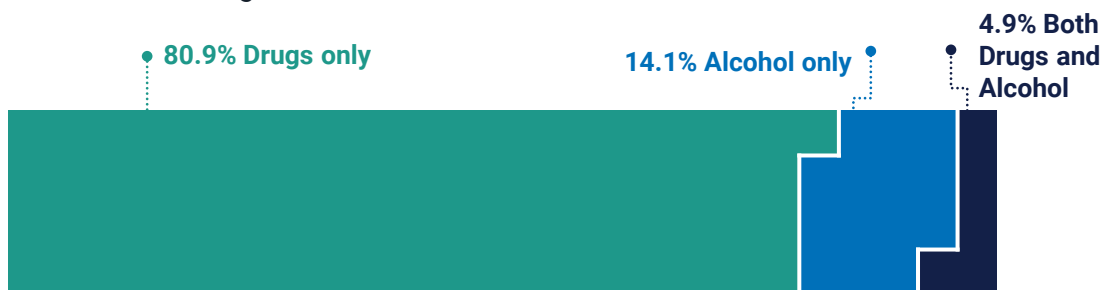
Maricopa County identified 283 deaths involving substance use, representing over two-thirds of all heat-associated deaths recorded in 2022. Substance use includes use of drugs and/or alcohol.



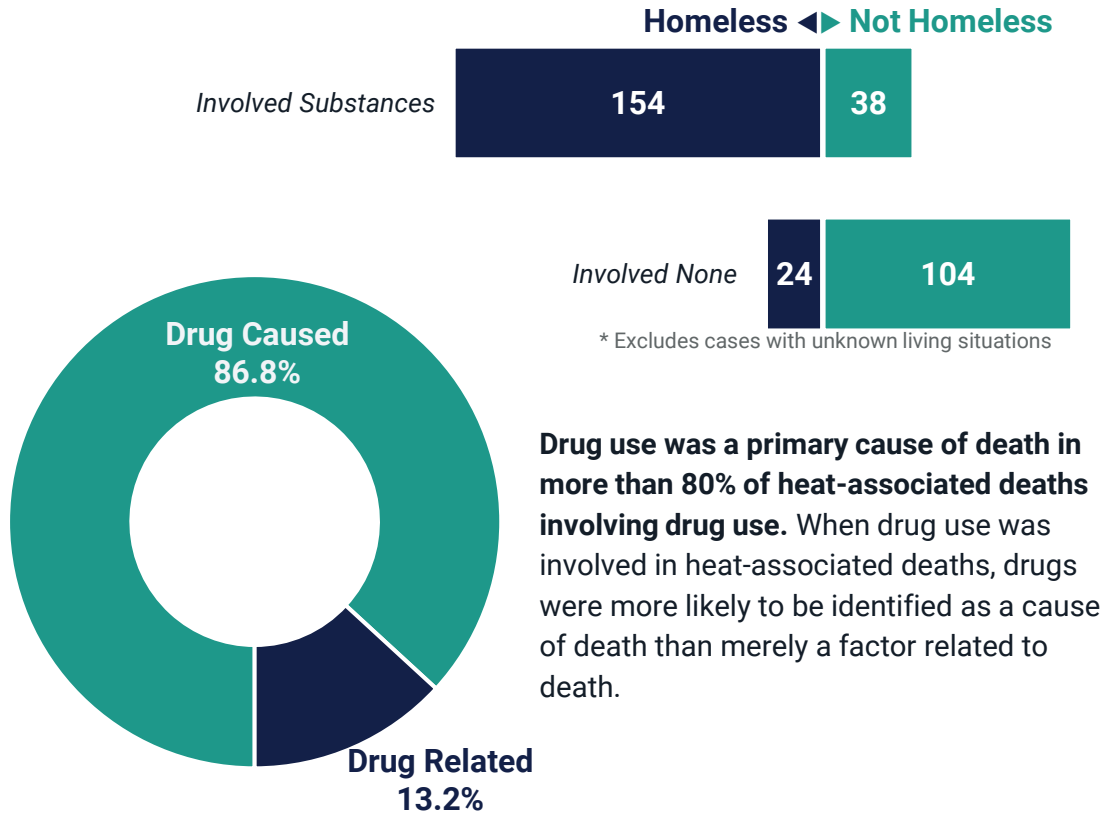
Over half of all heat-associated deaths involved drug use. The proportion of deaths involving drug use has increased in recent years.



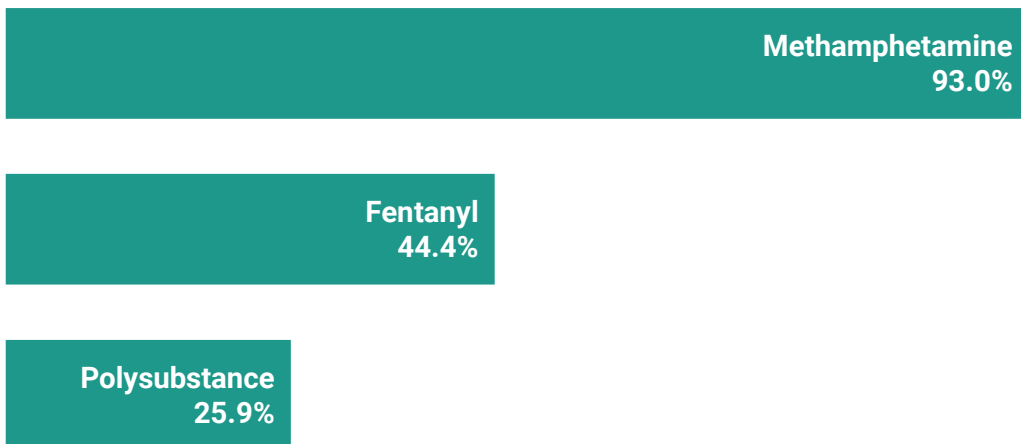
Among heat-associated deaths involving substance use, more than four-in-five deaths involved drug use alone in 2022.



In 2022, 54% of heat-associated deaths involving substance use were among individuals experiencing homelessness.



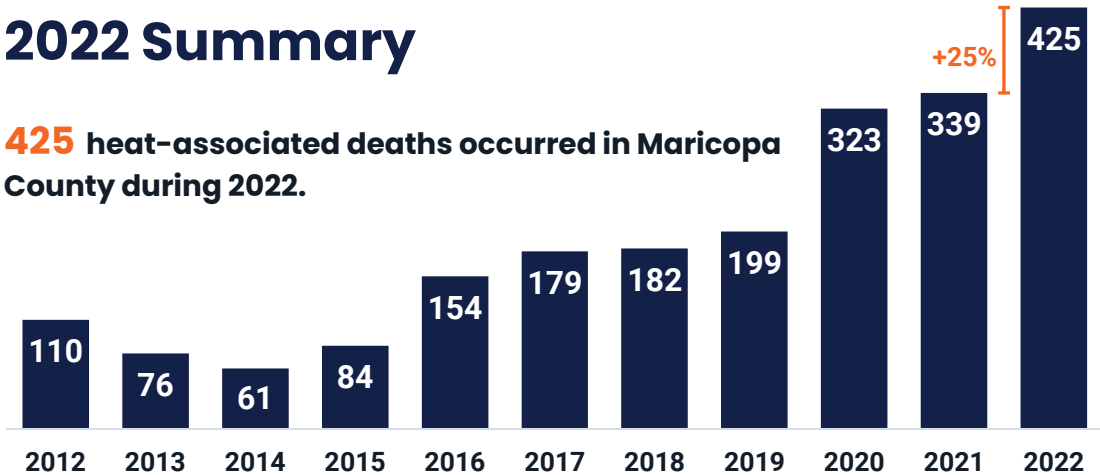
**Methamphetamine was involved in 90% of heat-associated deaths involving drug use.** Methamphetamine was a contributing factor or main cause of death in **53%** of all heat-associated deaths.



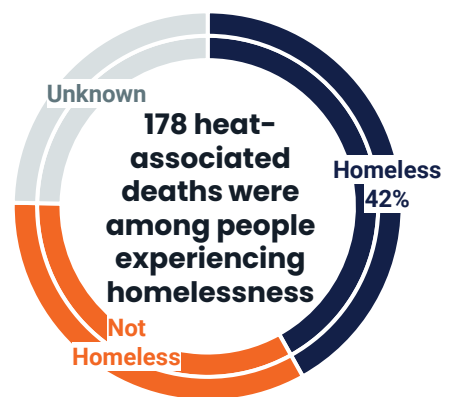
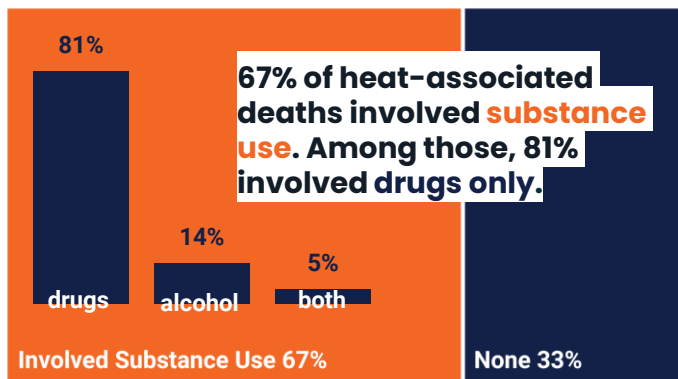
*\*These are the three most common substances involved in the cause of death found within the death certificates of heat-associated deaths. This is not an all-inclusive list of substances involved.*

# 2022 Summary

**425** heat-associated deaths occurred in Maricopa County during 2022.



- 4/5 heat-associated deaths were among males in 2022.
- 3/5 were among non-Hispanic white individuals.
- 2/3 were among people aged 50 or older or people who did not attend any post secondary schooling.



- 54% of heat-associated deaths involving substance use were among individual's experiencing homelessness.
- 53% of all heat-associated deaths involved methamphetamine.



# Appendices

## Background

In July 2005, Maricopa County (MC) experienced exceptionally high temperatures that contributed to 45 deaths, of which 35 occurred over nine consecutive days. Temperatures reached 116° F and three excessive heat warnings were issued during this month. After this event, the Maricopa County Department of Public Health (MCDPH) created a novel and effective approach for surveillance of heat-associated deaths in 2006 and has continued to use this system annually.

## Methodology

Surveillance data is obtained from the following sources:

1. The Maricopa County Office of the Medical Examiner (OME) forwards suspected heat-related deaths to MCDPH and provides data including demographics, preliminary information regarding how the death occurred, and the circumstances of death. In the past, this information came solely as a weekly line list with limited information for each case. However, in February of 2012, MCDPH started receiving all preliminary reports of death (PRODs) from the OME. These reports provide expanded information daily and have changed the screening methods used by MCDPH staff to ensure that all potential heat-related deaths are documented.
2. The MCDPH Office of Vital Registration registers all Maricopa County death certificates in the Arizona Department of Health Services vital records database. The MCDPH Office of Epidemiology searches this database looking for causes of death associated with environmental heat. A Statistical Analysis Software (SAS®) program looks for the key phrases and International Classification of Disease-10 (ICD-10) codes listed below.

Key Phrases
<ul style="list-style-type: none"><li>• Heat exposure</li><li>• Environ</li><li>• Exhaustion</li><li>• Sun</li><li>• Heat Stress</li><li>• Heat Stroke</li><li>• Hyperthermia</li></ul>

ICD-10 Codes
<ul style="list-style-type: none"><li>• X30 – Exposure to excessive natural heat</li><li>• T67.X – Effects of heat and light</li><li>• P810 – Environmental hyperthermia of newborn</li></ul>

3. Hospital and media reports can sometimes initiate a heat death investigation, for example, if a child is reportedly left in a hot car.

Once data are received, analysis of the information is required to identify only those deaths related to or caused by environmental heat. Environmental heat is heat generated by the climate (sun, humidity, etc.) rather than heat from man-made sources such as ovens or manufacturing equipment. Heat-associated deaths are categorized based on the classification criteria listed below:

**Heat-caused (HC) deaths** are those in which environmental heat was directly involved in the sequence of conditions causing deaths. These are deaths where environmental heat terms were indicated in **Part I**<sup>1</sup> of the death certificate causes of death (diseases or conditions in the direct sequence causing death), for cause of death variables (cod\_a, cod\_b, cod\_c, or cod\_d). County of death: Maricopa.

**Heat-related (HR) deaths** are those in which environmental heat contributed to the deaths but was not in the sequence of conditions causing these deaths. These are cases where environmental heat terms were mentioned in **Part II**<sup>2</sup> of the death certificate causes of death (diseases and conditions contributing but not directly resulting in the death sequence), but not in any of the Part I death variables (cod\_a, cod\_b, cod\_c, or cod\_d). County of death: Maricopa.

For the purposes of this report, heat-caused and heat-related deaths are combined and referred to as “heat-associated deaths.” Please note that most jurisdictions report only heat-caused deaths. This should be considered when comparing Maricopa County data with data from other locations.

Death certificate data, in combination with the OME notes, are used to produce the information that is contained in this report. Total case counts, demographics, residency, drug/alcohol use, and years lived in Arizona are directly retrieved from death certificate data. Place of death location, indoor/outdoor occurrence, air conditioning use, and homelessness are retrieved based on explicit notations made in the death certificate and/or OME notes. For the purposes of this report, reasons for not having a cooled environment at the time of death in indoor cases where an A/C unit was present were grouped into three categories: nonfunctioning, functioning but turned off, and no electricity. “Non-functioning” is defined as an A/C unit that was not operating properly, was broken, or could not be turned on despite the presence of electricity. Cases categorized as having a “functioning but turned off” A/C unit indicates that the unit worked properly but the A/C was turned off for some reason at the time of the OME scene inspection. In cases where the unit could not be turned on due to a lack of electricity, regardless of whether it was functioning or non-functioning, were counted in the “no electricity” category.

Homelessness is defined as having an address on the death certificate that matches a homeless shelter, government agency, business, or intersection. Cases are also classified as homeless if there is an indication on the death certificate. If the address is listed as unknown on the death certificate, then an examination of the medical examiner's notes is made. The medical examiner learns if someone is homeless by speaking to next of kin, law enforcement, and reviewing medical records. If the address is listed as out of jurisdiction, then time spent in Arizona, as provided by the death certificate, is taken into consideration.

Once classification is completed, the data are summarized for the production and dissemination of reports. Reports are generated weekly during the season and posted to the MCDPH website which can be found at: [www.heataz.org](http://www.heataz.org).

<sup>1</sup> **Part I of the death certificate:** cod a – is the immediate cause (final disease or condition resulting in death) cod b, cod c, cod d – are sequentially listed conditions leading to the cause listed on cod a.

<sup>2</sup> **Part II of the death certificate:** Other significant conditions contributing to death but not resulting in the underlying cause given in Part I.

To receive additional data, please submit a data request form through the Maricopa County Public Health website [here](#). A staff member from the Climate and Health team will contact you to discuss your request.

You may also contact the Climate and Health Team through email:

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# Tables: Resident Death Rates

Rates per 100,000 residents calculated using surveillance data for 425 heat-associated deaths among confirmed Maricopa County residents and 2020 US Census Bureau population estimates.

**Table 1. Heat-associated death rates per 100,000 residents by age**

AGE GROUP	RATE PER 100,000
0 to 4	0.0
5 to 19	0.1
20 to 34	4.0
35 to 49	9.1
50 to 64	12.1
65 to 74	13.8
75+	16.8
<b>ALL AGES</b>	<b>7.2</b>

Residents aged 50 years and older are disproportionately impacted by heat-associated death in Maricopa County

**Table 2. Heat-associated death rates per 100,000 residents by sex**

SEX	RATE PER 100,000
Female	3.1
Male	11.3

Males had a 3x higher death rate than females per 100,000 in 2022.

**Table 3. Heat-associated death rates per 100,000 residents by race**

RACE	RATE PER 100,000
Black or African American	13.0
American Indian or Alaska Native	8.9
White Non-Hispanic	7.7
Hispanic or Latino	5.3
Asian or Pacific Islander	1.6

African Americans and American Indians have the highest rates of heat-associated death.

**Table 4. Heat-associated death rates per 100,000 residents by age group and sex**

AGE GROUP	MALE RATE PER 100,000	FEMALE RATE PER 100,000
0 to 4	0.0	0.0
5 to 19	0.2	0.0
20 to 34	8.4	0.5
35 to 49	15.4	2.0
50 to 64	21.5	3.1
65 to 74	17.1	11.0
75+	21.3	13.2

Across all age groups, male residents were more likely than female residents to suffer fatal heat-associated injuries

# Tables: Demographics & Details

**Table 5. Cause of death among heat-associated deaths by year**

YEAR	HEAT CAUSED	HEAT RELATED	TOTAL
2006	58	27	85
2007	38	13	51
2008	32	17	49
2009	47	27	74
2010	48	34	82
2011	57	49	106
2012	63	47	110
2013	42	33	75
2014	33	28	61
2015	45	39	84
2016	88	66	154
2017	90	89	179
2018	119	63	182
2019	138	61	199
2020	213	110	323
2021	194	145	339
2022	240	185	425
<b>TOTAL</b>	<b>1545</b>	<b>1033</b>	<b>2578</b>

**Table 7. Heat-associated deaths by race - 2022**

RACE	HEAT DEATHS
Not Specified	2
Asian or Pacific Islander	8
American Indian or Alaska Native	34
Black or African American	48
Hispanic or Latino	83
White	250

**Table 6. Heat-associated deaths by sex - 2022**

SEX	HEAT DEATHS
Male	343
Female	81
Unknown	1

**Table 8. Heat-associated deaths by education level - 2022**

EDUCATION LEVEL	HEAT DEATHS
8th Grade or less	18
Some High School	74
High School Diploma or GED	163
Some College	42
Associates	19
Bachelors	21
Masters or higher	10
Unknown	78

**Table 9. Heat-associated deaths by age group -2022**

AGE GROUP	HEAT DEATHS
0-4	0
5-19	2
20-34	56
35-49	105
50-64	134
65-74	67
75+	58
Unknown	3

# Tables: Residency & Place of Injury

**Table 10. Heat-associated deaths among Maricopa residents by year**

YEAR	MARICOPA RESIDENT HEAT DEATHS
2012	93
2013	67
2014	56
2015	65
2016	141
2017	171
2018	138
2019	165
2020	273
2021	267
2022	328

**Table 11. Heat-associated deaths by time in AZ - 2022**

TIME IN AZ	HEAT DEATHS
Unknown	275
< 3 Years	4
3-9 Years	8
10-19 Years	12
20+ Years	70

**Table 12. Heat-associated deaths by residency status - 2022**

TIME IN AZ	HEAT DEATHS
< 3 Years	2
3-9 Years	6
10-19 Years	5
20+ Years	70

**Table 13. Heat-associated deaths by place of injury by year**

YEAR	OUTDOOR	INDOOR
2012	63	46
2013	46	30
2014	44	17
2015	51	33
2016	93	59
2017	108	71
2018	129	51
2019	152	47
2020	271	46
2021	252	82
2022	336	86

**Table 14. Heat-associated deaths by place of injury and sex - 2022**

PLACE OF INJURY	MALE	FEMALE
Outdoor	50	36
Indoor	290	45

**Table 15. Heat-associated deaths by place of injury and welfare checks - 2022**

PLACE OF INJURY	WELFARE CHECK	NO WELFARE CHECK
Outdoor	10	326
Indoor	48	38

# Tables: Substance Use & Living Situation

**Table 16. Heat-associated deaths and substance involvement by year**

YEAR	ALCOHOL	DRUGS + ALCOHOL	DRUGS	NONE	TOTAL
2012	17	3	12	78	110
2013	12	2	12	49	76
2014	6	0	14	41	61
2015	9	2	20	53	84
2016	23	5	32	94	154
2017	16	1	56	106	179
2018	23	7	61	91	182
2019	19	6	77	97	199
2020	19	9	158	137	323
2021	34	13	156	136	339
2022	40	14	229	142	425

**Table 17. Heat-associated deaths and substance involvement - 2022**

INVOLVED SUBSTANCE USE	HEAT DEATHS
YES	283
NO	142

**Table 19. Cause of death among heat-associated deaths involving drugs - 2022**

CAUSE OF DEATH	HEAT DEATHS
Drug Caused	211
Drug Related	32

**Table 20. Heat-associated deaths and drug type among deaths involving drugs - 2022**

DRUG TYPE	HEAT DEATHS
Methamphetamine	226
Fentanyl	108
Polysubstance	63

**Table 18. Heat-associated deaths and living status by year**

YEAR	HOMELESS	NON-HOMELESS
2012	20	90
2013	21	55
2014	7	54
2015	8	76
2016	54	100
2017	57	122
2018	61	121
2019	66	133
2020	172	116
2021	130	177
2022	178	142



**Maricopa County**

**Department of Public Health**

**Division of Epidemiology and Informatics**