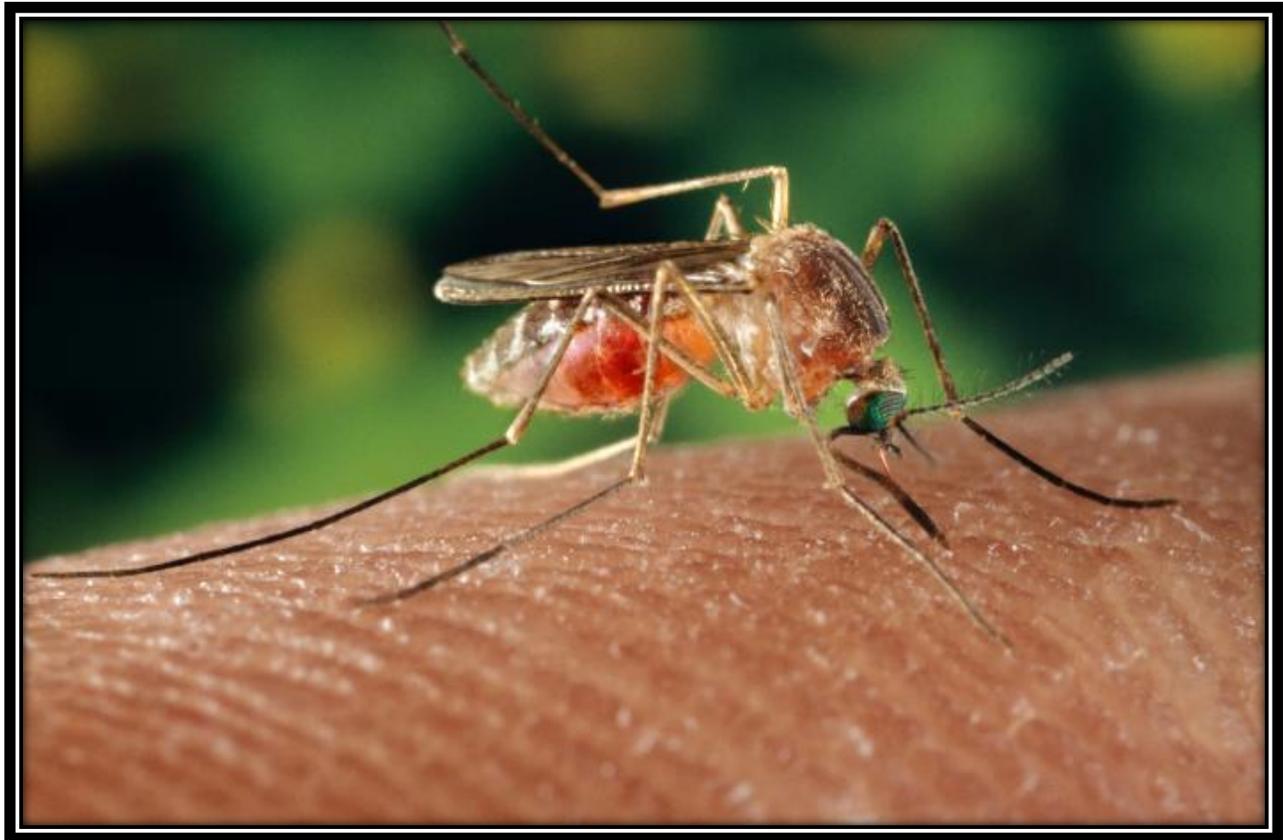


West Nile Virus in Maricopa County



A *Culex quinquefasciatus* mosquito on a human finger.

Image by James Gathany/ CDC gov/ public domain



Maricopa County Department of Public Health
Office of Epidemiology
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Commentary

West Nile virus (WNV) is a mosquito-borne virus that causes a non-specific, self-limited, febrile illness. Mosquitoes become infected when they feed on infected birds that have migrated into an area. The mosquitoes then bite people who may or may not become infected. The cycle of WNV occurs at an unusually high intensity when there is both a large number of infected birds and a high concentration of infected mosquitoes in a relatively small geographic area. Mosquitoes are the known carriers (vectors) of the virus from the host birds to humans. Humans and animals (i.e., horses) are incidental hosts in this bird-mosquito cycle, and thus cannot pass the virus to others. Because WNV causes death in birds, we expect dead birds to be the first warning of WNV activity in an area.

WNV is widespread in Africa, North America, Europe, the Middle East, India, Southeast Asia, Australia, the Caribbean and Central and South America. Although it is now widespread in the United States, WNV was not present in Arizona until 2003. WNV is now endemic in Maricopa County and is expected to be a public health concern indefinitely. WNV surveillance season begins April 1st and ends November 30th, however, in Arizona the majority of cases occur between the months of June and October, with cases as early as January and as late as November. All residents and visitors are urged to continue to take precautions against WNV infection every year.

The Maricopa County Department of Public Health (MCDPH) and the Maricopa County Department of Environmental Services (MCDES) work closely to educate and protect the residents of Maricopa County against WNV. MCDES has an extensive mosquito-trapping program that enables staff to identify areas where there is a lot of mosquito activity and to detect mosquito-borne diseases. Various types of mosquito traps are set up throughout the county that collect mosquitoes for testing. These mosquitoes are pooled together, by species, into groups of 1-50 mosquitoes. This collection of mosquitoes is called a mosquito pool. The mosquitoes are then ground up and tested for WNV and other mosquito-borne diseases. MCDES responds to complaints regarding green (unattended) swimming pools, stagnant water, dead birds, and mosquitoes.

MCDPH is responsible for monitoring the interaction of the virus with humans. Working with hospitals and medical providers throughout the county, MCDPH conducts disease surveillance to find “hot spots” in the Valley where there are a particularly high number of people with WNV. MCDPH nurses and epidemiologists monitor patients with potential

WNV symptoms who seek medical care, monitor disease patterns in order to stop transmission of the virus, and assist the public by giving recommendations for controlling the spread of or exposure to WNV in different settings.

The majority (~80%) of people infected with WNV will show no symptoms at all. For those that are symptomatic (~20%), symptoms will appear 2-14 days after receiving the mosquito bite. Symptomatic cases are characterized by the acute onset of fever, headache, arthralgias, myalgias, and sometimes accompanied by a maculopapular rash or lymphadenopathy. Rarely do symptoms get more severe; however, 1-3% of symptomatic infections will develop into a neuroinvasive form of the disease. In neuroinvasive West Nile Virus, the central nervous system (CNS) is involved and clinical syndromes ranging from meningitis (inflammation of the lining of the brain and spinal cord) to encephalitis (inflammation of the brain), or acute paralysis can occur. There is no treatment for WNV; only supportive care can be given.

Between January 1, 2011 and December 31, 2011, the MCDPH received reports of 50 residents infected with WNV, 45 of whom developed symptoms, and 5 of whom had no symptoms¹. Two of the symptomatic individuals died from the disease. Because WNV neuroinvasive disease cases are more severe, they are considered to be more consistently detected and reported than non-neuroinvasive disease cases. Of the 45 symptomatic individuals in 2011, 31 (69%) had neuroinvasive illness. It has been estimated that for every case of WNV neuroinvasive disease detected, approximately 140 infections occur. Using this method, it can be estimated that there were 4,340 infections and 868 non-neuroinvasive disease cases in residents of Maricopa County in 2011.

In contrast to the unusual focal outbreak of WNV that occurred early in the East Valley of Maricopa County in 2010, the 2011 season returned to the usual disease pattern, with low numbers of WNV cases reported in residents valley-wide. The reasons for the outbreak in 2010 or for the return to near baseline endemic levels in 2011 are not well understood and are being investigated.

The following pages summarize the incidence of WNV cases in humans by age, gender, case classification and by city of residence. In addition, WNV surveillance indicators and mosquito pools are also summarized.

¹ WNV detected through screening of blood donors

Figure 1. WNV Cases in Humans in Maricopa County by Month of Onset, 2006-2011

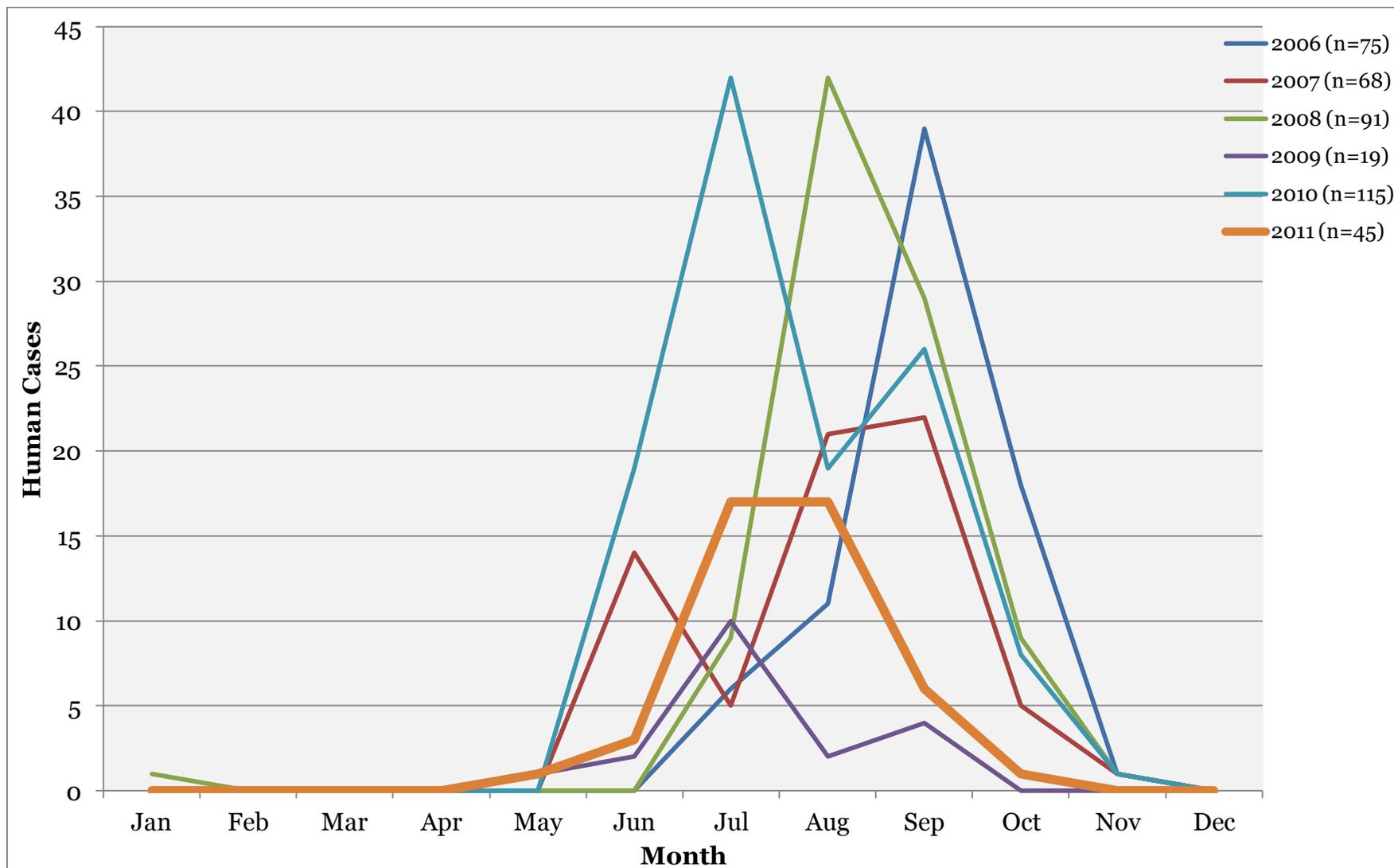
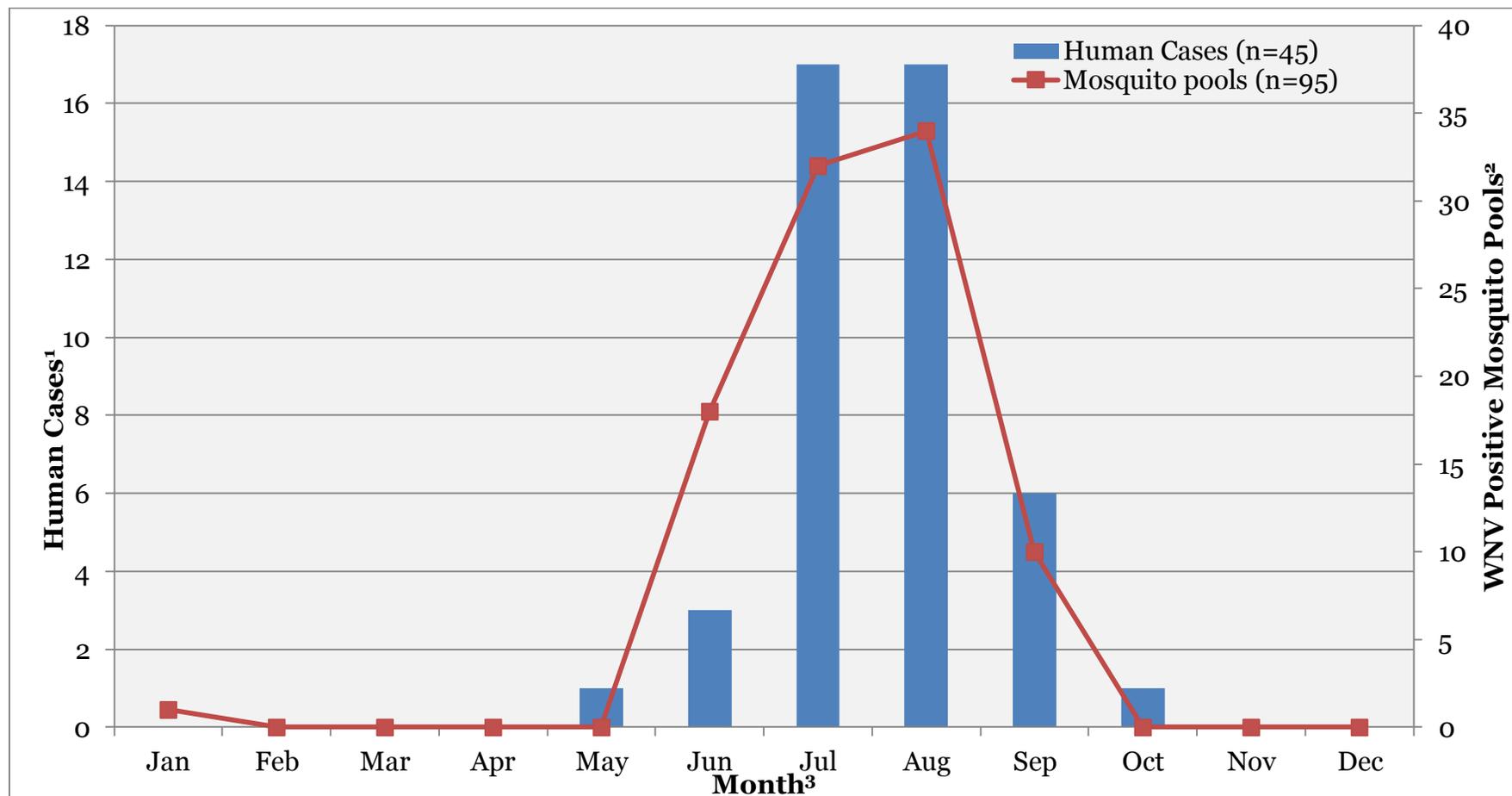


Figure 2. WNV Cases in Humans and WNV Positive Mosquito Pools in Maricopa County by Month, 2011



¹ A human case is an individual infected with WNV and with a clinically compatible illness.

² Mosquito pools are a collection of mosquitoes that have been collected from a county trap that are pooled together, by species, into groups of 1-50 mosquitoes and then ground up and tested for WNV.

³ Human data are based on the date of symptom onset. Mosquito data are based on date specimen was collected. Since WNV has an incubation period ranging from 2-14 days, it is expected that there will be a lag between mosquito and human case onsets; however this was not the case in 2011.

Figure 3. West Nile Virus Surveillance Indicators: Dates of First Positive Findings in a Mosquito Pool and Onset in a Human in Maricopa County, 2011

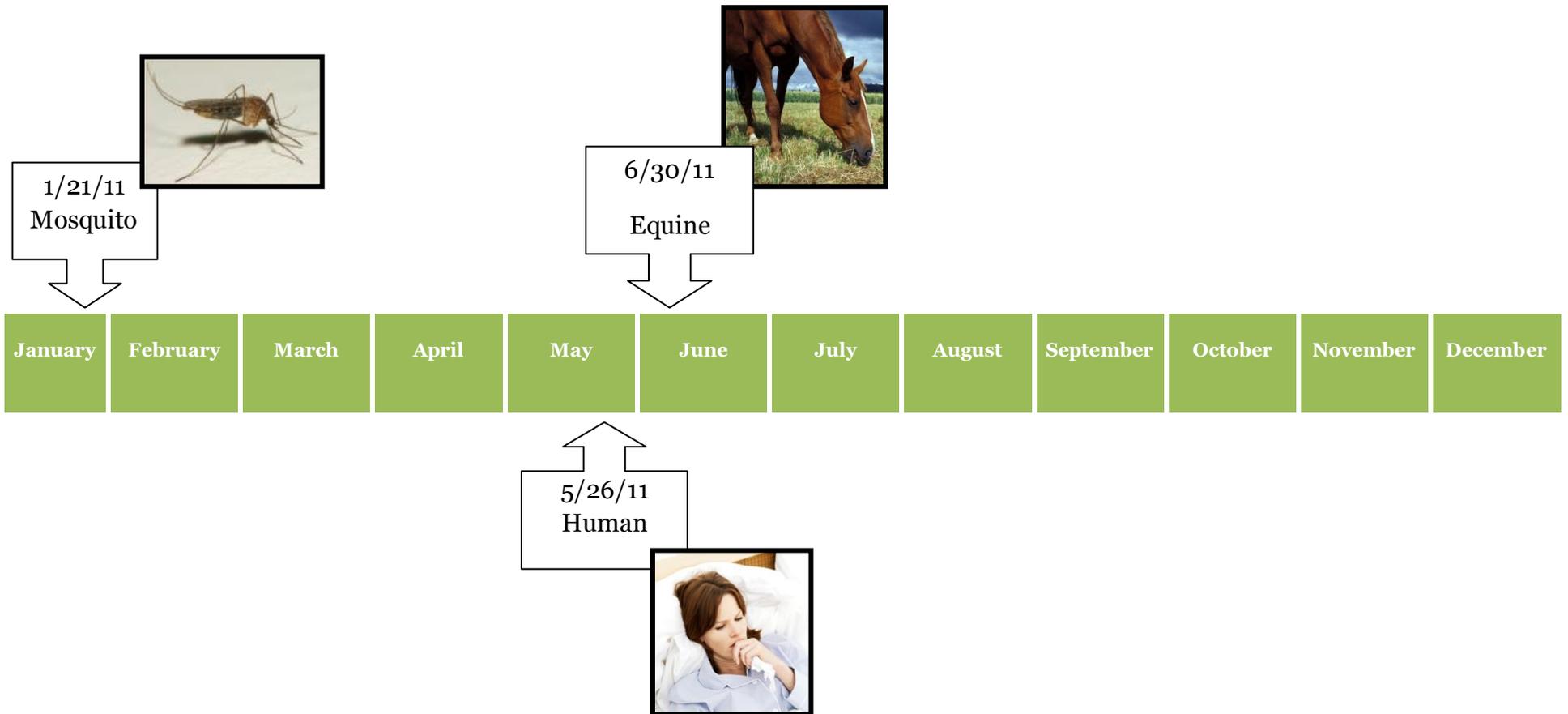


Table 1. West Nile Virus Cases in Maricopa County by Gender and Case Classification, 2011

Case Classification ¹	WNV Cases			% of Total Cases
	Male	Female	Total	
Meningitis	8	8	16	36
Encephalitis	8	5	13	29
Paralysis Syndrome	2	0	2	4
Neuroinvasive Disease Total	18	13	31	69
Fever	8	5	13	29
Fever in Viremic Donors ²	0	1	1	2
Non-Neuroinvasive Total	8	6	14	31
Total	26	19	45	100
Viremic Donors Asymptomatic	4	1	5	-

¹ Case Classification may differ from the numbers reported by Arizona Department of Health Services.

²Fever in a viremic donor cases are included in fever cases throughout the rest of this report.

Case Classifications:

The Maricopa County Department of Public Health uses the Centers for Disease Control and Prevention’s (CDC) case definition to confirm a case of West Nile virus. A case of WNV is a clinically compatible illness that is West Nile virus laboratory confirmed. WNV infection can be asymptomatic or result in a febrile illness of variable severity sometimes associated with CNS involvement. Cases of WNV are classified either as neuroinvasive or non-neuroinvasive, which are explained below:

Non-Neuroinvasive West Nile Virus: Requires, at minimum, the presence of documented fever, as measured by the patient or clinician, the absence of neuroinvasive disease, and the absence of a more likely clinical explanation for the illness.

- **Fever:** A non-localized, self-limited febrile illness characterized by the acute onset of fever, headache, arthralgias, myalgias, and sometimes accompanied by a maculopapular rash or lymphadenopathy.

Neuroinvasive West Nile Virus: Requires the presence of fever, the absence of a more likely clinical explanation for the illness, and at least one of the following documented by a physician:

1. Acutely altered mental status (e.g., disorientation, obtundation, stupor, or coma)
2. Acute signs of central or peripheral neurologic dysfunction (e.g., paresis or paralysis, nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions, or abnormal movements)
3. Pleocytosis (increased white blood cell concentration in cerebrospinal fluid [CSF]) associated with illness clinically compatible with meningitis (e.g., headache or stiff neck)

Neuroinvasive cases are classified using the following categories:

- Meningitis: WNV meningitis is characterized by fever, headache, stiff neck, and pleocytosis.
- Encephalitis: WNV encephalitis is characterized by fever, headache, and altered mental status ranging from confusion to coma with or without additional signs of brain dysfunction (e.g., paresis or paralysis, cranial nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions, and abnormal movements).
- Paralysis syndrome: No CDC case definition for this syndrome exists at the present time. The criteria applied to Maricopa County cases are:
 - Laboratory confirmed acute WNV-infection; AND
 - Physician documented acute paralysis.

Viremic Donor: The CDC defines a WNV positive viremic donor as a person who donated blood and had a positive test when screened for the presence of West Nile virus. Viremic donors are followed up by the blood agency to verify their infection with additional tests. Some viremic donors will remain asymptomatic, but others will go on to develop symptoms.

- Asymptomatic Viremic Donor: Viremic donors who do not become symptomatic are not included in case numbers. The criteria applied to Maricopa County cases are:
 - Laboratory confirmed acute WNV-infection; AND
 - No report of symptoms.
 - Symptomatic Viremic Donor: Once the symptoms are reviewed, the case will be classified as a confirmed case of viremic donor encephalitis, viremic donor meningitis, viremic donor paralysis syndrome, or viremic donor fever. The criteria applied to Maricopa County cases are:
 - Laboratory confirmed acute WNV-infection; AND
 - A report of symptoms compatible with West Nile fever, meningitis, encephalitis, or paralysis syndrome (see above definitions).
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For more information visit:

CDC Arboviral Diseases, Neuroinvasive and Non-Neuroinvasive 2011 Case Definition:

http://www.cdc.gov/osels/ph_surveillance/nndss/casedef/arboviral_current.htm

Arizona Department of Health Services Case Definitions for Reportable Communicable Morbidities:

<http://www.azdhs.gov/phs/oids/pdf/casedefinitions.pdf>

Figure 4. West Nile Virus Cases in Maricopa County by Gender and Case Classification, 2011 (n=45)

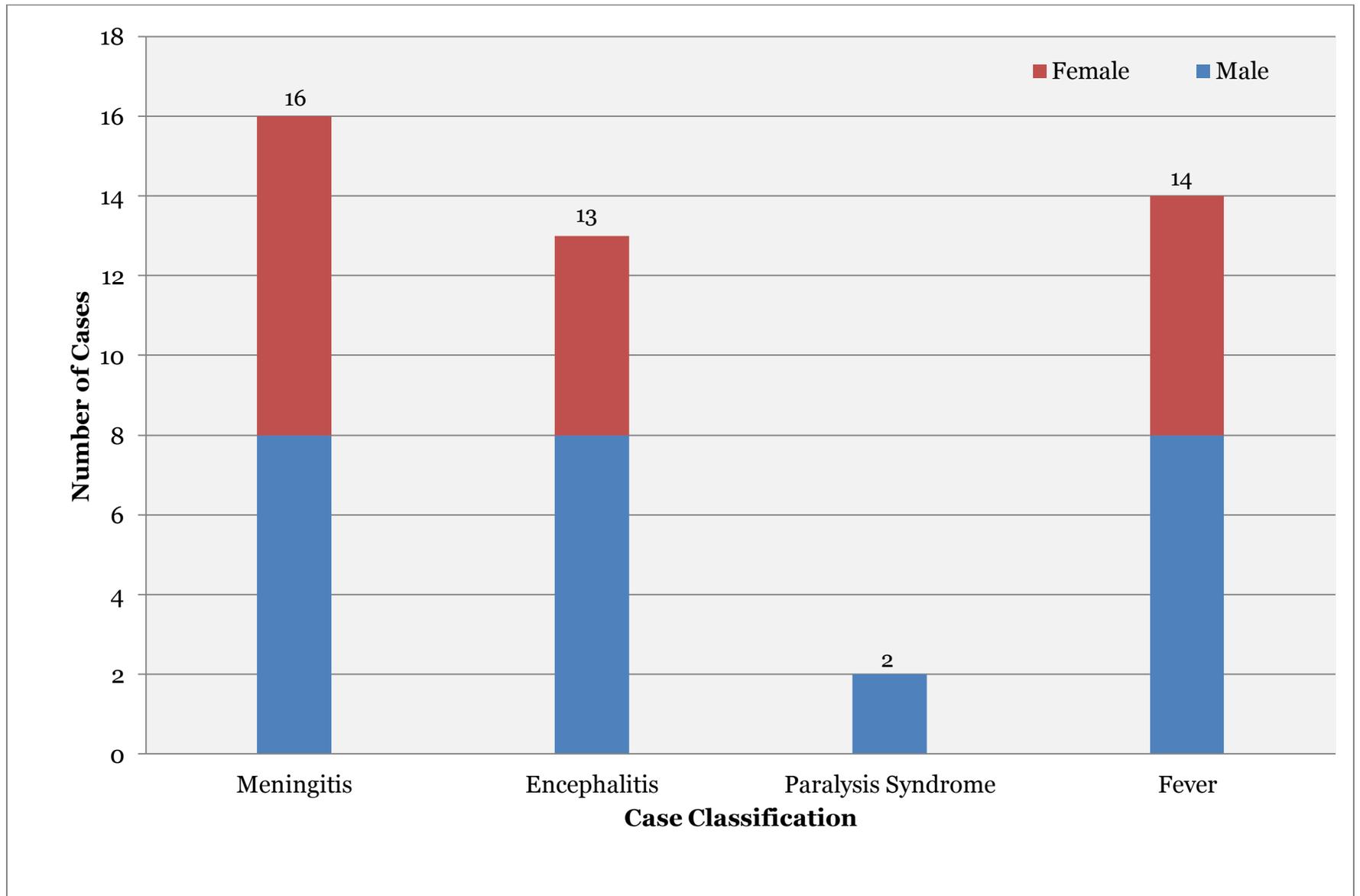


Figure 5. West Nile Virus Cases in Maricopa County by Case Classification, 2006- 2011

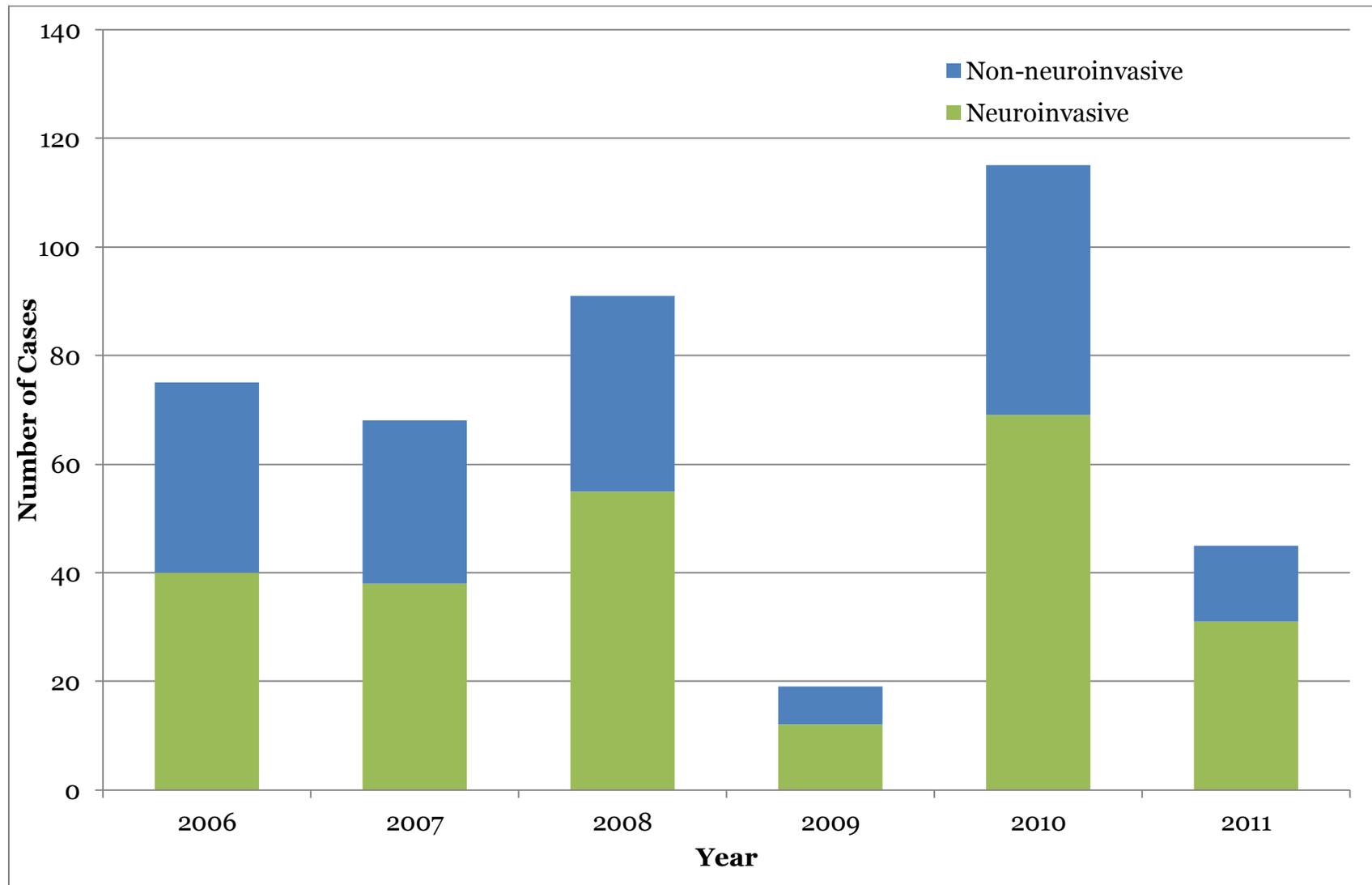


Table 2. Mean, Median, and Range of Ages of West Nile Virus Deaths and Survivors in Maricopa County, 2011

	Mean Age	Median Age	Age Range
Died (n=2)	81.5	81.5	81-82
Survived (n=36)	58.8	57	29-85
Total (n=45)	60	58	29-85

Mean age of West Nile virus survivors vs. deaths was significantly different, $p < 0.05$

Figure 6. West Nile Virus Deaths in Maricopa County by Gender, 2006-2011 (n=30)

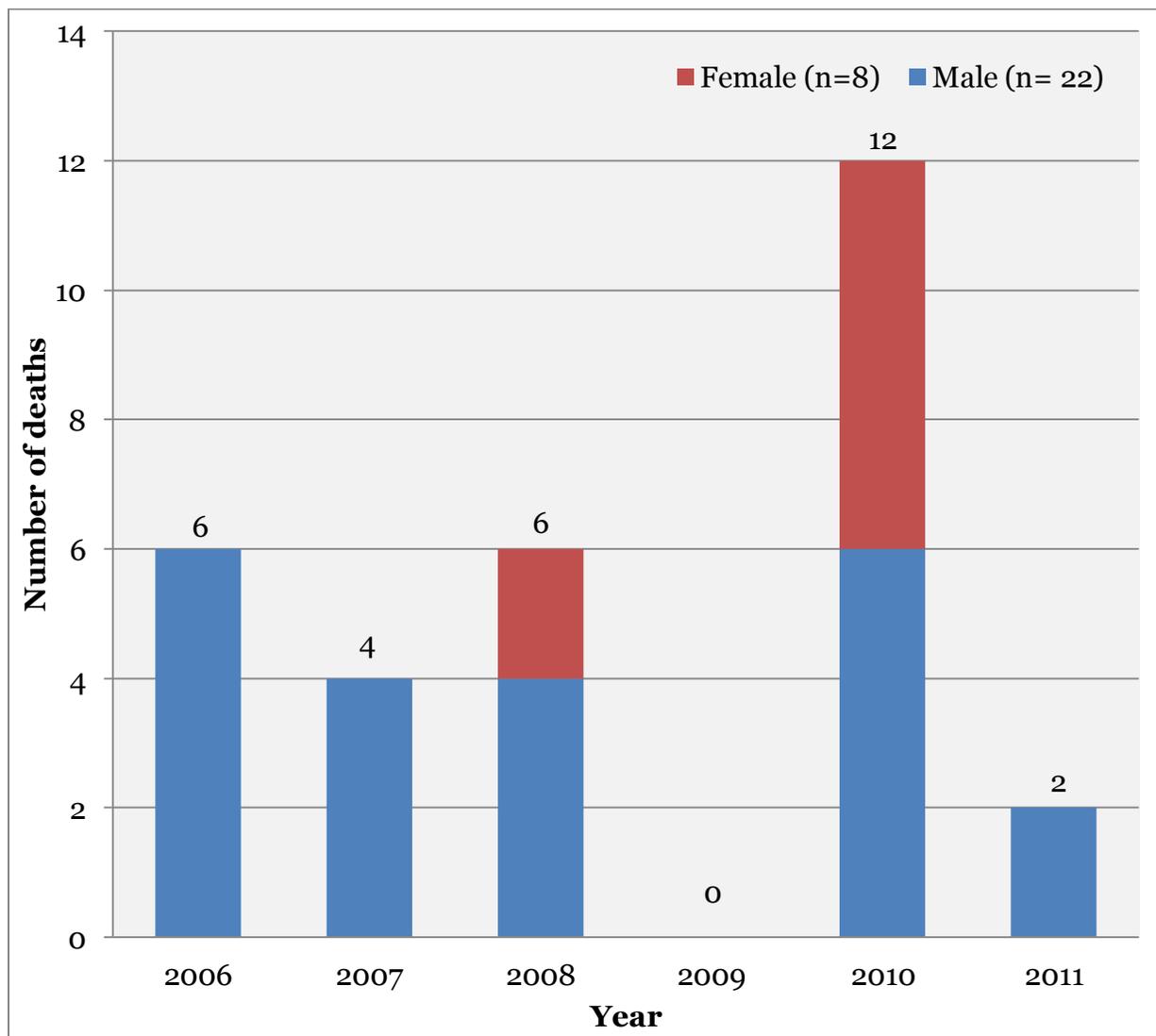


Table 3. Mean, Median, and Range of Ages of West Nile Virus Cases in Maricopa County, 2011 (n=45)

	Mean Age	Median Age	Age Range
Neuroinvasive ¹ (n=31)	60.6	58	29-85
Non-Neuroinvasive (n=14)	58.7	57.5	38-77
Total (n=45)	60	58	29-85

¹ Mean age of West Nile virus neuroinvasive cases vs. non-neuroinvasive cases was not significantly different, $p > 0.05$

Figure 7. West Nile Virus Cases in Maricopa County by Age and Case Classification, 2011 (n=45)

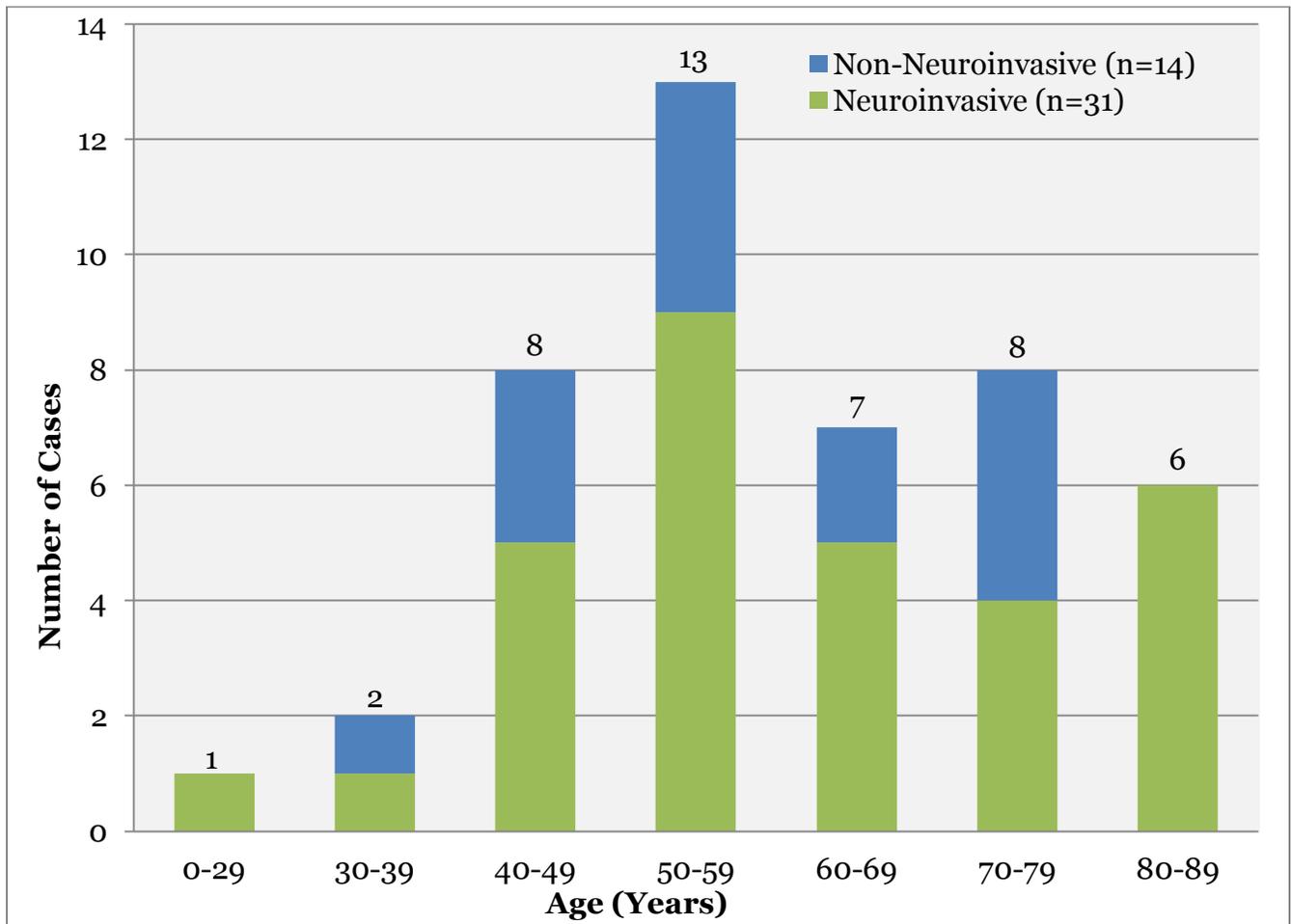


Figure 8. Mean Ages in Years of West Nile Virus Cases in Maricopa County by Case Classification, 2006-2011

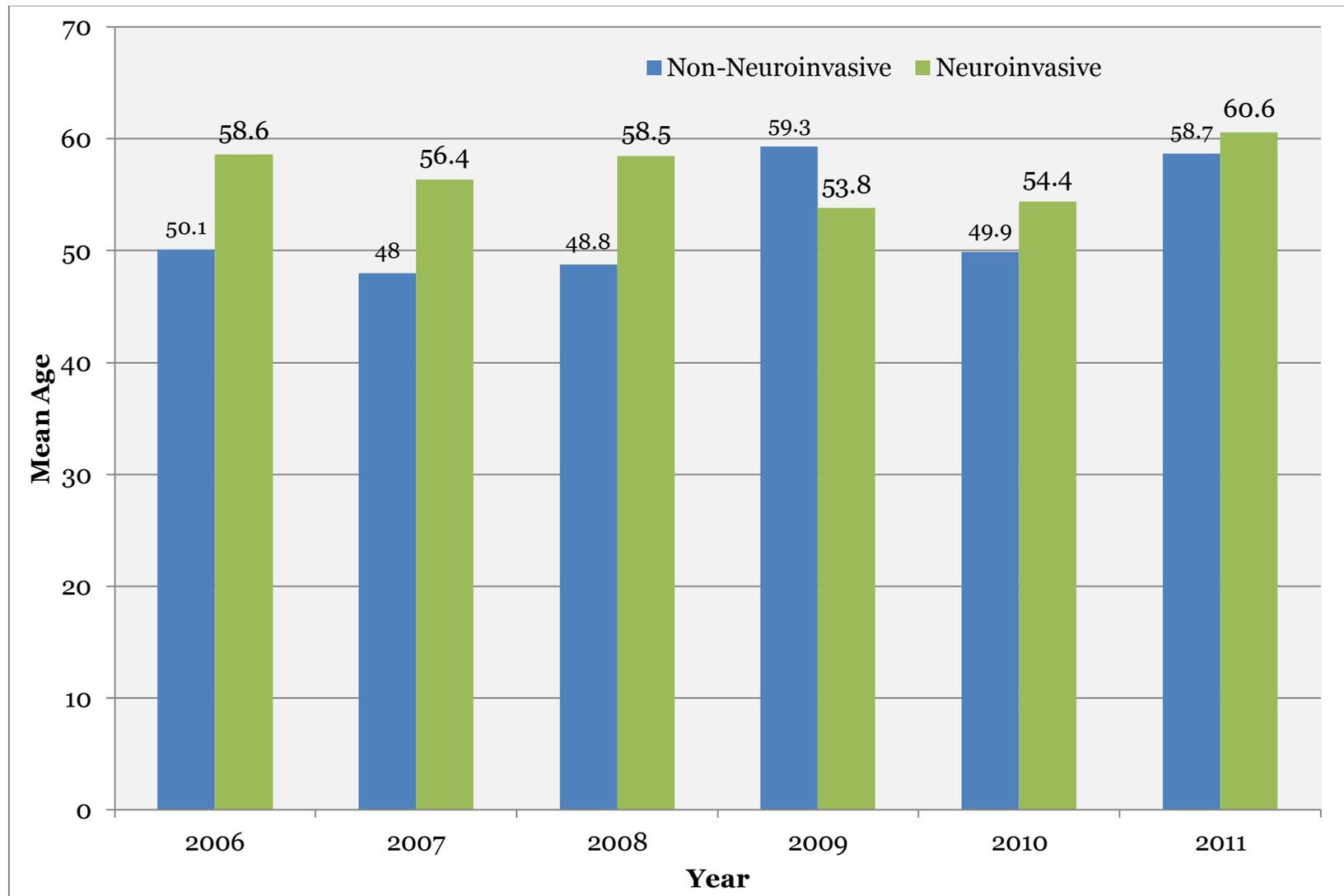
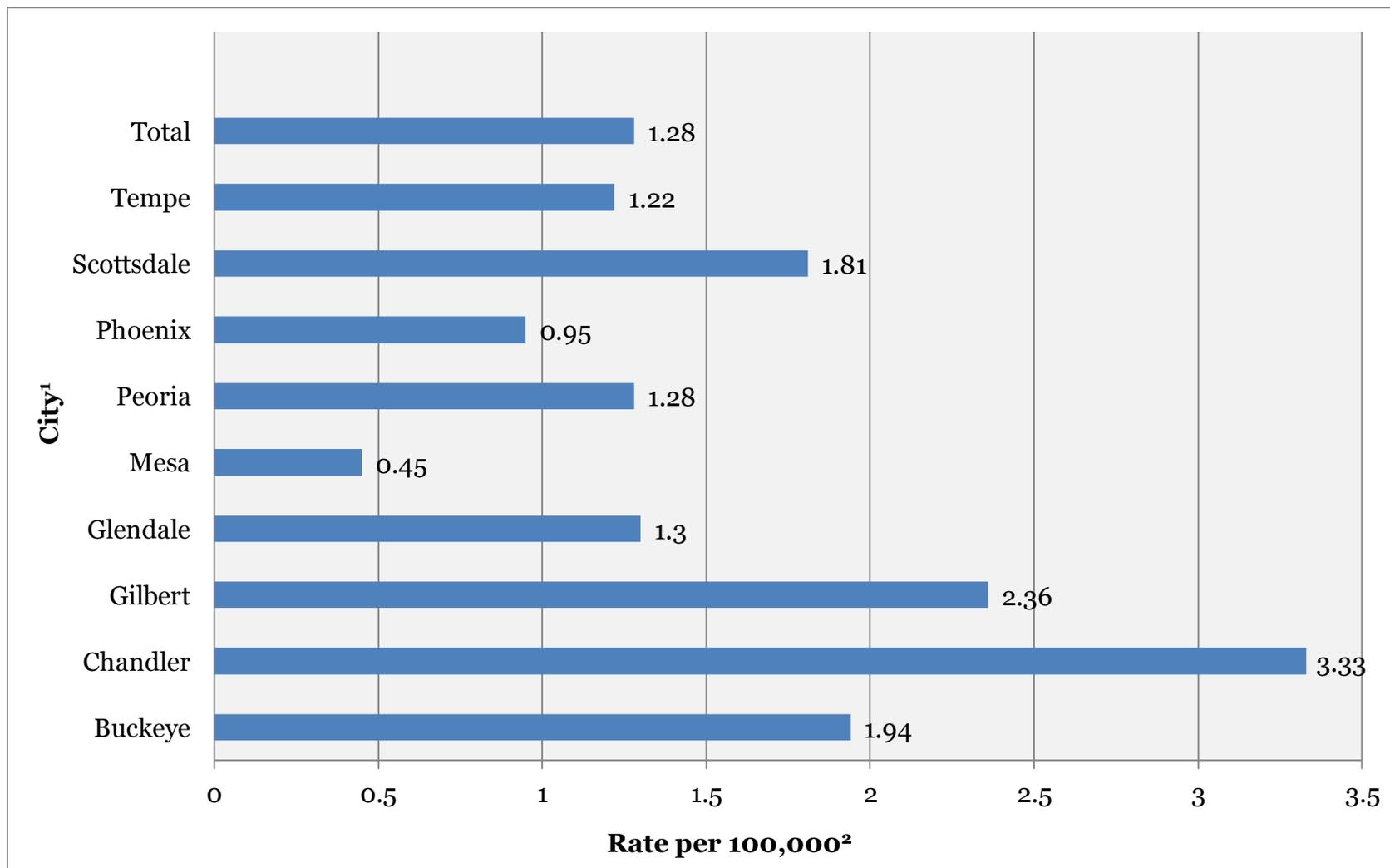


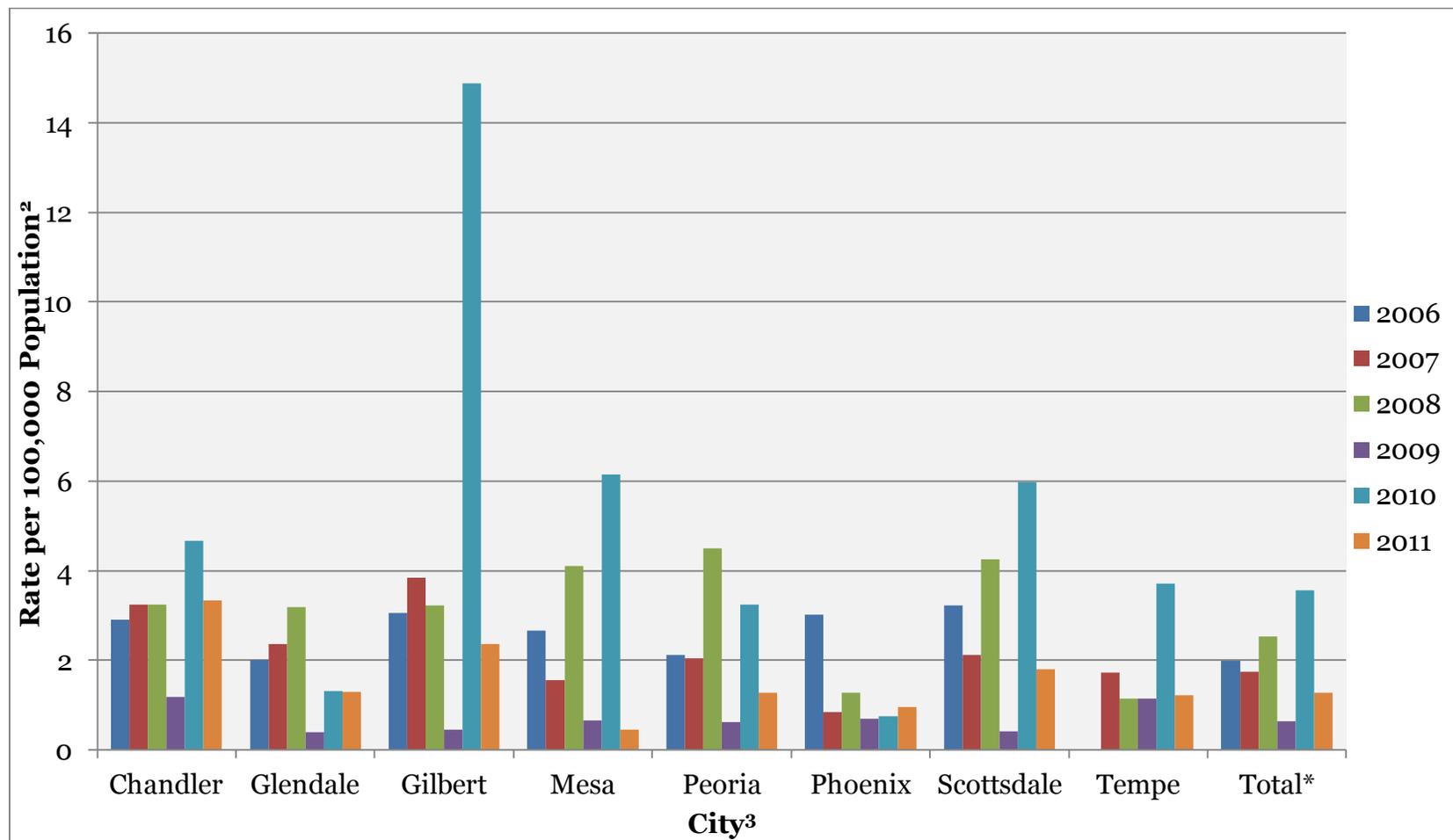
Figure 9. Rates of West Nile Virus in Maricopa County by City, 2011



¹ Population statistics for each city were obtained from United States Census Bureau 2011 population estimates.

² Rate per 100,000 population = (N/population) * 100,000.

Figure 10. Rates of West Nile Virus in Maricopa County by City¹, 2006-2011⁴



¹ Rates shown for the top 8 cities by population in Maricopa County.

²Rate per 100,000 population = (N/population) * 100,000.

³Population statistics for each city were obtained from United States Census Bureau 2006, 2007, 2008, 2009, and 2011 estimates and from the 2010 Census.

⁴In 2010 there was an East Valley outbreak.

*Total includes cities displayed in figure, as well as other cities and unincorporated areas with <5 cases.