Arbovirus Activity in Texas
2012 Surveillance Report

May 2014

Texas Department of State Health Services
Infectious Disease Control Unit
Zoonosis Control Branch

Overview

Viruses transmitted by mosquitoes are referred to as arthropod-borne viruses or arboviruses. Six major arbovirus groups that infect humans are endemic in or can be involved in local transmission in Texas, including West Nile virus (WNV), Saint Louis encephalitis virus (SLEV), Eastern equine encephalitis virus (EEEV), Western equine encephalitis virus (WEEV), California serogroup viruses (CAL), and dengue virus (DENV). In 2012, arbovirus activity in Texas was attributed to WNV (99%), DENV (<1%), EEEV (<1%), SLEV (<1%) and CAL (<1%) (Table 1).

Table 1. Year-End Arbovirus Activity Summary, Texas, 2012

Virus	Mosquito	Avian	Equine	Human						TOTAL
				Fever	Neuroinvasive	Hemorrhagic Fever	Total (Human)	Deaths	PVD‡	
CAL	2				3		3			5
DENV				16			16			16
EEEV			2							2
SLEV				2	1		3			3
WNV	1,403	211	121	1,024	844		1,868	89	103	3,603
TOTAL	1,405	211	123	1,042	848		1,890	89	103	3,629

CAL - California serogroup includes California encephalitis, Jamestown Canyon, Keystone, La Crosse, Snowshoe hare and Trivittatus viruses.
DENV – Dengue virus
EEEV – Eastern equine encephalitis virus
WNV - West Nile virus
SLEV - Saint Louis encephalitis virus
‡PVD-Presumptive viremic blood donors (PVDs) are people who had no symptoms at the time of donating blood through a blood collection agency, but whose blood tested positive when screened for the presence of West Nile virus. Unless they meet the case reporting criteria, they are not counted as a case for official reporting purposes and are not included in the "total reports" column.

California Serogroup Viruses

CAL serogroup viruses found in the United States include California encephalitis virus (CE), Jamestown Canyon virus, Keystone virus, La Crosse (LACV), Snowshoe hare virus and Trivittatus virus. These viruses are maintained in a cycle between *Aedes triseriatus* and vertebrate hosts in forest habitats. In the U.S., approximately 80-100 reported cases of human neuroinvasive disease are caused by LACV each year. Most of the cases have been reported from mid-Atlantic and southeastern states. From 2002-2012, Texas reported 5 cases of human CAL neuroinvasive disease (range: 0-3 cases): 1 case of human CE neuroinvasive disease and 4 cases of human LACV neuroinvasive disease. In 2012, 1 LACV positive mosquito pool and 1 CAL positive mosquito pool were reported in Orange County. Three cases of human LACV neuroinvasive disease were reported during 2012: 1 in Hardin County and 2 in Harris County.

Dengue Virus

DENV is a flavivirus maintained in a cycle between *Aedes aegypti* or *Ae. Albopictus* and human hosts. It is a re-emerging vector-borne disease that is endemic throughout the tropics and subtropics, including northern Mexico. Human cases are most often imported to the U.S. as a result of travel to a dengue-endemic country, but locally acquired cases have been reported in Florida, Hawaii and Texas. From 2002-2012, Texas reported 163 cases of dengue (median=14 cases, range: 1-32 cases). During this time, 4 cases of locally acquired dengue were reported: 3 in Cameron County and 1 in Hidalgo County. In 2012, Texas reported 16 cases of dengue; all were imported from endemic countries.

Eastern Equine Encephalitis Virus

EEEV is an alphavirus maintained in a cycle between *Culiseta melanura* mosquitoes and avian hosts in freshwater swamps. *Cs. melanura* is not considered to be an important vector of EEEV to humans because it feeds almost exclusively on birds. Transmission to humans requires a mosquito species, such as *Aedes*, *Coquillettidia* or *Culex*, capable of creating a "bridge" between infected birds and uninfected mammals. Eastern equine encephalitis (EEE) is a rare illness in humans and only a few cases are reported in the U.S. each year. Most cases of EEE have been reported from Florida, Georgia, Massachusetts, and New Jersey. The habitat in northeast Texas, bordering Louisiana, is suitable for EEEV transmission and EEEV-infected horses have been reported from this part of the state. From 2002-2012, Texas reported 70 horses infected with EEEV (median=2 cases, range: 0-29 cases). During this same period, no human cases of EEE or EEEV-positive mosquito pools were reported. In 2012, 2 EEEV-infected horses were reported: 1 in Hardin County and 1 in Orange County.

Saint Louis Encephalitis Virus

SLEV is a flavivirus maintained in a cycle between *Culex* species mosquitoes and birds. The geographic range of Saint Louis encephalitis (SLE) extends from North to South America, but the majority of cases have occurred in the eastern and central U.S., where periodic epidemics have occurred since the 1930s. In Texas and states with milder climates, SLE can occur year round. From 2002-2012, Texas reported 51 cases of human SLE disease (median=4 cases, range: 0-18 cases). In 2012, no positive mosquito pools were reported, and three human disease cases were reported: 2 fever cases and 1 case with neuroinvasive disease, all from Harris County.

West Nile Virus

WNV is a flavivirus maintained in a cycle between mosquitoes (primarily *Culex* species) and birds. Mosquitoes with WNV can also bite and infect people, horses and other mammals. WNV is found in Africa, India, Australia, the Middle East, Europe, and most recently, North America. Before 1999, WNV had not been documented in the Western Hemisphere. In 1999, human disease associated with WNV infection was identified in New York City. By the end of October 1999, WNV infections had been confirmed in multiple native species of birds as well as horses from New York City and areas within a 200-mile radius of the city. Since 1999, WNV infections in humans, birds, equines, other animals, and mosquitoes have been reported throughout the continental U.S.

The Texas Department of State Health Services (DSHS) has conducted surveillance for WNV since its arrival in Texas in 2002. The first big surge in the number of human cases of WNV disease occurred in 2003 with nearly 750 reported cases. In the years to follow, reported cases of human WNV disease decreased but remained stable. In 2011, Texas reported the lowest number of human WNV disease cases, since its arrival in the state. In 2012, a record high number of cases was reported (Figure 1). From 2002-2012, 4,070 cases of human WNV disease were reported in Texas (median=195 cases, range: 27-1,868 cases).

In 2012, some evidence of WNV activity (human, horse, bird or mosquito) was reported in 148 (58%) of the 254 Texas counties (Figure 2). Twenty-one counties (8%) reported WNV-positive mosquito pools, 134 (53%) reported human WNV disease cases, 68 (27%) reported WNV-infected horses, and only 1 county (<1%) reported WNV-positive birds*.

*Harris County is the only Texas County currently testing birds for WNV

Figure 1. Reported Human WNV Disease Cases Reported in Texas, 2002-2012

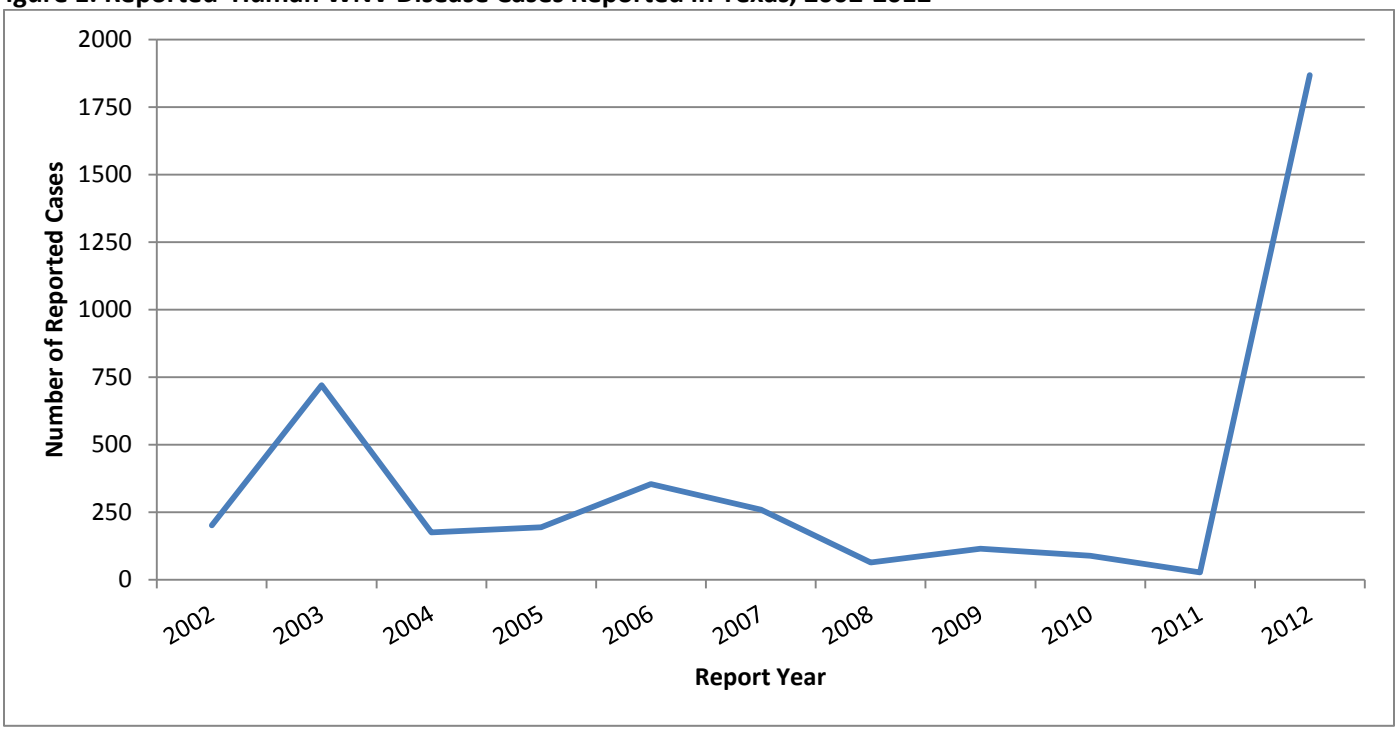
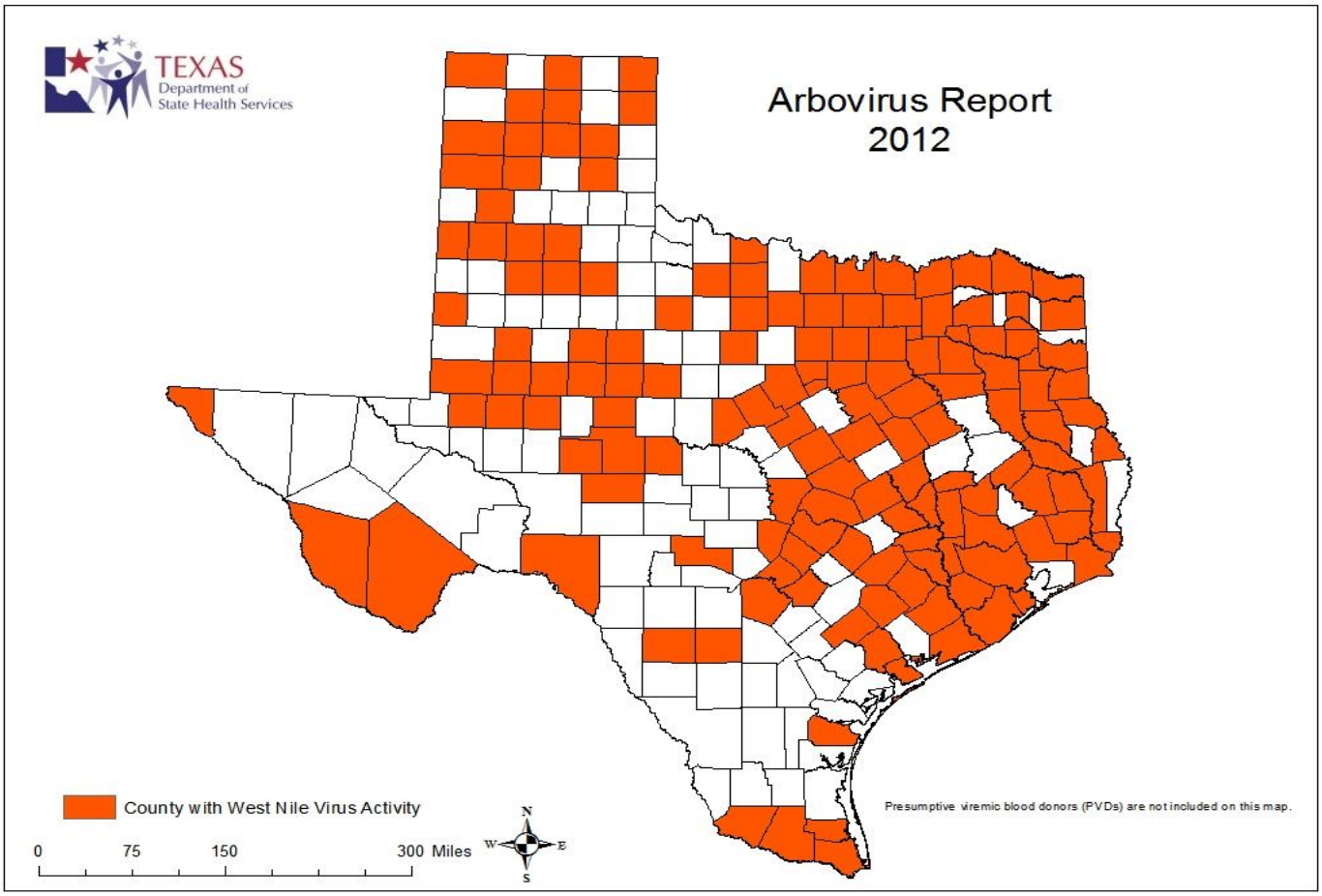


Figure 2. Texas Counties Reporting any WNV Activity, 2012**



**Counties with no WNV activity may be due to the absence of an active surveillance program.

In 2012, 1,403 WNV-positive mosquito pools, 211 birds, 121 horses and 1,868 human disease cases were reported (Table 2). Dallas, Harris and Montgomery Counties reported the highest number of positive mosquito pools. Counties reporting the greatest number of positive horses included Smith, Montgomery and Harris. A total of 103 presumptive viremic blood donors (PVD) were identified by blood collection agencies, the majority of which resided in Dallas or Tarrant County.

Table 2. WNV Activity Reported by County, Texas, 2012

County	WNV						
	M	A	E	H			
				WNF	WNND	PVD‡	TOTAL
Andrews				2	10		12
Angelina			1	10	9	3	19
Archer				2			2
Austin			2	1			1
Bailey			1	3			3
Bastrop				3	3		6
Baylor			1				
Bell			1	3	7	1	10
Bexar				12	19		31
Blanco					1		1
Bowie				6	8	1	14
Brazoria	11		3	4	4		8
Brazos	71		2	5	8		13
Brewster				1			1
Brown				1	1		2
Burleson			1	1			1
Burnet				1	1		2
Calhoun					1		1
Cameron	2		2	1	1	1	2
Camp					1		1
Carson				1	2		3
Cass			2	1	1	1	2
Castro				2	1		3
Cherokee			1	6	2		8
Coke			1				
Collin	29		3	42	22	5	64
Colorado					1		1
Comal				1			1
Comanche				1			1
Concho					2		2
Cooke			1	3	3		6
Coryell					1		1
Crosby				3			3
Dallam			1				
Dallas	167		3	221	175	14	396
Dawson					2		2
Deaf Smith				1	1		2
Denton	75			129	54	6	183
DeWitt				1	1		2
Dickens				1			1
Donley			1				
Ector			3	5	6		11
El Paso	8			11	21	4	32
Ellis	6		1	17	9	1	26

County	WNV						
	M	A	E	H			
				WNF	WNND	PVD‡	TOTAL
Erath			2	1		1	1
Fannin			1	1	1	1	2
Fayette				4	1		5
Fisher				1			1
Floyd				1			1
Fort Bend	21		2	10	4	1	14
Freestone			1		1		1
Frio				2			2
Galveston	13		1		1	1	1
Glasscock					1		1
Gray			1				
Grayson			2	6	6		12
Gregg			4	13	17	1	30
Grimes					2		2
Guadalupe				2	2		4
Hale				2	2		4
Hamilton			1				
Hansford				1	1		2
Hardin			1				
Harris	501	211	5	44	57	9	101
Harrison			1	3	3	2	6
Haskell			1				
Hays				1	5		6
Hemphill				1			1
Henderson				3	1		4
Hidalgo			3	1	2		3
Hill			2	2			2
Hood				3	2		5
Hopkins			3		3		3
Howard					1		1
Hunt			2	5	10		15
Hutchinson				1			1
Irion			1				
Jack			1	1			1
Jasper			1				
Jefferson	10		1	6	4	2	10
Johnson				7	6	1	13
Kaufman			1	3	8		11
Kerr				1			1
Lamar			1	7	4		11
Lamb					1		1
Lavaca					1		1
Liberty			2		4		4
Limestone				3	1		4
Lipscomb					1		1
Lubbock	3		1	4	13		17
Madison				1			1
Martin					1		1
Matagorda			1				
McLennan			2	13	31	2	44
Midland			1	3	3		6
Milam			1		1		1

County	WNV						
	M	A	E	H			
				WNF	WNND	PVD‡	TOTAL
Mitchell				2			2
Montague				1	1		2
Montgomery	199		5	9	8	2	17
Moore					1		1
Nacogdoches			3				
Navarro				5	3		8
Nolan				1			1
Nueces	24			4	4		8
Oldham					1		1
Orange	4			2		1	2
Panola				3	3		6
Parker			2		6	1	6
Polk					1		1
Potter				3	1		4
Presidio				2			2
Rains					1		1
Randall			4	9	9	1	18
Red River			3	1			1
Robertson			1	2	2		4
Rockwall				2	1		3
Rusk			1	3	9		12
Sabine			1	1			1
Schleicher				5	1		6
Scurry			1	1			1
Shelby			1	1		1	1
Smith			6	9	13	3	22
Somervell			1				
Starr				1			1
Stephens				2			2
Tarrant	103			154	105	24	259
Taylor	1			1	2		3
Titus				4	2		6
Tom Green				10	3	1	13
Travis	126		4	92	59	7	151
Trinity					1		1
Tyler			1				
Upshur				2			2
Val Verde					1		1
Van Zandt				6	2	1	8
Victoria				1	1		2
Walker				2			2
Waller			4		1	1	1
Washington			1		1		1
Wharton					3	1	3
Wichita	28			5		1	5
Willacy			1		1		1
Williamson	1		1	14	12		26
Wise				2	3		5
Wood			1	2			2
Yoakum				1			1
Young			1		1		1
Zavala					1		1

County	WNV						
	M	A	E	H			
				WNF	WNND	PVD‡	TOTAL
Total Number of Reports	1,403	211	121	1,024	844	103	1,868

M-mosquito A-avian E-equine H-human
WNF–West Nile fever
WNND-West Nile neuroinvasive disease
‡PVD-Presumptive viremic blood donors are people who had no symptoms at the time of donating blood through a blood collection agency, but whose blood tested positive when screened for the presence of West Nile virus. Unless they meet the case reporting criteria, they are not counted as a case for official reporting purposes and are not included in the "total reports" column.

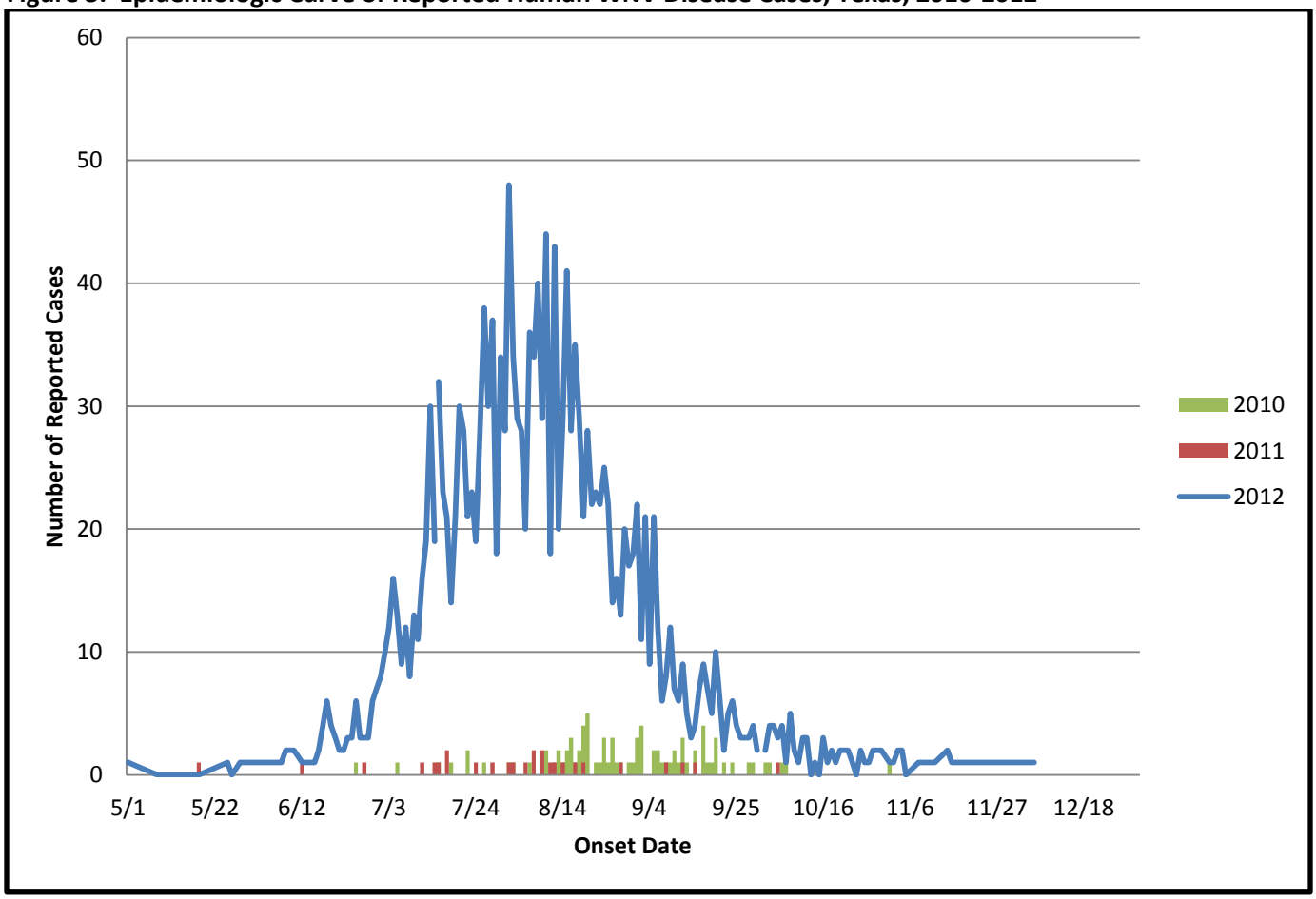
Table 3. Characteristics of Reported Human WNV Disease Cases, Texas, 2012

Characteristic	WNND (N=844)		WNF (N= 1,024)	
	Number	%	Number	%
Gender				
Male	509	60	519	51
Female	335	40	505	49
Age				
<1-09	9	1	14	1
10-19	26	3	42	4
20-29	47	6	74	7
30-39	80	9	146	14
40-49	115	14	194	19
50-59	174	21	224	22
60-69	144	17	188	18
70-79	136	16	97	9
80+	113	13	45	4
Race/Ethnicity				
Non-Hispanic White	525	62	733	72
Hispanic	186	22	136	13
Asian/Pacific Islander	6	1	11	1
Black	73	9	42	4
American Indian/Alaska Native	3	0	2	0
Unknown	51	6	100	10
Clinical Syndrome				
Encephalitis - Including Meningoencephalitis	493	58	-	-
Meningitis	351	42	-	-
Uncomplicated Fever	-	-	1,024	100
Symptoms				
Fever	836	99	1,015	99
Headache	650	77	873	85
Rash	240	28	453	44
Nausea or Vomiting	539	64	586	57
Diarrhea	255	30	318	31
Myalgia	360	43	598	58
Arthralgia	265	31	446	43
Paresis	104	12	10	1
Stiff Neck	495	59	167	16
Altered Mental Status	489	58	4	<1
Seizures	47	6	1	<1
Clinical Course				
Hospitalized	815	97	239	23
Death	83	10	6	<1

Of the 1,868 human WNV disease cases reported in 2012, 844 (45%) had neuroinvasive disease (WNND) and 1,024 (55%) had non-neuroinvasive (WNF) disease (Table 3). Of the cases with WNND, 58% presented with encephalitis, including meningoencephalitis and 42% presented with meningitis only. The median age of onset was 54 years (range: 1-100 years) for all cases. Cases with WNND tended to be older (median=63 years, range: 1-100), while cases with WNF were younger (median= 52 years, range: 3-94). The majority (67%) of all WNV disease cases were non-Hispanic whites, followed by Hispanics (17%). The most common symptoms reported by WNND cases were fever (99%), headache (77%), nausea or vomiting (64%), and stiff neck (59%). The most common symptoms reported by WNF cases were fever (99%), headache (85%), nausea or vomiting (57%) and myalgia (58%). The majority of WNND cases (97%) were hospitalized compared to 23% of WNF cases. Eighty-nine (5%) of all reported human WNV disease cases died, including 83 (10%) WNND cases.

In 2012, dates of symptom onset for all WNV cases ranged from May 1 to December 6 (Figure 3). The median date of onset for 2012 (August 7) was similar to the median onset in 2011 (August 2), but nearly a month earlier than the median onset date in 2010 (August 27).

Figure 3. Epidemiologic Curve of Reported Human WNV Disease Cases, Texas, 2010-2012



In 2012, the statewide incidence of all human WNV disease cases was 8.0 cases per 100,000 population (Table 4). Schleicher County (173.4 cases per 100,000 population) and Andrews County (81.2 cases per 100,000 population) reported the highest overall WNV disease incidence rates. The statewide incidence for WNND was 3.6 cases per 100,000 population. Andrews County (67.6 cases per 100,000 population) and Rusk County (16.9 case per 100,000 population) reported the highest WNND incidence rates.

Table 4. Reported Human WNV Disease Cases and Incidence Rates by County, Texas, 2012

County	Total Cases		WNND	
	Case Count	Incidence Rate (per 100,000)	Case Count	Incidence Rate (per 100,000)
Andrews	12	81.2	10	67.6
Angelina	19	21.9	9	10.4
Archer	2			
Austin	1			
Bailey	3			
Bastrop	6	8.1	3	
Bell	10	3.2	7	2.3
Bexar	31	1.8	19	1.1
Blanco	1		1	
Bowie	14	15.1	8	8.6
Brazoria	8	2.6	4	
Brazos	13	6.7	8	4.1
Brewster	1			
Brown	2		1	
Burleson	1			
Burnet	2		1	
Calhoun	1		1	
Cameron	2		1	
Camp	1		1	
Carson	3		2	
Cass	2		1	
Castro	3		1	
Cherokee	8	15.7	2	
Collin	64	8.2	22	2.8
Colorado	1		1	
Comal	1			
Comanche	1			
Concho	2		2	
Cooke	6	15.6	3	
Coryell	1		1	
Crosby	3			
Dallas	396	16.7	175	7.4
Dawson	2		2	
Deaf Smith	2		1	
Denton	183	27.6	54	8.1
DeWitt	2		1	
Dickens	1			
Ector	11	8.0	6	4.4
El Paso	32	4.0	21	2.6
Ellis	26	17.4	9	6.0
Erath	1			
Fannin	2		1	

County	Total Cases		WNND	
	Case Count	Incidence Rate (per 100,000)	Case Count	Incidence Rate (per 100,000)
Fayette	5	20.4	1	
Fisher	1			
Floyd	1			
Fort Bend	14	2.4	4	
Freestone	1		1	
Frio	2			
Galveston	1		1	
Glasscock	1		1	
Grayson	12	9.9	6	5.0
Gregg	30	24.6	17	14.0
Grimes	2		2	
Guadalupe	4		2	
Hale	4		2	
Hansford	2		1	
Harris	101	2.5	57	1.4
Harrison	6	9.1	3	
Hays	6	3.8	5	3.2
Hemphill	1			
Henderson	4		1	
Hidalgo	3		2	
Hill	2			
Hood	5	9.8	2	
Hopkins	3		3	
Howard	1		1	
Hunt	15	17.4	10	11.6
Hutchinson	1			
Jack	1			
Jefferson	10	4.0	4	
Johnson	13	8.6	6	4.0
Kaufman	11	10.6	8	7.7
Kerr	1			
Lamar	11	22.1	4	
Lamb	1		1	
Lavaca	1		1	
Liberty	4		4	
Limestone	4		1	
Lipscomb	1		1	
Lubbock	17	6.1	13	4.7
Madison	1			
Martin	1		1	
Mclennan	44	18.7	31	13.2
Midland	6	4.4	3	
Milam	1		1	

County	Total Cases		WNND	
	Case Count	Incidence Rate (per 100,000)	Case Count	Incidence Rate (per 100,000)
Mitchell	2			
Montague	2		1	
Montgomery	17	3.7	8	1.8
Moore	1		1	
Navarro	8	16.8	3	
Nolan	1			
Nueces	8	2.4	4	
Oldham	1		1	
Orange	2			
Panola	6	25.2	3	
Parker	6	5.1	6	5.1
Polk	1		1	
Potter	4		1	
Presidio	2			
Rains	1		1	
Randall	18	14.9	9	7.5
Red River	1			
Robertson	4		2	
Rockwall	3		1	
Rusk	12	22.5	9	16.9
Sabine	1			
Schleicher	6	173.4	1	
Scurry	1			
Shelby	1			
Smith	22	10.5	13	6.2
Starr	1			
Stephens	2			
Tarrant	259	14.3	105	5.8
Taylor	3		2	
Titus	6	18.6	2	
Tom Green	13	11.8	3	
Travis	151	14.7	59	5.8
Trinity	1		1	
Upshur	2			
Val Verde	1		1	
Van Zandt	8	15.2	2	
Victoria	2		1	
Walker	2			
Waller	1		1	
Washington	1		1	
Wharton	3		3	
Wichita	5	3.8		
Willacy	1		1	

County	Total Cases		WNND	
	Case Count	Incidence Rate (per 100,000)	Case Count	Incidence Rate (per 100,000)
Williamson	26	6.2	12	2.8
Wise	5	8.5	3	
Wood	2			
Yoakum	1			
Young	1		1	
Zavala	1		1	
TOTAL	1,868	7.4	844	3.6

WNND-West Nile neuroinvasive disease
*Population estimate based on 2010 Census
**Calculation of rates is not recommended when there are fewer than five events in the numerator because the calculated rate can be unstable and exhibit wide confidence intervals.

In 2012, DSHS Health Service Region 2/3 (HSR) was the most disproportionally affected by WNV disease (Table 5). HSR 2/3 is located in north Texas and includes Dallas, Denton, Tarrant and Collin Counties. HSR 2/3 reported 14.3 cases per 100,000 population.

Table 5. Reported Human WNV Cases and Incidence Rates by DSHS Health Service Region (HSR), Texas, 2012

HSR	Case Count	Incidence Rate (per 100,000)*
1	68	8.1
2/3	1,039	14.3
4/5N	162	10.9
6/5S	165	2.5
7	282	9.6
8	47	1.8
9/10	90	6.4
11	15	0.7
TOTAL	1,868	7.4

*Calculation of rates is not recommended when there are fewer than five events in the numerator because the calculated rate can be unstable and exhibit wide confidence intervals.
**Population estimate based on 2010 Census

Acknowledgements and Data Sources:
Local and regional health departments, DSHS laboratory, mosquito control agencies, medical providers, veterinarians and the Texas Veterinary Medical Diagnostic Laboratory.