

# 2012 West Nile Virus (WNV) Epidemic in Dallas County, TX:

## Spatial & Statistical Analysis

CEE 158: Elaine Wang

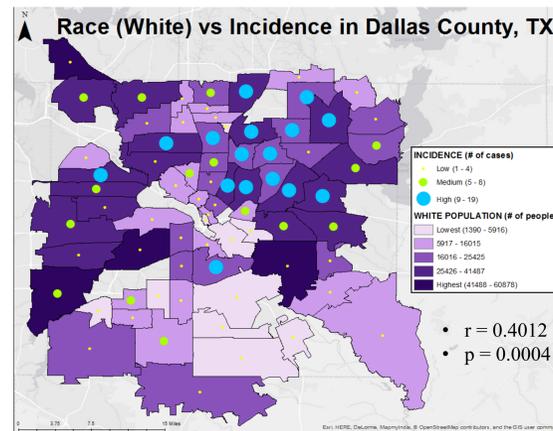
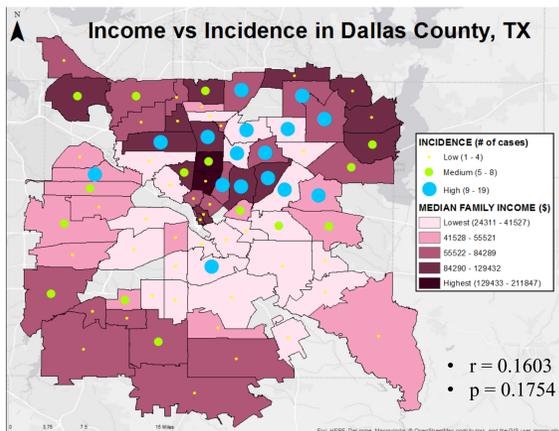
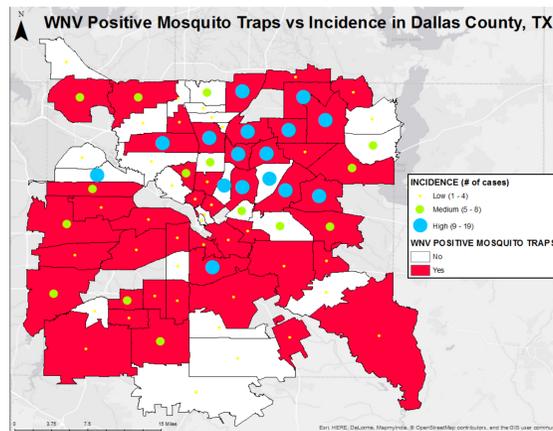
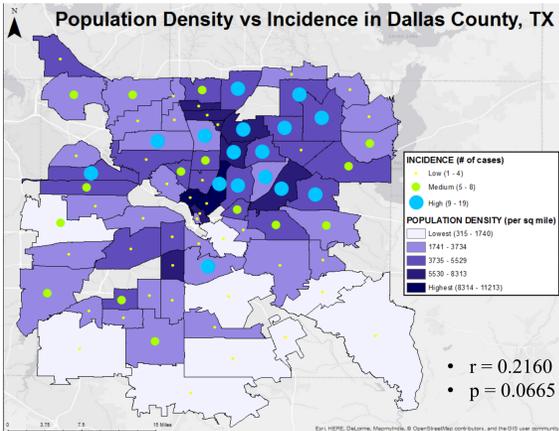
### PROBLEM STATEMENT

Since its arrival in the United States in 1999, West Nile virus (WNV) has become an endemic, “established seasonal cause of illness and mortality” (Labeaud et al., 2008). While 80% of people infected with WNV are asymptomatic, the most severe cases of WNV manifest in neuroinvasive forms such as meningitis or encephalitis, with no current treatment or cure available (Murray et al. 2013, Sejvar 2014). Because there is no current cure or treatment that has been detected, it is crucial that we begin to identify demographic and environmental trends and recognize potential risk indicators. In this project, I focus on identifying demographic trends that reveal who was most vulnerable during the 2012 WNV epidemic in Dallas County, TX.

### STUDY AREA & YEAR

Dallas County, TX, the county hit hardest with WNV incidence in the 2012 outbreak, witnessed the greatest increase in WNV infections of any urban area in the United States during the virus’s 2012 resurgence (Chung et al., 2013). The incidence rate of WNV in Dallas County in 2012 was 7.30 per 100,000 residents—a total of 398 cases reported (Chung et al., 2013). In this paper, my study area and year is Dallas County, Texas in 2012. Dallas County, Texas had 167 positive mosquito pools, no avian positive cases, 3 equine cases (Arbovirus Activity in Texas 2012 Surveillance Report).

### RESULTS ( p > 0.05)



### METHODOLOGY

- From the **United States Census Bureau**, I downloaded a U.S. cartographic boundary shapefiles with ZCTA data. I imported this shapefile into ArcGIS.
- From the **ACS 2011-2015 (5-Year Estimates)**, I downloaded a Social Explorer table with total population, population density, area, age (under 5, between 65-75, between 75-84, over 85, median age, race (white, black, Native American, Asian, pacific Islander, other, two or more), and median family income data.
- I **joined** this table with the U.S. Census Bureau data table on the field “ZCTA”.
- I then performed a second **join** between the recently joined table and the data table I have for cases of WNV by zip code in 2012. This information was derived from a report released by the Dallas County Health and Human Services on October 5, 2012. I saved this as a new layer in ArcMap.
- I created **output maps** for each of the dependent variables. For each of my maps, I had a basemap and two layers: one depicting the independent variable (incidence) as point vectors and another depicting the dependent variable as polygon vectors.

### RESULTS ( p < 0.05)

Comparing regression models of the three age groups over 65 separately manifests that although all are statistically significant, total population 85 years old and over is the best predictor of WNV incidence because adjusted r-squared is 0.4339, which is higher than the adjusted r-squared for the other two age groups. Moreover, total population 85 years old and over is most correlated with incidence at a correlation coefficient of 0.6647. Finally, the fact the adjusted r-squared increases by each age group proves that WNV incidence susceptibility increases as you age, especially when you are 65 years old and over. After performing regression analyses on several demographic variables, I found that being over 85 is the best predictor of WNV incidence— it has the highest correlation coefficient of any of the independent variables at 0.6647 and a statistically significant p-value of < 0.0001. Other variables tested, such as race, income, and population density are not good predictors of WNV incidence because they are statistically insignificant (p < 0.05) and have smaller correlation coefficients proving they are not as correlated with incidence.

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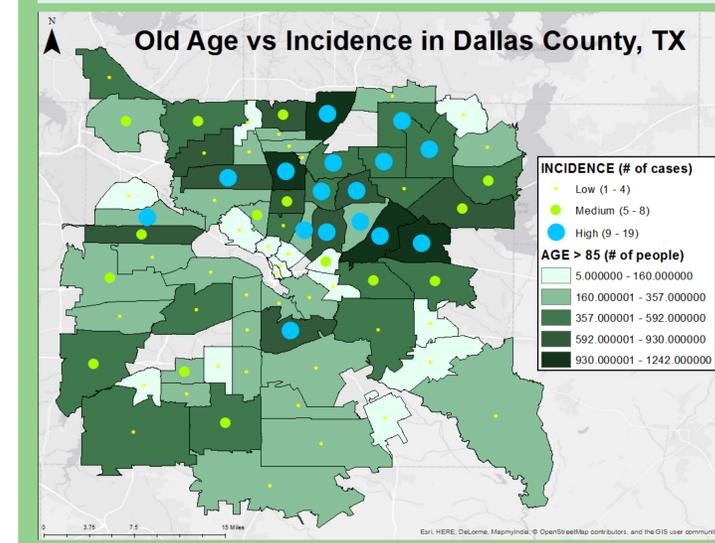
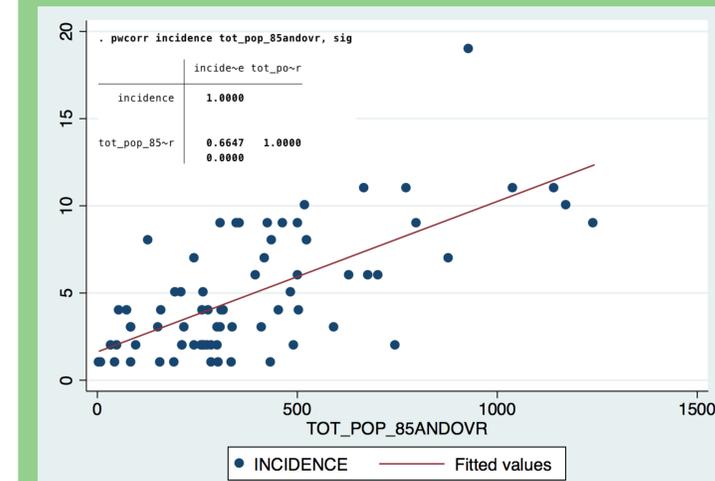
.regress incidence tot_pop_85andovr

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Source	SS	df	MS	Number of obs	F(1, 71)
Model	422.798354	1	422.798354	=	56.19
Residual	534.187947	71	7.52377391	=	0.0000
Total	956.986301	72	13.2914764	R-squared	0.4418
				Adj R-squared	0.4339
				Root MSE	2.7429

	incidence	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
tot_pop_85andovr		.00863312	.0011514	7.50	0.000	.0063354 .010927
_cons		1.621783	.5518211	2.94	0.004	.5214832 2.722083



### CONCLUSION

Because there is so much spatial variation and varying environmental factors that influence WNV transmission efficiency, we should tailor our intervention efforts by at-risk populations and not by environmental risk hotspots. People over 85 in Dallas County, TX should be the focus of our WNV educational outreach and prevention efforts.

Because the primary risk group is people over 85 years of age, WNV awareness campaigns must be tailored to speak to and reach either an older audience and/or their caretakers. It would be effective to work with senior centers or organizations that work with older populations to host informational sessions. Moreover, promotional material should not only feature younger people, but also include images of older people so as to increase relatability and attract the attention of older populations.

After calculating the average number of people over 85 in Dallas County zip codes, I derived that the median number of people over 85 is 390. Thus, if we focus our efforts on zip codes with higher than median (> 390) number of people over 85 years of age, I believe that the incidence and mortality rates can be lowered efficiently.

### LIMITATIONS

I had hoped to be given the age, race, and income of each case in each zip code, but that information was not available to the public for patient confidentiality reasons. Thus, I could only derive the median age, total population by age group, total population by race group, and median income in each zip code. From this, I could only perform ecological analysis, but not see which age, race, and income group specifically is most susceptible to WNV. It is worth mentioning because most people who are infected with WNV are asymptomatic, there might be an underrepresentation of the number of cases, as asymptomatic cases are not reported.

### REFERENCES

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**Coordinate System: GCS North American 1983**  
**Datum: North American 1983**  
**Units: Degree**

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ZIP	TOT_POP_85ANDOV
75150	1242
75080	1172
75228	1142
75230	1039
75214	930
75225	880
75216	798
75238	774
75234	747
75043	704
75248	679
75229	669
75061	631
75217	592
75243	547
75006	525
75040	519
75041	505
75149	501
75231	501
75211	491
75115	484
75044	464
75104	454
75052	438
75067	435
75042	427
75227	420
75205	411
75088	396