graphic location or point data, to track the occurrence of rabies in all of its animal case investigations. The latitude and longitude of the rabid animal is determined by using either Global Positioning System (GPS) or by address geocoding. These locations are then used to construct the vaccine/bait distribution areas for the year. Vaccine/bait unit distribution areas are designed using AutoCAD, which provides infinite accuracy for constructing the grids and transect lines which comprise the vector data. Satellite imagery or remotely-sensed data is utilized to study the distribution area for any possible natural or man-made obstructions, including large bodies of water or impermeable cover. Raster data sets used in the project include the National Land Cover Database (NLCD) and Federal Aviation Administration (FAA) aeronautical sectionals. Each cell in a raster file represents a unit or value of the area of interest. Vector data sets, such as those depicting international boundaries, county lines, and river basins, are used extensively to determine the extents and legal limits of the bait distribution zones within the state. Vector data sets include points, lines, and polygons. The flight grids and flight lines, which are also vector data sets, are drawn to exact specifications in order to optimize flight efficiency and safety. Geographical Information Systems have brought many old technologies into the modern age and created a boom in many existing trades, including utility companies, mapping services, health and human services as well as in the ever- expanding travel industry. The world would definitely be a different place without the advantages GIS and related technologies provide.

4. Adult Safety Net: Increasing Access to Immunization Services in the Uninsured Population

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In order to prevent the spread of disease in all populations, several immunizations are recommended for people over age 18 and throughout their adult life. There are nearly 5,000,000 uninsured adults in Texas. The goal of the Adult Safety Net (ASN) program of the Texas Department of State Health Services (DSHS) Immunization Branch is to increase immunization levels among uninsured adults by providing vaccines at no cost to enrolled providers. This spatial analysis aimed to use a GIS environment to: 1) visualize areas in Texas with limited access to ASN services, and 2) emphasize areas that have a high proportion of uninsured adults in addition to limited access. Proximity analysis was used to create buffer areas around ASN provider locations, revealing that large areas in West Texas and the panhandle of Texas do not have convenient access to ASN providers. In addition, mapping percentage of uninsured adults by county shows that many of these areas with gaps in access also have a high proportion of uninsured adults. The Immunization Branch will use this data to target areas of particular need for increased provider recruitment into the ASN program.

5. Economic Characteristics of School Districts with High Rates of Vaccine Refusal

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During the 2013-2014 school year, there were 38,647 students in Texas with a conscientious exemption on file at their school for one or more of the required vaccines. Research has shown that geographic clustering of such exemptions can lead to outbreaks of vaccine-preventable diseases in communities. Based on previous studies that show exemptions tend to be more common among affluent populations, the goal of this spatial analysis was to visualize and compare a school district's exemption percentage with socioeconomic characteristics of the student population. Using ArcGIS versions 10.1/10.2, hot spot analyses were used to see where there were clusters of school districts with high rates of conscientious exemptions as well as clusters of school districts with large percentages of students who were not economically disadvantaged. Areas in the Hill Country of Texas and in the Dallas-Fort Worth Metroplex show high levels of exemption clustering that coincides with high percentages of students who are not economically disadvantaged. Alternatively, areas near the southernmost tip of Texas show low rates of exemptions coinciding with high percentages of economically disadvantaged students. The Texas Department of State Health Services (DSHS) Immunization Branch will use these maps to gain a better understanding of the characteristics of school districts that have a large percentage of exemptors so that programs can be developed to increase immunization coverage.

6. Google Trends Geographic Heat Maps' Utility in Public Health: 2012 West Nile Virus Outbreak as an Example

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Background: Analysis of Internet searches may be a useful source of information concerning public interest in health-related topics. Google Trends (www.google.com/trends) analyzes a portion of Google web searches to calculate how many searches were done for a certain term relative to the total number of searches. Data are normalized and scaled 0-100. Results are shown as a time graph and as geographic heat map (world, specific country, state, metropolitan area). **Methods:** The 2012 West Nile virus outbreak in the US resulted in the highest number of reported cases since 2003. A high proportion of the cases were reported from North Texas. As a result, aerial insecticide spraying was conducted in Dallas County in August 2012. A Google Trends search was performed using "West Nile virus" as the key phrase and the time period limited to 2012. **Results:** Worldwide, the country with the highest search score was the US (100), followed by Canada (27). In the US, Texas had the highest search score (100), followed by Oklahoma (76). In Texas, the metropolitan areas with the highest search scores were Dallas/Fort Worth (100), Austin (55), and Houston (55). In Texas, the search scores peaked in August. **Discussion**: Google Trends indicates that West Nile virus searches in 2012 were focused in Texas, particularly in the Dallas-Fort Worth Metro area, the area with the highest proportion of reported West Nile virus cases. Since people may have searched Google for West Nile virus information after they had already heard about the outbreak, this suggests Google Trends may be of limited utility in predicting the time and location of West Nile virus outbreaks. But it might be useful for targeting education and prevention activities. Limitations of Google Trends include absolute numbers not being provided and dependence on the number of searches performed on a topic.

7. Geographic Distribution of Oil Production Worker Exposures Reported to Texas Poison Centers

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Background: Oil production is increasing in the United States, particularly in Texas. Injuries, including exposures to potentially hazardous substances, may occur among oil production workers. **Methods:** This study used data collected by Texas poison centers during 2003-2012. All records with any of the following terms in their notes fields were identified: oil field, oil rig, oil drill, oil work. These records then were reviewed to identify those that appeared to relate to exposures that occurred to workers while they were involved in oil production. The distribution of the exposures was determined with respect to

geographic groupings based on caller location: caller county, Public Health Region (clusters of counties), and counties grouped into rural or urban based on US Office of Management and Budget definitions of metropolitan and non-metropolitan. Rate per 1,000,000 population was calculated based on the 2010 Census. **Results:** There were 432 exposures. Calls were received from throughout the state (115 of 254 counties). Counties with the highest rates were Reagan (1,485), Andrews (1,217), and Upton (1,192), all counties in Public Health Region 9. Public Health Region 9 had the highest rate (244.8), followed by Public Health Regions 2 (54.5) and 3 (33.3). The rate was 74.8 in rural counties and 9.2 in urban counties. **Discussion**: The oil production worker exposure rate varied greatly throughout the state, being much higher in Public Health Region 9 than any other region. Geographic location of the exposures was likely related to the location of oil and its production in the state. The Permian Basin, much of which is located in Public Health Region 9, is a significant oil-producing area in the state. A major limitation of this study is that it depended on the occupation or industry related to the exposure being recorded in the record notes, which was not standard practice.

8. Geographic Distribution of Electronic Cigarette Exposures Reported to Texas Poison Centers

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Background: Electronic cigarettes are battery-powered devices that heat a solution of nicotine, flavorings, and other chemicals. Users inhale the vapors that result. Their use in the United States is increasing. Little is known about the impact of electronic cigarettes on public health; exposures may be dangerous because the nicotine solutions are highly concentrated. Differences in potentially adverse electronic cigarette exposures have been reported between the states. This study describes the geographic distribution of electronic cigarette exposures reported in Texas. **Methods:** Cases were electronic cigarette exposures reported to Texas poison centers during January 2009-August 2014. Exposures where the caller county was unknown were excluded. The number of exposures and rate per 1,000,000 population was determined for caller county and 11 Public Health Regions (PHRs, clusters of counties). Rates were calculated based on the 2010 Census. **Results:** 391 exposures were reported from 85 of 254 counties. Counties the with highest number of cases were Tarrant (43), Dallas (36), Harris (33), Denton (29), Bexar (19), and Travis (18). The number and rate of exposures by Public Health Region were PHR 1 (26, 31.0), PHR 2 (12, 21.8), PHR 3 (170, 25.2), PHR 4 (20, 18.0), PHR 5 (6, 7.8), PHR 6 (46, 7.6), PHR 7 (50, 17.0), PHR 8 (30, 11.5), PHR 9 (16, 28.0), PHR 10 (8, 9.7), and PHR 11 (7, 3.3). **Discussion**: Electronic cigarette exposure calls were received from throughout Texas. However, the calls were not evenly distributed. The highest number of exposures were reported from PHR 3 (counties around Dallas-Fort Worth), accounting for 43.5% of the exposures. Three of the counties in PHR 3 (Tarrant, Dallas, Denton) accounted for 27.6% of the total exposures. The exposure rate was highest in the northwest (PHR 1) and declined toward the east and south. The reason for this geographic pattern is unclear.

9. Using MODIS Land Surface Data to Interpret West Nile Virus in Texas Department of State Health Services

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West Nile Virus (WNV) was first isolated in the West Nile District of Uganda in 1937. Fortunately, most people infected with WNV will have no symptoms. About 20% of infected people will develop a fever and other flu-like symptoms. Less than 1% of infected people develop a more serious, sometimes fatal, neuroinvasive illness such as encephalitis or meningitis.

Birds act as a reservoir host for the virus, and mosquitoes are a vector for the virus. The virus amplifies in birds. Both humans and horses are incidental hosts unable to amplify the virus and transmit it. In 2012, West Nile cases were at their highest across the U.S., and Texas had the most cases and deaths. Forty six sets of files representing 8 day ranges of LST data are downloaded from NASA ECHO Reverb web site for each year from 2003 to 2012. The tif files are projected from sinusoidal to Lambert Conformal Conic using the MODIS reprojection tool. The files are then imported into ArcGIS. The tifs are clipped to the DFW study area and then converted to polygons so that an attribute table containing the 8 day average temperatures can be extracted. The average temperature of these pixels is calculated to obtain one temperature per 8 day range. A final table of all ten years and all 46 8 day ranges was created. It appears that a threshold for the mosquito population to proliferate is reached at around 90°F. And once this threshold is exceeded, a window for the West Nile Virus to amplify in the local bird population widens. By August the virus is in full force and able to be spread throughout the human population. Whenever temperatures exceed 90°F in early May the public and public health officials should prepare for a rise in WNV exposure.

10. Locating Health Vulnerability: Where are the Most Health-Related Risk Locations? A GIS-based Analysis, Case of Texas

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The advent of geospatial tools has great potential to long term monitoring and assessment of the epidemiology of disease trends and pattern over various spatio-temporal conditions In this study Geographic Information System (GIS) is shown to be an efficient tool to bring all datasets under one umbrella for the analysis of the health trend of the study area and relative vulnerability level of counties in the region. This work generated a composite measure of health risk areas by rescaling and overlaying various health-related, social resilience, and population density indicators. The objective of this study was to capture health risk and social vulnerability indices in a single integrated composite measure rather than a series of maps each documenting different facets of a problem. Thus, this study included around 26 health indicators, 12 social vulnerability indicators and population density variables to produce an overall composite model of the study area. All indicators were normalized on a scale from 0 to 1 using percent rank (a version of dispersion between the minimum and maximum) or percentiles method. The researcher converted 39 different indicators into the percent rank to show where a given value is in percentage terms between the minimum and maximum score as represented by the equation MinMax = 1 –(Value-min)/(Max-Min). A low score approaching 0 represented maximum health vulnerability and higher score approaching 1 represented no vulnerability (high overall resilience). Then, all indicators were joined to the county polygons, converted into raster format and summed up on raster calculator tool of map algebra to have the final health-vulnerability composite model. The model revealed that overall vulnerability level is high around Border Counties, North Western and West central Texas. By contrast, North and East central Texas have lowest overall health vulnerability.