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# Identification Of Stroke Risk Factors In The Adult Population In The Texas And New Mexico Border Region: A GIS And Statistical Approach

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IDENTIFICATION OF STROKE RISK FACTORS IN THE ADULT POPULATION IN THE  
TEXAS AND NEW MEXICO BORDER REGION: A GIS AND STATISTICAL APPROACH

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Dean of the Graduate School

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TEXAS AND NEW MEXICO BORDER REGION: A GIS AND STATISTICAL APPROACH

by

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## **Abstract**

Stroke is one of the leading causes of death among adults. Annually, an approximated 800,000 adults will suffer a stroke, and one victim will die every four minutes. In El Paso County and Dona Ana County it is estimated that the age-adjusted prevalence is 2.9% and 3.4% respectively. Little is known about the percentage of adults at risk for stroke in this border region. In this secondary analysis of a cross-sectional study conducted by the Far West Texas and Southern New Mexico Regional Advisory Council on Trauma and Emergency Healthcare (Border RAC), over 900 participants in these counties and rural areas were screened (6 sites in Texas and 4 in New Mexico). The participants over the age of 18 were assessed for blood pressure, risk for diabetes, and personal lifestyle risk factors. Data collected were analyzed to determine the percentage of adults living in the El Paso and Dona Ana County who are at risk for stroke. Additionally, the results were layered onto a Paso del Norte GIS map and United states map, in order to highlight the determined risk of areas (zip codes) in this border region, and their proximity to primary stroke centers were measured using GIS software. A total of 959 eligible participants were identified, of which 60.4% identified as being female. Most participants were between the ages of 36-45 (20.9%) and 46-55 (22.6%), and 56-65 (17.0%). The majority of the participants reported being Hispanic (47.2%) followed by non-Hispanic white (18.0%). Also, 87 different zip codes were identified in the analysis, and of those only nine zip codes had 25 or more participants. Evaluation of the participant response to the diabetes risk assessment revealed that over 47% of participant were at high risk for diabetes, and only 12.2% of participants were at low risk. Similarly, 39% of the participants were found to be at high risk for stroke, 30.3% were at medium risk, and 26.6% were found to be at low risk. A statistically significant difference was found between stroke risk factors (diabetes risk, blood pressure, and family history) and age and zip code.

There was a difference between stroke risk across the different age groups and zip codes,  $\chi^2(6) = 49.621$ ,  $p < 0.001$  and  $\chi^2(8) = 42.438$ ,  $p < 0.001$  respectively. There is a statistically significant difference in stroke risk level in Sierra County, New Mexico and Culberson County, Texas rural areas, (Cramer's  $V = 0.283$ ,  $p < 0.001$ ). Additionally, each rural area had similar rates of stroke as urban areas of the same state. GIS analysis showed that Culberson County and Sierra County had the furthest distance to the closest primary stroke center, 112.12 miles, and 76.72 miles respectively. Multiple risk factors known to increase stroke risk exist within the border land region which may contribute to the risk of stroke risk across age groups and area of residence. The implications of these findings can aide community, organizational, and political leaders to develop interventions and programs to educate and intervene individuals at risk and overall reduce the incidence of stroke in this border region.

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## Chapter 1: Introduction

In the United States, stroke has become one of the leading causes of death and long-term disability among adult men and women (Miniño and Murphy, 2010; American Stroke Association (ASA), 2012; Centers for Disease Control and Prevention (CDC), 2005; Roger, Go, Lloyd-Jones, Benjamin, Berry, Borden, 2012). Approximately, 800,000 adults suffer a stroke, and every four minutes one dies annually (Roger et al., 2012; Go et al, 2014). In addition, every year the United States spends an approximate 38.6 billion dollars to cover medical care costs and missed work days related to stroke (Heidenreich, Trogon, Khavjou, Butler, Dracup, Ezekowitz, 2011).

It is estimated that 80% of all strokes are preventable by modification of lifestyle and/or compliance with a medical regimen (Gorelick, 1995; Gorelick 2008; American Stroke Association, 2012). Furthermore, there are certain known risk factors that place an individual at risk for a stroke, and the more risk factors an individual has, the higher the risk of a stroke (Wolf, 1991).

Another significant aspect of stroke is the time it takes to identify and treat an acute event when it is occurring. In 2003, the American Stroke Association in collaboration of the American Heart Association launched the campaign, “*Time Lost is Brain Lost*”, which emphasized the importance of seeking rapid medical attention to treat a stroke, and prevent damage to the brain (ASA, 2012). Currently, the F.A.S.T. acronym has become a widely known outreach tool used to describe the signs of a stroke and stress that time is of the essence when dealing with a stroke. The acronym stands for *Facial* droopiness, *Arm* weakness, *Speech* difficulty, and *Time* is of the essence (National Stroke Association (NSA), 2014).

The projected growth of the country in the next five decades indicates that the U.S. will become more diversified, and no one group will be the majority. Another important projection is that Hispanics will make up close to a third of the population of the country making it the largest

minority group (United States (US) Census, 2012). This is important to regions of the country that currently have very diverse populations, especially those with large number of Hispanics, such as the U.S.-Mexico Border region. By undertaking complex health problems, such as stroke, those diverse regions can develop health interventions that could be used as templates for the health care of the nation for years to come.

## **1.1 DEFINITION OF STROKE**

Stroke can be referred to by different names such as cerebrovascular disease, cerebrovascular/brain attacks, cerebrovascular accidents (CVA), cerebral hemorrhage, cerebral infarction, hemorrhagic stroke, and ischemic strokes (National Heart, Lung, and Blood Institute (NHLBI), 2011; Luc, 2012). A stroke is defined as an interruption in the flow of blood in any portion of the brain (ASA, 2012; CDC, 2012). This can occur due to the blockage or rupture of a vessel in the brain, or any vessel that supplies oxygen filled blood to this area (ASA, 2012; CDC, 2012). When this occurs brain cells are deprived of oxygen and necessary nutrients, and in turn end up dying shortly (ASA, 2012; CDC, 2012). The more cells that die the more the physical and neurological damage in the individual affected.

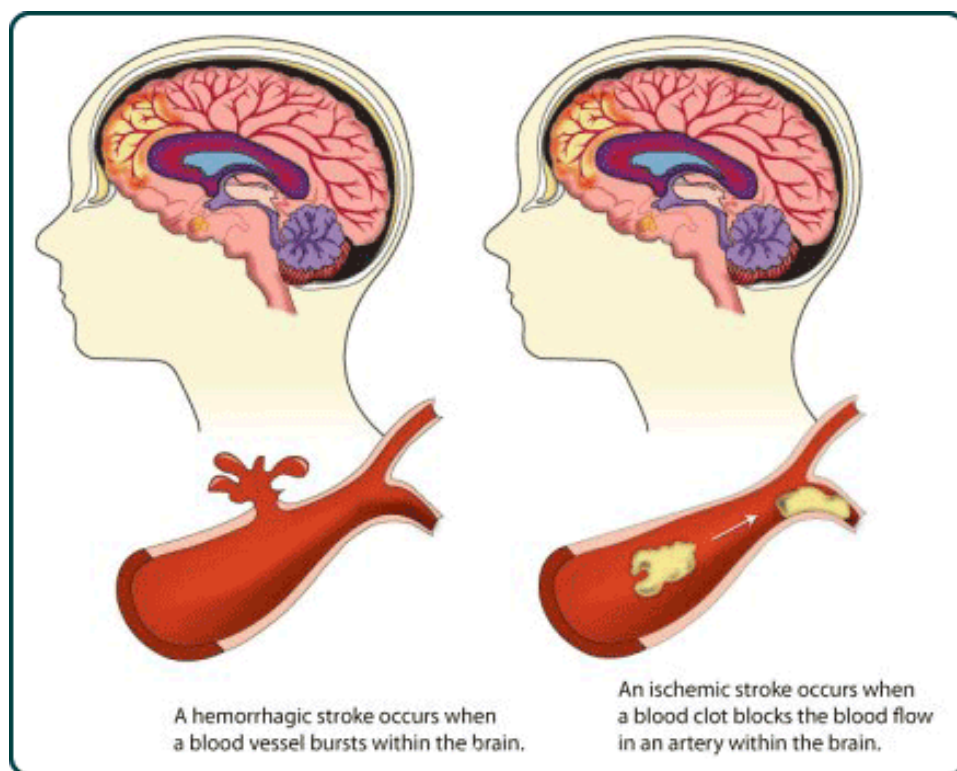
### **1.1.1. Types of Strokes**

There are several types of strokes. The most common stroke is called an ischemic stroke; it occurs in more than 80% of all strokes (ASA, 2012; CDC, 2012; Shah, 2008). This type of brain attack occurs when the artery that supplies blood to the brain is occluded. The blockage of the vessels is mostly contributed to the narrowing caused by plaque formation or by the lodging of a blood clot in a vessel (ASA, 2012; CDC, 2012).

Hemorrhagic strokes are less common, only affecting approximately 15-20% of stroke victims, and occur when a vessel ruptures and blood spills to all surrounding areas of the brain

(ASA, 2012; CDC, 2012; Shah, 2008). Aneurysms or weakening of blood vessels are largely responsible for this type of stroke (ASA, 2012; CDC, 2012). This event not only affects the flow of blood, but also disrupts the function of neurons in the brain, and ultimately the end result is the same as ischemic strokes.

Some individuals will develop a transient ischemic attack (TIA) prior to having an acute stroke. A TIA, sometimes referred to as a mini stroke, is a mild form of an ischemic stroke but most of the time does not have any of the lasting consequences because the blockage of blood is only for a short amount of time (ASA, 2012; CDC, 2012). Even though it does not have long lasting consequences, if the underlying cause is not treated, it can lead to a stroke and its accompanying effects.



**Figure 1.1.** Types of Strokes. Adapted from CDC, 2012.

## **1.2 TIME AND STROKE**

There is a proliferation of evidence that suggests that it is crucial for individuals to identify the signs of a stroke and seek medical attention as soon as possible. It is estimated that 2.4% of all reported disabilities are due to the effects of a stroke, and it is the number one cause of serious long-term disability among adults in the US (CDC, 2005; Roger et al., 2012). The longer it takes to treat the CVA the higher the risk of permanent disability, and the increase of death (Roger et al., 2012). In addition, it has been documented that the prevalence of physical, emotional, mental, and socially related disabilities post a stroke are higher in adults over the age of 65 years of age (National Center for Health Statistics (NCHS), 2011; Brault, 2008).

Before any treatment can be initiated, victims of a stroke need to identify the symptoms and seek medical help right away. This may not be possible in all cases, as people may interpret their sign and symptoms as other conditions or may underestimate the importance of seeking medical care immediately (Cruz-Flores, 2011). In a recent study it was suggested that Mexican-Americans and women were less likely to seek emergency care when compared to non-Hispanic whites and men (Smith, 2010). Another study noted that Hispanics are 50% less likely to have a favorable outcome 90 days post an ischemic stroke compared to non-Hispanics, and the major factor may be their lack of usage of emergency medical services (EMS) (Neil, 2012).

After an individual recognizes that a stroke is occurring, and emergency medical services are sought, it is up to the EMS team to rush the patients to the closest designated stroke centers. These centers are equipped with the personnel and tools necessary to diagnose and treat stroke victims. They are the ideal place for initial management of a CVA.

### **1.2.1 Stroke Centers**

Hospitals can become certified as a primary or comprehensive stroke center by The Joint Commission (TJC), or they can independently be certified as a stroke center by each state. Acute hospitals have to follow the highest standards of stroke care and treatment in order to get certified. Since 2003, more than 900 hospitals across 48 states have become certified as primary stroke centers (PSC) (TJC, 2013). This move for certification came about after the development of known treatments that can reduce amount of brain damage after a stroke (Karras, 2013). A study conducted in 2011, showed that hospitals that were TJC certified as primary stroke centers had marginally lower 30-day mortality rates than non-certified hospitals and similar re-admission rates (Lichtman, 2011).

### **1.3 HEALTH DISPARITIES**

The CDC defines health disparities as “differences in health outcomes and their determinants between segments of the population, as defined by social, demographic, environmental, and geographic attributes.” (CDC, 2011) This can be summarized as differences in the incidence, prevalence, and mortality of diseases in different groups in the population. Health disparities exist among people of different race or ethnicity, limited English proficiency, disabilities, sexual orientation, economic status, and geographic location may affect one’s ability to achieve good health (New Mexico Department of Health (NMDH), 2011). *Health inequalities* are used to measure the health of a population or group in terms of income, education, and race or ethnicity (CDC-2, 2011). There are classes of factors in health inequalities, environment, access and utilization of services, health status, and difference in health outcomes (Trimble, 2008). Lastly, health inequities are preventable inequalities in health among different groups (CDC, 2011; World Health Organization (WHO), 2010).



Poor health and health inequalities are one of the most common correlations in health disparities (CDC, 2011). The identification and modification of health disparities can greatly improve the overall health of a community. Health disparities have been reported to affect the life expectancy, risk factors, quality of life, and morbidity in certain groups of the population. (CDC, 2011).

The most common disparities in the border region are race, economic status, and health coverage (Anders, 2010; NSA, 2012). It is known that low socio-economic status increases the risk for disease and decrease the lifespan of an individual. In addition, it is known that strokes differ in race, and affect individuals of African American and Hispanic backgrounds at higher rates than non-Hispanic whites (NSA, 2013). El Paso is considered one of the counties with the lowest gross income in Texas and is made up of mostly Hispanic individuals (U.S. Census, 2010). These facts may place the city at higher risk for diseases such as stroke. These health disparities will be discussed in detail later in this paper.

### **1.3.1 Social Determinants of Health**

Social determinants of health can be best defined as *“the circumstances in which people are born, grow up, live, work, and age, as well as the systems put in place to deal with illness.”*(CDC, 2011, WHO, 2010). These factors can range from social, economic, and physical and can affect the overall health of a population. Some examples of social determinants are safe housing, availability of food, health care access, transportation options, social support, socioeconomic condition, educational, economic, and job opportunities (Health People 2020, 2011).

Increasing interest has risen in the understanding of how these social determinants affect the health of people, and how implementation of resources can help the overall health of a people;

and therefore decreasing or eliminating health disparities. (Healthy People, 2011) Several nationwide and worldwide initiatives have been set to address social determinants of health such as Healthy People 2020, WHO, National Partnership for Action to end Health Disparities, and the National Prevention and Health Promotion Strategy (Health People, 2011). The understanding of how social determinants directly and indirectly affect health can ultimately lead to the implementation of programs or initiatives that can change current health concerns and chronic diseases such as stroke. For this reason it is the duty of public health and healthcare members, as well as, researchers to provide some answers and comprehension of how these individuals can be helped in order to diminish health disparities across the country.

In El Paso County and Dona Ana County, some of the common social determinants of health are education, income, healthcare coverage and access, and immigration status. Low education levels in both of these counties may lead to lower employment opportunities and therefore affect the overall economic level of an individual and their families. In addition, these two counties have low rates of health coverage which may decrease their access to health care and preventive education and treatments. For example, 50% of Texas residents who had less than a high school diploma reported not having health coverage, and 50% of residents who made less than \$25,000 annually reported not having insurance as well (Texas Department of State Health Services (TDSHS), 2012).

Immigration of individuals may have a positive and/or negative impact to their overall health. Immigrants coming to the U.S. may not find high paying job opportunities, and may lead to a decrease in health. Conversely, the Latino paradox suggests that migrants from other countries tend to have a better health than U.S.-born individuals, but health status decreases as acculturation increases (Hajat, 2000). Some of these inequalities may be resolved with the newly implemented

“Affordable Health Care Act”, which promotes the access to affordable health coverage to increase health access to everyone in the country.

#### **1.4 MINORITIES AND STROKE**

Studies have shown that minorities, such as African Americans, Hispanics, and Native Americans, have a greater risk of first time stroke and recurrent strokes, as well as having stroke at a younger age when compared to non-Hispanic individuals (Trimble, 2008; Jacobs, 2002, NSA, 2012). Racial disparities have also been noted in the relationship between stroke and life expectancy, with minorities having variable life expectancies, and up to two times more likely to suffer a stroke before the age of 45 when compared to non-Hispanic whites (Cruz-Flores, 2011; Jacobs, 2002). Additionally, higher rates for stroke or severe strokes have been seen in minority ethnic groups (Stansbury, Jia, Williams, Vogel, Duncan, 2005). African Americans and Hispanics have had a steady increase in stroke risk factors such as hypertension and diabetes (Trimble, 2008; Daviglus, 2012). This is vital to understand and explore due to the projections in the changes of the demographics of our country in the coming years. Providing equal care to all who need it not only will it improve the health comes of the country, but also decrease yearly post stroke costs such rehabilitation, missed days of work, and ongoing complications after stroke (Trimble, 2008; Cruz-Flores, 2011).

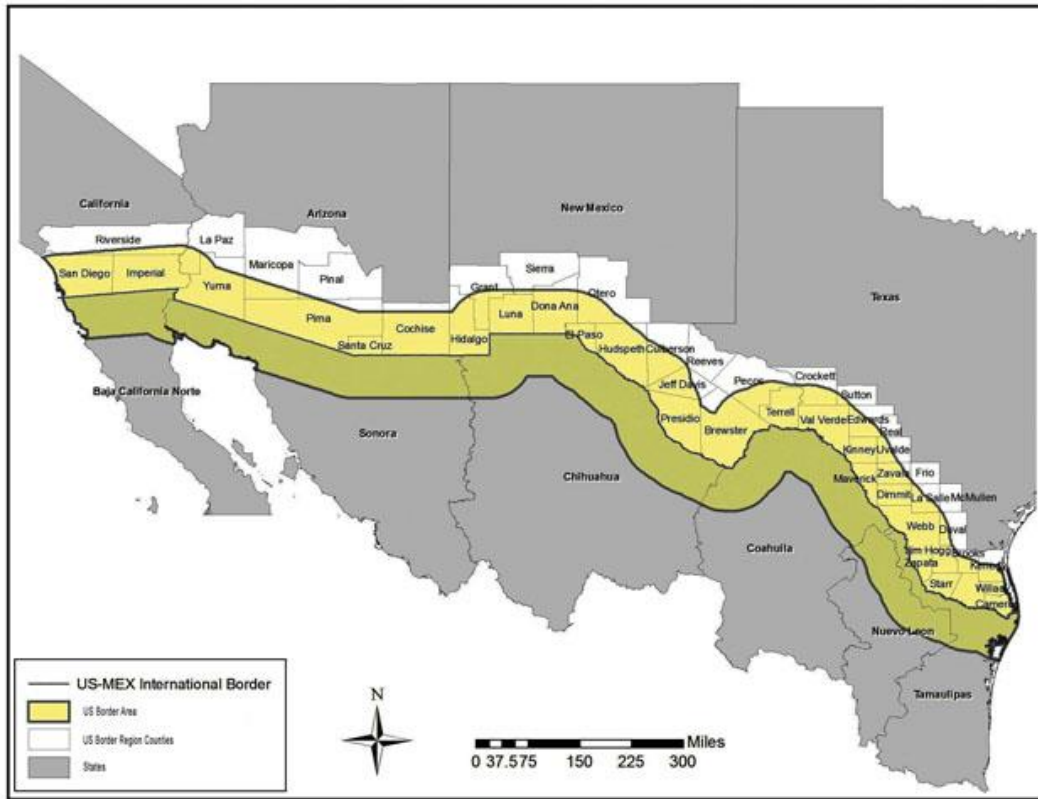
Factors such as differences in education, frequency and distribution of risk factors, income, and access to health care may contribute to the higher rates of stroke in minorities across the country. Minority groups continue to be over-represented by low education achievement, and lower socioeconomic status, when compared to non-Hispanic whites. It is also known that low education levels lead to a high incidence of disease. (TDSHS, 2012) Furthermore, minorities tend to not purchase health insurance due to external factors such as language barriers, income, and

affordability of insurance (Schier, 2011). All these factors can place many individuals at risk for life threatening diseases such as stroke in areas where minorities are the majority such as the case in El Paso County and Dona Ana County.

## **1.5 BORDER REGION**

The U.S.-Mexico border region is defined by the La Paz agreement “as extending more than 3,100 kilometers (approximately 2,000 miles) from the Gulf of Mexico to the Pacific Ocean, and 100 kilometers (approximately 62.5 miles) on either side of the border” (CDC, 2013.) See Figure 1.2. This area contains 80 municipalities in six Mexican states, and 48 counties in four U.S. states, and 14 pairs of sister cities (CDC, 2013; United States-Mexico Border Health Commission, 2009.)

Aside from the geographical definition, the border is a melting pot, rich in ethnic diversity, culture, as well as disease. Other factors common in the border region are high poverty levels, low education levels, and high flow of travelers to and from Mexico (United States-Mexico Border Health Commission, 2009; CDC, 2013.) Additionally, illnesses such as Tuberculosis, HIV/AIDS, food-borne illnesses, vector-borne illnesses, and chronic diseases affect both sides of the border (CDC, 2013.)



**Figure 1.2.** U.S-Mexico Border region as defined by the La Paz Agreement.

Adapted from the United States-Mexico Border Health Commission, 2009.

## **Chapter 2: Literature Review**

### **2.1 STROKE**

#### **2.1.1 Prevalence and Rates**

##### *a. United States (U.S.)*

Stroke is the fourth leading cause of death among adults in the United States (Miniño & Murphy, 2008; ASA, 2012). In 2010 the prevalence of stroke in the U.S. was 2.8% (TDSHS, 2012). Most of the victims who suffer a stroke are age 65 years and older, but 25% of all strokes affect individuals under the age of 65. Death rates are higher for African Americans at any age group compared to white population (ASA, 2012).

##### *b. Texas*

The Prevalence of stroke in adults in Texas has remained at 2.8% since 1999 (TDSHS, 2012). In Texas, females have a higher prevalence of stroke than males in any age group. African Americans of non-Hispanic origin had the highest prevalence of stroke followed by white non-Hispanic, and lastly Hispanics at 1.6% (TDSHS, 2012). In Texas, stroke is the third leading cause of death (Texas Vital Statistics Unit, 2010). Texas had significantly higher prevalence of high blood cholesterol (2009), overweight and obesity (2010), no leisure time physical activity (2010) among adults than the U.S. (TDSHS, 2012)

##### *b.1 El Paso, Texas (county)*

According to data from the Texas Behavioral Risk Factor Surveillance System, El Paso has an age-adjusted prevalence of 2.9% for 2010 (Center for Health Statistics (CHS), 2010). The age-adjusted Mortality rate per 100,000 is slightly lower in El Paso (43.8) compared to that of the state (44.9) for 2010 (TDSHS-2, 2012)

##### *c. New Mexico*

The prevalence rate for adults in New Mexico (NM) for 2010 was 2.5%, and has remained mostly constant since 2006 (Fang, 2012). Stroke is the 5<sup>th</sup> cause of death in NM at 44.2 deaths per 100, 000. The death rate for Hispanics (46.0) was higher than blacks (45.4) and whites (43.4), but below that of Asians (59.5) (NMDH, 2013). In addition, Hispanic males of all ages (47.7) had a mortality rate higher than blacks and whites, and had the highest rate between adults ages 65-84 and among all races (166.8) (NMDH, 2013).

#### c.1 Dona Ana County

In BRFSS (2010), it was reported that Dona Ana County had a 3.4% prevalence of stroke, and it was also noted to be the same for the City of Las Cruces. The prevalence rate in this county is higher than that of the state of New Mexico. Furthermore stroke is the fifth leading cause of death in the county with a death rate of 54.6 per 100,000 people (CHS, 2010).

## **2.2 RISK FACTORS**

The risk factors for stroke can be broken down into two major classes, controlled and uncontrolled factors. Controlled risk factors, as the names implies, are factors in which an individual can control with modifications in lifestyle, and/or medical regimen. Uncontrolled risk factors are not modifiable such as age, race, sex, and family history.

### **2.2.1 Controlled Risk Factors**

#### *a. Hypertension*

Hypertension or high blood pressure (HBP) is the leading cause of stroke in the United States (NIH, 2012; CDC, 2012). High blood pressure but especially uncontrolled HBP can damage arteries in the body, and weaken them to the point that they may rupture (ASA, 2012). The weakening of blood vessels increases the chances of a hemorrhagic stroke (ASA, 2012). High blood pressure is any reading higher than 140/90 (AHA, 2012). Currently in the US, one in every

three adults has hypertension, and 77% of people who have a stroke also have high blood pressure (CDC, 2012). HBP was noted to be more prevalent in adults of African-American race than whites and Hispanics in 2010, but there was a higher prevalence of undiagnosed, and uncontrolled blood pressure in minorities (CDC, 2012). Mexican Americans had higher rates of uncontrolled hypertension compared to non-Hispanic whites (TDSHS, 2009). Non-Hispanic blacks and Mexican- American teenagers have a greater prevalence of high blood pressure, and boys are more prevalent than girls to have HBP (TDSHS, 2009). Twenty-two percent of all Hispanics have high blood pressure, and of that group, Mexican Americans 20 years and older make up 30 percent. In 2009, about three in ten adults (29.1%) in Texas had high blood pressure (TDSHS, 2009).

#### *b. Diabetes*

There are three known types of diabetes, Type I, pregnancy induced diabetes, and Type II diabetes or diabetes mellitus (DM). For the purposes of this study only Type II diabetes will be the focus. Diabetes can best be described as body's inability to use insulin efficiently, and the end result is high blood sugar or hyperglycemia (ADA, 2011). The rate of newly diagnosed diabetes patients has quadrupled in the last thirty years (CDC, 2010) The most common reason for the increase in diabetes is the consumption of a poor diet and the lack of physical activity (CDC, 2012). Blacks and Hispanics are at higher risk for diabetes, at 13 and 12.9 per 1000 population respectively (CDC, 2012). In 2011, the median age of diagnosis was 54.2 years in the adult incidence cases reported, and the range was 16.7 to 87.9 years (CDC, 2012).

People who have diabetes have two to four times higher risk of having stroke, and in 2004, 16% of diabetes-related deaths had stroke as the leading cause of death. In 2010, about one in ten adults (9.7%) in Texas had diabetes. The prevalence of diabetes increased by 56.5% between 2000 and 2010 (TDSHS, 2012). In addition, individuals with diabetes are more prone to having one or



more other risk factors of stroke such as HBP, high cholesterol, and obesity (NSA, 2012). Furthermore, higher levels of blood glucose have been reported to increase the amount of brain damage at the time of a stroke (NSA, 2012).

In a study conducted in the City of El Paso, TX, it was found that Hispanic-Americans diagnosed with DM are 45 years of age and older. This is younger than national levels. They also had low education, low SES or were unemployed. Lastly, the odds of having diabetes were found to be 4 times greater with increasing age and 6 times with low SES in Hispanic-Americans (Martinez, 2007). Lastly, El Paso has a 2.5% prevalence of Type II diabetes in adults, and is the highest in the U.S. (Plan EP, 2010).

### *C, Hyperlipidemia*

Hyperlipidemia or high blood cholesterol is responsible for the hardening of vessels which can cause the blockage or rupture of vessels in adults which can lead to strokes (NSA, 2012). The body needs cholesterol to perform normal cellular functions. There are two types of cholesterol low-density lipoproteins (LDL) and high-density lipoproteins (HDL). LDL is most commonly referred to as the “bad” cholesterol because it is mostly responsible for plaque buildup in the arteries, and therefore can increase the chances of an ischemic strokes and TIAs (NSA, 2012). Some individuals may have genetic dispositions that may increase their amount of LDL in the body, and put them at higher risk of stroke and other heart conditions (CDC, 2012).

From 1999 to 2009, the prevalence of high blood pressure and high blood cholesterol among adults in Texas increased by 20.2 percent and 32.4 percent, respectively (TDSHS, 2012). Mexican American males have cholesterol levels above 200mg/dl and are higher than women (AHA, 2012). In 2009, about four in ten adults (40.9%) in Texas had high blood cholesterol (TDSHS, 2012).

#### *d. Obesity*

Over one-third of adults in the US are obese, and Mexican Americans have the second highest age-adjusted rates for obesity after African Americans (CDC, 2012). Stroke is one of the leading obesity related conditions. Individuals who have excess weight can lead to high blood pressure, high cholesterol, and diabetes (AHA, 2012; NSA, 2012). Additionally, excess fat in the body can strain blood flow and can cause blockage of vessels leading to a stroke (AHA, 2012).

Women with lower socio-economic status are less likely to become obese (CDC, 2011). More Mexican American males (81.3%) are overweight or obese compared to women (78.2%) In 2010, about two in three adults (66.6%) in Texas were overweight or obese in 2010. (TDSHS, 2012) Obesity prevention and management requires adherence to healthy eating and routine physical activity (NIH NHLBI, 2012).

#### *e. Atherosclerosis and Atrial Fibrillation*

Atherosclerosis is defined as the buildup of fatty deposits such as cholesterol in the walls of arteries in the body that cause them to harden over time. The build up of these deposits can block the blood flow to the body and more importantly to the brain (NSA, 2012). Risk factors as the ones mentioned above have also been associated with atherosclerosis, but factors such as age and family history are ones that an individual cannot modify and extra precaution needs to be taken (NSA, 2012). Risk of a stroke are higher in individuals with HBP and atherosclerosis. In a study of 588 white participants, 43.7% were noted to have plaque in the aorta, of which 7.6% had a substantial amount of plaque (Khronzon, 2006). Atherosclerosis makes up 3.4% of all cardiovascular deaths on its own (NHLBI, 2012).

Atrial Fibrillation (AF) is rapid, irregular beating of the upper chamber of the heart. The rapid beats tend to be weaker than normal beats and therefore move blood slowly in the atrium

which in turn leads to pooling of blood which can turn into clots (NINDS, 2012). If these clots dislodge they can block vessels and cause a stroke. High blood pressure has been associated with AF in adults (NINDS, 2012). Individuals are 4-6 times more likely to have a stroke if they have AF, and 25% of all strokes are directly caused by AF (NINDS, 2012).

*f. Lifestyle Risk Factors*

Smoking, lack of physical activity, and poor diet are some of the behavioral risk factors that can lead to a stroke. It has been established that healthy eating and daily exercise can help prevent many of the diseases and conditions previously discussed, but most importantly can decrease the overall risk of a stroke. In 2009, about three out of four adults (76.2%) in Texas consumed fewer than five servings of fruits and vegetables per day. In 2010, more than one in four adults (26.6%) in Texas reported no leisure time physical activity outside of work. In the past, Texas adults who reported having a stroke had significantly higher prevalence of high blood pressure, high cholesterol, diabetes, and no leisure time physical activity than those who did not have stroke (TDSHS, 2012).

Smoking reduces the amount of oxygen in the bloodstream, and forces the heart to work harder which may lead to the formation of blood clots; and raise triglycerides, lower HDL, damage cells lining vessels, thicken and narrow vessels. Secondhand smoking also has similar effects as direct smokers (NSA, 2012; CDC, 2013). Furthermore, smokers have twice as much risk of having a stroke compared to nonsmokers (NSA, 2012). In 2010, an estimated 15.8 percent of adults in Texas were current cigarette smokers. From 1999 to 2009, the prevalence of current cigarette smoking among adults in Texas declined by 29.5 percent.

*g. Metabolic Syndrome*

An individual is considered to have metabolic syndrome when 3 or more out of six risk factors are displayed. Those risk factors are abdominal obesity (body mass index, BMI), atherogenic dyslipidemia (elevated triglyceride, small LDL particles, low HDL), high blood pressure, insulin resistance (hyperglycemia), proinflammatory state, and prothrombotic state (Ervin, 2009). A review of the National Health and Nutrition Examination Survey (NHANES) 2003–2006, revealed that the three most common risk factors in individuals with metabolic syndrome were obesity, HBP, and hyperglycemia. It was also noted that the prevalence of the syndrome increases with age and BMI, and it differed in race and ethnicity (Ervin, 2009).

In a recent study conducted by Texas Tech University Health Sciences Center at El Paso, TX, it was noted that metabolic syndrome increases the chances of suffering an ischemic stroke in the Mexican Hispanic population, but more so below the age of 49 (Osborn, 2012). In the County of El Paso it has been noted that 139.7 cases per 100,000 people have heart disease in the city, and 28.6% of the population of the county is obese (Plan EP, 2010).

### **2.2.2 Uncontrolled Risk Factors**

#### *a. Age*

Most CVAs occur to individuals above the age of 65, but it was been documented that minorities such as African-Americans and Hispanics are having strokes at a much younger age (Jacobs, 2002). In addition a person's risk doubles for every decade past 55 years of age (NSA, 2012).

#### *b. Sex*

Even though there have been conflicting studies that show that men are more prone to a stroke, in the US women are recognized as having a higher risk of a stroke than males, and males having a higher incidence at younger age (NSA, 2012). This is mainly due to the fact that women

live longer, and most strokes occur at an older age (Appelros, 2009; NSA, 2012). In addition, it has been documented that more men suffer hemorrhagic strokes than women, but women tend to have more severe strokes (Appelros, 2009).

Women of African-American race are at greater risk of stroke than white women, and one of the leading causes of death for Hispanic women is stroke.

#### *c. Family History/ Recurrent Stroke*

Research shows that a family history of stroke increases the risk of a CVA for individuals. Every year 5-14% of people who have had a stroke will have a second stroke, and within a 5 year period women will have 24% and 47% recurrence in males (NSA, 2012). In addition, 40% of individuals who have a TIA will have a stroke (NSA, 2012).

#### *d. Race*

African-Americans have two times greater risk of developing a stroke compared to the white population, followed by Hispanics and Asian/Pacific Islanders (NSA, 2012). Studies have shown that atleast one third of all African-Americans have high blood pressure and therefore making them more at risk for stroke (NSA, 2012).

## **2.3 EL PASO COUNTY, TEXAS**

### **2.3.1 Geographical Considerations**

El Paso, Texas is located on the far west region of Texas, within the Chihuahuan Dessert. This city also borders New Mexico and the Mexican city of Juarez, and is inclusive for natural terrains such as the Franklin Mountains and the Rio Grande, which is shared with its neighboring country, Mexico. The city is part of the El Paso County; for purposes of our study we will focus

on the county. This county is composed of 1012.69 square miles, in which 790.6 persons occupy per square mile ( U. S. Census, 2010).

The projected population growth for El Paso County is 69.7% in a matter of 40 years (2000-2040), but it has to be expressed that this forecast does not account for the fluctuating expansion of the military base Fort Bliss (EPredco, 2012).

### **2.3.2 Demographics**

The county of El Paso, Texas had an estimated population of 800,647 in 2010 (US Census, 2010). The city of El Paso is the county seat for this district. This county is composed mainly of Hispanic population, 82.2 percent, followed by 14.2% non-Hispanic white, and 3.4% African Americans (U.S. Census, 2010, Schier, 2011). The majority of the Hispanic population in this region is Mexican-American and, more than 70% of the population is bilingual or speak another language other than English. Additionally, the median population age is 31.1 years old, and adults over the age of 65 make up 10% of the residents (U.S. Census, 2010).

It is known that low education levels lead to a high incidence of disease (TDSHS, 2012). In El Paso, this may be true due to the fact 72% of the population above the age of 25 were high school graduates, and only 19% of that age group have a bachelor degree or higher (U.S. Census, 2012). The median income is over \$36,000 per year, which is under the state's median income. This makes El Paso one of the poorest counties in the US. In addition 25.6% of the population lives under the US poverty level (Census, 2010). Its high immigration rate and its low-wage pay with no health benefits add to the poverty level (Shapleigh, 2008).

Data from the BRFFS reports that in 2010, 24.8% of the El Paso population were at risk of not seeking health care due to lack of insurance or health costs. This statistic is higher than the rest

of Texas and national percentages of 18.8% and 14.6% respectively (BRFSS, 2012). Furthermore, Hispanics are almost four times more likely to not seek medical care due to costs, than whites in the same region (BRFSS, 2012). Minorities tend to not purchase health insurance due to external factors such as language barriers, income and affordability of insurance (Schier, 2011). Finally, it is estimated that 37.1% of resident of El Paso County are at risk of not having insurance, which is almost twice as much higher than the national and state levels (BRFSS, 2012).

## **2.4 DONA ANA COUNTY, NEW MEXICO**

### **2.4.1 Geographic Overview**

Dona Ana County is located on the southern portion of New Mexico, and is surrounded by neighboring counties, Luna County, Sierra County, Otero County, and El Paso County. The county seat of this region is the City of Las Cruces. The county covers 3807.5 square miles, and holds 55 persons per square mile, and it is larger in area than El Paso but has less population per square mile (US Census, 2012).

It is projected that the county will have over 300,000 residents by 2040, and its county seat will have over 145,000; that is close to 38% and 50% population growth respectively (Smith, 2007). In addition, Hispanics will continue to remain the majority of the population in the projected years (Smith, 2007).

### **2.4.2 Demographics**

In 2012 the population of Dona Ana county was estimated at 214,445, and in its county seat had an estimated at 101,047, making it the second largest city in New Mexico (US Census, 2012). Similar to the county of El Paso, this county is composed of approximately 66% of

Hispanics, followed by 29.% of non-Hispanic whites, and 2.1% of black and American Indian populations (US Census, 2012). There is an even distribution between men and women in the county, and about 26% of the population is under the age of 18 and individuals of 65 years of age or older make up 13% (US Census, 2012).

Approximately three fourths of the population are high school graduates, but of that percentage, only 25.5% hold a bachelor's degree or higher (US Census, 2012). Also, over 50% of the population reported speaking another language other than English in their home (US Census, 2012). Furthermore, it is estimated that close to 26% of the population lives below the poverty level, which is similar to El Paso County (US Census, 2012).



**Figure 2.1** Texas and New Mexico Counties. Source: National Atlas of the United States, 2013.



## **2.5 RURAL REGIONS**

Even though the border is largely composed of large cities, in order to further understand the risk factors for stroke that impact individuals in the border region, rural areas in New Mexico and Texas need to be assessed. For this reason, Truth or Consequences (T or C), the county seat city of Sierra County, New Mexico; and Van Horn the county seat of Culberson County, Texas will also be analyzed.

Some factors associated with health disparities in rural areas are socio-economic status, health risk behaviors, geographic isolation which may lead to limited job opportunities and lack of access to health care (Rural Assistance Center (RAC), 2013.) Furthermore, rural communities have been associated with higher rates of chronic illness and overall poor health when compared to their urban counterparts (RAC, 2013.) This may be attributed to more uninsured, less Medicaid recipients, and fewer health care providers (RAC, 2013.)

### **2.5.1 Culberson County, Texas**

Culberson County is approximately 150 miles southeast of El Paso County, and the county seat, Van Horn, is about 120 miles. See Figure 2.1 for more information. The estimated population for Culberson County in 2012 was 2,293, and is considered one of the most sparsely populated areas in Texas (U.S. Census, 2013; Phillips, B. 2012.) Additionally, over 73% of the residents of this county are Hispanic and about 23% are non-Hispanic white (U.S. Census, 2013.) Also, 64.3% of adults above the age of 25 were high school graduates or had higher education (U.S. Census, 2013.) Lastly, the median household income between 2008-2012 was 33,500 dollars, and approximately 23% of Culberson County's resident live below the federal poverty level. (U.S. Census, 2012; Phillips, B. 2012.)

Culberson County has high rate of uninsured adults and children, 42.6% and 30.2% respectively. The death rate of heart disease in the county is 321.5 per 100,000 deaths, and the age-adjusted mortality rate was 104. (Community Health Status Indicators, 2009; Ang, 2012.) For 2011 there was only one death reported for stroke in the whole county (Texas Health Data, 2014.) This may be due to the under reporting of stroke or due to the transfer of patients to other regions such as El Paso County.

### **2.5.2 Sierra County, New Mexico**

The population in 2012 for this county was close to 12,000, and made up approximately 0.6% of the residents of New Mexico. As previously mentioned, T or C is the county seat for this county. See Figure 2.1 for more information. Hispanics make up 28.9% of the population, and 67.2% are non-Hispanic white (U.S. Census, 2013.) In addition, over 85% of the population is made up of high school graduates, and the median household income was \$29,185 (U.S. Census, 2013). In 2009, 27% of residents were living below the poverty level (U.S. Census, 2013.)

Between 2008- 2010 heart disease ranked as the number one leading cause of death, and stroke was the fifth cause of death in the county at 46.4 deaths per 100,000 population. The age-adjusted death rate was found to be 49.0 per 100,000 deaths between 2008 and 2010, making it one of the highest death rates for stroke in the state (New Mexico Department of Health, 2013).

## **2.6 HEALTH OUTCOMES PREVALENT IN THE BORDER REGION**

It is important to understand that in an area with a high population of Hispanics, especially Mexican-Americans, there may be a high incidence of diabetes, obesity, and heart disease. The majority of these two regions are composed of Mexican-Americans which makes them very vulnerable to many chronic diseases, and exposes many to life threatening conditions (US–México Border Health Commission, 2010).

The prevalence of hypertension, diabetes, obesity, and stroke is one of the highest in the state of Texas (TDSHS, 2012; EPHD, 2011). Furthermore, obesity and Type 2 diabetes and related complications are more common in Hispanic prevalent regions (Schier, 2011).

Treatment for heart diseases and obesity has proven to cost the city hundreds of millions of dollars, and it does not appear to be declining anytime soon (Schier, 2011). The leading causes of death in Texas and New Mexico are heart disease, cancer, stroke, accidents, respiratory distress, and diabetes among other things (TDSHS, 2008; NMDHS, 2012).

The people of this border region also suffer from infectious diseases such as Tuberculosis. El Paso has the highest rate of TB than any border county. This is true for Hepatitis A and C. El Paso and Dona Ana county also experience a high pregnancy rate, and has the highest pregnancy rate among women below the age of 18 (Paso del Norte Blue Ribbon Committee (PDNBRC), 2011; Shapleigh, 2008; TDSHS 2012; NMDHS, 2012). Lack of prenatal care in this area is also among the highest in the far west region (Paso del Norte Blue Ribbon Committee, 2011).

El Paso is also known for its low disease detection rates in the state (PDNBRC, 2011). Preventive care measures are essential to reduce health outcomes in the uninsured population (McCann, 2010). Modern health care is moving toward preventive measures, which in the long run will alleviate treatment and the health care cost burden (Schier, 2011; EPDPH, 2011).

Research has shown that the prevalence of hypertension, diabetes, and obesity in Hispanic populations increase the risk for cardiovascular diseases such as stroke (AHA, 2013). The rate of stroke in Hispanic communities that live in poverty or below poverty levels, with low education levels has not been thoroughly explored in border regions. Studying the relationship between these factors and strokes can aid health care providers in the planning and implementation of necessary interventions to reduce the incidence of stroke in this region.

## **Chapter 3: Methods**

### **3.1 GOALS AND OBJECTIVES**

**Goal:** The overall goal of this study is to reduce the incidence of stroke by identifying risk factors that are known to increase the risk of a stroke in the adult population in the El Paso County.

**Objectives:** The main objective of the proposed study is to identify the level of risk the population in the El Paso County, TX and Dona Ana County, NM for stroke. Currently, there has not been a formal assessment that identifies an individual's own risk for a stroke. Therefore a modified version of the Stroke Risk Scorecard developed by the National Stroke Association will be used to evaluate the risk for stroke by using the self-reported risk factors. Three levels of risk groups are identified in this scorecard: low risk, caution (medium), and high risk (See Appendix 3.1). The final objective is to inform local organizations, such as the Border RAC, of the risk level for stroke for different areas within the counties. This information can be used to create an educational intervention for community or clinical settings to aid patients who are at risk of a stroke, or who have had a stroke and need to decrease their chances of a recurrent episode.

### **3.2 STUDY AIMS AND HYPOTHESES**

**Aims:** The primary aim in this study is to identify the most common stroke risk factors among the adult population in El Paso, Texas and Las Cruces, NM. The second aim is to categorize the risk level for stroke into low, medium and high categories. The final aim is to determine if there is a relation between the risk level for stroke among zip codes and age groups in El Paso and Dona Ana counties, and selected rural counties.

#### **Hypothesis:**

Hypothesis 1: There will be a difference in stroke risk factors by zip code and age group.

Hypothesis 2: Stroke risk level will differ by zip code and age group.

Hypothesis 3: There will be a difference in the availability (i.e. distance) of primary/comprehensive stroke centers by zip code.

Hypothesis 4: There will be a difference in stroke risk level between rural areas in Texas and New Mexico.

### **3.3 STUDY DESIGN**

The proposed study is a cross-sectional design used to identify the most common risk factors for stroke in the El Paso County area. Participants were recruited by volunteers from the Far West Texas and Southern New Mexico Regional Advisory Council on Trauma and Emergency Healthcare (Border RAC) from one of the selected sites, and were administered a questionnaire. A manual blood pressure was also taken after consent was obtained. The questionnaire was approved by the Stroke Committee and System Performance Improvement Committees within the Border RAC. Upon proposal approval for this study, an IRB exemption will be sought for secondary data analysis gathered in the cross-sectional survey.

### **3.4 MEASURES**

The measures which were used for this study were located within the screening questionnaire. The survey instrument used by the Border RAC was comprised of several different sections that assessed the risk factors and lifestyle behaviors which have been commonly used by other organizations such as Wellness Councils of America, the Heartland Diabetes Center, and Discovery Fit and Health, American Heart Association. These measures are reviewed in detail below. The independent categorical variables for this study were zip codes and age groups. The dependent categorical variables were stroke risk factors, and stroke risk level.

### **3.4.1 Demographics**

The demographic information that was gathered was age, gender, family and personal history of stroke, and race/ethnicity.

### **3.4.2 Risk Factors**

#### **a. Controlled**

In the screening tool individuals were asked questions that were tallied in order to determine their type 2 diabetes risk. If participants stated that they had diabetes (either type I or type II) then this section for the form was not filled. Additionally, the brachial blood pressure was taken for each of the participants in order to determine if they had hypertension. Also, participants were asked whether they had been prescribed blood pressure and/or cholesterol medication, and if they were taking the medications prescribed. In addition, lifestyle behaviors were assessed such as, smoking status, alcohol consumption, weight, diet and exercise habits.

#### **b. Uncontrolled**

In this section of the questionnaire participants were asked if they had family history of a stroke, or if themselves have had a stroke. As previously mentioned, age was also assessed.

#### **c. Medication and Treatment Adherence (If applicable)**

In a previous section participants were asked if they were receiving or were prescribed any medications to control their blood pressure or cholesterol levels. Also, they were asked if they were taking their medications based on physician recommendations. In the survey participants were not given the opportunity to explain why they have not adhered to the medication regimen.

### **3.4.3 Zip Code**

Data provided by the U.S. Census were used to estimate the median income for zip codes for 2012. Knowing where participants are located in the county is essential in order to estimate

their median household, and the estimated beyond poverty level percentages in order to assess their social economic status. In addition, this information will be used to identify regions in El Paso and Dona Ana counties that may be at high risk. This information can assist government agencies to focus in high risk populations.

#### **3.4.4 Blood Pressure Reading**

A manual brachial measurement of blood pressure was taken by a licensed professional. Participants were informed of their readings, and if a blood pressure was critically found (systolic above 210 mmHg or diastolic above 110 mmHg), the participant would be offered transfer to an emergency room. If the participants refused to go to the emergency room, a refusal form and release of liability had to be signed.

#### **3.4.5 Stroke Risk Scorecard**

This evaluation instrument was developed by the National Stroke Association. This questionnaire queries information on eight risk factors (BP, atrial fibrillation, smoking, cholesterol, DM, exercise, diet, and family history of stroke). This scorecard was be filled out based on the responses given by each participant. Each answer is worth one point, and at the end of the scorecard all points are tallied in each level to determine the respective category (high risk, caution (medium), low risk),. The risk level with the highest number of points is the one that represents the participants risk for stroke. For this study the scorecard were modified by answering the atrial fibrillation risk of each participant as “I don’t know”, and therefore giving each participant one point in the caution category. Furthermore, the question regarding cholesterol levels were marked as “unknown” status, unless an actual level was provided in assessment. Lastly, diabetes risk assessment were used to answer the question regarding diabetes status.

#### **3.4.6 Stroke Centers**

Once the data have been analyzed and the regions of highest risk have been identified, the distance to the closest stroke center will be determined by measuring the distance between zip codes and primary stroke centers. This will be performed using the ArcGIS. Currently, New Mexico only has three primary stroke centers, two in Albuquerque, NM and the other in Las Cruces, NM. El Paso County has five TJC certified primary stroke centers.

### **3.5 STUDY PARTICIPANTS AND STUDY SIZE**

All participants were given an informational sheet regarding signs of a stroke, risk factors, and overall prevention upon the completion of the questionnaire (See Appendix 3.3). No monetary incentives were given to participants.

#### **3.5.1 Study Participants**

The participants for this study were individuals 18 years of age or older who resided within the El Paso County or Dona Ana County and surrounding areas. In addition, two rural areas, (Van Horn, NM and Truth or Consequences, NM), were assessed for rural comparison. Participants were invited to participate in the study if they were 18 years or older, lived within the county boundaries, and gave consent for participation. Participants were allowed to voluntarily choose if they wanted to participate and were not selected or forced to participate.

#### **3.5.2 Sample Size**

A total of 979 adult individuals from the communities selected participated in the study.

### **3.6 PROCEDURES**

Participants were recruited from one of the ten designated data collection sites by trained volunteers from the Border RAC. These sites were located at each of the malls in El Paso County,



(El Paso Outlet Mall, Bassett Center, Cielo Vista Mall, and Sunland Park) and two locations in Dona Ana County, (Mesilla Valley Mall and Lowes Hardware Store). The two rural areas were located at Culberson County Health Fair and Sierra Vista Hospital in Sierra County. All data were collected on the same day, except for two sites (one in El Paso and one in Las Cruces) that were collected on a date different from the initial 8 data collection sites. All of the sites were selected because of their high flow of pedestrian traffic.

Volunteers were trained by the Border RAC to collect data in the following order: 1) assess eligibility, 2) provide information of what a stroke is and its risk factors , 3) explain the purpose of the survey and explain its possible effect on the community, 4) obtain consent, 5) administer survey, 6) take blood pressure reading (by licensed staff), 7) provide results of BP reading and provide copy of survey sheet and preventive information for stroke.

Prior to the start of the data collection, participants were shown a poster of the risk factors for stroke and their definitions, as well as a chart showing expected weight based on height (BMI) (see Appendix). The Participants were explained the purpose of the study and were informed of any effects that their participation may have. Participants were also informed that they may withdrawal from the study at any point. Once the individuals were informed they were given an opportunity to give consent. After consent was obtained, the participants had to answer questions about demographics, potential risk factors, lifestyle habits, and lastly they had to have their manual blood pressure taken. All participants were informed of their blood pressure reading, and were informed if emergency measures needed to be sought. All participants were given a copy of their survey. Behind of each survey the risk factors, stroke prevention factors, and the importance of emergency care during a stroke were briefly explained.

No students, faculty, or staff from The University of Texas at El Paso collected any information from the participants, and all data were collected by volunteers from the Border RAC.

### **3.7 STATISTICAL ANALYSIS PLAN**

Data collected were entered into a database and were analyzed using SPSS 22.0. Data were coded appropriately for missing information as -9, and “not applicable” sections as -8, and a codebook was developed to identify codes for each variable. A descriptive analysis was performed on the demographics and social economic status (based on zip codes). Following that analysis the three levels of stroke risk will be analyzed using one way ANOVA and Kruskal Wallis to find any relationship if any, of risk factors and risk level between zip codes and age group of participants. Due to the categorical nature of most variables and the ordinal description of the dependent variable, the Kruskal Wallis one-way ANOVA were used for this analysis. Additionally, a chi square analysis was used to determine the association between rural areas.

Variables found to be statistically significant were used to develop a map that identified the risk groups and the closest stroke center in that area. Geographical Information System (GIS) maps of the United States and the Paso del Norte Region were used and were layered with the data files of zip codes and stroke risk level to plot and identify the stroke centers within regions. Additionally, ArcGIS software was used to determine if the data layered onto the maps had any significance.

### **3.8 POTENTIAL LIMITATIONS**

Potential limitations to this study are self-selection bias which may not provide a representative sample of the population, and populations of interest may have not been reached. In

addition, participants may have not fully understood the survey instrument or the risk factors, and self-reporting and recall bias may have also played a role in the data collection.

Furthermore, the recruitment sites could have potentially created a bias, as not everyone in all different levels of socioeconomic statuses visits high flowing areas such as malls and stores. Finally, once data are entered and reviewed there may not be a representative sample of certain zip codes and analysis may not be possible especially for rural areas.

## **Chapter 4: Results**

### **4.1 Descriptive Analysis**

#### **4.1.1 Participant Demographics**

The results of the descriptive analysis can be found in Table 4.2 and Table 4.3. There were a total of 979 screening forms identified. For the present analysis only 959 screening forms were used, and the remaining 20 had to be discarded because the participants were under the age of 18. Additionally, 741 forms were written in English and 218 were in Spanish. From the sample collected 574 females (60.4%), and 375 males (39.2) participated. The majority of the participants were found to be between the ages of 36-45 (20.9%) and 46-55 (22.6), followed by 56-65 (17.0%), 25-35 (14.9%), 66-75 (10.1%), 18-24 (7.9%), and 76+ (5.5%). See Table 4.2 for detailed information.

For this study the question regarding race had to be converted to ethnicity due to participants' response. Most of the participants answered this question as being "Hispanic or Mexican", and "Caucasian or black". The form of the question was fill in the blank, and did not provide the participants a list of races. For this reason it is believed that most participants did not understand and/or answered the question correctly. The data was grouped into 7 race/ethnic groups; Hispanic, non-Hispanic white, African American, Indian, Native American, Asian, and other. The majority of the participants reported being Hispanic or non-Hispanic white, 47.2% and 18.0% respectively. The analysis also showed that about 31% of all participants did not respond to the question.

From the data analysis, 87 different zip codes were identified, but only 9 zip codes had 25 participants or more. See Appendix for the list of all zip codes identified. Additionally, 208 participants (21.7%) did not report a zip code. The median household income for each of those

nine zip codes based on the 2012 U.S. Census estimates is listed in Table 4.1. Each county had at least one representative zip code, including rural areas. The El Paso County zip code with the highest percentage of individuals below the poverty level is 79905 (42.2%), and 79912 (13.7%) was the lowest. See Table 4.1 for more information on the nine zip codes with the most participants, and see the Appendix for a complete list of zip codes.

**Table 4.1** *Median Household Income by Zip Code. (U.S. Census, 2012)*

		Number of Samples	Median Household Income (Dollars)	Individuals Below Poverty Level	County
Zip Codes with 25 or more samples	79855	41	\$ 33,000	27.1%	Culberson
	79905	34	\$ 19,388	42.2%	El Paso
	79915	27	\$ 40,057	30.9%	El Paso
	79912	58	\$ 58,455	13.7%	El Paso
	79924	35	\$ 59,058	21.3%	El Paso
	79925	35	\$ 40,641	16.5%	El Paso
	79936	64	\$ 52,102	14.2%	El Paso
	87901	35	\$ 22,783	32.1%	Sierra
	88011	25	\$ 61,026	9.3%	Dona Ana

The descriptive analysis of the participants' health history is found in Table 4.2. Approximately one quarter of the participants reported having a family member who has had a stroke. Also, only 4% of the individuals screened reported having a prior stroke or having signs or symptoms of a stroke. Furthermore, 27.1% of participants reported having a prescription for blood pressure medication, and of those 88% reported taking their medications as prescribed. Similarly, 21% of respondents reported being prescribed cholesterol lowering medications, and of those, 83% reported taking their medications as prescribed.

**Table 4.2** *Descriptive, Demographics*

<b>VARIABLE</b>		<b>COUNT</b>	<b>PERCENT</b>
LANGUAGE	English	741	77.3
	Spanish	218	22.7
GENDER	Male	376	39.2
	Female	574	59.9
	Missing	9	0.9
RACE	Hispanic	453	47.2
	Non-Hispanic white	173	18
	African American	11	1.1
	Indian	2	0.2
	Native American	2	0.2
	Asian	5	0.5
	Other	8	0.8
	Missing	305	31.8
AGE GROUP	18-24	76	7.9
	25-35	143	14.9
	36-45	200	20.9
	46-55	217	22.6
	56-65	163	17
	66-75	97	10.1
	76+	53	5.5
	Missing	10	1
FAMILY HISTORY OF STROKE	Yes	242	25.2
	No	683	71.2
	Missing	34	3.5
HAVE YOU EVER HAD S&S OF STROKE	Yes	38	4
	No	850	88.6
	Missing	71	7.4
HAVE YOU BEEN RX BP MEDICATION	Yes	260	27.1
	No	678	70.7
	Missing	21	2.2
ARE YOU TAKING BP MEDICATION	Yes	227	23.7
	No	31	3.2
	Missing	23	2.4
HAVE YOU BEEN RX CHOLESTEROL MED	Yes	201	21
	No	740	77.2
	Missing	18	1.9
ARE YOU TAKING CHOLESTEROL MED	Yes	166	17.3
	No	33	3.4
	Missing	19	2

#### **4.1.2 Diabetes and Personal Risk Factors**

The distribution for the diabetes risk factor quiz and the personal risk factors can be found in the in Table 4.3, “Diabetes and Personal risk factors”. From the analysis the response rate for the diabetic risk factor quiz was between 93-94%, and the mean score was 8.67. Fifty four percent of the participants responded that their weight was equal to or grader than standard guidelines for age and height. Additionally, participants reported having a sibling or parent with type II diabetes, 20.9 and 36.6 respectively. The majority of the participants were found to be at high risk for diabetes (47.8%), followed by medium risk (34.9%), and low risk (12.2%). During data entry it was noted that 6 individuals reported having type II diabetes and 1 reported having type I diabetes. These individuals were excluded from the analysis for the risk factor quiz.

Approximately 43% of participants reported rarely exercising, and almost half (49%) reported eating salty, fried, or greasy food. A low percentage of participants reported smoking and/or drinking two or more drinks a day, 11.4% and 5.6% respectively. See Table 4.3 for detailed information.

The blood pressure readings were analyzed as systolic and diastolic blood pressure readings. Only the lowest or manual reading was used for screen forms with multiple readings. The results can be found in the “blood pressure” section of the output data. The mean systolic reading was found to be 129.71 (SD= 16.81) and the mean diastolic reading was 77.95 (SD= 10.858). The median values were found to be 129 and 78. The systolic and diastolic readings had positive skew values of .559 and .308 respectively. Refer to histograms for a distribution of the systolic and diastolic readings. Refer to Table 4.3 for more information.

The stroke risk card was filled out using the information from the screen form. The stroke risk card was not used for screen forms that were not complete or when less than 6 possible points

were available. When there was a tie in points between risk levels, then they were coded as medium or caution risk. Approximately, 39% of participants were found to be at high risk for stroke. The next level was low risk (30.3%), followed by medium risk (26.6%). See table below for more information.

**Table 4.3** *Descriptive, Diabetes risk, Personal Lifestyle Factors, and Stroke Risk*

VARIABLE		COUNT	PERCENT	MEAN	STDV
My weight is equal to or above chart	Yes	518	54		
	No	386	40.3		
	Missing	49	5.1		
I am under 65 y/o & get little or no exercise	Yes	311	32.4		
	No	588	61.3		
	Missing	54	5.6		
I am between 45 & 65	Yes	365	38.1		
	No	535	55.8		
	Missing	53	5.5		
I am 65 years old or older	Yes	145	15.1		
	No	754	78.6		
	Missing	54	5.6		
I am woman who had baby weighn <9lbs	Yes	67	7		
	No	825	86		
	Missing	53	5.5		
I have asister or brother with diabetes	Yes	200	20.9		
	No	697	72.7		
	Missing	55	5.7		
I have a parent with diabetes	Yes	348	36.3		
	No	545	56.8		
	0-2	117	12.2		
DM Risk	3-9	335	34.9		
	10+	458	47.8		
You rarely exercise?	Yes	415	43.3		
	No	478	49.8		
You often eat salty, fried or greasy food?	Yes	470	49		
	No	425	44.3		
You Smoke?	Yes	109	11.4		
	No	786	82		
You have more than 2 drinks per day?	Yes	54	5.6		
	No	835	87.1		
BLOOD PRESSURE	Systolic			129.71	16.81
	Diastolic			77.95	10.858
	Low	291	30.3		
STROKE RISK	Medium	255	26.6		
	High	375	39.1		



## 4.2 Bivariate Analysis

### **4.2.1 Hypothesis 1: There will be a difference in stroke risk factors by zip code and age group.**

#### ***Blood Pressure***

An independent t-test was conducted to compare the systolic and diastolic blood pressure reading for males and females. The results showed that there was a statistically significant difference in the mean scores of systolic and diastolic blood pressure readings of males ((Systolic M= 133.11, SD=16.054), (Diastolic M= 79.92, SD= 10.783)) and females [(Systolic M= 127.48, SD= 16.947;  $t(923)=5.052$ ,  $p<0.001$ )(Diastolic M=76.70, SD= 10.758;  $t(923)=5.107$ ,  $p<0.001$ )]. The magnitude of the differences in the means was small to moderate (eta squared= 0.0269 (Systolic) and eta squared= 0.0210 (Diastolic)).

#### ***Blood pressure by age group***

A one-way between-groups analysis of variance (ANOVA) was conducted to explore the differences of age on blood pressure, as measured by systolic and diastolic readings. The age groups were divided into seven age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above). There was a statistically significant difference at the  $p<.001$  level in systolic blood pressure readings for the seven age groups [ $F(6, 924)=16.696$ ,  $p<.001$ ]. The actual difference in mean scores between the groups was quite moderate. The effect size, calculated using eta squared (sum of squares between groups/ Total sum of squares), was .098.

Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 1 (M=121.41, SD=13.733) was significantly different from Group 4 (M= 130.40, SD= 15.854), Group 5 ( M= 134.77, SD= 17.451), Group 6 (M= 138.12, SD= 17.961) and Group 7 (M= 136.14, SD= 16.30). Group 2 (M=124.57, SD=16.440) was significantly different in terms of systolic

readings from Group 4, Group 5, Group 6, and Group 7. Group 3 ( $M= 125.39$ ,  $SD= 13.750$ ) differed significantly in systolic readings from every age group except Group 1 and Group 2. Group 4 differed from all groups in systolic blood pressure readings except Group 5 and Group 7. Group 5 differed in systolic reading only from Groups one thru three. Group 6 differed in all the age groups except the Group 5 and 7. Finally, Group 7 was significantly different in systolic blood pressure in Groups 1 thru 3.

There was a statistically significant difference at the  $p<.001$  level in diastolic blood pressure readings for the seven age groups [ $F(6, 924)=6.928$ ,  $p<.001$ ]. Even though, statistical significance was reached, the actual difference in mean scores between the groups was small. The effect size, calculated using eta squared (Sum of squares between groups/ Total sum of squares), was .043.

Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 1 ( $M=72.34$ ,  $SD=9.451$ ) was significantly different from Group 2 ( $M=76.47$ ,  $SD=11.579$ ), Group 3 ( $M= 78.60$ ,  $SD= 9.558$ ), and Group 4 ( $M= 79.89$ ,  $SD= 10.599$ ). Group 2 was not statistically different from any of the other groups. Group 3 ( $M= 78.60$ ,  $SD= 9.558$ ) differed significantly in diastolic readings only from Group 1. Also, Group 4 was only statistically different from Group 1. Group 5 ( $M= 79.85$ ,  $SD= 11.402$ ) did not differ from any other groups except from Group 1. Group 6 ( $M= 76.96$ ,  $SD= 10.159$ ) and Group 7 ( $M= 74.98$ ,  $SD= 11.370$ ) were not statistically different from any of the Groups.

### ***Blood pressure by zip code***

A one-way between-groups analysis of variance was conducted to explore the differences of zip codes on blood pressure, as measured by systolic and diastolic readings. The analysis could not be completed due to a violation of the homogeneity of variance assumption for ANOVA test

as determined by Levene's test,  $p < 0.001$ . A Welch and Brown-Forsythe test could not be performed due to the asymptotically F distribution. A second one-way between-groups analysis of variance was attempted with the condensed list of zip codes with 25 or more samples, and again the homogeneity of variance was failed, systolic  $p = 0.31$  and diastolic  $p = 0.004$ . Furthermore, a Kruskal Wallis analysis between systolic blood pressure readings and the condensed list of zip codes revealed a significance level of  $p = 0.052$ , this is more than the alpha level of .05. These results suggest that there is no difference in systolic blood pressure levels across the different zip codes,  $\chi^2(8) = 15.362, p = 0.052$ . Similarly, the Kruskal Wallis significant level for diastolic blood pressure was found to be  $p = 0.112$ , and therefore is not statistically significant,  $\chi^2(8) = 12.993, p = 0.0112$ .

### ***Smoking by Age Group***

A Kruskal Wallis analysis was performed to determine if there was a difference in smoking status between seven age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above). A significance level of  $p < 0.001$  was noted. This is less than the alpha level of .05, so these results suggest that there is a difference in smoking status between different age groups,  $\chi^2(6) = 25.893, p < 0.001$ . An inspection of the mean ranks for the groups suggest that Group 6 (66-75) had the highest smoking rates, and Group 2 (25-35) reporting the lowest.

### ***Smoking by Zip Code***

A Kruskal Wallis analysis was performed to determine if there was a difference in smoking status in nine different groups of zip codes (Group 1: 79855; Group 2: 79905; Group 3: 88011; Group 4: 79912; Group 5: 79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9:

87901). The results revealed a significance level of 0.173. This is more than the alpha level of 0.05, and no statistical significance can be determined,  $\chi^2(8) = 11.544$ ,  $p = 0.173$ .

### ***Diabetes risk by Age Group***

A one-way between-groups analysis of variance was conducted to explore the differences of age on diabetes risk, as measured by total score of diabetes risk factor quiz. The age groups were divided into seven age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above). There was a statistically significant difference at the  $p < .001$  level in total score for diabetes risk factor quiz for the seven age groups [ $F(6, 897) = 64.517$ ,  $p < .001$ ]. The actual difference in mean scores between the groups was quite high. The effect size, calculated using eta squared (sum of squares between groups/ Total sum of squares), was 0.30.

Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 1 ( $M = 4.20$ ,  $SD = 4.017$ ) was significantly different from all other groups except for Group 2 ( $M = 5.53$ ,  $SD = 3.879$ ). Group 2 was statistically significant different from all groups for the exception of Group 1 and Group 3 ( $M = 6.74$ ,  $SD = 4.020$ ). Group 3 was found to be significantly different from all groups except Group 2. Group 4 ( $M = 10.40$ ,  $SD = 4.159$ ) was statistically different from all groups except, Group 5 ( $M = 10.66$ ,  $SD = 4.154$ ). Group 5 was statistically different from all groups except Group 4. Group 6 ( $M = 11.92$ ,  $SD = 4.003$ ) is not statistically different from Group 5 and Group 7 ( $M = 12.23$ ,  $SD = 3.874$ ). Group 7 was found to be only statistically different from Group 1 thru 3.

### ***Diabetes risk by Zip Code***

A one-way between-groups analysis of variance was conducted to explore the differences of residences (zip codes) on diabetes risk, as measured by total score of diabetes risk factor quiz.

The zip codes were divided into nine zip codes (Group 1: 79855; Group 2: 79905; Group 3: 88011; Group 4: 79912; Group 5: 79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9: 87901). There was a statistically significant difference at the  $p < .001$  level in total score for diabetes risk factor quiz for the nine zip codes [ $F(8, 329) = 4.689$ ,  $p < .001$ ]. The actual difference in mean scores between the groups was high. The effect size, calculated using eta squared (sum of squares between groups/ Total sum of squares), was 0.10.

Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 1 ( $M = 10.73$ ,  $SD = 3.708$ ) was significantly different only from Group 3 ( $M = 7.13$ ,  $SD = 3.757$ ) and Group 6 ( $M = 7.50$ ,  $SD = 4.472$ ). Group 2 ( $M = 9.32$ ,  $SD = 5.341$ ) was not statistically significant different from any of the groups. Group 3 was found to be significantly different only from Group 5 ( $M = 11.56$ ,  $SD = 5.139$ ). Group 4 was found to be statistically different from all groups except Group 2. Group 4 ( $M = 7.29$ ,  $SD = 4.924$ ) was found to be statistically different from Group 1 and Group 5. Group 5 was statistically different from Group 3, Group 4, Group 6, Group 7 ( $M = 6.15$ ,  $SD = 4.992$ ). Group 6 was only statistically different from Group 5. Group 7 was found to be statistically different from Group 1 and Group 5. Groups 8 ( $M = 9.21$ ,  $SD = 5.100$ ) and 9 ( $M = 9.08$ ,  $SD = 5.123$ ) did not differ significantly from any of the other groups.

### ***Family History by Age Group***

A Kruskal Wallis analysis was performed to determine if family history of stroke was different between seven age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above). A significance level of  $p = 0.033$  was noted, this is less than the alpha level of .05, so these results suggest that there is a difference in family history of stroke across the different age groups,  $\chi^2(6) = 13.743$ ,  $p = 0.033$ . A review of

the mean ranks for the groups suggest that Group 7 (76 and above) and Group 1 (18-24) had the highest rates of family history of stroke, and Group 5 (56-65) reported the lowest.

### ***Family History by Zip Code***

A Kruskal Wallis analysis was performed to determine if there was a difference in family history of stroke and nine different zip code groups (Group 1: 79855; Group 2: 79905; Group 3: 88011; Group 4: 79912; Group 5: 79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9: 87901). A significance level of  $p=0.011$  was noted, this is less than the alpha level of .05, so these results suggest that there is a difference in reported family history of stroke and between different zip code groups,  $\chi^2(8) = 19.919, p = 0.011$ . An inspection of the mean ranks for the groups suggest that Group 5 (79915) had the highest reported family history of stroke, and Group 1 (79855) reporting the lowest.

### ***Diet by Age group***

A Kruskal Wallis test between reported intake of salty, fried or greasy food and seven different age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above). The results revealed a significance level of  $p<0.001$ , this is less than the alpha level of .05. These results suggest that there is a difference in the reported intake of salty or greasy food across the different age groups,  $\chi^2(6) = 47.051, p<0.001$ . A review of the mean ranks for the groups suggests that Group 6 (66-75) has the highest rates of consumption of salty, fried or greasy food. Furthermore, Group 1 (18-24) had the lowest reported mean ranks.

### ***Diet by Zip Code***

A Kruskal Wallis test between reported intake of salty, fried or greasy food and the nine different zip code groups ((Group 1: 79855; Group 2: 79905; Group 3: 88011; Group 4: 79912;

Group 5:79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9: 87901) revealed a significance level of  $p = 0.311$ , this is more than the alpha level of .05. These results suggest that there is no difference in the reported intake of salty or greasy food across the different zip codes,  $\chi^2(8) = 9.381, p = 0.311$ .

### **Exercise by Age group**

A Kruskal Wallis test was conducted between reported statement of “I rarely exercise” and seven different age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above), revealed a significance level of  $p = 0.468$ , this is more than the alpha level of .05. The results suggest that there is no difference in reported “I rarely exercise” across the different age groups.  $\chi^2(6) = 5.616, p = 0.468$ .

### **Exercise by Zip Code**

A Kruskal Wallis test was conducted to determine if the reported “I rarely exercise” was different from nine zip code groups (Group 1: 79855; Group 2: 79905; Group 3: 88011; Group 4: 79912; Group 5:79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9: 87901). The results revealed a significance level of  $p = 0.313$ , this is more than the alpha level of .05. These results suggest that there is no difference in the reported statement of “ I rarely exercise” across the different zip codes.  $\chi^2(8) = 9.362, p = 0.313$ .

### **4.2.2 Hypothesis 2: Stroke risk level will differ by zip code and age group.**

#### **Stroke risk by age group**

A Kruskal Wallis test was conducted to determine if stroke differed in seven different age groups (Group 1: 18-24; Group 2: 25-35; Group 3: 36-45; Group 4: 46-55; Group 5: 56-65; Group 6: 66-75; Group 7: 76 and above). The test results revealed a significance level of  $p < 0.001$ , this is less than the alpha level of .05. The results suggest that there is a difference in the reported stroke

risk across the different age groups.  $\chi^2(6) = 49.621, p < 0.001$ . A review of the mean ranks for the groups suggests that Group 4 and Group 5 had the highest stroke risk, with Group 1 and Group 7 reporting the lowest.

### **Stroke risk by zip code**

A Kruskal Wallis test was conducted to determine if stroke risk was different in nine zip codes (Group 1: 79855; Group 2: 79905; Group 3: 88011; Group 4: 79912; Group 5: 79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9: 87901). The results revealed a significance level of  $p < 0.001$ , this is less than the alpha level of .05. These results suggest that there is a difference in the reported stroke risk across the different zip codes,  $\chi^2(8) = 42.438, p < 0.001$ . A review of the mean ranks for the groups suggests that Group 1 has the highest rates of stroke risk and Group 9 had the lowest stroke risk.

### **4.2.3 Hypothesis 3: There will be a difference in the availability (i.e. distance) of primary/comprehensive stroke centers by zip code and age group.**

Pivot tables were created for zip code and stroke risk. These were uploaded into the ARCGIS software to create layers. All the zip codes and risk level pairs were plotted on a map of the U.S. Refer to GIS Map 4.1 for a graphical representation of results. A layer was created for reach risk level (low, medium, and high risk) based on zip code, See GIS Maps 4.2, 4.3, 4.4 and 4.5. The data were also analyzed to identify “hot and cold spots” or areas of high and low values that are statistically significant. Based on GIS analysis no statistically significant areas were found. Additionally, zip codes that were found to be statistically significant through SPSS analysis were used, but GIS analysis was not able to be performed because minimum requirements of 30 data sets were not met.



The nine zip codes that were identified were layered on a U.S. map. Stroke centers previously identified were identified on the map and the distance was measured between the centroids, or middle point of each zip code. The closest two primary stroke centers were recorded. See Table 4.4 for more information about distance between zip codes and primary stroke centers.

The area code for Culberson County (79855) had the furthest primary care center (113.12 miles), Sierra Providence East Medical Center. A secondary primary care center was not measured for Culberson County, due to the long distance of travel. Sierra County (87901) had the second longest distance to primary care centers. The distance from the primary stroke center, Mountain View Regional Medical Center, was found to be 76.72 miles; followed by Las Palmas Medical Center (188.06 miles). With the exception of 79924, most zip codes were 6 miles or less away from a primary care center.

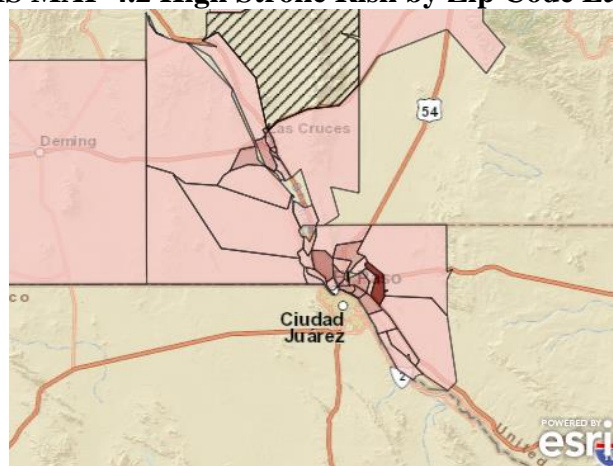
**Table 4.4.** Distance between zip codes and primary stroke centers.

<b>Distance to closest Stroke Centers by Zip Codes</b>					
		<b>Stroke Center #1</b>	<b>Distance #1 (Miles)</b>	<b>Stroke Center #2</b>	<b>Distance #2 (Miles)</b>
<b>Zip Codes with 25 or more samples</b>	79855	Sierra Providence East Medical Center	112.12	None	N/A
	79905	University Medical Center	0.17	Sierra Medical Center	3.87
	79915	Del Sol Medical	2.38	University Medical Center	4.81
	79912	Las Palmas Medical Center	6.28	Providence Memorial Hospital	6.14
	79924	University Medical Center	11.94	Sierra Medical Center	12.75
	79925	Del Sol Medical	3.17	University Medical Center	5.04
	79936	Sierra Providence East Medical Center	4.37	Del Sol Medical	4.47
	87901	Mountain View Regional Medical Center	76.72	Las Palmas Medical Center	188.06
	88011	Mountain View Regional Medical Center	1.05	Las Palmas Medical Center	44.79

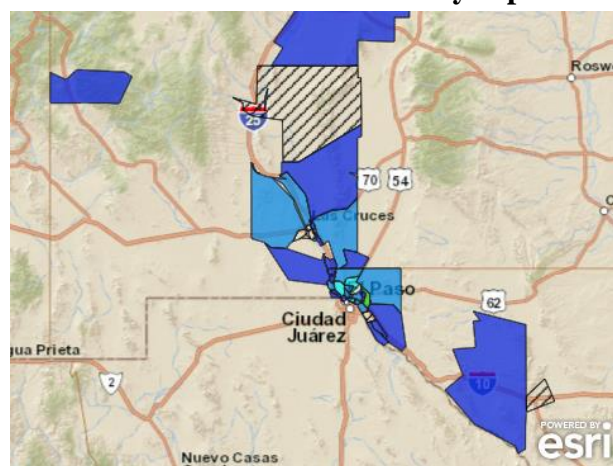
**GIS Map 4.1.** Identified Zip Codes.



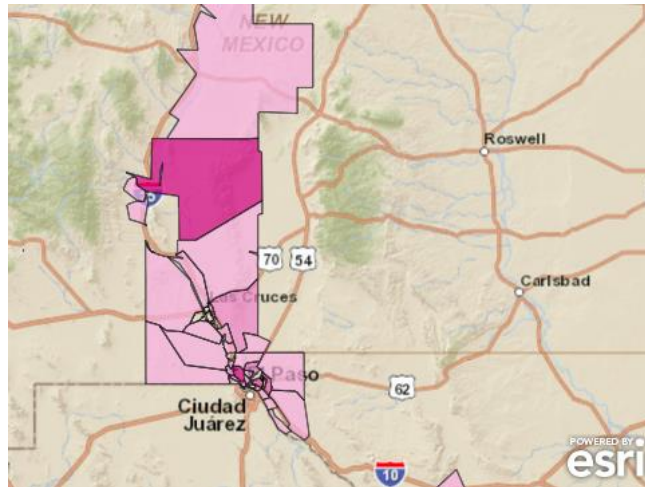
**GIS MAP 4.2 High Stroke Risk by Zip Code Layer**



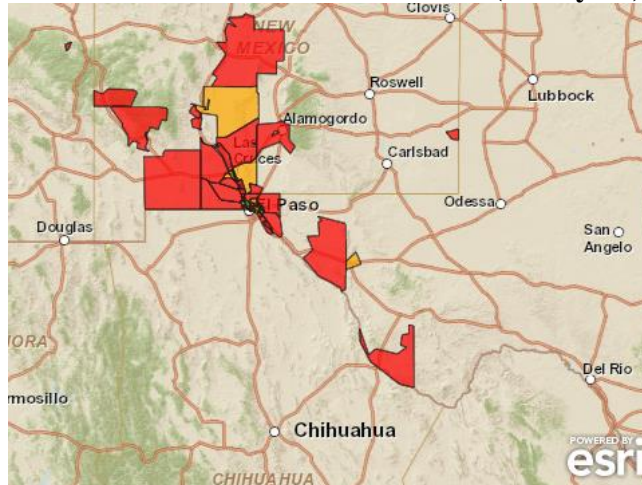
**GIS MAP 4.3 Medium Stroke Risk by Zip Code layer**



**GIS MAP 4.4 Low Stroke Risk by Zip Code layer**



**GIS MAP 4.5 Overall Stroke Risk (All layers)**

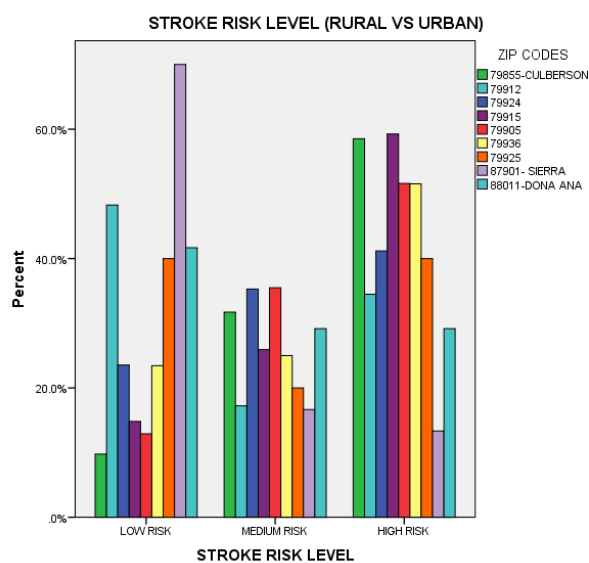


**4.2.4 Hypothesis 4 There will be a difference in stroke risk level between rural areas in Texas and New Mexico**

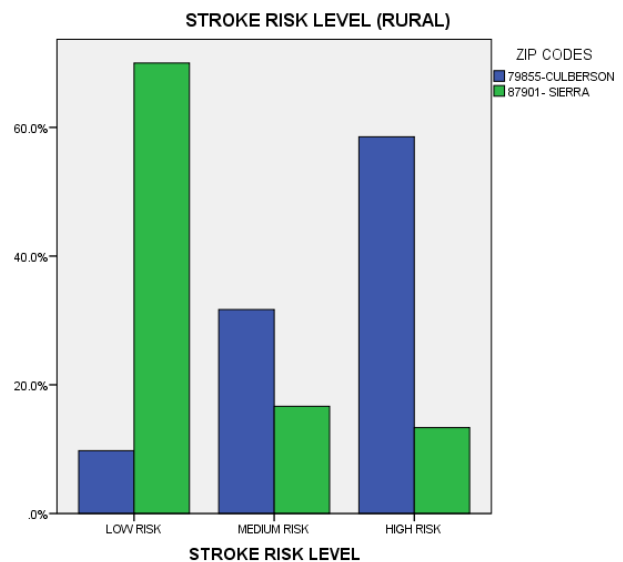
From hypothesis two, it was determined that there is a difference in stroke risk level between rural areas in Texas and New Mexico as evidenced by the representative zip codes of Culberson County and Sierra County. For this hypothesis, the associations between stroke risk and zip codes is further explored.

A Chi Square test was performed to determine the relationship between stroke risk in rural areas with stroke risk in urban areas (as determined by zip code) (Group 1: 79855; Group 2: 79905;

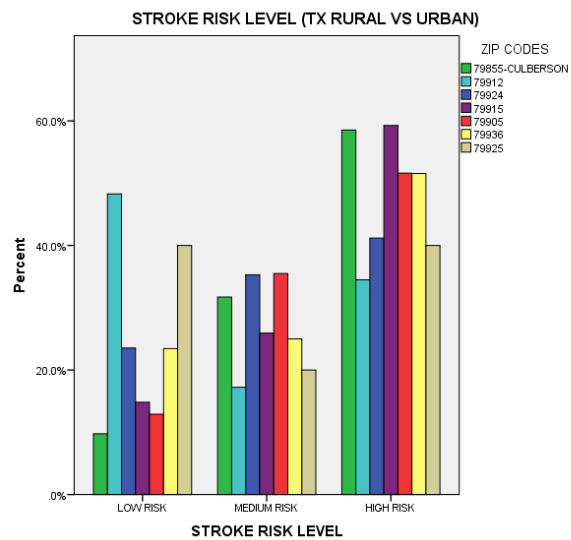
Group 3: 88011; Group 4: 79912; Group 5:79915; Group 6: 79924; Group 7: 79925; Group 8: 79936; Group 9: 87901). The results showed that a relationship was found between stroke risk and zip code  $X^2(16, N = 344) = 54.929, p < 0.001$ . There is a difference in stroke risk level in New Mexico and Texas rural areas, (Cramer's  $V = 0.283, p < 0.001$ ). Rural areas in New Mexico had a higher percentage of low stroke risk (70%) than rural areas in Texas (9.8%). Additionally, each rural area had similar rates of stroke risk as urban areas in the same state. See Bar Graph 4.1, 4.2, 4.3 and 4.4 for more information.



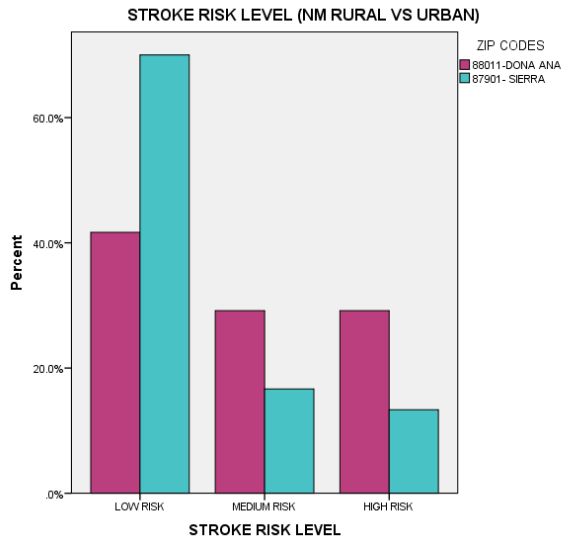
Bar Graph 4.1



Bar Graph 4.2



Bar Graph 4.3



Bar Graph 4.4

## **Chapter 5 Discussion**

From the results, it was noted that there was a difference in some of the stroke risk factors between zip codes and age group. It has to be mentioned that age adjustments were not possible due the preset ranges for the age groups on the screening form.

The race variable, not used for any bivariate analysis, had many issues. Most of the participants did not answer the question correctly, and reported their ethnicity instead. For the purpose of this study the answers for this question were grouped. Individuals who reported their race as “Hispanic, Puerto Rican or Mexican” were grouped as Hispanic. Additionally, participants who left the race question blank, but who used a Spanish screening form were grouped in the Hispanic category. Individuals who reported being Caucasian, Irish, or white were grouped as “non-Hispanic white” (NHW). The issue with this category is that individuals who answered as “white”, and were any other ethnicity aside from Caucasian, they were placed in the incorrect group. Participants who reported being black or African American were grouped as African American. Most participants who identified as being Asian did not give an ethnic background, as well as Native Americans. The Indian group was formed of one Hindi and Indian participant. Any person identified as biracial or of two or more ethnic backgrounds was grouped as other. Even though most participants were placed in the most appropriate group, there may still be a high chance of distortion in the participant characteristics. Further studies should give participants answer choices or description of race, or completely change the question to ethnicity.

There was a difference between blood pressure between men and women. The mean systolic and diastolic blood pressures were higher in male. This may have been due to the higher number of women in the study which could have affected the overall average. A significant difference was noted in systolic blood pressure by age. Younger age groups (18-45) noted to have

similar systolic readings, but older groups (46-76+) were different and reported higher averages of systolic blood pressure. This can be indicative of the age groups that may need more information on the effects of high blood pressure and stroke risk. Most statistics show that individuals above the age of 65 are at highest risk for stroke. If individuals in the 46-64 age groups are having high blood pressure then they may be at risk for stroke at a younger age than initially believed. With the exception of Group 1 and Group 7, similar results were also noted for the diastolic blood pressure readings.

A great deal of the analysis regarding zip codes was not able to be analyzed as easily as the data with age groups. This was due to the increase number of zip codes identified (78), with low number of sample/participants. Only nine zip codes with a minimum of 25 participants were identified, and it included at least one representative zip code for each county. Most analyses were performed using the nine zip codes that contained a significant amount of samples. For this reason a Kruskal Wallis had to be performed to analyze the blood pressures readings, but no significance was discovered.

A significant difference in smoking status between age groups was noted, but not in zip codes. These findings could be due to the small percentage of (11.4%) smokers in the sample collected.

There was a significant difference in age group and diabetes risk. Individuals in Groups 1-3 had averages in the low to medium risk range. In Groups 4-7 the averages were in the high risk range. This indicates that individuals above the age of 45 are at the highest risk for diabetes. Additionally, the calculated effect size implies that 30% of variance in diabetes risk is based on age or age group. This information can be used to inform health care providers on what age groups they should be educating regarding diabetes and risk factors. Furthermore, there was a statistically

significant difference between zip codes indicating that zip codes also play a factor in diabetes risk. Ten percent of the variance in diabetes risk can be attributed to the area that an individual resides.

A statistical significance was noted in individuals in the 18-24 age group and 76 years old and above who reported having a family history of stroke. This variable was based on personal recount of family history of stroke, and this could have impacted the results. There was also a statistical significance in family history of stroke and zip code. These findings were based on the nine zip codes that had enough data sets. One of the zip codes that were found to be statistically significant was in Van Horn which is part of Culberson County. This county has a low mortality rate of stroke, but reports suggest that many individuals who have a stroke may travel outside of the area for care. This finding may suggest that individuals are having strokes more often, but due to limited health care in the area many do travel outside of the county to find the proper care.

This study revealed that individuals between 66-75 years of age consumed the most salty and greasy foods, and individuals between 18-24 years of age consumed the least of these foods. Even though this study did not find a statistical significance in consumption of greasy and salty food between zip codes some studies have found differences in diet between areas declared as food deserts. Food deserts as defined by the United States Department of Agriculture (USDA) are “urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food”. These areas are characterized as having large amounts of fast food restaurants and little or lack of supermarkets (USDA, 2014). Certain food deserts have been identified in the border region. All counties in the present study for the exception of Culberson County have designated food desert census tract (USDA, 2014).



There was no statistically significance in exercise between age groups and zip codes, but there was similar distribution in mean ranks. More studies may need to be done to adjust for age.

The results showed that there was a statistical difference in stroke risk between age groups, and individuals 46-55, 56-65 years of age had the highest risk of stroke. Conversely, individuals older than 76 had the lowest risk. This may indicate that individuals in the border region may be having strokes at an earlier age than reports have suggested. Also, older individuals may be on medication to control their risk factors and may therefore decrease their risk for stroke. Additionally, a significant difference was noted on stroke risk and zip code. Once again Van Horn (Culberson County) was found to have the highest rate for stroke risk while Truth or Consequence (Sierra County) had the lowest stroke risk. These two sites are rural areas found in different states, Texas and New Mexico respectively. More studies may need to be conducted in order to determine the factors that may influence the difference between these two rural areas.

To further explore this finding a chi square analysis was performed to determine if there was an association in stroke risk level between rural areas in both states. The results revealed that there was a difference in stroke level between rural areas in Texas and New Mexico. Rural areas appeared to have similar risk level rates as major counties in their respective states. Sierra County had a larger percentage of individuals that were at low risk for stroke just as Dona Ana County. Conversely, Culberson County had a higher risk for stroke than Sierra County, but it followed similar percentages as other zip codes in El Paso County. These results suggest that there may be other regional factors that may account for the differences not only in rural areas, but overall in Texas and New Mexico.

The median household income for Dona Ana County was found to be more than 61,000 dollars and its poverty level was only 9.3%. In Sierra County the median household income was

below 23,000 dollars, and it had a below poverty level of 32.1%. Interestingly, Sierra County had a higher percentage of individuals who were at low stroke risk than Dona Ana County, and had farther primary stroke centers too. This data could have been skewed due to the representative age groups in the data, and is unable to be further analyzed due to age adjustments constraints.

Another factor that may have to be considered is race. For instance, Sierra County is mainly composed of non-Hispanic Whites (67%) and inversely, Culberson County has 73% Hispanic population. This is not true for Dona Ana County. Further studies are necessary in order to identify if race and age factors play a role in the results.

The GIS analysis provided a graphical representation of all the zip codes identified in the sample, and it provided a closer look of stroke risk levels in the border region. No “hot or cold spots” were identified during the analysis. Hot and cold spots refer to high and low values within the data set. Additionally, significance was not able to be performed in the analysis due to lack of samples for each zip code, 30 samples are the minimum necessary. For that reason no hot and cold samples or significance were noted in the data set that contained the nine zip codes that contained 25 or more samples per area. Although, the distance between zip codes and primary stroke centers was determined.

Van Horn, county seat for Culberson County, was identified as the zip code as having the longest distance between zip code and the closest primary care center. More than 100 miles were measured, and this can play a big role in the overall prevention and treatment of strokes. As previous results in this study indicated, Culberson County is at high risk for stroke, and has statistically significant stroke risk factors. Truth or Consequence, county seat for Sierra County, also had the second furthest distance (76.7 miles) between primary stroke centers and the zip code.

Even though this zip code is over an hour away from the closest stroke center it still has a significant difference in stroke risk than its rural counterpart.

### ***Recommendations for Health Education Programs***

Studies have shown that individuals who were at high risk for stroke were less likely to identify the risk factors for stroke. Future health education programs should be aimed at primary prevention, by educating the population in the border region to identify the risk factors for strokes, and how to modify controllable risk factors to promote better health outcomes. Individuals who have had a stroke, the goal should be aimed at preventing recurring strokes by providing individuals education tailored to their identified needs, in collaboration with their primary care provider.

Education should be provided to priority areas or areas where there has been high reports of hospitalizations related to stroke risk factors. In order to identify these areas a public database should be developed in the border region that monitors the hospitalizations that are considered preventable by good primary health care. The data base should be listed by zip code and not grouped by county. Currently, no such database exists in the counties in this study, and the health indicators available are tracked by county. The advantages of databases such as the ones available in the state of New York, Prevention Quality Indicator (PQI), should be explored by educators in order to implement systems that prioritize care by zip code or priority area.

As identified by the analysis of this study, individuals above the age of 45 were at significant risk for stroke. For this reason opportunities for education should start before this age in order to prevent and treat any modifiable risk factors. Additionally, educational opportunities should not be limited to a primary care provider office, but should be expanded throughout the community in forms of television, radio, and social media. This will increase the likelihood that

most individuals in the region will receive the desired message regardless of age and residential area. The use of evidenced based programs such as the CDC's WiseWoman Program, should be implemented in high priority areas in order to teach members of the community, in this case women, how to monitor their blood pressure and also provide the resources to control their high blood pressure. Furthermore, the idea of "blood pressure" clinics should be explored by communities and organizations, as an opportunity to provide education and services to the community.

Even though these recommendations may be very ambitious, it may be necessary in this region due to growing rates of obesity, diabetes, and hypertension which contribute to the overall risk of stroke.

### ***Recommendations for Health Agencies That Focus in Decreasing Stroke Risk***

One of the major findings noted in this study is the distance between primary stroke centers and rural areas. Agencies should focus in providing stroke education to primary care physicians as well as members within those communities. Providing them with information on the risk factors and modifiable risk factors that directly influence stroke risk is essential in these communities. Also, emergency response teams (EMTs, ER physicians and staff) need to be able to identify individuals promptly and utilize services available in their immediate regions prior to transferring individuals to surrounding cities or counties. Additionally, local and state agencies in these rural areas should collaborate with agencies in larger counties in order to identify individuals within their counties who have had strokes and who have been transferred to surrounding locations. This will help them keep a more precise record of prevalence, incidence, and mortality rates for their regions.

Agencies at state and federal levels should also collaborate with state and federal agencies of neighboring states in order to identify similarities and difference of stroke risk. This may lead to identification of resources or tools that have been implemented within certain regions that may have proven to be successful.

As mentioned above, health care agencies should collaborate with hospitals in order to develop educational packets for individuals who are at risk for stroke. This information should not be limited to individuals who are admitted to the hospital, but also to those who are seen within the emergency room for acute issues.

### ***Recommendations for Primary Stroke Centers and Primary Care Physicians***

Prompt medical care is essential to decrease the amount of cell death in the brain, and decrease physical disability in the individual experiencing a stroke. In recent years, medical treatments such as the use of tissue plasminogen activator or TPA, that are known to help reduce the amount of brain damage after a stroke, have elevated the standard of care and initiated the movement toward certification of hospitals (Karras, 2013). These hospitals designated as primary stroke centers are equipped with staff and protocols that are intended to quickly identify stroke victims in order to provide appropriate care in order to improve outcomes and decrease death and complications.

Studies have shown that hospitals that were TJC certified as primary stroke centers had marginally lower 30-day mortality rates than non-certified hospitals, but had similar re-admission rates (Lichtman, 2011). Additionally, it is known that certain geographical regions have a higher stroke mortality rate, such in the case of the southeastern area of the United States, named the “Stroke Belt” (NHLBI). The geographical variations of each region may pose a risk for individuals who are not close to a selected stroke center (Mullen, 2013). Currently, there is not an even

distribution of certified stroke centers across the country (Mullen, 2013; Albright, 2010). This means that some areas have several designated stroke centers while other areas may not have any in proximity, as seen in the present study.

A study published in 2013, showed that individuals who lived in nonurban areas, had recurrent strokes, and those who lived in the Stroke Belt were less likely to be treated at non-certified hospitals (Mullen, 2013). This study also showed that geographical regions are a major component in stroke treatment disparities, and that race, education and income was not a main factor (Mullen, 2013). These studies support the idea that stroke survival rates and physical disabilities in rural areas such as those in Culberson and Sierra Counties may be directly associated to the proximity to primary stroke centers. The vicinity of stroke centers may not play a role in areas where there are a vast number of stroke centers available for individuals, such in the case of residents in El Paso and Dona Ana Counties.

Primary care physicians should be educated on how to identify individuals who are noted to be at risk for stroke. Due to the cultural diversity of the border region, health care providers should be culturally competent in order to efficiently identify individuals at risk within the population. Next, physicians should provide education to their patients, such as what are the risk factors for stroke and how to change controllable risk factors in order to reduce their risk for stroke. In impoverished areas, like the border region, there may be an increase of individuals who use the emergency department as their only access to health care. In these instances, individuals who are identified as having multiple risk factors or who are at risk for stroke should be educated on the risk factors for stroke as well as how to decrease their risk for stroke. Emergency departments should not miss out on the opportunity to educate at risk individuals regarding stroke. Lastly, collaboration between community health agencies and primary health providers is essential in

order to develop programs that aim at educating individuals as well as providing them with the tools and resources necessary to improve their overall health as well as to maintain lifelong behavioral changes.

### ***Recommendations for Future Research Studies***

Future studies should explore specific risk factors such as BMI, blood glucose levels (to include Hg A1c), blood cholesterol levels. Additionally, future screening forms should specify race and/or ethnicity, and should allow individuals to elaborate in certain questions such as medication adherence. Additionally, a standardized method for stroke risk level (such as stroke risk score card) should be implemented into the questionnaire. Social determinants of health should also be explored during screenings, and should include highest education level attained, access to health care, health insurance, and socio-economic status. Even though median household outcomes can be estimated by zip code, it may not be representative of the individual providing the information.

Collaboration between entities such as the Border RAC and community health organizations and PCPs is essential to not only educate the study population, but to also provide them with the tool and resources in order for them to manage and modify risk factors that may be present at time of screening.

### **Strengths**

The primary strength of this study is that the majority of the sample came from Hispanics living in the border region in Texas and New Mexico. Additionally, the large sample size helped determine statistically significant results. Few studies have been done to identify stroke risk factors and stroke risk levels in Hispanic populations in the border region.

### **Limitations**

## ***Methodological***

Several limitations were identified in this study. The data for this study were mostly collected from individuals in malls and shopping centers. This could have potentially created a bias, as not everyone in all different levels of socioeconomic statuses visit malls and large stores. Data collected from health fairs and clinics may not be representative for that area for not everyone has health care accessibility and health insurance. Another limitation of this study is self-selection bias. Allowing individuals to volunteer to participate in the study may lead to anomalies in the sample, and can make it difficult to determine causation, if it exists.

Furthermore, participants may have not fully understood the survey instrument or the risk factors, and this may have led to inaccurate data reporting. Also, self-reporting and recall bias may have also played a factor in the data collection process.

The screening tool limited participant response. Participants were asked information regarding medication adherence, but participants were not allowed to state why they were not taking their medications as prescribed if they reported not taking the medication. Additionally, the diabetes quiz had many redundant questions regarding age, and physical activity that were covered in other sections of the screening tools. The survey instrument failed to list different types of race (white, African American, Asian, etc.), and instead individuals reported their ethnicity. No information was collected regarding socio-economic status and education attainment levels. Lastly, screening forms were filled out differently at each location which affected the method in which stroke risk level was determine. Some sites provided, weight, height, BMI, while others provided cholesterol levels and blood glucose levels, and some just filled out questionnaire as required. When quantitative data were available for participants it was used to determine stroke



risk instead of direct responses from the questionnaire, and this could have created inconsistencies on risk levels.

### ***Analytical***

Even though a large data sample was collected, a lot of zip codes were underrepresented or not represented at all. This led to only having nine zip codes with enough information for bivariate analysis. Limiting analysis to only nine zip codes restricted the possible generalization of the results within the sample population, and results may not be true for everyone in the population. Another factor that may have influenced the lack of representation of the zip codes was the high percentage of missing values for zip codes. An explanation for the lack of response on this variable may have been due to immigration concerns, and residence outside of the U.S.

Lastly, problems with the screening instrument created difficulties in the data analysis. A lot of the variables were categorical of nominal or ordinal origin, and this limited the methods of possible analysis.

### **Conclusion**

Multiple risk factors known to increase stroke risk exist within the border land region which may contribute to the risk of stroke risk across age groups and area of residence. Further studies are necessary to explore different risk factors (i.e. weight, BMI, actual blood glucose and cholesterol levels) and social determinants of health (i.e. SES, education level, health care access, health insurance) in order to determine underlined vulnerabilities and risk reduction strategies for individuals living in the border region. Primary prevention should continue to be the main goal to decrease to incidence of stroke. Additionally, programs in the border region need to teach individuals to identify risk factors for stroke as well as to inform them on how to reduce their risk for stroke.

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[QCTVOnADcyWNtnNguAI&usg=AFQjCNEwUg6rMX7Jwv7KmRbDHHrUD-FmiQ&bvm=bv.82001339,d.cGU](http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCMQFjAB&url=http%3A%2F%2Fnmhealth.org%2Fpublication%2Fview%2Freport%2F436%2F&ei=-QCTVOnADcyWNtnNguAI&usg=AFQjCNEwUg6rMX7Jwv7KmRbDHHrUD-FmiQ&bvm=bv.82001339,d.cGU)

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## Appendix



**THE UNIVERSITY OF TEXAS AT EL PASO**  
Office of the Vice President for Research and Sponsored Projects  
**Institutional Review Board**  
El Paso, Texas 79968-0587  
phone: 915 747-8841 fax: 915 747-5931

**FWA No: 00001224**

DATE: July 22, 2014

TO: Nancy Rondeau, B.S.

FROM: University of Texas at El Paso IRB

STUDY TITLE: [628887-1] Identification of Stroke Risk Factors in the Adult Population in the Texas and New Mexico Border Region: A GIS and Statistical Approach

IRB REFERENCE #: 628887-1

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS

DECISION DATE: July 22, 2014

Thank you for your submission of New Project materials for this research study. University of Texas at El Paso IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulation [45 CFR 46.101(b)(4)]:

- Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects

Exempt protocols do not need to be renewed. Please note that it is the Principal Investigator's responsibility to resubmit the proposal for review if there are any modifications made to the originally submitted proposal. This review is required in order to determine if "Exemption" status remains.

We will put a copy of this correspondence on file in our office.

If you have any questions, please contact Christina Ramirez at (915) 747-7693 or [cramirez22@utep.edu](mailto:cramirez22@utep.edu). Please include your study title and reference number in all correspondence with this office.

cc:



## APPENDIX 1



# Stroke Risk Scorecard

Each box that applies to you equals 1 point. Total your score at the bottom of each column and compare with the stroke risk levels on the back.

RISK FACTOR	HIGH RISK	CAUTION	LOW RISK
Blood Pressure	<input type="checkbox"/> >140/90 or unknown	<input type="checkbox"/> 120-139/80-89	<input type="checkbox"/> <120/80
Atrial Fibrillation	<input type="checkbox"/> Irregular heartbeat	<input type="checkbox"/> I don't know	<input type="checkbox"/> Regular heartbeat
Smoking	<input type="checkbox"/> Smoker	<input type="checkbox"/> Trying to quit	<input type="checkbox"/> Nonsmoker
Cholesterol	<input type="checkbox"/> >240 or unknown	<input type="checkbox"/> 200-239	<input type="checkbox"/> <200
Diabetes	<input type="checkbox"/> Yes	<input type="checkbox"/> Borderline	<input type="checkbox"/> No
Exercise	<input type="checkbox"/> Couch potato	<input type="checkbox"/> Some exercise	<input type="checkbox"/> Regular exercise
Diet	<input type="checkbox"/> Overweight	<input type="checkbox"/> Slightly overweight	<input type="checkbox"/> Healthy weight
Stroke in Family	<input type="checkbox"/> Yes	<input type="checkbox"/> Not sure	<input type="checkbox"/> No
TOTAL SCORE	<input type="checkbox"/> High Risk	<input type="checkbox"/> Caution	<input type="checkbox"/> Low Risk



# Risk Scorecard Results

High Risk  $\geq 3$ : Ask about stroke prevention right away.

Caution 4-6: A good start. Work on reducing risk.

Low Risk 6-8: You're doing very well at controlling stroke risk!

**Ask your healthcare professional how to reduce your risk of stroke.**

**To reduce your risk:**

1. Know your blood pressure.
2. Find out whether you have atrial fibrillation.
3. If you smoke, stop.
4. Find out if you have high cholesterol.
5. If diabetic, follow recommendations to control your diabetes.
6. Include exercise in your daily routine.
7. Enjoy a lower-sodium (salt), lower-fat diet.

**Act FAST and CALL 9-1-1 IMMEDIATELY at any sign of a stroke:**

**F** **FACE:** Ask the person to smile. Does one side of the face droop?

**A** **ARMS:** Ask the person to raise both arms. Does one arm drift downward?

**S** **SPEECH:** Ask the person to repeat a simple phrase. Is their speech slurred or strange?

**T** **TIME:** If you observe any of these signs, call 9-1-1 immediately.

**1-800-STROKES (787-6537) • [www.stroke.org](http://www.stroke.org)**

## APPENDIX 3.2



*To provide the leadership necessary to sustain high quality, professional services required of an inclusive trauma and emergency healthcare system.*

# Screening Form

### Health Screening Information/Consent Release Form

**You Must be At Least 18 Years of Age to Participate.**

<b>Last Name:</b> _____		<b>First Name:</b> _____		<b>Middle Initial:</b> _____	
<b>Gender:</b> Male <input type="checkbox"/> Female <input type="checkbox"/>		<b>Age Group:</b>			
<b>Race:</b> _____		18-24 <input type="checkbox"/>	25-35 <input type="checkbox"/>	36-45 <input type="checkbox"/>	46-55 <input type="checkbox"/>
		56-65 <input type="checkbox"/>	66-75 <input type="checkbox"/>	76+ <input type="checkbox"/>	
<b>Family History of Stroke:</b> Yes <input type="checkbox"/> No <input type="checkbox"/>		<b>Zip:</b> _____			
		<b>Have you previously experienced the signs and symptoms or have you been diagnosed as having a Stroke?</b> Yes <input type="checkbox"/> No <input type="checkbox"/>			
<b>Have you been prescribed Blood Pressure medications?</b> Yes <input type="checkbox"/> No <input type="checkbox"/>		<b>Are you taking your medications as directed</b> Yes <input type="checkbox"/> No <input type="checkbox"/>			
<b>Have you been prescribed high Cholesterol medication?</b> Yes <input type="checkbox"/> No <input type="checkbox"/>		<b>Are you taking your medication as directed?</b> Yes <input type="checkbox"/> No <input type="checkbox"/>			

### Release of Information

I hereby consent and authorize to the performance of a brief health screening. These tests are not definitive for either the presence or absence of medical problems, and I understand that it is my responsibility to contact my personal physician with any questions I might have regarding the significance of the results. The results of the screening will be released directly to me. "I hereby release and hold harmless BorderRAC, its staff, employees, agents, officers, directors, and any persons involved, from liability, damage or claim arising from any injury or complication that may result from the performance of the screening.

**Authorized Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

### Risk Factors: Diabetes Risk Factor Quiz

Write in the points next to the statement that is true for you. If a statement is not true, put a zero. Then add your total score.

1	My weight is equal to or above that listed in the chart?	Yes - 5
2	I am under 65 years of age and I get little or no exercise during a usual day?	Yes - 5
3	I am between 45 and 64 years of age?	Yes - 5
4	I am 65 years old or older?	Yes - 9
5	I am a woman who has had a baby weighing more than 9 pounds at birth?	Yes - 1
6	I have a sister or brother with diabetes?	Yes - 1
7	I have a parent with diabetes?	Yes - 1
<b>Total : Score: 0-2 Very Low Risk / 3-9 Low to Medium Risk / ; and 10+ High</b>		

### Personal Lifestyle Risk Factors

1	You rarely exercise?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
2	You often eat salty, fried or greasy foods?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
3	You smoke?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4	You have more than 2 alcoholic drinks per day?	Yes <input type="checkbox"/>	No <input type="checkbox"/>

### Blood Pressure Results

Screening	Your Results	Desired Result
Blood Pressure	/	<120/80 mm Hg

IW-Revised 08/2011

BorderRAC use only

The following education was provided by BorderRAC:

☐ Med Compliance   ☐ Blood Pressure   ☐ Cholesterol   ☐ Diet   ☐ Exercise   ☐ See Physician   ☐ Seek Urgent Medical Care

**Refusal Statement:** I have been advised my blood pressure is dangerously high and I refuse emergency transport to a hospital.

X \_\_\_\_\_

## APPENDIX 3.3

### Medical Conditions

**High Blood Pressure.** High blood pressure, also called hypertension, can greatly increase your risk for stroke. Smoking cigarettes, eating a diet high in salt, and drinking too much alcohol can all raise your blood pressure. Desired result is less than 120/80.

**High Blood Cholesterol.** High blood cholesterol can build up fatty deposits (plaque) on blood vessel walls. The deposits can block blood flow to the brain, causing a stroke. Diet, exercise, and family history affect blood cholesterol levels.

**Heart Disease.** Common heart disorders can increase your risk for stroke. For example, coronary artery disease (CAD) increases your risk because a fatty substance called plaque blocks the arteries that bring blood to the heart. Other heart conditions, such as heart valve defects, irregular heart beat (including atrial fibrillation), and enlarged heart chambers, can cause blood clots that may break loose and cause a stroke.

**Diabetes.** Having diabetes can increase your risk of stroke and can make the outcome of strokes worse. Diabetes is a condition that causes blood to build up too much sugar instead of delivering it to body tissues. High blood sugar tends to occur with high blood pressure and high cholesterol. Normal fasting blood glucose is 70-100.

**Overweight and Obesity.** Being overweight or obese can raise total cholesterol levels, increase blood pressure, and promote the development of diabetes.

**Previous Stroke or Transient Ischemic Attack (TIA).** If you have already had a stroke or a TIA, also known as a 'mini stroke' there is a great chance that you could have a stroke in the future.

**Sickle Cell Disease.** This a blood disorder that is associated with ischemic stroke, and mainly affects African-American and Hispanic children. A stroke can happen if sickle cells get stuck in a blood vessel and clog blood flow to the brain. About 10% of children with sickle cell disease will a stroke.

### Stroke Behavior

**Tobacco Use.** Smoking injures blood vessels and speeds up the hardening of the arteries. The carbon monoxide in cigarette smoke reduces the amount of oxygen that your blood can carry. Second hand smoke can increase the risk of stroke for non-smokers.

**Alcohol Use.** Drinking too much alcohol raises your blood pressure, which increases the risk for stroke. It also increases levels of triglycerides, a form of cholesterol, which can harden the arteries.

**Physical Inactivity.** Not getting enough exercise can make your gain weight, which can lead to increased blood pressure and cholesterol levels. Inactivity also is a risk factor for diabetes.

### Stroke Hereditary

**Family History.** Having a family history of stroke increases the chance of stroke. Find out more about this type of risk at CDC's genomics and disease prevention website.

#### RECOGNIZING THE SIGN & SYMPTOMS OF STROKE

- ✗ Sudden numbness or weakness of the face, arm or leg, especially on one side of the body.
- ✗ Sudden confusion, trouble speaking or understanding.
- ✗ Sudden trouble seeing in one or both eyes.
- ✗ Sudden trouble walking, dizziness, loss of balance or coordination.
- ✗ Sudden headache with no known cause.

***Call 911 immediately - if you have any of these warning sign. If caught WITHIN 2 HOURS of onset, we have a good chance to reverse the stroke using a medication called t-PA.***

#### **FAST: Face-Arms-Speech-Time**

**Face:** Ask the person to smile. Does one side of the face droop?

**Arms:** Ask the person to raise both arms. Does one arm drift downward?

**Speech:** Ask the person to repeat a simple sentence. Are the words slurred? Can the patient repeat the sentence correctly?

**Time:** Time matters – CALL 911.

# APPENDIX 4

## Complete list of all identified zip codes.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-9.0	205	21.3	21.4	21.4
	-8.0	3	.3	.3	21.7
	7935.0	1	.1	.1	21.8
	8753.0	1	.1	.1	21.9
	19382.0	1	.1	.1	22.0
	28725.0	1	.1	.1	22.1
	31050.0	1	.1	.1	22.2
	31124.0	2	.2	.2	22.4
	31535.0	1	.1	.1	22.5
	32540.0	1	.1	.1	22.6
	32695.0	2	.2	.2	22.8
	35610.0	1	.1	.1	22.9
	48187.0	1	.1	.1	23.0
	56001.0	1	.1	.1	23.1
	57201.0	1	.1	.1	23.3
	78213.0	2	.2	.2	23.5
	79821.0	1	.1	.1	23.6
	79835.0	11	1.1	1.1	24.7
	79836.0	3	.3	.3	25.0
	79838.0	1	.1	.1	25.1
	79845.0	1	.1	.1	25.2
	79849.0	4	.4	.4	25.7
	79851.0	1	.1	.1	25.8
	79855.0	41	4.3	4.3	30.0
	79885.0	1	.1	.1	30.1
	79901.0	1	.1	.1	30.2
	79902.0	15	1.6	1.6	31.8
	79903.0	16	1.7	1.7	33.5
	79904.0	16	1.7	1.7	35.1
	79905.0	34	3.5	3.5	38.7

79907.0	18	1.9	1.9	40.6
79908.0	1	.1	.1	40.7
79910.0	1	.1	.1	40.8
79911.0	3	.3	.3	41.1
79912.0	58	6.0	6.0	47.1
79914.0	1	.1	.1	47.2
79915.0	27	2.8	2.8	50.1
79916.0	1	.1	.1	50.2
79922.0	8	.8	.8	51.0
79924.0	35	3.6	3.6	54.6
79925.0	35	3.6	3.6	58.3
79927.0	13	1.3	1.4	59.6
79928.0	16	1.7	1.7	61.3
79930.0	20	2.1	2.1	63.4
79932.0	23	2.4	2.4	65.8
79933.0	1	.1	.1	65.9
79934.0	16	1.7	1.7	67.6
79935.0	13	1.3	1.4	68.9
79936.0	64	6.6	6.7	75.6
79938.0	12	1.2	1.3	76.9
79965.0	1	.1	.1	77.0
79995.0	1	.1	.1	77.1
80802.0	1	.1	.1	77.2
81052.0	1	.1	.1	77.3
82520.0	1	.1	.1	77.4
85704.0	1	.1	.1	77.5
85745.0	1	.1	.1	77.6
85927.0	1	.1	.1	77.7
87016.0	1	.1	.1	77.8
87105.0	1	.1	.1	77.9
87120.0	1	.1	.1	78.0
87801.0	2	.2	.2	78.2
87901.0	35	3.6	3.6	81.9
87931.0	1	.1	.1	82.0
87935.0	12	1.2	1.3	83.2

	87942.0	6	.6	.6	83.8
	88001.0	21	2.2	2.2	86.0
	88003.0	1	.1	.1	86.1
	88004.0	1	.1	.1	86.2
	88005.0	23	2.4	2.4	88.6
	88007.0	18	1.9	1.9	90.5
	88008.0	4	.4	.4	90.9
	88011.0	25	2.6	2.6	93.5
	88012.0	19	2.0	2.0	95.5
	88021.0	7	.7	.7	96.2
	88022.0	1	.1	.1	96.4
	88030.0	1	.1	.1	96.5
	88032.0	2	.2	.2	96.7
	88039.0	6	.6	.6	97.3
	88044.0	3	.3	.3	97.6
	88047.0	2	.2	.2	97.8
	88048.0	1	.1	.1	97.9
	88054.0	1	.1	.1	98.0
	88061.0	3	.3	.3	98.3
	88062.0	1	.1	.1	98.4
	88063.0	10	1.0	1.0	99.5
	88065.0	1	.1	.1	99.6
	88081.0	2	.2	.2	99.8
	88242.0	1	.1	.1	99.9
	88310.0	1	.1	.1	100.0
	Total	959	99.6	100.0	
Missing	System	4	.4		
Total		963	100.0		

## **Vita**

Nancy Ulloa Rondeau was born in Los Angeles, California. She has lived in El Paso, Texas for more than 15 years, and considers herself as an El Pasoan. She graduated from Maxine L. Silva Magnet High School, and in that same summer graduated as a Licensed Vocational Nurse from El Paso Community College. She went on to attend The University of Texas at El Paso (UTEP), and graduated with a Bachelor's of Science in Chemistry in 2009. In the fall of 2012, she enrolled in the Masters in Public Health at UTEP. Her interests include chronic diseases such as stroke, heart disease, diabetes, and dementia disorders such as Alzheimer's disease in the adult and elderly population. During her academic studies she served as the treasurer for Students for Public Health (SPH). She is also a recipient of the Louis Stokes Alliance for Minority Participation (LSAMP) and Directors of Health Promotion and Education (DHPE) internships. She interned at El Paso First Health Plans Inc. in the summer of 2014, and at the El Paso Diabetes Association in the fall of 2014. Upon completion of her Master's degree she will continue to work within the Community of El Paso.