ABSTRACT

Disparities in healthcare: Diabetes outcomes among low-income individuals living in Texas

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The ballooning epidemic of chronic diseases in general, and diabetes in particular, is representative of the changes in health and disease in the twenty-first century. Despite these drastic disease burden changes towards more chronic conditions, disparities persist among low-income populations.

The purpose of this research is to explore what marks the disparities in diabetes using Texas public health data from the Behavioral Risk Factor Surveillance System, the world's largest telephone survey. SAS analyses were executed to compare socioeconomic factors with diabetes complications. By comparing diabetes with demographic data and other comorbidities this research found how strong of an association exists between critical diseases like cardiovascular disease.

The results demonstrated people living below the poverty line were 6.78 times (95% CI 6.06, 7.59) more likely to be uninsured as compared to people living above the poverty line. Insurance in America is the gateway to preventative health services. It follows that the poor are at a heightened risk for mismanaged blood sugar in diabetes, which leads to gaping disparities in diabetes complications. In better understanding what marks these disparities, the hope is improve health care for the poor and marginalized.

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DISPARITIES IN HEALTHCARE: DIABETES OUTCOMES AMONG LOW-INCOME INDIVIDUALS LIVING IN TEXAS

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DEDICATION

I would like to dedicate this thesis to the further study of people living in poverty and the marginalized of society to improve access and quality of care. I hope that as a future doctor to use this thesis as a lens to help the poor and the needy. My service to the poor is not only a vocational calling but a ministry calling. Chronic diseases like diabetes are increasing prevalent but the disparity between health care services available for the poor continues to lag behind current standards. I hope to join a health care system that does a better job at caring for and managing the needs of the poor.

CHAPTER ONE

Background of Diabetes: History, Pathophysiology, and Health Care

Introduction: Medicine in the 21st Century

A transformation is underway in medicine with life expectancy improving from 47.3 years in 1900 to 78.7 in 2010 (Tippett, 2014). Linked to this is a shift in away from infectious diseases, like pneumonia, and a precipitous rise in chronic diseases—specifically diabetes mellitus, or DM (Jones et at., 2012). In 1900, the three biggest killers were infectious diseases, but due to vaccines, sanitation, and antibiotics these killers have been largely mitigated in the modern era (Tippett, 2014). As a result of living longer and changing lifestyles, chronic diseases now dominate the list for the top ten leading causes of death (Jones et al., 2012). However, this does not paint the full picture. What is most troubling is "even as prevailing diseases have changed, health disparities have endured. Inequalities in health status have always existed, regardless of how health has been measured or populations defined" (Jones et al., 2012). Despite medicine's momentous leaps in advancement of treatment of disease, especially in infectious diseases, it has failed to wholly meet the needs of all people—especially the poor.

According to data from the Centers for Disease Control, or CDC, diabetes was the sixth leading cause of death from 2002-2007 in Texas (5,105 deaths in 2007), but even this is thought to be a low estimate (Texas Diabetes Council, 2011). A 2009 report of the Behavioral Risk Factor Surveillance System (BRFSS) data found 1.7 million Texans living with diabetes (9.3%) aged 18 years and older (Texas Diabetes Council, 2011). The CDC estimates that a total of 29.1 million people in the U.S. have diabetes

(CDC, 2014). However, out of that, 8.1 million or 27.8% of diabetics are undiagnosed (CDC, 2014). The reason many are undiagnosed is related to lack of access to care due to the lack of health insurance. Diabetes is a condition that lurks quietly in the background without any presenting symptoms in the early stages (Crowley, 2013). Only an astute individual would notice changes like polyuria, polydipsia, and blurred vision (Crowley, 2013). However, as time progresses without treatment, drastic, even fatal, complications develop (Crowley, 2013). Texas is home of the highest uninsured rate in the United States with more than 6.3 million Texans without health insurance or 24% of the population of Texas (Texas Medical Association, 2012). In light of the escalation of chronic diseases, health insurance is likely the most effective way to manage these chronic conditions with preventative care; this is particularly true for diabetes. The uninsured may unconsciously be insulting their bodies with elevated blood sugar because they do not present with symptoms that warrant serious concern. When things do become serious, an uninsured patient with diabetes may seek medical help through an emergency room, the most expensive type of health care (Texas Medical Association, 2012). Not only is the individual's quality of life diminished due to his or her uncontrolled chronic disease, but this also places excessive economic burden on the health care industry. When patients with uncontrolled diabetes do end up receiving care, their disease prognosis is negatively affected. The lack of preventative health services has simply pushed them down a road full of complications like cardiovascular disease and renal failure.

The Cost of Diabetes in the U.S.

In 2012, the American Diabetes Association published a report finding the total estimated cost of diabetes in the U.S. at $245 billion. It is estimated that one fifth of health care spending in in the U.S. goes towards people with diabetes (American Diabetes Association, 2012). The report also found people with diabetes had health costs 2.3 times greater than people without diabetes (American Diabetes Association, 2012). While this report evaluates the financial burden of diabetes, it fails to quantify the lost quality of life or suffering experienced by individuals with diabetes (American Diabetes Association, 2012).

The Cost of Uninsured Medicine

With or without insurance, most patients in the United States will receive medical attention at some point. However, the context and cost in which they receive this care can vary greatly. According to a report by the Legislative Budget Board using Medicaid data estimates, if a condition can be managed by a primary care provider for $56.21, the same service balloons to $193.92 in the ER—a whopping $137.71 excess (Texas Medical Association, 2012). So the question becomes why does the United States provide medical care in such an inefficient manner.

Since uninsured patients cannot pay for the ER visit that costs 245% more than the primary care visit, the bill is largely paid by others. The others end up being "taxpayers, Texans with insurance, and employers who offer health benefits" (Texas Medical Association, 2012). The $116 billion bill for uninsured care gets divided into three main groups: 37% is paid by the patients and their families, 26% by government health programs and charity organizations, and the final $42.7 billion is covered by those

with private health insurance (Texas Medical Association, 2012). This cost burden causes people with insurance to pay higher premiums and higher monthly rates.

Types of Diabetes

DM is either characterized by the pancreas's inability to secrete insulin by the beta cells in the islets of Langerhans, called Type I, or by secreting insulin that is not effective in the setting of "insulin resistance," called Type 2 (Crowley, 2013). Type I DM is an autoimmune disorder in which the body's immune cells destroy the beta cells of the pancreas (Crowley, 2013). In Type 2, the beta cells are functional, but ineffective, as the body's cells are nearly nonresponsive to the glucose-shuttling ability of insulin (Crowley, 2013). There are many risk factors for DM Type 2 that predispose one to acquiring DM, but these are labeled as lifestyle factors because they are environmental (Crowley, 2013).

History of Diabetes

Diabetes was first identified around 1500 B.C.E. by the ancient Egyptians (Polonsky, 2012). The term diabetes mellitus was first used by the Greek physician Aretaeus to describe the sweet urine of those with the condition (Polonsky, 2012). In 1776, Matthew Dobson first measured the concentration of glucose in the urine of people who were sick with diabetes and found it was elevated (Polonsky, 2012). Diabetes has seen many advances and ten scientists who studied diabetes have been awarded the Nobel Prize since 1923 (Polonsky, 2012). The occurrence of type 2 diabetes is increasing; most patients affected by this disease are classified as overweight or obese. The relationship between weight gain and diabetes is pronounced, however, scientists have yet to determine the cause and the effect in this correlation (Polonsky, 2012). In the past three

to four decades, diabetes has become "one of the most common and most serious medical conditions mankind has had to face" (Polonsky, 2012).

In the past two-hundred years there have been many advances in the scientific community in understanding how carbohydrates are metabolized (Polonsky, 2012). Insulin became named after an experiment by Sharpey-Schafer determined there was one chemical lacking in diabetes—he named it "from the Latin word *insula,*" meaning island and referring to the pancreatic islet of Langerhans (Polonsky, 2012). It was Frederick Sanger who was able to fully elucidate the amino acid sequence of insulin and this led to its proliferation in biotechnology (Polonsky, 2012). This was one of the most exciting times in basic science as the research was able to be translated to human health, the understanding the human body, and using that knowledge to treat a lethal condition (Polonsky, 2012). There is still more to be learned about this complex and multivariable disease, but if science can stand on the shoulder of giants like Sanger, there is hope for better outcomes in the future (Polonsky, 2012).

Epidemiology and Hereditary

The prevalence of diabetes has been growing in recent history with a total 29.1 million Americans living with diabetes, 9.3% of the population (CDC, 2014). Geiss et al. examined diabetes diagnosis trends starting in 1980 (2014). Their study found the diabetes prevalence rate were relatively constant during the 1980s, but from 1990-2008 it sharply increased (Geiss et al., 2014). Furthermore, the annual percent change in prevalence during this time period was 4.5% and the annual percent change for incidence was 4.7%; in other words, the incidence and prevalence of diabetes doubled during 1990-

2008 (Geiss et al., 2014). Fortunately, from 2008-2012 the increases did not persist and rates plateaued (Geiss et al., 2014).

Diabetes disproportionally affects people by race/ethnicity with non-Hispanic whites at the lowest rate of 7.6%, Asian Americans are next at 9%, jumping to 12.8% for Hispanics, non-Hispanic blacks are next with 13.2%, and finally American Indians/Alaska Natives have the highest rate at 15.9% (CDC, 2014). One group that is heavily affected is the Pima Indians of Arizona who have a 40% diabetes rate among adults (Crowley, 2013).

Using epidemiology modeling, one study found if current diabetes trends continue, as many as 1 in 3 (33%) of the U.S. adult population could have diabetes by 2050 (Boyle et al., 2010). On the other hand, the lower end of the model, with low incidence and high diabetes mortality, finds that 21%, or about 1 in 5, of U.S. adults will have diabetes by 2050 (Boyle et al., 2010). However, the author states, “Intervention can reduce, but not eliminate, increases in diabetes prevalence” (Boyle et al., 2010).

There are known genetic factors that predispose one to diabetes (Crowley, 2013). Type 1 also has some components of inheritance, but is much more subtle in comparison to type 2 (Crowley, 2013). It is very common for children who have parents that are type 2 diabetics to later develop type 2 diabetes (Crowley, 2013).

Complications of Diabetes

Two main classification of diabetes complications exist: microvascular (retinopathy, neuropathy, and nephropathy) and macrovasular (cardiovascular disease) (Unachukwu, 2012). While the microvascular complications increase diabetic morbidity, it is the macrovasular complications that contribute to mortality (Unachukwu, 2012).

Microvascular Complications

In microvascular complications the basement membrane thickens in response to insult of hyperglycemia and leads to arteriosclerosis, or thickening of the artery wall (Medscape, 2014). This leads to a multitude of insufficiencies in the peripheral nervous system and the circulatory systems named diabetic retinopathy, nephropathy, and neuropathy (Medscape, 2014). Furthermore, as a result of poor peripheral sensation foot ulcers are common among diabetics (Medscape, 2014).

Retinopathy. Diabetic retinopathy occurs when the blood vessels of the eye sustain prolonged damage from uncontrolled or chronic diabetes (Medscape, 2014). The ultimate result of this damage can be loss of vision or even blindness (Medscape, 2014). In fact, diabetes is the most common cause of blindness in the US (Medscape, 2014). This damage occurs due to the thickening of the basement membrane of the blood vessels and impedes the flux of oxygen and nutrient transport across the capillaries (Medscape, 2014). In turn, the eye responds by growing new friable blood vessels that develop microaneurysms that have a risk to rupture causing blood to pool in the eye (Medscape, 2014). Also hard exudates often form as the blood-retina barrier is broken down and serum proteins and lipids leak from vessels and pool on the retinal surface (Medscape,

2014). As proteins leak, macular edema can result (Medscape, 2014). This is a sign that the disease is becoming more advanced (Medscape, 2014). Macular edema is the major contributor for blindness (Medscape, 2014). Treatment of microvascular retinal disease is accomplished by using a laser to coagulate the leaky blood vessels (Medscape, 2014).

Nephropathy. The effects of diabetes complications cannot be emphasized enough. Consider this statement, "diabetic nephropathy is the most common cause of kidney failure in the United States" (Medscape, 2014). Without functional kidneys, diabetic patients rely on peritoneal dialysis, hemodialysis, or a kidney transplant (Medscape, 2014). The first sign of nephropathy is mesangial expansion brought on by hyperglycemia which may increase matrix production or glycosylate the matrix proteins (Medscape, 2014). Next, the glomerular basement membrane thickens (Medscape, 2014). Finally, "glomerular sclerosis occurs from intraglomerular hypertension" (Medscape, 2014). This "hypertension is caused by renal vasodilation or ischemic injury from hyaline narrowing of the vessels supplying the glomeruli" (Medscape, 2014). There are five stages in diabetic nephropathy. Stage one occurs at time of diabetes diagnosis and characterized by increased glomerular filtration (Medscape, 2014). Stage five is when things are very serious and occurs 25-30 years after the initial diagnosis of DM. Its characteristics are uremia, end-stage renal disease, and a low glomerular filtration rate, or GFR (Medscape, 2014). This is due to an increased albuminuria as a result from angiopathy of the kidney glomeruli capillaries. Further, the GFR decreases with time and hypertension results (Medscape, 2014). As hypertension develops or is exacerbated this puts a greater strain on the heart and contributes to cardiovascular disease and the risk of

a myocardial infarction (Mayo Clinic, 2014). The disease process is slow and occurs with incessant insult to the vessels (Medscape, 2014).

Neuropathy. Another complication from hyperglycemia is neuropathy or increasing loss of nerve fibers (Medscape, 2014). While at a pathophysiologic level the mechanism is unknown, it may occur from oxidative stress, excessive neuronal intracellular glucose, and glycation end product disruption of cellular metabolism (Medscape, 2014). It mainly affects the peripheral nerves or the autonomic nervous system. As a result of less sensation in the feet, patients cannot feel pain when an accidental injury occurs or when infection sets in (Medscape, 2014). The longest nerves are first affected due to their disproportionate delay in nerve conduction (Medscape, 2014). Another complication related to this is neuropathic osteoarthropathy—or Charcot joint (Medscape, 2014). This is an advanced complication of DM when loss of sensation causes progressive damage to weight-bearing joints and degeneration, destruction, and deformity result (Medscape…, 2014). To treat diabetic neuropathy glycemic control is paramount along with constant foot checks (Medscape, 2014). The pain can be managed with "tricyclic antidepressants, gabapentin, pregablin, duloxetine, topical lidocaine or capsaicin" (Medscape…, 2014).

High blood pressure or hypertension. A bridge between microvascular complications and macrovascular complications is high blood pressure (HBP). HBP can be caused from atherosclerosis, nephropathy, or without known medical cause (essential hypertension). Blood pressure is largely misunderstood by the public. Blood vessels carry vital oxygen and nutrients to all the cells through the circulation system (American Heart

Association, 2015). To accomplish this impressive task requires a force to pump the blood (American Heart Association, 2015). This force comes from heartbeat and then when the heart rests between heart beats (American Heart Association, 2015). This is where the systolic and diastolic numbers comes from, as in 120/80 (American Heart Association, 2015). HBP is a result of higher than normal force from the heart (American Heart Association, 2015). This force causes a few potentially dangerous problems: 1) vascular weakness from over-stretching the arteries, 2) vascular scarring (overstretching can leave small tears and scar tissue, cholesterol, and debris fill the scars), 3) increased risk of blood clots, 4) increased plaque build-up which increases pressure on the rest of the system and the heart compensates by working harder, exacerbating the initial issue in a vicious snowball effect (American Heart Association, 2015). These issues can buildup overtime, damage the kidneys, and culminate in a potentially fatal heart attack (American Heart Association, 2015).

Macrovascular Complications. Cardiovascular disease is most often the fatal complication associated with diabetes (Standards of Care, 2015). Generally defined CVD is the buildup of plaque on the artery walls called atherosclerosis (American Heart Association, 2015). As this plaque accumulates, it narrows or even occludes the blood vessel and can cause a stroke, or more often a heart attack, also called a myocardial infarction (American Heart Association, 2015). This happens when blood vessels supplying the heart muscles become occluded and the heart muscle dies—infarction (American Heart Assoication, 2015). As Guglin and colleagues found, diabetes and heart failure are interrelated with diabetes increasing risk for heart failure and vice versa (2014).

Cardiovascular disease (CVD) is most often the fatal complication associated with diabetes (Standards of Care, 2015). This occurs primarily through thickening of arterial lumina from chronic inflammation (Fowler, 2008). "In response to endothelial injury and inflammation, oxidized lipids from LDL particles accumulate in the endothelial wall of arteries" (Fowler, 2008). As the immune system responds to the insult to the arterial wall the "net result of the process is the formation of a lipid-rich atherosclerotic lesions with a fibrous cap. Rupture of this lesion leads to acute vascular infarction" (Fowler, 2008). Also, "the combination of increased coagulability and impaired fibrinolysis likely further increases the risk of vascular occlusion and cardiovascular events in type 2 diabetes" (Fowler, 2008). While the exact process of plaque formation is not fully known, diabetes greatly increases CVD risk (Fowler, 2008). Type 2 diabetes is heavily associated with metabolic syndrome (hyperglycemia, central obesity, dyslipidemia, and hypertension), which further contributes excessive risk for CVD (Fowler, 2008). This elevated risk has dramatic effects for health care as "CVD accounts for the greatest component of health care expenditures in people with diabetes" (Fowler, 2008).

Diabetic Emergency. When blood glucose is not properly regulated it can cause vascular damage, but more crucial is acute diabetic ketoacidosis (DKA) or hyperosmolar coma (Crowley, 2013). DKA occurs when the internal acid-base balance is disrupted due to the metabolism of fats, which produce ketone bodies (Crowley, 2013). Fats are metabolized because insulin is insufficient and glucose cannot transport into the cells—diabetes is ironic because the cells are in famine in the midst of excess sugar (Crowley, 2013). DKA is not frequently found in Type 2 diabetics, but is more common in Type 1 due to lack of any insulin (Crowley, 2013). Hyperosmolar coma is more frequent among

Type 2 diabetics and results from extreme hyperglycemia and leads to neurological dysfunction (Crowley, 2013). As the blood glucose can climb to levels 10-20 times normal, the osmolality of the blood rises to staggering levels as well (Crowley, 2013). This leads to a movement of water by osmosis and dehydration of the cells which affects neurons and brain function—eventually leading to coma (Crowley, 2013).

Treatment of Diabetes

Diabetes is a complex disease and requires the whole health care team to come together to collaborate (Standards…, 2014). A plan needs to devised that both incorporates the goals of the patient and uses the best clinical evidence—combining both evidence based medicine (EBM) and patient centered medicine (PCM) (Standards…, 2014). Diabetes self-management education (DSME) is a crucial component to equipping the patient to be a self-advocate (Standards…, 2014). Constant and consistent monitoring of blood glucose levels is foundational in diabetes care and frequent tests help the patient understand how his or her body responds to both food and insulin (Standards…, 2014). It is recommended that a hemoglobin A_{1C} be performed at least twice a year in well managed patients and quarterly for patients with a recent change in therapy or who are not meeting glycemic control goals (Standards…, 2014). The goal for this test is to be near or less than 7%, but if the patient is able to get to 6.5% without risk of hypoglycemia, this is best. A goal of 8% for patients with severe hypoglycemia, limited life expectancy or advanced end stage diabetes is appropriate (Standards…, 2014). Studies like the UK Prospective Diabetes Study (UKPDS, 1999) show that tight glycemic control improves outcomes for Type 2 diabetics. These improved outcomes last beyond

the period in which they are maintained and microvascular damage is mitigated (UKPDS, 1999).

Hemoglobin A_{1C} Test

Type 2 DM is much more common than Type 1 and is therefore of greater clinical significance and can be prevented more effectively than Type 1 (Crowley, 2013). One of the key diagnostic tests of patient management of DM is the hemoglobin A_{1C} test (Crowley, 2013). This test gives a running total of the percent of red blood cells with glycosylated hemoglobin over a two month span (Crowley, 2013). The major benefit of this test is that it is able to give a more comprehensive and long-term measure of how the patient is controlling his or her blood glucose—a normal value for a non-DM patient would be less than 5.6% (Standards of Medical Care in Diabetes, 2014). In 2014, the professional medical society the American Diabetes Association (ADA) endorsed recommendations of hemoglobin A_{1C} of less than 7%, but this goal is often personalized due to variability with various ethnic groups of normal hemoglobin A_{1C} (Standards…, 2014).

While hemoglobin A_{1C} is a good measure for the level of blood glucose control, it is not a sufficient diagnostic tool (Standards, 2014). Instead, tools like Fasting Plasma Glucose (FPG) of greater than 126 mg/dL (7.0 mmol/L) when fasting for eight hours qualifies as a diagnosis for diabetes (Standards…, 2014). Further, the two-hour Plasma Glucose (PG) test with a result greater than 200 mg/dL (11.1 mmol/L) qualifies one for diabetes with an oral glucose tolerance test (OGTT) in which 75 grams of anhydrous glucose, dissolved in water, is given to the patient (Standards…, 2014). On the other hand, there is no need for clinical tests when there is substantial evidence of classic

symptoms or any random PG greater than 200 mg/dL (11.1 mmol/L) (Standards…, 2014).

Prediabetes

It is estimated by the CDC, that 86 million Americans aged 20 or older have prediabetes (2014). One of the largest diabetes studies conducted, the Diabetes Prevention Program (DPP, 2002), found that individuals with prediabetes could reduce their risk for diabetes by losing 5-7% of their body weight through diet and exercise interventions (DPP, 2002). Even "ten years after the DPP, modest weight loss delayed onset of type 2 diabetes by an average of 4 years" (DPP, 2009). The DPP showed that taking metformin for 10 years delayed type two diabetes by two years (DPP, 2009). However, it has been questioned if it is cost effective to take a drug for 10 years to only delay diabetes for 2 years (DPP, 2009).

Affordable Care Act

The Patient Protection and Affordable Care Act (ACA) was signed into law on March 23rd, 2010 by President Obama (Kaiser, 2013). This law sought to widen the access of health care within the US by expanding Medicaid to 138% ($27,310 for a family of three) of the federal poverty level (Kaiser, 2013). It also requires all US citizens to have health care coverage and a fee will imposed on those who do not comply (Kaiser, 2013). Health care is more accessible through federally regulated exchanges (Kaiser, 2013). The implications for low income populations with diabetes may be improved with better access to consistent care. In the Diabetes Prevention Program and Diabetes Prevention Program Outcomes Study, consistent health care was strongly associated with improved diabetes outcomes.

Health Care in Texas. As mentioned earlier, Texas has the highest uninsured rate in the US, but in June 2012 the Supreme Court ruling made Medicaid expansion optional for states (Garfield et al., 2014). Texas chose not to expand Medicaid (Garfield et al. 2014). What is most surprising is a family of three has to make less than 25% of Federal Poverty Level, FPL, ($4,935) if working and 12% of FPL ($2,308) if jobless under Texas Medicaid eligibility requirements (Kaiser Family Foundation, 2013). So while Texas has over 6 million uninsured people, state officials decided to deny Medicaid expansion (Garfield et al., 2014). If there is any light, Texas Medicaid eligibility expanded to families of three making less than $4,935 (previously was $3,736) on January 2014, but even this light is dim in comparison to other states where the average coverage under Medicaid begins for any family earning less than $26,951 (Kaiser Family Foundation, 2013).

The Coverage Gap. Starting in 2014, families of three living in Texas, who make more than $3,736, but less than $19,790 fall into the ominous "coverage gap" (Garfield et al., 2014). The "coverage gap" provides no health coverage, Medicaid, or subsidies on marketplace health plans (Garfield et al., 2014). These families or individuals do not make enough to afford to pay for full priced health insurance, yet the state government is making no effort to aid them (Garfield et al., 2014). In fact, "a quarter of people in the coverage gap reside in Texas, which has both a large uninsured population and very limited Medicaid eligibility" (Garfield et al., 2014). The saying "everything is bigger in Texas" is true as Texas contributes one million to the coverage gap—the more than any other state (Garfield et al., 2014). There seem to be cultural differences in the South where almost half (11 of 23) of the states opted not to expand Medicaid (Garfield et al.,

2014). Also, more poor uninsured adults live in the South and when these two factors combine, 86% of people in the coverage gap live in the South (Garfield et al., 2014). As Garfield et al. mention, those in the coverage gap "are less likely than those with insurance to receive preventative care and services for major health conditions and chronic disease. When they do seek care, the uninured often face unaffordable medical bills" (Garfield et al., 2014). This means that care is delayed until a crisis requires emergent, expensive care. The majority of those in the coverage gap are the working poor who cannot afford health insurance (Garfield et al., 2014). The ACA was created with the intent to grant health care coverage to the uninsured, but still four million Americans fall in the coverage gap (Garfield et al., 2014).

Conclusion: Improving understanding of disparities in diabetes in Texas

The goal of this thesis is to elucidate the effects of lack of access to care of low income diabetic populations on the natural history of diabetes. Health insurance is not the only factor that can be changed as it has been demonstrated that diabetes is a multifactorial disease that has complex interactions with sociology, economics, and even psychology. The necessary approach requires holistic medicine that addresses the entire person, not merely the medical or physical. There is a shift in modern medicine to patient centered medicine and using the wonderful data and wealth of research of evidence-based medicine doctors and health care teams now have an incredible opportunity for innovation and collaboration for the benefit of the patient's holistic care. I hope to demonstrate the link between low income socioeconomic status and the lack of access to health care on diabetes outcomes and complications. Even improved access does not fix this chronic disease; there are structural features at work that inhibit health to low income

populations. These forces are difficult to define and even tougher to change, but with a careful examination of what mechanisms are at work, a paradigm shift has an opportunity to occur. It will require a collaborative effort by health care providers, policy makers, and members of the public. The first step towards change is awareness of the problem.

CHAPTER TWO

Methods

Introduction

The purpose of this research is to explore if low income individuals with diabetes develop complications, like cardiovascular disease, sooner than individuals with diabetes who are not low income. To answer this question, secondary data was acquired through an agreement with the Texas Department of State Health Statistics.

Participants

On the Texas Department of State Health Statistics webpage, a request was made to use the Behavioral Risk Factor Surveillance System (BRFSS) data from 2011. "The Behavioral Risk Factor Surveillance System (BRFSS) is the world's largest, on-going telephone health survey system. More than 500,000 interviews were conducted in 2011, making the BRFSS the largest telephone survey in the world" (CDC, 2015).

Started in 1984, states use a standardized core questionnaire, optional modules, and state-added questions. The survey is conducted using Random Digit Dialing (RDD) techniques on both landlines and cell phones. A detailed description of the BRFSS survey design, random-sampling procedures, and how it was updated in 2011 to permit use of cell phones for data collection is available elsewhere (CDC, 2011).

This Public Use Data File (PUDF) is populated with a core survey that is designed by the CDC (2015). In addition, optional modules allow for a more in-depth focus on

health issues like diabetes (Texas DSHS).This data is used to monitor public health and provides insight to develop chronic diseases interventions (Texas DSHS).

In the 2011 BRFSS, a total of 14,973 participants were surveyed (Texas DSHS). There were 289 potential response data field for each subject (Texas DSHS). This gives a possible 4.3 million possible fields for the entire data set. These include calculated answers using data from other questions in the survey. For example, Body Mass Index (BMI) was calculated using self-reported weight and height according to the formula weight (lb) / [height (in)]^2 x 703" (CDC, 2015). BMI correlates well with body fat and may be used to screen for chronic health problems like diabetes (CDC, 2015).

BRFSS 2011 Overview

BRFSS has been so widely used because telephone survey can be quality controlled with computer assisted systems, it is inexpensive, and offers streamlined data gathering (CDC, 2011). The average interview is 18 minutes long with between 5-10 minutes added for the additional question modules (CDC, 2011). A cell phone protocol was added in 2011 to include the cell phone only populations who are renting their homes, are mostly Hispanic, and often unmarried (CDC, 2011). "Overall, an estimated 96.3% of U.S. households had telephone service in 2010" (CDC, 2011).

Statistical Analysis

To analyze the data, it was imported into Statistical Analysis Software (SAS) by Baylor University Statistics graduate student Johanie Van Zyl. Variables of interest that have significance in diabetes outcomes are both physical (high blood pressure, high

cholesterol, cardiovascular disease, myocardial infarction, Hb A1c test, and BMI) and social or behavioral (income, education, smoking, and physical activity).

Previously, studies have examined the effects of social determinants of health other than just socioeconomic status (SES), household income, or health insurance. While these are certainly important, it was to equally important to avoid bias and seek only the expected results. Instead, a wide comparison of many different behavioral health characteristics were conducted to see which ones were most predictive of having poor diabetes outcomes. Analysis of "Diabetes Module" data from the BRFSS involved a comparison of physical, socioeconomic, health insurance utilization, and behavior factors.

All missing category values within the variables were coded as missing in SAS. See Appendix for detailed codebook listing questions and answer options on survey points of interest.

SAS UNIVARIATE Procedure. This is a descriptive statistical test run by SAS. It gives useful data about quartiles, median, or frequency tables. It can also provide a histogram that can be overlaid with a kernel density estimate (SAS, 2015). This shows the distribution of the data in a more specific line graph.

SAS PROC FREQ Procedure. This command in SAS allows for descending frequency count and find which data point has the greatest observance (SAS, 2015). It also easily allows the user to select which data SAS should analyze and which data to omit (SAS, 2015). It can be easily modified to run statistical tests or to express outputs in useful to analyze (SAS, 2015). In contingency tables, it can be used to analyze various

statistics to explore the relationship the two variables (SAS, 2015). Some of the key tests were chi-square tests, phi coefficient, and odds ratios and relative risks (SAS, 2015). This was very useful in this research to find the correlation between two variables.

Limitations of BRFSS

Some of the limitations of this study became glaring as the research question was applied to the data available from the BRFSS. There was no clinical data and all the values were self-reported. A healthy level of skepticism must be used when analyzing data that has been collected from a self-reported health survey. People are known to have biases when self-reporting that may cast their health in better light than reality. Alternatively, some of this false reporting is not the fault of the individuals because they may be totally unware of parts of their health and may be pressured to fabricate or make up answers.

A telephone survey has a few drawbacks including the fact that people without telephone communication are often poor and therefore have a greater health risk (CDC, 2011). "Therefore, for many of the health risks measured, the results are likely to understate the true level of risk in the total population of adults in Texas" (CDC, 2011). Furthermore, survey data is all self-reported and is likely to understate true health risk, "especially those that are illegal or socially unacceptable" (CDC, 2011).

Question Specific Methods

Age Living with Diabetes. To elucidate how long someone has had diabetes, we used the data from "age of diagnosis of diabetes" subtracted from "age," to find years living with diabetes. This gave us a working model to understand and differentiate

between individuals who had diabetes for a shorter time (<10 years) who were developing macrovasular conditions like cardiovascular disease compared to individuals who had diabetes for over 30 years and had minimal complications.

Poverty Calculation. Poverty was calculated using the Federal Poverty Guidelines from 2011 based on the number of people in household: "Poverty guideline: 1=$10,890, 2=14,710, 3=18,530, 4=22,350, 5=26,170, 6=29,990, 7=33,810, 8=37,630. For families with more than 8 persons, add $3,820 for each additional person" (U.S. Department of Health & Human Services, 2011).

Pairing this with the question in the BRFSS:

newincome - C08Q10

Is your annual household income from all sources…?

01 Less than $10,000
02 $10,000 to less than $15,000
03 $15,000 to less than $20,000
04 $20,000 to less than $25,000
05 $25,000 to less than $35,000
06 $35,000 to less than $50,000
07 $50,000 to less than $75,000
08 $75,000 or more

We assumed that every house has two people in it. The survey does not ask how many people are living in the home, only the number of children. This limitation poses potential issues, but by assuming that each home has two adults the limitation is mitigated. Next we used if/then statements to determine if someone qualifies for below the poverty line:

(0 children) Therefore, every household answering "01" (Less than $10,000) is below the poverty line.

(1 child) If someone has one child in the household (assuming three total in family as with previous situation), answering "01" (Less than $10,000) or "02" ($10,000 to less than $15,000) would be below the poverty line.

(2 children) If someone has two children in the household (assuming four total in family as with previous situation), answering "01" (Less than $10,000) or "02" ($10,000 to less than $15,000) or "03" ($15,000 to less than $20,000) would be below the poverty line.

(3 children) If someone has three children in the household (assuming five total in family as with previous situation), answering "01" (Less than $10,000) or "02" ($10,000 to less than $15,000) or "03" ($15,000 to less than $20,000) or "04" ($20,000 to less than $25,000) would be below the poverty line.

(4 children) If someone has four children in the household (assuming six total in family as with previous situation), answering "01" (Less than $10,000) or "02" ($10,000 to less than $15,000) or "03" ($15,000 to less than $20,000) or "04" ($20,000 to less than $25,000) would be below the poverty line.

(5 children) If someone has five children in the household (assuming seven total in family as with previous situation), answering "01" (Less than $10,000) or "02" ($10,000 to less than $15,000) or "03" ($15,000 to less than $20,000) or "04" ($20,000 to less than $25,000) would be below the poverty line.

After three children the categories that include poverty do not expand because of the gap spacing of the BRFSS. A family would need to have six children to qualify for the next category of income "05" $25,000 to less than $35,000 to be fully included. In summary, this could estimate who qualifies as 100% or less of the FPL. Then poverty was compared against "diabcvd" variable to see if complications were at a high rate in this group compared to people who do not qualify as poverty in "diabcvd". I was interested in finding if there was a correlation because previous research has examined the effects of low socioeconomic status with risk of death among diabetics (Beckles, Imperatore, and Saydah, 2013). They found that the highest levels of mortality were among people with the lowest income (Beckles et al., 2013).

CHAPTER THREE

Results: Data exploration and correlations

Overview of results

This data report of over 14,000 people surveyed in Texas from the Behavior Risk Factor Surveillance Survey (BRFSS) in 2011 compares trends and relationships between critical public health variables. Graphs are utilized to better understand the results with a variety of contingency tables examined. There will be four sections: health insurance status, socioeconomic factors, physical health factors, and behavioral factors. The first section is on health insurance and utilization of care. This includes results from questions like insurance rates in Texas, access to a doctor, Hb A1c test done in past year, insurance and chronic disease, and poverty and insurance. The next section covers socioeconomic factors with trends between diabetes and education, income, race/ethnicity, myocardial infarction, and cardiovascular disease (CVD). Physical health comes next in the results with comparisons between diabetes and health, body mass index (BMI), high blood pressure, high cholesterol, heart disease, and CVD. Finally, the behavioral factors include comparisons between diabetes and physical activity, alcohol intake, smoking, eating habits, education, and dilatability.

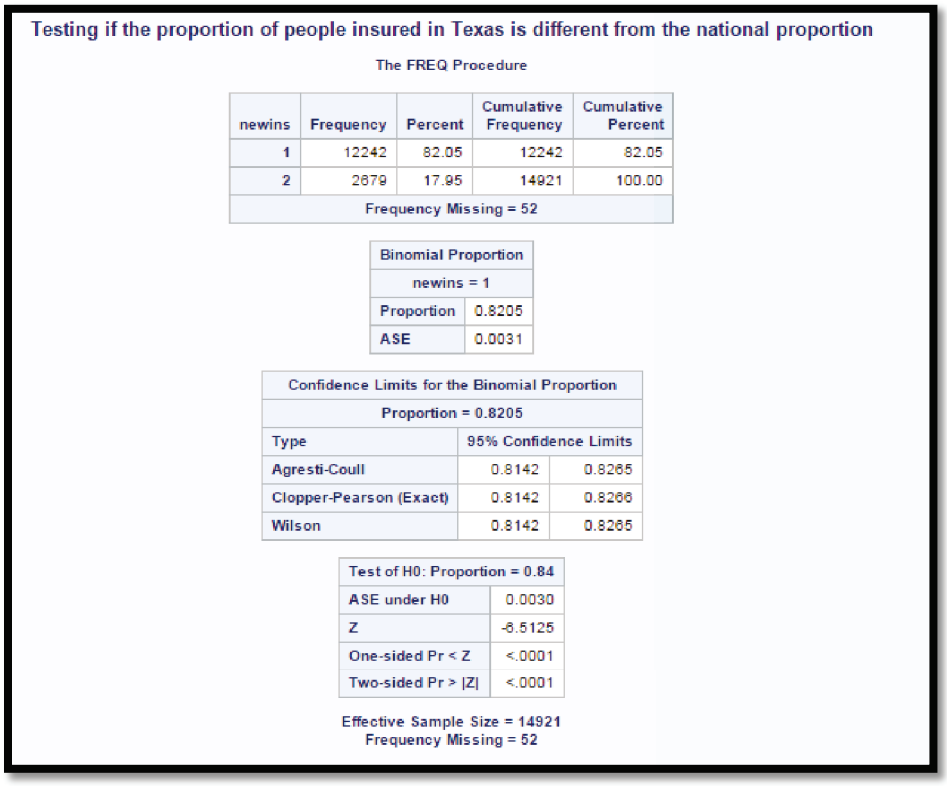
Survey Response Rate

For the 2011 BRFSS report in Texas the overall response rate was 29.56% (CDC, 2013). The landline response rate was 53.0% and 27.9% for cell phones (CDC, 2013).

This was the first year to include cell phone lines as well as land lines and the cellular response rate was encouraging compared to similar surveys (CDC, 2013).

Health Insurance and Utilization of Care

Insurance proportional rate difference between survey and U.S. population



Testing if the proportion of people insured in Texas is different from the national proportion

The FREQ Procedure

newins	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	12242	82.05	12242	82.05
2	2679	17.95	14921	100.00
Frequency Missing = 52				

Binomial Proportion	
newins = 1	
Proportion	0.8205
ASE	0.0031

Confidence Limits for the Binomial Proportion		
Proportion = 0.8205		
Type	95% Confidence Limits	
Agresti-Coull	0.8142	0.8265
Clopper-Pearson (Exact)	0.8142	0.8266
Wilson	0.8142	0.8265

Test of H0: Proportion = 0.84	
ASE under H0	0.0030
Z	-6.5125
One-sided Pr < Z	<.0001
Two-sided Pr > |Z|	<.0001

Effective Sample Size = 14921
Frequency Missing = 52

Figure 1: Testing if national insured rate differs from Texas insured rate based on this survey. Tables from SAS output of 2011 BFRSS survey.

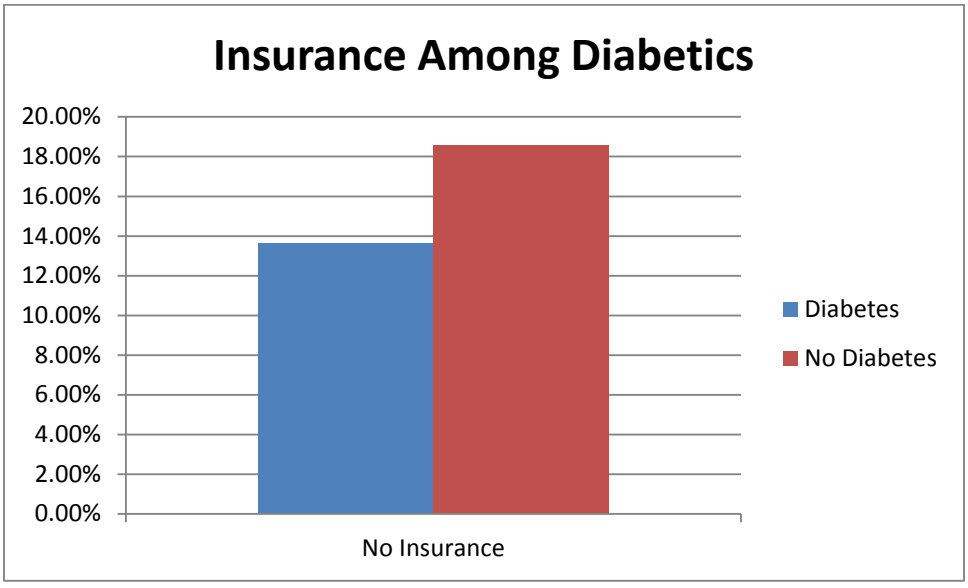
Based on the US Census Bureau report from 2011, the national rate for health insurance was approximately 84% (2012). To statistically test if Texas has a different rate of people covered under health insurance a hypothesis test was used. The null hypothesis was H_0: p = 0.84 and the alternative hypothesis was H_a: p ≠ 0.84. The p-value for this test is 0.003. Since it is less than a significance level of 0.05, we reject the null hypothesis. There is sufficient evidence to conclude that the proportion of people insured

in Texas, based on this survey, is different from the national proportion. The 95% confidence interval for the proportion of people who are insured in Texas is between 0.8142 and 0.8265, on average. This finding is confirmed by other studies with rates as low as 76% insured being reported by Texas Medical Association (2012). In fact, Texas is home to the largest percentage of uninsured people in the US (Texas Medical Association, 2012).

Uninsurance Rates and Diabetes

1) Topic and relevance: With the passage of the Affordable Care Act (Obamacare) in March of 2010, insurance and chronic disease have been of high importance, both in the media and scientific literature. Uninsurance rates and diabetes were compared to explore the relationship between them—the results were surprising.

2) Data



The survey revealed 13.6% of diabetics and 18.6% of non-diabetics did not have insurance, respectively.

3) Interpretation of data: It is interesting to find people with diabetes have insurance at a higher rate than non-diabetics. However, we suspect that those who self-report diabetes are more likely to have health insurance based on simple screening tests. In fact, it is quite surprising to find 13.6% of those who self-report diabetes to lack insurance. It seems odd that they would even be aware of their diabetes if they did not have health insurance. The CDC found that 1 out of every 4 people estimated to have diabetes does not know of their condition (2014).

The importance of diabetes management, and therefore health care access through insurance, cannot be overemphasized. In a similar study using national survey data, Albright et al. (2012) found that uninsured diabetics have higher Hb A1c tests and worse glycemic control. As mentioned previously, insurance determines how much preventative care is received and without insurance someone may not go to the doctor until he or she is in the middle of a crisis and need emergency medical help (Texas Medical Association, 2012). This is the most expensive way to provide medical care. The CDC reports that about 7% of all ER visits could be treated in clinics (Texas Medical Association, 2012). The uninsured tend to be young (age 19-34), Hispanic, have incomes below 200% of the FPL, and do part-time work (Texas Medical Association, 2012).

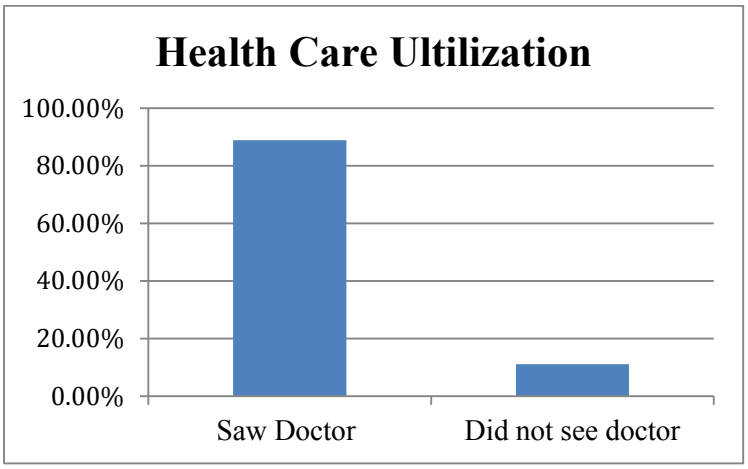
The Affordable Care Act has reduced the number of uninsured by 16.4 million, a 35 percent decrease since open enrollment began in October 2013 to March 2015 (Hamblin, 2015). “That is the biggest improvement in 40 years” (Hamblin, 2015).

Health Care Access and Utilization and Diabetes

1) Topic and relevance: Simply having access and utilizing health care can give patients significantly better control and management of their diabetes (Albright et al.,

2012). In this comparison, we examined the rate of visiting a doctor at least once in the past 12 months among diabetic patients.

2) Data



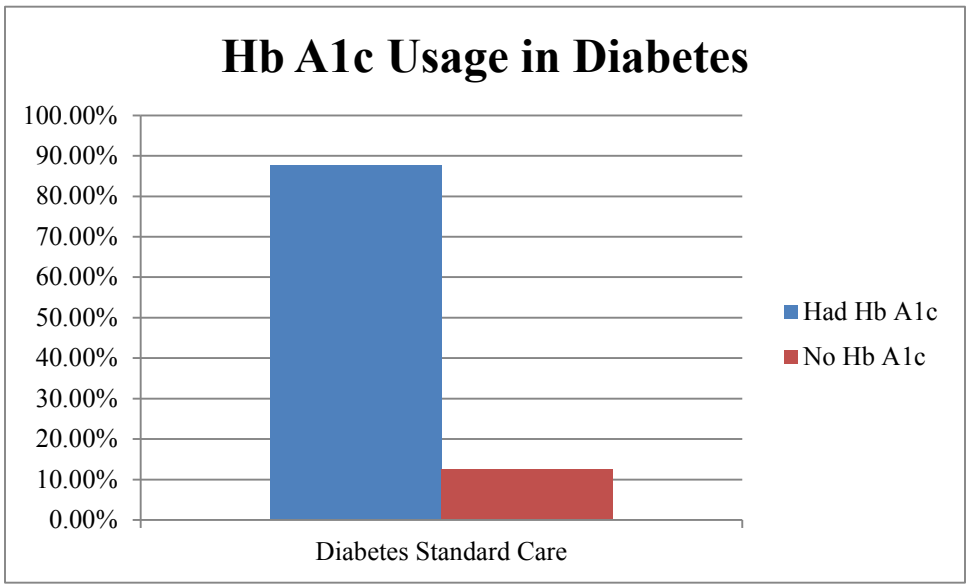
In this study, 11% of those surveyed (n=930) did not see a doctor or health professional in the past year for their diabetes.

3) Interpretation of data: While uninsurance rate is higher than this number, this number includes any visit to the doctor, not necessarily to a primary care doctor. For example, this report includes ER visits or even visits to urgent care centers. This is a significant finding because a study in 2012 by Albright et al. found that those who reported no health care visits were associated with HbA1c greater than 9% and hypertension. These are risk factors for cardiovascular disease because high blood sugars as indicated by HbA1c greater than 5.7% cause damage to blood vessels and high blood pressure points to greater stress on the heart (Mayo Clinic, 2014). While diabetes is a "huge health and economic burden to society, effective diabetes control and management", such as blood glucose and hypertension control can prevent or delay complications like cardiovascular disease and myocardial infarctions (Albright et al., 2012).

HbA1c and Diabetes

1) Topic and relevance: Hb A1c is the most important clinical indicator for how well patients are managing their diabetes. Without this test, patients are in the dark about their risks for developing complications and do not know if they need to change their treatment or management regimen.

2) Data



Out of the diabetics in this survey (n=794), 12.5% did not have a Hb A1c test in the past year.

3) Interpretation of data: The 12.5% of diabetic patients without a Hb A1c test are elevated risk for having mismanaged blood sugars. The economic cost to regulate blood sugars is minimal, as little as $4/month for metformin, but the cost if mismanaged blood sugars develop into complications can skyrocket (American College of Physicians, 2012). Furthermore, the hemoglobin A1c (Hb A1c) test can be used as an indicator of health care access and is the single most important clinical test to measure how a patient with diabetes is managing his or her blood glucose levels (Crowley, 2013). The American

Diabetes Association (ADA) recommends two Hb A1c tests annually for people with well controlled diabetes and four Hb A1c tests annually for patients who changed therapy or are not meeting glycemic goals (Standards of Medical Care in Diabetes, 2014). Without this key test, people could unconsciously have elevated glucose levels that cause vascular damage.

In a separate study of Type 1 Diabetes, multivariable-adjusted hazard ratios for death from cardiovascular causes increased exponentially starting at 2.92 (Hb A1c ≤6.9%), 3.39 (Hb A1c 7-7.8%), 4.44 (Hb A1c 7.9-8.7%), 5.35 (Hb A1c 8.8-9.6%), and 10.46 (Hb A1c ≥9.7%) (Lind et al., 2014). This suggests that even slight adjustments in managing blood glucose could help mitigate mortality from cardiovascular complications. For example, even bringing a patient who has a Hb A1c of 10, or average glucose of 240, down to a Hb A1c of 8, or average glucose of 183, can significantly reduce his or her risk for death from 10.46 to 4.44 times the control group, respectively (Lind et al., 2014). In large cohort study of heart failure patients with newly diagnosed diabetes, patients with Hb A1c >7.0% had a hazards ratio of death of 5.62 (95% CI 3.86-7.40) (Guglin et al., 2014). However, in ambulatory care, some studies suggest that lower Hb A1c are associated with increased mortality rates because of hypoglycemia and Hb A1c levels are optimal between 7.1-7.8% (Guglin et al., 2014).

Table 6.1—Mean glucose levels for specified A1C levels (21,25)

	Mean plasma glucose*		Mean fasting glucose	Mean premeal glucose	Mean postmeal glucose	Mean bedtime glucose
A1C (%)	mg/dL	mmol/L	mg/dL	mg/dL	mg/dL	mg/dL
6	126	7.0				
<6.5			122	118	144	136
6.5–6.99			142	139	164	153
7	154	8.6				
7.0–7.49			152	152	176	177
7.5–7.99			167	155	189	175
8	183	10.2				
8–8.5			178	179	206	222
9	212	11.8				
10	240	13.4				
11	269	14.9				
12	298	16.5				

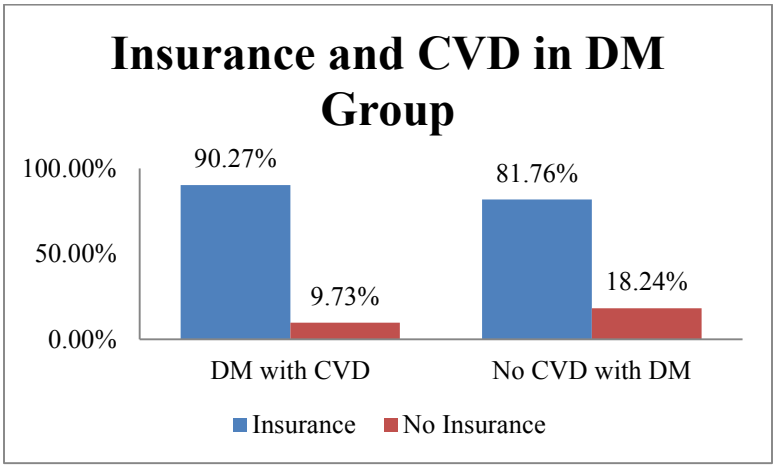
A calculator for converting A1C results into eAG, in either mg/dL or mmol/L, is available at http://professional.diabetes.org/eAG.
*These estimates are based on ADAG data of ~2,700 glucose measurements over 3 months per A1C measurement in 507 adults with type 1, type 2, and no diabetes. The correlation between A1C and average glucose was 0.92 (25).

This chart is from the ADA's Standards of Medical Care in Diabetes (2015) and is based upon two studies that measured both glucose levels and Hb A1c to discover the relationship between the two. It converts results from the Hb A1c test to average glucose levels and demonstrates that regulating average glucose slightly can dramatically change the Hb A1c. This is closely associated with lower cardiovascular mortality as previously shown (ADA, 2015).

Diabetes with CVD and Insurance Status

1) Topic and relevance: While diabetes is of importance, it is really the end-stage macrovascular damage, CVD, which warrants the most concern. Of central interest to this thesis was the exploration of whether people without insurance had a higher CVD burden than those with insurance. The results indicated something unexpected.

2) Data



Those who reported with both CVD and diabetes had insurance 90.27% of the time while 18.2% of the people without both CVD and diabetes did not have insurance. In short, people with comorbid chronic conditions of CVD and diabetes were more likely to be insured than those without comorbid conditions.

3) Interpretation of data: In interpreting these results, it is important to keep in mind that all health conditions and insurance status is entirely self-reported. Therefore, one could have one of these chronic conditions but may be unaware of his or her condition if he or she irregularly sees the doctor because of lack of insurance.

Further, it must be noted that people who knew they had diabetes had insurance at a greater rate than non-diabetics. These results may reflect the individual's awareness of their health, rather than his or her actual health status.

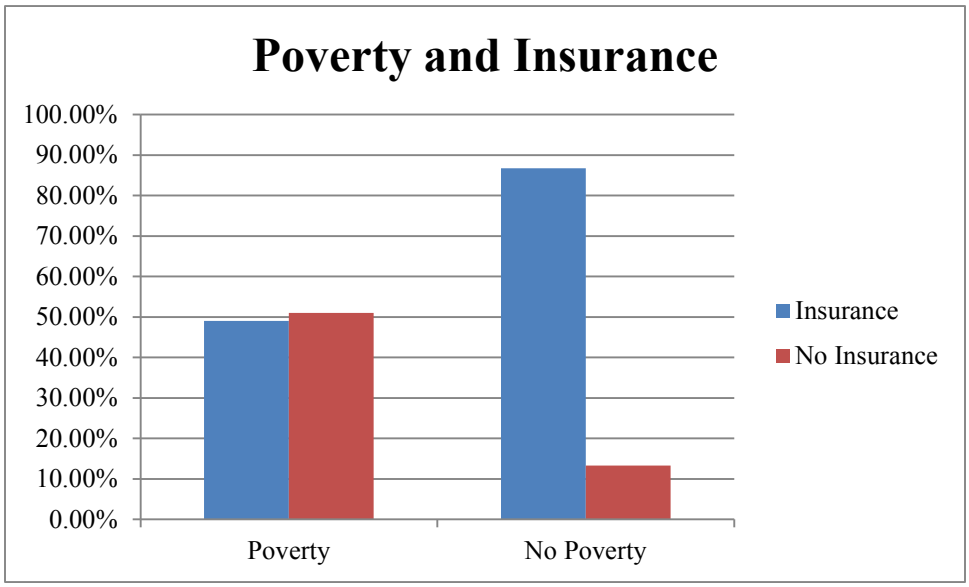
Since the passage of Medicare into law in 1965, adults over the age of 65 receive health insurance through the national government (Berkowitz, 2008). The results of the study fail to distinguish between adults living with diabetes who have not had prior health care insurance and adults with diabetes who have had health insurance prior to turning age 65. This fails to adequately show the difference of complications stemming from

poor glycemic management. In other words, adults living with diabetes, but without insurance may develop complications like CVD, turn 65 years old, and then receive Medicare. It is difficult to assess these differences in care in large public health surveys.

Poverty and Insurance

1) Topic and relevance: Poverty was of great significance because this project wanted to find what factors contributed to the decline of health in diabetics. It was of significance to see if poverty and insurance were linked.

2) Data



While only 13.3% of those without poverty did not have insurance, more than half, 51%, of those in the poverty category did not have health insurance of any kind. People living ≤%100 of Federal Poverty Level (FPL), were 6.78 times (95% CI 6.06, 7.59) more likely to be uninsured as compared to people living above the FPL.

3) Interpretation of data: This comparison offered one of the most dramatic difference between any of the groups evaluated. While the insurance rate was not lower, it was in fact higher, in the diabetes group compared to the non-diabetic group, there is

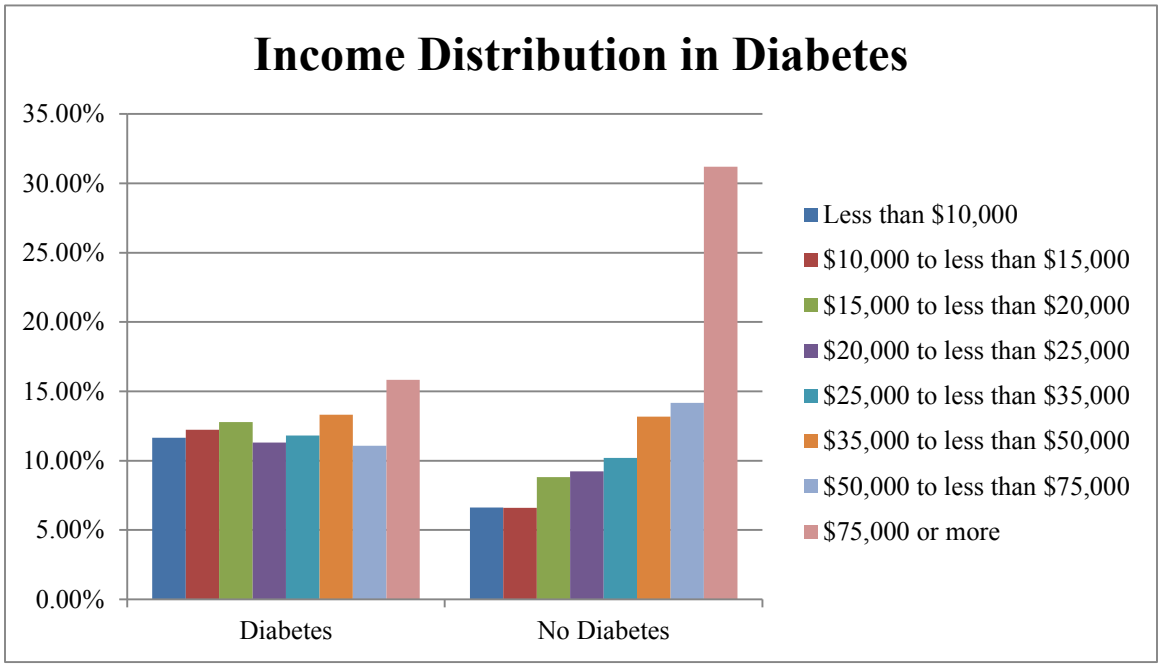
staggering lower rate of insurance in people living in poverty compared to the non-poverty group. Juxtaposing these two groups highlights the disparities in health care that persist due to economic factors.

Socioeconomic Factors

Diabetes and Income (8 categories)

1) Topic and relevance: In looking at disparities in health care, income compared to diabetes showed the stark contrast between diabetes and non-diabetes groups. Diabetes has been strongly linked to income level and tends to affect the poor disproportionally.

2) Data



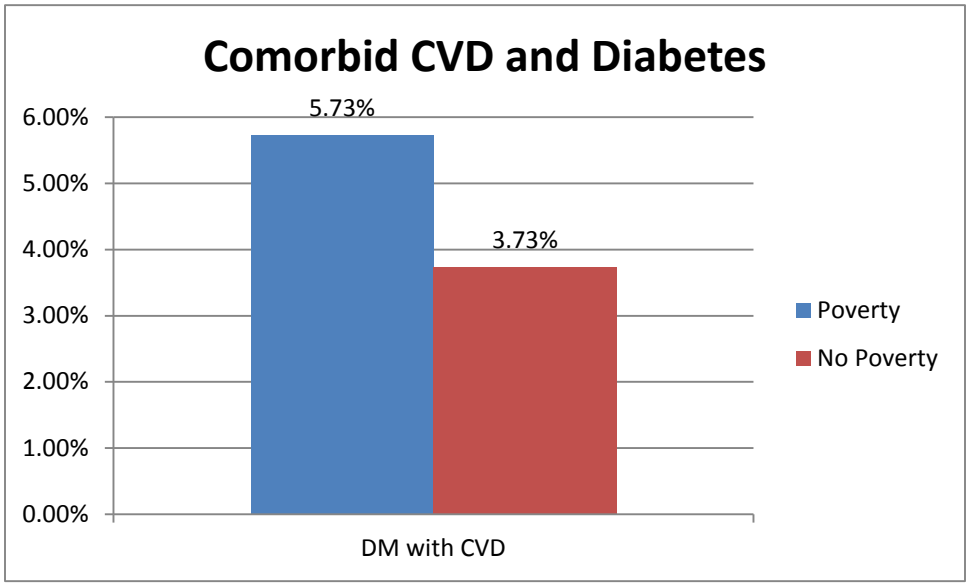
People with household incomes less than $35,000 (Categories 1, 2, 3, 4, and 5) who also had diabetes made up 59.8% of the group. On the other hand, people with household incomes less than $35,000 (Categories 1, 2, 3, 4, and 5) who did not have diabetes made up 41.46%.

3) Interpretation of data: One of the biggest disparities in health care is based on household income. Diabetes disproportionally affects the poor (<$35,000) and the poor are less likely to have insurance. The synergistic effects of uninsurance and diabetes greatly increase the likelihood of diabetic complications. Much of the excessive cost of diabetes care could potentially be mitigated by simply providing preventative care to manage diabetes among the poor.

Poverty and Diabetes/CVD

1) Topic and relevance: As Gaskin and colleagues found in 2014, "prevalence of diabetes was inversely related to household poverty level." Said another way, being poor puts someone at increased risk of having diabetes. We wanted to know if the same would be observed in the BRFSS in Texas.

2) Data



The percentage of diabetics with CVD was higher in the poverty group (5.7%) compared to in the non-poverty group (3.73%).

3) Interpretation of data: While there were not glaring differences between the two groups, the differences were statistically significant. People who are poor and living with diabetes had a greater risk for also developing CVD than those living above poverty with diabetes. As stated previously, self-reported diabetes and insurance were linked and uninsurance and poverty were linked. Therefore, people living in poverty were unlikely to have insurance and also unlikely to know if they have diabetes. In short, the relationship here may be more dramatic than it appears.

The rate of poverty found in this study is 12.3%. This was an unexpected result with only a few people qualified under the poverty line, but after further consideration, it is probably correct. It is impossible to call someone for a telephone survey who is homeless or does not have the money for a phone. This is one of the limitations innate in this survey.

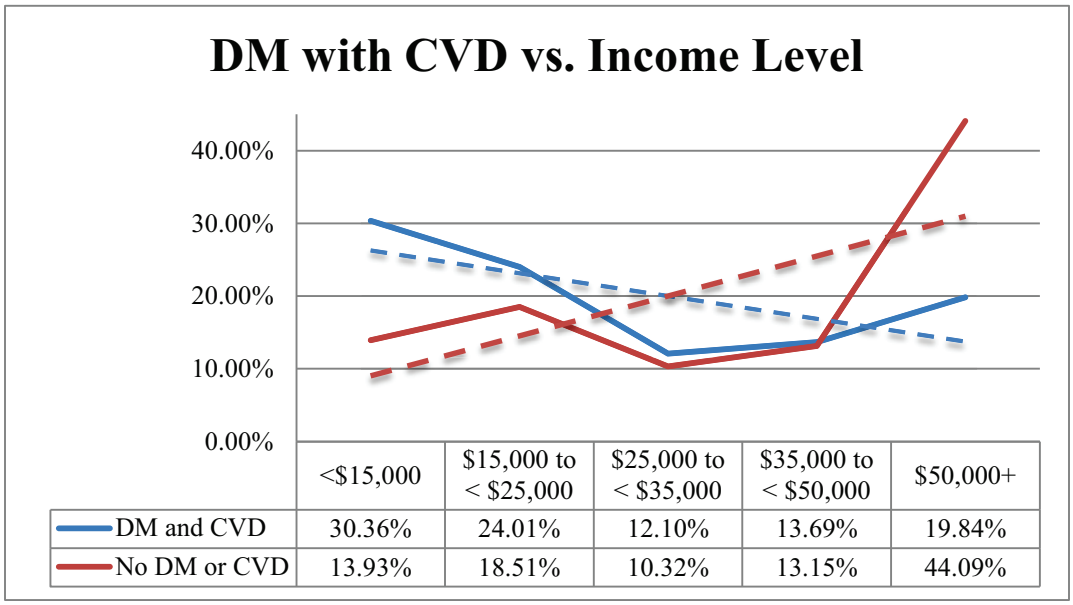
In a larger report "some 18.4% of Texans were impoverished in 2010, up from 17.3% a year earlier, according to Census Bureau data released this week. The national average is 15.1%" (Money CNN). "And being poor in Texas isn't easy. The state has one of the lowest rates of spending on its citizens per capita and the highest share of those lacking health insurance" (Money CNN). Texas is a state with a high poverty rate and a high uninsurance rate. Furthermore, it is a state with a high diabetes burden. These factors combine to create a public health crisis of diabetes that is poorly recognized and not well controlled.

Diabetes with CVD and Income (5 categories)

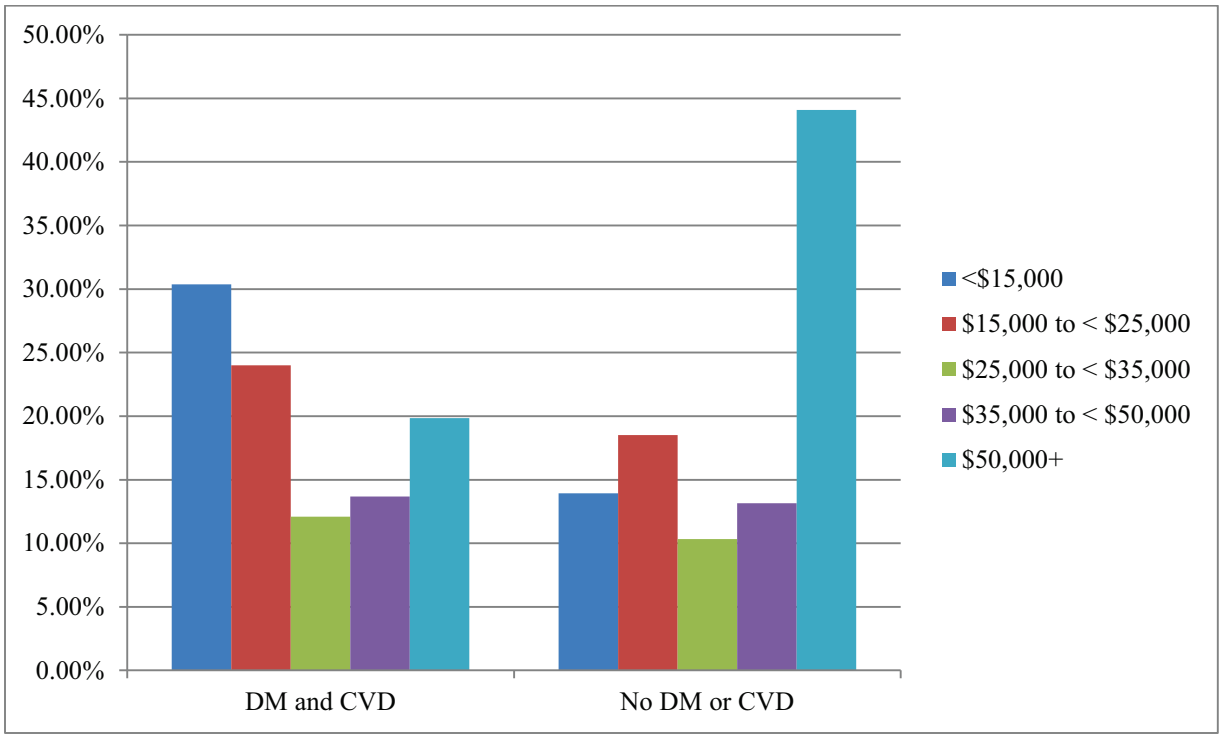
1) Topic and relevance: These variables were picked to explore the relationship between income and diabetes with comorbid CVD. CVD is the leading cause of death in

the U.S. killing 611,105 people in 2013 (CDC, 2013). This further explores disparities in health (diabetes and CVD) and economic status (income levels).

2) Data



	<$15,000	$15,000 to < $25,000	$25,000 to < $35,000	$35,000 to < $50,000	$50,000+
DM and CVD	30.36%	24.01%	12.10%	13.69%	19.84%
No DM or CVD	13.93%	18.51%	10.32%	13.15%	44.09%



Prevalence rates for diabetes with comorbid CVD were inversely related to income level. The lowest income category made up a significant portion of the diabetics with comorbid CVD group (30.4%). On the other hand, the opposite was true for the highest income category in the non-comorbid diabetes with CVD group (44.1%).

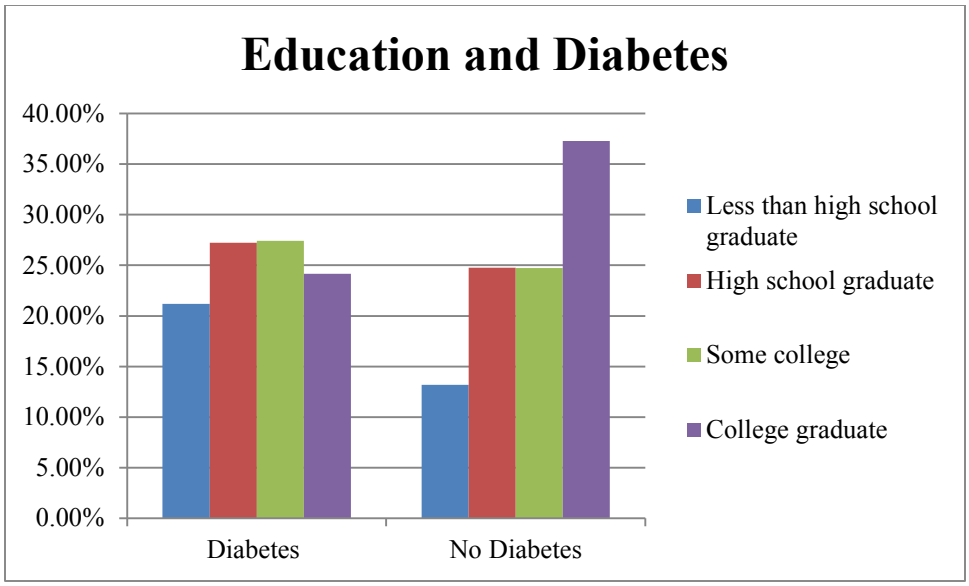
3) Interpretation of data: This data offered a clear relationship, as indicated by the trend lines in the top graph, between income level and comorbid diabetes with CVD. This is significant because end-stage CVD is the biggest killer for people living with diabetes (Lind et al., 2014).

Furthermore, people living with both diabetes and CVD reported lower incomes, on average, compared people living without diabetes. Those who reported both CVD and diabetes were much more likely to make less than $25,000 (54%) than those without CVD and diabetes (32.4%).

Distribution of Education and Diabetes

1) Topic and relevance: Inequalities in health care stem from a variety of socioeconomic sources with one main contributor being the level of education. Education is crucial because it largely determines an individual's earning capacity. Poverty and lower categories of education go hand-in-hand. These two factors combine for detrimental effects in diabetes. In fact, a systematic review by Grintsova and colleagues found higher Hb A1c values, more non-compliance, higher BMI, more complications, and higher LDL levels among patients with lower education (2014).

2) Data



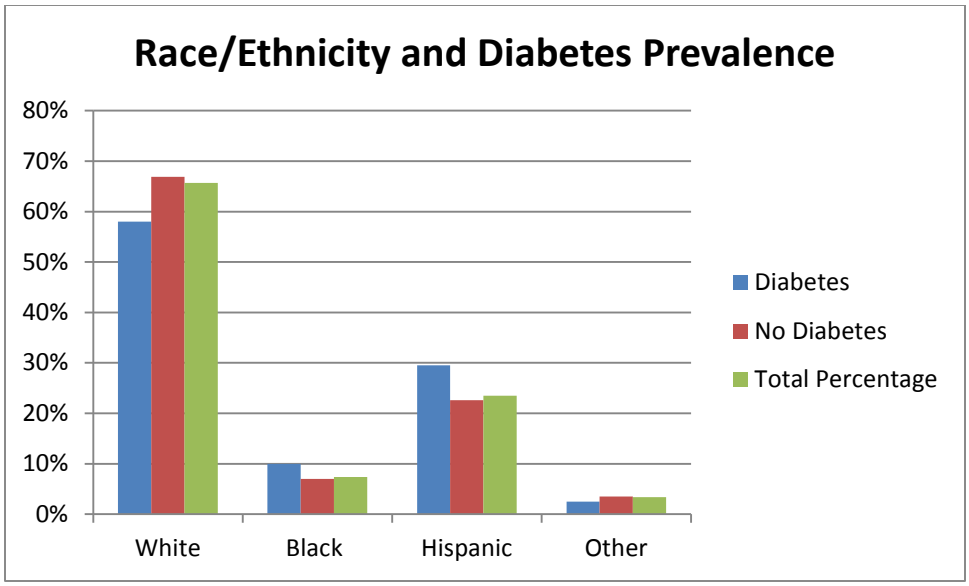
Graduating from high school or less was associated with having diabetes (48.4%) compared to no diabetes (38%).

3) Interpretation of data: This research is not only concerned with the high prevalence of diabetes but the outcomes of people with diabetes. People with a high school diploma or less education had a greater diabetes burden. Not only was prevalence increased in this group but there were also worse outcomes found in type 2 diabetics with lower socio-economic status, or SES (Grintsova et al., 2014). This means that poor diabetes outcomes disproportionally affect low SES individuals.

Race/Ethnicity and Diabetes

1) Topic and relevance: As Gaskins' study on diabetes race disparities demonstrated, there is a larger burden of diabetes among blacks with a prevalence of 12.3% in blacks, while it is only 8.4% in whites (2014). We were interested to see if such disparities would be found in Texas as well.

2) Data



Out of all the people who had diabetes, 58% were white, 10% were black, 29.5% were Hispanic and 2.5% were other. This is of little use if the total percentage of all the people surveyed is unknown. Therefore, the total percentage of the race/ethnicity category is included as a reference to determine if a group is over or under represented for diabetes. Out of all surveyed, 65.7% were white, 7.4% were black, 23.5% were Hispanic, and 3.4% were other. The results show the Hispanic and black groups carried a greater portion of the diabetes burden when compared to whites, based on proportion of the survey. In fact, the white group had a lower burden than would be anticipated based on their total percentage of 65.7% as only 58% of diabetics were white.

3) Interpretation of data: Race is not an exclusive factor in diabetes or even to poor health outcomes, but it can be a strong contributor. Compared to the total percent of each category whites and other were underrepresented in diabetes classification, while blacks and Hispanics were overrepresented. These finding are revealing of larger trends in diabetes disparities. In 2014, Gaskin et al. found that blacks that live in concentrated

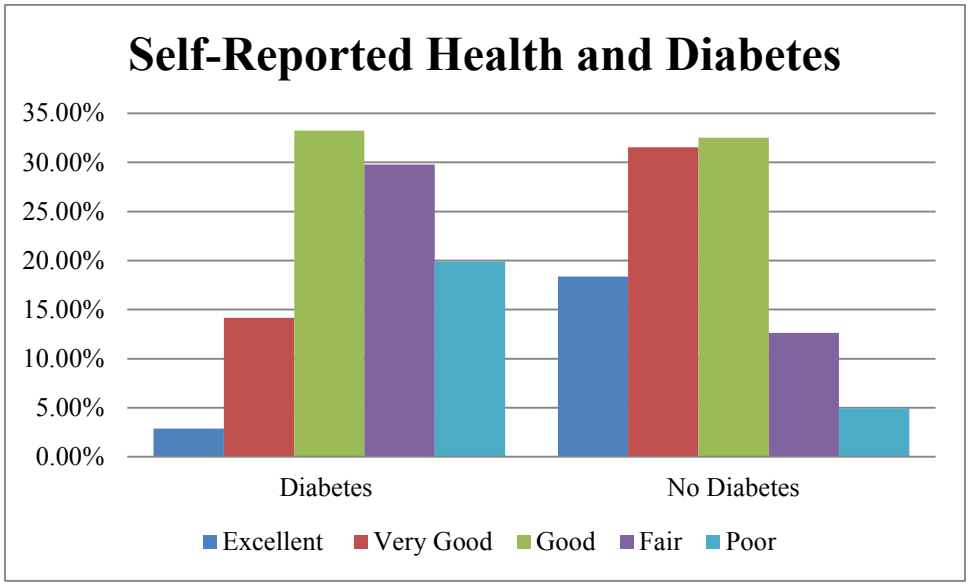
poor neighborhoods are at higher risk for diabetes. In summary, race is associated with disparities in disease burden of diabetes.

Physical Health and Diabetes

Self-Reported Health and Diabetes

1) Topic and relevance: This question asked "Would you say that in general your health is: 1 Excellent, 2 Very Good, 3 Good, 4 Fair, 5 Poor" (Appendix). Self-reported health is important because it shows how an individual views his or her own health outside of the clinical parameters.

2) Data



Only 2.9% of people with diabetes rated their health as "Excellent", while 18.4% of non-diabetic did. In people without diabetes, 31.5% rated their health as "Very Good", but only 14.2% said the same for the diabetic group. Interestingly, for "Good" both groups were similar at 33.3% and 32.5% for the diabetic and non-diabetic respectively.

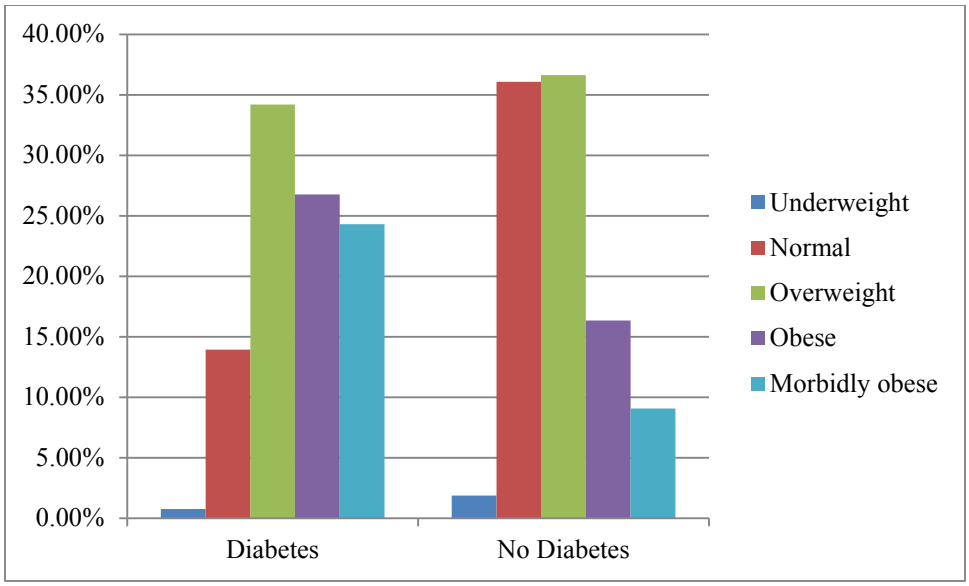
For the “Fair” and “Poor” categories, the diabetic group predominated at 29.8% and 19.9% respectively, while the group without diabetes was 12.6% and 4.9% respectively.

3) Interpretation of data: It is clear diabetes and general wellness are strongly correlated in this question. This was surprising to see that even in a self-reported survey people living with diabetes were significantly more likely to report worse health. It may be telling of a larger psychological issue in diabetes. Anderson et al. found people living with diabetes at an increased risk of depression, anxiety, and eating disorders (2014). In fact, depression and eating disorders in women with type 1 diabetes are both twice as likely among women with diabetes (Anderson et al., 2014). This research shows that how a patient views his or her disease has large implications for mental disorders and quality of life. Also it significant to note that anyone could deem his or her health to be “good” while someone with diabetes has objective information upon which to base his or her health status.

Diabetes and BMI Categories

1) Topic and relevance: BMI has been closely associated with type 2 diabetes risk, but this relationship is certainly not complete—there are examples of morbidly obese people without type 2 diabetes and vice versa. However, even obese people without diabetes still have significant health risks for other chronic conditions such as heart disease. The relationship between diabetes and BMI is categorically examined here.

2) Data



The categories for BMI are defined as:

Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

3) Interpretation of data: People who had diabetes predominated in the BMI categories: overweight, obese, and morbidly obese with 85.3% of all the diabetics falling in these categories. However, for the non-diabetic population, only 62% of this group fell in the afore mentioned categories. This shows the strong correlation between being overweight, obese, or morbidly obese and diabetes.

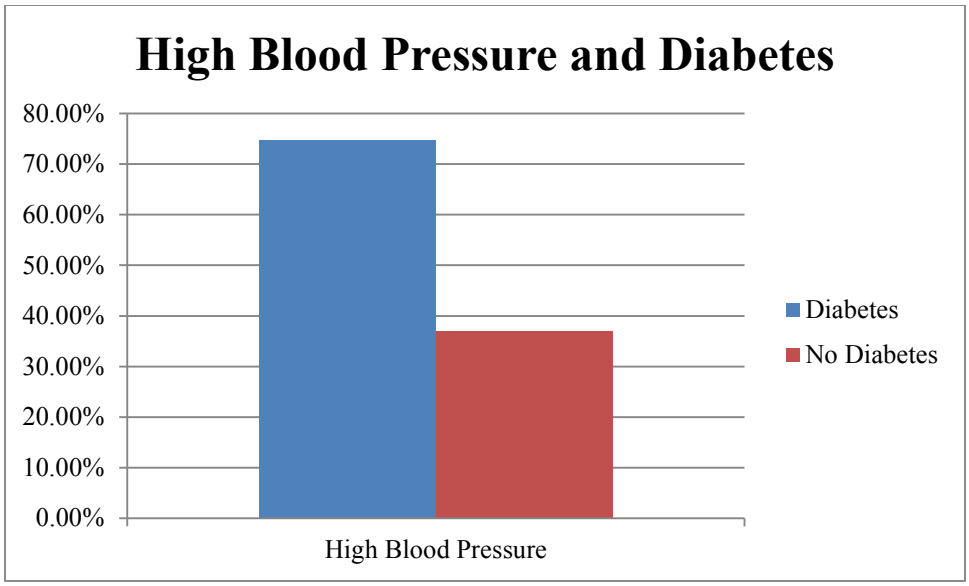
In a carefully designed study combining the Nurses' Health Study and Health Professionals Follow-up Study, BMI was compared to mortality rates in people with incident, to decrease reverse-causation bias, diabetes (Tobias et al., 2014). There has been speculation in some studies about a phenomenon known as the "obesity paradox" where individuals with a greater BMI have a reduced mortality and it suggests some protective benefit of obesity (Tobias et al., 2014). However, as Tobias and colleagues point out, these studies often fail to control for smoking and other risk factors that may account for

why it appears obesity is beneficial (2014). When Tobias et al. controlled for smoking, "there was a significant direct linear relationship between BMI and cardiovascular mortality among all participants" (2014). In participants who smoked in the Tobias et al. study, they were linked with the lowest BMI category (18.5-22.4) and also had higher cancer rates (2014). Tobias et al. found "a J-shaped relationship between BMI at the time of diabetes diagnosis and the risk of death from all causes, with the lowest risk observed among normal-weight participants with a BMI of 22.5-24.9 (2014). Further, they found no evidence for support of an "obesity paradox" (Tobias et al., 2014)

High Blood Pressure and Diabetes

1) Topic and relevance: When high blood pressure, or hypertension, is in addition to, or even caused by, diabetes, the insult to blood vessels is in synergy. The physiological mechanism causes the nephrons of the kidney to be damaged by the insult of high blood sugar and the kidneys ineffectively filter blood and fail to maintain proper isotonic blood chemistry leading to high blood pressure (Medscape, 2014). Hypertension and diabetes combine to heighten risk of death from CVD (UK Prospective Diabetes Study Group, 1998). However, if hypertension can be tightly controlled, the risk of dying from diabetes related complications is reduced by 32% (UK Prospective Diabetes Study Group, 1998).

2) Data



This question calculates if the respondents have doctor diagnosed high blood pressure. Of the people with diabetes, 74.6% said "Yes", while among non-diabetes only 36.9% said "Yes." People with diabetes were 2.02 (CI 95% 1.96, 2.09) time more likely to have high blood pressure than the non-diabetes group.

3) Interpretation of data: Clearly, diabetes and high blood pressure are associated. The CDC found similar statistics with 71% of those with diabetes also having high blood pressure (2014). With the development of high blood pressure in someone living with diabetes, the risk of dying from a cardiovascular emergency becomes a primary concern (Diabetes Standards of Care, 2015). Often clinicians attempt to control both blood pressure and blood sugar simultaneously to mitigate MI risk (Diabetes Standards of Care, 2015).

High blood pressure is one of the key risk factors for CVD and MI (Diabetes Standards of Care, 2015). Unachukwu and Ofori recommend tight blood pressure control to reduce macrovascular complications in diabetic patients (2012). High blood pressure

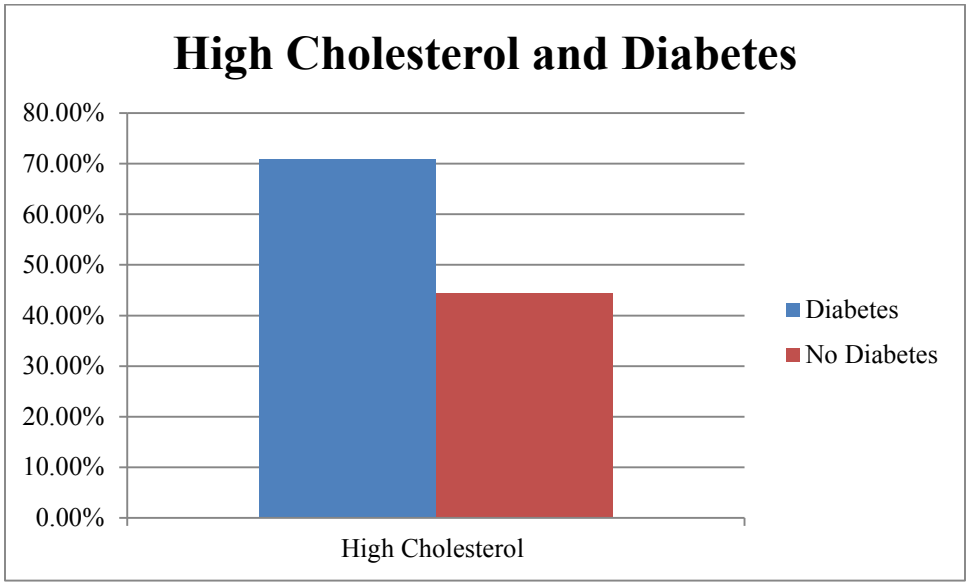
(HBP) and diabetes had one of the highest odds ratio 5.03 (95% CI 4.53, 5.59). This confirms the relationship between diabetes and high blood pressure (HBP).

HBP is greatly misunderstood by the layperson (American Heart Association, 2015). It is worth noting that HBP (or hypertension) is defined as greater than 140/90 mmHg (Diabetes Standards of Care, 2015). Unfortunately, HBP does not have any alarming symptoms that would make a layperson acutely aware of this illness (American Heart Association, 2015). Similar to diabetes, an individual may have HBP chronically and may not find out until he or she visits the doctor. This may not be a huge problem for the people who annually visit a health care provider for a checkup. Therefore, people without insurance or regular access to a doctor may have HBP or diabetes and may not find out until his or her symptoms have reached a place of catastrophic levels. It may take a heart attack or severe headache and a visit to the ER to discover what has been lingering in the background slowly deteriorating one's health. Slowly, but progressively destroying the circulatory system without alarming symptoms is a public health tragedy. It severely affects the quality of life and life expectancy for the individual. Most unjustly, this deepens the chasm of health disparities between the poorest and those who appreciate the very best of US health care.

High Cholesterol and Diabetes

1) Topic and relevance: High cholesterol is a risk factor for MI, especially in patients with comorbid diabetes (American Heart Association, 2015). "Numerous studies have shown decreased risk in macrovascular disease in patients with diabetes who are treated with lipid-lowering agents" (Fowler, 2008). Therefore, it was crucial to explore how high cholesterol was associated with diabetes.

2) Data



Based on this survey, 70.8% of the diabetes group had high cholesterol, compared to only 44.4% in the non-diabetes group. The relative risk of having high cholesterol with diabetes was 1.60 (95% CI 1.54, 1.65) times more than the non-diabetes group.

3) Interpretation of data: A very strong predictor of heart attack risk is determined by total cholesterol levels, high levels of bad low density lipoproteins (LDL) and low levels of good high density lipoprotein (HDL) (Diabetes Standards of Care, 2015). LDL above 100 mg/dL is associated with a higher risk profile for CVD, while HDL above 40/50 mg/dL for men/women is protective for CVD (Diabetes Standards of Care, 2015).

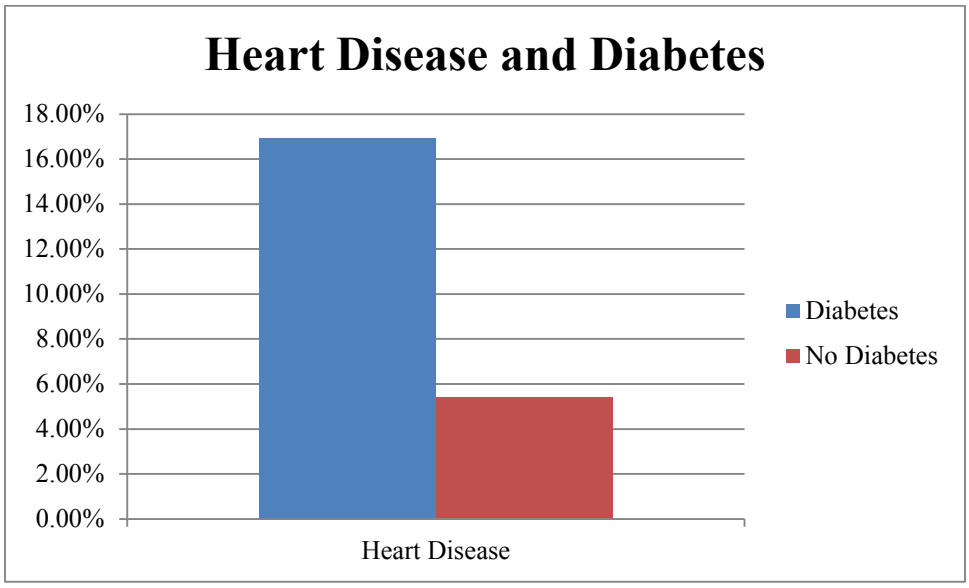
Not only does diabetes pose increase one's risk for a cardiovascular event, but combined with high cholesterol one's risk profile jumps significantly. In a report published by the CDC in 2014, 65% of diabetics also had high cholesterol, defined as LDL ≥100 mg/dl. One of the major clinical and public health goals is to increase HDL levels above 40 mg/dL for men and above 50 mg/dL for women or to lower LDL levels below 100 mg/dL (Diabetes Standards of Care, 2015). Not only is high cholesterol a major risk factor for cardiovascular disease, but diabetic dyslipidemia, which is increased

"very-low-density lipoproteins (VLDL), small LDL particles, and low high-density-lipoprotein (HDL) cholesterol" increase the risk for CVD (Unachukwu and Ofori, 2012). This condition causes a proliferation in plaque and atherosclerosis in arteries (Unachukwu and Ofori, 2012). In order to prevent macrovascular complications it is not only key to keep glycemic levels controlled but also to control diabetic dyslipidemia (Unachukwu and Ofori, 2012).

Heart Disease and Diabetes

1) Topic and relevance: As noted by the CDC, the leading cause of death in 2013 was heart disease. Further, diabetes was number six on that same list. Diabetes is a known risk factor for exacerbating heart disease (Diabetes Standards of Care, 2015). Therefore, people with both conditions have significant increased mortality risk.

2) Data



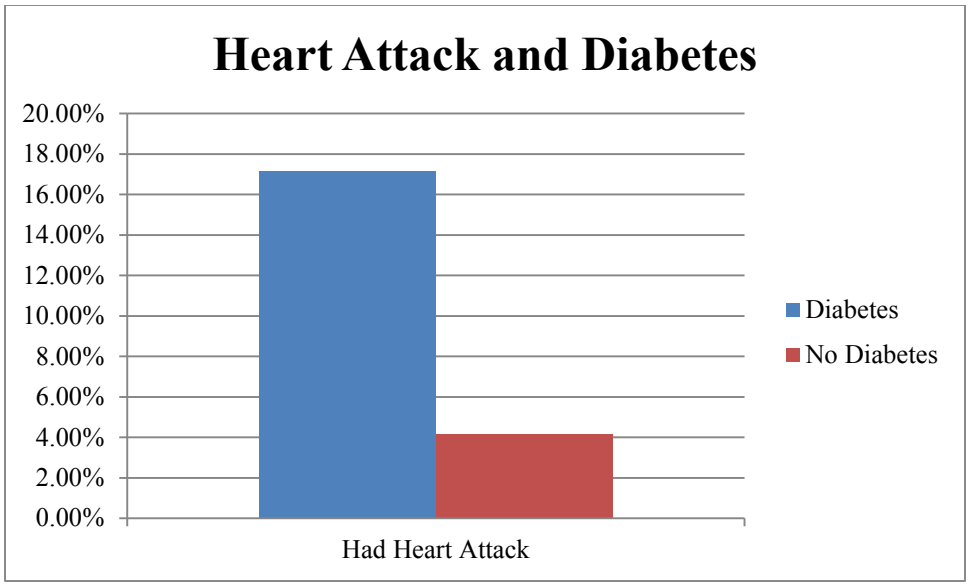
People living with diabetes also had heart disease at a higher rate, 16.9%, versus 5.4% in people without diabetes. This gave the diabetes group a relative risk of 3.14 (2.78, 3.55) times greater than the non-diabetes group for having heart disease.

3) Interpretation of data: Heart disease, or congestive heart failure, is one of the cardiovascular diseases that contributes to high diabetes mortality rates (CDC, 2014). In fact, in a report by the CDC in 2014, calculated cardiovascular mortality rates were 1.7 times greater in people living with diabetes. Diabetes and heart disease are strongly correlated with heart disease 3.14 times (95% CI 2.78, 3.55) more likely among diabetics group than the non-diabetic group. Since the Framingham studies, diabetes has long been associated with a greater risk of coronary heart disease, 2-8 times the risk (Haffner et al., 1998). However, heart failure is also associated with increased risk for acquiring diabetes (Guglin et al., 2014). In one of the studies reviewed by Guglin and colleagues, 27.3% of those with newly diagnosed heart failure had diabetes after five years (2014). It seems that the relationship between heart disease and diabetes is more complicated and intertwined that first thought, but the conclusion for these conditions is that mortality is significantly increased.

Heart Attack and Diabetes

1) Topic and relevance: One of the most important clinical outcomes is a myocardial infarction because it has such a high mortality rate (CDC, 2013). This is often an end-stage complication among those with diabetes. Central to this research is the association of a previous MI among people living with diabetes.

2) Data



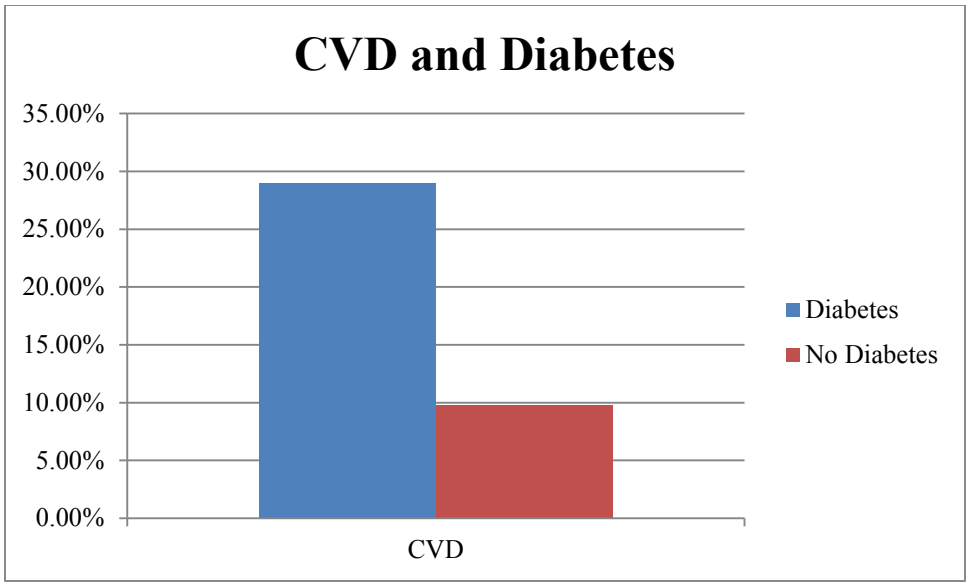
While 17.2% of the diabetes group have had a myocardial infarction, only 4.8% of the non-diabetes group had one. This gave the diabetes group a relative risk of 3.57 (95% CI 3.16, 4.04) for having a heart attack.

3) Interpretation of data: It is clear that people living with diabetes have an elevated risk of a MI. Simply by having diabetes, the risk of a MI spikes. According to Unachukwu and Ofori, "having diabetes mellitus is as bad as having a previous myocardial infarction" (2012). Encouragingly, with better blood sugar and diabetes management, this risk of MI can be decreased (Diabetes Standards of Care, 2015).

CVD and Diabetes

1) Topic and relevance: CVD and diabetes is the most important relationship of this study. It represents the comorbidity that makes this condition, diabetes, so deadly (American Heart Assoication, 2015).

2) Data



About 29% of people diagnosed with diabetes also had cardiovascular disease (CVD), while in the group without diabetes only 9.8% of them had CVD. Those with diabetes are 2.88 (95% CI 2.65, 3.12) times more likely to have CVD than the non-diabetes group.

3) Interpretation of data: This demonstrates the strong association between diabetes and CVD. Cardiovascular disease in diabetes is broken into two groups: cardiomyopathy and atherosclerotic vascular disease (Unachukwu and Ofori, 2012).

There are a few types of cardiomyopathy. Dilated cardiomyopathy is disease of the heart muscle that causes weakening and thinning of the left ventricle and pumping efficiency is diminished (Mayo Clinic, 2014). Hypertrophic cardiomyopathy is where the heart muscle thickens and increases the strain on the heart (Mayo Clinic, 2014). However, unique to diabetic cardiomyopathy, fibrosis occurs even in the absence of observable disease clinically (Unachukwu and Ofori, 2012). The effects of this combination of diabetes with cardiomyopathy, "contributes significantly to CVD morbidity and mortality in diabetic patients, especially those with coexistent hypertension

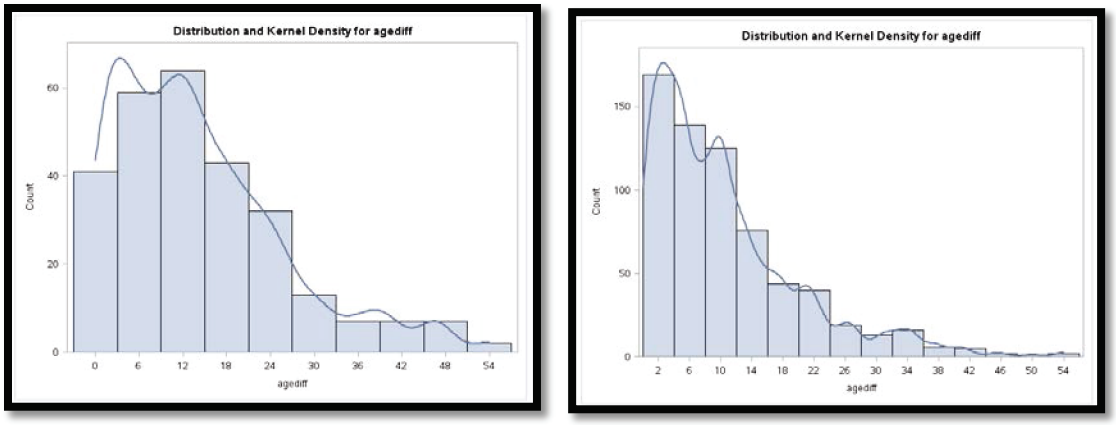
or coronary artery disease with resulting synergistic adverse effects" (Unachukwu and Ofori, 2012).

Atherosclerosis is the other branch of cardiovascular diseases. Diabetes creates a 2-4 times greater risk of a cardiovascular event (Unachukwu and Ofori, 2012). This is the cause of death for 80% of diabetics, with most coming from coronary heart disease (Unachukwu and Ofori, 2012). Diabetic patients have blood chemistry that promotes plaque formation and hyperlipidemia accelerates this process (Unachukwu and Ofori, 2012). Further, the endothelial tissue in diabetics has an impaired response to and production of nitric oxide (NO) and other endothelium-derived relaxing factors (Unachukwu and Ofori, 2012). This contributes to decreased vasodilation and vascular impairment which narrows the arteries (Unachukwu and Ofori, 2012). The synergistic adverse effects of high cholesterol, obesity, diabetes, and atherosclerosis increase cardiovascular risk by the persistent insult to the endothelial tissue (Unachukwu and Ofori, 2012). In the Copenhagen Heart Study, diabetes was the biggest contributor of risk for coronary heart disease with a 2-3 times increase in risk of MI or stroke (Unachukwu and Ofori, 2012).

Age Distribution: Diabetes and CVD

1) Topic and relevance: These graphs are crucial because they compare comorbid CVD in diabetes to people with diabetes but without CVD. The distribution is based on the number of years the individual has been living since being diagnosed with diabetes.

2) Data



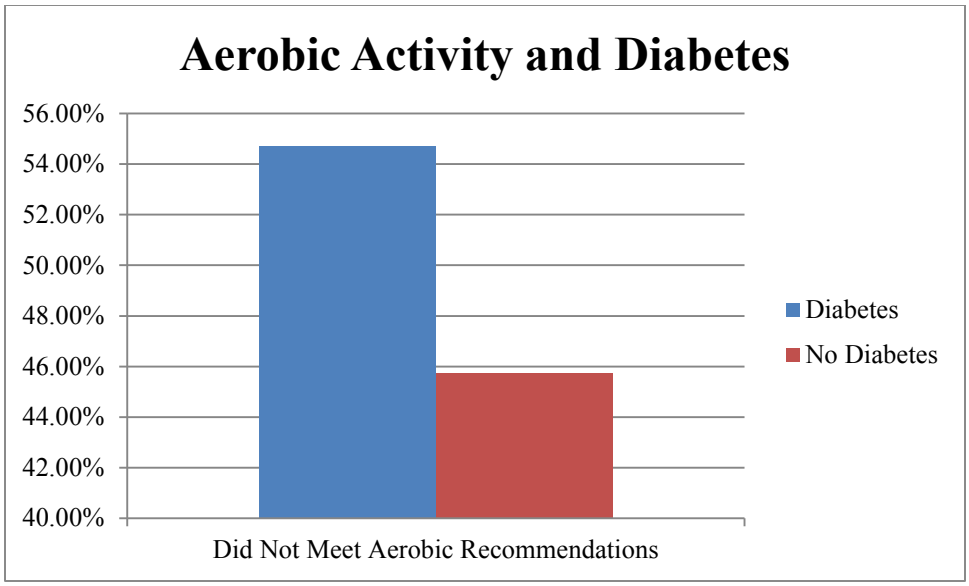
3) Interpretation of data: On the left, the graph shows the distribution of the number of years after being diagnosed with diabetes for people who had diabetes and CVD, comorbid conditions (n=275). The median was 12 years living with diabetes. On the right, the graph shows the number of years after being diagnosed with diabetes for people who had diabetes, but did not have CVD (n=657). The median was 8 years living with diabetes. By comparing these two graphs, it becomes evident that CVD is associated with a history of living longer with diabetes. It is the persistent insult to the vasculature that damages the arteries over time. On the other hand, it is also possible that CVD also could cause an increased likelihood of diabetes.

Behavioral Factors and Diabetes

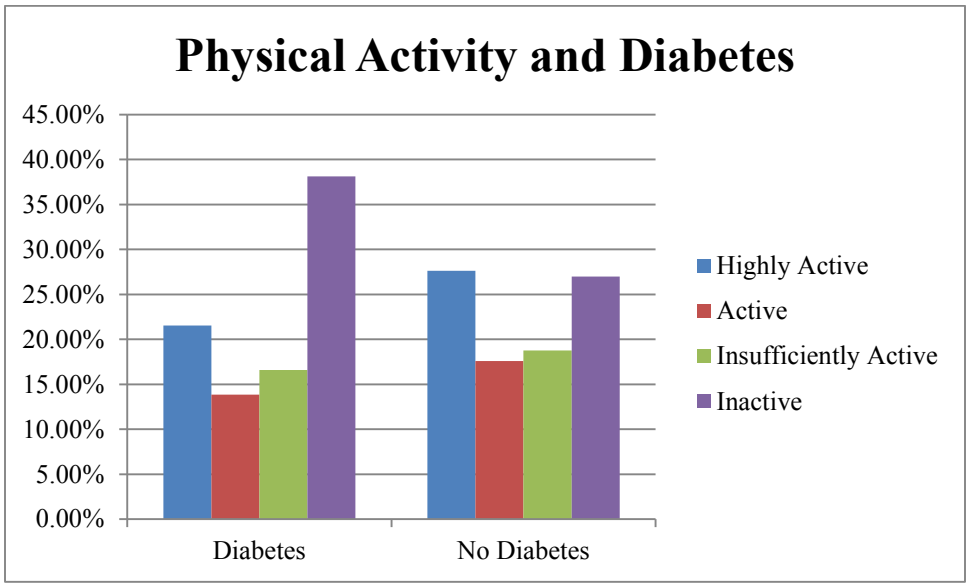
Physical Activity

1) Topic and relevance: Physical activity and exercise are key lifestyle interventions in people living with diabetes (Diabetes Standards of Care, 2015). To see how people with diabetes were doing, a comparison was performed between them and non-diabetic people.

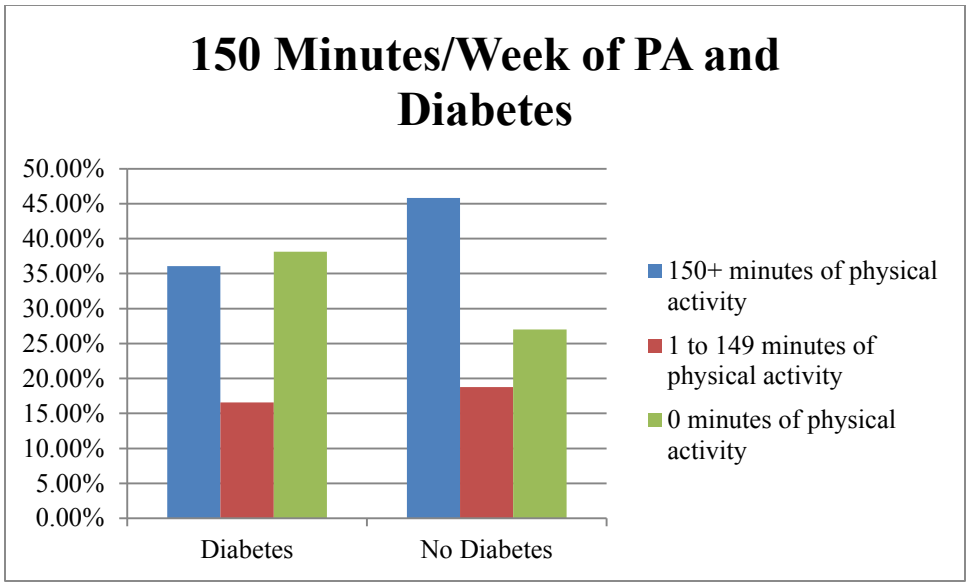
2) Data



54.7% of the diabetes group did not meet aerobic activity guidelines. On the other hand, only 45.7% of the non-diabetes group did not meet the guideline.



In the diabetes group 38.1% were inactive and 21.5% were highly active, while in the non-diabetes group only 27% were inactive and 27.6% were highly active.



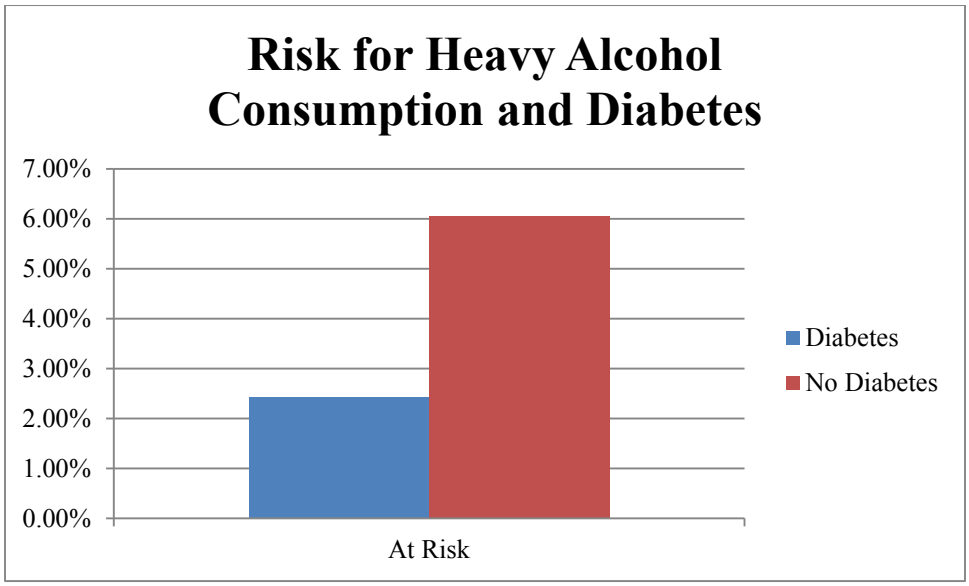
As recommended by the Diabetes Prevention Program (2002) study, 150 minutes of cardiovascular, aerobic activity helped prevent diabetes among those diagnosed with prediabetes. However, only 36.1% of the diabetes group attained this goal, while 45.8% did in the other group. Further, 38.1% of the diabetes group were entirely inactive, but only 27% of the other group was.

3) Interpretation of the data: In general, people living with diabetes did not meet recommended physical activity guidelines. This was especially evident when compared to non-diabetics. Further, there were higher rates of inactivity (no exercise) among diabetics. Exercise is important for clinical outcomes too: "exercise interventions of at least 8 weeks' duration have been shown to lower A1C by an average of 0.66% in people with type 2 diabetes" (Diabetes Standards of Care, 2015). Regular exercise is also found to improve blood glucose control, help with weight loss, and improve general health (Diabetes Standards of Care, 2015). Even in high-risk patients low intensity exercise, such as walking, is strongly encouraged (Diabetes Standards of Care, 2015).

Heavy Alcohol Consumption Risk and Diabetes

1) Topic and relevance: Heavy alcohol consumption is linked to higher mortality from CVD and increased prevalence of hypertension (Diabetes Standards of Care, 2015). This study examined the relationship between heavy alcohol consumption and diabetes.

2) Data



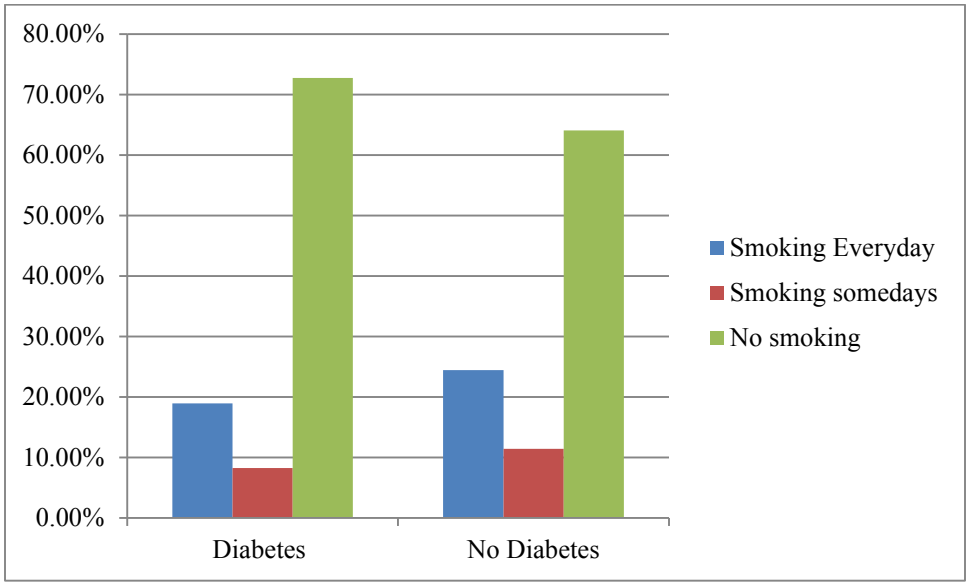
The results for this comparison was promising with only 2.4% of diabetics at risk for heavy alcohol consumption, defined as more than 2 drinks a day for men or 1 drink a day for women. 6.1% of the non-diabetic group consumed alcohol heavily.

3) Interpretation of data: It is encouraging to know that people living with diabetes were less likely to be heavy drinkers compared to the non-diabetes group. Heavy alcohol consumption can put diabetics at "increased risk for delayed hypoglycemia" (Diabetes Standards of Care, 2015). The American Diabetes Association recommends moderation in alcohol consumption, if any (Diabetes Standards of Care, 2015).

Smoking and Diabetes

1) Topic and relevance: Smoking is strongly linked to lung cancer but also puts an individual at a heightened risk for CVD and MI (CDC, 2013). Smoking with diabetes can be particularly damaging to small vessels, increasing the risk for microvascular and macrovascular complications (Diabetes Standards of Care, 2015).

2) Data



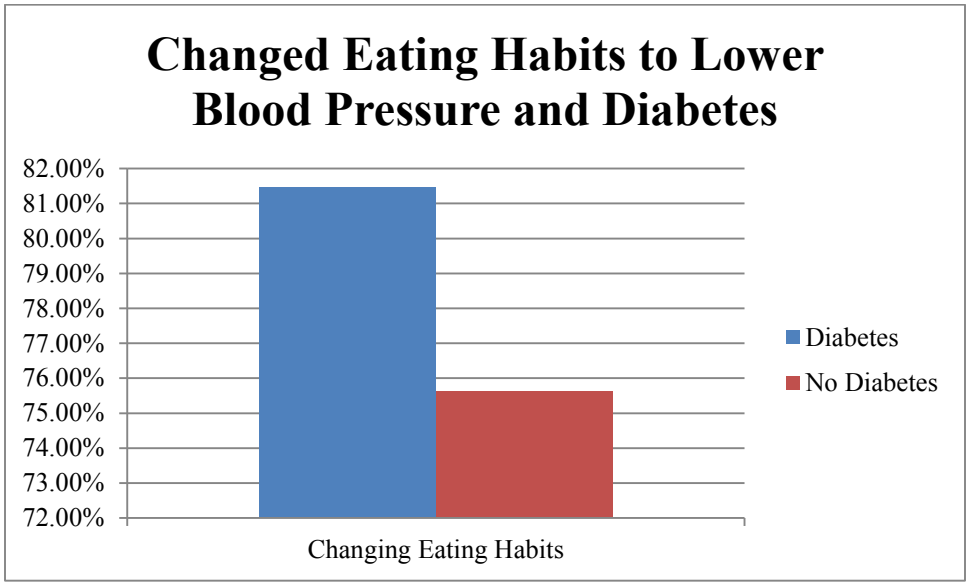
Smoking, in general, was more common among people without diabetes (35.9%) versus people living with diabetes (27.3%). Specifically, smoking everyday was significantly higher (24.5%) among non-diabetics than in people with diabetes (19%).

3) Interpretation of data: It is again encouraging to see the diabetes group have lower rates of smoking than the non-diabetes group. Results from epidemiological, case control, and cohort studies provide convincing evidence to support the causal link between cigarette smoking and health risks. The adverse health effects of smoking are well recognized with respect to future cancer and CVD risk (ADA Standards of Medical Care in Diabetes, 2015).

Changing Eating to Lower Blood Pressure and Diabetes

1) Topic and relevance: As mentioned previously, blood pressure plays a significant role in CVD risk (Diabetes Standards of Care, 2015). It is interesting to know if people living with diabetes were actively trying to control their blood pressure by altering their eating habits.

2) Data



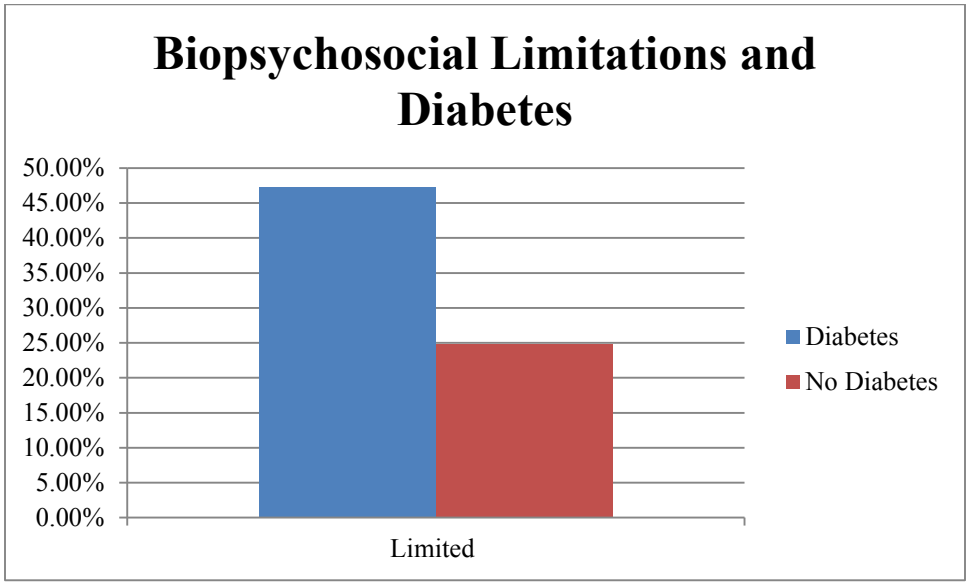
People living with diabetes were more likely to report changing eating habits to lower blood pressure (81.5%) versus 75.6% in the non-diabetes group.

3) Interpretation of data: In another encouraging outcome amongst diabetics, it seems that diabetics are taking an active role in the management of the disease and their risk of CVD. The ADA recommends that people with both diabetes and high blood pressure reduce their sodium intake to lower than the 2,300 mg/day recommendation for the general public (Diabetes Standards of Care, 2015).

Disability: Physical, Mental, or Emotional Limitations

1) Topic and relevance: As mentioned in Chapter One, $69 million was lost in 2012 due to reduced productivity as a result of diabetes (American Diabetes Association, 2012). People with diabetes are more likely to miss work, be less effective while at work, or not be employed because of their limitations (American Diabetes Association, 2012). These are serious concerns, not only economically but also for people's quality of life.

2) Data



People living with diabetes were almost twice as likely to report biopsychosocial disabilities (47.3%) compared to people living without diabetes (24.8%).

3) Interpretation of data: It is distressing to know the impact this disease has on not only one's physical body but also on one's mental health. "Psychological and social problems can impair the individual's or family's ability to carry out diabetes care tasks and therefore compromise health status" (Standards of Medical Care in Diabetes, 2015). Said another way, diabetes may cause psychological or social issues that can impair

ability to care for diabetes and, therefore, accelerate the disease process. Diabetes is not limited to its physical consequences, but also its has social and psychological effects.

CHAPTER FOUR

Summary: Crucial findings in diabetes disparities

Discussion of key results with recommendations

In this analysis, people with diabetes are more likely to have household incomes of less than $35,000 (59.8%) than people without diabetes (41.5%). This demonstrates the link between diabetes and low household incomes. Further, this research found that those that were less than or equal to the FPL had a significantly greater likelihood of not having insurance (51%) than people living above the poverty line (13.3%). Based on these comparisons, there is a correlation between low income, diabetes, and no insurance.

More critically, the analysis found people living with diabetes were 2.88 times (95% CI 2.65, 3.12) more likely to have CVD than the non-diabetes group. This demonstrates the strong association between diabetes and CVD. After 12 years of living with diabetes most people also have CVD. How quickly CVD develops is mostly dependent on how well controlled one's blood sugar is, as represented in Hb A1c values. As Lind et al. found, a Hb A1c of greater than or equal to 9.7% (mean glucose level of approximately 240 mg/dL) was associated with a 10.46 times increase in cardiovascular mortality (2014). However, if one's blood sugar is well controlled to mean glucose level of approximately 154 mg/dL or a Hb A1c test of 7%, this cardiovascular mortality risk was reduced to only 3.39 times greater than non-diabetics (Lind et al., 2014). If basic medical care can be provided to low-income people living with diabetes, great reductions in CVD risk would almost certainly result.

Basic Medical Care

Diabetes is a unique condition because it can be self-managed by the patient. This puts significant responsibility in the hands of the patient. This can be good for many patients that possess high levels of accountability and self-efficacy. According to the American Diabetes Association's Standards of Medical Care in Diabetes, in order to most effectively manage diabetes, the patient must feel empowered (2015). Medicine's role should be transformed to a patient centered model where the patient is educated through diabetes self-management education and diabetes self-management support to provide self-care (Standards of Medical Care in Diabetes, 2015). The best medical care can often be provided by the patient when "a combination of dietary and lifestyle modifications including exercise, losing weight to maintain a normal body mass index, smoking cessation and moderate alcohol consumption must be implemented" (Unachukwu et al., 2012). Maybe what is sweetest to policy maker's ears is that this care is found to improve clinical outcomes in a very cost effective manner (Standards of Medical Care in Diabetes, 2015). For example, "Patients who participate in diabetes education are more likely to follow best practice treatment recommendations, particularly among the Medicare population, and have lower Medicare and insurance claim costs" (Standards of Medical Care in Diabetes, 2015). In conclusion, these findings suggest that implementation of basic medical care to low income diabetics would greatly reduce costs and improve patient outcomes—a win-win.

Insurance goals for the future

As the ADA says, "diabetes imposes a substantial burden on the economy of the U.S….high intangible costs on society in terms of reduced quality of life and pain and suffering of people with diabetes, their families, and friends" (ADA, 2012). Diabetes is not only widespread, but also has deep economic costs (ADA, 2012). "The total estimated cost of diagnosed diabetes in 2012 is $245 billion, including $176 billion in direct medical costs and $69 billion in reduced productivity" (ADA, 2012). With one out of every five health care dollars spent towards diabetes, effectively managing this condition is paramount (ADA, 2012). With such an enormous sum of money going towards diabetes care, even small improvements in efficiency of care will have a substantial impact.

Economically, it makes more sense to provide preventative health care than emergency, crisis care (Texas Medical Association, 2012). As mentioned earlier, ER services can cost 245% of what the cost is in the primary care setting (Texas Medical Association, 2012). The cost of a month's supply of metformin can cost as little as $4 or just $10 for a three month's supply (American College of Physicians, 2012). Not only does this drug lower blood sugars and keep them in the normal physiologic range but it is also one of the safest and most used diabetes medications (American College of Physicians, 2014). For about $40/year most people's type 2 diabetes can be well controlled. Preventative care can reduce the cost burden of diabetes, especially if implemented in a setting like Texas where 1.7 million Texans have diabetes (Texas Diabetes Council, 2011).

This research has shown that those with insurance are more likely to be above the FPL. Moving forward, this research suggests that Texas should reform Medicaid and expand it in accord with other states to provide health coverage to the poor. As mentioned before, Texas has the highest percentage of uninsured people in the U.S. at 24%, or 6.3 million, (Texas Medical Association, 2012) and the greatest number of people falling in the "coverage gap" of the ACA with about one million Texans left without health coverage (Garfield et al., 2014). Great progress would be made in diabetes care in Texas if basic medical care, like Hb A1c screening tests, were available annually (Standards of Medical Care in Diabetes, 2015). The data estimates that 27.8% of people with diabetes are undiagnosed (CDC, 2014). With health insurance broadened for more people, that number could be reduced and the potential risks associated with undiagnosed diabetes, like CVD, would be mitigated.

As previously stated, it is encouraging that as of first quarter reports from 2015, the Affordable Care Act has reduced the number of uninsured by 16.4 million, a 35 percent decrease since open enrollment began in October 2013 to March 2015 (Hamblin, 2015). "That is the biggest improvement in 40 years" (Hamblin, 2015).

Conclusion: The role of medicine in diabetes

The role of medicine in serving the poor is to meet their fundamental needs. As Jones and colleagues write, "Recognition of the contingency of health inequalities should make them a target for intervention, yet the opposite has frequently happened: the ill health of impoverished or marginalized groups has been used against them — as evidence of their inferiority or as an argument that they're unworthy of assistance" (2012). If a homeless person has diabetes, the U.S. health care system should offer

dignity and respect to his or her humanity by giving him or her a visit with a primary care physician at least once a year with a full physical and Hb A1c labs. By providing him or her with resources like nutrition counseling and diabetes management counseling, it empowers him or her to make better choices. These services provided annually could make a tremendous impact. Based on the research on Hb A1c and mean glucose levels, if blood sugar spikes could be mitigated, even partially, it would greatly reduce mortality rates from cardiovascular disease (Lind et al., 2014). By providing diabetics counseling not only is that patient's humanity being dignified, but the economic burden to the health care system and private insurance payers is reduced. The cost of an ER visit by a patient with diabetic complications is far greater than providing preventative care in the primary care setting (Texas Medicine Council, 2012). A health care system dependent on emergency care does not provide health, it merely treats disease. The prevention of disease is more compassionate and more efficient—a win-win. "Disparities in health and disease are outcomes that are contingent on the ways society structures the lives and risks of individuals" (Jones et al., 2012). Healing inequalities in health care is equally as important as healing patients. The greatest opportunity is not in providing even more extravagant care to the affluent but in serving the poor and the needy.

As Jones et al. recounts the history of medicine and systemic pressures that affect medicine, his call to action is well put:

> In many respects, our medical systems are best suited to diseases of the past, not those of the present or future. We must continue to adapt health systems and health policy as the burden of disease evolves. But we must also do more. Diseases can never be reduced to molecular pathways, mere technical problems requiring treatments or cures. Disease is a complex domain of human experience, involving explanation, expectation, and meaning. Doctors must acknowledge this complexity and formulate theories, practices, and systems that fully address the breadth and subtlety of disease. (2012)

In closing, I want to reflect on the power of these words written over 2000 years ago. “He pled the cause of the afflicted and needy; Then it was well. Is not that what it means to know Me?” (Jeremiah 22:16, NIV). As the psalmist writes, “Defend the weak and the fatherless; uphold the cause of the poor and the oppressed” (Psalms 82:3, NIV). Serving the poor is not only right medically and economically but also morally.

APPENDIX

Health insurance status

Frequency
Percent
Row Pct
Col Pct

Table of pov by newins

pov	newins 1	2	Total
0	9706 76.02 86.70 92.64	1489 11.66 13.30 64.99	11195 87.68
1	771 6.04 49.01 7.36	802 6.28 50.99 35.01	1573 12.32
Total	10477 82.06	2291 17.94	12768 100.00

Frequency Missing = 2205

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newins

Diabetes(Doctor Diagnosed Diabetes)	newins 1	2	Total
1	1776 11.92 86.38 14.52	280 1.88 13.62 10.51	2056 13.80
2	10456 70.19 81.43 85.48	2385 16.01 18.57 89.49	12841 86.20
Total	12232 82.11	2665 17.89	14897 100.00

Frequency Missing = 76

Frequency
Percent
Row Pct
Col Pct

Table of diabcvd by newins

diabcvd	newins 1	2	Total
0	11566 78.51 81.76 95.63	2580 17.51 18.24 97.84	14146 96.02
1	529 3.59 90.27 4.37	57 0.39 9.73 2.16	586 3.98
Total	12095 82.10	2637 17.90	14732 100.00

Frequency Missing = 241

Table of Diabetes by newaoccat

Diabetes(Doctor Diagnosed Diabetes)	newaoccat 1	2	Total
1	695 87.53 87.53 100.00	99 12.47 12.47 100.00	794 100.00
2	0 0.00 . 0.00	0 0.00 . 0.00	0 0.00
Total	695 87.53	99 12.47	794 100.00

Frequency Missing = 14179

Table of Diabetes by newseedoc

Diabetes(Doctor Diagnosed Diabetes)	newseedoc 1	2	Total
1	827 88.92 88.92 100.00	103 11.08 11.08 100.00	930 100.00
2	0 0.00 . 0.00	0 0.00 . 0.00	0 0.00
Total	827 88.92	103 11.08	930 100.00

Frequency Missing = 14043

Testing if the proportion of people insured in Texas is different from the national proportion

The FREQ Procedure

newins	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	12242	82.05	12242	82.05
2	2679	17.95	14921	100.00
Frequency Missing = 52				

Binomial Proportion	
newins = 1	
Proportion	0.8205
ASE	0.0031

Confidence Limits for the Binomial Proportion		
Proportion = 0.8205		
Type	95% Confidence Limits	
Agresti-Coull	0.8142	0.8265
Clopper-Pearson (Exact)	0.8142	0.8266
Wilson	0.8142	0.8265

Test of H0: Proportion = 0.84	
ASE under H0	0.0030
Z	-6.5125
One-sided Pr < Z	<.0001
Two-sided Pr > |Z|	<.0001

Effective Sample Size = 14921
Frequency Missing = 52

Table of diabcvd by newins

diabcvd	newins 1	2	Total
0	11713 78.50 81.71 95.68	2622 17.57 18.29 97.87	14335 96.07
1	529 3.55 90.27 4.32	57 0.38 9.73 2.13	586 3.93
Total	12242 82.05	2679 17.95	14921 100.00
Frequency Missing = 52			

Physical health factors

Table of Diabetes by newhighbp

Diabetes(Doctor Diagnosed Diabetes)	newhighbp 1	2	Total
1	1533 10.29 74.63 24.43	521 3.50 25.37 6.04	2054 13.78
2	4741 31.81 36.89 75.57	8110 54.41 63.11 93.96	12851 86.22
Total	6274 42.09	8631 57.91	14905 100.00

Frequency Missing = 68

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newhealth

Diabetes(Doctor Diagnosed Diabetes)	newhealth 1	2	3	4	5	Total
1	59 0.40 2.89 2.44	290 1.95 14.18 6.70	680 4.58 33.25 14.03	609 4.10 29.78 27.32	407 2.74 19.90 39.17	2045 13.76
2	2355 15.85 18.38 97.56	4040 27.19 31.53 93.30	4167 28.04 32.52 85.97	1620 10.90 12.64 72.68	632 4.25 4.93 60.83	12814 86.24
Total	2414 16.25	4330 29.14	4847 32.62	2229 15.00	1039 6.99	14859 100.00

Frequency Missing = 114

Table of Diabetes by newmi

Diabetes(Doctor Diagnosed Diabetes)	newmi 1	2	Total
1	351 2.36 17.16 36.30	1694 11.39 82.84 12.19	2045 13.75
2	616 4.14 4.80 63.70	12208 82.10 95.20 87.81	12824 86.25
Total	967 6.50	13902 93.50	14869 100.00

Frequency Missing = 104

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by cvd

Diabetes(Doctor Diagnosed Diabetes)	cvd(Cardiovascular Disease) 1	2	Total
1	588 3.98 28.99 31.99	1440 9.74 71.01 11.13	2028 13.72
2	1250 8.46 9.80 68.01	11503 77.82 90.20 88.87	12753 86.28
Total	1838 12.43	12943 87.57	14781 100.00

Frequency Missing = 192

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by bmicat2

Diabetes(Doctor Diagnosed Diabetes)	bmicat2(BMI Categories) 1	2	3	4	5	Total
1	15 0.11 0.77 6.17	270 1.93 13.93 5.84	663 4.73 34.21 13.05	519 3.71 26.78 20.84	471 3.36 24.30 30.08	1938 13.84
2	228 1.63 1.89 93.83	4353 31.08 36.08 94.16	4418 31.55 36.62 86.95	1972 14.08 16.34 79.16	1095 7.82 9.08 69.92	12066 86.16
Total	243 1.74	4623 33.01	5081 36.28	2491 17.79	1566 11.18	14004 100.00

Frequency Missing = 969

Table of newhighbp by cvd

newhighbp	cvd(Cardiovascular Disease) 1	2	Total
1	1395 9.45 22.55 76.31	4791 32.47 77.45 37.06	6186 41.92
2	433 2.93 5.05 23.69	8136 55.14 94.95 62.94	8569 58.08
Total	1828 12.39	12927 87.61	14755 100.00

Frequency Missing = 218

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by neweatbp

Diabetes(Doctor Diagnosed Diabetes)	neweatbp 1	2	Total
1	536 18.73 81.46 24.34	122 4.26 18.54 18.51	658 23.00
2	1666 58.23 75.62 75.66	537 18.77 24.38 81.49	2203 77.00
Total	2202 76.97	659 23.03	2861 100.00

Frequency Missing = 12112

Frequency
Percent
Row Pct
Col Pct

Table of newchldcnt by inccat5

newchldcnt	inccat5(Income Categories) 1	2	3	4	5	Total
0	1272 9.94 14.29 67.52	1698 13.27 19.08 70.34	1000 7.81 11.24 74.06	1283 10.03 14.42 76.10	3646 28.49 40.97 66.53	8899 69.53
1	209 1.63 14.40 11.09	237 1.85 16.33 9.82	112 0.88 7.72 8.40	162 1.27 11.16 9.61	731 5.71 50.38 13.34	1451 11.34
2	198 1.55 13.56 10.51	250 1.95 17.12 10.36	126 0.98 8.63 9.45	142 1.11 9.73 8.42	744 5.81 50.96 13.58	1460 11.41
3	133 1.04 19.36 7.06	148 1.16 21.54 6.13	62 0.48 9.02 4.65	63 0.49 9.17 3.74	281 2.20 40.90 5.13	687 5.37
4	42 0.33 21.11 2.23	54 0.42 27.14 2.24	23 0.18 11.56 1.72	24 0.19 12.06 1.42	56 0.44 28.14 1.02	199 1.55
5	25 0.20 32.89 1.33	23 0.18 30.26 0.95	8 0.06 10.53 0.60	7 0.05 9.21 0.42	13 0.10 17.11 0.24	76 0.59
6	3 0.02 17.65 0.16	4 0.03 23.53 0.17	2 0.02 11.76 0.15	4 0.03 23.53 0.24	4 0.03 23.53 0.07	17 0.13
7	2 0.02 22.22 0.11	0 0.00 0.00 0.00	1 0.01 11.11 0.07	1 0.01 11.11 0.06	5 0.04 55.56 0.09	9 0.07
Total	1884 14.72	2414 18.86	1334 10.42	1686 13.17	5480 42.82	12798 100.00

Frequency Missing = 2175

Frequency
Percent
Row Pct
Col Pct

Table of cvd by pov

cvd(Cardiovascular Disease)	pov 0	1	Total
1	1348 10.64 85.86 12.13	222 1.75 14.14 14.24	1570 12.39
2	9764 77.06 87.96 87.87	1337 10.55 12.04 85.76	11101 87.61
Total	11112 87.70	1559 12.30	12671 100.00

Frequency Missing = 2302

Summary Statistics for cvd by pov

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	5.6008	0.0180
2	Row Mean Scores Differ	1	5.6008	0.0180

Common Odds Ratio and Relative Risks

Statistic	Method	Value	95% Confidence Limits	
Odds Ratio	Mantel-Haenszel	0.8315	0.7135	0.9690
	Logit	0.8315	0.7135	0.9690
Relative Risk (Column 1)	Mantel-Haenszel	0.9762	0.9557	0.9971
	Logit	0.9762	0.9557	0.9971
Relative Risk (Column 2)	Mantel-Haenszel	1.1740	1.0290	1.3395
	Logit	1.1740	1.0290	1.3395

Table of pov by newmi

pov	newmi 1	2	Total
0	688 5.40 6.16 82.99	10479 82.29 93.84 88.02	11167 87.69
1	141 1.11 9.00 17.01	1426 11.20 91.00 11.98	1567 12.31
Total	829 6.51	11905 93.49	12734 100.00

Frequency Missing = 2239

Table of Diabetes by pov

Diabetes(Doctor Diagnosed Diabetes)	pov 0	1	Total
1	1470 11.50 84.05 13.12	279 2.18 15.95 17.71	1749 13.68
2	9736 76.18 88.25 86.88	1296 10.14 11.75 82.29	11032 86.32
Total	11206 87.68	1575 12.32	12781 100.00

Frequency Missing = 2192

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newsmoke				
	newsmoke			
Diabetes(Doctor Diagnosed Diabetes)	1	2	3	Total
1	183 2.92 18.96 12.36	80 1.28 8.29 11.61	702 11.19 72.75 17.11	965 15.38
2	1298 20.69 24.45 87.64	609 9.71 11.47 88.39	3401 54.22 64.07 82.89	5308 84.62
Total	1481 23.61	689 10.98	4103 65.41	6273 100.00
Frequency Missing = 8700				

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newchol			
	newchol		
Diabetes(Doctor Diagnosed Diabetes)	1	2	Total
1	1355 11.04 70.83 22.77	558 4.55 29.17 8.83	1913 15.59
2	4596 37.45 44.37 77.23	5762 46.96 55.63 91.17	10358 84.41
Total	5951 48.50	6320 51.50	12271 100.00
Frequency Missing = 2702			

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newhealth

Diabetes(Doctor Diagnosed Diabetes)	newhealth 1	2	3	4	5	Total
1	59 0.40 2.89 2.44	290 1.95 14.18 6.70	680 4.58 33.25 14.03	609 4.10 29.78 27.32	407 2.74 19.90 39.17	2045 13.76
2	2355 15.85 18.38 97.56	4040 27.19 31.53 93.30	4167 28.04 32.52 85.97	1620 10.90 12.64 72.68	632 4.25 4.93 60.83	12814 86.24
Total	2414 16.25	4330 29.14	4847 32.62	2229 15.00	1039 6.99	14859 100.00

Frequency Missing = 114

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newhbp

Diabetes(Doctor Diagnosed Diabetes)	newhbp 1	2	3	4	Total
1	1533 10.29 74.63 24.43	11 0.07 0.54 7.91	503 3.37 24.49 6.03	7 0.05 0.34 4.83	2054 13.78
2	4741 31.81 36.89 75.57	128 0.86 1.00 92.09	7844 52.63 61.04 93.97	138 0.93 1.07 95.17	12851 86.22
Total	6274 42.09	139 0.93	8347 56.00	145 0.97	14905 100.00

Frequency Missing = 68

Table of Diabetes by newhd

Diabetes(Doctor Diagnosed Diabetes)	newhd 1	2	Total
1	340 2.30 16.92 33.07	1669 11.29 83.08 12.14	2009 13.59
2	688 4.66 5.39 66.93	12081 81.75 94.61 87.86	12769 86.41
Total	1028 6.96	13750 93.04	14778 100.00

Frequency Missing = 195

Socioeconomic factors

Frequency
Percent
Row Pct
Col Pct

Table of diabcvd by inccat5

diabcvd	inccat5(Income Categories) 1	2	3	4	5	Total
0	1695 13.38 13.93 91.72	2252 17.77 18.51 94.90	1256 9.91 10.32 95.37	1600 12.63 13.15 95.87	5364 42.33 44.09 98.17	12167 96.02
1	153 1.21 30.36 8.28	121 0.95 24.01 5.10	61 0.48 12.10 4.63	69 0.54 13.69 4.13	100 0.79 19.84 1.83	504 3.98
Total	1848 14.58	2373 18.73	1317 10.39	1669 13.17	5464 43.12	12671 100.00

Frequency Missing = 2302

Table of diabcvd by inccat5

diabcvd	inccat5(Income Categories) 1	2	3	4	5	Total
0	1733 13.53 14.08 91.89	2296 17.92 18.65 94.99	1274 9.94 10.35 95.43	1621 12.65 13.17 95.92	5385 42.03 43.75 98.18	12309 96.07
1	153 1.19 30.36 8.11	121 0.94 24.01 5.01	61 0.48 12.10 4.57	69 0.54 13.69 4.08	100 0.78 19.84 1.82	504 3.93
Total	1886 14.72	2417 18.86	1335 10.42	1690 13.19	5485 42.81	12813 100.00

Frequency Missing = 2160

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by educat4

Diabetes(Doctor Diagnosed Diabetes)	educat4(Education Categories) 1	2	3	4	Total
1	435 2.92 21.19 20.44	559 3.75 27.23 14.95	563 3.78 27.42 15.05	496 3.33 24.16 9.38	2053 13.78
2	1693 11.37 13.18 79.56	3181 21.35 24.77 85.05	3178 21.33 24.74 84.95	4791 32.16 37.30 90.62	12843 86.22
Total	2128 14.29	3740 25.11	3741 25.11	5287 35.49	14896 100.00

Frequency Missing = 77

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newincome

Diabetes(Doctor Diagnosed Diabetes)	newincome 1	2	3	4	5	6	7	8	Total
1	204 1.59 11.65 21.79	214 1.67 12.22 22.69	224 1.75 12.79 18.71	198 1.55 11.31 16.28	207 1.62 11.82 15.53	233 1.82 13.31 13.81	194 1.52 11.08 11.03	277 2.16 15.82 7.44	1751 13.69
2	732 5.72 6.63 78.21	729 5.70 6.60 77.31	973 7.60 8.81 81.29	1018 7.96 9.22 83.72	1126 8.80 10.20 84.47	1454 11.36 13.17 86.19	1565 12.23 14.17 88.97	3447 26.94 31.21 92.56	11044 86.31
Total	936 7.32	943 7.37	1197 9.36	1216 9.50	1333 10.42	1687 13.18	1759 13.75	3724 29.11	12795 100.00

Frequency Missing = 2178

Frequency
Percent
Row Pct
Col Pct

Table of Diabetes by newedu

Diabetes(Doctor Diagnosed Diabetes)	newedu 1	2	3	4	5	6	Total
1	19 0.13 0.93 31.15	223 1.50 10.86 23.57	193 1.30 9.40 17.22	559 3.75 27.23 14.95	563 3.78 27.42 15.05	496 3.33 24.16 9.38	2053 13.78
2	42 0.28 0.33 68.85	723 4.85 5.63 76.43	928 6.23 7.23 82.78	3181 21.35 24.77 85.05	3178 21.33 24.74 84.95	4791 32.16 37.30 90.62	12843 86.22
Total	61 0.41	946 6.35	1121 7.53	3740 25.11	3741 25.11	5287 35.49	14896 100.00

Frequency Missing = 77

Behavioral factors

Frequency Percent Row Pct Col Pct	Table of Diabetes by newexlim		
	newexlim		
Diabetes(Doctor Diagnosed Diabetes)	1	2	Total
1	903 6.45 47.25 23.11	1008 7.20 52.75 9.98	1911 13.65
2	3004 21.45 24.84 76.89	9090 64.91 75.16 90.02	12094 86.35
Total	3907 27.90	10098 72.10	14005 100.00
Frequency Missing = 968			

Frequency Percent Row Pct Col Pct	Table of Diabetes by pacat					
	pacat(Physical Activity Categories)					
Diabetes(Doctor Diagnosed Diabetes)	1	2	3	4	9	Total
1	444 2.97 21.53 11.09	286 1.91 13.87 11.21	342 2.29 16.59 12.40	786 5.26 38.12 18.43	204 1.36 9.89 14.88	2062 13.79
2	3559 23.81 27.62 88.91	2266 15.16 17.58 88.79	2417 16.17 18.76 87.60	3478 23.27 26.99 81.57	1167 7.81 9.06 85.12	12887 86.21
Total	4003 26.78	2552 17.07	2759 18.46	4264 28.52	1371 9.17	14949 100.00
Frequency Missing = 24						

CLEANED VARIABLES:

The following may help the curious reader to know what variables were used in the SAS analyses and above outputs. Each question is from the original BRFSS and has been modified into the following codebook.

- C01Q01
Would you say that in general your health is:
1 Excellent
2 Very Good
3 Good
4 Fair
5 Poor

newins - C03Q01
Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?
1 Yes
2 No

newdoc - C03Q02
Do you have one person you think of as your personal doctor or health care provider?
1 Yes, only one
2 More than one
3 No

newcost - C03Q03
Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?
1 Yes
2 No

newhbp - C04Q01
Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?
1 Yes
2 Yes, but female told only during pregnancy
3 No
4 Told borderline high or pre-hypertensive

newhighbp – highbp
Doctor diagnosed High Blood Pressure
1 Yes
2 No

newbpmed - C04Q02
Are you currently taking medicine for your high blood pressure?
1 Yes
2 No

newchol - C05Q03
Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high?
1 Yes
2 No

newmi - C06Q01
Has a doctor, nurse, or other health professional ever told you that you had a heart attack, also called a myocardial infarction?
1 Yes
2 No

newhd - C06Q02
Has a doctor, nurse, or other health professional ever told you that you had angina or coronary heart disease?
1 Yes
2 No

newstroke - C06Q03
Has a doctor, nurse, or other health professional ever told you that you had a stroke?
1 Yes
2 No

cvd – cvd
Cardiovascular Disease **(**Calculated)
1 Yes
2 No

newkid - C06Q11
Has a doctor, nurse or other health professional ever told you that you have a kidney disease?
1 Yes
2 No

newvis - C06Q12
Has a doctor, nurse or other health professional ever told you that you have vision impairment in one or both eyes, even when wearing glasses?
1 Yes
2 No

Diabetes – Diabetes
Calculated
Doctor Diagnosed Diabetes
1 Yes
2 No

newhbs - M01Q01
Have you had a test for high blood sugar or diabetes within the past three years
1 Yes
2 No

newdage - M02Q01
How old were you when you were told you have diabetes?
_ _ (Age in years)

newdage3 - diabage3
Age at diagnosis of diabetes, stratified 3 age groups
1 Less than 40 years
2 41 to 64 years
3 65+ years

newinsul - M02Q02
Are you now taking insulin?
1 Yes
2 No

newckfeet – ckfeet
Calculated
Check feet daily for any sores or irritations
1 Yes
2 No

newdocvis - M02Q05
About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?
_ _ (Number of times; 76 =76 or more)

newseedoc – seedoc
Calculated
Seen a doctor, nurse or other health professional in the past 12 months for diabetes
1 Yes
2 No

newaoc - M02Q06
A test for "A one C' measure the average level of blood sugar over the past three months. About how many times in the past 12 months has a doctor, nurse, or other health professional checked you for "A one C"?
_ _ (Number of times; 76 =76 or more)

newaoccat – aonec
Calculated
Had an "A one C" test in the past 12 months
1 Yes
2 No

newdocfeet – docfeet
Calculated
Had a health professional check your feet for any sores or irritations in the past 12 months
1 Yes
2 No

newdoceye - M02Q09
Has a doctor ever told you that diabetes has affected your eyes or that you had retinopathy?
1 Yes
2 No

newsmoke - C07Q02
Do you now smoke cigarettes every day, some days, or not at all?
1 Every day
2 Some days
3 Not at all

newage - C08Q01
What is your age?
_ _ Code age in years

agegr3 - agegr3
Calculated
Age Group
1 18 to 44
2 45 to 64
3 65+

raceeth – raceeth
Calculated
Race/Ethnicity
1 White
2 Black
3 Hispanic
4 Other

newedu - C08Q08
What is the highest grade or year of school you completed?
1 Never attended school or only attended kindergarten
2 Grades 1 through 8 (Elementary)
3 Grades 9 through 11 (Some high school)
4 Grade 12 or GED (High school graduate)
5 College 1 year to 3 years (Some college or technical school)
6 College 4 years or more (College graduate)

educat4 - educat4
Calculated
Education Categories
1 Less than high school graduate
2 High school graduate
3 Some college
4 College graduate

employed – employed
Calculated
Employed
1 Yes
2 No

newincome - C08Q10
Is your annual household income from all sources…?
01 Less than $10,000
02 $10,000 to less than $15,000
03 $15,000 to less than $20,000
04 $20,000 to less than $25,000
05 $25,000 to less than $35,000
06 $35,000 to less than $50,000
07 $50,000 to less than $75,000
08 $75,000 or more

inccat5 - inccat5
Calculated
Income Categories
1 < $15,000
2 $15,000 to < $25,000
3 $25,000 to < $35,000
4 $35,000 to < $50,000
5 $50,000+

bmi – bmi
Calculated
Body Mass Index
Notes: Calculated from self reported height and weight

bmicat2 - bmicat2
Calculated
BMI Categories
1 Underweight
2 Normal
3 Overweight
4 Obese
5 Morbidly obese

phr – phr
Public Health Region
1 PHR 1
2 PHR 2
3 PHR 3
4 PHR 4
5 PHR 5
6 PHR 6
7 PHR 7
8 PHR 8
9 PHR 9
10 PHR 10
11 PHR 11

newex - C10Q01
During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?
1 Yes
2 No

pacat – pacat
Calculated
Physical Activity Categories – TDSHS Calculated
1 Highly Active
2 Active
3 Insufficiently Active
4 Inactive

paindex – paindex
Calculated
Physical Activity Index – TDSHS Calculated
1 Met Aerobic Recommendations
2 Did Not Meet Aerobic Recommendations

pa150r1 - pa150r1
Calculated
Adults that participated in 150 minutes (or vigorous equivalent minutes) of physical activity per week – TDSHS Calculated
1 150+ minutes (or vigorous equivalent minutes) of physical activity
2 1 to 149 minutes (or vigorous equivalent minutes) of physical activity
3 0 minutes of physical activity

pa3002l - pa3002l
Calculated
Adults that participated in 300 minutes (or vigorous equivalent minutes) of physical activity per week – TDSHS Calculated
1 301+ minutes (or vigorous equivalent minutes) of physical activity
2 0 to 300 minutes (or vigorous equivalent minutes) of physical activity

pastaer – pastaer
Calculated
Calculated variable for aerobic and strengthening – TDSHS Calculated
1 Met both guidelines
2 Did not meet both guidelines

newexlim - C11Q01
Are you limited in any way in any activities because of physical, mental, or emotional problems?
1 Yes
2 No

rfdrhv2 - rfdrhv2
Calculated
Risk Factor for Heavy Alcohol Consumption
1 Not at risk
2 At risk

Notes: More than 2 drinks a day for men or 1 drink a day for women

neweatbp - M10Q01
Are you changing your eating habits to help lower or control your high blood pressure? (Survey A)
1 Yes
2 No

newsalt - M10Q02
Are you cutting down on salt to help lower or control your high blood pressure? (Survey A)
1 Yes
2 No
3 Do not use salt

newexbp - M10Q04
Are you exercising to help lower or control your high blood pressure? (Survey A)
1 Yes
2 No

newdoceat - M10Q05
Has a doctor or other health professional advised you to change your eating habits to help lower or control your high blood pressure? (Survey A)
1 Yes
2 No

newdocsalt - M10Q06
Has a doctor or other health professional advised you to cut down on salt to help lower or control your high blood pressure? (Survey A)
1 Yes
2 No
3 Do not use salt

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