Type 2 Diabetes related to chronic health disease, health status, and effect on quality of life

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Type 2 Diabetes related to chronic health disease, health status, and effect on quality of life

An honors thesis/project in partial fulfillment
of the requirements for the degree of
Honors Baccalaureate in Nursing

By

Samantha Hieger
Honors Nursing Student

March 20, 2015
University of Arkansas

This honors undergraduate thesis/project is approved for recommendation to the
College of Education and Health Professions Honors Council

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Honors Thesis/ Project Director

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Marie-Rachelle Narcisse
Committee Member

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Nan Smith-Blair
Committee Member
Abstract

Background

In the United States, 29.1 million people, or 9.3% of the population have diabetes mellitus (CDC, 2014). The total cost of diabetes in the United States has been estimated at $245 billion, which included the direct medical costs as well as the reduced productivity (CDC, 2014). Diabetes greatly increases the risk of other chronic illnesses such as coronary heart disease, myocardial infarction (MI), retinopathy, nephropathy and stroke. These chronic conditions may cause serious harm or even death.

Objectives

The objectives of this study are to determine the prevalence of chronic health diseases among diabetic adults in the United States, and describe the demographic characteristics as well as the health, lifestyle, satisfaction with life and care received as well as the utilization of care by diabetic adults with chronic diseases.

Methods

This study is based on a secondary data analysis based on data from the Behavioral Risk Factor Surveillance System (BRFSS, 2013). We performed descriptive statistics to describe the diabetic population. We conducted multinomial logistic regression analysis to examine the effects of the main predictors of stroke, heart attack, coronary heart disease, nephropathy, and retinopathy on health status. We further conducted negative binomial regression
analysis to investigate the independent effects of stroke, heart attack, coronary heart disease, nephropathy, and retinopathy on the number of days during which diabetics reported their physical and mental health as being not good in the past month, as well as the number of visits to the doctor in the past 12 months.

**Results**

In the U.S., 25,234,904 adults stated they had been diagnosed with diabetes by a healthcare professional. Four out of ten adults with diabetes were 65 years and older, and close to three out of ten of them were between the ages of 55-64 years. Close to six out of ten adults with diabetes was Non-Hispanic white. Over half of people with diabetes were also obese as compared to a quarter of those without diabetes. Close to two out of ten diabetic adults reported having a visual impairment secondary to diabetes; 14% reported having suffered a heart attack or a coronary heart disease, and 9% reported having been diagnosed with stroke or nephropathy. Over the past month, diabetic adults with either of the chronic diseases reported poor good physical health for an average of 18 days, and poor mental health for an average of 15 days. Although 14% of people with diabetes reported their health as being very good, only 9% for diabetics with retinopathy, 8% of diabetics who had sustained a stroke or a heart attack, 6% and 5% of those who have been diagnosed with a coronary heart disease or a nephropathy, respectively reported the same. A higher proportion of adults without diabetes than with diabetes reported being very satisfied with life (47% vs. 37%), and 65% were very satisfied with the care they received. Multinomial logistic and regressions further revealed that stroke, heart attack, coronary heart
disease, nephropathy, and retinopathy have a deleterious effect on the health status of diabetics, and increase the number of days spent in poor physical and mental health.

**Conclusions**

The results of this study indicate that diabetes has a great impact on the quality of life of these individuals, and has the potential to cause multiple chronic illnesses if it goes untreated. It also greatly impacts the mental and physical health status of each person in a negative way. With U.S. healthcare in disarray, lack of access to care for diabetic patients is extremely relevant to the results in this study. Healthcare professionals, especially nurses, play a key role in the prevention and management of diabetes through education. This in addition to the use of interdisciplinary teams will allow diabetic patients a more wholesome healthcare experience that provides all necessary information and treatment needed.
Background

According to the National Diabetes Statistics Report for 2014, 29.1 million people, or 9.3% of the US population have diabetes mellitus (CDC, 2014). This prevalence accounts for approximately 12% of the total population, and is greatest in those 65 years and older (ADA, 2011). In 2012, the total cost of diabetes in the United States was $245 billion, which included the direct medical costs as well as the reduced productivity (CDC, 2014).

There are two types of diabetes mellitus, type 1 and type 2, and both have a great impact on the health of an individual. For the purpose of this study we will primarily focus on type 2 diabetes, but both will be discussed initially. To begin, insulin is a hormone produced and secreted by the pancreas, and is responsible for breaking down glucose in the blood. When someone does not make or secrete insulin properly this leads to diabetes mellitus, which can be categorized into two types. Type 1 diabetes occurs when the pancreas does not produce insulin at all, which in turn leads to a major buildup of glucose in the blood. In many, but not all cases this type of diabetes mellitus is diagnosed during childhood. Type 2 diabetes is caused when the body does not make enough insulin, or the body does not use the insulin that is being produced. Similarly to type 1 diabetes this leads to an increase in the amount of glucose in the blood. Some factors that may lead to this type of diabetes are things such as age, lifestyle, and diet (ADA, 2014). With this increase of glucose in the blood there is the potential for a rise in blood pressure, and potentially an increase in the viscosity of the blood. Over time, this
change will begin to cause damage to the blood vessels, leading to more
dangerous outcomes. While type 1 diabetes is becoming more and more common,
type 2 diabetes is growing at a much more rapid rate, and has become a very
serious issue in this country. Over time we have gradually made our way from
healthy, home grown, organic eating to processed, fast food, and a sedentary
lifestyle. With the lack of exercise, and an overload of glucose in the body there is
a loss of function on the part of insulin, and therefore it will not break the glucose
taken in leading to high blood sugar. These changes diet and exercise have caused
us to take a major decline in our health and well being, and will continue to do so
unless changes are made.

Whether controlled or not, diabetes can lead to many chronic illnesses or
conditions including some that may cause serious harm or even death. In 2010,
diabetes mellitus was the seventh leading cause of death in the United States
(CDC, 2014). In many cases patients have at least one co morbid condition, and
almost half have at least three conditions (Abdelhafiz, 2013). These can by caused
by many factors including poor adherence to medications and insulin, or poor
glucose control, both of which can lead to micro or macro vascular changes in the
body. Changes such as these have the ability to greatly impact the quality of life
of an individual, and may even cause permanent damage to the body. Due to the
increased amount of glucose in the blood, there is an increased risk for damage to
blood vessels, in turn leading to micro and macro vascular complications.

Micro and macro vascular complications caused by type 2 diabetes have
the potential to precipitate some very serious health risks. As such, macro
vascular changes are known to cause things like stroke, hypertension, myocardial infarction (MI), and coronary heart disease. In addition to atherosclerosis, there is also increased platelet adhesion and hypercoagulability with type 2 diabetes (Fowler, 2008). Therefore, diabetes is a major risk factor for stroke and hypertension, and is also associated with a poor outcome after stroke (Tanaka, 2013). According to the American Diabetes Association (ADA), people with diabetes are 2 to 4 times more likely to suffer a stroke. According to Fowler (2008), microvascular disease may also be a predictor of coronary heart events. Not only that, but diabetes can affect the prognosis in patients with a myocardial infarction (Wang, 2014). Macrovascular diseases are caused primarily by atherosclerosis, which leads to narrowing of the blood vessels resulting in decreased blood flow and damage to vessel walls. This in addition to hypercoagulability leads to further lack of oxygenation to certain vital organs such as the heart, which will result in an MI or even end organ failure (Fowler, 2008). Type 2 diabetic patients have a decreased health-related quality of life, especially regarding physical functioning and well being. Diabetic patients with macrovascular and non-vascular disease have a decreased health-related quality of life compared to those with out co-existing conditions (Wermeling, 2012). Collectively these co-morbidities affect not only the quality of life, but drastically increase the chances of mortality for these patients.

Diabetes requires a self-management system made up of insulin injections and/or oral agents, diet and exercise modifications, and monitoring blood glucose levels on a regular basis (Fowler, 2007). Adherence to these recommendations is
important, but the lack of glycemic control suggests there may be a challenge to self-management (Shreck, 2014). In addition to lifestyle modifications, and medication adherence diabetes is a stepping-stone to many other health related issues such as diabetic neuropathy, diabetic nephropathy, diabetic retinopathy, and even depression. Diabetic peripheral neuropathy is a highly ranked complication of diabetes (Deng, 2014). Due to the decreased blood flow caused by damage to the vessels over time, there is a decrease in blood flow to the periphery. The exact cause of damage to the peripheral nerves is unknown, but could be related to polyol accumulation, injury from AGEs, or oxidative stress (Fowler, 2008). This symptom of diabetes can cause a great deal of more severe occurrences such as foot ulcers, and in some cases amputation. Over 80% of amputations in the US are the result of a foot ulceration or injury from diabetic neuropathy (Fowler, 2008).

Diabetic nephropathy is the leading cause of renal failure in the US. Alterations within the kidney include increased glomerular basement membrane thickness, microaneurysm formation, mesangial nodule formation (Kimmelsteil-Wilson bodies, among many others (Fowler, 2008). In these cases it is necessary for the patient to be put on a form of dialysis to ensure the blood is filtered properly.

Diabetic retinopathy could be the most common micro vascular complication in type 2 diabetes (Fowler, 2008). Risk factors for diabetic retinopathy include hyperglycemia and hypertension, suggesting that adherence to medications that control glycemia and pressure levels are highly important in
controlling the disease process (Jannuzzi, 2014). It is recommended by the ADA that diabetic individuals receive an eye exam at least once per year to check for any eye complications that may arise (ADA, 2014). These patients may have severe eye problems, and may eventually end up being partially or fully blind. Non-adherence to medication may lead to worsening of retinal complications, and a decrease in visual acuity, which could affect the quality of life of these individuals (Jannuzzi, 2014).

Depression is a chronic disease often associated with type 2 diabetes because it drastically alters their lifestyle. According to Ceretta (2012), symptoms of depression with activation of the hypothalamic pituitary adrenal may lead to alterations in the immune system, leading to insulin resistance and the development of diabetes mellitus. Not only can depression cause diabetes, but it can also worsen the disease process, and continue to make the patient feel more depressed. Diabetic patients have poorer glycemic control, more complications from the disease, and a decrease in quality of life as well as increased mortality (Ceretta, 2012). These patients go through endless insulin injections, blood glucose readings, and drastic lifestyle changes in order to keep them from dying. This disease process has such a negative effect on many people, and it can in many ways make them feel miserable.

Obesity is one of the biggest risk factors for diabetes. According to the CDC (2012), a body mass index (BMI) between 25 and 29.9 is considered overweight, while a BMI greater than 30 is considered obese. According to Twig (2014), compared to normal weight individuals, obese and overweight individuals
are at a higher risk of developing diabetes based on family history, physical activity, fasting plasma glucose, triglyceride levels, HDL cholesterol, systolic blood pressure, and white blood cell counts. When compared to normal-weight females with type 2 diabetes, obese women had more pain which lead to increased physical limitations. Obese females with type 2 diabetes felt that the disease was more difficult to deal with compared to obese diabetic males (Svenningsson, 2011).

Diabetes constitutes a serious public health problem. According to Healthy People 2020, diabetes increases the risk of heart disease by 2 to 4 times. It is important to understand that diabetes is growing at a rapid rate, and with that comes a myriad of co morbid conditions affecting patients, providers, and insurers. An important objective of Healthy People 2020 is to: Reduce the disease and economic burden of diabetes mellitus and improve the quality of life for all persons who have, or are at risk for, DM (US Department of Health and Human Services).

**Purpose of the Study and Research Questions**

This study has the following specific aims:

1. To determine the prevalence of chronic health diseases among diabetic adults in the United States,
2. To describe the health, lifestyle, satisfaction with life and care received as well as the utilization of care by diabetic adults with chronic diseases.
3. To examine the effect of chronic diseases on how diabetics rate their health.

4. To examine the effect of chronic diseases, and marginal effect of weight status on the number of days diabetics spend in poor physical and mental health.

5. To examine the effect of chronic diseases, and marginal effect of weight status on the utilization of care by diabetic adults in the United States.

Methodology

The Behavioral Risk Factor Surveillance System

This study is based on the Behavioral Risk Factor Surveillance System (BRFSS, 2013). The BRFSS is the world's largest, on-going telephone health survey system. The BRFSS is a collaborative project between all of the U.S. states and participating U.S. territories and the Centers for Disease Control and Prevention (CDC). The BRFSS is administered by CDC's Population Health Surveillance Branch, under the Division of Population Health at the National Center for Chronic Disease Prevention and Health Promotion. The BRFSS started in 1984, and has been ongoing since (BRFSS, Overview 2013).

The BRFSS collects data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases that affect the adult population for each state. Factors assessed by the BRFSS in 2013 include tobacco use, HIV/AIDS knowledge and prevention, exercise,
immunization, health status, healthy days, health-related quality of life, health care access, inadequate sleep, hypertension awareness, cholesterol awareness, chronic health conditions, alcohol consumption, fruits and vegetables consumption, arthritis burden, and seatbelt use.

**Sample Description**

The BRFSS is designed to measure behavioral risk factors for the non-institutionalized adult population 18 years of age and older residing in the U.S. The survey uses two samples: one for landline telephone respondents and one for cellular telephone respondents. Household sampling is used in the landline sample, and this sampling requires interviewers to collect information on the number of adults living in a residence and then select randomly from all eligible adults. Cellular telephone respondents are weighted as single adult households (BRFSS, Userguide, 2013).

In the BRFSS, a sample record is one telephone number in the list of all telephone numbers randomly selected for dialing. In 2013, all states met the BRFSS criterion for justifying sample records as a probability sample of all households with telephones. The states used Computer-Assisted Telephone Interview (CATI) systems to administer the questionnaire. In 2013, interviewer retention was very high among the participating states that conducted the survey.

**Weighting Method**

BRFSS applies a final weight assigned to each respondent. Data weighting is a statistical process that attempts to remove bias in the sample. The BRFSS
weighting process includes two steps: design weighting and iterative proportional fitting ("raking" weighting). When data are unweighted, each record counts the same as any other record. Unweighted data analyses make the assumption that each record has an equal probability of being selected and that nonresponse are equal among all segments of the population. If these assumptions are violated, weighting each record appropriately corrects for these violations. Furthermore, the use of the final weight in the analyses is necessary for making generalizations from the sample to the population.

Study Population

In this research, the study population is composed of respondents aged 18 years of age and older who in 2013 had answered “Yes” to the question “has a doctor, nurse, or other health professional ever told you that you had diabetes?” In 2013, 25,234,904 adults (10.3%) reported that they were diabetic. Those who were diagnosed with diabetes only during pregnancy were excluded from the analysis.

Variables

In table 1 below, we present the variables used in the statistical analyses.

<table>
<thead>
<tr>
<th>DEFINITION OF VARIABLES</th>
<th>LEVEL OF MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Definition</td>
</tr>
<tr>
<td>Have you ever been told by a doctor or other health professional you have diabetes</td>
<td>- Yes</td>
</tr>
<tr>
<td></td>
<td>- No</td>
</tr>
<tr>
<td>Have you ever been told you had a stroke?</td>
<td>- Yes</td>
</tr>
<tr>
<td></td>
<td>- No</td>
</tr>
<tr>
<td>Question</td>
<td>Response Options</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
</tbody>
</table>
| Have you ever been told that you had a heart attack also called a myocardial infarction? | - Yes  
- No          | Dichotomous |
| Have you ever been told you had angina or coronary heart disease?       | - Yes  
- No          | Dichotomous |
| Have you ever been told you had kidney disease?                         | - Yes  
- No          | Dichotomous |
| Have you ever been told that diabetes has affected your eyes or that you have retinopathy? | - Yes  
- No          | Dichotomous |
| Would you say that in general your health is:                            | - Excellent  
- Very good  
- Good  
- Fair  
- Poor          | Ordinal |
| In general, how satisfied are you with your life?                        | - Very satisfied  
- Satisfied  
- Dissatisfied  
- Very dissatisfied          | Ordinal |
| In general, how satisfied are you with the health care you received?     | - Very satisfied  
- Somewhat Satisfied  
- Not at all Satisfied          | Ordinal |
| Now thinking about your physical health, which includes physical illness and injury, for How many days during the past 30 days was your physical health not good? | Number of days          | Counts |
| Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good? | Number of days          | Counts |
| About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your | Visits          | Counts |
| Weight Status                                                           | - Underweight  
- Normal Weight  
- Overweight  
- Obese          | Ordinal |
| Physical Activity                                                       | - Highly Active  
- Active  
- Insufficiently Active  
- Inactive          | Ordinal |

**SOCIO-DEMOGRAPHIC CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Response Options</th>
<th>Type</th>
</tr>
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|                | - White  
- White, Non- | Nominal |
Hispanic
- Black, Non-Hispanic
- Asian, Non-Hispanic
- American
- Indian/Alaskan
- Native, Non-Hispanic
- Hispanic
- Other race, Non-Hispanic

<table>
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<th>Age category</th>
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<tr>
<td>Age 18 - 24</td>
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<tr>
<td>Age 25 - 34</td>
<td></td>
</tr>
<tr>
<td>Age 35 - 44</td>
<td></td>
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<tr>
<td>Age 45 - 54</td>
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<tr>
<td>Age 55 - 64</td>
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</tr>
<tr>
<td>Age 65 or older</td>
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</table>

<table>
<thead>
<tr>
<th>Gender.</th>
<th>Dichotomous</th>
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<tbody>
<tr>
<td>Male</td>
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</tr>
<tr>
<td>Female</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Ordinal</th>
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<tbody>
<tr>
<td>Less than $10,000</td>
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</tr>
<tr>
<td>$10,000 to less than $15,000</td>
<td></td>
</tr>
<tr>
<td>$15,000 to less than $20,000</td>
<td></td>
</tr>
<tr>
<td>$20,000 to less than $25,000</td>
<td></td>
</tr>
<tr>
<td>$25,000 to less than $35,000</td>
<td></td>
</tr>
<tr>
<td>$35,000 to less than $50,000</td>
<td></td>
</tr>
<tr>
<td>$50,000 to less than $75,000</td>
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<table>
<thead>
<tr>
<th>Education Level</th>
<th>Ordinal</th>
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<tbody>
<tr>
<td>Never attended school or only kindergarten</td>
<td></td>
</tr>
<tr>
<td>Grades 1 through 8 (Elementary)</td>
<td></td>
</tr>
<tr>
<td>Grades 9 through 11 (Some high school)</td>
<td></td>
</tr>
<tr>
<td>Grade 12 or GED (High school graduate)</td>
<td></td>
</tr>
<tr>
<td>College 1 year to 3 years (Some college or technical school)</td>
<td></td>
</tr>
<tr>
<td>College 4 years or more (College graduate)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 1. Operational Definition of Variables*
Age. In this study we looked particularly at individuals 18 years and older. There were a total of 25,234,904 adults that reported having diabetes mellitus. Of the total number, approximately 504,699 individuals were 18-24 years old. Roughly 1,009,396 were between the ages of 25-34, and approximately 2,018,792 individuals were 35-44 years old. Furthermore, the number of people between 45-54 was about 4,794,632, and those in the range of 55-64 were roughly 6,813,424 people. Finally, those greater than 65 years of age equated to 10,346,311 individuals. This data suggests there is a correlation between the age and number of diagnosed diabetics. According to the CDC, in 2011 over 60% of the individuals diagnosed with diabetes in the previous year were between the ages of 40 and 64 years old (CDC, 2013). Age has a very significant impact on the number of diabetics in the US, with more than a quarter of the US population over the age of 65 years (Lopez, 2014).

Gender. In this study we compared the number of men and women diagnosed with diabetes. According to the CDC (2014), in 2012, there were approximately 15.5 million men and 13.4 million women diagnosed with diabetes. These numbers equate to about 13% of men, and 11% of women in the United States with diabetes. Women diagnosed with diabetes have a shorter life expectancy than those without diabetes (CDC, 2014).

Ethnicity. We compared the prevalence of type 2 diabetes in a variety of ethnic groups. We examined white non-Hispanic, Asian non-Hispanic, Hispanic,
black non-Hispanic, American Indian/Alaskan native, and other ethnicity, non-Hispanic. African Americans, Hispanics, and American Indians when compared to non-Hispanic whites, have a much higher prevalence of visual impairment, ESRD, hospital discharges, and mortality (Lopez, 2014).

**Obesity.** In this study we looked at the prevalence of obesity in diabetic adults. In 2001, about 3% of US adults were both obese and had a diagnosis of diabetes, which was an increase from 1991 at only about 1% of the population (Espeland, 2014). There is a higher incidence of hypertension and hyperlipidemia in obese individuals, which may increase their risk of the micro vascular and macro vascular complications that come with diabetes (Fowler, 2007).

**Statistical Analysis**

All statistical analyses were conducted taking into account stratification, clustering, and appropriate sample weight to account for the complex sampling design of the survey data. We performed descriptive statistics of both categorical and continuous data. Descriptive analyses of these measures are intended to characterize the distributions of the selected variables, and to brush a portrait of the diabetic population. A univariate analysis of the categorical was conducted by presenting weighted graphical displays of the frequency distribution of the variables.

We fitted five separate multinomial logit models to examine the effects of the main predictors of stroke, heart attack, coronary heart disease, nephropathy,
and retinopathy. First, potential confounders such as age, gender, race, income and education level, insurance coverage, weight status, and physical activity level were not included in the models. Then, the models were re-fitted, but this time accounting for the potential effect of the confounders. Ordinal logistic regression could not be performed as the assumption of proportional odds was violated.

To investigate the independent effects of stroke, heart attack, coronary heart disease, nephropathy, and retinopathy on the number of days during which diabetics reported their physical and mental health as being not good in the past month, as well as the number of visits to the doctor in the past 12 months, we fitted five separate negative binomial regression models. Our choice for the negative binomial regression was justified first by the scale of measurement of the outcome variables (counts). Secondly, since the conditional variance of the count variables was greater than their condition mean, (i.e. situation of overdispersion), we favored the negative binomial regression model over a Poisson, as this would have violated a key assumption of the latter model.

We then predicted the average days in poor physical and mental days based on the occurrence of a chronic disease and the weight status of diabetics. Equivalently, we predicted the average times diabetics went to the doctor in the past year based on their weight status and the occurrence of a chronic disease in the past.

The study received IRB approval from the University of Arkansas, Fayetteville.
Results

Socio-Demographic Characteristics of Diabetic Adults in the U.S

Chart 1 displays a graphical display of the age frequency distribution of diabetic adults 18 years and older in 2013. Four out of ten adults with diabetes were 65 years and older, and close to three out of ten of them were between the ages of 55-64 years. The vast majority of diabetics were aged 45 years and older.

Chart 2 shows that women and men were almost as likely to be diabetic. Close to six out of ten adults with diabetes were Non-Hispanic white. African American and Latinos are almost as likely to suffer from the disease (16% and 17%, respectively). A small proportion (4%) of the population afflicted by diabetes is of non-Hispanic Asian descent.

Chart 1. Age Distribution of Diabetic Adults in the U.S.
Source: BRFSS, 2013
Chart 2. Gender Distribution

Chart 3. Racial/Ethnic Distribution of Diabetic Adults

A Portrait of the Health of Diabetic Adults in the United States

Chart 4 describes how adults with diabetes versus those without the condition rated their overall health in 2013. Striking disparities can be observed
between these two groups. Whereas two out of ten adults (21%) without diabetes rated their health as being excellent, a very small proportion of diabetics reported having excellent health (3%). Three out of ten adults (31%) with diabetes reported their health as being fair, whereas only one out of ten (11%) of their counterparts without diabetes rated their health as being fair. On the other end of the spectrum, 16% of diabetic adults reported having poor health, as compared to a mere 3% of those without diabetes.

On average, diabetic adults reported spending 15 days (standard deviation of 0.15) in the past 30 days during which their physical health was not good, as compared to an average of 10 days (standard deviation of 0.05) for adults without diabetes. Moreover, diabetic adults reported being either stressed, depressed, or having problems with emotions on average 14 days (standard deviation of 0.18) in the past month, as compared to an average of 11 days for people without the condition.

*Chart 4. Health Status of Diabetic vs. Non-Diabetic Adults in the U.S.*
Obesity affects diabetic adults disproportionally. Indeed, over half of people with diabetes were also obese – based on their body mass index - as compared to a quarter of those without diabetes. Concomitantly, only 14% of diabetic adults have a normal weight as compared to 37% of adults who do not suffer the condition (Chart 5). Of note, in 2013, 44% of diabetic adults were inactive, as compared to 29% of adults without diabetes (Chart 6).

![Chart 5. Weight Status of Diabetic vs. Non-Diabetic Adults in the U.S.](image1.png)

![Chart 6. Physical Activity of Diabetic vs. Non-Diabetic Adults in the U.S.](image2.png)
As Chart 7 depicts, chronic diseases are more prevalent among adults with diabetes than they are among those without the condition. In 2013, close to two out of ten diabetic adults reported that diabetes had affected their eyes or that they have been diagnosed with retinopathy. An equal proportion of diabetics reported having suffered a heart attack or a coronary heart disease (14%). Similarly, 9% of adults with diabetes have reported having been diagnosed with stroke or nephropathy. As expected, these chronic diseases are less prevalent in the population of adults without diabetes.

Over the past month, diabetic adults with either of the chronic diseases reported poor good physical health for an average of 18 days, and poor mental health (e.g. stressed, depressed, and emotional) for an average of 15 days.

Chart 7. Prevalence of Chronic Diseases in the Diabetic and Non-Diabetic Population
Next, we looked at how diabetics with each of the chronic diseases evaluated their health. Overall, distribution of health across the chronic disease categories is quite similar. Nonetheless, there is notable difference between how the overall population of diabetics rated their health, and how those with a chronic health condition did so. Although 14% of people with diabetes reported their health as being very good, this proportion dropped to 8% for those who had sustained a stroke or a heart attack, respectively, to 6% and 5% for those who have been diagnosed with a coronary heart disease or a nephropathy, respectively, and 9% for diabetics with retinopathy. It is noteworthy that the proportion of diabetic adults with a chronic health disease who rated their health as being poor is quite large (close to a third), and in stark contrast to the 16% of diabetics who considered their health as being poor (Chart 4).

*Chart 8. Health Status of Diabetics with Chronic Diseases*
Assessing Satisfaction with Life and Health Care in the Diabetic Population

A higher proportion of adults without diabetes than with diabetes reported being very satisfied with life (47% vs. 37%) (Chart 9). However, half of diabetic adults reported being satisfied with life (53%). When we stratified it by chronic disease, the proportion of adults with a chronic condition reported being very satisfied with life decreased, with the exception of diabetics with retinopathy (Chart 10).

Chart 9. Satisfaction with Life Among Adults With and Without Diabetes

Chart 10. Satisfaction With Life Among Diabetic Adults With Chronic Diseases
As Chart 11 depicts, in 2013 over six out of ten people with diabetes were very satisfied with the care they received; a proportion very similar to that of adults without diabetes. Similarly, close to a third of adults with and without diabetes were somewhat satisfied with the care that they received (31% and 33%, respectively), and a very small proportion is not at all satisfied. Diabetic adults with chronic diseases rated their satisfaction of the care they received in a similar fashion than the overall diabetic population (Chart 12).

**Chart 11.** Satisfaction With Care Received Among Adults With and Without Diabetes

```
<table>
<thead>
<tr>
<th></th>
<th>Very satisfied</th>
<th>Somewhat satisfied</th>
<th>Not at all satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic Population</td>
<td>65%</td>
<td>31%</td>
<td>4%</td>
</tr>
<tr>
<td>Non-Diabetic Population</td>
<td>63%</td>
<td>33%</td>
<td>5%</td>
</tr>
</tbody>
</table>
```

**Chart 12.** Satisfaction With Care Among Diabetic Adults With Chronic Diseases

```
<table>
<thead>
<tr>
<th>Chronic Disease</th>
<th>Very satisfied</th>
<th>Somewhat satisfied</th>
<th>Not at all satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>64%</td>
<td>30%</td>
<td>5%</td>
</tr>
<tr>
<td>Heart attack</td>
<td>66%</td>
<td>29%</td>
<td>5%</td>
</tr>
<tr>
<td>Coronary heart attack</td>
<td>66%</td>
<td>30%</td>
<td>5%</td>
</tr>
<tr>
<td>Nephropathy</td>
<td>64%</td>
<td>32%</td>
<td>4%</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>60%</td>
<td>34%</td>
<td>6%</td>
</tr>
</tbody>
</table>
```
**Multinomial Logistic Regression**

In this section, the outcome of interest is the variable *Health Status*. Tables 2 and 3 present the non-adjusted and adjusted odds-ratios with their respective confidence intervals. Each outcome category of health status was compared to the base outcome “good health”.

- Diabetics who have suffered from a stroke were less likely to report their health as being very good (AOR=0.66; CI:0.50;0.87). They were 1.44 times as likely to report their health as being fair (AOR=1.44; CI:1.17;1.77), and were almost 3 times as likely to rate their health as being very poor (AOR=2.70; CI:2.11;3.45) as compared to diabetics who have not sustained a stroke, after controlling for the influence of all the other predictors in the model.

- Diabetics who have suffered from a heart attack were less likely to report their health as being very good (AOR=0.74; CI:0.59;0.93). On the contrary, they were at 1.23 times as likely to report their health as being fair (AOR=1.48; CI:1.23;1.78), and were 2.68 times as likely of rating their health as being very poor (AOR=2.68; CI:2.16;3.33), as compared to diabetics who have not had a heart attack, after controlling for the influence of all the other predictors in the model.

- Diabetics who have suffered from coronary heart disease were less likely to report their health as being very good (AOR=0.51; CI:0.41; 0.63). On the other hand, they were 1.48 times as likely to report their health as being fair (AOR=1.71; CI:1.45;-2.02), and were 3.54 times as likely of rating their
health as being very poor (AOR=3.54; CI:2.92; 4.29), as compared to diabetics who have not suffered from a coronary heart disease, holding the other factors constant.

- Diabetics who have suffered from nephropathy were less likely to report their health as being very good (AOR=0.58; CI: 0.43; 0.79), whereas, they were almost twice as likely to report their health as being fair (AOR=1.85; CI:1.48;2.31), and almost four times as likely of rating their health as being very poor (AOR=3.76; CI:2.91; 4.86), as compared to diabetics who have not suffered from nephropathy, holding the other factors constant.

- Diabetics who have suffered from retinopathy were 1.59 times as likely to report their health as being fair (AOR=1.59; CI: 1.35; 1.88), and almost three times as likely of rating their health as being very poor (AOR=2.74; CI:2.28; 3.30), as compared to diabetics who have not suffered from nephropathy, holding the other factors constant.

<table>
<thead>
<tr>
<th></th>
<th>EXCELLENT</th>
<th>VERY GOOD</th>
<th>FAIR</th>
<th>VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>1.05</td>
<td>0.70*</td>
<td>1.47*</td>
<td>2.86*</td>
</tr>
<tr>
<td></td>
<td>[0.68 1.61]</td>
<td>[0.57 0.88]</td>
<td>[1.26 1.71]</td>
<td>[2.44 3.35]</td>
</tr>
<tr>
<td>Heart attack</td>
<td>0.96</td>
<td>0.68*</td>
<td>1.52*</td>
<td>2.92*</td>
</tr>
<tr>
<td></td>
<td>[0.68 1.35]</td>
<td>[0.56 0.83]</td>
<td>[1.33 1.73]</td>
<td>[2.53 3.37]</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
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<td>0.53*</td>
<td>1.58*</td>
<td>3.12*</td>
</tr>
<tr>
<td></td>
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<td>[0.45 0.63]</td>
<td>[1.38 1.80]</td>
<td>[2.71 3.59]</td>
</tr>
<tr>
<td>Nephropathy</td>
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<td>0.48*</td>
<td>1.90*</td>
<td>3.40*</td>
</tr>
<tr>
<td></td>
<td>[0.47 1.16]</td>
<td>[0.37 0.62]</td>
<td>[1.55 2.33]</td>
<td>[2.78 4.17]</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>0.88</td>
<td>0.80*</td>
<td>1.58*</td>
<td>2.85*</td>
</tr>
<tr>
<td></td>
<td>[0.62 1.23]</td>
<td>[0.67 0.95]</td>
<td>[1.39 1.80]</td>
<td>[2.48 3.27]</td>
</tr>
</tbody>
</table>

*Table 2. Estimated Multinomial Logistic Regression (Unadjusted ORs, CIs)*

<table>
<thead>
<tr>
<th></th>
<th>EXCELLENT</th>
<th>VERY GOOD</th>
<th>FAIR</th>
<th>VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>1.16</td>
<td>0.66*</td>
<td>1.44*</td>
<td>2.70*</td>
</tr>
</tbody>
</table>

*Table 2. Estimated Multinomial Logistic Regression (Unadjusted ORs, CIs)*

†
Table 3. Estimated Multinomial Logistic Regression (AORs, CIs)†
†Adjusted for age, gender, race, income and education level, insurance coverage, weight status, and physical activity level. Estimates for these predictors are not reported. The category “Good health” is the base outcome. *p<0.05

Negative Binomial Regression

Tables 4, 5 and 6 present non-adjusted and adjusted incident rate ratios. We can notice that in most cases, only a small change occurred in the estimates after adjusting for the effect of the confounders.

- For diabetic adults, having had a stroke increases the number of expected days in poor physical health by 18%, holding the other factors constant.

- For diabetic adults, having had a heart attack increases the number of expected days in poor physical health by 20%, holding the other factors constant.

- For diabetic adults, having had coronary heart disease increases the number of expected days in poor physical health by 23%, holding the other factors constant.

- For diabetic adults, having had a nephropathy increases the number of expected days in poor physical health by 23%, holding the other factors constant.
• For diabetic adults, having had a retinopathy increases the number of expected days in poor physical health by 12%, holding the other factors constant.

• For diabetic adults, having had a heart attack increases the number of expected days in poor mental health by 20%, holding the other factors constant.

• For diabetic adults, having had a coronary heart disease increases the number of expected days in poor mental health by 19%, holding the other factors constant.

• For diabetic adults, having had a stroke increases the number of expected days in poor physical health by 12%, holding the other factors constant.

• For diabetic adults, having had a heart attack increases the number of expected visits to the doctor in the past year by 24%, holding the other factors constant.

• For diabetic adults, having had a coronary heart disease increases the number of expected visits to the doctor in the past year by 20%, holding the other factors constant.

• For diabetic adults, having had a nephropathy increases the number of expected visits to the doctor in the past year by 25%, holding the other factors constant.

• For diabetic adults, having had a retinopathy increases the number of expected visits to the doctor in the past year by 26%, holding the other factors constant.

<table>
<thead>
<tr>
<th>Condition</th>
<th>NON-ADJUSTED IRRs</th>
<th>ADJUSTED IRRs†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
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<td>1.18*</td>
</tr>
<tr>
<td></td>
<td>[1.17 1.29]</td>
<td>[1.10 1.27]</td>
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</tbody>
</table>
### Table 4. Estimated Binomial Logistic Regression for Number of days in poor Physical Health

<table>
<thead>
<tr>
<th>Condition</th>
<th>NON-ADJUSTED IRRs</th>
<th>ADJUSTED IRRs†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
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<td>1.07</td>
</tr>
<tr>
<td></td>
<td>[1.06 1.21]</td>
<td>[0.97 1.19]</td>
</tr>
<tr>
<td>Heart attack</td>
<td>1.14*</td>
<td>1.20*</td>
</tr>
<tr>
<td></td>
<td>[1.05 1.23]</td>
<td>[1.10 1.32]</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>1.14*</td>
<td>1.19*</td>
</tr>
<tr>
<td></td>
<td>[1.06 1.22]</td>
<td>[1.10 1.29]</td>
</tr>
<tr>
<td>Nephropathy</td>
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<td>1.08</td>
</tr>
<tr>
<td></td>
<td>[0.95 1.16]</td>
<td>[0.98 1.19]</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>1.14</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>[1.07 1.21]</td>
<td>[1.01 1.19]</td>
</tr>
</tbody>
</table>

†Adjusted for age, gender, race, income and education level, insurance coverage, weight status, and physical activity level. Estimates for these predictors are not reported. *p<0.05

### Table 5. Estimated Binomial Logistic Regression for Number of days in poor Mental Health

<table>
<thead>
<tr>
<th>Condition</th>
<th>NON-ADJUSTED IRRs</th>
<th>ADJUSTED IRRs†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>1.23*</td>
<td>1.18*</td>
</tr>
<tr>
<td></td>
<td>[1.14 1.32]</td>
<td>[1.09 1.26]</td>
</tr>
<tr>
<td>Heart attack</td>
<td>1.34*</td>
<td>1.24*</td>
</tr>
<tr>
<td></td>
<td>[1.23 1.46]</td>
<td>[1.16 1.32]</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>1.30*</td>
<td>1.20*</td>
</tr>
<tr>
<td></td>
<td>[1.19 1.42]</td>
<td>[1.13 1.27]</td>
</tr>
<tr>
<td>Nephropathy</td>
<td>1.23*</td>
<td>1.25*</td>
</tr>
<tr>
<td></td>
<td>[1.15 1.31]</td>
<td>[1.15 1.37]</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>1.36*</td>
<td>1.26*</td>
</tr>
<tr>
<td></td>
<td>[1.23 1.50]</td>
<td>[1.17 1.35]</td>
</tr>
</tbody>
</table>

†Adjusted for age, gender, race, income and education level, insurance coverage, weight status, and physical activity level. Estimates for these predictors are not reported. *p<0.05

### Table 6. Estimated Binomial Logistic Regression for Number of visits to the Doctor in the past 12 months
Next, we predicted the average number of days diabetics will be in poor physical health and mental health, as well as the average number of visits to the doctor depending on whether they had suffered from a chronic disease or not, and their weight status. All estimated coefficients were statistically significant at the level of 0.001.

- The predicted average number of days in poor physical health is 14 days for diabetics who are underweight but had not sustained a stroke, as compared to 17 days for underweight diabetics who had suffered a stroke.
- The predicted average number of days in poor physical health is 12 days for diabetics with a normal weight but had not sustained a stroke, as compared to 14 days for their counterparts who had suffered a stroke.
- The predicted average number of days in poor physical health is 12 days for overweight diabetics who had not sustained a stroke, as compared to 14 days for their counterparts who had suffered a stroke.
- The predicted average number of days in poor physical health is 12 days for obese diabetics who had not sustained a stroke, as compared to 14 days for their counterparts who had suffered a stroke.
Chart 13. Predicted Average Days in Poor Physical Health By Weight Status And Occurrence Of Stroke

- The predicted average number of days in poor physical health is 14 days for diabetics who are underweight but had not sustained a heart attack, as compared to 17 days for underweight diabetics who had suffered a heart attack.

- The predicted average number of days in poor physical health is 12 days for diabetics with a normal weight but had not sustained a heart attack as compared to 15 days for their counterparts who had suffered a heart attack.

- The predicted average number of days in poor physical health is 12 days for overweight diabetics who had not sustained a heart attack, as compared to 14 days for their counterparts who had suffered a heart attack.

- The predicted average number of days in poor physical health is 12 days for obese diabetics who had not sustained a heart attack, as compared to 14 days for their counterparts who had suffered a heart attack.
Chart 14. Predicted Average Days In Poor Physical Health By Weight Status And Occurrence Of Heart Attack

- The predicted average number of days in poor physical health is 14 days for diabetics who are underweight but had not suffered from a coronary heart disease, as compared to 18 days for underweight diabetics who had suffered a coronary heart disease.

- The predicted average number of days in poor physical health is 12 days for diabetics with a normal weight but had not sustained a coronary heart disease, as compared to 15 days for their counterparts who had suffered a coronary heart disease.

- The predicted average number of days in poor physical health is 12 days for overweight diabetics who had not sustained a coronary heart disease, as compared to 14 days for their counterparts who had suffered a coronary heart disease.

- The predicted average number of days in poor physical health is 12 days for obese diabetics who had not sustained a coronary heart disease, as
compared to 14 days for their counterparts who had suffered a coronary heart disease.

*Chart 15. Predicted Average Days In Poor Physical Health By Weight Status And Occurrence Of Coronary Heart Disease*

- The predicted average number in days in poor physical health is 14 days for diabetics who are underweight but had not suffered from a nephropathy, as compared to 17 days for underweight diabetics who had suffered a nephropathy.
- The predicted average number in days in poor physical health is 12 days for diabetics with a normal weight but had not sustained a nephropathy, as compared to 15 days for their counterparts who had suffered a nephropathy.
- The predicted average number in days in poor physical health is 12 days for overweight diabetics who had not sustained a nephropathy, as
compared to 14 days for their counterparts who had suffered a nephropathy.

- The predicted average number in days in poor physical health is 12 days for obese diabetics who had not sustained a nephropathy, as compared to 14 days for their counterparts who had suffered a nephropathy.

![Chart 16: Predicted Average Days In Poor Physical Health By Weight Status And Occurrence Of Nephropathy]

- The predicted average number of days in poor physical health is 20 days for diabetics who are underweight but had not suffered from a retinopathy, as compared to 22 days for underweight diabetics who had suffered a retinopathy.
• The predicted average number of days in poor physical health is 16 days for diabetics with a normal weight but had not sustained a retinopathy, as compared to 18 days for their counterparts who had suffered a retinopathy.

• The predicted average number of days in poor physical health is 15 days for overweight diabetics who had not sustained a retinopathy, as compared to 17 days for their counterparts who had suffered a retinopathy.

• The predicted average number of days in poor physical health is 15 days for obese diabetics who had not sustained a retinopathy, as compared to 16 days for their counterparts who had suffered a retinopathy.

*Chart 17. Predicted Average Days In Poor Physical Health By Weight Status And Occurrence Of Retinopathy*
• The predicted average number of days in poor mental health is 13 days for diabetics who are underweight but had not suffered from a stroke, as compared to 14 days for underweight diabetics who had suffered a stroke.

• The predicted average number of days in poor mental health for diabetics with a normal weight who had not sustained a stroke or not is 12 days, as compared to 15 days for their counterparts who had suffered a stroke.

• The predicted average number of days in poor mental health for overweight diabetics who had not sustained is 11 days a stroke as compared to 12 days for their counterparts who had suffered a stroke.

• The predicted average number of days in poor mental health for obese diabetics who had sustained a stroke or not is 12 days.

*Chart 18. Predicted Average Days in Poor Mental Health By Weight Status And Occurrence Of Stroke*

• The predicted average number of days in poor mental health for diabetics who are underweight but had not sustained a heart attack is 13 days, as
compared to 15 days for underweight diabetics who had suffered a heart attack.

- The predicted average number of days in poor mental health for diabetics with a normal weight but had not sustained a heart attack is 11 days, as compared to 14 days for their counterparts who had suffered a heart attack.

- The predicted average number of days in poor mental health for overweight diabetics who had not sustained a heart attack is 11 days, as compared to 13 days for their counterparts who had suffered a heart attack.

- The predicted average number of days in poor mental health for obese diabetics who had not sustained a heart attack 11 days, as compared to 14 days for their counterparts who had suffered a heart attack.

*Chart 19. Predicted Average Days in Poor Mental Health By Weight Status And Occurrence Of Heart Attack*
• The predicted average number of days in poor mental health is 13 days for diabetics who are underweight but had not suffered from a coronary heart disease, as compared to 16 days for underweight diabetics who had suffered a coronary heart disease.

• The predicted average number of days in poor mental health is 12 days for diabetics with a normal weight but had not sustained a coronary heart disease, as compared to 14 days for their counterparts who had suffered a coronary heart disease.

• The predicted average number of days in poor mental health is 11 days for overweight diabetics who had not sustained a coronary heart disease, as compared to 13 days for their counterparts who had suffered a coronary heart disease.

• The predicted average number of days in poor mental health is 11 days for obese diabetics who had not sustained a coronary heart disease, as compared to 14 days for their counterparts who had suffered a coronary heart disease.
Chart 20. Predicted Average Days in Poor Mental Health By Weight Status And Occurrence Of Coronary Heart Disease

- The predicted average number of days in poor mental health is 13 days for diabetics who are underweight but had not suffered from a nephropathy, as compared to 14 days for underweight diabetics who had suffered a nephropathy.

- The predicted average number of days in poor mental health is 12 days for diabetics with a normal weight but had not sustained a nephropathy, as compared to 13 days for their counterparts who had suffered a nephropathy.

- The predicted average number of days in poor mental health is 11 days for overweight diabetics who had not sustained a nephropathy, as compared to 12 days for their counterparts who had suffered a nephropathy.

- The predicted average number of days in poor mental health for obese diabetics who had not sustained a nephropathy or not is 12 days.
Chart 21. Predicted Average Days in Poor Mental Health By Weight Status And Occurrence Of Nephropathy

- The predicted average number of days in poor mental health is 13 days for diabetics who are underweight but had not suffered from a retinopathy, as compared to 14 days for underweight diabetics who had suffered a retinopathy.

- The predicted average number of days in poor mental health is 13 days for diabetics with a normal weight but had not sustained a retinopathy, as compared to 15 days for their counterparts who had suffered a retinopathy.

- The predicted average number of days in poor mental health is 13 days for overweight diabetics who had not sustained a retinopathy, as compared to 15 days for their counterparts who had suffered a retinopathy.

- The predicted average number of days in poor mental health is 14 days for obese diabetics who had not sustained a retinopathy, as compared to 15 days for their counterparts who had suffered a retinopathy.
The predicted average number of visits to the doctor in the past 12 months is 3.61 for diabetics who are underweight but had not sustained a stroke, as compared to 4.24 for underweight diabetics who had suffered a stroke.

The predicted average number of visits to the doctor in the past 12 months is 3.72 for diabetics with a normal weight but had not sustained a stroke, as compared to 4.36 for their counterparts who had suffered a stroke.

The predicted average number of visits to the doctor in the past 12 months is 3.65 for overweight diabetics who had not sustained a stroke, as compared to 4.29 for their counterparts who had suffered a stroke.

The predicted average number of visits to the doctor in the past 12 months is 3.86 for obese diabetics who had not sustained a stroke, as compared to 4.54 for their counterparts who had suffered a stroke.
The predicted average number of visits to the doctor in the past 12 months is 3.52 for diabetics who are underweight but had not sustained a heart attack, as compared to 4.36 for underweight diabetics who had suffered a heart attack.

The predicted average number of visits to the doctor in the past 12 months is 3.67 for diabetics with a normal weight but had not sustained a heart attack, as compared to 4.55 for their counterparts who had suffered a heart attack.

The predicted average number of visits to the doctor in the past 12 months is 3.61 for overweight diabetics who had not sustained a heart attack, as compared to 4.47 for their counterparts who had suffered a heart attack.

The predicted average number of visits to the doctor in the past 12 months is 3.81 for obese diabetics who had not sustained a heart attack, as compared to 4.71 for their counterparts who had suffered a heart attack.
The predicted average number of visits to the doctor in the past 12 months is 3.52 for underweight diabetics who but had not sustained a coronary heart disease, as compared to 4.36 for underweight diabetics who had suffered a coronary heart disease.

The predicted average number of visits to the doctor in the past 12 months is 3.67 for diabetics with a normal weight but had not sustained a coronary heart disease, as compared to 4.55 for their counterparts who had suffered a coronary heart disease.

The predicted average number of visits to the doctor in the past 12 months is 3.61 for overweight diabetics who had not sustained a coronary heart disease, as compared to 4.47 for their counterparts who had suffered a coronary heart disease.

The predicted average number of visits to the doctor in the past 12 months is 3.81 for obese diabetics who had not sustained a coronary heart disease, as
compared to 4.71 for their counterparts who had suffered a coronary heart disease.

<table>
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<tr>
<th>Series 1</th>
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<th>Underweight-CHD</th>
<th>Normal weight-No CHD</th>
<th>Normal weight-CHD</th>
<th>Overweight-No CHD</th>
<th>Overweight-CHD</th>
<th>Obese-No CHD</th>
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<tbody>
<tr>
<td></td>
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<td>3.71</td>
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<td>3.60</td>
<td>4.32</td>
<td>3.81</td>
<td>4.57</td>
</tr>
</tbody>
</table>

*Chart 25. Predicted Average Number of Visits to the Doctor by Weight Status and Occurrence of Coronary Heart Disease*

- The predicted average number of visits to the doctor in the past 12 months is 3.56 for diabetics who are underweight but had not sustained a nephropathy, as compared to 4.44 for underweight diabetics who had suffered a nephropathy.
- The predicted average number of visits to the doctor in the past 12 months is 3.68 for diabetics with a normal weight but had not sustained a nephropathy, as compared to 4.59 for their counterparts who had suffered a nephropathy.
- The predicted average number of visits to the doctor in the past 12 months is 3.64 for overweight diabetics who had not sustained a nephropathy, as compared to 4.54 for their counterparts who had suffered a nephropathy.
• The predicted average number of visits to the doctor in the past 12 months is 3.84 for obese diabetics who had not sustained a nephropathy, as compared to 4.79 for their counterparts who had suffered a nephropathy.

<table>
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<th>Series 1</th>
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</thead>
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<tr>
<td></td>
<td>Yes</td>
<td></td>
<td>3.84</td>
<td>4.79</td>
</tr>
</tbody>
</table>

*Chart 26. Predicted Average Number of Visits to the Doctor by Weight Status and Occurrence of Nephropathy*

• The predicted average number of visits to the doctor in the past 12 months is 3.74 for diabetics who are underweight but had not sustained a retinopathy, as compared to 4.70 for underweight diabetics who had suffered a retinopathy.

• The predicted average number of visits to the doctor in the past 12 months is 3.72 for diabetics with a normal weight but had not sustained a retinopathy, as compared to 4.68 for their counterparts who had suffered a retinopathy.

• The predicted average number of visits to the doctor in the past 12 months is 3.71 for overweight diabetics who had not sustained a retinopathy, as compared to 4.67 for their counterparts who had suffered a retinopathy.
• The predicted average number of visits to the doctor in the past 12 months is 3.90 for obese diabetics who had not sustained a retinopathy, as compared to 4.91 for their counterparts who had suffered a retinopathy.

*Chart 27. Predicted Average Number of Visits to the Doctor by Weight Status and Occurrence of Retinopathy*

**Discussion**

In this study, we examined the prevalence of type 2 diabetes among the adult population in the United States, and the occurrences of chronic illness among those diabetic individuals. Variables that were examined included: gender, racial/ethnic, health status, weight, physical activity, the number of days during which diabetics reported their physical and mental health as being not good in the past month, as well as the number of visits to the doctor in the past 12 months. In addition, we compared the prevalence of chronic disease, satisfaction with life, and satisfaction with care among diabetic and non-diabetic patients.
According to the results of this study, there is a major factor that plays into the development of diabetes, and that is age. Study participants were 18 years or older, however, the vast majority of diabetics were >45 years old. The CDC notes that the incidences of diabetes increases with age. According to recent statistics, there are approximately 4 million individuals age 20, 13 million age 45-64, and 11 million age 65 and over with a diagnosis of type 2 diabetes. (CDC, 2014). The American Diabetes Association offers a free risk assessment to determine whether or not an individual is at risk of developing diabetes mellitus. Based on a point system, this screening tool gives one point for 40-49 years old, two points for 50-59 years old, and three points for 60+ years old. This confirms that the age of an individual determines the risk of developing type 2 diabetes (ADA, 2014). There was equal prevalence of diabetes among men and women. Although the majority of people in the sample were non-Hispanic White, prevalence of diabetes was greater among African Americans, Hispanics, and Asians. According to one study, blacks are more than twice as likely to develop diabetes than whites (Shai, 2006). However, according to the CDC, American Indians/Alaskan natives are among the highest percentage of individuals to develop type 2 diabetes (CDC, 2014).

The majority of the diabetic population rated their overall health status as being either good or fair, as compared to the non-diabetic population being either very good or good. This suggests that having a chronic condition can affect the overall health of an individual, even if only by a small amount. Not surprisingly, the amount of diabetic individuals that were either overweight or obese indicates
that weight is a major risk factor in the development of type 2 diabetes. One study showed that the odds of undiagnosed type 2 diabetes were significantly higher among patients who were obese (Klein Woolthuis, E.P., et al., 2009).

Furthermore, the lack of physical activity only increases the risk of developing type 2 diabetes, and further declining the overall health status. Diabetes can also be associated with decreased muscle strength, decreased muscle quality, and loss of extremity strength, which leads to physical limitations and frailty (Abdelhafiz, 2013). According to one study comparing health-related quality of life with physical activity, physically more active persons had lower body weight and they had better perceived general health and physical functioning compared with the physically less active groups. This study also suggested that lifestyle changes, including increased physical activity will have positive affects on health, as well as decreased the risk of developing type 2 diabetes (Hakkinen, 2009). When looking at the past 30 days most of the individuals had poor physical and mental health for at least half of the month. Indeed, Aczon-Armstrong (2013) found that people with chronic diseases such as diabetes, heart disease, or respiratory conditions are twice as likely to be at risk for depression compared to those who do not suffer from these chronic conditions. This indicates that in addition to the disease itself, the coexistence of chronic diseases may exacerbate poor physical and mental health.

Among those individuals with diabetes there is a drastic increase in the likelihood of developing at least one chronic illness, if not multiple. The data indicate close to 65% of diabetic patients reported having at least one chronic
illness in addition to the diabetes itself. According to this study, the most common among the chronic illness was diabetic retinopathy, followed by heart attack, and coronary heart disease, and finally stroke and nephropathy being the least common of the group. This further intensifies the need for diabetic self-management and maintenance in order to reduce the risk of developing these chronic illnesses. When examining chronic illness among those with diabetes, the majority of individuals rated their health as being either fair or poor which indicates that there is a massive decline in the health status of individuals with diabetes and chronic illness as compared to those with only diabetes.

Most of the diabetic population stated they either were satisfied or very satisfied with their lives as compared to those non-diabetic individuals. Furthermore, when we looked at those individuals with diabetes and chronic illness the majority of those individuals also stated they were either satisfied or very satisfied with their lives. Although these individuals are dealing with many illnesses and disease, there was no significant impact on the life satisfaction. Similarly those individuals with diabetes were very satisfied with the care they received, and the same goes for those with diabetes and chronic illness.

Management of diabetes by controlling blood glucose levels, blood pressure, cholesterol levels and weight in addition to the implementation of preventative measures to avoid vascular complications are vital factors that could lead to improved quality of life. The health-related quality of life of diabetic individuals does not need to be lower than those non-diabetic individuals (Oliva, 2012). These factors seem to have no impact on the satisfaction with care.
Limitations

The limitations for this study are as follows: (1) The sample population used for this study was only taken from one year of data, which did not allow us to compare the previous years for a decline or incline in the results. (2) There is no real determinant for the time in which it took these individuals to develop each of these chronic illnesses. (3) The choice of the scales for the variables “satisfaction with life” and “satisfaction with care” constitutes another limitation of the study. The former is considered a “forced option as it lacks a neutral stance (i.e. a middle option such as neither agree or disagree) whereas the latter only uses three categories.

Future Implications

We have learned from this study that the impact of diabetes takes a major toll on the individuals who suffer from it. Not only do they need to adjust their lifestyle, but there is a much higher risk of developing a chronic illness. Unfortunately, due to the nature of the data (cross-sectional), we are unable to assess how the care of these patients has changed over time. An extended length of time to capture data would allow the trend of diabetes and chronic illness across several years to be seen. Since there was no time determinant for each chronic illness we recommend examining the period of time from initial diagnosis to the development of target end organ disease. Monitor trends of diabetics with the intent to examine how care changes when a collaborative approach is utilized consisting of an interdisciplinary team. The use of interdisciplinary teams for
diabetic patients would greatly improve the outcomes, and drastically decrease the cost of care for these individuals. The use of structured care processes, primary care physicians and nurse practitioners in teams could improve patient care as well as clinical outcomes. Team care includes pharmacists and nurses for medication management, as well as individualized case management in coordination with physicians, and proves to be a vital asset when addressing the needs of these patients. (Willens, 2011). Also, expansion of the likert scale is recommended for examining satisfaction and quality of life. Utilization of the quality of life tool, or one that has been used widely used would allow for a better assessment of this topic. This study brought to light the tremendous need for patient education and preventative measures for these individuals with diabetes. Although we cannot reverse all of the chronic illnesses that have been brought on by diabetes, we as healthcare professionals have an obligation to promote health and well being for all patients.

**Conclusion**

Type 2 diabetes is a life-limiting disease that affects much of our population today. Not only do these individuals have to self-manage their diseases with medication regimens, blood glucose monitoring, and lifestyle changes, many of them also have the burden of secondary chronic illness caused by diabetes. For them, it affects their quality of life, and in some cases may cause them to fall into depression. Each of these chronic illnesses has its own way of putting a damper
on life, and has an overall impact on mental and physical well being of so many of its victims. With this high number of individuals affected by this tremendous burden, it is our job as healthcare professionals to take control, and to education these people on how to not only effectively manage type 2 diabetes, but also in some instances, how to prevent it from occurring. With the use of interdisciplinary teams, and well-rounded education there is a great possibility of decreasing the overall impact that type 2 diabetes has on our lives.

The United States healthcare system leaves ample room for improvement. With the lack of access to care for every individual it is extremely hard to prevent every case of diabetes. However, with more access to healthcare professionals such as physicians, nurses, dentists, and ophthalmologists there would be a decrease in the number of secondary chronic illnesses related to diabetes, and possibly even a decrease in the prevalence of diabetes. In addition to that, nurses have an obligation to promote health and well being in the individuals already diagnosed with diabetes. By making changes to lifestyle and diet, we as nurses can improve the quality of life in diabetic patients, and allow them to be as healthy as they can possibly be. Education is key for those individuals already suffering from multiple chronic illnesses, and it is important for nurses to offer their knowledge and skills to properly manage these disease processes.
References


