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Chronic Disease Control: Factors Associated with Adherence to Physicians' Recommendations

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DEDICATION

I would like to dedicate the following thesis to all my family, friends, and loved ones who have given me the support to prosper throughout my life.

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ABSTRACT

Background: Recently across the United States, chronic diseases have been becoming more prevalent and compliance rates to recommendations have been declining. Non-adherence to health professionals recommendations creates a greater risk of complications for the patient.

Objective: The objective of this study is to discover which populations have the highest prevalence of chronic disease and compare adherence to physicians' recommendations throughout those populations. If a physician tells a patient to complete a certain behavioral change to improve health, a physician would assume that the adherence level should be nearly 100%, but it is clear adherence levels do not reach those levels. Different demographic factors play a role in adherence: gender, age, race, socioeconomic status, education status, marital status, medical insurance coverage, and comorbidity of chronic diseases.

Methods: The 2007-2008 National Health and Nutrition Examination Survey (NHANES), a secondary data source, was used for data collection. The total number of people who participated in the 2007-2008 NHANES study was 5,687. Data analysis was performed with the statistical software program SPSS 19.0. A number of descriptive analyses, cross tabulations, correlations, and binary logistic regression were used to conduct a univariate and multivariate analysis of the subjects. The chronic diseases chosen to assess were hypercholesterolemia, hypertension, and diabetes. The different recommendations were made to all the patients included: eating less fat, control weight, increase exercise, and take a prescription medication for each specific condition

Results: The 5,687 participants were included in the study. The prevalence of hypertension was 21.2%, hypercholesterolemia was 19.3%, and diabetes was 8.7% among those who were surveyed. Among those who were told to eat less fat, control weight, increase exercise and take prescription to control their chronic disease condition, adherence levels ranged greatly. The significance of a physician recommending a behavioral change had the biggest impact on whether a patient would adhere. No significance was seen between any of the demographic variables except for marital status for those who were told to take a prescription to control hypercholesterolemia.

Discussion: The study has proven physician recommendations to control chronic disease are usually to take a medication. An individual's demographics have a small impact on whether he or she will adhere to the advice of the physician. Additional research needs to be completed to understand the patient to physician relationship, which seems to have the biggest impact on behavioral change. Furthermore, new interventions are needed to increase adherence to 100%. Increasing chronic disease adherence across the United States will result in decrease spending in health care costs in the United States.

Index Words: Adherence, Hypertension, Hypercholesterolemia, Diabetes, Behavioral Changes, Chronic Disease.

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Introduction

Chronic diseases are currently the leading cause of morbidity and mortality worldwide. (WHO) People are not living their fullest potential life because of the long time struggles with a particular chronic disease, which reduces the quality and quantity of life. Chronic diseases impact our society's health in addition to the huge economic burden they have on individuals, families, and communities. In the United States, 125 million people had a chronic disease in 2000, and since then the number has increased. In addition to the vast number of people with one chronic disease, one in every four Americans is fighting more than one chronic disease daily. This statistic becomes even more staggering after the age of 65 nearly seventy percent of people have more than one chronic disease (Anderson, 2004).

An analysis on the cost of the top seven leading chronic diseases in 2007 was conducted and found 162 million cases per year, which costs a total of $277 billion to treat all the reported cases. The top seven chronic diseases include multiple types of cancer, diabetes, hypertension, stroke, heart disease, pulmonary conditions, and mental disorders, and these are just a few of the most common chronic diseases impacting lives (DeVol, 2004).

The biggest economical impact is estimated to be $1.1 trillion lost due to the lack of work productivity while being treated for chronic disease issues. If the same trend continues until 2023, then the United States would see an estimated $4.3 trillion lost due to treatment costs in addition to loss of work productivity (DeVol, 2004). Currently, the average cost of an individual with at least one chronic disease is five times greater than the average cost of healthcare for an individual without a chronic disease. The United States uses $3 out of every $4 spent on healthcare to treat chronic diseases.

The main reason for the staggering high growth of chronic diseases is because adherence to medical and health professionals' recommendations are not being followed well. Adherence is defined as "the extent to which patient behavior corresponds with recommendations from a health care provider" (WHO). Adherence is multifaceted behavioral progression influenced by patients' support system, health care providers' methods of practice, and the characteristics of healthcare delivery. The common belief is once a patient is told by a health professional the certain behavior or lifestyle change, then a patient will adhere to the medical advice such as taking a certain medication for the disease, increasing physical activity, reducing the amount of food intake, or following up with doctors in a timely manner. Many potential reasons for nonadherence to prescribed medical advice include: misunderstanding prescribed instructions, constant changes to medication regimens, having many physicians, lack of faith in the drug or healthcare professional, inability to read directions, forgetfulness, denial of chronic disease, irritation about the illness, apathy, depression, high stress, lack of symptoms, fear of taking drugs, expense, trouble getting prescriptions filled, previous history of noncompliance, problems with home assistance, substance abuse, not proper education about the illness, or limited social support. Because all of these factors have roles in the health of an individual, then clearly a need for a well developed, comprehensible plan needs to be created to help people slow the progression or eventually reverse the disease (Vlasnik, 2005).

As previously noted the cost of healthcare in the United States has been increasing at an incredible rate. It has been estimated that nearly $300 billion is spent due to the lack of adherence to a prescribed treatment. Originally the responsibility of adherence for a treatment was the physician relaying information to each of his patients. Nonadherence makes the treatments' effectiveness decrease significantly; therefore increasing healthcare costs of chronic diseases. The World Health Organization has recommended more components of the healthcare system take on the responsibility of treatment adherence and promote healthier lifestyles, which will eventually save money in the long run (Bender, 2004).

Examining the distribution of demographic and adherence variables among a study population can help solve the problem of nonadhernence. Some people have difficulties following the health providers' directions and recommendations due to a number of different factors. Investigating which factors and demographics lead to the most nonadherence for individuals with chronic diseases can get rid of the burden of many treatable chronic diseases.

Literature Review

Nonadherence

Different interventions formulated to increase adherence have various effects on whether someone will comply with the prescribed medications of the physician, but the same study says that increasing compliance to the prescribed treatment will help reduce the malignant effects of the chronic disease. (Doggrell, 2010). At times the quality of care people receive with at least one chronic disease does not meet the standards to which are given.

The morbidity and mortality rates would certainly decrease if the physicians and patients followed the Chronic Care Model that is presented by the MacColl Institute for Healthcare Innovation. It uses a patient centered approach promoting a health system that encourages safe, high quality health care by defining the roles of individuals, practicing evidence-based care, educating patients about their treatments, and monitoring the performance of the specialists (MacColl Institute, 2012).

One study from by Hovstadius and Petersson stated nonadherence could be divided into two groups, which are primary adherence and secondary adherence. Primary adherence is when a patient does not fill a necessary prescription from the pharmacy. Secondary adherence, which is much more common, is when someone filled the prescription but does not take the medication as prescribed. Secondary adherence happens for many reasons. Some patients might have an adverse side effect from taking the drug, some do not feel like the drug is working well for them, and some just forget to take the medication. Many factors can be attributed to secondary adherence such as age of the patient, gender, disease burden, complexity of the drug therapy, and the quality of interaction between prescriber with the patient. If a prescriber does not follow up with the patient, then the patient may find different methods of taking the medication that works for him or her but actually is ineffective. The main reason for primary adherence rates being low is due to cost of the drugs. The rate of primary adherence and secondary adherence determines the wastefulness of the drugs and medical spending.

Frequently, medication adherence is the only type of adherence researchers study extensively, but nonadherence to health professionals' recommendations comes in many forms not just whether a patient takes or does not take their medication. Certain chronic diseases are prevalent because people eat too much fat in their foods, do not exercise enough, need to lose weight, forget to take medications, use too much tobacco, drink too much alcohol, and do not monitor their bodies' blood pressure or blood sugar levels enough. Physicians and health care professionals encourage good compliance to all recommendations. One study suggests positive reinforcement has a higher and more constructive effect on adherence than negative reinforcement. It is less likely for an individual to comply to the recommendations of a physician who threatens dismal outcomes because that extra anxiety and stress can give a patient additional problems (Oller-Canet, 2011.)

Nonadherence affects everyone especially older patients, who are not always cognizant about their medical history and frequently forgetful about their recommended routine. One study conducted by suggested a significant increase in the number of emergency department visits due to nonadherence to different chronic diseases. An increase in emergency department visits also significantly increases the money spent on healthcare. Medicare and Medicaid rate will continue to skyrocket, but these cases can be preventable if better measures were made to increase the adherence to the prescribed treatment (Butler, 2011).

Age

Age is an important demographic factor affecting nonadherence to health professionals' recommendations. According to Hill and Roberts, nonahderence is related to conscientiousness more than age, but each age group have different health behaviors that are more pertinent to their needs. For example, the older age groups typically adhere to medication regimens more than their younger counterparts, while the younger age groups adhere to exercise and physical activity recommendations more often. Therefore, adherence and conscientiousness are highly related for those who are younger more than those who are older. Because adherence is a multi-faceted concept, it is difficult to determine adherence levels because each individual in their particular stage of life might adhere to certain health professionals' recommendations over others (Hill, 2010).

Gender

Men and women have many chronic disease conditions that affect health. According to Haukkala, men are more likely to have preexisting cardiovascular disease while women have been more prone to depressive thoughts, which can lead to cardiovascular disease. Chronic cardiovascular diseases come from many different areas. Another study concluded that gender differences cannot predict chronic disease outcomes because the data supports age has more of a factor on chronic disease than gender. Much more money is spent on men who have a cardiovascular chronic disease than women, but the study goes on further to find that women are actually diagnosed more often than men for a chronic cardiovascular disease (Basu, 2010).

Race

Another study was completed to determine the association between black and white seniors using medications to control hypertension. It was determined blacks were less likely to adhere to the recommendations, but they were more likely to adhere to complementary and alternative medicine plan than whites. This type of therapy was different than physicians' typical recommendations, and blacks were less likely to report the use of the therapy to their physician or pharmacist. If alternative type of treatment seems to work to control the chronic disease, then they are more likely to adhere to these recommendations. (Krousel-Wood, 2010)

A report released by The American Journal of Medicine in 2009 concluded the relationship between long-term medication adherence and demographic variables such as race were not significant. The only significant factors that were reported were the behavioral modifications for the patient to reduce the chances of having a myocardial infarction. After some time, adherence to medication treatments will decrease in patients, but if they are enrolled in a health professional program or see a physician on a regular basis, then they are less likely to decrease the adherence (Shah, 2009).

Marital Status

One important factor to help control chronic disease is a social support system, which is typically family driven. Marital status can play an important role in developing the support system necessary to help treatment of a chronic disease. It is not necessary to have family as the support system, but it seems to have the biggest influence on a patient's chronic health condition. Family-based interventions have the greatest impact on controlling the disease. Different populations have a greater sense of strong family values and beliefs. In a study found in Hispanic Health Care International, the family ties were strong and chronic disease was successful because of these strong support groups. All the chronic diseases were measured over two years, and the results were good for those who enrolled in the support intervention. Blood pressure was lowered, cholesterol levels decreased, and HbA1c levels declined (Yeo, 2011).

In addition to good family support to control chronic cardiovascular disease, if a patient does not have a significant other then he or she is likely to have a higher prevalence rate of cardiovascular disease. According to Zhenmai Zhang and Mark Hayward from the Journal of Marriage and Family, men and women who experienced marital loss tend to develop more cardiovascular disease than their continuously married counterparts. Women typically have continuous cardiovascular issues during their mid-life because of unsuccessful marriages (Zhang, 2006)

Socioeconomic Status

Many studies have linked low socioeconomic status with low adherence to health professionals' recommendations to improve health and control chronic disease. Typically, the rising costs in medications and lack of medical insurance are the main reasons to believe the low adherence for chronic diseases. Patients will skip their daily regimens because the medication does not have a physical effect or the patient may not trust their physician, but the majority of those who do not follow the prescribed medications due to the price. According to a study done by Mishra, people were more likely to adhere to their medication plans if they were not complex and self-efficacy was not an issue for the individual taking the medications. The study continues to support the idea that good family and social encouragement can help break down a financial barrier to help increase medication adherence for their certain chronic disease (Mishra, 2011).

A low socioeconomic community typically has a higher prevalence in chronic disease. Individuals who have cancer typically die more often in low socioeconomic community because they are experiencing more chronic disease comorbidity than individuals with high socioeconomic status. (Louwman, 2010) Prevalence is often higher because of a lack of high quality health care facilities, poor access to healthy and affordable food choices, and less physical activity outside mainly due to violence and other crime.

Health Insurance Status

According to Chima D. Ndumele, a difference was established between patients' awareness of individuals who receive primary care at physicians' offices, outpatient facilities, and community-based health care facilities and those who received regular health care from emergency rooms. Also those who do not receive standard health care are usually unaware of chronic health conditions. These patients are most likely suffering from hypertension, hypercholesterolemia, or diabetes because the lack of knowledge. If they continue to be underserved then they will more likely have even more serious cardiovascular issues such as a myocardial infarction. Chronic disease care is necessary for those who are put into these situations because they can prevent serious life threatening events if they were aware of their condition (Ndumele, 2011)

Education Level

Not every patient knows how to treat and control their chronic disease to develop the best possible outcome, and every patient has a different background, which means some will quickly learn how to deal with their condition while others need to be walked through the motions. Teaching patients on how to adhere is important for chronic disease control. Sometimes people believe they are overusing the medication so they discontinue the medication regimen. This practice is considered unintentional non-adherence. Behavior that is intentional comes because of cognitive beliefs about the medication, which could be the physician's interpretation to a patient. The major reason why people continue to take the medication is because they believe that the medication has a positive effect on them. If they cannot tell the effect of the medication, then they may not adhere to the recommendation. The overall effect of education does not seem to play a major role in the adherence process because adherence is mainly based on perception of a positive health outcome (Schüz, 2011).

Hypertension

Many types of interventions have been studied to help improve the adherence for hypertension and other cardiovascular diseases. Cardiovascular diseases constitute for one of the largest burdens to the healthcare system. Adherence to recommendations is still low even thought the number of people who have problems is so high. Different social, behavioral, and informational interventions were created to help improve adherence. It is clear by multiple studies that behavioral interventions have the biggest positive impact on adherence change for people. (van Dalem, 2012).

Hypercholesterolemia

Many patients with hypercholesterolemia rarely feel the effects of their chronic condition yet it is highly dangerous disease because it leads to blocked arteries and other chronic diseases such as atherosclerosis. Adherence is usually poor because the disease is asymptomatic. It is important to control the build-up of cholesterol in the body to prevent future heart disease or stroke. Many different recommendations are made by physicians to patients to control high levels of cholesterol in the body such as eating less fatty foods, increasing physical activity, and reducing weight. Cholesterol levels can also be controlled by medications if it is being monitored. One study by the CDC suggested that a patient is two to three times more likely to never be told about their chronic disease condition if it is asymptomatic and is not checked routinely. Typically the patients who do not have health insurance are not checked routinely for hypercholesterolemia. The study concluded that having insurance would have an effect a patient to find out about awareness of a chronic disease condition. Nearly three in every ten people are unaware of hypercholesterolemia and go untreated (Nguyen, 2005)

Diabetes

A meta analysis concluded depression is a common risk factor for diabetes, and it can be a reason for low adherence of recommendations from health care providers (Knol, 2006). The study found depressed people are 37% more likely to become diabetic than the population who is not depressed. It is understood that interventions are needed to increase adherence for those with diabetes and depression. The better quality patient interaction and educational instructions health care providers give to their patients, then the more likely the diabetes and depression will be controlled (Bogner, 2012).

Diabetics can also develop an insulin resistance, which is a decrease in the sensitivity insulin has on the metabolic process. It requires more insulin to maintain proper glucose levels in the body. This problem can cause other problems such as hypertension and other cardiovascular disease (Mercurio, 2012). Also there seems to be a difference between African Americans and Whites when it comes to adherence for diabetic medications to control for blood sugar levels (Zhu, 2010).

Summary

Research continues to be done on adherence to chronic disease adherence based on health professionals' recommendations. Unfortunately, the country has seen a new epidemic in chronic diseases in the population especially over the past 30 years. Finding out the solution to the problem should decrease the amount of health care spending across the nation. Different prevention interventions over the past couple decades have been created to control the chronic diseases from occurring, but questions still remain about why rates of these chronic diseases are increasing.

The main questions that will be addressed in this study are to describe:

- Examine if demographic differences exist between people with chronic cardiovascular diseases.
- What is the frequency of behavioral change recommendations for the particular chronic cardiovascular diseases?
- What is the association of actual behavioral health change related to recommendations from a physician?

Methods

This particular study is based on 2007-2008 National Health and Nutrition Examination Survey (NHANES). The National Center for Health Statistics (NCHS), which is associated with the Center for Disease Control and Prevention, conducted these surveys to determine the health status of the United States population. Beginning in the 1960s the National Health and Nutrition Examination Survey has established the standards for public health across the nation. Over the years, the various findings lead to policy changes and new guidelines for healthcare in U.S. populations such as pediatricians' height progression tables, blood pressure criterion for individuals, and new interventions to prevent increasing obesity trends. In addition to those important policies, NHANES data has helped researchers establish asthma prevalence, depression rates, and trends in undiagnosed diabetes. (CDC/National Center for Health Statistics, 2011).

NHANES collects data designed for epidemiological analysis of many chronic diseases. The surveys yearly pull together over 5,000 individual responses to demographics, laboratory results, medical examinations, disease status questionnaires, and much more personal health information. The diseases studied range from anemia, cancer, cardiovascular, diabetes, ear, eye, infectious, kidney, mental, obesity, oral, osteoporosis, respiratory, and sexually transmitted diseases. In addition to disease, it examines environment, nutrition, physical fitness, and sexual behavior (CDC/National Center for Health Statistics, 2011).

The study highlights risk factors found in the literature such as age, gender, income, education, marital status, number of medications one takes, insurance status of individuals, current chronic disease status, adherence to doctors' recommendations, and others. Data was made available from the questionnaire section of NHANES for disease status and physicians recommendations about controlling weight, reducing fat, increasing physical activity, and taking medications for chronic diseases of hypertension, hypercholesterolemia, obesity, and diabetes.

NHANES conducts in-home surveys and examinations administered in mobile examination centers (MECs) for thousands of participants. To ensure privacy, respondents use touch screen computers for the computer assisted self-interview (CASI) or audio computer assisted self-interview (ACASI). Results are sent to NCHS within 24 hrs. Trained clinicians performed the examinations, and lab and exam results are stored in an electronic database. This eliminated the need for paper records, and provided another layer of security for participant health information. The participants are compensated for their surveys, and if the trained professional finds any new medical condition then the findings are reported directly to the patient (CDC/National Center for Health Statistics, 2011).

The populations surveyed for the analysis included 10, 149 participants for 2007-2008. Everyone who conducted a survey was included in the chronic disease analysis. Different populations including people over 60, Blacks, and Hispanics were recruited more to make the sample represent the national population. NHANES was the primary reason for educating the aging population about their health status. No additional years' data was used because sufficient data was collected in the 2007-2008 survey (CDC/National Center for Health Statistics, 2011).

All of the information in the 2007-2008 NHANES data is made public through the CDC's website. It also contains information about the survey questions such as the people included in the questioning, the number of people who answered each question, and the variables that were produced from the surveys.

The demographics files for the 2007-2008 survey were combined to obtain information about each respondent's age, gender, education, income, race/ethnicity, and marital status.

Questionnaires files regarding hypertension, hypercholesterolemia, and diabetes status were included in the data collection. Also, physicians' recommendations about taking medications, increasing exercise, reducing weight, and reducing fats were taken from the questionnaire section. Insurance status, support status, and prescription status were all incorporated in the study to find the most important factors that determine adherence.

The study measures obtained from the demographics file needed to be recoded to accommodate the 10,149 respondents. The following are descriptions of how the variables were recoded:

Age of the surveyed participants is recoded from "Age at screening adjudicated-recoded" ranged from 0- 150 years. The new variable only included ages 20+ years of age, but the data had any over the age of 80 listed as 80.

Gender is taken from the demographic file and labeled the same way NHANES coded the variable in which (1 = Male) and (2= Female).

Race is recoded from the "Race/Ethnicity-recode" variable in which (1= Mexican American), (2= Other Hispanic), (3= Non-Hispanic White), (4= Non-Hispanic Black), (5= Multi-racial/Other). Combining the Mexican American and Other Hispanic as a single variable and removing Multi-racial/ Other helped distinguish the studied population. The new variables were labeled (1= Non-Hispanic White), (2= Non-Hispanic Black), (3= Hispanic).

The income is recoded from the "Annual Household Income" variable in which (1= \$0-\$4,999), (2= \$5,000-\$9,999), (3= \$10,000-\$14,999), (4= \$15,000-\$19,999), (5= \$20,000-\$24,999), (6= \$25,000-\$34,999), (7= \$35,000-\$44,999), (8= \$45,000- \$54,999), (9= \$55,000-\$64,999), (10= \$65,000-\$74,999), (12= over \$20,000),(13= under \$20,000), (14= \$75,000-\$99,999), (77= refused), (99= don't know). The categories within the variable are recoded into

$0- $14,999, $15,000- $34,999, $35,000-$64,999, $65,000-$99,999, and $100,000+.

The insurance file is taken from the questionnaire file and labeled the same way NHANES coded the variable in which (1 = Covered by Insurance) and (2= Not Covered by Insurance).

The education was recoded from the "Educational Level-20+" variable in which (1= less than 9th grade), (2= 9th -11th grade), (3= HS grad/GED or equivalent), (4= Some college or AA), (5= College grad or above), (7= refused), (9= don't know). The new variable combined these categories by highest level of education in which less than 9th grade, 9th-11th grade, and high school/ GED or equivalent were (1= High School Education) and some college or AA was combined with college grad or above to make (2= College Education).

Marital status is recoded from the "Marital Status" variable in which (1= Married), (2= Widowed), (3= Divorced), (4= Separated), (5= Never Married), (6= Living with partner), (77= Refused), (99= don't know). The categories within the variable were recoded into either has a significant other or has no significant other. The new variable combined married and living with a partner as having a significant other and divorced, separated, and never married as having no significant other.

Hypertension is recoded from "Ever told you had high blood pressure" variable, which was either coded as (1= Yes) and (2= No). Variable was taken from Blood Pressure and Cholesterol data file.

Hypercholesterolemia is recoded from "Doctor told you – high cholesterol level" variable, which was either coded as (1= Yes) and (2= No). Variable was taken from Blood Pressure and Cholesterol data file.

Diabetes is recoded from "Doctor told you have diabetes" variable, which was either coded as (1= Yes), (2= No), and (3= Borderline). All Borderline answers were recoded as yes.

Variable was taken from Diabetes data file.

Individuals were asked in the survey if physicians made recommendations to change daily behavior. This data is taken from "Told to eat less fat for cholesterol", "Told to reduce weight for cholesterol", "Told to exercise more for cholesterol", "Told to take prescription for cholesterol", and "Taking prescription for hypertension." All recommendations are coded as (1= Yes) and (2= No). All the variables are taken from the Blood Pressure and Cholesterol data file.

Individuals who were surveyed were asked if they adhere to the physician's recommendations. This data is taken from "Now eating fewer high fat foods", "Now controlling weight", "Now increasing exercise", "Now taking prescribed medicine", and "Now taking prescribed medicine for HBP." All adherence variables are coded as (1= Yes) and (2= No). All the variables are taken from the Blood Pressure and Cholesterol data file.

Finally, individuals were asked if they were now taking diabetic pills to lower blood sugar. The data is taken from "Take diabetic pills to lower blood sugar." This variable is recoded as (1= Yes) and (2=No). The variable does not have a corresponding question asking if the patient was told to take diabetic pills.

To analyze all the data collected from NHANES, Statistical Package for the Social Sciences (SPSS) statistical program software was used. SPSS was originally created in 1968 to serve a wide variety of researchers to have a better understanding of the population, products, programs, and issues that were being studied. SPSS has gone through many revisions since its inception, and to complete this particular study SPSS 19 was used to do all the analysis. SPSS can run descriptive analysis, correlation analysis, and regression.

The dependent variables are considered all the variables in which individual behavior changed based on the health professional's recommendations. The behavior change is more likely to occur based on the physician's recommendations. To prevent and control chronic diseases such as hypertension, hypercholesterolemia, and diabetes, a physician's goal is change the patient's daily behavior. The behavioral change recommended for the three diseases are similar to each other: taking a medication for the specific disease, eating less fat, controlling weight, and increasing amount of exercise.

The physician's recommendations are the independent variables for each disease. These variables determine if a health care professional recommended to the patient a particular behavioral health change to help the disease dissipate. A physician could tell a patient to reduce fat, tell patient to control weight, tell patient to increase exercise, and tell patient to take medication for a specific condition. These recommendations can have a direct impact on whether a patient can control their chronic disease.

A binary logistic regression is used to determine the correlation between the dependent variables in the independent variables. Univariate analysis is completed comparing the dependent variable against the independent variable. Comparing a dependent variable against just one independent variable is how the univariate analysis is completed.

A binary logistic regression is also used to analyze any cofounders in the study. Completing multivariate analysis can help determine the confounders of the study because it will analyze multiple variables simultaneously. All of the variables including the demographic variables are used to compare to the dependent variables. All of the variables are given an odds ratio and a 95% confidence interval to determine the average range of odds between the variable. If the confidence interval contains one then no significance has been determined between the variables.

Results

Table 1 demonstrates the demographics of the population studied. The Hispanic population surveyed was on average younger than the non-Hispanic white population, and the non- Hispanic Black population is in between. The mean age was 53.82 for the non-Hispanic white population, 50.30 for the non-Hispanic black population, and 47.09 for Hispanic population.

Income was another main difference among the races. Non-Hispanic Whites had 13.9% have an income greater than $100,000 compared to 6.7% for non-Hispanic Black and 12.3% for Hispanic population. In the lowest income bracket of $0- $14,999, Hispanic had the highest rate at 16.3%, then non-Hispanic Black at 14.7%, and finally non-Hispanic white at 13.3%.

The data supports non-Hispanic whites graduate from college more often than non-Hispanic black. Hispanic population graduates college the least out of all the races identified. Adult males who never completed high school were 59.3% Hispanic, 57.1% non-Hispanic black, and 55.5% non-Hispanic white.

Another major difference was in the marital status of the three races. The individuals who were least often married or living with a partner were Hispanics at 55.9%, non-Hispanic blacks at 59.7%, and non-Hispanic whites at 60.1%.

Finally, the biggest difference in health care coverage can be seen between the different races. Non-Hispanic white males are covered 84.9% compared to Hispanics who are covered 60.0%. Non-Hispanic black males are covered 79.5%.

Table 1: Characteristics of Studied Population

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
Sample Size	2761	1227	1699
Age (years)	53.82 ± 18.434	49.57 ± 17.200	47.09 ± 16.978
Gender			
Male	1395 (50.5%)	588 (47.9%)	797 (46.9%)
Female	1366 (49.5%)	639 (52.1%)	902 (53.1%)
Income			
$0-$14,999	204 (13.3%)	99 (14.7%)	146 (16.3%)
$15,000-$34,999	485 (31.6%)	237 (19.3%)	273 (30.6%)
$35,000-$64,999	400 (26.1%)	158 (12.9%)	241 (27.0%)
$65,000-$99,999	232 (15.1%)	99 (8.1%)	123 (13.8%)
$100,000+	213 (13.9%)	82 (6.7%)	110 (12.3%)
Education			
High School or Less	1310 (55.5%)	412 (57.1%)	589 (59.3%)
College or More	744 (44.5%)	347 (42.9%)	405 (40.7%)
Marital Status			
Significant Other	1004 (60.1%)	431 (59.7%)	556 (55.9%)
No Significant Other	667 (39.9%)	291 (40.3%)	438 (44.1%)
Health Insurance Status			
Covered	2344 (84.9%)	976 (79.5%)	1019 (60.0%)
Not Covered	415 (35.6%)	249 (20.3%)	680 (40.0%)

This table gives the descriptive data for all demographic variables in the study group divided into the racial groups.

The chronic diseases, hypertension, hypercholesterolemia, and diabetes, were also analyzed as a part of this study. The prevalence of hypertension between the different races are 21.4% for non-Hispanic whites, 21.8% for non-Hispanic blacks, and 20.8% for Hispanics. Furthermore, the prevalence of hypercholesterolemia between the races is also close in prevalence ranging from 19.1% in non-Hispanic whites to 19.6% in non-Hispanic blacks. Similarly, prevalence of diabetes between the races is also similar to each other because they range is from 7.6% in Hispanic to 9.6% in non-Hispanic black.

Clinical testing of blood pressure, cholesterol levels, and blood sugar readings analyzed through the study to determine if a patient had the conditions. Systolic blood pressure over 140 is considered higher than normal, and a person with that reading or higher is regarded as hypertensive. In Table 3, the non-Hispanic white population has 16.2% prevalence of hypertension based on the clinical data, 15.9% prevalence in non-Hispanic black, and 16.3% for Hispanic. Also, the clinical data demonstrates the LDL levels being highest for non-Hispanic black at 29.3%, and it was lowest for Hispanic at 26.1%. An LDL level above 220 mmol/L is considered to be higher than normal, and the patient is believed to have hypercholesterolemia (Zieve, 2010). Lastly, the blood sugar level was measured in some people of the study. The range was between 4.8%-5.1%. Non-Hispanic whites had the highest rate and Hispanic had the lowest.

Table 2: Prevalence of Chronic Disease in the Population

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
Sample Size	2761	1227	1699
Hypertension	590 (21.4%)	268 (21.8%)	345 (20.8%)
Hypercholesterolemia	526 (19.1%)	240 (19.6%)	330 (19.4%)
Diabetes	245 (8.9%)	118 (9.6%)	129 (7.6%)

This table gives the prevalence data for all chronic diseases in the study group divided into racial groups.

Table 3: Clinical Tests Indicating Chronic Disease

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
Sample Size	2761	1227	1699
High Systolic Blood Pressure	319 (16.2%)	137 (15.9%)	196 (16.3%)
High LDL Levels	236 (27.5%)	106 (29.3%)	135 (26.1%)
High Glucose Sugar	140 (5.1%)	61 (5.0%)	81 (4.8%)

This table shows many of the laboratory results indicating chronic disease prevalence in patients divided into racial group.

If a patient has hypercholesterolemia, hypertension, or diabetes, then they are typically recommended to modify their daily behavior to regress the chronic disease. The most common recommendations are to eat less fat, reduce weight, increase the amount of exercise, or take a medication to control the condition. For all the recommendations, the rate at which a physician would tell patients to change certain behavior does not depend on race. The range of each recommendation is between one percent difference of the three races.

NHANES also asked patients if they were adhering to the recommendation of the physician. The results show behavioral change was similar among the races. The range among the races was no greater than 1.3%, which can be seen for patients now taking a prescription medication for hypercholesterolemia.

Table 4: Behavioral Change Recommended by the Physician to the Patient

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
Sample Size	2761	1227	1699
Eat Less Fat	420 (15.2%)	194 (15.8%)	269 (15.8%)
Reduce Weight	305 (11.1%)	144 (11.7%)	187 (11.0%)
Exercise More	360 (13.0%)	159 (13.0%)	220 (12.9%)
Take Prescription for Hypercholesterolemia	366 (13.3%)	173 (14.1%)	234 (13.8%)
Take Prescription for Hypertension	430 (15.5%)	189 (15.4%)	258 (15.1%)

This table demonstrates whether a physician told a patient to change behavior to prevent or treat a chronic disease divided into racial group.

Table 5: Behavioral Change of Patient

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
Sample Size	2761	1227	1699
Eat Less Fat	357 (12.9%)	162 (13.2%)	227 (13.4%)
Reduce Weight	252 (9.1%)	122 (9.9%)	161 (9.5%)
Exercise More	271 (9.8%)	121 (9.9%)	162 (9.5%)
Take Prescription for Hypercholesterolemia	295 (10.7%)	147 (12.0%)	195 (11.5%)
Take Prescription for Hypertension	348 (12.6%)	159 (12.9%)	215 (12.6%)

This table demonstrates whether an individual is adhering to the recommendation of the physician by changing daily behavior divided into racial group.

Cross tabulations helped analyze the number of people who were told by the physician they had hypertension with a clinical test of whether the systolic blood pressure was above normal. The results showed that many in the survey were diagnosed in their lifetime with hypertension, and 62.5% of those who were diagnosed have a normal blood pressure. It also determines that of those who have not been told they are hypertensive, 11.1% of them do have higher than normal blood pressure.

Levels of cholesterol were compared to whether a physician told a patient they had hypercholesterolemia. These results determined those diagnosed were now back to a normal level 38.7% of the time. Of the people not diagnosed, 73.1% of the people had high cholesterol levels.

The results of blood sugar in the body compared to whether a physician told a patient they have diabetes shows those diagnosed had a high blood glucose reading 67.7%. The blood sugar has gone back to normal for the other 32.3% of diagnosed patients. Data also shows those not diagnosed with diabetes only had 8.8% high blood sugar levels.

Table 6: Physician Diagnosing Patient with Hypertension with the Lab Indicating Blood Pressure Levels

		Systolic Blood Pressure		Totals
		High	Normal	
Physician Told Patient Hypertension	Hypertensive	438 (37.5%)	741 (62.5%)	1179
	Not Hypertensive	205 (11.1%)	1635 (88.9%)	1840
	Totals	643 (21.2%)	2376 (78.8%)	3019

p= <.01* This table indicates the number of people who have been diagnosed with hypertension by a physician and confirms diagnosis with systolic blood pressure levels of the patient.

Table 7: Physician Diagnosing Patient with Hypercholesterolemia with the Lab Indicating LDL Cholesterol Levels

		Cholesterol Level		Totals
		High	Normal	
Physician Told Patient Hypercholesterolemia	Hypercholesterolemia	492 (61.3%)	310 (38.7%)	802
	No Hypercholesterolemia	732 (73.1%)	269 (26.9%)	1001
	Totals	1224 (67.9%)	579 (32.1%)	1803

p= <.01* This table indicates the number of people who have been diagnosed with hypertension by a physician and confirms diagnosis with LDL cholesterol levels of the patient.

Table 8: Physician Diagnosing Patient with Diabetes with the Lab Indicating Blood Glucose Levels

		Blood Glucose Level		Totals
		High	Normal	
Physician Told Patient Diabetes	Diabetes	264 (67.7%)	126 (32.3%)	343
	No Diabetes	197 (8.8%)	2033 (91.2%)	2230
	Totals	461 (17.6%)	2159 (82.4%)	2622

p= <.05** This table indicates the number of people who have been diagnosed with diabetes by a physician and confirms diagnosis with blood glucose levels of the patient.

In Table 9, the number of people who were told they have hypertension is compared to those told to eat less fat. The results show 83.3% of people are told by a physician to eat less fat if they are diagnosed with hypertension. On the other hand, 78.8% were told to eat less fat but never diagnosed with hypertension. Overall, 81.1% of people are recommended by physician's to eat less fat than they are consuming on a normal basis.

Table 10 shows the recommendation to reduce weight if a patient is hypertensive. This advice is given to 65.9% of patients with hypertension. Those who do not have hypertension are told 51.4% of the time to lose weight by a physician.

Table 11 presents data on how often a patient is told to increase the amount of exercise based on a diagnosis of hypertension. If the patient was diagnosed with the condition, he or she would have been told to increase the current amount of exercise 73.8% of the time. Patients not diagnosed with hypertension are told to increase exercise 68.3% of the time.

Table 12 analyzes if a physician recommends eating less fat to a patient if they are diagnosed with hypercholesterolemia. The data shows patients diagnosed with hypercholesterolemia are recommended to eat less fat 78.7% of the time. The patients who were not diagnosed were advised to eat less fat 51.3%.

In Table 13, the data demonstrates 61% of patients who are told they have hypercholesterolemia are told to reduce their weight. Physician's also tell people without the condition to lose weight 54.3% of the time.

Table 14 describes the results of increasing the amount of exercise based on a physician's diagnosis of hypercholesterolemia. 46.3% of patients diagnosed with hypercholesterolemia are never told to increase exercise.

In Table 15, the data reveals patients who have been told by a physician that they have diabetes, then 85.5% of those patients are told to eat less fat from their food. Even patients without diabetes are told to reduce fat from their food consumption 79.6% of the time. Physicians recommend this behavioral change the most for diabetics.

According to Table 16, 76 % of diabetics are recommended to reduce weight by a physician. People without diabetes are recommended to reduce weight 54.2% of the time.

Physicians recommend increasing exercise for patients who were also told they had diabetes78.3% of the time. 64.9% of patients who were never told they have diabetes were told to increase exercise by the physician.

Table 9: Physician Diagnosing a Patient with Hypertension and Recommended to Eat Less Fat

		Told to Eat Less Fat		Totals
		Yes	No	
Physician Told Patient Hypertension	Hypertensive	919 (83.3%)	184 (16.7%)	1103
	Not Hypertensive	621 (78.1%)	174 (21.9%)	795
	Totals	1540 (81.1%)	358 (18.9%)	1898

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with hypertension and those told to eat less fat.

Table 10: Physician Diagnosing a Patient with Hypertension and Recommended to Reduce Weight

		Told to Reduce Weight		Totals
		Yes	No	
Physician Told Patient Hypertension	Hypertensive	726 (65.9%)	376 (34.1%)	1102
	Not Hypertensive	411 (51.4%)	388 (48.6%)	799
	Totals	1137 (59.8%)	764 (40.2%)	1901

P=<.01* This table is a cross tabulation of variables among people that have been diagnosed with hypertension and those told to control weight.

Table 11: Physician Diagnosing a Patient with Hypertension and Recommended to Increase Physical Activity

		Told to Increase Exercise		Totals
		Yes	No	
Physician Told Patient Hypertension	Hypertensive	812 (73.5%)	293 (26.5%)	1102
	Not Hypertensive	488 (61.2%)	310 (38.8%)	799
	Totals	1300 (68.3%)	603 (31.7%)	1901

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with hypertension and those told to increase exercise.

Table 12: Physician Diagnosing a Patient with Hypercholesterolemia and Recommended to Eat Less Fat

		Told to Eat Less Fat		Totals
		Yes	No	
Physician Told Patient Hypercholesterolemia	Hypercholesterolemia	718 (78.7%)	194 (21.3%)	912
	No Hypercholesterolemia	355 (51.3%)	336 (48.7%)	691
	Totals	1073 (66.9%)	530 (33.1%)	1603

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with hypercholesterolemia and those told to eat less fat.

Table 13: Physician Diagnosing a Patient with Hypercholesterolemia and Recommended to Reduce Weight

		Told to Reduce Weight		Totals
		Yes	No	
Physician Told Patient Hypercholesterolemia	Hypercholesterolemia	449 (61.0%)	286 (39.0%)	735
	No Hypercholesterolemia	471 (54.3%)	395(45.7%)	866
	Totals	920 (57.3%)	681 (42.3%)	1601

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with hypercholesterolemia and those told to control weight.

Table 14: Physician Diagnosing a Patient with Hypercholesterolemia and Recommended to Increase Exercise

		Told to Increase Exercise		Totals
		Yes	No	
Physician Told Patient Hypercholesterolemia	Hypercholesterolemia	394 (53.7%)	341 (46.3%)	735
	No Hypercholesterolemia	426 (49.6%)	435 (50.4%)	861
	Totals	820 (51.5%)	776 (48.4%)	1596

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with hypercholesterolemia and those told to increase exercise.

Table 15: Physician Diagnosing Patient with Diabetes and Recommended to Eat Less Fat

		Told to Eat Less Fat		Totals
		Yes	No	
Physician Told Patient Diabetes	Diabetes	415 (85.5%)	70 (14.5%)	482
	No Diabetes	1125 (79.6%)	289 (20.4%)	1414
	Totals	1540 (81.1%)	359 (18.9%)	1899

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with diabetes and those told to eat less fat.

Table 16: Physician Diagnosing Patient with Diabetes and Recommended to Reduce Weight

		Told to Reduce Weight		Totals
		Yes	No	
Physician Told Patient Diabetes	Diabetes	369 (76.0%)	117 (24.0%)	486
	No Diabetes	768 (54.2%)	648 (45.8%)	1414
	Totals	1137 (59.8%)	765 (40.2%)	1902

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with diabetes and those told to control weight.

Table 17: Physician Diagnosing Patient with Diabetes and Recommended to Increase Exercise

		Told to Increase Exercise		Totals
		Yes	No	
Physician Told Patient Diabetes	Diabetes	381 (78.3%)	106 (21.7%)	487
	No Diabetes	919 (64.9%)	498 (35.1%)	1417
	Totals	1300 (68.3%)	604 (31.7%)	1904

p=<.01* This table is a cross tabulation of variables among people that have been diagnosed with diabetes and those told to increase exercise.

Conducting a binary logistic regression determines the odds ratio and confidence interval for the dependent variables. Table 18 and Table 19 are the univariate analyses for different behavioral changes a physician recommends. Table 18 describes the behavioral modifications eating less fat, controlling weight, and increasing exercise, while Table 19 explains behavioral changes for medications of each of the chronic diseases.

In univariate analysis of Table 18, the data reveals a patient is 1.603 times more likely to eat less fat if they were told to control weight. Also, the patient is 1.480 times more likely to eat less fat if they are told to take medication for cholesterol. Another significant finding was for every year an individual ages, the likelihood of eating less fat decreases by .982. This finding has a confidence interval of 0.972- 0.992. All other results were not significant in Table 18 except for a patient increasing exercise if a person has health care coverage and if that individual earns has an annual household income of more than $100,000. A person is 1.712 times more likely to increase exercise if they live in a household earning more than $100,000 per year. The patient is also 1.440 times more likely to increase exercise if he or she has health care coverage.

Medications are utilized to control the condition if someone has the chronic disease. Data reveals it is 2.139 times more likely for an individual to take medication for blood pressure now if they were ever told to take medication for cholesterol. Similarly, the likelihood for an individual taking cholesterol medication now is 4.536 times greater if the person has been told by a physician to take a blood pressure pill. Also, a person taking diabetic pills are 3 times more likely to be told to take pills for hypertension and hypercholesterolemia.

Age was another significant result in the univariate analysis. For every year a person ages, the less likely they are going to take another medication for any of the chronic diseases discussed. The significance is weak, but it still is apparent for each chronic condition. In addition to age, health care coverage is significant for each medication. If an individual has health care coverage, then they are more likely to take the appropriate medication to regulate bodily functions. Lastly, the univariate analysis shows a 1.393 times more likely for someone with a high school degree or less education to now be taking medication for diabetes.

Table 20 and Table 21 show the multivariate analyses for physical behavioral modifications. Table 20 describes eating less fat, controlling weight, and increasing exercise, and Table 21 shows the analysis for behavioral changes for medications of the chronic diseases.

The multivariate analysis shows no significance for any of the factors previously found data from the univariate analysis for the physical behavioral modifications, but significance was found for those now taking medication for blood pressure are 2.312 times more likely to be told to take a medication for hypercholesterolemia. Similar results were found for patients taking diabetic pills were over 3 times more likely to be told to take medications for blood pressure and cholesterol. No significance was found for a patient now taking cholesterol medication and whether he or she is told to take blood pressure medication.

The multivariate analysis also showed age is still significant for patients now taking blood pressure medication and cholesterol medication, but it is not significant for diabetes medication. Having health insurance is significant for patients now taking blood pressure medication and diabetic medication, but it is not significant for those taking cholesterol medication.

Table 18: Univariate Analysis of Physical Behavioral Changes Associated with Chronic Disease Prevention

Variable	Now Eating Less Fat OR (95% CI)	Now Controlling Weight OR (95% CI)	Now Increasing Exercise OR (95% CI)
Told to Eat Less Fat (Reference No)	------------	1.002 (.515, 1.951)	1.434 (.910, 2.260)
Told to Control Weight (Reference No)	1.603 (1.206, 2.132)*	----------	1.296 (.955, 1.761)
Told to Exercise More (Reference No)	1.231 (.893, 1.696)	1.212 (.686, 2.141)	-----------
Told to Take Medication for Cholesterol (Reference No)	1.480 (1.108, 1.978)*	1.130 (.797, 1.603)	.968 (.731, 1.280)
Told to Take Medication for Blood Pressure (Reference No)	1.135 (.562, 2.291)	.975 (.444, 2.141)	.885 (.464, 1.685)
Age	.982 (.973, .992)*	.996 (.984, 1.007)	1.001 (.992, 1.010)
Gender (Reference Male)	.820 (.623, 1.080)	.905 (.662, 1.239)	1.245 (.970, 1.599)
Race (Reference Non-Hispanic White)			
Non-Hispanic Black	1.344 (.851, 2.123)	1.480 (.869, 2.520)	1.252 (.809, 1.938)
Hispanic	.953 (.618, 1.469)	1.409 (.780, 2.288)	1.258 (.853, 1.855)
Annual Household income (Reference $0-$14,999)			
$15,000-$34,999	.843 (.498, 1.426)	1.177 (.651, 2.127)	1.291 (.808, 2.063)
$35,000-$64,999	.872 (.717, 1.240)	.797 (.455, 1.395)	1.220 (.798, 1.865)
$65,000-$99,999	.930 (.595, 1.452)	1.447 (.875, 2.392)	1.358 (.903, 2.042)
$100,000+	1.094 (.661, 1.810)	1.728 (.974, 3.064)	1.712 (1.069, 2.742)*
Covered by Health Insurance (Reference No Coverage)	.975 (.644, 1.475)	1.094 (.673, 1.778)	1.440 (1.005, 2.063)*
Education Status (Reference College)	.912 (.692, 1.202)	.729 (.529, 1.005)	.689 (.535, .887)
Marital Status (Reference No Significant Other)	.821 (.616, 1.095)	1.138 (.825, 1.571)	1.061 (.822, 1.370)

The univariate analysis table shows the odds ratio and confidence intervals for the variables between physical behavioral change, adjusting for income.
*Significant variables are indicated.

Table 19: Univariate Analysis of Medication Behavioral Changes Associated with Chronic Disease Prevention

Variable	Now Taking Cholesterol Medication OR (95% CI)	Now Taking Blood Pressure Medication OR (95% CI)	Now Taking Blood Sugar Medication OR (95% CI)
Told to Eat Less Fat (Reference No)	1.237 (.873, 1.753)	.921 (.508, 1.671)	1.251 (.784, 1.996)
Told to Control Weight (Reference No)	1.216 (.917, 1.613)	1.068 (.680, 1.676)	1.502 (1.031, 2.189)
Told to Exercise More (Reference No)	1.235 (.918, 1.662)	.829 (.498, 1.379)	1.106 (.740, 1.654)
Told to Take Medication for Cholesterol (Reference No)	---------------	2.139 (1.296, 3.529)*	3.171 (1.983, 5.071)*
Told to Take Medication for Blood Pressure (Reference No)	4.536 (2.015, 10.214)*	-----------------	3.106 (1.432, 6.737)*
Age	.957 (.947, .968)*	.944 (.934, .954)*	.970 (.961, .979)*
Gender (Reference Male)	1.278 (.968, 1.687)	.925 (.698, 1.225)	1.088 (.854, 1.385)
Race (Reference Non-Hispanic White)			
Non-Hispanic Black	.777 (.476, 1.269)	.913 (.552, 1.510)	.918 (.612, 1.376)
Hispanic	.803 (.524, 1.231)	1.143 (.736, 1.774)	.914 (.623, 1.341)
Annual Household income (Reference $0-$14,999)			
$15,000-$34,999	.884 (.529, 1.498)	1.323 (.673, 2.601)	.788 (.338, 1.290)
$35,000-$64,999	.893 (.529, 1.506)	1.321 (.724, 2.411)	.852 (.540, 1.344)
$65,000-$99,999	.829 (.529, 1.300)	1.486 (.841, 2.626)	.959 (.594, 1.548)
$100,000+	.790 (.514, 1.212)	1.642 (.896, 3.009)	.816 (.471, 1.411)
Covered by Health Insurance (Reference Covered)	3.041 (2.038, 4.537)*	4.119 (2.945, 5.761)*	1.535 (1.085, 2.171)*
Education Status (Reference College)	1.156 (.875, 1.528)	1.034 (.775, 1.379)	1.393 (1.084, 1.790)*
Marital Status (Reference No Significant Other)	1.315 (.994, 1.740)	1.096 (.826, 1.454)	1.060 (.831, 1.352)

The univariate analysis table shows the odds ratio and confidence intervals for the variables between behavioral change of medication use, adjusting for income.
*Significant variables are indicated.

Table 20: Multivariate Analysis of Physical Behavioral Changes Associated with Chronic Disease Prevention

Variable	Now Eating Less Fat OR (95% CI)	Now Controlling Weight OR (95% CI)	Now Increasing Exercise OR (95% CI)
Told to Eat Less Fat (Reference No)	------------	.593 (.125, 2.819)	1.061 (.417, 2.701)
Told to Control Weight (Reference No)	.726 (.382, 1.382)	----------	.701 (.398, 1.235)
Told to Exercise More (Reference No)	.780 (.367, 1.658)	.680 (.250, 1.845)	-----------
Told to Take Medication for Cholesterol (Reference No)	.668 (.337, 1.325)	.708 (.334, 1.502)	1.016 (.528, 1.954)
Told to Take Medication for Blood Pressure (Reference No)	.952 (.314, 2.884)	.987 (.310, 3.139)	.819 (.302, 2.223)
Age	.998 (.975, 1.021)	1.001 (.976, 1.026)	1.007 (.987, 1.028)
Gender (Reference Male)	1.238 (.711, 2.156)	1.520 (.851, 2.716)	.776 (.484, 1.244)
Race (Reference Non-Hispanic White)			
Non-Hispanic Black	1.668 (.893, 3.116)	1.585 (.815, 3.084)	1.322 (.750, 2.331)
Hispanic	1.168 (.611, 2.234)	1.305 (.665, 2.560)	1.461 (.852, 2.506)
Annual Household income (Reference $0-$14,999)			
$15,000-$34,999	.908 (.325, 2.538)	1.025 (.359, 2.929)	1.241 (.517, 2.977)
$35,000-$64,999	.725 (.290, 1.814)	.546 (.197, 1.515)	.866 (.386, 1.939)
$65,000-$99,999	.831 (.337, 2.047)	1.653 (.665, 4.112)	1.053 (.481, 2.305)
$100,000+	1.165 (.405, 3.350)	1.264 (.401, 3.978)	.913 (.338, 2.466)
Covered by Health Insurance (Reference Covered)	.984 (.393, 2.464)	1.382 (.506, 3.775)	.926 (.412, 2.083)
Education Status (Reference College)	1.093 (.618, 1.933)	1.086 (.597, 1.974)	1.140 (.693, 1.875)
Marital Status (Reference No Significant Other)	1.003 (.549, 1.830)	1.081 (.571, 2.044)	1.312 (.777, 2.215)

The multivariate analysis table shows the odds ratio and confidence intervals for the variables between physical behavioral changes, adjusting for income.
*Significant variables are indicated.

Table 21: Multivariate Analysis of Medication Behavioral Changes Associated with Chronic Disease Prevention

Variable	Now Taking Cholesterol Medication OR (95% CI)	Now Taking Blood Pressure Medication OR (95% CI)	Now Taking Blood Sugar Medication OR (95% CI)
Told to Eat Less Fat (Reference No)	1.221 (.528, 2.820)	1.468 (.521, 4.132)	1.330 (.504, 3.512)
Told to Control Weight (Reference No)	.821 (.392, 1.720)	.812 (.346, 1.906)	.758 (.317, 1.811)
Told to Exercise More (Reference No)	.713 (.318, 1.600)	.790 (.288, 2.164)	.625 (.253, 1.548)
Told to Take Medication for Cholesterol (Reference No)	----------------	2.312 (1.080, 4.945)*	3.112 (1.066, 9.627)*
Told to Take Medication for Blood Pressure (Reference No)	3.084 (.886, 10.739)	-----------------	3.521 (1.043, 11.261)*
Age	.963 (.940, .986)*	.954 (.927, .981)*	.976 (.947, 1.006)
Gender (Reference Male)	.686 (.389, 1.208)	1.112 (.562, 2.203)	.677 (.367, 1.251)
Race (Reference Non-Hispanic White)			
Non-Hispanic Black	.706 (.347, 1.437)	.447 (.170, 1.176)	.976 (.480, 1.985)
Hispanic	.988 (.519, 1.881)	1.234 (.585, 2.606)	1.411 (.670, 2.974)
Annual Household income (Reference $0-$14,999)			
$15,000-$34,999	.722 (.255, 2.043)	1.041 (.235, 4.609)	.725 (.216, 2.435)
$35,000-$64,999	.686 (.272, 1.726)	1.847 (.571, 5.231)	1.048 (.359, 3.060)
$65,000-$99,999	.533 (.215, 1.322)	1.589 (.482, 5.980)	.598 (.212, 1.687)
$100,000+	.861 (.305, 2.434)	1.041 (.235, 4.609)	.350 (.096, 1.267)
Covered by Health Insurance (Reference Covered)	2.051 (.866, 4.856)	2.863 (1.170, 7.003)*	4.025 (1.644, 8.018)*
Education Status (Reference College)	.782 (.438, 1.397)	.863 (.426, 1.748)	1.003 (.525, 1.919)
Marital Status (Reference No Significant Other)	.884 (.487, 1.604)	1.104 (.533, 2.289)	.931 (.488, 1.777)

The multivariate analysis table shows the odds ratio and confidence intervals for the variables between behavioral change of medication use, adjusting for income.
*Significant variables are indicated.

Discussion

Adherence to physicians' recommendations is critical when a patient struggles with a chronic disease. Prior studies have been completed to determine the relationship between adherence to physicians' behavioral change recommendations and impact of patients' health. Patients can suffer from extreme setbacks if treatment and preventative measures are not taken to control the condition (Bezreh, 2011).

The purpose of the study was to determine if a certain population was at higher risk for non-adherence to recommendations, which would eventually cause an increase of preventable health care spending. Hypertension, hypercholesterolemia, and diabetes are a few of the most common chronic diseases. If the adherence to physicians' recommendations of just these three diseases were higher, then the rates of complications and money lost due to these conditions would most likely decrease (Anderson, 2004).

The data demonstrated people of different races had similar prevalence of disease within those populations. Similar results were seen from the clinical data and the diagnosis data in which a patient was told whether he or she had a chronic disease. Diagnosis of hypertension was highest for hypertension for the entire population, but the clinical results showed the study group being highest for high levels of LDL. A high level of LDL is considered higher than 220 mmol/dL in adults (Zieve, 2010). The clinical data suggests many more people have high levels of cholesterol, but the physicians do not diagnose hypercholesterolemia. The data also shows higher diagnoses for those with high blood pressure than actual clinical data provides. Similarly, a higher diagnosis of diabetes is found than those with high blood sugar levels. The data included every patient who was borderline diabetic to be considered diabetic.

Those who were diagnosed with hypertension sometimes have a fluctuating blood pressure.

It can be controlled through the behavioral changes and medication, which can be seen in the data. 63.1% of patients who have been diagnosed with hypertension were seen to have normal blood pressure. 12.5% of the patients never diagnosed with high blood pressure had high blood pressure from the clinical data. On the other hand, those patients diagnosed with hypercholesterolemia can control their cholesterol levels if they are high, but only 38.7% were seen to have normal cholesterol levels. Also, it is seen that many have high cholesterol levels, but data shows cholesterol is high in 73.1% of undiagnosed patients. If a patient was diagnosed with diabetes, the lab shows 67.7% have high glucose levels. Only 8.8% of the patients have high blood sugar levels if they were not diagnosed with diabetes.

The reason many patients go undiagnosed even if they have high blood pressure, LDL levels, or glucose levels is because chronic diseases need to have multiple tests before determining a diagnosis sometimes. These tests are important factors for a diagnosis, but they may not be the only factor determining if a patient has hypertension, hypercholesterolemia, or diabetes because these diseases are more complex than just analyzing systolic blood pressure, LDL levels, and glucose level.

A physician is the primary source of advice for patients. Although a physician gives a patient advice, the patient may not always adhere to those recommendations. Adherence to a physician's recommendations can be seen in Table 4 and Table 5. The frequency of a physician advocates a behavioral change is greater than the frequency the patients actually change behavior. Adherence levels are below 100%. The analysis implies the frequency of patients told to change behavior in Table 4 is greater than the frequency of behavior change for each recommendation and race in Table 5. For example, 15.2% of non-Hispanic whites were told to decrease the amount of fat they consumed, but only 12.9% reported to change their behavior to consume fat foods. Many barriers are preventing people from accomplishing the physician's request, but those barriers were not found from this analysis.

Tables 9-17 each gave the number of patients who were advised to change physical behavior based on the chronic condition they were dealing with. For each chronic condition, a patient was counseled to eat less fat the more than any other recommendation. Increasing exercise was recommended for patients with diabetes and hypertension more than reducing the patient's weight, but it was greater for a patient with hypercholesterolemia. Exercise for hypercholesterolemia was recommended the least of all the advice given for people with these chronic diseases.

Hypertension can be caused by damage to arteries, and fat in foods are a major contributor to the damage on the arteries. The data shows patients are who have been diagnosed with hypertension are highly likely to be told by a physician to quit eating fat. This trend is similar to patients who are diabetic because over 75% of patients are recommended to eat less fat. The data suggests many people who are not diagnosed with a disease are still advised to change behavior whether the patient is diagnosed with a chronic disease or is never diagnosed with a chronic disease. It is unclear how comorbidity might have an effect on the resulting data.

The data suggests a high correlation between the specific advice and physical behavioral change, even if the odds ratio cannot be determined. Collinearity existed between the independent variable, the physicians' recommendation, and the dependent variable, behavioral change, for each recommendation's respective behavioral change. This statistical phenomenon is the reason the univariate and multivariate analysis had no odds ratio for that particular condition. For example, Table 18 shows no odds ratio of a patient now eating less fat when he or she was told to eat less fat. The same is true for every dependent variable and its counter independent variable. These odds ratios might have given a better since of how likely a patient adheres to a physician's advice, but due to collinearity of the variables, SPSS could not calculate the odds ratio.

Odds ratios in the univariate analysis are found to be significant for patients who are now eating less fat if they were told to control their weight and told to take a medication for cholesterol. No other physical behavioral changes had significance in the study. Furthermore, the multivariate analysis indicates no significance for the physical behavioral changes. These results mean the recommendations of physicians does not have any significance on the likelihood a patient will change their behavior for an advice given to them. The data suggests if a patient was told to increase the amount of exercise then the recommendation would have no effect on whether that individual would control their weight or eat less fat. These factors are not associated with each other possibly because patients typically follow specific action plans a physician tells him or her to take. Also, the demographics of the patients do not have show any significance for any physical behavioral change.

The univariate data for medication behavioral change found significance for patients now taking a prescription for any of the studied chronic diseases is more likely to be told to take a prescription to control blood pressure or cholesterol levels. For example, this data implies if a patient is taking a diabetic pill, then the patient is about three times more likely to be told to take a medication for blood pressure and cholesterol. If a patient is taking medication, then a physician is just going to recommend more medication for the patient to take for different chronic diseases. This phenomenon could be caused by a physician understanding the patient is used to taking medication therefore the patient is more likely to take an additional medication for a different chronic disease rather than make a physical behavioral change. NHANES did not collect data on whether a patient was told to diabetic pills, so that information could not be collected for this study.

Also, the univariate analysis found significance for age and health insurance for each medication. For each year a person ages, he or she will be slightly less likely to take a prescription for a chronic disease. An aging patient might not want to take any new drugs because it might seem excessive if the patient is already taking mediations. Also, a patient is more likely to take a medication, if he or she has health care coverage. Most insurance coverage will help pay for the necessary prescriptions for the chronic diseases. Medication is typically an easier and quicker way to control these conditions, which is the reason they are prescribed so often.

In the multivariate analysis, the results were significant for patients now taking medications for blood pressure and diabetes, but it was not significant for cholesterol medication. This indicates the physician telling the patient to take a prescription for hypertension if the patient is already taking a medication to control cholesterol is a confounder. Other confounding variables seen in the study include age, annual household income, and education for those now taking a blood sugar medication. Age had a slight significance in the univariate analysis, but after stratifying the dependent variables in the multivariate analysis, it appears to be an extraneous variable. Similarly, the data also concludes from the univariate analysis that patients now taking a prescription for diabetes are .558 times less likely to earn between $15,000-$34,999 as well as 1.393 times more likely to have no college education. These two variables are confounding variables in this study. Also, the data demonstrates health insurance coverage is a confounding variable because it is not significant for the multivariate analysis, while significance exists for those who have health care coverage for patients who are now taking hypertension and diabetes medications.

Health insurance coverage can differ for different people depending on the plan they own. Cholesterol medication may not be covered as often as blood pressure and diabetes because of the prevalence or seriousness of the condition, which is a reason health insurance coverage is not significant for patients taking medication for cholesterol. Contrarily, a significance does exist in the multivariate analysis for patients now taking blood sugar medication. These chronic conditions can have high rates of comorbidity, which results in patients taking multiple medications for different chronic conditions.

Physicians recommend many different behavior changes for patients to control chronic diseases. The data demonstrates physicians are just as likely to recommend medications as physical behavioral changes. Many influences can be causing physicians to give patients a medication, which will help control their condition quicker and more efficiently than doing physical behavioral changes. For example, the analysis suggests if a patient is currently taking a prescription for diabetes, then they are more likely to be told to take a pill rather than physically modify their behavior.

Suggestions

Future research could be done to analyze the relationship between patients with chronic diseases and physicians who treats the chronic disease. Based on this study, the correlation between recommendation and behavioral changes were high, but adherence was not 100%. If a physician can describe the importance of controlling chronic diseases, then the patients will less likely suffer from the setbacks of the disease. It is important for physicians to understand if the patient does not know how to properly change their behavior then they will not adhere to the recommendations.

Another important study could analyze the effects of comorbidity of the chronic diseases has on an individual. If an individual has multiple chronic diseases, he or she may be less likely to treat the condition. Comorbidity could lead to additional problems for a patient trying to control one condition. The patient could have more different chronic conditions, which were not addressed in this study.

Limitations

The sampling methodology came from NHANES, which is a large, multifaceted, secondary data source. The data could be misrepresented because NHANES oversampled for certain ethnic groups and populations that may not be an accurate representation of the country on the whole. Additionally, certain populations are not represented at all, which include people who are institutionalized or currently listed in the armed forces.

NHANES had limited data on adherence factors. Because of the lack of adherence variables for diseases such as kidney disease, osteoporosis, glaucoma, and depression, an analysis was not performed with these variables. If NHANES included questions about medications and other preventions strategies of these diseases, an analysis could have been completed to include other chronic diseases.

In addition, the data came from a two-year sample from 2007- 2008, which limits the amount of analysis that can be preformed. If additional years of data were included in the study, it would give different results.

Also, previous studies have shown a greater risk of having comorbidity if a patient has one chronic disease already. Comorbidity could cause the data to be misrepresented because a patient might adhere to the recommendations from one disease but might not report behavioral changes for the other disease.

Conclusion

The findings from this study were similar to other literature found about adherence levels to chronic diseases. Demographics were not a factor when determining chronic disease adherence. The main factors that determined adherence were behavioral aspects to health. Physicians and other health care professionals are the key component to having a successful model for health in a community because they can give the necessary recommendations for the population to understand how to live a healthy lifestyle. Interactions between physician and patient which are efficient and recommendations that are easy to understand can give the best results for health.

Preventing chronic disease is important because the cost continues to rise across the nation, and one way to integrate a system of improved health quality is to increase transparency from health care provider to patient. Positive recommendations such as decreasing fatty food intake, increasing exercise, controlling weight, and taking a medication for a chronic disease can reduce the amount of hypertension, hypercholesterolemia, and diabetes. Ultimately, creating an environment for educating patients about positive health outcomes will help control chronic disease.

Also, physicians are recommending medications just as often as they recommend changing physical behavior. By reducing the amount of chronic disease, which has been growing over the past few decades, the nation can have a stronger economy as well. A system should be developed to reward doctors if they can change the physical behavior, which will then help lower the overall cost of health care.

Many factors impact adherence of an individual with one chronic diseases. Adherence to recommendations can help prevent chronic diseases from worsening, but different issues can develop, which will cause a patient to not adhere to the recommendations of the physicians. People can prevent and control chronic disease from affecting their life, but it is necessary for patients to change their daily behavior to be free of these conditions.

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