ABSTRACT

TITLE: A SECONDARY ANALYSIS OF NHANES 1999-2000 EXAMINING DISPARITIES IN DIABETES COMPLICATIONS BETWEEN BLACK, WHITE, AND MEXICAN AMERICAN DIABETICS.

Teaniese P. Latham, Masters in Public Health

Thesis Directed by: Associate Professor Sharon M. Desmond
Department of Public and Community Health

In the United States there are an estimated 18.2 million cases of diabetes, and 5.2 million of these cases are undiagnosed (Centers for Disease Control and Prevention [CDC], National Diabetes Facts Sheet, 2003). Diabetes has numerous associated debilitating complications (CDC, 2003) and requires access to health care to obtain on-going treatment. Black and Mexican diabetics experience significantly more complications than White diabetics. This study examined social and health care factors that contribute to racial disparities in diabetes complications by conducting a secondary data analysis using the National Health and Nutrition Examination Survey (NHANES) 1999-2000 (NHANES, 2003). The researcher investigated racial disparities in diabetes complications among Black, White, and Mexican diabetics. There were significant differences between race/ethnicity and education level, diet, physical activity, smoking and health care utilization. Logistic regression analyses indicated that health care utilization and physical functioning limitations were significant predictors of diabetes complications among all diabetics.

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by

Teaniese P. Latham

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Advisory Committee:

Associate Professor Sharon M. Desmond, Chair
Professor Min Chi Wang
Associate Professor Donna Howard

Dedication

I would like to dedicate this thesis to my family who has given me their incessant and unconditional support throughout the thesis writing process.

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Chapter 1: The Problem

Overview of Diabetes

The United States has the highest prevalence of diabetes compared to other developed countries (American Diabetes Association [ADA], 2000). There are an estimated 18.2 million cases of diabetes in the U.S. (6.3% of the population), of which 5.2 million cases are undiagnosed (Centers for Disease Control and Prevention [CDC], National Diabetes Fact Sheet, 2003). Diabetes is a chronic illness presently classified into four clinical categories: type 1, type 2, gestational diabetes mellitus and malnutrition-related diabetes. The primary focus of this research involves diabetes mellitus type 1 (previously known as insulin-dependent diabetes mellitus (IDDM)) and type 2 (previously termed non-insulin-dependent diabetes mellitus (NIDDM). Type 2 diabetes is the most prevalent form of diabetes (ADA, 2003). Nineteen percent of the deaths in the U.S. in 1999 were among people with diabetes over 25 years of age. The risk of mortality for diabetics is twice the risk of mortality for non-diabetics. Further, the risk of death associated with diabetes is greater for younger people (ages 25-44) and women. Diabetics are more susceptible to other illnesses as well, making it challenging to overcome co-existing complications. There are numerous health complications for diabetics, including: heart disease, stroke, high blood pressure, blindness, kidney disease, nervous system disease, amputations, dental disease, pregnancy complications, diabetic acidosis and others (CDC National Diabetes Fact Sheet, 2003).

The prevalence of diagnosed diabetes has steadily increased in the United States, from 5.76 million cases in 1980 to 11.1 million cases in 2000 (Diabetes Surveillance

System, 2003) to 13 million cases in 2003 (CDC, National Diabetes Facts Sheet 2003). A portion of the increased prevalence is attributed to enhanced diabetes surveillance and data systems (Glasgow, Wagner, Kaplan, Vinicor, Smith & Norman, 1999; Diabetes Surveillance System, 2003) and an increasing national population. However, between 1980 and 2000, the CDC reported that the age-adjusted and crude prevalence rates of diagnosed diabetes increased in a similar manner, indicating that the prevalence increase was not due to variations in population age (Diabetes Surveillance System, 2003).

The prevalence of diagnosed diabetes varies among different populations. Based on age, the highest prevalence of diabetes occurs in people aged 65-74, then individuals over 75 year of age, followed by the 45 to 64 year old age group, and finally individuals 45 and under. In 2000, the prevalence of diagnosed diabetes was 13 times greater for people aged 65-74 compared to persons less than 45 years of age. Between 1997 and 2000, there was a 27% increase in the prevalence of diagnosed diabetes among males The greatest relative increase in diagnosed diabetes among females occurred in the under 45 age group, a 33% increase (Diabetes Surveillance System, 2003).

As previously mentioned, there are an estimated 5.2 million cases of undiagnosed diabetes (CDC, National Diabetes Facts Sheet, 2003). A target goal of Healthy People 2010 (HP 2010) is to identify 80% of the undiagnosed cases by 2010. Early diagnosis of diabetes can decrease the risk of diabetic complications and mortality. Identifying or tracking undiagnosed cases is a major challenge. It is difficult to ascertain who died as a result of diabetes given that related health services and health complications are sometimes not logged on hospital records, death certificates or other documents (HP2010, 2000).

Complications

Diabetes can result in acute and long term complications. Hyperglycemia with acidosis and nonketotic hyperosmolar syndrome is acute, potentially life-threatening outcomes of diabetes (Expert Committee, 2003). There are four major long-term diabetic complications: retinopathy, nephropathy, peripheral neuropathy and autonomic neuropathy. Retinopathy can lead to vision impairment or blindness. Nephropathy leads to renal failure. Peripheral neuropathy involves the risk of amputations, foot ulcers and Charcot joints. Autonomic neuropathy causes symptoms of gastrointestinal, genitourinary and cardiovascular problems, as well as sexual dysfunction. Diabetes carries an increased incidence of macro/microvascular diseases. Other physical complications include hypertension, periodontal disease and abnormal lipoprotein metabolism (Expert Committee, 2003).

During the 1980's and 1990's, more diabetic complications were reported for Blacks and Latinos relative to Whites in the United States. These complications included micro-vascular complications, end-stage renal disease (ESRD), and lower extremity amputation (LEA). However, there is a gap in research regarding the current ethnic health disparities in diabetic complications. Karter, Jerrara, Liu, Moffet, Ackerson, & Selby (2002) indicated that updated research on diabetes related health disparities must be conducted. These researchers also suggested examining multiple factors to identify the true causes of ethnic disparities in diabetes (Karter et al., 2002).

Diabetes is a largely self-managed disease that requires substantial interface with the health care community on both an inpatient and outpatient basis (ADA, 2003). Fourteen percent of diabetics have had at least one hospitalization or visit to the

emergency department over a six year period. Hyperglycemia (94%) was the reason for 94% of hospital admission, due primarily to acidosis and a combination of hyperglycemic coma and acidosis (Booth & Hux, 2003). An ADA (2003) report detailed that there were 99,264 days of health care use attributed to inpatient care services and 120,638 days of care attributed to outpatient diabetes health care services in the United States in 2002. Most of the causes of diabetes related health care visits, inpatient and outpatient, were due to general medical conditions, cardiovascular complications and direct diabetes care (ADA, 2003). Diabetics consume more health care resources and at a greater intensity than non-diabetics (Laditka, Mastanduno & Laditka, 2001).

Purpose

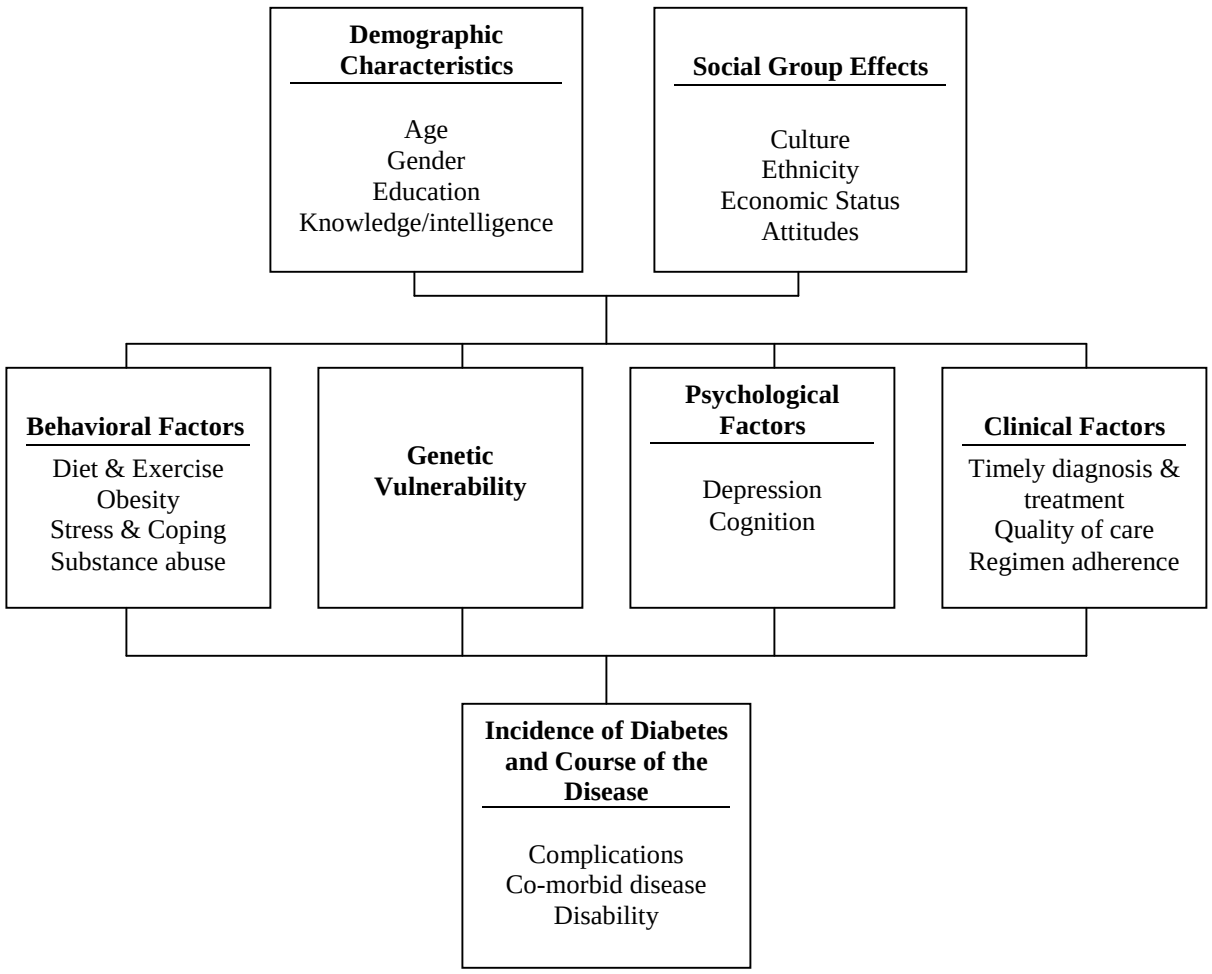
The purpose of this study was to assess social and demographic factors that may contribute to racial disparities in diabetes related complications, using NHANES 1999-2000 data (NHANES, 2003). Particular attention was paid to access to health care, quality of health care, education level, employment status, behavioral factors and indirect costs of diabetes to determine how these factors possibly contributed to the racial disparity in diabetes related complications. This study asked the question: What factors are the strongest predictors of racial disparities in diabetes related complications?

Theoretical Framework

This research was based on a conceptual framework developed by Sandra Black (2002) regarding risk factors for the development of diabetes and diabetes complications (Figure 1). This model states that demographic and social characteristics contribute to 1) genetic vulnerability, 2) behavioral factors, 3) psychological factors, and 4) clinical factors. These four factors contribute to the incidence of diabetes and related

complications, co-morbid diseases, and disability (Black, 2002).). Black's (2002) diabetes framework is similar to the Social Ecology Model which is often applied when attempting to understand health issues.

Figure 1. Factors that Influence Diabetes and Diabetes Complications.



Black, S. A. (2002). Diabetes, diversity, and disparity: What do we do with the evidence? American Journal of Public Health, 92(4), 543-548.

Ecological models emphasize the connection between an individual and the environment. There are numerous social ecological models that affect health promotion policies. Sallis and Owen (1997) provide a working definition of social ecological models of health, stating that intra-personal, social and cultural, and physical environmental factors influence health behaviors. These factors interact on multiple levels to impact behavior change among individuals (Sallis & Owen, 1997).

Also, in the 1970's The Lalonde Report presented four elements that influence health: environment, lifestyle, human biology, and health care organizations. Rudolph Moos (as cited in Sallis & Owen, 1997) expanded upon the ecological model in relation to understanding health issues. His model proposed four environmental factors (physical setting, human aggregate, organizational, and social climate) that explain the factors that affect the health of individuals. Each of these models (Black, 2002; Sallis & Owen, 1997) focus specifically on the relationship between environmental factors and health (Sallis & Owen, 1997).

This study examined the prevalence of Black, White, and Mexican populations, in addition to any differences in the demographic and social factors between the two groups. There are significant differences in diabetes complications, with a higher prevalence of complications in the Black and Mexican communities. This research went beyond examining differences in the prevalence of social and demographic factors by also examining how a combination of these factors may contribute to the higher burden of complications experienced by Black diabetic patients. As the ecological theories state, health is affected not only by the presence of environmental factors but by the reciprocal

relationship that exists among these environmental factors and health that impacts the health status of individuals.

Hypotheses

Based on Black's (2002) theoretical framework, this study hypothesized that social and economic factors would predict racial disparities in diabetes complications. The hypotheses are that health and social factors among Black and Mexican diabetics will likely account for racial disparities found in diabetes complications.

The research hypotheses were:

H_1: Black and Mexican diabetics will have fewer interfaces with health care systems when compared to White diabetics.

H_2: Black and Mexican diabetics will have more physical functioning limitations compared to White diabetics.

H_3: Black and Mexican diabetics will have a lower educational level compared to White diabetics.

H_4: Black and Mexican diabetics will have more behavioral risk factors for developing diabetes complications than White diabetics.

H_5: Black and Mexican diabetics will encounter more indirect costs related to diabetes mellitus than will White diabetics.

H_6: Fewer interfaces with health care systems and higher indirect costs associated with diabetes mellitus will be the strongest predictors of diabetes complications among White, Black and Mexican diabetics.

H_7: Black, Mexican and White diabetics have different predictor variables for diabetes complications.

Lack of access to quality care is a barrier to care for patients with diabetes. Without health care, patients with diabetes are at even greater risk of developing complications associated with the disease. The literature review that follows presents studies that examine the prevalence of diabetes in the United States, complications associated with diabetes, diabetes events that lead to hospitalizations, the unmet needs of diabetics and health care for individuals with diabetes.

Chapter 2: Literature Review

This review of the literature examined studies concerning the prevalence of diabetes, the complications associated with diabetes, indirect and direct costs of diabetes, access to health care to cover related costs, and the disparities in diabetes complications and access to quality health care. The factors examined in this study are health care and social and economic factors that contribute to diabetes complications, as identified in Black's (2002) diabetes framework. These factors are also part of the ecological theory, especially the theory highlighted in the Lalond Report, which focused on health care organizations as an integral environmental factor. This was a unique contribution to ecological models. Additionally, social-ecological theory was examined, specifically Black's (2002) diabetes framework.

Diabetes

The prevalence of diabetes is alarmingly high, and according to projections based on the U.S. Census Bureau, cases of diagnosed diabetes will steadily increase. The Census has approximated that there will be 14.5 million cases of diagnosed diabetes by 2010 and 17.4 million by 2020. Data trends in diabetes diagnoses indicate that the prevalence of diagnosed diabetes differs based on race and ethnicity. For each year between 1980 and 2000, Blacks had a higher prevalence of diagnosed diabetes compared to Whites. In 1980, the rates for Black males and females were 4.0 and 4.9 respectively, compared to the diabetes prevalence rates for White males (2.5) and females (2.6). In 2000, the rates for Black males and females were 6.6 and 7.9 respectively, compared to the diabetes prevalence rates for White males (4.4) and females (3.8). There was diabetes surveillance system data available until 1998. In 2000 the diabetes rates for Hispanic

males and females were 6.74 and 6.35 respectively. Black females consistently had the highest prevalence rate of diabetes between 1980 and 2000. Between 1997 and 2000, the prevalence rates for Hispanic males and females mirrored that of Black males. During this time, the greatest increase (10%) in diabetes prevalence occurred among White males and Black females (Diabetes Surveillance System, 2003).

Another public health concern is the cost of diabetes, especially with such alarming prevalence projections. Based on changing demographics, diabetes will cost $156 billion in 2010 and $192 billion in 2020 (ADA, 2003). Diabetes related treatment places a steep burden on the U.S. economy. In 2002, diabetes cost an estimated $132 billion; these costs include both health care expenditures and lost productivity. Diabetics spend twice as much per capita on direct medical expenditures compared to non-diabetics (ADA, 2003). In a 2001 study, the Centers for Medicaid and Medicare Services (CMS) suggested that continuous access to quality health care is an effective method of addressing the high cost and burden of diabetes and related complications. The CMS study used the Behavioral Risk Factor Survey in Oklahoma to assess the burden of diabetes among diabetic patients. Of the 800 participants in this study, 16% of the diabetics did not have any health insurance, and 22% of the people with diabetes reported that they needed a physician but were unable to pay for one. The unemployment rate for persons with diabetes was 16% compared to a 3% unemployment rate for people without diabetes. Of the diabetics, 71% had an income under $20,000 per year (Valdmanis, Smith, & Page, 2001). The inability to access health care is a detrimental factor for diabetics, since diabetes is accompanied by numerous complications.

The Kaiser Permanente Medical Care Program conducted a longitudinal observational study from 1995 to 1998 of their diabetic patients. The study's goal was to assess ethnic disparities in diabetic complications using an insured population. Diabetic complications were defined as: 1) myocardial infarction (MI), 2) stroke, 3) heart failure, 4) ESRD, and 5) LEA. Results indicated that Blacks had a significantly greater number of complications, with the exception of MIs. Despite having access to care, Black diabetics with health care coverage often do not have adequate or quality health care to cover the high economic cost of diabetes (Karter et al., 2002). Schneider, Zaslavsky, and Epstein (2002) addressed quality of care among Black diabetics by examining diabetic enrollees in a Medicare managed care health plan. Results showed that there were statistically significant racial disparities in the quality of health care received among Black and White diabetic patients.

Diabetes Complications

The patient primarily manages her or his diabetes care. However, diabetes requires consistent interface with the health care community to detect and manage related complications. Compared to Whites, Blacks and Hispanics with diabetes tend to experience more severe complications associated with diabetes.

Due to the higher reported prevalence of micro-vascular complications for Blacks and Hispanics, compared to Whites in the 1990's, Karter et al. (2002) conducted a study to address the lack of updated epidemiological data on ethnic disparities in diabetes complications. They designed a longitudinal observational study using a cohort of 62,432 enrollees in the Kaiser Permanente Medical Care Program who had diabetes. Members of the Kaiser Permanente Diabetes Registry, established in 1993, (i.e. individuals with

diabetes who were 19 years of age and older) were asked to complete a health survey via a self-administered questionnaire or a computerized assessment in English or Spanish. Individuals who discontinued their health plan or denied having diabetes were excluded from the study. The survey provided information on ethnicity, education, behavioral factors, diabetes family history and information regarding diabetes type (type 1 or type 2) (Karter et al., 2002).

Analysis of ethnicity was restricted to four primary ethnic groups (Blacks, Asians, Latinos, and non-Latino Whites) for a total of 62,432 respondents. Karter et al. (2002) were interested in the incidence of five diabetes related complications between January 1995 and March 1997, including MI, stroke, congestive heart failure (CHF), ESRD and non-traumatic LEA. They selected these outcomes based on incidence of the complications on reported hospital discharge diagnosis codes, underlying cause of death on death certificates, Kaiser's ESRD treatment registry and previous study results. Because they were interested in incidence, not prevalence of diabetes complications, individuals with a history of events related to MI, stroke, CHF, and LEA in the five years prior to the study were excluded from the analysis of complications. Members with ESRD were excluded based on prevalence cases of ESRD because Kaiser's treatment registry contains lifetime histories of transplants and renal disease (Karter et al., 2002).

For the descriptive analysis, researchers calculated the age-adjusted, sex-specific and ethnic-specific rates for each of the five complications. The multivariate analysis consisted of a base regression model and three models that each built on the base model. The base model was a demographic model controlling for age and sex. The socioeconomic status (SES) model added education level and census block income level.

The modifiable risk model added diabetes treatment, self monitoring of glucose, smoking status, alcohol intake and obesity to the base demographic model. The clinical model (also referred to as the fully adjusted model) added type of diabetes, diabetes duration and family history of diabetes as well as height and peripheral neuropathy for LEA. There were no statistically significant differences between men and women related to ethnicity and complications, therefore, researchers combined the data for men and women for the analysis (Karter et al. 2002).

The study population included Black (14%), Asian (12%), Latino (10%) and non-Latino White (64%) patients with diabetes. Blacks and Latinos were twice as likely to live in a census-block with more than 20% of families living below the poverty line and at least 66% of the people with working-class employment. Blacks were more likely to treat their diabetes with pharmacological therapy (insulin or oral agents) compared to the other groups. Blacks had the shortest duration of diabetes, indicating a later age of diabetes diagnosis. For related health concerns, more Black patients reported hypertension; Black and White patients had the same percentage of self-reported peripheral neuropathy. Relative to White patients, Black patients had the same proportion of overweight individuals; however, Black patients had the highest percent of obese individuals, based on their body mass index (BMI) (Karter et al., 2002).

For strokes, CHF, non-traumatic LEA and ESRD, Blacks had the highest incidence rate of all the ethnic groups. White diabetics had the highest incidence rate of MI, compared to Blacks, Latinos, and Asians. Based on the models created by the researchers, there were ethnic disparities in the incidence of the five diabetes related complications. Researchers suggested that since disparities persisted in the fully adjusted

model, there are some factors not included in the model that also explain ethnic disparities, including various psychosocial issues, literacy and discrimination (Karter et al., 2002).

The study sample was a limitation. A majority of the Kaiser Permanente health plan enrollees younger than 65 years old were employed, which carries the assumption that they were healthy enough to work (Karter et al., 2002). This may serve as a sample bias. Despite this limitation, the study included a range of diabetes related complications, a large sample size and a prospective study design. These findings are generalizable to insured adults with diabetes. The researchers recommended that steps be taken to bridge the gap between access to and quality of care. They suggested that future research seek to understand the true extent and root of the disparity in diabetes related complications and care (Karter et al., 2002).

Complications and Socioeconomic Factors

As Karter et al. (2002) indicated, ethnic minorities in the United States have a higher incidence rate of ESRD compared to White diabetic patients. Krop, Coresh, Chambless, Shahar, Watson, Szklo and Brancati (1999) conducted the Atherosclerosis Risk in Communities (ARIC) study to examine factors contributing to the excess risk of ESRD in Black versus White patients. These researchers conducted a prospective cohort study over a three-year period in a multi-racial community of adults (n=15,792) with diabetes between 45 and 64 years old (Krop et al., 1999).

Krop and colleagues (1999) identified cases of diabetes mellitus based on the following criteria: oral medication, insulin, physician diagnosis (self-report) and a specific cut off for a fasting and non-fasting glucose level. Individuals who were not

Black or White were ineligible to participate in the study. Other than a few demographic differences, there were no statistically significant behavioral or clinical differences between the ineligible and eligible participants that would indicate a selection bias, which would threaten the study's internal validity (Krop et al., 1999).

Compared to White adults with diabetes, Blacks were more likely to be younger, female, smokers, and have a household income below $16,000 per year. Further, in comparison to Whites, Black adults with diabetes were less likely to have completed high school and have health insurance. The statistical analyses indicated Blacks were more likely to develop early renal function decline. Factors positively associated with the risk of developing ESRD were serum creatinine level, systolic blood pressure and serum glucose level. Educational attainment, having health insurance, a household income above $16,000 and engaging in leisure physical activity served as protective factors against early development of renal function decline (Krop et al., 1999).

Krop et al. (1999) created a model using a logistic regression and results indicated there was a 54% reduction in the excess risk of developing early renal function decline in Blacks after adjusting for socioeconomic factors. Also, after adjusting for age, sex, serum creatinine level, health behaviors, physiological factors and socioeconomic factors, there was an 83% reduction in the excess risk of early renal function decline among Black adults with diabetes. The importance of these findings is that the excess ESRD risk among Blacks can be primarily explained by modifiable and preventable factors. Because of study limitations, these results can be generalized to populations with type 2 (but not type 1) diabetes (Krop et al., 1999).

Diabetic complications can be prevented or delayed by improving socioeconomic factors, as Krop et al. (1999) demonstrated with early renal function decline. To extend their research others must examine how socioeconomic factors impact diabetes complications that are preventable. Booth and Hux (2003) conducted a study to examine the effect of socio-economic status on the number of times a person had been hospitalized for acute diabetic complications that could be prevented, which were hypoglycemia and hyperglycemia. Booth and Hux (2003) used the Ontario Diabetes Database (ODD) of patients with diabetes mellitus (DM) gathered from physician and hospital claims. Patients with at least one hospitalization or two physician claims for DM within any two-year period were included in the database. The ODD has a reported specificity of 95% and sensitivity of 86% for detecting primary care patients with diabetes mellitus. Individuals included in the Booth and Hux (2003) analyses were all those in the database with DM between April 1, 1992, and March 31, 1999 (Booth & Hux, 2003).

The study outcomes of interest were at least one hospitalization or an emergency department visit for acute diabetes mellitus complications. The main predictor variable was socio economic status (SES). Due to lack of available data, individual income level was estimated using neighborhood level data from the Canadian census. Binomial methods of analyses were used. The main analysis was a chi-square comparing the proportion of individuals with an acute DM event across their income quintile. Researchers used a logistic regression to adjust for sex, age, co-morbidity and type of residential area (urban versus rural), geographic region and use of ambulatory care. Ambulatory care was operationalized as having a usual care provider, number of primary

care office visits and DM care by specialists. Researchers were able to control for access to health care since there is universal health coverage in Canada (Booth & Hux, 2003).

Descriptive statistics showed there were 611,404 DM cases during the established study years. Results indicated that more people with DM were in the lowest income quintile. Patients in the highest quintile were younger and less likely to live in rural and remote areas. Researchers reported that 14% of the patients had at least one hospitalization or visit to the emergency department. Hyperglycemia (94%) was the most common reason for hospital admission, due primarily to ketacidosis and a combination of hyperglycemic coma and acidosis. Reasons for visits to the emergency department followed a pattern similar to that of hospital admissions (Booth & Hux, 2003).

Findings indicated there was an inverse relationship between acute diabetic event rates and income level. DM patients in the lowest income quintile were 44% more likely to have an acute DM event than patients in the highest income quintile. For each decrease in income quintile level, the risk of hospital admission or emergency department visits increased 10% (Booth & Hux, 2003).

Based on the logistic regression, Booth and Hux (2003) found that failure to see a primary care physician in the previous year was the strongest predictor of an acute DM event. Patients that had more primary care visits, a usual primary care provider and DM care by a specialist experienced fewer DM events. Individuals with lower incomes were at increased risk for acute events in rural settings rather than an urban setting. After adjusting for income, age and SES still had a significant effect on acute DM event rates (Booth & Hux, 2003).

According to the Booth and Hux (2003), the magnitude of the differences in this study was substantially lower than differences observed in the United States. This suggests that universal health coverage decreases but does not eradicate the frequency of hospital admissions for DM patients with low income levels (Box & Hux, 2003). Researchers acknowledged the study's limited external validity in regards to the United States. Therefore, they (2003) suggested that social inequalities and other social factors contributed to the variance in diabetic complications across income groups (Booth & Hux, 2003).

Direct and Indirect Costs Associated with Diabetes

It has been established that health care coverage (Karter et al., 2002) and economic status (Krop et al., 1999; Booth & Hux, 2003) are contributing factors to the health care an individual with diabetes receives. As previously noted, diabetes is an expensive illness.

The ADA estimated the size of the diabetes population, health care use and expenditures associated with diabetes (direct cost) and the value of productivity lost due to diabetes (indirect cost) among individuals in the United States. Estimated costs were based on the 12.1 million cases of diagnosed diabetes in the U.S. as of 2002 (ADA, 2003). They also took into consideration any health care expenditures and productivity lost due to diabetes related complications, including: neurological complications, peripheral vascular disease, cardiovascular disease, renal disease, endocrine/metabolic disease, ophthalmic complications, general medical conditions and other chronic complications. The ADA identified health care expenditures as costs incurred by people with diabetes that would not otherwise exist if the person did not have diabetes. The

estimated costs used in the analysis were based on actual payments for care services, not charges for services. These were the direct costs of diabetes. To calculate the indirect costs, the ADA examined lost or forgone productivity, which included temporary incapacity due to lost workdays and bed days, permanent disability and premature mortality (ADA, 2003).

Adults 65 years and older comprised the greatest proportion of people receiving institutional care, outpatient care, home health visits and hospice care days for diabetes, even though persons 45 to 64 years old had the highest prevalence of diabetes. Approximately $91.8 billion in health care expenditures were linked to diabetes, 52% was spent on adults 65 years and older and 34% on adults 45-64 years of age with diabetes. The primary use for diabetes related health care is attributed to general medical conditions for non specialty health care. General medical conditions account for 48% ($44 million) of diabetes health care expenditures. Of the primary complications, cardiovascular disease accounts for the largest share of health care use, approximately four million hospital inpatient days or 24% of hospital days are attributable to diabetes. All together, chronic diabetes complications account for 27% of associated health expenditures (ADA, 2003).

In total, the United States has spent approximately $865 billion in 2002, 58% of the total U.S. health expenditures ($1.5 trillion). This analysis of costs does not take school-based clinics, public health clinics, dental care, podiatric care, optometry care and products, research and over-the-counter medications into consideration. Diabetes is not only expensive for the U.S., it is a heavy economic burden on individuals. In 2002, people with diabetes spent approximately $13,243 in health care expenditures, whereas

people without diabetes expended $2,560 in health expenditures (ADA, 2003). These are the direct costs of diabetes. The indirect costs to the individual are also steep. In 2002, there were 176,000 cases of diabetes related permanent disability, costing more than $7.5 billion annually. Also in 2002, there were 186,000 total deaths attributed to diabetes, more than 2.5 million years of potential life lost and $21.5 billion lost in productivity (ADA, 2003).

U.S. health care spending for diabetes is double the estimated health care spending of people without diabetes. These direct and indirect costs are a gross underestimation of the true cost of diabetes to society and the individual (ADA, 2003). To specifically examine the costs of diabetes on the individual, Valdmanis et al. (2001) used the Behavioral Risk Factor Surveillance Survey (BRFSS) for Oklahoma and followed the ADA's guidelines to define direct and indirect costs of diabetes. These researchers hypothesized that persons with diabetes had more disability, less access to care and fewer economic resources than individuals without diabetes. They matched people with diabetes to those without diabetes, based on age, race/ethnicity and sex. Ninety-four percent (94%) of the respondents were successfully matched and 400 subjects with diabetes were used in the sample. The outcomes of interest were general health status, possession of a health insurance plan, impaired physical health, impaired mental health, disability days, inability to pay for a physician, employment status and annual household income. Investigators used chi-square analyses to assess any statistically significant relationships between matched respondent pairs (Valdmanis et al., 2001).

Results indicated that 47% of diabetics compared to 23% of non-diabetics reported at least one day of poor physical health. Diabetics averaged 8.3 days of poor physical health compared to their non-diabetic counterparts, who averaged 3.0 days. Diabetics averaged significantly more days of poor mental health, more days of total disability, higher rates of unemployment, and were more likely to have a household income under $20,000 compared to their non-diabetic counterparts. Also, people with diabetes were more likely to report a poor or fair general health status while people without diabetes were more likely to report their health status as excellent or very good (Valdmanis et al., 2001). Similar to other studies (Ayanian, Weissman, Schneider, Ginsburg & Zaslavsky, 2000), this study reported that people with diabetes were more likely to lack health care coverage and twice as many people with diabetes reported that they could not see a physician when they needed one due to cost barriers (Valdmanis et al., 2001).

The diabetics in Valdmanis et al.'s (2001) study did not score as well on measures of general health status, disability days, access to health care and economic burden associated with accessing physician care. Diabetics also experienced a higher burden of diabetes related to social factors. There were statistically significant differences in burden for diabetics compared to non-diabetics. Valdmanis et al. (2001) suggested that their results were generalizable to racial and ethnic minorities in the U.S.

Another indirect cost measure of diabetes complications is the number of years of potential life lost (YPLL). Using the National Health Interview Survey (NHIS) data from 1986 through 1994, Wong, Shapiro, Boscardin and Ettner (2002) calculated the differences in YPLL and potential gains in life expectancy based on race and level of

education. Potential gain in life expectancy is what an individual's life expectancy would be if her or his specific disease was eliminated. Wong et al. (2002) examined 621,398 participants who were either Black or White and over 18 years old. Results indicated that individuals with a lower level of education had more YPLL (12.8 years) compared to persons with more education (3.6 YPLL). Hypertension was the biggest contributor to the racial disparity in YPLL; there was a 15% difference in YPLL between Blacks and Whites with diabetes. Further, diabetes was the third largest contributor to the health status racial disparity between Black and White diabetics, with an 8.5% difference in YPLL (Wong et al., 2002).

The racial disparity in potential gains in life expectancy by eliminating hypertension was 1.57 years, 0.23 fewer years gained for Blacks. This finding implies that even if diabetes were eliminated, Blacks would gain fewer years of life. Similar to the YPLL, hypertension had the largest effect on the racial disparity regarding gains in life expectancy. Diabetes was the fourth largest cause of the disparity, preceded by HIV and homicide. There were 0.18 fewer years gained for Blacks, compared to Whites, with diabetes (Wong et al., 2001).

Health Care Services

Even though access to health care does not fully eliminate diabetes related complications, improved access to care is a beneficial service for diabetics. Laditka, et al. (2001) investigated the use of health care among diabetics with employer-based insurance. They examined all insurance claims in 1996 in Ohio. All eligible individuals (i.e. under 64 years of age and not on Medicare or Medicaid) were enrolled in an employer based insurance plan, regardless of health history (Laditka et al., 2001).

Laditka and colleagues (2001) believed that diabetes complications affecting diabetics over 65 years of age are different from the diabetes complications that individuals under 65 years of age experience. Therefore, they wanted to gain a thorough understanding of the effects of diabetes on adults below 65 years of age (Karter et al., 2000).

When examining the data, unique identifiers were provided for each claim submitted. Claims were organized by demographic information, medical event (defined by type of service or procedure), and total diabetes complications. Diabetes cases were identified by previously established diagnosis codes. Individuals were identified as having diabetes if they had one inpatient admission recorded as diabetes or two outpatient claims recorded as diabetes. All diagnoses and procedures specified in the claims were then identified. Diabetics' health care uses and costs were then compared to participants in the entire study population (Laditka et al., 2001).

Almost two percent (1.6%) of the total population was classified as diabetic, however, the population of people with diabetes accounted for 9.4% of the overall health care costs. Individuals with diabetes spent six times more money annually on health care than those without diabetes. The total annual health care costs for people without diabetes was $909, compared to $5,659 annually for diabetes related costs for individuals with diabetes. Demographic data indicated that a higher percentage of the population with diabetes was concentrated in the older age group, 55 to 64 year olds, which was consistent with what is expected given that adult onset (type 2) diabetes is more prevalent among people 40 years of age and older. Despite this population having more cases of diabetes, they did not consume the largest amount of health care resources. The authors

did not report which age group consumed the largest portion of their health care costs on their diabetes care. Laditka et al. (2001) demonstrated that use of health care services for those with diabetes was higher than individuals without diabetes (Laditka et al., 2001).

More specifically, the rates of use were four times higher for inpatient services, two times higher for outpatient services, and 2.6 times higher for professional services among diabetics, in comparison to the total population. In addition to higher rates of using health care, the diabetic population incurred more health care costs than the total population. Regarding health care expenditures for diabetics, costs were 4.8 times greater for inpatient services, approximately three times greater for outpatient services, and three times greater for professional services compared to the total population (Laditka et al., 2001). However, these differences were not tested for statistical significance. Based on the higher use of health care and higher expenditures for diabetics, Laditka et al. (2001) suggested that higher health care costs incurred by people with diabetes are based on the higher use of health care and not higher costs for the services they receive.

Laditka et al. (2001) also compared the use of ambulatory care services for diabetics and non-diabetics. Results indicated that diabetics had higher uses of outpatient facilities (2.5 times higher), emergency department visits (2 times higher), office visits (2.4 times higher), physician consultations (3 times higher), and laboratory and radiology tests (2.8 times higher) compared to the total population. These higher rates for diabetics were statistically significant for each of the above-mentioned services (Laditka et al., 2001).

Researchers examined the volume of resources used by physicians to provide care to individuals with diabetes. The analysis included nine physician categories, including

all primary care physicians, ophthalmologists, cardiologists, cardiothoracic surgeons, endocrinologists, general surgeons, infectious disease specialists, nephrologists, and vascular surgeons. Physicians used more resources to treat diabetics across all categories compared to physician resources used to treat the total population. Of the physicians included in the analysis, those who treat long-term diabetes related complications (ophthalmologists, endocrinologists, and nephrologists) used the greatest number of health care resources (Laditka et al., 2001).

There is a difference between access to health care and access to quality health care. Assessing the quality of health care is an involved task. Schneider et al. (2002) suggested that Blacks are at increased risk for health complications because they do not receive quality health care. Their research targeted people enrolled in a managed care insurance plan. They chose a managed care program because one of the plan's main features included mandatory enrollment with a primary care physician, outreach for populations with special needs and case management programs for chronic conditions. Schneider et al. (2002) wanted to specifically look at quality of care to determine whether racial disparities exist in the quality of care Medicare enrollees received. To assess the quality of health care received among Medicare enrollees, they used CMS' Health Plan Employer Data and Information Set (HEDIS). The Medicare database allowed researchers to study racial disparities in the quality of health care (Schneider et al., 2002).

The 1998 HEDIS focused on four health outcomes to measure quality of care, including breast cancer screening, eye examinations for diabetics, beta-blocker (b-blocker) use after MI and post hospitalization follow-up for mental illness. Eligible individuals had to be continuously enrolled in a health care plan for 45 days or more

without a break. There were 415,040 enrollees in the HEDIS included in at least one of the four clinical measures previously mentioned (Schneider et al., 2002).

CMS also provided demographic data for 4.7 million managed care enrollees. Schneider and colleagues used the following demographic characteristics: age, sex, race, Medicaid recipient (also termed dual-eligible), low-income residence, residence in an area with low, medium or high proportion of individuals who attended college and rural residence. Information about the type of residence was based on the 1990 census using the zip code provided in the enrollee's demographic file. This file also provided the eligibility of the individual, based on her or his disability, presence of ESRD, or being older than 65 years of age. After matching the files from CMS, there was HEDIS and demographic data for 363,199 beneficiaries. After exclusions based on ineligibility, there were 305,574 enrollees in the study sample population (Schneider et al., 2002).

In addition to socio-demographic characteristics, they examined the characteristics of the beneficiaries' health plans. The health plan characteristics of interest included total enrollment, Medicare enrollment, presence of Medicaid beneficiaries, age of health plan, plan type, tax status and region. Based on the proportion of Black enrollees (8% of the enrollees were Black), Schneider et al. (2002) classified each plan into three textiles, low, medium, or high.

Among enrollees in the entire sample, the service most utilized was eye examinations for diabetics. There were 161,179 managed care enrollees with diabetes who received eye examinations, and these enrollees used 263 different health plans. Eleven percent of this population was Black and 80% were White. Schneider et al. (2002), attributed this relatively high proportion to the higher prevalence of diabetes

among the Black population. Of the four HEDIS measures, the lowest performance rate was on eye examinations for patients with diabetes (49.6%), meaning that only 49.6% of individuals with diabetes received the necessary eye examinations. Compared to White enrollees, Blacks were significantly less likely to receive each of the HEDIS services.

According to the researchers, the analysis illustrated that quality of care received was significantly lower for Black enrollees compared to White enrollees for eye examinations, breast cancer screenings, b-blocker use for MI and follow-up for mental illness hospitalization. There were consistent racial disparities for each HEDIS measure; however, racial disparities were not completely explained by the socioeconomic factors or racial differences in health plan enrollment. Even within the same health plan, Blacks were more likely than Whites to receive a poorer quality of health coverage for eye examinations, B-Blocker use for MI and follow-up for mental illness hospitalization. Based on this result, researchers suggested that health plans address racial disparities in care. The implication of these findings was that identifying racial disparities can be used as leverage to ignite change in managed care organizations to implement interventions aimed at improving the quality of care for minority enrollees (Schneider et al., 2002). Schneider et al. (2002) identified lack of information about patients' knowledge, beliefs, attitudes toward health care, and co-morbidities as a limitation in their study and suggested future studies consider these factors and address why racial disparities exist.

There are disparities in accessing care for insured diabetic patients and there are disparities in the quality of care received. Ayanian et al. (2000) identified the numerous unmet health needs of uninsured adults in the United States using the 1997 and 1998 Behavioral Risk Factor Surveillance System (BRFSS). Their study compared access to

physicians for both uninsured and insured adults. They examined the rate at which individuals used preventive health services (Ayanian et al., 2000).

The BRFSS was designed by the Centers for Disease Control and Prevention (CDC) to study health related behaviors in the United States. The BRFSS randomly selected and interviewed one adult in each household, between 18 and 64 years of age (CDC's BRFSS, 2000). This study population included 105,764 respondents in 1997 and 117,364 in 1998 (Ayanian et al., 2000).

Uninsured adults were stratified into long-term uninsured (uninsured for more than one year) and short-term uninsured (uninsured for less than one year) at the time they were surveyed. Insured adults were defined by having any public or private source of health insurance coverage. The demographic variables of interest were sex, age, race, education, income, employment status and health status, all of which were self-reported. Risk factors were identified, including smoking, obesity, hypertension, diabetes mellitus, elevated cholesterol, binge drinking and self-perceived risk of HIV infection (Ayanian et al, 2000).

The two unmet health needs examined were inadequate access to a physician and failing to receive clinically necessary preventive services. Inadequate access was defined as not receiving a routine check up in the past two years and a period in the previous year when an individual needed to see a physician, but did not because of cost. Failure to receive primary preventive care was defined as receiving adequate, not optimal care, based upon nationally established age-based recommendations and guidelines. These preventive services were related to cancer screening, cardiovascular preventive services, HIV screening and diabetes preventive services. Diabetes related preventive services

included eye exams, foot exams, cholesterol screenings, glycosylated hemoglobin measures, influenza vaccinations and pneumococcal vaccinations (Ayanian et al., 2000).

In 1998 and 1997, respectively, 4.3% and 4.2% of all respondents were uninsured for less than one year and 9.7% and 9.8% were uninsured for more than one year. There were more uninsured adults among men, younger adults, Blacks, Hispanics, residents in the South and West U.S., individuals with lower education and income levels, self-employed persons, unemployed persons and persons not in the labor force. Adults reporting a good, fair or poor health status were two to three times more likely to be in the long-term uninsured group compared to adults reporting their health status as excellent or very good (Ayanian et al., 2000).

Of the individuals reporting they could not see a physician because of cost, 40% were long-term uninsured adults, 33% were short-term uninsured adults and 7% were insured adults. Cost barriers to seeing a physician for long-term uninsured adults were most prevalent for women, older adults, Blacks, unemployed persons and individuals with low incomes. After adjusting for age, sex, race, region, employment, income and education, results indicated that long and short term uninsured adults were significantly more likely to experience cost barriers to care in the previous year. Long-term uninsured adults were also significantly more likely than insured adults not to have a routine check-up in the prior two years. The differences were smaller, yet significant, between long-term and short-term uninsured adults. Long-term uninsured adults were significantly more likely to have unmet health needs for preventive care services compared to insured adults (Ayanian et al., 2000).

Results of this study indicated that approximately half of the uninsured adults in the U. S. with less than a $15,000 annual income could not receive physician care for cost reasons. Uninsured adults with chronic conditions and severe health risks, compared to insured adults, were more likely to indicate they could not see a physician due to cost purposes, even after adjusting for income and other possible confounding variables. A majority of long-term uninsured adults who reported poor or fair health indicated they had abstained from needed care, and they were less likely to receive routine check-ups. Ayanian et al. (2000) suggest that the periods during which long-term uninsured adults have gone without care are the points at which their health risks and concerns could have been addressed. Based on the results, the authors also highlight that even short term-periods without care can result in high proportions of people missing needed care (Ayanian et al., 2000).

Long-term uninsured adults with diabetes were less likely to receive the necessary preventive care services specifically outlined for diabetics, which is of special concern because it increases the risk for the severe and life threatening complications associated with diabetes. Improving access to health care for diabetics can delay preventable complications (Ayanian et al., 2000).

Conclusion

The spectrum of diabetes related complications can best be addressed by a strong partnership between the health care community and the individual. Research shows that complications experienced by people with diabetes are primarily preventable with proper self-management and interface with the health care community. Regular eye examinations, screening, proper nutrition, physical activity, and health care coverage play

an integral role in secondary prevention for people with diabetes. However, complications associated with diabetes are not evenly distributed; there are racial disparities in complications. Black and Hispanic patients with diabetes experience significantly more complications, including ESRD, cardiovascular heart disease, stroke and LEA. There are also disparities in quality of health care services accessed by Black and Hispanic patients, compared to White patients.

Health care concerns related to diabetes include a lack of access to health care and inadequate quality of health care services. In addition to the 16% of people in the U.S. who lack access to health care, there are a number of individuals who are not accessing the proper services to address their health care needs (CDC Wonder, 2003). Diabetics that get their eyes examined but do not get screened periodically for other complications are not entirely attending to their health care needs.

Further, research also indicates that gaps in periods of health care coverage are strongly related to an increased risk of complications. There are also economic issues related to the disparities in diabetes complications. In comparison to individuals without diabetes, people with diabetes are more likely to report they were unable to see a physician when they needed one and lacked access to a routine physical check-up due primarily to cost (Ayanian et al., 2000). Having a low income level coupled with lack of access to a primary care physician are strong predictors of diabetes complications and having to be hospitalized for a diabetes event (Booth & Hux, 2003).

Chapter 3: Methodology

This chapter describes the methods used for conducting this secondary data analysis of the NHANES 1999-2000 dataset. The methodology provides a detailed description of the study's population of interest, sample participants, and materials used to collect data. The procedures section describes the experimental design, how study groups were formed, and experimental manipulations. The chapter ends with a description of the data analysis plan.

Participants

The NHANES 1999-2000 participants were selected using Census information. NHANES split the U.S. into communities and then neighborhoods, which were selected at random. Housing units in each neighborhood were randomly chosen. Trained interviewers approached an individual within the selected households and asked questions to assess household eligibility. Participants in each household were selected based on age, race/ethnicity, and gender. Once eligibility was determined, the interviewer set up an appointment with the respondent for an in-home interview. The interview lasted approximately one hour and responses were entered on a laptop computer. The same person's responses were represented throughout the in-home questionnaires and mobile unit physical health examinations (NHANES, 2000).

There were 9,965 total participants in the NHANES 1999-2000 data set. Each participant represented approximately 50,000 other U.S. residents (NHANES, 2000). In concordance with previous literature regarding health disparities, diabetes, and issues of access and quality of health care, this investigation used participants between 18 to 64 years old. Populations within this age range share unique issues apart from individuals

under 18 and over 65 years of age. The analyses did not include any individuals who did not complete the Household Interview Component Questionnaires (NHANES, 2000) related to diabetes, health care and pertinent demographic information. The population of interest included individuals diagnosed with diabetes by a health care physician, but not those diagnosed during pregnancy. This study included only participants that identified their race as Mexican, non-Hispanic Black/African-American, or non-Hispanic White. Previous research identified a significant health disparity between these three groups (NHANES, 2000); hence, the Healthy People 2010's national focus on eliminating health disparities.

Materials

This study was a secondary analysis of national population based data, the NHANES 1999-2000, created by the CDC's National Center for Health Statistics (NCHS). In 1970, the U. S. Secretary of the Department of Health, Education and Welfare (now the Department of Health and Human Services) called for a task force to develop a national surveillance system to conduct clinical observations, professional assessments and record dietary intake patterns. The product of this task force was the NHANES. There have been four waves of the NHANES, 1) 1971-1975, 2) 1976-1980, 3) 1988-1994 and 4) 1999-2000. There was also a Hispanic Health and Nutrition Examination Survey conducted from 1982-1984 to capture data on the Hispanic population in the U.S. The NHANES has effectively provided longitudinal surveillance data regarding the health status of the U.S. population since 1971 (CDC, 2003).

The NHANES questionnaires were administered using household interviews. There are eight different questionnaires and a physical examination and laboratory

component for NHANES 1999-2000. This research study only used information provided in the Sample Person Questionnaire portion of the NHANES survey. All participants in this section were 18 years of age or older. Only one person per household is represented in the Sample Person Questionnaire. The Sample Person Questionnaire includes items on a variety of different topical areas (NHANES, 2000). This study focused on sections related to demographic information, diabetes and related medical conditions and complications, physical functioning and activity, hospital utilization and access to care, and items related to the health behaviors of individuals and their diabetes risk factors (Table 1).

Table 1. Topic Areas in the NHANES 1999-2000 Sample Question Questionnaire.

- Acculturation
- Audiometry
- Balance
- Blood Pressure*
- Cardiovascular disease*
- Demographic information*
- Dermatology
- Diabetes*
- Dietary supplements and prescription medication
- Diet behavior and nutrition*
- Early childhood
- Hospital utilization & access to care*
- Immunization
- Kidney conditions*
- Medical conditions*
- Miscellaneous pain
- Physical activity and fitness*
- Physical functioning*
- Occupation*
- Oral health
- Osteoporosis
- Respiratory health and disease
- Smoking and tobacco use*
- Social support*
- Tuberculosis
- Vision
- Weight history

NHANES 1999-2000
Areas with an asterisk (*) were included in this study.

Procedures

When collecting NHANES 1999 and 2000 data, participants were first given a consent form. They were told about all aspects of the survey and physical examination

data collection process. They were fully aware the results would be used for research purposes, and the Final Report of Findings was mailed to each household 12 to 16 weeks after participants completed all examinations. There was no deception in the informed consent process. There was a separate consent form completed allowing researchers to keep specimen samples frozen for future research purposes. Participants are given an 800 number in case they decide they no longer want their samples frozen for future research use (NHANES, 2003). For the purpose of this study, only the survey questionnaire data were examined, not results from the laboratory examinations.

Subjects were interviewed in their home. For Spanish speaking participants, Spanish versions of the NHANES were administered using computer-assisted personal interviews (CAPI) as well as an English language version. Once the household eligibility was determined, the interviewer set up a date for the in-home questionnaire interview to take place. Interviewers presented NHANES photo identification. Participants were asked questions about their health status, health behaviors, and disease history. The interviews took approximately one hour and responses were recorded on a laptop computer. Upon completing the interview, participants made appointments for the Mobile Examination Center (MEC). They were also given a contact number for inquiries about the survey (NHANES, 2003).

Participants were made aware that the MEC visit did not replace their regular physician visits. They were also told that the information collected would be used for studying health issues and that researchers with access to the data would not be able to identify them or their families. All participants were provided a cash payment for their

time and effort. They were also reimbursed for transportation, child care and elderly care (NHANES, 2003).

As previously mentioned, the present study consisted of a secondary analysis of the NHANES 1999-2000 Household Interview Component Questionnaire, the in home questionnaire interview. Only respondents with diabetes who were Black, White or Mexican and between the ages of 18-64 were included in the analyses.

Data Analysis

This study employed descriptive and inferential statistics to examine the issues of diabetes complications and health disparities using Statistical Package for the Social Sciences (SPSS). Descriptive analyses were run on all variables to determine frequency, percents, median, mode, and mean and standard deviation where appropriate. Participant race was determined using item race/ethnicity recode (RIDRETH1). This question allowed respondents the option of identifying more than one racial/ethnic category. This study included only those individuals that chose non-Hispanic Black/African American, Mexican American or non-Hispanic White and did not select any other racial or ethnic category. All other participants were excluded from the sample.

There were seven research hypotheses. The first hypothesis (H_1) stated that Black and Mexican diabetics will have fewer interactions with the health care system when compared to White diabetics. Interaction (or interface) with the health care system is equivalent to contact with the health care system, including the frequency of health care visits, availability of health care, use of health care services, type of health care services, and health care coverage. Health care interface was measured using a number of variables, including whether health insurance was offered at the respondent's main job

(OCQ.280), having a routine place to go for health care (HUQ.030), the type of place the individual went most often for care (HUQ.040), the number of times she/he received care in the past 12 months (HUQ.050), the length of time since her/his last health care visit (HUQ.060), whether the person was a patient in a hospital overnight (HUQ.070), the number of times spent overnight in a hospital (HUQ.080) and whether the person had seen a mental health professional in the past year (HUQ.090). Hypothesis one was analyzed by conducting chi-square analyses using race/ethnicity and the health care interface variables.

Hypothesis 2 (H_2) stated that Black and Mexican diabetics will have more physical functioning limitations compared to White diabetics. Physical functioning limitations included limitations keeping one from working (PFQ.048), physical, mental or emotional limitations (PFQ.059), and any limitations because of experiencing memory or confusion problems (PFQ.056). The physical functioning scale was cumulative, and included the total number of limitations respondents reported. Higher numbers represented more physical functioning limitations. Physical functioning limitations were also used when measuring the indirect cost of diabetes. To determine the relationship between physical functioning variables and race/ethnicity, chi-square analyses were conducted.

Hypothesis 3 (H_3) stated that Black and Mexican diabetics will have a lower educational level compared to White diabetics. Educational level was measured by highest level of education completed (DMD.140). This relationship was examined using a chi-square analysis of race/ethnicity and education level.

Hypothesis 4 (H_4) stated that Black and Mexican diabetics will have more behavioral risk factors for developing diabetes complications than White diabetics. The health behaviors examined were smoking behavior, dietary behavior, alcohol consumption and physical activity. The smoking behavior variables included smoked 100 or more cigarettes ever (SMQ.020), do you now cigarettes (SMQ.040), the number of cigarettes smoked per day before quitting (SMQ.057R), at screening (SMQ.080R), and in the past 30 days (SMD.070R), the number of years smoked current amount of cigarettes (SMD.075R), number of days smoked cigarettes during the past 30 days (SMD.040R), the age started smoking cigarettes (SMD.030R), and the age last smoked cigarettes regularly (SMD.055R). The dietary behaviors and alcohol consumption variables were type of salt used at the table (DBQ095), how often the skin of poultry was consumed (DBQ120), having meals delivered at home (DBQ.330), whether meals were eaten at a community or senior center (DBQ.300), number of times per week respondents ate restaurant food (DBD.090), helpings of protein, milk/dairy, fruit/fruit juice, breads/grains, vegetables eaten per day (DBD.270AR-DBD.270ER), and frequency of drinking beer, wine, and alcohol per month (ALD.240, ALD.250, and ALD.260). The physical activity variables included moderate tasks done around the home or yard (PAQ.100), usual daily activities (PAQ.180), and daily hours of television watching (PAQ.480). Some of these variables were categorical while others were interval, therefore, their relationship with race/ethnicity was analyzed using either one-way analysis of variance (ANOVA) or chi-square analyses.

Hypothesis 5 (H_5) stated that Black and Mexican diabetics will encounter more indirect costs related to diabetes mellitus than will White diabetics. This study used the

ADA's definition of indirect costs which is measured byanalyzing forgone productivity. This study's indirect cost measures included the type of work activity done last week (OCQ.150) and the main reason for not working last week (OCQ.380). These variables were used to get a sense of whether individuals had worked the previous week and if they were out of work due to health reasons. The relationship between indirect costs and race/ethnicity was determined using a chi-square analysis.

Hypothesis 6 (H_6) stated that fewer interactions with health care system and higher indirect costs associated with diabetes mellitus will be the strongest predictors of diabetes complications among White, Black and Mexican diabetics. There were two separate logistic regressions conducted to create two separate models. The dependent variable for both models was diabetes complications (COMREC4); each model controlled for age (RIDAGEYR), gender (RIAGENDR), education level (DMD.140) and racial/ethnic category (RACETHN).

The predictor variables in the health care model included diagnosed blood pressure (BPQ.020), having a routine place to go for health care (HUQ.030), the number of times she/he received care in the past 12 months (HUQ.050), and whether the person had seen a mental health professional in the past year (HUQ.090).

The predictor variables in the indirect costs model were physical, mental or emotional problems preventing the individual from working (PFQ.048), work limited because of a physical, mental or emotional problem (PFQ.059), limitations because of experiencing memory or confusion problems (PFQ.056), the type of work activity done last week (OCQ.150), and the main reason for not working last week (OCQ.380R3). Physical functioning limitations and lost productivity variables were both used in the

indirect costs model based on the ADA definition stating that both capture temporary incapacity for diabetics (ADA, 2003).

Hypothesis 7 (H_7) stated that Black, Mexican and White diabetics will have different predictor variables for diabetes complications. The predictor variables included physical, mental or emotional problems preventing the individual from working (PFQ.048), work limited because of a physical, mental or emotional problem (PFQ.059), limitations because of experiencing memory or confusion problems (PFQ.056), the type of work activity done last week (OCQ.150), the main reason for not working last week (OCQ.380R3), diagnosed blood pressure (BPQ.020), having a routine place to go for health care (HUQ.030), the number of times she/he received care in the past 12 months (HUQ.050), and whether the person had seen a mental health professional in the past year (HUQ.090).

Chapter 4: Results

Sample Demographics

This study's sample included the 189 participants from the NHANES 1999-2000 sample who were diagnosed with type I and type II diabetes mellitus and were non-Hispanic White, non-Hispanic Black or Mexican American. At the time of screening, the mean age of the sample was 53 years (SD = 10). The sample's average years of diagnosed diabetes was 44 years (SD = 13). The demographic characteristics of the sample are listed in Table 2.

Table 2. Demographic and Background Variables.

	Diabetics		NHANES Sample	
Variable	n	(%)	n	(%)
Gender				
Males	95	(50)	4,883	(49)
Females	94	(50)	5,082	(51)
Race				
Non-Hispanic White	52	(28)	3,367	(37)
Non-Hispanic Black	56	(30)	2,228	(25)
Mexican American	81	(42)	3,393	(38)
Served in the Armed Forces				
Yes	20	(11)	717	(13)
No	168	(89)	5,004	(87)
Country of Birth				
United States	137	(73)	8,037	(81)
Mexico	45	(24)	1,146	(12)
Other country	5	(05)	714	(07)
Education				
Less than High School Education	103	(55)	5,124	(61)
High School Diploma	37	(20)	1,286	(15)
Post-High School Education	49	(26)	1,971	(24)
Work Status				
Working at a job or business	95	(50)	3,130	(60)
Looking for work	4	(02)	127	(02)
Not working at a job or business	90	(48)	2,775	(38)

Sample: N = 189
NHANES 1999-2000: N = 9,965

A majority of this sample rated their general health condition as 'fair or poor' (86%, n=163) and their health now compared to a year ago as 'about the same' (60%, n=113). For their diabetes treatment 69% (n=130) took oral hypoglycemic agents. Of the working respondents in the sample, 64% (n=61) had health insurance offered at main job. Of the 95% (n=179) who reported having a routine place to go for healthcare and 32% (n=60) had two to nine health care visits in the past year (Table 3).

Table 3. Health Related Background Characteristics

Variable	n	(%)
General Health Condition		
Fair or poor	163	(86)
Good to excellent	26	(14)
Health Now Compared to a Year Ago		
Better	40	(21)
Worse	36	(19)
About the same	113	(60)
Health Status		
High Blood Pressure	109	(58)
High Cholesterol	82	(53)
Medications		
Insulin	42	(22)
Oral hypoglycemic agents	130	(69)
Health Care		
Health insurance offered at main job	61	(64)
Seen mental health professional in past year	14	(07)
Routine place to go for health care	179	(95)
Overnight hospital patient in past year	55	(29)
Health Care Facility Used Most Often		
Clinic or health center	54	(30)
Doctor's office or HMO	117	(65)
Hospital ER or outpatient department	6	(04)
Other	3	(02)
Frequency of Health Care Visits in Past Year		
None	9	(05)
1 time	14	(07)
2-3 times	41	(22)
4-9 times	60	(32)
10-12 times	29	(15)
13 or more times	36	(19)

N=189

Table 3a depicts the diabetes complications of this sample of diabetics. A majority of this sample, (66%, n=125). Having pain in the calf or calves (78%, n=54) painful sensation in hands and/or feet (39%, n=67) and nephropathy (33%, n=55) were the most reported diabetes complications. Twenty-four percent (n=45) of diabetics had three or more complications.

Table 3a. Health Related Background Characteristics – Diabetes Complications

Variable	n	(%)
Diabetes Complications		
Congestive heart failure	12	(06)
Coronary heart disease	14	(08)
Angina pectoris	16	(09)
Myocardial infarction/Heart attack	13	(07)
Stroke	13	(07)
Retinopathy	61	(32)
Ulcer or sore on leg/foot	16	(09)
Nephropathy	55	(33)
Painful sensation in hands and/or feet	67	(39)
Pain in leg while walking	69	(41)
Pain in calf or calves	54	(78)
Weak or failing kidneys	23	(12)
Complications Scale		
0 complications	125	(66)
1-2 complications	19	(10)
3 or more complications	45	(24)

N = 189

Health Behaviors

Table 4 describes the health behaviors of this sample, including smoking behavior, dietary behaviors, and physical activity. Of the diabetics that smoked more than 100 cigarettes in their lifetime (n=102), the average age of onset of smoking was 19 years of age (SD=8). Thirty-five percent (35%) of the sample indicated they smoked cigarettes

Table 4. Health Behaviors Practiced

Variables	n	(%)
Smoking Behavior		
Of those who smoked over 100 cigarettes in life,		
Smoke cigarettes at time of screening		
Everyday	30	(29)
Some days	6	(06)
Not at all	69	(66)
Dietary Behaviors		
Community/government meals delivered	3	(02)
Ate meals at community/senior center	1	(01)
Number of times ate restaurant food		
None	34	(18)
Less than weekly	41	(22)
1-2 times a week	75	(40)
3 or more times a week	39	(21)
Type of salt used at table		
Ordinary salt	81	(43)
Light salt or salt substitute	12	(06)
Don't use/add salt	96	(51)
When eating poultry, how often eat skin?		
Never	70	(38)
Rarely or Seldom	32	(17)
Sometimes or occasionally	34	(18)
Often or very often	14	(08)
Always	35	(19)
Physical Activity		
Moderate tasks around home/yard		
Yes	90	(48)
No or unable to do physical activity	99	(52)
Description of usual daily activities		
Sits & does not walk around much	60	(31)
Stands/walks & does not carry things	92	(49)
Lifts/carries light items or climbs hills/stairs often	24	(13)
Does heavy work or carries heavy loads	13	(07)
Daily hours of TV or video watching		
Less than 1 hour	26	(14)
1-2 hours	75	(39)
3-4 hours	54	(29)
5 hours or more	32	(17)
Does not use TV/video/computer outside work	2	(01)

N = 189

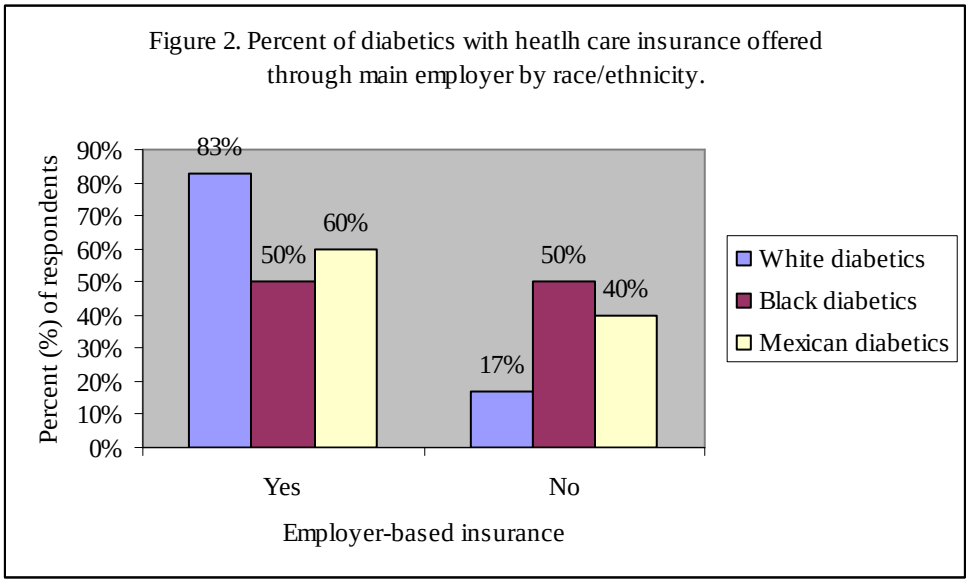
every day or some days at the time of screening. Current smokers reported smoking an average of 15 (SD=10) cigarettes a day for 19 years (SD=14, n=29).

A majority of this sample reported that per month, they never drink beer (79%, n=149), wine (92%, n=174) or hard liquor (87%, n=165) per month. Over half of the respondents did not use salt at the table (51%, n=96) and of those who do use salt, 31% (n=59) stated they rarely or occasionally added salt to their food at the table. Fifty-two percent (52%, n=99) of the sample reported that they either did not do or were unable to do moderate physical activity. When asked about their usual daily practices, 31% (n=60) sat and did not walk around much while 49% (n=92) indicated they walked or stood and carried items. A majority of respondents indicated that they either watched 1-2 hours of television or videos per day (39%, n=75) or 3-4 hours per day (29%, n=54). Seventeen percent (17%, n=32) watched 5 or more hours per day.

Hypotheses

H_1: Black and Mexican diabetics will have less frequent health care interface when compared to White diabetics.

Based on the chi-square analysis, there was a statistically significant relationship between Black, White, and Mexican diabetics regarding whether or not health insurance was offered through their employer, $\chi^2_{(2,\, n = 95)} = 7.60$, $p = .02$ (Figure 2). Health insurance was offered at the place of employment to 64% (n=61) of respondents (see Table 3 above); 83% (n=25) of White diabetics compared to 50% (n=14) of Black diabetics and 60% (n=22) of Mexican diabetics.



A chi-square analysis indicated there was a statistically significant relationship among diabetics who had seen a mental health professional in the past year, $\chi^2_{(2, N = 187)} = 10.75$, $p = .01$ (Figure 3). Black diabetics were more likely to have seen a mental heath professional in the past year compared to White or Mexican diabetics (16% vs. 8% and 1% respectively).

There was also a statistically significant relationship between race/ethnicity and the number of times a participant received health care in the past year, $\chi^2_{(4, N = 189)} = 10.02$, $p = .04$ (Figure 4). The highest reported frequency of health care visits for all respondents was 2-9 times in the past year; 64% (n=36) for Black diabetics, 52% (n=27) for White diabetics and 47% (n=38) for Mexican diabetics. Mexican diabetics were most likely (42%) to have seen a health care provider 10 or more times in the past year, compared to Black (30%) and White (27%) diabetics.

Figure 3. Percent of diabetics who reported seeing a mental health professional in the past year by race/ethnicity.

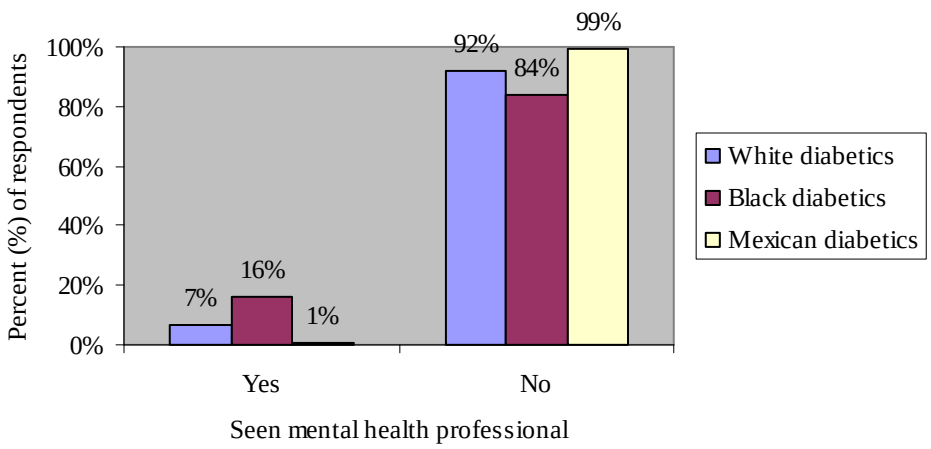
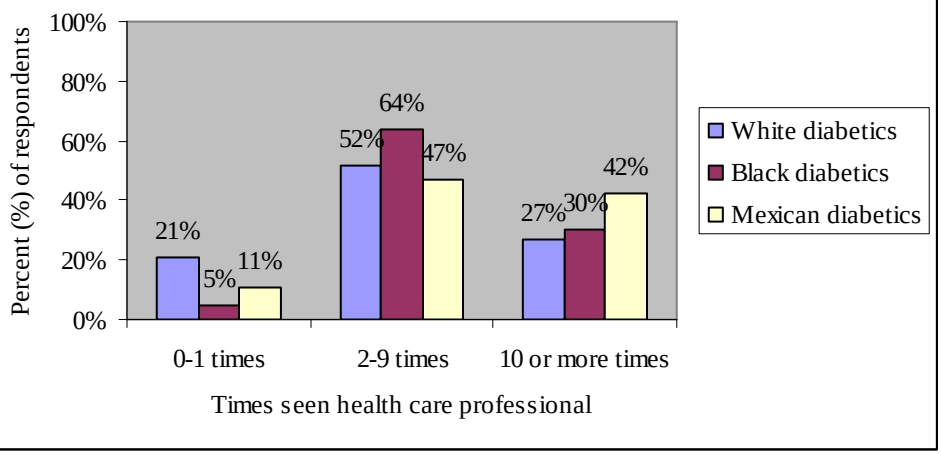


Figure 4. Number of times diabetics received health care in the past year by race/ethnicity.



Although the relationship was not statistically significant, 90%, (n=73) of Mexican diabetics, 79% (n=41) of White diabetics, and 88% (n=49) of Black diabetics reported their general health condition as fair or poor. In addition, there was no statistically significant relationship among Black, White, and Mexican diabetics when examining their use of other health care facilities (Table 5).

Table 5. Diabetics' Utilization of Health Care Facilities by Race/Ethnicity

	White diabetics		Black diabetics		Mexican diabetics	
Variable	n	(%)	n	(%)	n	(%)
Routine place for health care						
Yes	52	(100)	52	(93)	75	(93)
No	0	(00)	3	(05)	6	(07)
More than one place	0	(00)	1	(02)	0	(00)
Health care facility						
Clinic/health center	9	(17)	12	(23)	33	(44)
Doctor's office	41	(79)	38	(72)	38	(51)
Hospital emergency room	0	(00)	0	(00)	1	(01)
Hospital outpatient	1	(02)	2	(04)	2	(03)
Other Place	1	(02)	1	(02)	2	(01)
Overnight patient in past year						
Yes	14	(27)	20	(36)	21	(26)
No	38	(73)	36	(64)	60	(74)
For diabetics that had received care in the past year, time since last health care visit?						
1-3 years	1	(50)	1	(100)	2	(33)
More than 3 years	1	(50)	0	(00)	4	(67)

N=189

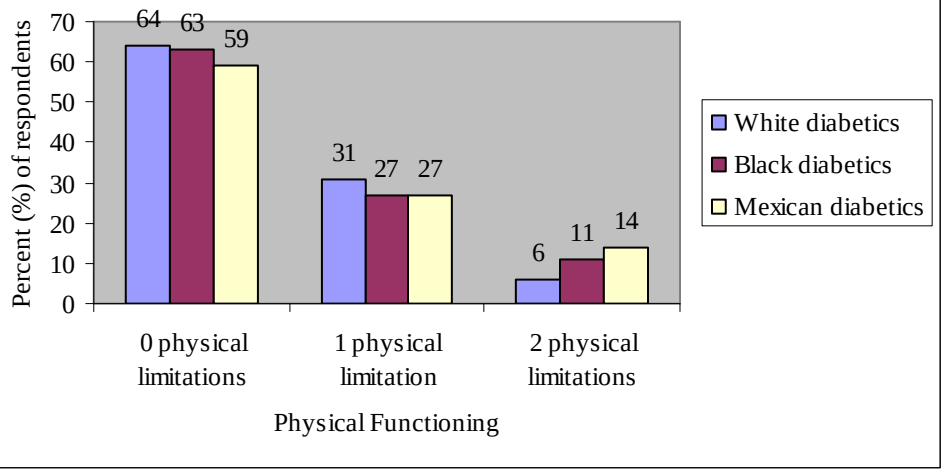
H_2: Black and Mexican diabetics will have more physical functioning limitations compared to White diabetics

A chi-square analysis indicated there was not a statistically significant relationship between White, Black, and Mexican diabetics regarding the number of physical functioning limitations they reported (Figure 5). The physical functioning computation included limitations that kept one from working, physical, mental, or emotional limitations, and whether one experienced confusion or memory problems. The majority of White, Black and Mexican respondents reported experiencing no physical limitations (59%, [n=48], 64% [n=33] and 63% [n=35] respectively. More Black (11%,

n=6) and Mexican (14%, n=11) diabetics reported two physical functioning limitations compared to White (6%, n=3) diabetics.

More Black and Mexican diabetics reported experiencing problems that kept them from working compared to White diabetics (32% [n=18] and 31% [n=25] vs. 23 [n=12], respectively) as well as more confusion/memory problems compared to White diabetics (13% [n=7] and 20% [n=16] vs. 8% n=4], respectively). White diabetics reported more physical, mental, and/or emotional limitations compared to Black or Mexican diabetics (12% vs. 4% and 4%). The relationships between racial/ethnic status and these three physical functioning limitations were not statistically significant. There were no diabetics that reported having all three limitations.

Figure 5. Physical functioning limitations of diabetics by race/ethnicity.

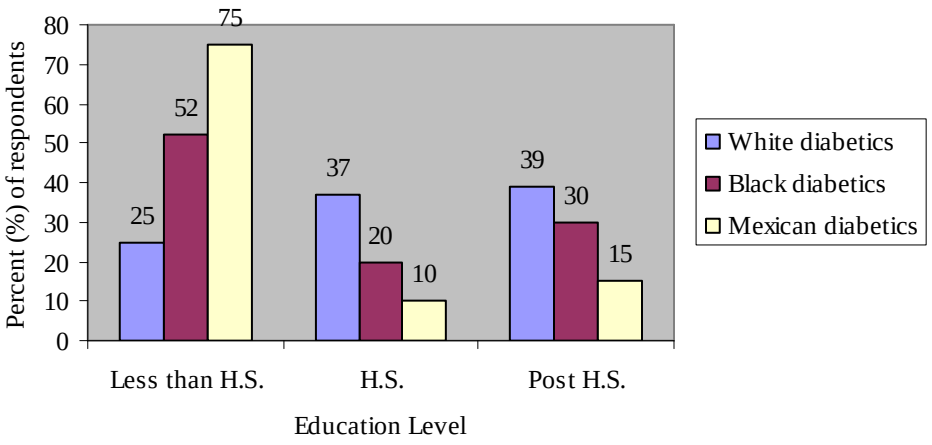


H_3: Black and Mexican diabetics will have a lower educational level compared to White diabetics.

There was a statistically significant relationship between the highest education level completed for Black, White, and Mexican diabetics, $\chi^2_{(4, N = 189)} = 33.87$, $p = .00$ (Figure 6). More Black (52%, n=29) and Mexican (75%, n=61) diabetics reported having less

than a high school education compared to White diabetics (25%, n=13). More White diabetics had either a high school education (37%, n=19) or post high school education (39%, n=20).

Figure 6. Highest education level completed by race/ethnicity.

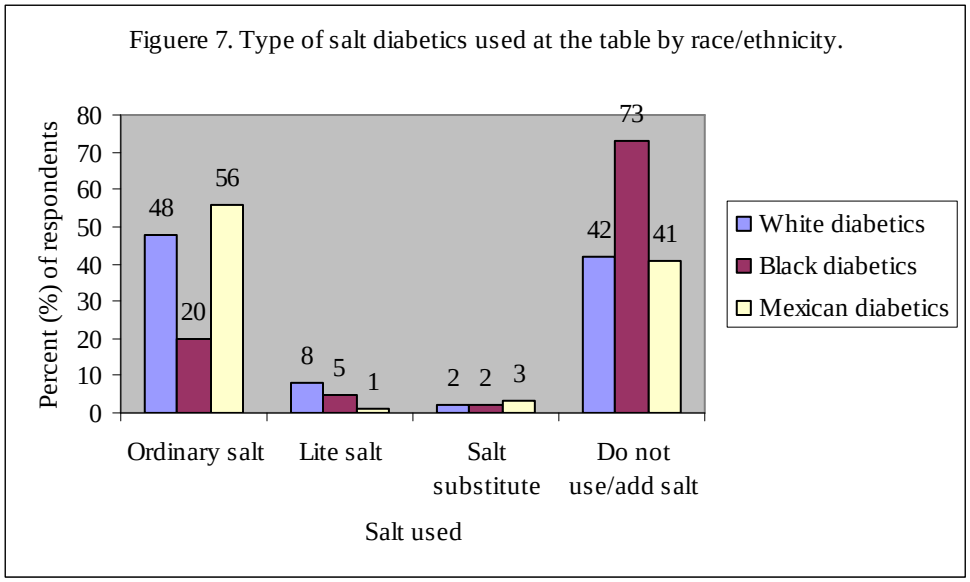


H_4: Black and Mexican diabetics will have more behavioral risk factors for developing diabetes complications than White diabetics.

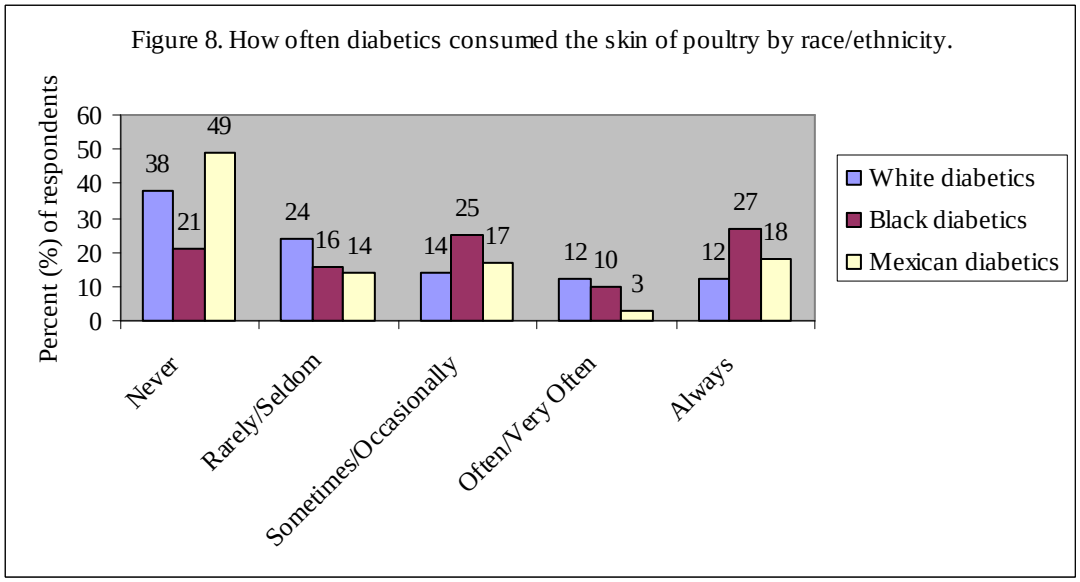
Behavioral risk factors for developing diabetes complications include dietary behaviors, alcohol consumption, physical activity levels, and smoking.

Diet Behavior & Alcohol Consumption

Based on a chi-square analysis, there was a statistically significant relationship between Black, White, and Mexican diabetics regarding the type of salt used at the table, $\chi^2_{(6, N = 189)} = 21.75$, $p = .00$ (Figure 7). A majority of Black diabetics (73%, n=41) reported not using or adding salt at the table. The most frequent response for White (48%, n=25) and Mexican (56%, n=45) diabetics was that they use ordinary salt at the table.



There was also a statistically significant relationship between the racial/ethnic category and how often the skin of poultry was consumed, $\chi^2_{(8, N = 185)} = 18.48$, $p = .02$ (Figure 8). Thirty-six percent (36%, n=19) of White diabetics and 49% (n=39) of Mexican diabetics reported they never ate poultry skin, while twenty-seven percent (27%, n=15) of Black diabetics reported they always consumed poultry skin.



There was not a statistically significant relationship between Black, White and Mexican diabetics regarding whether meals were delivered to their home and whether

they ate meals at a community/senior center. Four percent (4%, n=3) of the sample reported having community or government meals delivered to their home (5% (n=1) of White diabetics and 5% (n=2) of Mexican diabetics). One percent (1%, n=1) of respondents ate meals at a community or senior center; this respondent was Black.

Table 6 depicts other dietary behaviors and alcohol consumption of diabetics by racial/ethnic category. A one-way analysis of variance (ANOVA) indicated there was not a statistically significant difference between Black, White, and Mexican diabetics regarding the number of times per week they ate out at restaurants or the amount of protein, milk/dairy, fruit/fruit juice, vegetables, and/or breads/grains they ate per day. For alcohol consumption, a one-way ANOVA indicated there was not a statistically significant difference between Black, White and Mexican diabetics regarding how often they drank beer, wine, and hard liquor per month.

Table 6. Dietary Behavior and Alcohol Consumption of Diabetics by Racial/Ethnic Category

	White diabetics		Black diabetics		Mexican diabetics	
Variable	M	(SD)	M	(SD)	M	(SD)
Times/week eat restaurant food	2.1	(2.1)	1.7	(2.0)	2.2	(2.7)
Helping of foods per day	1.6		1.4		1.5	
Protein	2.0	(1.0)	1.0	(0.9)	1.9	(1.1)
Milk/dairy	1.2	(0.9)	0.8	(0.7)	1.1	(0.9)
Fruit/fruit juice	1.5	(1.0)	1.7	(1.0)	1.2	(0.8)
Breads/grains	2.0	(1.5)	1.6	(0.9)	2.2	(1.5)
Vegetables	1.5	(1.0)	1.7	(1.0)	1.2	(1.5)
Average	1.6		1.4		1.5	
Times drink/month						
Beer	1.5	(4.7)	0.9	(2.8)	1.7	(5.1)
Wine	0.2	(0.8)	0.2	(1.3)	0.8	(3.9)
Hard liquor	0.4	(1.4)	0.8	(4.3)	0.3	(0.9)

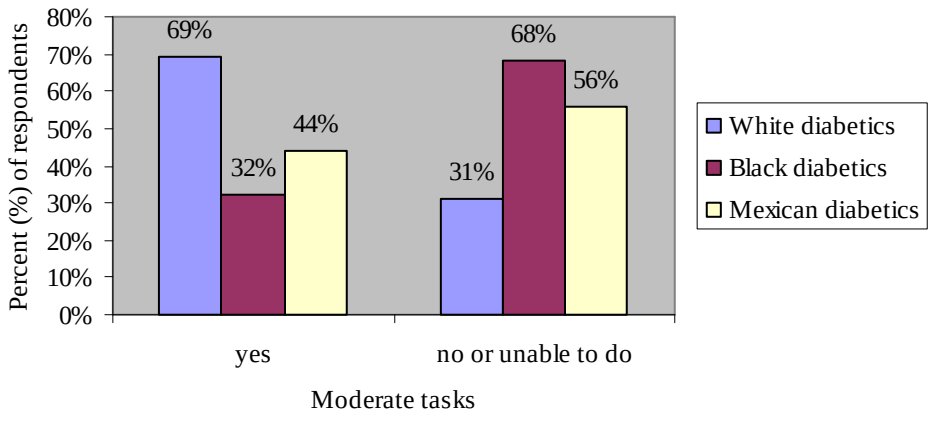
N=189

* None of these relationships were statistically significant.

Physical Activity

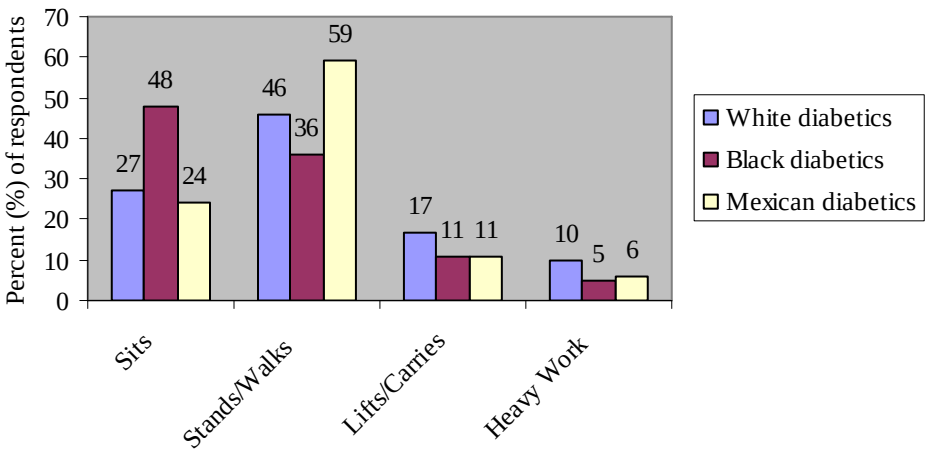
Based on a chi-square analysis, there was a statistically significant relationship between Black, White, and Mexican diabetics when examining moderate tasks done around the home or yard, $\chi^2_{(4, N = 189)} = 21.72$, $p = .00$ (Figure 9). More Mexican and Black diabetics declared they either did not or were not able to do moderate tasks around their home or yard compared to White diabetics (56% [n=45]and 68% [n=38] vs. 31% [n=16], respectively).

Figure 9. Percent of diabetics who do moderate tasks around the home or yard by race/ethnicity.



There was also a statistically significant relationship between racial/ethnic category and usual daily activities, $\chi^2_{(6, N = 189)} = 12.80$, $p = .05$ (Figure 10). A higher percent of White (46%, n=24) and Mexican (59%, n=48)) diabetics' daily activities included standing or walking compared to Black diabetics (36%, n=20). The most common usual daily activity for Black diabetics was to sit (48%, n=27).

Figure 10. Description of usual daily activities by race/ethnicity.



There was a statistically significant relationship when examining daily hours of television or video watching and racial/ethnic category as well, $\chi^2_{(12, N = 189)} = 22.47$, p = .03 (Table 7). A majority of White diabetics (65%, n=34) watched two to four hours of television daily compared to 50% (n=28) of Black diabetics and 44% (n=36) Mexican diabetics.

Table 7. Daily Hours of Television or Video Watching by Race/Ethnicity

	White diabetics		Black diabetics		Mexican diabetics	
Hours**	n	(%)	n	(%)	n	(%)
No television/video	0	(00)	0	(00)	2	(03)
Less than 1 hour	4	(08)	8	(14)	14	(17)
1 hour	4	(08)	7	(13)	20	(25)
2 hours	15	(29)	8	(14)	21	(26)
3 hours	12	(23)	13	(23)	11	(14)
4 hours	7	(13)	7	(13)	4	(05)
5 or more hours	10	(19)	13	(23)	9	(11)

N=189
**Statistically significant difference, p<.05

Smoking

A one-way ANOVA indicated there was a statistically significant difference between Black, White and Mexican diabetics regarding the number of cigarettes smoked per day

before quitting ($F_{(2,58)} = 4.895$, p = .01). Tukey's post hoc test indicated White diabetics smoked significantly more cigarettes per day before quitting than Mexican and Black diabetics (Table 8).

There was also a statistically significant difference in the number of cigarettes smoked per day at the time of screening, $F_{(2,27)} = 6.659$, p=.00. The post hoc test indicated that White diabetics smoked significantly more cigarettes per day at the time of screening. Further, the racial differences between the average number of cigarettes smoked per day during the past 30 days was statistically significant, $F_{(2,33)} = 7.333$, p = .00. Again, post hoc analyses revealed that White diabetics smoked significantly more cigarettes per day in the past 30 days compared to Black and Mexican diabetics (Table 8).

Table 8. Smoking Behaviors of Sample by Race/Ethnicity

	White diabetics		Black diabetics		Mexican diabetics	
Variable	M	(SD)	M	(SD)	M	(SD)
Number of cigarettes smoked/day						
Before quitting**	27	(17.2)	13	(10.8)	14	(15.6)
At screening**	24	(11.7)	16	(7.8)	9	(5.2)
In the past 30 days**	23	(10.8)	14	(8.0)	9	(6.0)
Number of years smoked current						
Amount of cigarettes	22	(22.3)	19	(14.4)	16	(14.6)
Number of days smoked cigarettes						
During past 30 days	30	(00)	24	(9.5)	24	(10.2)
Age started smoking cigarettes	18	(5.6)	20	(8.6)	20	(9.2)
Age last smoked cigarettes regularly	43	(11.3)	44	(10.7)	42	(8.7)

N=189

** Statistically significant difference, p<.05

A one-way ANOVA indicated there was not a statistically significant difference between race and the age at which sample participants began smoking cigarettes, the age they last smoked regularly, the number of years they smoked cigarettes, and the number of days during the past 30 days they smoked cigarettes (Table 8).

A chi-square analysis indicated there was not a statistically significant relationship between race/ethnicity and whether participants smoked at least 100 cigarettes in their lifetime and how frequently these individuals currently smoke (Table 9).

Table 9. Smoking Behaviors of Sample by Race/Ethnicity (Categorical Variables).

	White diabetics		Black diabetics		Mexican diabetics	
Variable	n	(%)	n	(%)	n	(%)
Smoked 100+ cigarettes ever						
Yes	30	(58)	30	(54)	45	(56)
No	22	(42)	26	(46)	35	(44)
Of the above smokers (n=105), How often smoke cigarettes						
Every day	8	(27)	11	(37)	11	(24)
Some days	0	(00)	3	(10)	3	(07)
Not at all	22	(73)	16	(53)	31	(69)

N=189

H_5: Black and Mexican diabetics will encounter more indirect costs related to diabetes mellitus than will White diabetics.

This study used the ADA's definition of indirect costs which is measured by forgone productivity. This study's indirect cost measures were used to get a sense of whether the individuals were working the previous week and if they were out of work due to health reasons. Chi-square analyses indicated there was not a statistically significant relationship between racial/ethnic category and the type of work done in the previous week and the whether the individual was off work for health reasons in the previous week. Although the relationship was not statistically significant, a majority of White and Black diabetics reported they were working in the previous week (58%, n =30 and 50%, n=28). A majority of Mexican diabetics (52%, n=42) were not working in the previous week. (Figure 11).

Of the 94 diabetics who indicated they were not working, 56% (n=53) reported they did not work in the previous week because of health or disability reasons. More Mexican and Black diabetics reported not working for health reasons or due to a disability compared to White diabetics (43% [n=23] and 34% [n=18] vs. 23% [n=12], respectively) (Figure 12).

Figure 11. Work status of diabetics in the previous week by race/ethnicity.

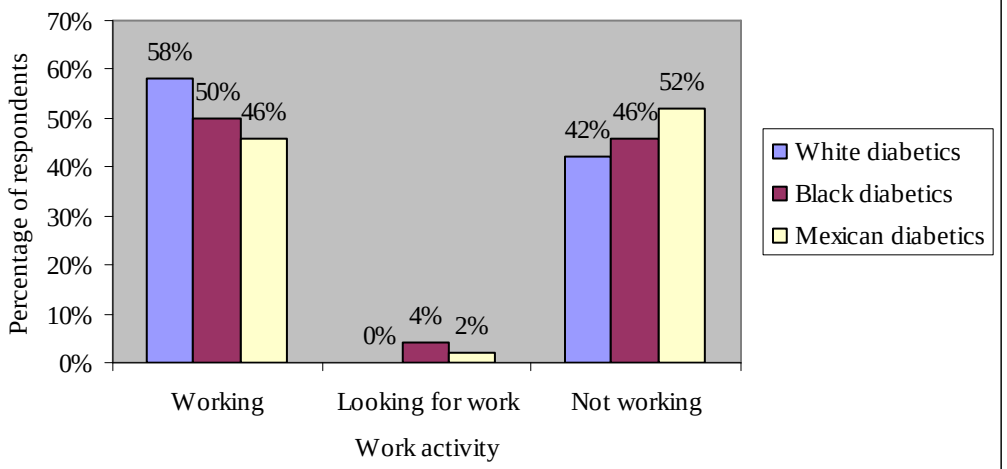
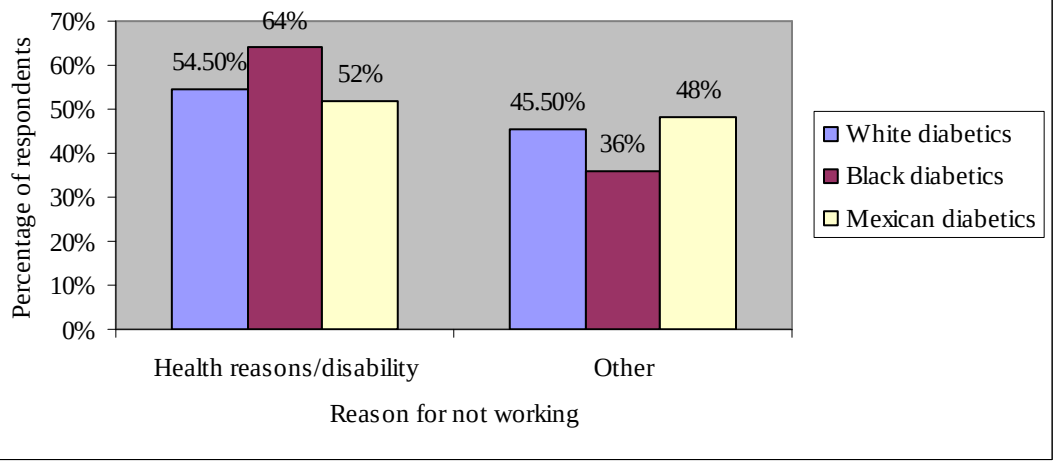


Figure 12. Missed work for health reasons in the previous week by race/ethnicity.



H_6: Fewer interfaces with health care systems and higher indirect costs associated with diabetes mellitus will be the strongest predictors of diabetes complications among White, Black and Mexican diabetics.

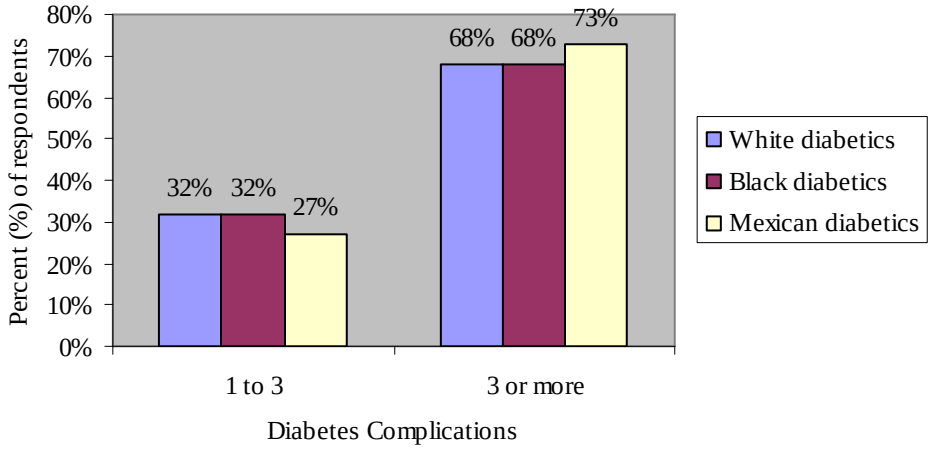
The health care model was created using a forward stepwise logistic regression including health care variables, as the independent variables and diabetes complications as the dependent variable. The model controlled for education, race/ethnicity, gender, and age. The variables entered into the health care model were diagnosed blood pressure, the number of times individuals received health care in the past year, whether or not they had a routine place to go for healthcare, and whether they had seen a mental health professional in the past year. The number of times an individual received health care in the past year was a significant predictor of diabetes complications (OR = 4.63, 95% CI 1.09-6.75, p = 0.01). Diabetics who received health care two to nine times were more likely to have diabetes complications.

The indirect costs model was created using a logistic regression including indirect cost measures and physical functioning limitations as the independent variables and diabetes complications as the dependent variable. The model controlled for education, race/ethnicity, gender, and age. The variables entered into the model were limitations keeping individuals from working, confusion or memory problems, off work for health reasons, and the type of work done last week. Limitations keeping diabetics from working was a significant predictor of diabetes complications (OR = 4.82, 95% CI .03-.83, p = .03). Of the diabetics with complications, those who reported not having limitations keeping them from working had a lower percentage of complications.

H_7: Black, Mexican and White diabetics will have different predictor variables for diabetes complications.

Based on the criterion established for the logistic regressions in SPSS, none of the predictor variables were statistically significant and therefore could not be entered into three separate models for Black, White, and Mexican diabetics. The established criterion for the model included classification cut off (.05), maximum iterations (20) and probability for variables in the stepwise regression (entry = .05 and removal = .10). The predictor variables were all health care and indirect costs variables entered into the health care and indirect costs models. Because no variables could be entered into the model, a chi-square analysis was conducted to see if there was a relationship between racial/ethnic category and diabetes complications (Figure 13). This figure excluded the individuals who reported no diabetes complications (66%, n=125). There was not a statistically significant relationship (Figure 13).

Figure 13. Diabetes complications by race/ethnicity.



Chapter 5: Discussion

Summary

Of the total NHANES 1999-2000 sample (n=9,965), 5% (n=489) had diagnosed diabetes. According to the CDC, 6.3% of the U.S. population has diabetes, diagnosed (13.0 million) and undiagnosed (5.2 million) diabetes (CDC, National Diabetes Facts Sheet, 2003). The sample for this secondary analysis included 189 Black, White and Mexican diabetics ages 18 to 64, comprising 39% of the NHANES 1999-2000 sample of diabetics. A majority of the diabetics in this sample (55%) had less than a high school education and 50% were working (either full or part-time). The majority of this sample rated their health status as fair or poor health (86%), had high blood pressure (58%), and high cholesterol (53%). Twelve different complications were examined, and 66% of respondents reported having no complications.

As expected, statistically significant relationships were found between racial/ethnic category and specific variables, including interface with the health care system, educational level, dietary behavior items, and physical activity items. Statistically significant relationships were found among racial/ethnic categories when examining whether employer-based health insurance was available, having seen a mental health professional in the past year, and having received health care in the past year. A majority of Black and Mexican diabetics had less than a high school education when compared to Whites. Regarding dietary and physical activity behaviors, there was a statistically significant relationship between race/ethnicity and the type of salt used at the table, how often poultry skin was consumed, moderate tasks done around the home or yard, usual daily activities, and hours per day individuals watched television or played videos.

However, there were no statistically significant relationships when examining physical functioning limitations items and race/ethnicity. Physical functioning limitations included having physical, mental or emotional limitations, confusion or memory problems, and limitations that kept individuals from working. There were also no statistically significant relationships between diabetics and indirect cost measures based on race/ethnicity.

Black and Mexican diabetics had more behavioral risk factors for developing diabetes complications than White diabetics, with the exception of some smoking behavior items and dietary behavior items. White diabetics smoked more cigarettes per day before quitting, at screening and in the past 30 days. Interestingly, Black and Mexican diabetics were more likely to be current smokers. Mexican and White diabetics added more salt to their food at the table compared to Black diabetics.

As hypothesized, a logistic regression demonstrated that the number of times an individual received care from a health care provider was a significant factor associated with diabetes complications. When conducting the logistic regression to determine whether indirect cost variables were significantly associated with diabetes complications, the "limitations keeping individuals from working" item was a significant predictor. Another hypothesis proposed was that there would be racial/ethnic disparities when examining factors that predict diabetes complications. However, there were no statistically significant predictor variables to enter into the equation.

Discussion

As hypothesized, Black and Mexican diabetics had less access to health care; 50% (n=14) of Black and 40% (n=15) of Mexican diabetics did not have access to insurance

through their employer compared to 17% (n=5) of White diabetics. Of the respondents in this study who were employed (50%), 36% (n=34) did not have health insurance offered through their employer. The racial breakdown of diabetics working was 56% (n=29) for White diabetics, 43% (n=24) for Black diabetics and 43% (n=35) for Mexican diabetics. Valdmanis et al. (2001) reported that 16% of diabetics in their sample (n=400) did not have health insurance. Compared to Valdmanis et al.'s (2001) sample of diabetics, this sample had almost twice as many uninsured diabetics. This is most likely because NHANES 1999-2000 asked about employer based insurance, which does not take into account individuals who are covered by Medicare, Medicaid or private insurance.

Additionally, Black diabetics were significantly more likely to have seen a mental health professional in the past year compared to White and Mexican diabetics (16% vs. 8% and 1% respectively). Traditionally Black diabetics do not receive mental health services when needed due to the associated stigma in the Black community. The African Americans Mental Health Facts Sheet (2004) offers some possible reasons for this finding. African Americans (Blacks) are overrepresented when examining those who receive inpatient mental health services. Additionally, some rates of mental illness are higher in Blacks, including phobias, somatization, isolated sleep paralysis, inability to move while waking up or falling asleep, and dizziness followed by collapsing (African American Mental Health Facts Sheet, 2004). It is also possible that this sample of Black diabetics was accustomed to interfacing with the health care community to manage their diabetes care. Perhaps seeking necessary mental health services was not as uncomfortable due to their familiarity with the health care system.

This sample of diabetics reported continued interface with the health care community. A majority indicated they received health care from a health care professional two to nine times (54%) or ten or more times (34%) in the past year. Of the 12% (n=23) who reported receiving care from a health care professional zero or one times in the past year, 21% (n=11) were White, 5% (n=3) were Black, and 11% (n=9) were Mexican diabetics. Further, 100% of the individuals who received health care ten or more times all rated their general health condition as 'fair or poor', while 81% of the diabetics who received care two to nine times rated their health as 'fair or poor'. As their interface with health care professionals increased, their perception of their general health condition worsened. Since 66% of the sample did not have any diabetes complications, it was not anticipated that this sample would have such a poor view of their health.

Less than 1% of this sample used a hospital emergency room (ER) for health care. Laditka et al. (2001) found that diabetics had significantly more emergency room visits (2 times more) than non-diabetics. The lower reported incidence of emergency room care in this study may have been due to the small sample size, and that the majority of respondents had a regular source of health care and therefore did not need to go to the ER as often as those without a regular source of healthcare. However, all respondents in the Laditka et al (2001) study were likely to also have had a regular source of health care as they all had employer based health insurance coverage. Respondents in this study and the Laditka et al. (2001) study had comparable rates of diabetes complications, with the exception of heart failure. Of the 13,561 diabetics in the Laditka et al. (2001) study, 22% experienced heart failure, compared to 8% of this sample. This may contribute to the higher rates of emergency room care found by Laditka et al. (2001).

This study found that 29% (n=55) of diabetics experienced at least one hospitalization in the past year. This percentage is more than twice the 14% reported by Booth and Hux (2003) when they examined individuals with diabetes mellitus. Given that such a large percentage of this sample rated their health status as fair or poor (86%, n=163), it is not surprising that there was a higher occurrence of hospitalizations.

Ayanian et al. (2000) reported that people with a good, fair or poor health status (compared to those who rated their health as excellent or very good) were more likely to be uninsured. The relationship between health status and health insurance was not a hypothesis examined in this study, but a chi-square analysis revealed there was no significant relationship between having employer-based health insurance and rating one's health status as fair or poor. Contrary to Ayanian's et al (2000) findings, respondents in this sample who rated their health as fair or poor were more likely to be insured than uninsured. Again, perhaps sample size differences explain this discrepancy.

Income data for sample participants were not available at the time this data set was analyzed. Therefore, as a proxy measure of socioeconomic status, the highest level of education completed, was measured. White diabetics (76%) were significantly more likely to have completed a high school or post-high school education compared to Black (50%) and Mexican (25%) diabetics. A majority of Black and Mexican diabetics, 52% and 75% respectively, had less than a high school education. Krop et al. (1999) reported that higher educational attainment was also a protective factor against developing diabetes complications. This may have been a reason why White diabetics in this study reported fewer complications. Inequities in income and education level are the basis for many health disparities in the U.S. Individuals with a lower education level are also likely

to experience a poorer health status compared to their educated counterparts. People with less than 12 years of education are the least likely to have a usual primary care provider. Also, a higher education level increases the likelihood that individuals will better understand health information (Healthy People 2010, 2000).

A majority of Black and Mexican diabetics were significantly more likely to report they did not do, or were unable to do, moderate physical activity tasks compared to White diabetics, which concurs with previous research (Egede & Poston, 2004). Mexican diabetics reported watching fewer hours of television compared to Black and White diabetics. This may be due to fewer available television options if individuals are not fluent in English; 24% of this sample was born outside of the United States. The overall poor level of healthy dietary behaviors and lack of physical activity in Blacks and Mexicans may be due to a lack of consistent education on these topics, or non-adherence to physician prescribed regimens. Results from the National Health Interview Survey indicated that Black and Mexican adults were more likely to be physically inactive compared to White adults (Schoenborn, Adams, Barnes, Vickerie & Schiller, 2004).

There was a low level of alcohol consumption per month among this sample. Over three-quarters of the respondents reported they did not drink wine, beer or alcohol at all during the past month. In fact, more respondents in this subgroup of diabetics reported never drinking beer, wine or hard liquor each month compared to their counterparts in the NHANES 1999-2000 sample. There is a U-shaped relationship between alcohol and diabetes (Howard, Arnsten and Gourevitch, 2004), meaning that no drinking and light levels of alcohol intake indicate a decreased incidence of heart disease

among diabetics. However, heavy alcohol consumption increases the risk of heart disease (Howard et al., 2004).

Black and Mexican diabetics had riskier health behaviors compared to White diabetics, with the exception of adding salt to food at the table, the number of cigarettes smoked per day at the time of screening, during the previous 30 days, and when they quit. Poor monitoring of salt intake, unhealthy dietary behaviors, and lack of physical activity can lead to micro- and macro- vascular complications for diabetics (Kendall & Bergenstal, 2001). A significantly higher percent of Mexican (60%) and White (58%) diabetics added salt to their food at the table. Black diabetics may have used more salt in their food while cooking rather than adding salt at the table. More Blacks (27%) reported always eating poultry skin, compared to White (12%) and Mexican (18%) diabetics This sample's high sodium intake was also consistent with the majority of the sample (58%) having high blood pressure. Significantly more Black (77%) and Mexican (51%) diabetics were diagnosed with high blood pressure at one point in time compared to White diabetics (49%).

White diabetics smoked significantly more cigarettes per day at the time of screening, during the previous 30 days, and when they quit compared to Black and Mexican diabetics. This is consistent with the research conducted by Muscat and colleagues (2002), who found that Whites smoke more cigarettes per day and are heavier smokers than Blacks. However, compared to Whites, Blacks were more likely to be current smokers (Muscat et al., 2002). This study's results also indicated that 47% of Black diabetics who were current smokers reported smoking everyday or some days compared to 31% of Mexican diabetics and 27% of White diabetics. White diabetics in

this sample started smoking at an earlier age and smoked more cigarettes per day than the Black and Mexican smokers. However, more Black diabetics were current smokers. The higher prevalence of current Black smokers may be attributed to the later age of onset of cigarette smoking among Blacks.

When examining the indirect costs of diabetes, most diabetics who reported not working in the past week were out due to health reasons. According to the National Center for Health Statistics (NCHS, 2003), a higher percentage of Blacks have limited physical activity due to a chronic illness when compared to Whites and Hispanics (12% vs. 10% and 8%, respectively). More Black and Mexican diabetics reported experiencing problems that kept them from working and confusion/memory problems compared to White diabetics. However, White diabetics reported more physical, mental, and/or emotional limitations compared to Black or Mexican diabetics.

Despite the higher reports of physical, mental and/or emotional limitations experienced, White diabetics (1%) were less likely to see a mental health professional, compared to Black (16%) and Mexican (7%) diabetics. The higher percent of Black and Mexican diabetics who reported seeing a mental health professional was unexpected because Black and Mexican populations tend to resist voluntary mental health services (Chow, Jaffee and Snowden, 2003). Black diabetics, compared to non-diabetic Blacks, may be more familiar with the medical system and as a result they are less resistant to mental health services. Perhaps their health care provider informed them about mental health issues associated with diabetes and coping with a chronic disease, and therefore encouraged them to seek assistance.

When trying to determine which health care utilization items predicted complications in diabetics (regardless of race/ethnicity), those who received more health care services also experienced more complications. This makes sense, but what was surprising was that having employer-based health insurance was not a statistically significant predictor of diabetes complications in this study. The expected relationship was that health insurance would be a protective factor against developing diabetes complications (Krop et al., 1999). Diabetics without insurance also reported fewer associated complications. It is possible that people without access reported fewer diabetes complications because they had not been diagnosed by a health care professional; they may have undiagnosed complications. Regardless, lack of access to employer-based health insurance was not a significantly related to complications but it was significantly related to race/ethnicity.

When using a logistic regression to predict which indirect cost factors were statistical predictors of diabetes complications, limitations keeping diabetics from working was significantly related to diabetes complications. This is consistent with previous diabetes research that examined indirect costs, focusing on disability, lost workdays and lost or forgone productivity (ADA, 2003; Valdmanis et al., 2001). Another study suggested that there was a link between depression among diabetics and measures of work loss and disability bed days (Egede, 2004). The study further suggested that an extensive period of depression increases the likelihood of extended disability bed days (Egede, 2004).

Separate logistic regressions were to be conducted to identify specific predictor variables which would explain differences in complications among White, Black, and

Mexican diabetics. However, no variables could be entered into the models because they did not meet the logistic regressions established criteria. A possible explanation for this is that there were not enough diabetics in this sample with diabetes complications. Of diabetics in this sample, 66% did not report any diabetes complications. Also, White and Black diabetics had the same frequency and percent of diabetes complications (Figure 13).

A final explanation of this study's inability to address racial differences in complications comes from The National Center for Health Statistics' (2003) Health Report, which indicated that the gap in the life expectancy (in years) between Black and White Americans has narrowed, due to increasing death rates for Whites and decreasing rates for Blacks. It is a possibility that the narrowing life expectancy gap between Blacks and Whites indicates that there are fewer factors separating these two groups.

Limitations

There were several limitations to this study, including the study design, operationalization of specific variables, and administration of the NHANES Household Interview Component Questionnaire. First, this study was limited in that it was a cross sectional analysis (examining one slice in time) and not a longitudinal study. Therefore the study can not provide evidence of causality; it can only speak to relationships between variables, which jeopardize internal validity. For example, even though "receiving health care in the past year" and "physical, mental, and emotional limitations keeping individuals from working" were significant factors related to diabetes complications in this study, it cannot be definitely said that the presence of these two factors caused complications among diabetics.

Future research could include longitudinal analyses to further understand and determine the multiple factors that contribute to health disparities and diabetes related complications. Conducting prospective studies would allow researchers to observe how social and health care factors interact with diabetes complications over time and examine any changes or developments in associated complications. Some of the factors hypothesized to have a relationship with race/ethnicity that were not supported, such as physical functioning limitations and indirect costs, may have an impact on diabetes complications over time.

Secondly, the operational definitions of indirect costs, physical functioning limitations, access to health care, health care utilization, and socioeconomic status were threats to this study's construct validity. Because income data were not available for this sample, the highest education level completed was used as a proxy measure of socio-economic status (SES). Measures used to define access to and utilization of health care, indirect costs and physical functioning limitations were limited to questions asked on the NHANES 1999-2000 survey and variables available for public use.

At the time of this study's analyses, access to employer based insurance was the only publicly available measure of health care. As of July 2004, NCHS released the updated health insurance data for NHANES 1999-2000. These measures of health insurance are more accurate when determining health insurance coverage as opposed to only having information on employer based insurance. The newly released health insurance measures include whether one has private health insurance, Medicaid, the State Children's Health Insurance Program (SCHIP), Medicare, other governmental insurance,

single service plans, dental coverage, gaps in current insurance and length of time for gaps in insurance.

Future studies should use "multiple operationalisms" (Johnson & Burke, 2003) to define indirect costs. For example, other studies have measured indirect costs using differences in years of potential life lost (YPLL) and potential gains in life expectancy (Wong et al., 2002), lost or forgone productivity, temporary incapacity due to lost workdays and bed days, as well as permanent disability and premature mortality (ADA, 2003). Future studies should construct a measure that includes multiple measures to capture indirect costs of diabetes.

The NHANES 1999-2000 Sample Person Questionnaire responses are provided by one person in each household. In some instances, the respondent was the spouse of the diabetic person in the household. This is a potential threat to the study's ecological validity because a third party may have represented the diabetic individual. There is room for bias if the participant did not accurately represent the diabetic's information.

Finally, this is a national sample of diabetics; however, results from this study must be generalized cautiously. These results are applicable only to Black, White and Mexican American diabetics living in the U.S. This study did not examine racial differences of other ethnic and racial groups in the U.S.

Implications

One implication of this study is that there are significant associations among Blacks, Whites and Mexicans when examining health care utilization variables (health care coverage, frequency of health care visits and seeing a mental health professional). Further, frequency of health care visits is significantly associated with diabetes

complications. Because of the need for frequent health care services (including mental health services) among diabetics, utilization of health care services is especially important for disenfranchised populations. Findings from this secondary analysis support this necessity.

Another implication of this study is that programs to prevent diabetes complications should focus on increasing physical activity and improving dietary behaviors in Black and Mexican diabetics. The CDC has identified multiple state-level initiatives and programs that target diabetics. Inactive diabetic populations could benefit from physical activity programs targeted specifically to their needs and abilities, as well as programs addressing the associated complications of diabetes. Project Assist in Louisiana successfully promoted healthy behaviors and lifestyles among diabetics or people at risk for diabetes (CDC, State Programs in Action, 2004). Other identified exemplary programs have improved the level of diabetes care and services and increased diabetics' interface with the health care community (CDC, State Programs in Action, 2004).

Recommendations for Future Research

This research established some relationships between race/ethnicity and access to health care, physical activity, dietary behaviors, education level and physical limitations, which concurs which the current literature on racial disparities in diabetes complications (Healthy People 2010, 2000; Karter et al., 2002). Future research should examine measures of indirect costs and socio-economic status, as many studies do not appropriately measure and or define these variables.

Frequency of health care utilization and indirect costs of diabetes contributed to diabetes complications. There may be other factors that are also significant predictors of diabetes complications and racial disparities. One suggestion is that socioeconomic status (SES) may be the source of disparities in diabetes complications. Income data are now available for NHANES 1999-2000 that would allow researchers to examine the SES of this sample to determine if there were statistically significant relationships between income level and diabetes complications. It is likely that many of the disparities in diabetes complications are due to differences in the SES of diabetics and not race/ethnicity.

Based on findings from this study, it would be interesting to examine the relationship between mental health and indirect costs of diabetes, including lost productivity, physical limitations and disability.

Conclusion

The goal of this research was to look at the relationship between race/ethnicity and social factors and then load the significant factors into a model to see if they were predictive of diabetes complications. Even though this study was not able to create such a model, relationships between Black, White, and Mexican diabetics and factors that possibly contribute to diabetes complications for all diabetics were examined. Health care utilization items, physical activity items, dietary behavior items, smoking behavior items and education level were significantly associated with race/ethnicity.

Health care professionals cannot eliminate diabetes complications without paying attention to the need for culturally and racially specific programs. There are established associations between race and complications. Some risk factors for developing diabetes

complications, such as smoking behavior, are significantly higher among White diabetics compared to Mexican and Black diabetics. Fewer Black diabetics engaged in moderate physical activity, and more Mexican diabetics added salt to their food at the table. These groups of diabetics have different challenges and needs and could benefit from programs that consider their diverse needs. Appropriate health education programs for diabetics can decrease morbidity and mortality due to preventable diabetes complications.

Definition of Terms

1. Acute: describes something that happens suddenly and for a short time. Opposite of chronic.
2. Background retinopathy: a type of damage to the retina of the eye marked by bleeding, fluid accumulation, and abnormal dilation of the blood vessels. Background retinopathy is an early stage of diabetic retinopathy.
3. Blood glucose: the main sugar found in the blood and the body's main source of energy. Also called blood sugar.
4. Cardiovascular disease: disease of the heart and blood vessels .
5. Chronic: describes something that is long-lasting. Opposite of acute.
6. Complications*: Microvascular complications are small vessel abnormalities in the eyes and kidneys. Macrovascular complications are large vessel abnormalities in the heart, brain, and legs. Metabolic complications are abnormalities in nerves and during pregnancy.
7. Coronary heart disease: heart disease caused by narrowing of the arteries that supply blood to the heart. If the blood supply is cut off the result is a heart attack.
8. Creatinine: a waste product from protein in the diet and from the muscles of the body; removed from the body by the kidneys; as kidney disease progresses, the level of creatinine in the blood increases.
9. Diabetes mellitus (DM): a condition characterized by hyperglycemia resulting from the body's inability to use blood glucose for energy. In type 1 diabetes, the pancreas no longer makes insulin and therefore blood glucose cannot enter the cells to be used

for energy. In type 2 diabetes, either the pancreas does not make enough insulin or the body is unable to use insulin correctly.

10. Diabetic acidosis: an emergency condition in which extremely high blood glucose levels, along with a severe lack of insulin, result in the breakdown of body fat for energy and an accumulation of ketones in the blood and urine. Signs of DKA are nausea and vomiting, stomach pain, fruity breath odor, and rapid breathing. Untreated DKA can lead to coma and death.
11. Diabetic retinopathy: diabetic eye disease; damage to the small blood vessels in the retina. Loss of vision may result.
12. Direct costs*: Costs associated with an illness that can be attributed to a medical service, procedure, medication, and any other service requiring payment.
13. Emergency services*: Health care services that appear to be needed immediately because of injury or sudden illness that threatens serious impairment of any bodily function or serious dysfunction of any bodily part or organ.
14. Endocrinologist: doctor who treats people with endocrine gland problems such as diabetes.
15. Fasting blood glucose test: a check of a person's blood glucose level after the person has not eaten for 8 to 12 hours. This test is used to diagnose pre-diabetes and diabetes. It is also used to monitor people with diabetes.
16. Gestational diabetes mellitus (GDM): a type of diabetes mellitus that develops only during pregnancy and usually disappears upon delivery.
17. Health insurance*: Any type of third party payment, reimbursement, or financial coverage for an agreed upon set of health care services.

18. Health outcomes*: The results or consequences of a process of care. Includes clinical outcomes, such as changes in health status and changes in the length and quality of life as a result of detecting or treating disease.
19. Hyperglycemia: excessive blood glucose.
20. Hyperosmolar hyperglycemic nonketotic syndrome (HHNS): an emergency condition in which one's blood glucose level is very high and ketones are not present in the blood or urine. Can lead to coma or death if untreated.
21. Hypertension: a condition present when blood flows through the blood vessels with a force greater than normal. Also called high blood pressure
22. Hypoglycemia: a condition that occurs when one's blood glucose is lower than normal. Also called an insulin reaction.
23. Indirect costs*: Costs associated with an illness that occur because an individual cannot work at his or her usual job due to premature death, sickness, or disability; lost or forgone productivity, including being temporarily incapacitated due to bed days, lost workdays, permanent disability and premature mortality.
24. Insulin: a hormone that helps the body use glucose for energy.
25. Insulin resistance: the body's inability to respond to and use the insulin it produces. Insulin resistance may be linked to obesity, hypertension, and high levels of fat in the blood.
26. Interface with health systems: variables that address any actions that bring an individual in contact with the health care system, including the frequency of health care visits, availability of health care, use of health care services, type of health care services, and health care coverage.

27. Kidney failure: a chronic condition in which the body retains fluid and harmful wastes build up because the kidneys no longer work properly. Also called end-stage renal disease (ESRD).
28. Managed care*: techniques used by or for health care purchasers to manage health care costs by influencing patient decision making via assessments of appropriate care.
29. Myocardial infarction: an interruption in the blood supply to the heart because of narrowed or blocked blood vessels. Also called a heart attack.
30. Nephropathy: disease of the kidneys. Hyperglycemia and hypertension can damage the kidneys, preventing kidneys from removing waste and extra fluids from the bloodstream.
31. Neuropathy: disease of the nervous system.
32. Peripheral neuropathy: nerve damage that affects the feet, legs, or hands.
33. Peripheral vascular disease (PVD): a disease of the large blood vessels of the arms, legs, and feet.
34. Potential gain in life expectancy: what an individual's life expectancy would be if their specific disease was eliminated
35. Prevalence: the number of people in a given group or population who are reported to have a disease
36. Prevention*: Primary prevention is stopping or delaying the onset of diabetes. Secondary prevention is early identification of diabetes and/or stopping or delaying the onset of complications. Tertiary prevention is stopping disability from disease and its complications.

37. Primary care (provider)*: A physician specializing in general, family, general internal medicine, general pediatrician, physician assistant, or nurse practitioner.
38. Renal: having to do with the kidneys. A renal disease is a disease of the kidneys. Renal failure means the kidneys have stopped working.
39. Self-management: the ongoing process of managing diabetes.
40. Stroke: condition caused by damage to blood vessels in the brain; may cause loss of ability to speak or to move parts of the body
41. Type 1 diabetes: a condition characterized by high blood glucose levels caused by a total lack of insulin; develops most often in young people but can appear in adults.
42. Type 2 diabetes: a condition characterized by high blood glucose levels caused by either a lack of insulin or the body's inability to use insulin efficiently; develops most often in middle-aged and older adults but can appear in young people.
43. Years of potential life lost (YPLL): number of years an individual would have lived had that person not died (Wong et al., 2002).

-All definitions were taken directly from the Diabetes Dictionary, created by the National Diabetes Information Clearinghouse, with the exception of definitions marked with an asterisk (*). Definitions with an * came from Healthy People 2010.

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