2017

Depressive Symptoms Association With Health Outcomes And Treatment In Older Americans With Diabetes

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DEPRESSIVE SYMPTOMS ASSOCIATION WITH HEALTH OUTCOMES AND TREATMENT IN OLDER AMERICANS WITH DIABETES

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Submitted in Partial Fulfillment of the Requirements

For the Degree of Doctor of Philosophy in

Health Services Policy & Management

The Norman J. Arnold School of Public Health

University of South Carolina

2017

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DEDICATION

This is dedicated to my family who has encouraged me and kept me motivated during this process. I thank my family for their constant support and belief in me. First, I would like to dedicate this dissertation to my beloved mother who passed away too soon from complications with diabetes. I pray that this is just the first step in allowing me to help my people and reduce complications in diabetes.

ACKNOWLEDGEMENTS

I would like to take this moment to acknowledge and thank my dissertation chair, Dr. Saundra Glover. Dr. Glover, I thank you for your support and help in getting me through this process. In addition, I would like to acknowledge my dissertation committee, Dr. Janice Probst, Dr. James Hardin, and Dr. Zaina Qureshi for their expertise and knowledge and taking the time to help me get through this process. In addition, I would like to thank Ms. Debra Brown for her love and support.

ABSTRACT

Introduction: Diabetes remains the 7th leading cause of death in the United States. Diabetes is a major public health concern of its own, but when you add the co-morbidity of depression, diabetes outcomes are amplified. This dissertation examines how depressive symptomatology and treatment for depression are associated with self-reported health (SRH) and diabetes control.

Methods: Chi-square and logistic regression were used to analyze data from the Health and Retirement Study (2012). We assessed the associations between SRH and diabetes control with depressive symptomatology data.

Results: In our sample (n=4374), 19% of respondents reported high depressive symptomatology and 59% self-reported "good" health compared to 41% self-reported "bad" health. Associated with "bad" SRH were psychiatric medication or psychotherapy treatment (p=.0211), education (p=<.0001), insulin usage (<.0001), diabetes control (p=<.0001), depressive symptomatology (p=<.0001), and clinical diagnosis for depression (p=.0005). For the second outcome, only 9% of the sample reported no diabetes control. Insulin usage (p=<.0001), SRH (p=<.0001), depressive symptoms (p=.0039), sex (p=.0363) and age (p=.0015) were associated with no diabetes control.

Conclusion: Depressive symptomatology is associated with SRH and diabetes control. Treatment is moderately significant with SRH, but not significant with diabetes control. A depression diagnosis was not significantly associated with diabetes control.

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LIST OF ABBREVIATIONS

CESD ..... Centers for Epidemiological Studies for Depression Scale

SES..... Socio-Economic Status

SRH..... Self-Reported Health

T2D ..... Type 2 Diabetes

CHAPTER ONE

INTRODUCTION

Diabetes is the 7th leading cause of death in the United States (Centers for Disease Control and Prevention, 2014). Approximately 29.1 million Americans or 9.3% of the population have diabetes (Centers for Disease Control and Prevention, 2014). Diabetes is more prevalent amidst disadvantaged groups and communities predicted by race and socioeconomic status (Nicklett, 2011). Diabetes is a huge public health concern because of its rising prevalence and the many co-morbidities and complications associated with a diagnosis. Diabetes is associated with several diseases and conditions such as cancer, infectious disease, intentional self-harm, depression, nerve disease periodontal gum disease, erectile dysfunction, and degenerative disorders (Centers for Disease Control and Prevention, 2014; Egede, Grubaugh, & Ellis, 2010; Rao Kondapally Seshasai et al., 2011). Complications with diabetes may originate from improperly managing diabetes and may lead to a decrease in length and quality of life. The Centers for Disease Control reports that diabetes is the leading cause of non-traumatic lower limb amputations, kidney disease, and preventable blindness. Managing diabetes requires people with diabetes to participate in recommended self-care activities. Lack of participation in these self-care activities leads to risk of complications and decreases the ability to control diabetes.

In 2010, diabetes contributed to 234, 051 deaths and was listed as the leading cause of death for 69,0671 people (Centers for Disease Control and Prevention, 2014) Not

only is diabetes a significant contributor to death, but the risks for death among diabetics are twice as high as a person of similar age with no diabetes diagnosis.

The complications and the economic burdens of diabetes are great. The burden of diabetes includes increased medical costs, indirect costs from work-related absenteeism, reduced productivity at work and home, reduced labor force participation from chronic disability, and premature mortality. (Centers for Disease Control and Prevention, 2014). The total estimated cost for treating diabetes in 2012 was $245 billion dollars. People with a diabetes diagnosis have 2.3 times higher medical expenditure than people without the diabetes diagnosis (Centers for Disease Control and Prevention, 2014). Due to the overwhelming cost burden of diabetes, diabetic complications, and heighten morbidity and mortality rates, further research is needed to decrease the prevalence of diabetes and complications that arise.

The complications and the economic burden of diabetes are great for adults with diabetes. However, when you add the co-morbidity of depression to diabetes it increases health expenditures and adults with diabetes may report lower self-reported health. (Egede, Zheng, & Simpson, 2002) study reports that diabetic patients who were depressed had significantly higher health expenditures ($247,492,008 vs. 55,406,559; p=<.0001) than diabetic patients who were not depressed. (Ludman et al., 2004) argues that diabetic patients with depression reported more symptoms then patients without depression. Depression may amplify diabetic symptoms or problems with adults with diabetes. (Egede et al., 2002) reported individuals with diabetes were 2.5 times more likely to have co-morbid clinical depression then individuals without diabetes.

Approximately 1/3 of diabetic patients with diabetes also report having depression (Anderson, Freedland, Clouse, & Lustman, 2001). Diabetes and depression combined lead to lower self-reported health and diabetes control, higher medical expenditures and health care utilization.

Statement of the Problem

Patients with diabetes self-report that they are depressed, but they have not been treated or told by a doctor that they have depression. (Gupchup, Borrego, Raisch, & Knapp's 2011) study found that only 62 of the 112 patients with possible depression had a documented diagnosis of depression. Previous studies have shown that patients who have both depression and diabetes have higher health expenditures, lower self-reported health, and less diabetic control. Incorporating depression screening for patients with diabetes may improve both diabetes and depression in patients with diabetes. Understanding whether a patient is depressed, could help primary care doctors treat patients for depression which would reduce depression and improve health outcomes of diabetic patients.

Purpose of the Study

The proposed study is based on predisposing, enabling, need for services, and health behaviors to influence self-reported health in an elderly population. One of the purposes of this study is to understand how self-reported depressive symptomatology is associated with a clinical depression diagnosis, self-reported health, and perceived diabetes control. Secondly, this study aims to examine the association between treatment for depression and depressive symptomatology, self-reported health, and

perceived diabetes control in later years.

Theoretical Framework

The theoretical framework for this study will be based on Andersen's Behavioral Model for Health Services Use. The conceptual framework will examine older Americans who have diabetes and study the association between predisposal, enabling, and need characteristics that influences health behavior which in turn determines health outcomes such as self-reported health status, perceived diabetes control, and depressive symptomatology (CES-D score). Andersen's Behavioral Model for Health Services Use will explain how predisposing, enabling, and need factors influence health behaviors which leads to health outcomes. For this study, we will examine how predisposing factors such as age and sex are associated with self-reported health, depressive symptomatology, and diabetes control. The enabling factors in this study are education. The need factors are mental health and diabetes diagnosis. The health behavior this study will address is treatment for depression. The outcomes for this study are self-reported health status and perceived diabetes control.

The Behavioral Model for Health Services Use include predisposing, enabling, and need factors. Predisposing factors in the Behavioral Model of Health Services Use are factors that illustrate the tendency for individuals to use health services such as mental health treatment, checkups, or explain personal health behaviors such as smoking and physical activity (please see figure 1). The enabling factors are an individual's ability to gain access to needed health services (Gelberg, Andersen, & Leake, 2000). In the enabling factor, process of medical care is an important component. Process of medical care might include measures such as patient

counseling, test ordering, prescriptions, and the quality of provider patient communication (Gelberg et al., 2000). Access to health care services is limited by the ability of a person to pay for services, rurality, and health insurance. The need factor is related to the condition of the individual such as diabetes and mental health condition as well as the perceived health status (Gelberg et al., 2000).

From previous studies, researchers have identified sex, marital status, and duration of diabetes as important variables to examine when researching depression. The conceptual framework will allow the researcher to explain the relationship between depression and self-reported health and compare diabetic patients based on predisposing, enabling, and need factors and health behaviors to assess the health outcomes of self-reported health and diabetes control.

Importance of the Study

This study is significant because the researchers will examine the associations between patients' perceptions of depression and depressive symptomatology and self-reported health. If associations are found, this information could be used to change policy to encourage depression screening for patients as part of routine care. If depression is detected in patients with Type 2 diabetes, then providers can make proper referrals for diabetic patients to receive treatment. Once the referrals are made and depression is treated, improvements should be seen in diabetes outcomes and depression. Treatment of depression with patients with diabetes could lower healthcare expenditures and improve quality of life for patients with diabetes. This study is also significant because it is a national survey examining an older American population.

Scope of the Study

This study will be conducted using a secondary national data set. The Health and Retirement Study (HRS) and the RAND HRS data are the sources of data used to conduct the study. The Health and Retirement Study is a national longitudinal dataset that interviews respondents every two years. The initial target population was adults born between 1931 and 1941 living in the US and their spouses. The HRS dataset oversamples Blacks, Hispanics, and residents of Florida. The RAND Center Study of Aging created the RAND HRS data to make the data more accessible to researchers and for the ability to compare variables across survey years. The data are limited to the number of participants who completed the CES-D part of the questionnaire, have diabetes, and have a clinical depression diagnosis. These inclusion factors will limit the sample size of the study.

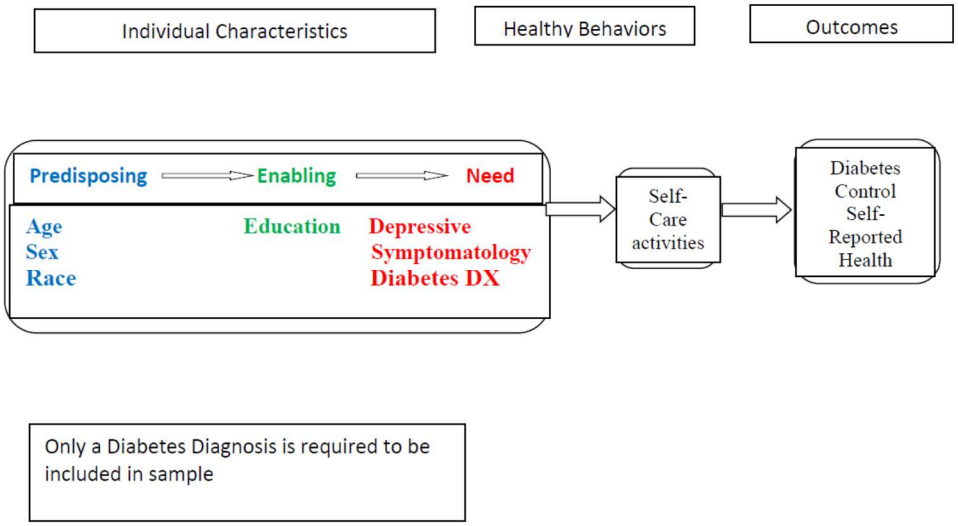

Figure 1.1: Andersen's Behavioral Model for Health Services Use for RQ 1-2

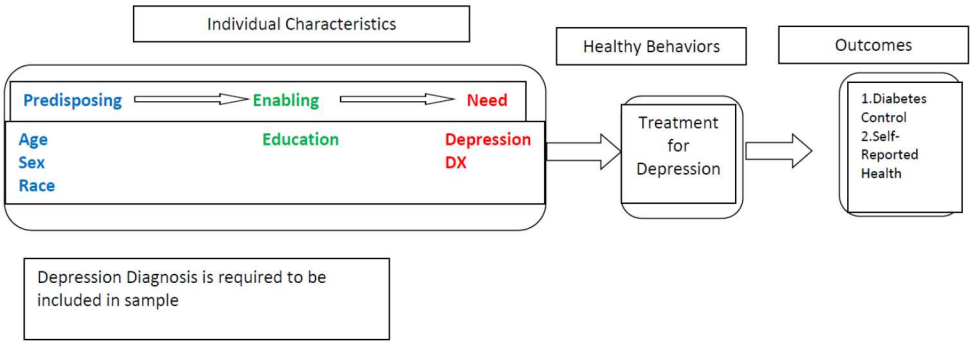

Figure 1.2: Andersen's Behavioral Model for Health Services Use for RQ 3-4

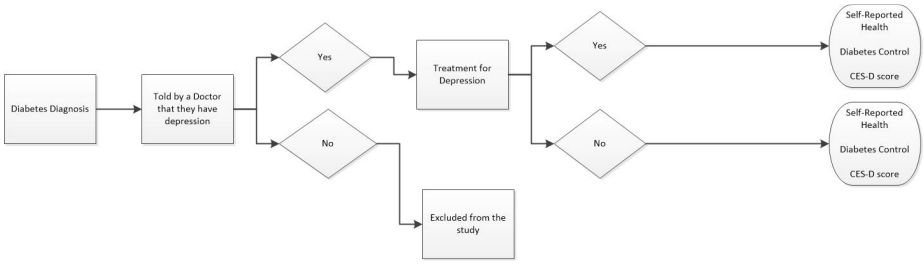

Figure 1.3 Flow chart for RQ 3 – 4

Research questions three and four include all participants that have diabetes and a depression diagnosis. In this research project, we will assess the association between treatment, self-reported health and diabetes control. Figure 1.3 outlines the inclusions and exclusions for this study.

CHAPTER TWO

LITERATURE REVIEW

Depression Defined

Depression is defined as a mood disorder that causes a persistent feeling of sadness and loss of interest. Depression alters how a person feels, thinks, or behaves (Mayo Clinic Staff). Depressive symptoms are associated with the management and control of Type 2 Diabetes (T2D). Symptoms of depression are: depressed mood, marked diminished interest/pleasure, sleep disturbance, appetite disturbance, fatigue/loss of energy, diminished concentration or indecisiveness, feelings of worthlessness or excessive or inappropriate guilt, psychomotor retardations or agitation, and recurrent thoughts of death or suicide (Park & Reynolds, 2015). The DSM-IV criteria requires that patients present at least five symptoms nearly every day for 2 weeks and causes significant distress or functional impairment to be diagnosed as depressed.

Depression can be identified through self-report measures. Depressive Symptomatology is measured through self-report instruments that are looking for the following symptoms: feeling sad/depressed mood, inability to sleep, early waking, lack of interest/enjoyment, tiredness/lack of energy, loss of appetite, feelings of guilt/worthlessness, and recurrent thoughts about death/suicide ("Depression," 2016.).

Repeated symptoms are what can be used to report depressive symptomatology in patients.

Factors associated with Depression/Depressive Symptomatology

Certain risk factors are associated with depressive symptomatology. Sex, age, household living arrangements, social support, and socio-economic status are risk factors associated with depression in the general population (Roy & Lloyd, 2012a). In regards to ex, depression is more prevalent in the female population than in the male population. A study conducted by (Riolo, Nguyen, Greden, & King, 2005) reported the prevalence of depression was higher among the female population for Whites, Blacks, and Mexican population than for males. Females are three times more likely to have depression in response to a stressful event than males (Maciejewski, Prigerson, & Mazure, 2001). In a meta-analysis by Anderson et al., 2001, the prevalence of depression was 27% in females compared to 18% in males. Women experience unique life experiences such as childbirth and menopause that contributes to the hormonal and environmental imbalances that may trigger depression (Chang et al., 2010). Females also experiences more negative life experiences such as physical and sexual abuse, poverty, discrimination, and they are more likely to depend on others in comparison to males which contributes to the higher risk of depression in females (Keita, 2007). Sex is not only a risk factor for depression in the general population, but it is also a risk factor for depression for persons with diabetes (Fisher et al., 2008; Katon, 2008). Secondly, age is a risk factor for depression in the general population as well as the diabetic population. In the older age population, depression is more prevalent than the younger population with other health problems (Maraldi et al., 2007). Some studies

show that people with the co morbidity of depression and diabetes tend to be younger than patients with diabetes and without depression.

However, some studies suggest depression is more prevalent in the younger population than in the older population (Fisher et al., 2008; Katon, 2008; Knol et al., 2006; Lin et al., 2009; Nouwen et al., 2010). Another study conducted by (Golden et al., 2008) reported older age as a risk factor for higher prevalence of depression. Other studies show that depression is prevalent in both the young and the old.

Another risk factor for depression is individuals who live alone. A study by (Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006) reported that higher levels of loneliness were associated with more depressive symptoms. In another study by Wilson et al., 2007 reported that risk factors associated with the prevalence of depression included not living close to family and friends (OR: 2.540, CI 1.442-4.466) and poor satisfaction with living accommodation (OR:.840, CI 735-.961). Older people who live alone are at risk for developing depression.

The fourth risk factor for developing depression is poor social support. (Cohen & Wills, 1985) defines social support in health as purported to exert its influence in two main ways. One way social support influences health is it provides essential support to cope with health problems, adhere to self-care regimens and eludes potentially negative influences or indirectly as protection against the influence of stressful events. Having high levels of social support are likely protective factors in developing depression (Zhang et al., 2015). People without depression had higher scores on the social support scale compared to people who did have depression (Kim et al., 2015). Social support is very important in reducing the risk factor for depression.

In a study by Cohen and Willis, 1985, researchers reported that lack of positive social support is associated with poor mental health outcomes and physical health outcomes. In a study by (Badawi, Gariépy, Pagé, & Schmitz, 2012), respondents with very good and good self-rated health reported more social support than respondents who self-rated their health as excellent, fair, and poor self-rated health.

The fifth risk factor for depression is low socio-economic status (SES). Researchers have reported that low SES is a common risk factor for depression and T2D. In developed countries, there is a link between depression and SES. For example, low SES is linked to poor physical and poor psychological health in developed countries (Chang et al., 2010). Literature suggests that socioeconomic status contributes to unhealthy lifestyles that could lead to the development of depression and diabetes (Chang et al., 2010). In a study by (Groffen et al., 2013), they found that white women who were current smokers vs. never smoked and who were inactive vs exercise had a higher hazard ratio to develop depressive symptoms (1.65: 95% CI 1.08-2.53) and (1.74: 95% CI: 1.17-2.60) respectively. (Groffen et al., 2013) study linked SES to developing depressive symptoms. Researchers found that low education in white women and black women were associated with higher incident depressive symptoms (1.84: 95% CI: 1.27- 2.66) and (1.84: 95% CI: 1.27-2.68). For white men hazard ratios where incident depressive symptoms were significantly higher were observed in the lowest income group (3.08: 95% CI: 1.12-8.53); and for black men hazard ratios were higher in low income and low education (5.02: 95% CI: 2.09-12.05) and (2.31: 95% CI: 1.52-3.54) (Groffen et al., 2013). These studies suggest because people in low SES have high levels of stress, live in financial hardship, and

have poor healthcare they are more likely to develop depression. Researchers have also found differences in SES between rural and urban elderly adults. In a study conducted by (Li, Liu, Xu, & Zhang, 2015), researchers found that rural older adults were 2.549 points higher than their urban peers in depressive symptomatology. For example, participants with more education, higher pension benefits, more household assets, and who live in better infrastructure had less depressive symptoms than elderly adults who had a lower SES (Li et al., 2015). In a study by (Everson, Maty, Lynch, & Kaplan, 2002), researchers examined four significant studies to see the relation between depression and SES and found that the prevalence of depression was almost twice as high for men and women with less than a high school education compared to those with a high school diploma or more. SES has been linked to obesity, diabetes, and depression prevalence (Everson et al., 2002). Many people who are obese, diabetic, or depressed have similar health behaviors as precursors to chronic conditions and diseases.

Prevalence of Depression in Patients with T2D

Studies and reviews have been conducted to examine the relationship between depression and diabetes. Some researchers conclude that there is a bidirectional association between depression and Type 2 diabetes (T2D) (Pan et al., 2010). A meta-analysis conducted by (Mezuk, Eaton, Albrecht, & Golden, 2008) found 13 studies representing 6,916 incidents that depression predicted onset of diabetes and found 7 studies representing 6,414 incidents where diabetes predicted the onset of depression. Pan et al., 2010, found that the relative risk for developing clinical depression in patients with T2D was 1.44 (95% CI, 1.33-1.57) in the age adjusted model, the relative risk for developing T2D for participants who were clinically diagnosed as depressed or

scored between 53-75 on the MHI-5 was 1.24 (95% CI, 1.11-1.38), and for participants who scored less than or equal to 52 on the MHI-5 relative risk was 1.42 (95% CI, 1.28-1.58). In Pan's study, they found that women using antidepressants medication had a significant increased risk of incident T2D compared with those with MHI-5 scores of 86 to 100 (RR 1.25; 95% CI, 1.10-1.41). In a meta-analysis conducted by (Anderson et al., 2001), the odds of developing diabetes were 1.41 among patients who were depressed (Yu et al., 2015). Approximately, 31% of individuals with diabetes had elevated depressive symptoms (Anderson et al., 2001).

Depressive Symptoms in Patients with T2D

Some symptoms of depression could also be linked back to high blood sugar. High blood sugar or uncontrollable blood sugar could leave individuals feeling fatigued and loss of appetite. Symptoms of high blood sugar or hyperglycemia are frequent urination, increased thirst, blurred vision, fatigue, and headaches (Mayo Clinic Staff). Being fatigued is a symptom of depression as well as symptom of having hyperglycemia or high blood sugar. (Roy & Lloyd, 2012) study reported that symptoms that overlap between depression and diabetes and its long-term complications are tiredness, lethargy, lack of energy, sleeping difficulties and appetite changes. Signs of uncontrollable diabetes could lead to depression in patients with T2D because they might feel they have no control over managing diabetes and the limitations that patients with T2D face to manage and control their diabetes.

Research has identified self-care activities or lifestyle factors as important elements in diabetic control. Participants who were highly depressed had significantly lower concurrent baseline health behaviors than participants who were in low/no and

moderately depressed groups (Chiu, Wray, Beverly, & Dominic, 2010). Depressive symptoms are associated with non-adherence to diabetes self-care and hemoglobin a1c levels (Chiu et al., 2010; Ciechanowski, Katon, Russo, & Hirsch, 2003). Diabetic patients who were depressed were more likely to have decreased adherence to a healthy eating plan and physical activity (Bell et al., 2010). Healthy eating plans and physical activity are two of the five self-care activities in which diabetes patients should routinely participate. Greater fruits and vegetables intake was associated with lower odds for depression in a Canadian sample (Mcmartin, Jacka, & Colman, 2013). Greater adherence to self-care activities lead to greater control of diabetes (Lustman et al., 2000). When diabetic patients are depressed it influences their participation in self-care activities such as medication adherence, poor nutrition, and lack of exercise (Lin et al., 2004). Understanding the risk factors for depression and screening patients for depression could help patients control their diabetes better and report better general health.

Self-Reported Health Status and Depression in Patients with T2D

Self-reported health status has been linked to an association with depression and mortality in patients with diabetes. In a study by (Badawi et al., 2012), researchers found that 36.6% of individuals who developed major depression at follow up were more likely to have reported their health as fair or poor compared to 14.4% of those who had not developed major depression. The odds of developing depression were higher for individuals who rated their health as fair or poor at baseline during a 3-year follow-up period after controlling for socio demographics, lifestyle related behaviors, and disability and diabetes specific characteristics (OR=2.05, 95% CI: 1.20-3:48)

(Badawi et al., 2012). However, in a study by (Kosloski, Stull, Kercher, & Van Dussen, 2005) researchers found that self-rated health has effects on depressive symptomatology, but there is minimal to no association between depressive symptomatology and self-rated health. (Kosloski et al., 2005) used longitudinal data from the Health and Retirement Study from 1992 to 2000. (Badawi et al., 2012) found that depressive symptomatology was strongly associated with self-rated health when controlling for covariates. For example, the (OR:1.43, 95% CI 1.14-181), the odds of depression for a respondent who self-rated their health status as excellent, very good, or good vs. a respondent who self-rated their health as fair/poor (Badawi et al., 2012).

In conclusion, depressive symptomatology is associated with self-reported health in the general population as well as with persons with diabetes. However, this study will add to the body of literature by assessing the relationship between clinical diagnosis of depression and perceived depression symptomatology with patients with diabetes. Not only will this study assess differences in clinical diagnosis and depressive symptomatology, but this study will examine the associations between treatment for depression, self-reported health and diabetes control. This study will be useful because it will begin to identify ways treatment for depression is associated with depressive symptomatology, perceived diabetes control and perceived self-reported health.

CHAPTER THREE

RESEARCH DESIGN AND METHODS

Conceptual Framework

This study will utilize Andersen's Behavioral Model of Health Services Use as the conceptual framework. The Behavioral Model of Health Services Use will explain how predisposing, enabling, and need factors influence health behaviors which leads to health outcomes. For this study, we will examine how predisposing factors such as age, sex, and race are associated with health status and health outcomes. The enabling factors in this study is education. Education is being used as a proxy for income. The need factors are depression diagnosis, depressive symptomatology, and having a diabetes diagnosis. A health behavior this study will address is treatment for depression. The outcomes for this study are self-reported health status, perceived depression, and perceived control of diabetes.

The Behavioral Model of Health Services Use utilizes predisposing, enabling, and need factors. Predisposing factors in the Behavioral Model of Health Services Use are factors that illustrate the tendency for individuals to use health services such as mental health treatment, checkups, or explain personal health behaviors such as smoking and physical activity. The enabling factors are an individual's ability to gain access to needed health services (Gelberg et al., 2000). In the enabling factor, process

of medical care is an important component. Process of medical care might include measures such as patient counseling, test ordering, prescriptions, and the quality of provider patient communication (Andersen, 2008). Access to healthcare services is limited by the ability of a person to pay for services, rurality, and health insurance. The need factor is related to the condition of the individual such as diabetes and mental health condition as well as the perceived health status (Gelberg et al., 2000).

Sample Description

This study uses data from the Health and Retirement Study (HRS) and the RAND HRS data. The Health and Retirement is a longitudinal dataset that includes six cohorts and interviews respondents every two years (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). The six cohorts are the initial HRS cohort, the AHEAD (The Study of Assets & Health Dynamics, The CODA (Children of Depression), War Baby, Early Baby Boomer, and Mid Baby Boomer. The initial HRS cohort oversampled blacks, Hispanics, and people who live in Florida, who were born between the years 1931 to 1941. The initial cohort was originally interviewed in 1992 and subsequently every two years after. The second cohort is (AHEAD). The AHEAD cohort interviewed individuals who were born before 1924. The AHEAD cohort was originally interviewed in 1993, 1995, 1998, and subsequently every two years thereafter. The third cohort is the Children of Depression (CODA). The CODA cohort were born in 1924 to 1930 and the first interview was in 1998. The CODA cohort is interviewed every two years after 1998. The fourth cohort is the war baby cohort.

Individuals in this cohort were born in 1942 to 1947. The initial interview was in 1998. The fifth cohort is the early baby boomer. The individuals in this cohort were born in 1948 to 1953. The initial interview for the early baby boomer cohort was 2004. Lastly, the mid-baby boomer was the last cohort. The mid baby boomers were born in 1954 to 1959. The baby boomers were first interviewed in 2010. The RAND dataset combined data from each wave and cohorts and included respondent level information that is comparable across all waves (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). The RAND data report on individuals and everyone is assigned a unique household number and person number.

Dependent Variables

The main outcome variables of interest are *self-reported health* and *diabetes control*. Self-reported health (SRH) status is a common measurement of health outcomes. Global self-report health status is one of the most frequently measured health perceptions in epidemiological research (Salomon, Nordhagen, Oza, & Murray, 2009). SRH can be measured by asking one single question, "Would you say your health is excellent, very good, good, fair, or poor?" (Mavaddat et al., 2011; Ware, Snow, Kosinski, & Gandek, 1993). In a study conducted by (Mavaddat et al., 2011), researchers reported that all the dimensions of health (SF-36) were strongly associated with the SRH with a significant p-value (<.00001), to show that poorer SRH categories had lower SF-36 scores. Although all the dimensions of health were significant, the physical functioning dimension of SRH (OR: 3.7, 95% CI: 3.3 to 4.1) had a twofold

stronger association with 'poor' health than with mental health (OR: 1.4, 95% CI: 1.2 to 1.5). Many studies have determined that SRH is a strong predictor of mortality in both population and clinical samples (Idler & Benyamini, 1997). In a review by (Idler & Benyamini, 1997), researchers found that SRH is likely a global assessment of health for the organism and its environment and the organism uses a range of emotional, physical, and social inputs to yield a fused response. Self-reported health is a combination of symptoms, biological inputs, and physical functioning, and even of subclinical disease or unmeasured biological processes yet to be revealed (Mavaddat et al., 2011). In a study conducted by (Mossey & Shapiro, 1982), researchers reported that elderly self-reported health were better predictors of 7 years' survival than their medical records. In another study by Idler et al., 2000, researchers found that global self-ratings of health in support of males but not in females add significantly to mortality predictions, even when a large array of covariates are added in the model. In a meta-analysis by (Desalvo, Fan, Mcdonell, & Fihn, 2005), researchers found that persons with "poor" SRH had a twofold higher mortality risks compared with persons with "excellent" SRH. SRH is an important predictor of health outcomes because poor perceptions of health may contribute to nonadherence in preventive practices or self-care (Idler & Benyamini, 1997). Lack of participation in self-care or preventive practices leads to worse health outcomes and chronic conditions. In a classic study by (Haug, Wykle, & Namazi, 1989), researchers reported that older respondents with better perceived health were more likely to engage in self-care activities.

Respondents in our study were asked the following question, "Would you say your health is, "excellent, very good, good, fair or poor". Respondents answered using the

5 point lickert scale. SRH is coded as a categorical variable. SRH will be divided into "bad" versus "good" self-reported health. The researcher will combine excellent, very good, and good into the "good" category and will combine fair and poor into the "bad" category.

Diabetes control is the next outcome of interest. Respondents were asked the following question, "Is your diabetes general under control answering yes, no, don't know"? Perceived diabetes control is coded as a binary variable, with responses coded as either yes or no. The researchers only used yes and no responses.

Independent Variables

For this study, we examined two primary independent variables. The first independent variable we examined was depressive symptomatology. In the first research question, we examined the association between depressive symptomatology and self-reported health and diabetes control. Depression is measured either by a clinical diagnostic exam or by depressive symptomology. In a recent systematic review, researchers examined screening tools used to measure depression in patients with diabetes. The five most common screening tools to measure depression in patients with diabetes were: Beck Depression Inventory (BDI) which was cited 24%, Centre for Epidemiologic Studies Depression Scale, (CES-D) which was cited 21%, Problems Areas In Diabetes (PAID) scale which was cited 12%, Patient Health Questionnaire (PHQ) which was cited 11%, and the Hospital Anxiety and Depression Scale (HADS) which was cited 10% (Roy et al., 2012). The Beck Depression Scale is the most common self-report instrument used to measure depressive symptomatology in patients with diabetes. (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) created

a self-report instrument by systematically observing and recording the characteristics, attitudes, and symptoms of depressed patients. The (BDI or BDI-II) scale is composed of 21 categories of symptoms and attitudes that were clinically derived. The different categories are mood, pessimism, sense of failure, lack of satisfaction, guilty feeling, sense of punishment, self-hate, self-accusations, self-punitive wishes, crying spells, irritability, social withdrawal, indecisiveness, body image, work inhibitions, sleep disturbance, fatigability, loss of appetite, weight loss, somatic preoccupation and loss of libido (Beck et al., 1961). (Beck et al., 1961) tested the validity and reliability of the scale. The BDI scale has an internal consistency of 93% and construct validity is seen when the demographic variables had no or weak association with the PDMS scores (Beck et al., 1961). The next scale used the most to assess depression in patients with diabetes is the Center for Epidemiologic Studies Depression Scale (CES-D).

The (CES-D) scale was created to measure depressive symptomatology with a focus on the symptoms of clinical depression (Radloff, 1977). The components of the CES-D included depressed mood, feelings of guilt and worthlessness, feeling of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance (Radloff, 1977). The original (CES-D) contained 20 items that listed different symptoms of depression that was based upon previous validated scales (Radloff, 1977). The validity of the CES-D scale can be seen when discriminant validity was utilized to show the correlations between the CES-D scale and other validated scales. Reliability of the CES-D scale was tested when, researchers conducted test/retest analysis with both clinicians and self-reported testing (Radloff,

1977). The CES-D scale has been shortened from 20 items to 8 items and it is a validated and reliable tool to measure current depression symptomatology (Steffick, 2000). On the original scale a cutoff score of 16 or higher indicated major depressive symptoms, for the shortened version of the scale a cutoff score of 4 corresponds to the score of 16 on the original version (Steffick, 2000). Recent studies have used the shortened (CES-D) to correlate depressive symptoms with diabetes risk and clinical factors (Mojtabai & Olfson, 2004; Ratliff & Mezuk, 2015). In a study by (McHale, Hendrikz, Dann, & Kenardy, 2008), researchers examined four depression screening tools, which were the Center for Epidemiological Studies Depression Scale (CES-D), The Silverstone Concise Assessment for Depression (SCAD), the Hospital Anxiety and Depression Scale (HADS), and the Depression in the Medically Ill (DMI) Questionnaire to compare the effectiveness of the screening for depression tools. The CES-D was the best predictor of depression in the diabetes sample and could stand alone as predictors of major depression (McHale et al., 2008).

The CES-D score is an eight-item scale that is used to determine whether individuals report depressive symptomatology. The 8-item measure of depression symptomatology ask respondents if they have experienced the following sentiments all or most of the time, "depression, everything is an effort, sleep is restless, felt alone, felt sad, could not going, felt happy, and enjoyed life" (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). To calculate this mental health index, the score is derived from the sum of "negative" and reversed coding for the "positive" indicators (Chen,

Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). Research has shown that a score of four or greater is equal to high depression symptomatology (Steff, 2000). Depressive symptomatology is a binary variable.

Another primary independent variable is treatment for depression. Respondents were asked two questions, "Do you now get psychiatric or psychological treatment for your problems" and "Do you now take tranquilizers, antidepressants, or pills for nerves?" If respondents answered "yes" to either question, then the treatment variable was binary and was considered yes for treatment. If respondents answered "no" to both questions, the treatment variable was considered "no".

There are many different types of treatment for depression. Some different types of treatment for depression are psychological which may include cognitive behavior therapy (CBT), motivational interviewing, problem solving, counseling, interpersonal therapy, or brief psychodynamic. (Markowitz, Gonzalez, Wilkinson, & Safren, 2011) Treatment for depression can be divided into three major groups which are psychotherapy, pharmacological, and a combination of both psychotherapy and pharmacological (U.S. Department of Health & Human Services, 1999). Pharmacological or antidepressant medications (ADM) prescriptions have increased tremendously. A study by (Olfson et al., 2009), assessed national patterns in antidepressant medication from 1996 to 2005 which showed an increase from 13.3 million persons in 1996 to 27.0 million persons in 2005 that were treated with antidepressants. In a study by (Brieler, Lustman, Scherrer, Salas, & Schneider, 2016),

individuals who received ADM had better glycemic control (50.9%) vs. (34.6%) from individuals who received no treatment. Individuals who received ADM were twice as likely to achieve good glycemic control versus individuals who didn't receive ADM (OR:1.95; 95% C.I.: 1.02-3.71)(Brieler et al., 2016). However in a meta-analysis of randomized control trials by (Semenkovich, Brown, Svrakic, & Lustman, 2015) researchers found that ADM and psychotherapy were moderately effectively for depression and CBT had benefits on glycemic control. However in a randomized control trial by (Inouye, Li, Davis, & Arakaki, 2015) researchers reported a mean reduction in CES-D scores for the CBT group of (-2.45) and a slight reduction of (-.31) for the Diabetes Education Support group (DES). However, at 12 months these changes were not significant. This study by Inouye, Li, Davis, & Arakaki study reported no sustainable significant results with CBT for diabetes control.

Analysis Plan/Analytic Approach

Univariate analysis was conducted to describe the variables in the sample. Bivariate analysis was conducted of the study covariates by CESD scores, treatment, and mental health diagnosis. Chi-squared testing was performed on the weighted sample to examine differences in the proportion of depressive symptomatology among demographic variables and health variables. Bivariate logistic regression, using PROC SURVEY LOGISTIC, was performed on the weighted data to obtain the crude association between self-reported health and depressive symptomatology. The final models listed below are adjusted for the covariates listed in the Behavioral Model of Health Services Use (see Figure 1.1).

Table 3.1- Co-Variables for Research Study

Question ID	Variable	Question	Responses	Data Source
R1DIAB NC010	Diabetes Diagnosis	Has a doctor ever told you that you have diabetes or high blood sugar?	Yes No	RANDS HRS 2012
NC012	Insulin Treatment for diabetes	Are you now using insulin shots or a pump?	Yes No	HRS 2012
NC011	Medication Treatment for diabetes	In order to treat or control your diabetes are you now taking medication that you swallow?	Yes No	HRS 2012
NA019	Age		Continuous	HRS 2012
Gend_r	Gender		Male Female	HRS 2012
RARACEM	Race/Ethnicity	What race do you consider yourself to be?	White, black or African American, American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, or something else	RANDS

Table 3.1 Co-Variables for Research Study continued

NC271	Depression Diagnosis	Has a doctor ever told you that you have had problems with depression?	Yes No	HRS 2012
HHID	HHID	Household identification number		RANDS 2012
PN	Pin	Household Pin		RANDS HRS 2012
B014 RAEDYRS NB015	Educational Level	What is the highest grade of school or year of college you completed? Earn high School diploma	-0 For no formal education -1-11 grades -12 high school -13-15 some college -16 college grad -17 post college	RANDS

Research Questions

The proposed study is based on contextual, individual, and health behavior factors hypothesized to influence the association of self-reported health and depression symptomatology. Four research questions are proposed to be answered through this study. Research questions and hypotheses are organized under each specific aim.

Specific Aim #1: Among a nationally representative sample of older adults, assess the relationship among depressive symptomatology and self-reported health.

Research Question 1: How is depressive symptomatology associated with self-reported health?

Hypothesis:	Diabetic patients who score >=4 on the CES-D score are more likely to report poor for perceived self- reported health status than diabetic patients who score <4 on the CES-D.
Independent Variable:	Depressive Symptomatology
Outcome	Self-Reported Health (good or bad)
Covariates:	Behavioral Model of Health Services Use covariates (see Figure 1.1)
Analysis:	Logistic Regression (Model self-reported health=bad)

Specific Aim #2: Among a nationally representative sample of older adults, assess the relationship among depressive symptomatology and diabetes control, and to assess the association between Andersen's Behavioral Model of Health Service Use covariates with the outcomes of interest (see figure 1.1).

Research Question 2: How is depressive symptomatology associated with perceived diabetes control?

Hypothesis:	Diabetic patients who score >=4 on the CES-D score are more likely to report no for perceived diabetes control than diabetic patients who score <4 on the CES-D
Outcome:	Diabetes Control
Exposure:	CES-D score (>=4 vs. <4)
Covariates:	Behavioral Model of Health Services Use covariates (see Figure 1.1)
Analysis:	Chi-square and logistic regression (Model Diabetes Control=No)

Specific Aim 3: To assess the relationship among patients who were diagnosed and treated for depression and examine how treatment is associated with self-reported health and control of diabetes.

Research Question 3: How is treatment for depression associated with self-reported health?

Hypothesis:	Diabetic patients who were treated for depression are more likely to report favorable health status.
Outcome:	Self-Reported Health Status

Exposure:	Treatment for depression
Covariates:	Behavioral Model of Health Services Use covariates (see Figure 1.2)
Analysis:	Chi-square and logistic regression (Model self-report health status=good)

Research Question 4: How is treatment for depression associated with diabetes control?

Hypothesis:	Diabetic patients who were treated for depression are more likely to report affirmative in control for diabetes.
Outcome:	Diabetes control
Exposure:	Treatment for depression
Covariates:	Behavioral Model of Health Services Use covariates (see Figure 1.2)
Analysis:	Chi-square and logistic regression (Model perceived diabetes control=yes)

CHAPTER FOUR

MANUSCRIPT #1[1] THE ASSOCIATION BETWEEN DEPRESSIVE SYMPTOMS AND SELF-REPORTED HEALTH AND PERCEIVED DIABETES CONTROL IN OLDER AMERICANS WITH DIABETES

[1] Williams, L., Glover, S., Probst, J., Hardin, J., & Qureshi, Z. (2017). *The Association between depressive symptoms and self-reported health and perceived diabetes control in older Americans with diabetes.* Unpublished Manuscript.

ABSTRACT

Introduction: Diabetes remains the 7th leading cause of death in the United States. Diabetes is a major public health concern of its own, but when you add the co-morbidity of depression, diabetes outcomes are amplified. This dissertation examines how depressive symptomatology and treatment for depression are associated with self-reported health (SRH) and diabetes control.

Methods: Chi-square and logistic regression were used to analyze data from the Health and Retirement Study (2012). We assessed the associations between SRH and diabetes control with depressive symptomatology data.

Results: In our sample (n=4374), 19% of respondents reported high depressive symptomatology and 59% self-reported "good" health compared to 41% self-reported "bad" health. Associated with "bad" SRH were psychiatric medication or psychotherapy treatment (p=.0211), education (p=<.0001), insulin usage (<.0001), diabetes control (p=<.0001), depressive symptomatology (p=<.0001), and clinical diagnosis for depression (p=.0005). For the second outcome, only 9% of the sample reported no diabetes control. Insulin usage (p=<.0001), self-reported health (p=<.0001), depressive symptoms (p=.0039), sex (p=.0363) and age (p=.0015) were associated with no diabetes control.

Conclusion: Depressive symptomatology is associated with self-reported health and diabetes control. Whether respondents were clinically diagnosed as depressed was not significantly associated perceived diabetes control.

Introduction

Diabetes remains the 7th leading cause of death in the United States (Centers for Disease Control and Prevention, 2014). Greater than 29 million Americans or 9.3% of the population have diabetes (Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention, & and Health Promotion, 2016). By 2050, it is estimated that as many as 1 in 3 US adults could have diabetes if patterns and trends remain the same (Centers for Disease Control and Prevention et al., 2016). In older Americans, 25.9% or 11.8 million Americans 65 and older are diabetic or suffer from diabetes either diagnosed or undiagnosed. (American Diabetes Association, 2015). Diabetes is more prevalent in disadvantaged groups and communities predicted by race and socioeconomic status (Nicklett, 2011). Diabetes is also associated with several diseases and conditions such as cancer, infectious disease, intentional self-harm, depression, nerve disease, periodontal gum disease, erectile dysfunction, and degenerative disorders. (Centers for Disease Control and Prevention, 2014; Egede, Grubaugh, & Ellis, 2010; Rao Kondapally Seshasai et al., 2011). Furthermore, complications originate from improper management of diabetes and may lead to a decrease in length and quality of life. The Centers for Disease Control and Prevention reports diabetes is the leading cause of non-traumatic lower limb amputations, kidney failure, and adult onset blindness. Managing diabetes requires people to participate in recommended self-care activities. Lack of participation in these self-care activities leads to risks of complications and decreases the ability to control diabetes.

In 2010, diabetes contributed to 234,051 deaths and was listed as the leading cause of death for 69,071 people (Centers for Disease Control and Prevention, 2014) Not

only is diabetes a significant contributor to death, but the risks for death among diabetics are twice as high as a person of similar age with no diabetes diagnosis (Centers for Disease Control and Prevention, 2014).

Complications and economic burdens of diabetes are a major public health concern. Approximately 20% of health care spending is for people with diagnosed diabetes (Centers for Disease Control and Prevention et al., 2016). The burden of diabetes includes increased medical costs, indirect costs from work-related absenteeism, reduced productivity at work and home, reduced labor force participation from chronic disability, and premature mortality. (Centers for Disease Control and Prevention, 2014). The total estimated cost for treating diabetes in 2012 was $245 billion dollars. People with a diabetes diagnosis have 2.3 times higher medical expenditure than people without the diabetes diagnosis (Centers for Disease Control and Prevention, 2014). Due to the overwhelming cost burden of diabetes, diabetic complications, and heightened morbidity and mortality rates, further research is needed to decrease the prevalence of diabetes and complications that arise.

Depressive Symptoms in Patients with Type 2 Diabetes

Depression is defined as a mood disorder that causes a persistent feeling of sadness and loss of interest. When a person is depressed it affects how they feel, think, and behave (Mayo Clinic Staff, 2016). Depressive symptoms are associated with the management and control of Type 2 Diabetes. Symptoms of depression are: depressed mood, marked diminished interest/pleasure, sleep disturbance, appetite disturbance, fatigue/loss of energy, diminished concentration or indecisiveness, feelings of worthlessness or excessive or inappropriate guilt, psychomotor retardations or agitation,

and recurrent thoughts of death or suicide (Park & Reynolds, 2015).

Research has identified self-care activities or lifestyle factors as important elements in diabetic control. Participants who were highly depressed had significantly lower concurrent baseline health behaviors than participants who were in low/no and moderately depressed groups (Chiu, Wray, Beverly, & Dominic, 2010). Depressive symptoms are associated with non-adherence to diabetes self-care and hemoglobin a1c levels (Chiu et al., 2010; Ciechanowski, Katon, Russo, & Hirsch, 2003). Diabetic patients who were depressed were more likely to have decreased adherence to a healthy eating plan and physical activity (Bell et al., 2010). Healthy eating plans and physical activity are two of the five self-care activities in which diabetes patients should routinely participate. Greater intake of fruits and vegetables was associated with lower odds for depression in a Canadian sample (McMartin, Jacka, & Colman, 2013). Greater adherence to self-care activities led to greater control of diabetes (Lustman et al., 2000). When diabetic patients are depressed it influences their participation in self-care activities such as medication adherence, poor nutrition, and lack of exercise (Lin et al., 2004). Understanding the risk factors for depression and screening patients for depression could help patients control their diabetes better and report better general health.

Relationship between depression and diabetes

Diabetes is a major public health concern of its own, however, when you add the co-morbidity of depression to diabetes it increases health expenditures and adults with diabetes may report lower self-reported health. Egede, Zeng & Simpson, (2002) study reports that diabetic patients who were depressed had significantly higher health expenditures ($247,492,008 vs. 55,406,559; $p<.0001$) than diabetic patients who were not

depressed. Ludman et al., 2004 researchers argue that diabetic patients with depression reported more symptoms than patients without depression. Depression may amplify diabetic symptoms or problems with adults with diabetes. Egede, Zeng, & Simpson, (2002) reported individuals with diabetes were 2.5 times more likely to have co-morbid clinical depression than individuals without diabetes. Approximately 1/3 of diabetic patients report having depression (Anderson, Freedland, Clouse, & Lustman, 2001). Diabetes and depression combined lead to lower reports of self-reported health and diabetes control, higher medical expenditures and health care utilization.

Diabetes, Self-Reported Health and Diabetes Control

Self-reported health (SRH) is a common measurement of health outcomes. Global self-report health status is one of the most frequently measured health perceptions in epidemiological research (Salomon, Nordhagen, Oza, & Murray, 2009). SRH can be measured by asking one single question, "Would you say your health is excellent, very good, good, fair, or poor?" (Ware, Snow, Kosinski, & Gandek, 1993; Mavaddat et al., 2011). In a study conducted Mavaddat et al., (2011), researchers reported that all of the dimensions of health (SF-36) were strongly associated with the SRH with a significant p-value (<.00001), to show that poorer SRH categories had lower SF-36 scores. In a meta-analysis by Desalvo, Fan, Mcdonell, & Fihn, (2005), researchers found that persons with "poor" SRH had a twofold higher mortality risks compared with persons with "excellent" SRH. SRH is an important predictor of health outcomes because poor perceptions of health may contribute to nonadherence in preventive practices or self-care (Idler & Benyamini, 1997). Lack of participation in self-care or preventive practices leads to worse health outcomes and chronic conditions. A classic study by Haug, Wykle, &

Namazi, (1989), reported that older respondents with better perceived health were more likely to engage in self-care activities. Self-care activities can be classified as health behaviors in Andersen's Health Behavior Model of Health Services Uses. Therefore, it is important to assess if there is an association between perceived health and depressive symptomatology. If an association is seen between depressive symptomatology and self-reported health, efforts could be made to improve depressive symptomatology which could improve health outcomes such as self-reported health and perceived diabetes control.

Theoretical Framework

The theoretical framework for this study will be based on Andersen's Behavioral Model of Health Services Use. The conceptual framework will examine older Americans who have diabetes and assess the association between predisposal, enabling, and need characteristics that influences health behavior which in turn determines health outcomes such as self-reported health status, diabetes control, and depressive symptomatology. The Andersen's Behavioral Model of Health Services Use will explain how predisposing, enabling, and need factors influence health behaviors which leads to health outcomes. For this study, we will examine how predisposing factors such as age and sex are associated with self-reported health, depressive symptomatology, and diabetes control. The enabling factor in this study is education. The need factors are mental health diagnosis, diabetes diagnosis, and diabetes control. The outcomes for this study are self-reported health status and perceived diabetes control.

One of the purposes of this study is to understand how self-reported depressive symptomatology is associated with clinical diagnosis of depression, self-reported health,

and perceived diabetes control. Secondly, this study will examine the characteristics that are associated with low and high depressive symptomatology. Some studies report that older age is a risk factor for higher prevalence of depression (Golden et al., 2008). Therefore, for this study the sample population will consist of older Americans.

This study is significant because the researchers will examine the associations between depressive symptomatology and self-reported health. If associations are found this information could be used to change policy to encourage depression screening for patients as part of routine care. If depression is detected in patients with Type 2 diabetes, then providers can make proper referrals for diabetic patients to receive treatment. Once the referrals are made and depression is treated, improvements should be seen in diabetes outcomes and depression. Treatment of depression with patients with diabetes could lower healthcare expenditures and improve quality of life for patients with diabetes

Methods

Design and Sample

We conducted a cross-sectional analysis of data from the 2012 Health and Retirement Study (HRS) and the RAND Health and Retirement Study (HRS) data. The Health and Retirement Study is a longitudinal dataset that includes six cohorts and interviews respondents every two years (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). The RAND dataset combined data from each wave and cohorts and included respondent level information that is comparable across all waves(Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen;

Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). The RAND data report on individuals and each individual is assigned a unique household number and person number. The HRS is a national longitudinal dataset that oversamples Blacks, Hispanics, and residents of Florida. The initial target population was adults born between 1931 and 1941 living in the US and their spouses. The HRS Data include data from an older population and has questions related to diabetes in its survey design. This dataset will allow the researchers to answer questions related to depressive symptomatology and health outcomes. The final analytic sample included 4,374 respondents. The inclusion criteria to be included in this study was for participants to have a diabetes diagnosis and respond to all covariates. Diabetes status was a self-report variable calculated at each wave and determined by asking participants the following, "Has a doctor ever told you that you have diabetes or high blood sugar?" If respondents answered "yes" then they were included in the final analytic sample. In our sample, there were statistically significant differences between our final analytical model that included only participants who answered all questions and excluded participants who were missing some covariates. For example, differences were found for race (.0029), self-reported health (.0470), doctor diagnosed depression (.0043), and age (<.0001).

Independent Variable

Depressive symptomatology was the independent variable in the study. Depressive symptomatology was measured by the Centers for Epidemiological Studies Depression Scale (CES-D). The CES-D is an index score that was derived from asking respondents eight questions, "if they had experienced the following sentiments all or most of the time, "depression, everything is an effort, sleep is restless, felt alone, felt sad,

could not going, felt happy, and enjoyed life" (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). To calculate this mental health index, the score is derived from the sum of the "negative" indicators and the (reverse-coded) "positive" indicators (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015) Research has shown that a score greater than or equal to 4 equates to high depression symptomatology (Steff, 2000). We categorized CES-D into a bivariate variable, which included greater than or equal to 4 or less than 4.

Dependent Variables

The main outcome variables of interest were *self-reported health* and *diabetes control*. For ***self-reported health***, respondents were asked the following question, "Would you say your health is, "excellent, very good, good, fair or poor". Respondents answered using the 5 point Likert scale. Perceived self-reported health was coded as a categorical variable divided into bad versus good self-reported health. The researcher combined excellent, very good, and good into the "good" category and fair and poor into the "bad" category.

For ***diabetes control, r***espondents were asked the following question, "Is your diabetes generally under control" answering yes, no, don't know. Perceived diabetes control was coded as a binary variable, with responses coded as either yes or no.

Demographic Covariate Variables

Demographic covariates included age (under 65 and 65 and over), race/ethnicity (White, Black, & Other), sex (male vs female), education (high school or less vs. at least some college).

Doctor Diagnosed Depression

Doctor Diagnosed Depression was calculated by asking respondents the following question, "Has a doctor ever told you that you have had problems with depression?" Respondents answered "yes" or "no". Doctor Diagnosed Depression was chosen as an individual characteristic that will identify the need for services using the Behavioral Model of Health Services Use.

Insulin Treatment for Diabetes

Insulin Treatment for Diabetes was calculated by asking respondents the following question, "Are you now using insulin shots or a pump?" Respondents answered "yes" or "no". Insulin Treatment for Diabetes was chosen as a health behavior in the Behavioral Model of Health Services Use.

Medication Treatment for Diabetes

Medication Treatment for Diabetes was calculated by asking respondents the following question, "In order to treat or control your diabetes are you now taking medication that you swallow?" Respondents answered "yes" or "no". Medication Treatment for Diabetes was chosen as a health behavior in the Behavioral Model of Health Services Use.

Psychiatric Medication Use or Psychiatric Treatment

Psychiatric Medication Usage or Psychiatric Treatment was calculated by asking respondents two questions: "Do you now get psychiatric or psychological treatment for your problems" and "Do you now take tranquilizers, antidepressants, or pills for nerves?" If respondents answered "yes" to either question, the treatment variable was considered yes for treatment. If respondents answered "no" to both questions or if responses were left blank, the psychiatric medication use or psychiatric treatment variable was considered "no". Psychiatric Medication usage or psychiatric treatment was chosen as a health behavior in the Behavioral Model of Health Services Use.

Statistical Analysis

Bivariate relationships were examined using chi-square analysis. Bivariate Analysis was used to select variables for an initial adjusted model, and then any variable that had a p-value greater than .25 was removed to determine the final model. The odds ratio and its 95% confidence interval were estimated. Multivariable logistic regression analysis was used to explore the factors associated with self-reported health and perceived diabetes control. All data were analyzed using SAS 9.4, (SAS, Inc., Cary, NC, USA), and a p-value of <0.05 was considered statistically significant. Institutional Review Board approval was received for this study and complex survey weights were used.

Results

Description of the study sample

This study had 4,374 respondents who had diabetes and had responses for all covariates. The characteristics of the study sample were female (51%), white (77%), had

at least some college (46%), reported psychiatric treatment or medication usage (21%), and were told by a doctor that they were depressed (30%).

In this sample, 19% self-reported that they had high depressive symptoms or a CESD Index score of four or higher (Table 4.1). Sex, race, education, doctor-diagnosed depression, insulin usage, diabetes control, self-reported health status, psychiatric treatment or medication usage, and age were significant with p-values less than .05. For example, 62% of females reported high CESD scores, but only 38% of males reported high CESD scores. For race, 12% of Other and 18% of African Americans reported high CESD scores compared to 70% of Whites who reported high CESD scores. Of respondents who reported high CESD scores, 63% had a high school diploma or less compared to 37% who had some college, 30% use insulin compared to 70% who did not use insulin, 71% reported "bad" self -reported health compared to 29% who reported "good" health.

Self-Reported Health

Self-Reported Health was categorized into two separate categories, "bad" or "good" health. Most people in this sample self-reported their health as "good" (59%) compared to (41%) of the sample who self-reported their health as "bad" (Please see Table 4.1). Diabetes medication, race, sex, and age were not significant covariates in the analysis. The following covariates were significant: treatment, depressive symptomatology, diabetes control, insulin usage, and education.

For this analysis, the following variables were used sex, race, education, insulin usage, diabetes control, depressive symptomatology, doctor diagnosed depression, and treatment. Diabetes medication and age were removed from the model because of a

insignificant p-value >.25.

In this sample, respondents who had a high school diploma or less (OR:1.96, 95% CI:1.66-2.32), received psychiatric medication or treatment (OR:1.36, 95% CI:1.04-1.77), had a clinical diagnosis of depression (OR:1.56, 95% CI:1.21-2.03), used insulin (OR:1.95, 95% CI:1.55-2.46), haves no diabetes control (OR:2.73, 95% CI:1.96-3.82), and have depressive symptomatology scores greater than or equal to 4 (OR:3.25, 95% CI:2.54-4.16), the odds were higher that they reported bad self-reported health compared to respondents who had some college, no psychiatric medication or treatment, no clinical diagnosis of depression, doesn't use insulin, and have control of their diabetes (Please see Table 4.3).

Perceived Diabetes Control

Approximately 9% of the sample reported not having diabetes control (Please see Table 4.1). Of the respondents who reported no diabetes control, 66% received psychiatric medication or psychotherapy treatment, 37% had depressive symptomatology scores greater than or equal to 4, 27% reported bad SRH, 46% were told by a doctor they were depressed, and 62% were females.

For the logistic regression analysis, the following covariates were used: sex, age, insulin usage, SRH, diabetes medication, and depressive symptomatology. The following covariates were removed for not being significant and having p-values greater than .25: race, education, treatment, and doctor diagnosed depression.

In this sample, respondents who were female (OR:1.38, 95% CI:1.01-1.87), under 65 (OR:1.84, 95% CI:1.25-2.71), use insulin (OR:5.81, 95% CI:4.34-7.77), had bad self-reported health (OR:2.77, 95% CI:2.02-3.79), and had depressive symptomatology scores

greater than or equal to 4 (OR:1.83, 95% CI:1.20-2.78), the odds were higher that they had no diabetes control compared to males, respondents 65 and older, didn't use insulin, self-reported their health as good, and had depressive symptomatology scores less than 4.

Discussion

This study examined the association between depressive symptomatology and self-reported health and perceived diabetes control. In this study, sex, a predisposing factor in Anderson's Model of Healthcare Use, significant differences were found for sex. For example, 62% of females reported a high depressive symptomatology score vs 38% for males. These findings are similar to a study conducted by Riolo, Nguyen, Greden, & King, researchers reported the prevalence of depression was higher among the female population for Whites, Blacks, and Mexican population than for males (Riolo, Nguyen, Greden, & King, 2005). Education, another predisposing factor was significant in this study. For example, 63% of the sample who reported high depressive symptomatology had a high school diploma or less vs. 37% of the sample who reported some college also reported high depressive symptomatology. In another study, researchers found that low education in white women and black women were associated with higher incident depressive symptoms (1.84: 95% CI: 1.27-2.66) (Groffen et al., 2013).

Next, the researchers assess the association between depressive symptomatology and perceived self-reported health. Respondents who reported high depressive symptomatology, the odds were higher that they would report bad self-reported health compared to respondents who reported a low depressive symptomatology score (OR:3.25, 95% CI, 2.54-4.16). These findings are similar to a study by Badakwi et al., 2012, where researchers found that 36.6% of individuals who developed major

depression at follow up were more likely to have reported their health as fair or poor compared to 14.4% of those who had not developed major depression. The odds of developing depression were higher for individuals who rated their health as fair or poor at baseline during a 3-year follow-up period after controlling for socio demographics, lifestyle related behaviors, and disability and diabetes specific characteristics (OR=2.05, 95% CI: 1.20-3:48) (Badawi, Gariépy, Pagé, & Schmitz, 2012).

In this study, among older adults who all have diabetes, high depressive symptomatology was associated with no diabetes control after controlling for disease severity by medication and insulin (OR=1.83, 95% CI:1.20-2.78) compared to low depressive symptomatology. For participants who were on insulin, the odds were higher that they reported no diabetes control compared to individuals who were not taking insulin (OR = 5.8, 95% CI: 4.34-7.77). In these findings, there was significant association between clinical diagnosis of depression and depression symptomatology. In addition, in a meta-analysis by (Desalvo, Fan, Mcdonell, & Fihn, 2005), researchers found that persons with "poor" SRH had a twofold higher mortality risks compared with persons with "excellent" SRH.

This study has several limitations. One limitation is that diabetes diagnosis, perceived diabetes control, and depression diagnosis are self-reported variables. These self-reported variables limit the researchers' ability to validate these variables. However, in a study by (Jackson et al., 2014) they found that 91.8% of medical records confirmed self-reported prevalent diabetes cases. In another study by (Jeffrey S. Gonzalez et al., 2008) reported that adherence self-reports were significantly associated with HbA1c and medication event monitoring system. Although some researches may see self-report as a

limitation, self-report data has been proven to be valid and reliable. Another limitation is that the study sample only included respondents who answered all variables in the analysis. Therefore, this study doesn't include an analysis of respondents who didn't answer all variables.

In conclusion, depression symptomatology is associated with self-reported health and perceived diabetes control in persons with diabetes. Depressive symptomatology was significant in perceived diabetes control as well as self-reported health in patients with diabetes. Proverbs 23:7 states, "As a man thinketh so is he". Therefore, if a man thinks he is depressed and has depressive symptoms it will affect his health status and perceived diabetes control regardless of a clinical diagnosis of depression. Among older adults who all have diabetes, depressive symptoms are associated with self-reported health, even after controlling for disease severity with diabetes medication and insulin. This implies that depressive symptoms influence the self-reported health of older Americans with diabetes and clinicians, doctors, and researchers should evaluate depressive symptomatology when treating patients with diabetes. Further research should be conducted to see how treatment is associated with perceived diabetes control and self-reported health.

Table 4.1: Characteristics of Sample by high and low depressive symptomatology, Health and Retirement Study, 2012.

Covariates	Total Observations	Total Population	Low Depressive symptomatology	High Depressive Symptomatology	P-Value
Total Sample	4374		81(1.1)	19 (1.1)	<.0001
Self-Reported Health					<.0001
Bad	1901	41 (1.2)	35 (1.1)	71 (2.2)	
Good	2473	59 (1.2)	65 (1.1)	29 (2.2)	
Diabetes Control					<.0001
No	372	9 (.60)	7 (.50)	17 (2.3)	
Yes	4002	91 (.60)	93 (.50)	83 (2.3)	
Psychiatric Medication or Psychotherapy Treatment					<.0001
No	3528	79 (1)	85 (1)	56 (2.7)	
Yes	846	21 (1)	15 (1)	44 (2.7)	
Doctor Diagnosed Depression					<.0001
No	3135	70 (1.1)	77 (1.1)	39 (3.1)	
Yes	1239	30 (1.1)	23 (1.1)	61 (3.1)	
Diabetes Medication					0.27
No	1145	28 (1)	27 (1.2)	30 (2.1)	
Yes	3229	72 (1)	73 (1.2)	70 (2.1)	
Insulin Usage					<.0001
No	3304	76 (.70)	78 (.80)	70 (1.7)	
Yes	1070	24 (.70)	22 (.80)	30 (1.6)	
Education					0.0002
High School or less	2618	54 (1.3)	52 (1.3)	63 (2.8)	
Some College	1756	46 (1.3)	48 (1.3)	37 (2.8)	
Sex					<.0001
Male	2008	49 (.80)	52 (.90)	38 (2.1)	
Female	2366	51 (.80)	48 (.90)	62 (2.1)	
Race					0.0023
White	2840	77 (1.2)	78 (1.1)	70 (2.5)	
Black	1092	14 (1)	14 (.80)	18 (2.3)	
Other	442	9 (.70)	8 (.80)	12 (1.5)	
Age					<.0001
under 65	1743	45 (1.4)	42 (1.5)	57 (3.1)	
65 and older	2631	55 (1.4)	58 (1.5)	43 (3.1)	

S.E.: Standard Error

Table 4:2: Weighted Chi- Square Analysis of Self-reported health status and Diabetes Control, HRS 2012

Covariates	Self-Reported Health Bad	Self-Reported Health Good	P-value	Diabetes Control No	Diabetes Control Yes	P-value
Psychiatric Medication or Psychotherapy Treatment			<.0001			<.0001
Any Treatment	70 (1.5)	86 (.90)		66 (2.9)	80 (1)	
No Treatment	30 (1.5)	14 (.90)		34 (2.9)	20 (1)	
Depressive Symptoms			<.0001			<.0001
<4	68 (1.6)	91 (1)		63 (4.3)	83 (1.1)	
>=4	32 (1.6)	9 (1)		37 (4.3)	17 (1.1)	
Self-Reported Health			-			<.0001
Bad	-	-		73 (3.2)	39 (1.2)	
Good	-	-		27 (3.2)	61 (1.2)	
Diabetes Control			<.0001			-
No	15 (1.3)	4 (.40)		-	-	
Yes	85 (1.3)	96 (.40)		-	-	
Race			0.0199			
White	74 (1.7)	79 (1.2)		76 (2.3)	77 (1.2)	0.7181
Black	16 (1.6)	13 (.90)		16 (2.3)	14 (1)	
Other	10 (1)	8 (1)		8 (1.5)	9 (.75)	
Doctor Diagnosed Depression			<.0001			<.0001
No	58 (1.6)	79 (1.2)		54 (3.7)	72 (1.1)	
Yes	42 (1.6)	21 (1.2)		46 (3.7)	28 (1.1)	
Diabetes Medication			0.4295			0.7242
No	29 (1.5)	27 (1.3)		29 (3.3)	28 (1.1)	
Yes	71 (1.5)	73 (1.3)		71 (3.3)	72 (1.1)	
Insulin Usage			<.0001			<.0001
No	67 (1.4)	83 (.90)		38 (3.1)	80 (.70)	
Yes	33 (1.4)	17 (90)		62 (3.1)	20 (.70)	
Education			<.0001			0.131
High School or less	64 (1.6)	47 (1.5)		59 (3.7)	54 (1.4)	
Some College	36 (1.6)	53 (1.5)		41 (3.7)	46 (1.4)	
Sex			0.0345			0.0271
Male	47 (1.6)	51 (.90)		42(3.4)	50 (.90)	
Female	53 (1.6)	49 (.90)		58 (3.4)	50 (.90)	
Age			0.058			0.0001
Under 65	52 (2.2)	48 (1.4)		63 (4)	48 (1.4)	
65 and older	48 (2.2)	52 (1.4)		37 (4)	52 (1.4)	

S.E.: Standard Error

Table 4.3: Odds Ratio Modeling "Bad" Self-Reported Health, Health and Retirement Study, 2012

Covariates	Point Estimate	95% C.I.	S. E.	P-value
Education (High School or less vs. Some College)	1.96	1.66-2.32	0.0414	<.00001
Treatment (Yes vs. No)	1.36	1.04-1.77	0.0661	0.0211
Doctor Diagnosed Depression (Yes vs. No)	1.56	1.21-2.03	0.0646	0.0005
Insulin Usage (Yes vs. No)	1.95	1.55-2.46	0.0577	<.0001
Diabetes Control (No vs. Yes)	2.73	1.96-3.82	0.0831	<.0001
Depressive Symptomatology (>=4 vs. <4)	3.25	2.54-4.16	0.0615	<.0001
Race (Black vs. White)	1.25	.999-1.57	0.0911	0.0926
Race (Other vs. White	1.2	.846-1.70	0.1192	0.0926
Sex (Male vs. Female)	1.16	.978-1.37	0.0831	0.0421

S. E.: Standard Error

Table 4.4: Odds Ratio Modeling "No" Diabetes Self-control, Health and Retirement Study, 2012

Covariates	Point Estimate	95% C. I.	S. E.	P-value
Sex (Female vs. Male)	1.38	1.01-1.87	0.076	0.0363
Age (Under 65 vs. 65 and older)	1.84	1.25-2.71	0.0961	0.0015
Insulin Usage (Yes vs. No)	5.81	4.34-7.77	0.0726	<.0001
Self-Reported Health (Bad vs. Good)	2.77	2.02-3.79	0.0784	<.0001
Diabetes Medicine (No vs. Yes)	0.762	.509-1.14	0.1005	0.1821
Depressive Symptomatology (>=4 vs. <4)	1.83	1.20-2.78	0.1044	0.0039

CHAPTER FIVE

MANUSCRIPT #2[2] ASSOCIATION OF TREATMENT FOR DEPRESSION WITH SELF-REPORTED HEALTH STATUS AND PERCEIVED DIABETES CONTROL IN OLDER AMERICANS WITH DIABETS AND CO-MORBID DEPRESSION

[2] Williams, L., Glover, S., Probst, J., Hardin, J., & Qureshi, Z. (2017) *Association of Treatment for depression with self-reported health status and perceived diabetes control in Older Americans with diabetes and co-morbid depression.* Unpublished Manuscript.

Abstract

Introduction

The aims of this study were to examine the association between treatment for depression, self-reported health, diabetes control and depressive symptomatology among older Americans who were clinically diagnosed with diabetes and depression.

Methods

This analysis included 1,239 respondents from the Health and Retirement Study, 2012 who self-reported that they had diabetes and co-morbid depression. The main outcome variables were self-reported health and perceived diabetes control. The independent variable, treatment was categorized as yes, if respondents received either psychotherapy or psychiatric medication.

Results

This sample had (n=1239) respondents who had both a depression and diabetes diagnosis. Almost, two-thirds of the population was treated for depression (p=<.0001). Treatment was not significant for diabetes control (p-value=.8043). Treatment was moderately associated with SRH (OR=1.33, 95% CI:.995-1.76).

Conclusion

Treatment for depression was not significantly associated with diabetes control. However, treatment was moderately associated with self-reported health. Further research is needed to determine if continuity of treatment is associated with self-reported

health and diabetes control and to determine if the method of treatment is associated with self-reported health.

Keywords

Diabetes, self-reported health, depressive symptomatology, treatment for depression

Introduction

Diabetes remains the 7th leading cause of death in the United States (Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention, & and Health Promotion, 2016). Diabetes is a major public health concern of its own, but when you add the co-morbidity of depression, diabetes outcomes are amplified. This paper aims to examine how treatment for depression is associated with diabetes outcomes in persons with depression and diabetes.

Depression is prevalent in approximately one-third of patients with diabetes (Anderson, Freedland, Clouse, & Lustman, 2001). Even though patients are diagnosed with depression, less than 1/3 of adults with diagnosable mental illness are being treated for their illness. (Surgeon General Report). There are many barriers that prevent people with depression from participating in depression treatment. Mental Health: A Report of the Surgeon General lists demographic factors, patient attitudes toward a service system, financial and organizational are barriers to treatment for depression (72). Pre-disposal characteristics such as race and sex often influences how people engage in treatment for depression. In a study by Sussman et al., researchers found that persons seeking treatment for mental health go through a complex process that requires individuals to determine that the behavior is severe enough to seek treatment (Sussman, Robins, & Earls, 1987). There are two main categories of treatment for mental health which are

psychotherapy and psychiatric medication.

Methods

The first Health and Retirement Study was administered in 1992 and oversampled Blacks, Hispanics, and people who live in Florida. This first survey was administered to older Americans living in the US born between 1931 and 1941 and their spouses. Participants were surveyed every two years after the initial survey in 1992. The RAND dataset combined data from each wave and cohorts and included respondent level information that is comparable across all waves (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). This cross-sectional study used data from the 2012 HRS and RAND data.

Only respondents who responded to all covariates were included in the sample. The researcher also restricted the study population to respondents who answered "yes" to "Has a doctor ever told that you have diabetes or high blood sugar" and answered "yes" to "Has a doctor ever told you that you have had problems with depression" The final sample size was n=1239.

Treatment for depression

Treatment for depression was assessed by asking respondents two questions: "Do you now get psychiatric or psychological treatment for your problems" and "Do you now take tranquilizers, antidepressants, or pills for nerves?" If respondents answered "yes" to either question, the treatment variable was considered yes for treatment. If respondents answered "no" to both questions, the psychiatric medication use or psychiatric treatment

variable was considered "no". If respondents did not respond, the psychiatric medication use or psychiatric treatment variable was categorized as "no". Psychiatric Medication usage or psychiatric treatment was chosen as a health behavior in the Behavioral Model of Health Services Use.

Self-Reported Health

Self-Reported Health was assessed by respondents response to the following question "Would you say your health is, "excellent, very good, good, fair or poor". Respondents answered using the 5 point Likert scale. Perceived self-reported health was coded as a categorical variable divided into bad versus good self-reported health. The researcher combined excellent, very good, and good into the "good" category and fair and poor into the "bad" category.

Perceived Diabetes Control

Perceived diabetes control was assessed by respondents response to the following question, "Is your diabetes generally under control" answering yes, no, don't know, perceived diabetes control was coded as a binary variable, with responses coded as either yes or no.

Depressive Symptomatology

Depressive symptomatology was measured by the Centers for Epidemiological Studies Depression Scale (CES-D). The CES-D is an index score that was derived from asking respondents eight questions, "if they had experienced the following sentiments all or most of the time, "depression, everything is an effort, sleep is restless, felt alone, felt sad, could not going, felt happy, and enjoyed life" (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough,

Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015). To calculate this mental health index, the score is derived from the sum of the "negative" indicators and the (reverse-coded) "positive" indicators (Chen, Sandy; Campbell, Nancy; Chan & Orla; Hurd, Michael; Main, Regan; Mallett, Joshua; Martin, Craig; McCullough, Colleen; Meijer, Eric; Moldoff, Michael; Pantoja, Philip; Rohwedder, Susann; St.Clair, 2015) Research has shown that a score of 4 or greater is equal to high depression symptomatology (Steff, 2000). We categorized CES-D into a bivariate variable, which included greater than or equal to 4 or less than 4.

Demographic Covariates

Demographic covariates included age (under 65 and 65 and over), race/ethnicity (White, Black, & Other), sex (male vs female), education (high school or less vs. at least some college). These demographic covariates are also known as predisposing factors as part of the Behavioral Model of Health Services Use.

Insulin Treatment for Diabetes

Insulin Treatment for Diabetes was calculated by asking respondents the following question, "Are you now using insulin shots or a pump?" Respondents answered "yes" or "no". Insulin Treatment for Diabetes was chosen as a health behavior in the Behavioral Model of Health Services Use.

Medication Treatment for Diabetes

Medication Treatment for Diabetes was calculated by asking respondents the following question, "In order to treat or control your diabetes are you now taking medication that you swallow?" Respondents answered "yes" or "no". Medication Treatment for Diabetes was chosen as a health behavior in the Behavioral Model of

Health Services Use.

Conceptual Model

The Behavioral Model of Health Services Use framework was used to assess whether the covariates can explain the associations between treatment for depression and self-reported health, diabetes control and depressive symptomatology in older Americans with depression and diabetes. Characteristics associated with depression were assessed.

Statistical Analysis

Bivariate relationships were examined using chi-square analysis. Bivariate Analysis was used to select variables for the final model. Any variable that had a p-value greater than .25 was removed from the final model. The odds ratio and its 95% confidence interval were estimated. Multivariable logistic regression analysis was used to explore the factors associated with treatment, self-reported health, and diabetes control. All data were analyzed using SAS 9.4, (SAS, Inc., Cary, NC, USA), and a p-value of <0.05 was considered statistically significant. Institutional Review Board approval was received for this study and complex survey weights were used in our analyses.

Results

Description of the study sample

Although everyone in the study population was told by a doctor that they have depression, only 64% received any type of treatment for depression. Of the respondents who received treatment, 41% of the study population reported a depressive symptomatology score greater than or equal to 4, 61% reported "bad" self-reported health, 87% reported "yes" for diabetes control, 70% reported "yes" for diabetes medication, 32% reported "yes" for taking insulin, 80% reported "White" for race, and

55% of the population reported a high school diploma or less. These and other descriptive data are reported in **Table 5.1.**

Self-Reported Health

Self-Reported Health was categorized into "bad" or "good" categories. Of the sample that received treatment, 61% reported "bad" self-reported health whereas 53% who received no treatment reported "bad" self-reported health. Based on the bivariate analysis the following covariates were significant: treatment, depressive symptomatology, diabetes control, insulin usage, and education. Of the respondents who reported "bad" self-reported health, 69% received treatment vs. 31% who reported no treatment (p-value=.0175), 51% reported "high" depressive symptomatology vs. 49% who reported "low" depressive symptomatology (p-value=<.0001), 82% reported "yes" diabetes control vs. 18% who reported "no" for diabetes control (p-value=<.0001), 36% reported "yes" to insulin usage vs. 64% who reported "no" to insulin usage (p-value=.0034), and 63% reported "high school or less" for educational attainment vs. 37% who reported "some college for educational attainment. These descriptive characteristics are reported in **Table 5.2.**

The logistic regression analysis modeling "good" self-reported health produced three significant variables including diabetes control, education, and depressive symptomatology. Respondents who reported some college (OR:1.75, 95% CI:1.27-2.4), having control of their diabetes (OR:2.01, 95% CI:1.26-3.2, and depressive symptomatology less than 4 (OR:3.58, 95% CI:2.48-5.14) the odds were higher that they would report good SRH compared to respondents with a high school diploma, having no control of their diabetes, and depressive symptomatology greater than or equal to 4. The

logistic regression analysis is reported in **Table 5.3.**

Diabetes Control

Diabetes control was divided into "yes" or "no" categories. Of the sample that received treatment, 13% reported "no" diabetes control vs. 87% who reported "yes" to diabetes control. Based on the bivariate analysis, depressive symptomatology, self-reported health, insulin usage, and age were significant. Of the respondents who reported "no" diabetes control, 67% received treatment vs. 33% who reported no treatment (p-value=.0614), 56% reported "high" depressive symptomatology vs. 44% who reported "low" depressive symptomatology (p-value=<.0001), 78% reported "bad" self-reported health vs. 22% who reported "good" for self-reported health (p-value=<.0001), 31% reported "no" to insulin usage vs. 69% who reported "yes" to insulin usage (p-value=<.0001), 69% were under 65, and 31% were 65 and older (p-value =.0306). These descriptive characteristics are reported in **Table 5.2.**

The logistic regression modeling "yes" diabetes control produced three significant variables: self-reported health (OR:2.01, 95% CI:1.25-3.35), insulin usage (OR:6.22, 95% CI:3:38-11.44), and depressive symptomatology (OR:1.78, 95% CI:1.02-3.11). Respondents who were not on insulin, had good SRH, and depressive symptomatology lower than 4, the odds were higher that they reported yes for diabetes control compared to individuals who were on insulin, had bad SRH, and had depressive symptomatology scores greater than or equal to 4. The logistic regression analysis is in **Table 5.4.**

Table 5.1 Sample Characteristics by Treatment, N=1239, Health and Retirement Study, 2012

Covariates	Total Observations	Total Population	Psychiatric or Psychotherapy Treatment (No)	Psychiatric or Psychotherapy Treatment (Yes)	P-Value
Total Sample	1239		34 (2)	64 (2)	<.0001
Self-Reported Health					<.0001
Bad	748	58 (1.9)	53 (3)	61 (2)	0.0175
Good	491	42 (1.9)	47 (3)	39 (2)	
Diabetes Control					0.8043
No	162	13 (1.5)	13 (2.3)	13 (1.6)	
Yes	1077	87 (1.5)	87 (2.3)	87 (1.6)	
Depressive Symptomatology					0.1471
<4	735	61 (2.4)	65 (3.8)	59 (2.5)	
>=4	504	39 (2.4)	35 (3.8)	41 (2.5)	
Diabetes Medication					0.1218
No	361	32 (1.8)	35 (3.1)	30 (2.1)	
Yes	878	68 (1.8)	65 (3.1)	70 (2.1)	
Insulin Usage					0.6749
No	863	69 (1.5)	70 (2.5)	68 (1.8)	
Yes	376	31 (1.5)	30 (2.5)	32 (1.8)	
Education					0.0876
High School or less	763	57 (2.2)	61 (3.3)	55 (2.5)	
Some College	476	43 (2.2)	39 (3.3)	45 (2.5)	
Sex					0.2642
Male	420	36 (1.7)	38 (2.6)	35 (2)	
Female	819	64 (1.7)	62 (2.6)	65 (2)	
Race					0.0374
White	816	78 (1.7)	73 (2.9)	80 (1.9)	
Black	280	13 (1.3)	15 (1.9)	12 (1.4)	
Other	143	9 (1.3)	12 (2.2)	8 (1.3)	
Age					0.2504
under 65	444	34 (2)	57 (3.5)	62 (2.5)	
65 and older	795	66 (2)	43 (3.5)	38 (2.5)	

S.E.: Standard Error

Table 5.2 Bivariate Analysis of Self-Reported Health and Diabetes Control, N=1128, Health and Retirement Study, 2012

Covariates	Self-Reported Health Bad	Self-Reported Health Good	P-value	Diabetes Control No	Diabetes Control Yes	P-value
Psychiatric Medication or Psychotherapy Treatment			0.0175			0.0614
No Treatment	31 (2.2)	37 (2.6)		33 (4.4)	34 (2.1)	
Any Treatment	69 (2.2)	63 (2.6)		67 (4.4)	66 (2.1)	
Depressive Symptoms			<.0001			0.0014
<4	49 (3.2)	79 (2.2)		44 (6.6)	64 (2.2)	
>=4	51 (3.2)	21 (2.2)		56 (6.6)	36 (2.2)	
Self-Reported Health			-			<.0001
Bad	-	-		78 (4.1)	55 (2)	
Good	-	-		22 (4.1)	45 (2)	
Diabetes Control			<.0001			-
No	18 (2)	7 (1.5)		-	-	
Yes	82 (2)	93 (1.5)		-	-	
Race			0.712			0.5208
White	77 (2.3)	78 (2.3)		76 (3.7)	78 (2)	
Black	14 (2)	12 (1.6)		16 (3)	12 (1.5)	
Other	9 (1.4)	10 (2)		8 (2.1)	10 (1.4)	
Diabetes Medication			0.9277			0.6506
No	32 (2.2)	32 (2.9)		29 (5.3)	32 (2.1)	
Yes	68 (2.2)	68 (2.9)		71 (5.3)	68 (2.1)	
Insulin Usage			0.0034			<.0001
No	64 (2.2)	76 (2.7)		31 (5.8)	75 (1.5)	
Yes	36 (2.2)	24 (2.7)		69 (5.8)	25 (1.5)	
Education			0.0001			0.1802
High School or less	63 (2.5)	49 (3.2)		63 (5.1)	56 (2.2)	
Some College	37 (2.5)	51 (3.2)		37 (5.1)	44 (2.2)	
Sex			0.6278			0.633
Male	37 (2.2)	35 (2.7)		38 (4.9)	36 (1.8)	
Female	63 (2.2)	65 (2.7)		62 (4.9)	64 (1.8)	
Age			0.1223			0.0306
Under 65	62 (3)	57 (2.6)		69 (5)	59 (2.1)	
65 and older	38 (3)	43 (2.6)		31 (5)	41 (2.1)	

S.E.: Standard Error

Table 5.3 Odds Ratio Modeling "Good" Self-Reported Health, Health and Retirement Study, 2012

Covariates	Point Estimate	95% C.I.	S.E.	p-value
Sex (Female vs. Male)	1.23	.888-1.71	0.0814	0.2029
Education (Some college vs. High School Diploma)	1.75	1.27-2.4	0.0794	0.0004
Psychotherapy or Psychiatric Medication (No vs. Yes)	1.33	.995-1.76	0.0714	0.0489
Control for Diabetes (Yes vs. No)	2.01	1.26-3.2	0.116	0.0026
Depressive Symptomatology (<4 vs. >=4)	3.58	2.48-5.14	0.0906	<.0001
Insulin (Yes vs. No)	0.71	.451-1.11	0.116	0.1241

S.E.: Standard Error

Table 5.4 Odds Ratio, Modeling "Yes" Diabetes Control, Health and Retirement Study, 2012.

Covariates	Point Estimate	95% C.I.	S.E.	p-value
Age (under 65 vs. 65 and older)	0.645	.397-1.05	0.1208	0.0695
Insulin Usage (No vs. Yes)	6.22	3.38-11.44	0.152	<.0001
Self-Reported Health (Good vs. Bad)	2.01	1.25-3.35	0.1229	0.0036
Depressive Symptomatology (<4 vs. >=4)	1.78	1.02-3.11	0.1388	0.0374

Discussion

In this study, treatment for depression was not significant for diabetes control. However, treatment for depression was significant for self-reported health (p-value:.0175). There were significant relationships between self-reported health and depressive symptomatology. In a study by Badawi, Gariépy, Pagé, & Schmitz, 2012), researchers found that 36.6% of individuals who developed major depression at follow up were more likely to have reported their health as fair or poor compared to 14.4% of those who had not developed major depression. The odds of developing depression was higher for individuals who rated their health as fair or poor at baseline during a 3 year follow-up period after controlling for socio demographics, lifestyle related behaviors, and disability and diabetes specific characteristics (OR=2.05, 95% CI: 1.20-3:48) (Badawi et al., 2012). However, in a study by (Kosloski, Stull, Kercher, & Van Dussen, 2005) researchers found that there was little to no association between depressive symptomatology and self-rated health. (Kosloski et al., 2005) used longitudinal data from the Health and Retirement Study from 1992 to 2000. Badawi et al., 2012 found that depressive symptomatology was strongly associated with self-rated health when controlling for covariates. For example, the (OR: 1.43, 95% CI 1.14-181), the odds of depression for a respondent who self-rated their health status as excellent, very good, or good vs. a respondent who self-rated their health as fair/poor (Badawi et al., 2012).

This study only examined respondents who affirmed that a doctor told them that they were depressed. Although all respondents were clinically diagnosed as depressed, only 67% received treatment. Per the Surgeon General Report for Mental Health, approximately 33% of people who are diagnosed with depression receives treatment.

This study produced more favorable numbers where 67% of the respondents received treatment. One reason we could attribute to more favorable numbers is that we used an older population and these individuals might already be in the healthcare system.

Study Limitations

One major limitation of this study is the responses are self-reported by the respondents. For example, we assessed clinical diagnosis of depression by asking respondents, "Has a doctor ever told you that you have had problems with depression". Studies have shown the validity and reliability of self-report data. Our results might have been different if we had clinical data versus self-reported data. Although in a study by Gonzalez et al., researchers reported that adherence self-reports such as diabetes medication was significantly associated with HbA1c and Medication Event Monitoring System. Another limitation in our study is that there was no division of the method of treatment. The treatment variable was calculated by combining psychiatric medication and psychiatric psychotherapy together. Another limitation in the survey is that questions are not asked related to length of treatment and when depression diagnosis was made. Despite the limitations in our study, the Health and Retirement Study allowed the researchers to assess the association between treatment and depressive symptomatology with an older population.

Conclusion

In conclusion, even though all respondents were clinically diagnosed as depressed, treatment was not significantly associated with diabetes control. However, treatment was moderately significant in self-reported health (p-value=.0489). Ironically, even though two-thirds of our sample received treatment, this study reports

respondents who did not receive psychiatric or psychotherapy treatment for depression the odds were higher that they would report good SRH vs respondents who did receive treatment. Thus, we conclude from our findings that more research is needed to examine the association with treatment over multiple years vs. only examining one year. Further research could be conducted to assess the continuity and method of treatment influences on self-reported health and diabetes control.

CHAPTER SIX

DISCUSSION

Conclusions

Diabetes remains the 7th leading cause of death in the United States (Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention, & and Health Promotion, 2016). The co-morbidity of diabetes and depression influences self-reported health, diabetes control, and depressive symptomatology. Currently, less than 1/3 of people who are diagnosed with depression are utilizing mental health services. Patients with diabetes are required to participate in self-management activities. Studies report that individuals who are depressed participate in less self-care activities than individuals who are not depressed (Lin et al., 2004). Self-care activities are essential in managing diabetes. Therefore, it is important for diabetic patients to reduce depressive symptomatology so that they may improve their participation in self-care activities, which may improve diabetes outcomes.

This study reported that depressive symptomatology was significantly associated with self-reported health and perceived diabetes control (p=<.0001). In our study, 19% of persons with diabetes reported high depressive symptomatology. For example, individuals who had depressive symptomatology scores greater than or equal to 4, the odds were higher that they would report bad SRH when compared to individuals who reported depressive symptomatology scores less than 4 (OR=3.25, 95% 2.54-4.16). For individuals who reported depressive symptomatology scores greater than or equal to 4, the odds were almost two times higher that they would report no diabetes control vs. respondents who reported depressive symptomatology less than 4. Ironically, a clinical diagnosis of depression was not significantly associated with perceived diabetes control.

However, a depression diagnosis was significantly associated with SRH (OR:1.56, 95% CI:1.21-2.03). Self-reported depressive symptomatology significantly made a difference in the outcomes of perceived diabetes control and self-reported health. As practitioners, it is important to consider depressive symptomatology when treating patients for diabetes. Patients who have reported high depressive symptomatology often have not been clinically diagnosed as depressed. However, in this study we found that depressive symptomatology is what mattered in self-reported health and perceived diabetes control, a clinical diagnosis was not significantly associated with diabetes control.

Pre-disposal and enabling characteristics were significantly associated with "bad" self-reported health. Race (p=.01999) a pre-disposal characteristic and education (p=<.0001) an enabling characteristic were significantly associated with "bad" self-reported health. In our study, education was used as a proxy for enabling characteristics. The significant co-variates were insulin usage (p=<.0001), diabetes control (p=<.0001), depressive symptomatology (p=<.0001), and treatment (p=<.0001). This study further examined the association between depressive symptomatology and self-reported health and diabetes control. In addition, there was an association between depressive symptomatology and clinical depression (p-value=<0001) found in the bivariate analysis. However, doctor diagnosed depression was only significant in one model, whereas depressive symptomology was significant in all the models. Therefore, it is important to screen for depressive symptomatology in diabetic patients. Although patients might not be clinically depressed, depressive symptomatology must be considered for treatment of patients with diabetes. The researchers also examined the association between diabetes control and depressive symptomatology. In our study, 9% of the sample reported "no" diabetes control. Similarly, to self-reported health, insulin usage (p=<.0001) and depressive symptomatology (p=<.0001) were significant in reporting "no" diabetes control. Additionally, self-reported health (p=<.0001) and age (p=.0001) were significant in reporting "no" diabetes control. Insulin usage was significant both in reporting "bad" self-reported health and "no" diabetes control. Not

surprisingly, we found that insulin was significant in both "bad" self-reported health and "no" to diabetes control. Insulin is normally prescribed to patients after they have tried using an oral medication and made lifestyles changes. If oral medication or lifestyle changes are not receptive, then patients with Type 2 diabetes could be prescribed insulin to have better control of their diabetes.

Surprisingly, treatment for depression was not significant in diabetes control. Our findings were different than a study by Brieler et al., 2016 where researchers reported that individuals who received ADM has better glycemic control. Treatment for depression was moderately significant in self-reported health. Originally, the researchers hypothesize that treatment for depression would improve diabetes outcomes. Even though two-third of our sample received treatment for depression, treatment was only moderately significant in the self-report model. According to the Surgeon General Report for Mental Health, approximately 1/3 of people who are diagnosed with depression actually receives treatment. This study produced more favorable numbers where two-third of the respondents received treatment. Even though respondents received treatment, to be included in our study, participants had to answer the following question, "has a doctor ever told you that you have depression" There is a possibility that even though they were diagnosed as depressed, the diagnosis might not be current diagnosis. In our study, we only did an analysis of participants who received treatment and were clinically diagnosis. One potential problem is that our question asked, "Have a doctor ever told you that you were depressed?". Perhaps individuals are no longer depressed and were depressed at an earlier time.

Potential limitations and strengths

One significant limitation is the classification of the treatment variable. The treatment variable was categorized into two dichotomous variables. The "yes" for

treatment included if you receive either psychiatric medication or psychotherapy. The "no" for treatment was defined if you answered either "no" to treatment or "missing". Because we only looked at treatment as a group, we were not able to analyze if the method of treatment was significant in the outcomes. Also, because this study was cross-sectional, the researcher was unable to determine the continuity of treatment and its effect on outcome. The researchers were unable to determine when treatment was first started with each respondent and how long each participant utilized treatment for depression.

Another limitation in this study is the usage of self-reported variables. All variables used for the analysis were based on self-reported responses. Although the questions asked participants, if a doctor ever told them they had depression or diabetes, the responses were based on the participant. Ideally, we could have used clinically data to determine when patients were diagnosed with depression and diabetes. However, in a research study by Jackson et al, researchers found that medical records confirmed 91.8% of individuals who self-reported prevalent diabetes. Self-reported information may limit the amount of details the researchers received, however this information is valid and reliable. Our cross-sectional design does not allow us to make causal inferences between depressive symptomatology and self-reported health and diabetes control.

Another limitation in this study is that participants were required to answer all covariates. If any of the main covariates were missing the respondents were excluded from the analysis. For our analysis, the researchers used a cross-sectional design. Our cross-sectional design does not allow us to make causal inferences between depressive symptomatology and self-reported health and diabetes control. This cross-sectional design limits the ability to examine the continuity of treatment. The researchers only

examined one study year instead of examining the association between the continuity of treatment over multiple years.

One major benefit of this study is that we could look at an older population. Studies have shown that depression prevalence is high in older Americans. Researchers could examine an older population with a diabetes diagnosis. The data from this study came from a nationally representative sample which adds to the external validity of our study's findings. A major benefit of the Health and Retirement Study is that this sample oversamples blacks and Hispanics.

Implications for Future Research

Depressive Symptomatology is significantly associated with self-reported health and diabetes control in patients with diabetes. Preventive services should be given to patients with diabetes to help diminish or eliminate depressive symptomatology. For example, diabetes education classes could incorporate material on depression and how to manage depressive symptomatology. When healthcare providers add this to the curriculum it can help prevent depression in patients with diabetes. When healthcare providers start to see, that patients are expressing symptoms of depression, immediate action should take place to help patients reduce depressive symptomatology.

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