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Foot Reflexology and Type 2 Diabetes: Analyzing HbA1c, Perceived Stress, Coping Ability, and Sense of Coherence

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Walden University
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Abstract

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by

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MS, Walden University, 2012

BLS, University of Tampa, 2007

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Psychology

Health Psychology

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May 2022

Abstract

There are 28.7 million people diagnosed with diabetes and 8.5 million undiagnosed, with another 96 million prediabetic in the United States. Diabetes health care cost in the United States is $327 billion in 2017. Type 2 diabetes constitutes 90-95% of those numbers. Type 2 diabetes has many psychosocial factors plagued by stress that advance this illness. Foot reflexology has addressed these psychosocial factors with other illnesses. The conceptual framework of this study were the stress and coping theory, cognitive activation theory of stress, and the sense of coherence theory. The purpose of this study was to analyze type 2 diabetics using foot reflexology in contrast to type 2 diabetics not using foot reflexology. The variables measured were HbA1c (self-reported), perceived stress, coping ability, and a sense of coherence. A convenience sample of 10 type 2 diabetic foot reflexology respondents and 31 type 2 diabetic non-foot reflexology respondents were reached through computer access. The quantitative survey design was quasi-experimental with two scalable questionnaires, the Perceived Stress Scale-10 (PSS-10) and the Sense of Coherence-13 (SOC-13), and the demographics included self-report of blood sugar level. The results indicated there was no significant difference in the two groups. Findings from this study encourage positive social change by empowering type 2 diabetics with a means of managing their illness, decreasing future complications, and lowering societal cost of this disease. Future research in this area may wish to enlarge the sample size and recruit through additional organizations.

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Dedication

I am dedicating this study to all the type 2 diabetics that struggle with this illness daily and to my mom and dad who never stopped believing in me.

Acknowledgments

I would like to thank my chair Dr. Lee Stadtlander, Dr. Rose Wilson (second committee member), Dr. Amy Sickel (Program Direct/ Psychology Program), Dr. Kelly Chermack (Style and Form), and Dr.Peggy Gallagher (University Review) for supporting me on my journey in reaching this point in my academic career. A big thanks to my friend Dr. Marietta Miller who was incredibly supportive throughout this last year.

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Chapter 1: Introduction to Study

Introduction

Type 2 diabetes has reached global pandemic levels (Awad et al., 2018; Unnikrishman et al., 2017). In this study, type 2 diabetics who received foot reflexology were compared to type 2 diabetics who did not receive foot reflexology. I analyzed HbA1c (self-report), perceived stress, coping ability, and a sense of coherence, addressing the research question: can foot reflexology show a difference in these variables by helping the type 2 diabetic?

Diabetes is a nontransferable disease that is progressive (World Health Organization [WHO], 2021) which means it cannot be passed on to anyone else, and the longer one has it, the worse it gets. There are two types of diabetes. Type 1 diabetes is insulin dependent (insulin must be injected) and is classified as an acquired early age disease from damage to insulin producing cells (American Diabetes Association [ADA], 2022). Type 2 diabetes is a chronic disease that is defined by being noninsulin dependent or insulin resistance, which means the body does not use insulin well (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2018). The risk factors in developing type 2 diabetes are being middle age, overweight, and sedentary (lack of exercise) which would indicate behavioral changes can correct this condition (NIDDK, 2016).

There are 28.7 million people diagnosed with diabetes and 8.5 million undiagnosed, with another 96 million prediabetic in the United States from the National Diabetes Statistics Report and type 2 diabetes constitutes 90-95% of those numbers

(CDC, 2022). Diabetes health care cost in the United States was $327 billion in 2017 (ADA, 2022). Obesity in the United States from 2017-2018 was 42.4 % of the adult population (ADA, 2022). The WHO (2021) stated 422 million people have diabetes worldwide. The growth of diabetes is expected to reach 642 million people by the year 2040 (Awad et al., 2018). As the global population continues to increase, so do the risk factors of obesity, smoking, and physical inactivity (Awad et al., 2018).

Type 2 diabetes leads to costly health care from complications as the disease progresses with age (WHO, 2021). Problems or future complications for diabetes include heart disease and stroke, high blood pressure, blindness, kidney disease, neuropathy, and amputation (NIDDK, n.d.). These complications increase hospital and medical care costs and decrease the quality of life. The average health care cost for a newly diagnosed diabetic over their lifetime is $85,200, and 53% of that cost will be used for treating complications (Zhuo et al., 2013).

There are several stressful psychosocial factors that progress type 2 diabetes creating life changing complications; however, foot reflexology can be a simple and natural means to manage this illness. Factors affecting diabetes are seen in other diseases that foot reflexology has helped. Chapter 2 will review the literature on type 2 diabetes and foot reflexology.

The desired impact of positive social change was to empower type 2 diabetic individuals with a means of managing their illness, decrease future complications, and lower societal cost of this disease. Furthermore, foot reflexology as a self-care practice,

when combined with a sense of coherence approach, may promote biopsychosocial interventions. This study filled in the gap in the literature and can be replicated.

Chapter 1 presents the topic of the study and potential implications of social change. The background section summarizes the research, describes the gap, and explains why the study is important. The problem statement summarizes evidence that the problem is current and significant to health psychology. The purpose of the study describes the study's intent and the variables. The last section reviews the research questions and hypotheses.

Background

Previous research in the past 5 years has not examined the gap in literature with foot reflexology and type 2 diabetes together with the biopsychosocial model or the sense of coherence. The biopsychosocial model explains how psychosocial factors of an illness can affect an individual's quality of life. Type 2 diabetes is an emotionally and mentally demanding chronic disease in adults creating comorbidity of mental illness, such as depression, anxiety, and severe psychological distress (Habtewold et al., 2016). Some psychosocial factors in type 2 diabetes are distress and depression (Fisher et al., 2014; Li et al., 2013), stress (Morris et al., 2011), coping and social support (Hara et al., 2014; Rook et al., 2016; Stopford et al., 2013), and sleep (Irwin, 2015). Poor Quality of Life (QoL) from stressful psychosocial factors has been suggested as a reason for the disease to progress and complications to develop (Glover et al., 2016; Zurita-Cruz et al., 2018) leading to morbidity and a global economic burden on health care (Patel et al., 2014). In addition, stressful psychosocial factors make self-care difficult leading to nonadherence

(Patel et al., 2014; Sexton et al., 2015). Stress (Morris et al., 2011), perceived stress (Hara et al. 2014), and workplace stress (Lian et al., 2018; Novak et al., 2013) have been reported as the major reasons why blood sugar levels were not in a controlled range. Stress is the main factor that, through psychological and physiological pathways, contributes to ongoing inflammation (Sharma & Singh, 2020; Slavish et al., 2015). With any physical ailment creating stress in the body, the QoL for those individuals change (Ventegodt et al., 2003).

Lifestyle changes in managing type 2 diabetes, should include stress reduction, improved coping skills, social support, as well as improved diet, and exercise. Foot reflexology can reduce stress and improve coping ability plus provide one on one social support from the reflexologist. The current study focused on foot reflexology as the salutogenic tool, a sense of coherence for managing type 2 diabetics. Foot reflexology is a touch modality applied to bottom of the feet by a licensed reflexologist (Dalal et al., 2014).

A sample of the literature on foot reflexology showed it was beneficial for psychosocial factors (e.g., distress, depression, sleep, stress, quality of life) with other illnesses and conditions. For example, foot reflexology showed improved bladder control, balance (homeostasis) to the bladder, and increased circulation (Aydin et al., 2016). Foot reflexology has improved sleep (Bakir et al., 2018; Lee, Ng, et al., 2017; Unal & Akpinar, 2016), decreased anxiety (Korhan et al., 2014; Ramezanibadr et al., 2018; Shahsavari et al., 2017), and relieved pain in fibromyalgia (Korhan et al., 2016). Diabetics who have reported poor QoL (Glover et al., 2016; Zhu et al., 2016; Zurita-Cruz

et al., 2018) may benefit from foot reflexology that has improved QoL in other illnesses (Miller et al., 2013; Wyatt et al., 2012). In addition, foot reflexology helped reduce blood pressure and heart rate (Ebadi et al., 2015; Hughes et al., 2011; Korhan et al., 2014; McCullough et al., 2014). This study is needed to provide a clearer vision of what foot reflexology can offer type 2 diabetics and society.

Problem Statement

As global numbers continue to increase, leading organizations, such as the WHO, CDC, NIH, and NIDDK, are aware of the type 2 diabetes pandemic and have been following the increase in the number of individuals diagnosed with type 2 diabetes. There are 28.7 million people diagnosed with diabetes and 8.5 million undiagnosed, with another 96 million prediabetic in the United States from the National Diabetes Statistics Report and type 2 diabetes constitutes 90-95% of those numbers (CDC, 2022.). Diabetes health care cost in the United States was $327 billion in 2017 (ADA, 2022). The growing numbers and cost indicate that other ways of managing this illness must be investigated.

The cause of type 2 diabetes is still unclear. The NIDDK (2016) listed obesity, age (45 or older), and lack of exercise as major factors. Certain diseases that can affect glucose metabolism are genetic mutations, hormone imbalances, and pancreatitis (NIDDK, 2016). People at risk for type 2 diabetes have low-income status, severe mental health conditions (e.g., depression, alcohol dependency, posttraumatic stress disorder), aggressive behaviors, and are consistently exposed to chronic stressors (Kelly & Ismail, 2015). Other risk factors for developing type 2 are depression, strokes, high blood

pressure, and high triglycerides (NIDDK, 2016). Stress and a history of depression leads to modified metabolic responses as well (Razzoli & Bartotomucci, 2016).

Obesity is considered a major contributor to the development of type 2 diabetes (Zurita-Cruz et al., 2018). According to the Hales et al. (2020), obesity was present in 42.4% of the population in a 2017-2018 survey. Obesity risk factors include heart disease, stroke, type 2 diabetes, and certain cancers. Overweight or obese individuals having higher perceived stress and lower coping ability had a higher incidence of type 2 diabetes (Sagui & Levens, 2016). Additionally, chronic stress plays a key role in obesity (Wallace, 2016).

Chronic stressors are listed as stressful working environments, traumatic events, personality characteristics, and racial/ethnic conditions (Kelly & Ismail, 2015). Wallace (2016) explained the biopsycho processes of prolonged periods of unresolved stress in the hypothalamus-pituitary-adrenal axis (HPA) that keep cortisol elevated. This link is detailed more in the CATS theory by Ursin and Eriksen (2004). Abnormal functioning from the stress response in this feedback system creates stored belly fat (Wallace, 2016). This psychological stress response (PSR) is explained in Kelly and Ismail's (2015) review. Chronic stressors and the PSR will be discussed further in Chapter 2.

There is a gap in the literature with type 2 diabetes and foot reflexology. Through the literature review, I noticed chronic stress within psychosocial factors of type 2 diabetes that makes the illness worse and develops complications. I then noticed those same factors were addressed with foot reflexology as a natural therapy in managing other diseases. In type 2 diabetes, managing blood sugar levels and coping with stressful

psychosocial factors is hard to do. The solution is to find a good coping mechanism to reduce stress that reduces inflammation, positively leading to better health and a better quality of life.

Purpose of the Study

The purpose of this quantitative study was to compare type 2 diabetics that used foot reflexology to type 2 diabetics who did not use foot reflexology. The study was searching for differences in blood sugar levels, sense of coherence, perceived stress, and coping ability. Comparison of the variables was conducted with respondents from a small sample size. The independent variable was foot reflexology and, and the dependent variables were HbA1c (self-report), a sense of coherence, perceived stress, and coping ability. This study was designed to investigate how type 2 diabetics can be helped through foot reflexology by those type 2 diabetics already receiving this natural therapy.

Research Questions and Hypotheses

The foundational research question was: How do type 2 diabetics regularly using foot reflexology differ in their HbA1c, perceived stress, coping ability, and a sense of coherence from type 2 diabetics who do not use foot reflexology to manage their illness? There were several hypotheses based on this research question:

H_{A1}: Type 2 diabetics regularly using foot reflexology differ in their HbA1c from type 2 diabetics who do not use foot reflexology.

H_{01}: Type 2 diabetics regularly using foot reflexology do not differ in their HbA1c from type 2 diabetics who do not use foot reflexology.

H_{A2}: Type 2 diabetics regularly using foot reflexology differ in sense of coherence from type 2 diabetics who do not use foot reflexology.

H_{02}: Type 2 diabetics regularly using foot reflexology do not differ in sense of coherence from type 2 diabetics who do not use foot reflexology.

H_{A3}: Type 2 diabetics regularly using foot reflexology differ in perceived stress from type 2 diabetics who do not use foot reflexology.

H_{03}: Type 2 diabetics regularly using foot reflexology do not differ in perceived stress from type 2 diabetics who do not use foot reflexology.

H_{A4}: Type 2 diabetics regularly using foot reflexology differ in coping ability from type 2 diabetics who do not use foot reflexology.

H_{04}: Type 2 diabetics regularly using foot reflexology do not differ in coping ability from type 2 diabetics who do not use foot reflexology.

The variables are being measured with unequal variance of the Welch's t-test, Mann-Whitney, and the Chi-square in the SPSS computer statistic platform.

Conceptual Framework

The theoretical foundation of this study was based on stress and its biopsychosocial effects. I used several stress theories and other elements of the biopsychosocial model to build a conceptual framework. Stress can be defined as an "imbalance between one's resources and the demands of a given situation" (Ottino-Gonzalez et al., 2017, p. 2). The theoretical foundation conveyed the biopsychosocial perspective (Engel, 1977) of type 2 diabetes by using two stress theories to understand type 2 diabetes development and progression plus another theory for a solution of coping.

The theories work together to explain what stress does and what needs to be done for helping type 2 diabetics lead a better quality of life.

The first stress theory, Lazarus and Folkman's (1984) theory of stress and coping, explains the psychological stress with appraisal of the environment when using coping resources (Berjot & Gillet, 2011). Coping would need to reflect a positive outcome expectancy (hope) for it to affect health or illness as explained in Lazarus and Folkman's (1984) stress and coping theory (Kristofferzon et al., 2018). Stress and coping theory states that stress is dependent upon a transaction between a person and their environment and is judged or appraised as being hazardous to their well-being (Folkman, 1984). This environment is also continuously changing. Therefore, the person and the environment are in a two-way relationship (Folkman, 1984).

The second theory is Ursin and Eriksen's (2004) cognitive activation theory of stress (CATS). CATS will clarify that real or perceived stress imposes a change in cognition, and physiology (Ursin & Eriksen, 2004). CATS have four stimuli: stress, experience of stress, general stress response, and experience of the stress response. The stress response is an alarm that something is not right in the balance (homeostasis) of the organism. The stress response contains a neurophysiological action and psychological arousal and is a normal reaction to stress. However, if the stress is prolonged, it may lead to disease from pathophysiological processes or better known as allostatic. The alarm signal also lets the individual know coping with the stressor is required. The intensity of the alarm depends on expectancy of outcome and resources available for coping. Expectancy responses play an important part as to whether the results are positive,

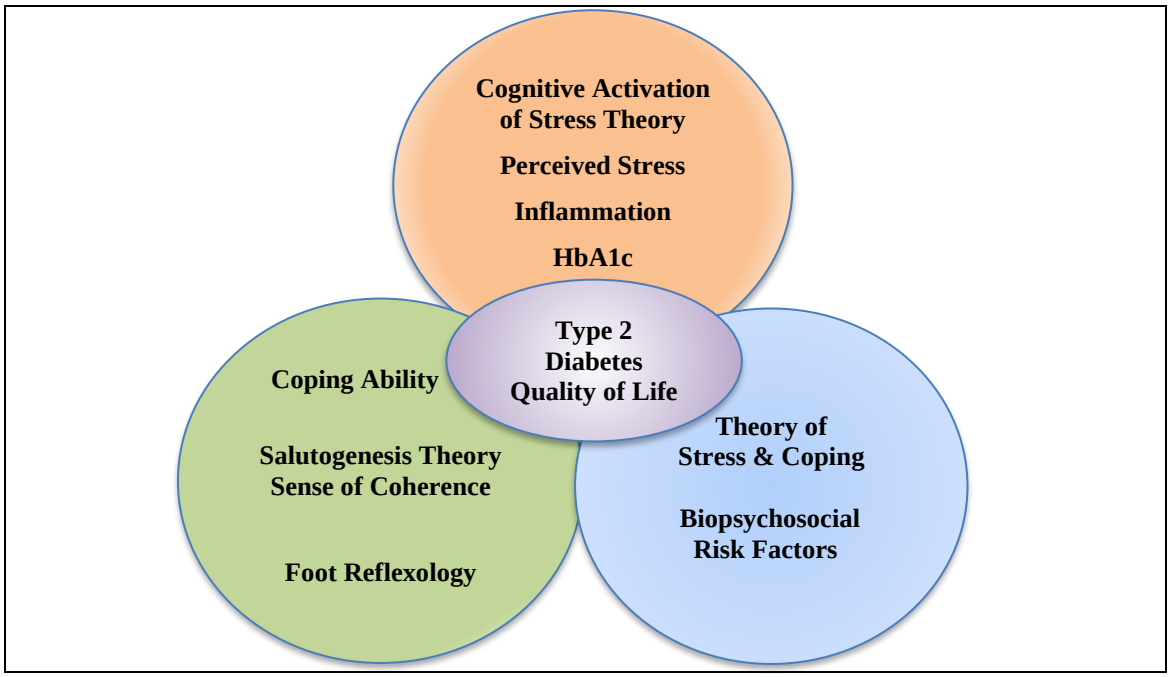
negative, or none and this leads to outcomes that are defined as coping, hopelessness, or helplessness (Ursin & Eriksen, 2004).

In the third theory, Antonovsky's (1979) theory of salutogenesis and a sense of coherence (SOC) focuses on what promotes health as opposed to what promotes illness. Antonovsky (1987), who originally focused on stress, established the salutogenesis theory with the sense of coherence concept. Encouraging coping skills or behaviors such as receiving foot reflexology, should be comprehensible, manageable, and meaningful to offset the stress response and move toward well-being (Bauer et al., 2019). Salutogenesis looks at health as a continuum from good health to ill health and the degree of variation on this scale throughout life depends on internal and external resources (Antonovsky, 1996). A coping mechanism will need to be applied that will create comprehensibility or clarity, manageability, and meaningfulness described in salutogenesis sense of coherence (Kristofferzon et al., 2018). Two theories point to stress as a primary initiator on a biopsychosocial level and the third theory talks about coping and the focus on health. More about the theoretical foundation in Chapter 2.

The conceptual framework of this study reflects on stress being the major factor in and through other factors that initiates and progresses type 2 diabetes. See Figure 1 for the conceptual framework model that was developed from comparing the biopsychosocial model to this study. Each circle has a theory and the corresponding elements, all connecting to type 2 diabetes and the quality of life.

Figure 1

Conceptual Framework Model of the Study



Note. This configuration illuminates this study on the stress theories, biopsychosocial factors, perceived stress, inflammation, and foot reflexology involved with type 2 diabetes and quality of life.

Nature of the Study

Chronic stress and psychosocial factors shown in type 2 diabetes literature reflect the need for a stress-reducing, self-managing therapy. The literature on foot reflexology has shown benefits as a coping mechanism and self-management tool to address issues of nonadherence and psychosocial factors. This quantitative study was a quasi-experimental design of foot reflexology and type 2 diabetes. The intent was to analyze type 2 diabetics using foot reflexology and type 2 diabetics who did not use this modality. The study consisted of two questionnaires that covered the research questions and hypotheses. The

dependent variables were self-report HbA1c, perceived stress, coping ability, and a sense of coherence. Foot reflexology was the independent variables. The surveys included the PSS-10 (see Cohen et al., 1983) and the SOC (see Antonovsky, 1993) with a total number of 23 survey questions and seven demographic questions. The total number of type 2 diabetes respondents was 41 with 10 of them having had foot reflexology. Data was collected through online host SurveyMonkey and analyzed with SPSS on a secured computer.

Term Definitions

Terms in this study that may need a better understanding are HbA1c normally know as blood sugar level test and foot reflexology. The HbA1c is an abbreviated medical term used for a test measuring sugar levels in the blood. Sugar (glucose) in a person's blood attaches to their hemoglobin. Hemoglobin is an iron rich protein molecule that carries the oxygen to the cells. Excess sugar in the blood will attach to the hemoglobin. The HbA1c (hemoglobin blood test) will show the average blood sugar level over the last 3 months (NIDDK, 2016). The higher the HbA1c number, the more damage being done by excess sugar in the blood. The CDC (2021) defines normal blood sugar as 4 to 5.6 and prediabetes levels are 5.7 to 6.4. Diabetes is diagnosed when A1c is above 6.5 (NIDDK, 2018). A person with diabetes should try to keep below a 7.0 A1c. The higher A1c levels, the increased risk for future complications. It is important to get a blood sugar level test to check for prediabetes at yearly check-ups. Diabetics should try to keep A1c less than 7.0 to minimize damage. Blood sugar levels measured daily by finger

pricks are taken 1–2 hours after the meal and should range between 80–120 mg/dl (ADA, 2022).

Foot reflexology has been around for thousands of years. This is a touch modality in holistic therapies that applies pressure on points located on the soles of the feet (Embong et al., 2015). Foot reflexology is a hands-on technique that disrupts the stress cycle (Embong et al., 2015) thus relieving tension and reducing stress (Hughes et al., 2011). These reflexology points can also be found on the hand and ears.

Assumptions

In this study, I made several assumptions. First, I assumed respondents would answer the questionnaire honestly. I also assumed respondents were a good population sample. In addition, I assumed the variables I used in the questionnaire would be of interest to the respondents. Additional assumptions made were also that this population could read and speak English, that all eligible respondents would have access to a computer and know how to use one. Finally, I assumed everyone would complete the entire survey.

I recruited a small convenience sample of adult type 2 diabetics online, who also spoke English and could use a computer. Type 2 diabetic respondents who were receiving foot reflexology and those who were not answered the same perceived stress and sense of coherence questions regarding their experience with this illness. The latest level of HbA1c self-report and other demographics were also asked.

Limitations

The answers to the study's survey were self-reported by respondents. The survey was in English so individuals who speak other languages were not included. Type 2 diabetics that participated may have been different than those who did not participate, for example, they may have had stronger opinions. The online study did not divide respondents into two groups until the data was gathered to reflect who had received foot reflexology. No biases were noted.

Significance

There are many potential implications for this research. Potential implications of this study will bring awareness about foot reflexology to type 2 diabetics for managing their illness. Foot reflexology will provide the diabetic with stress reduction, a salutogenic means for self-care, self-efficacy, and assist with adherence to medical advice. Another potential implication will be to advance the field of health psychology by using the conceptual framework model and the biopsychosocial model with type 2 diabetics and foot reflexology. This study will fill in the gap in the literature of foot reflexology and type 2 diabetes. In addition, this study may inspire educators to develop full spectrum intervention programs with a sense of coherence. Furthermore, the field of complementary therapies will expand its investigation of foot reflexology in managing type 2 diabetes. The final contribution is to have foot reflexology added to conventional medicine that may bring down the global cost of this disease by reducing future complications (Johnson, 2013; Patel et al., 2014; WHO, 2015). This study can be replicated.

Summary

Chapter 1 introduced type 2 diabetes with numbers at pandemic levels (Unnikrishnan et al., 2017). Type 2 diabetes has many variables or factors that can lead to costly and devastating complications (WHO, 2020). Chapter 1 described preexisting conditions such as health attacks, stokes, and mental illness. This chapter suggested the development of type 2 diabetes with the cyclical causes of age, obesity, psychosocial factors, stress, chronic stressors, low income, sleep disturbances, and mental health conditions. A conceptual framework model was also introduced. This chapter provided the background information and included the problem statement about type 2 diabetes. The study's purpose and intention were covered, as well as the literature gap reviewed. A study with type 2 diabetes and foot reflexology investigating blood sugar levels, perceived stress, coping ability, and a sense of coherence using a biopsychosocial model has not been previously conducted, to my knowledge.

In this chapter, research questions and hypothesis were introduced and described. The theoretical section presented a biopsychosocial perspective of the stress and coping theory, the cognitive activation theory of stress, and the sense of coherence theory. The significance of this study described potential advancements to the health psychology field, the biopsychosocial model, foot reflexology, and additionally added to type 2 diabetes literature.

In the next chapter, type 2 diabetes research studies will expand on how stress affects psychosocial factors such as sleep, distress, depression, QoL, and social support. Inflammation and adherence factors that affect the management and progression of type 2

diabetes will be discussed. Chapter 2 contains research studies on the benefits of foot reflexology. The conceptual framework will provide the theoretical foundation of three theories. The biopsychosocial model, the revised version, and the conceptual model are diagramed.

Chapter 2: Literature Review

Introduction

Type 2 diabetes is an illness that has reached pandemic proportions in numbers and dollars (Awad et al., 2018; Unnikrishnan et al., 2017) and is considered a biopsychosocial disease dilemma (de Groot et al., 2016). The NIDDK (n.d.) has reported physical inactivity and conditions such as high blood pressure are risk factors in the development of type 2 diabetes. Biologically, the disease may develop from genetics, being overweight, and/or getting older. This former view is changing to the early loss of B cells function according to recent research of non-obese individuals (Unnikrishnan et al., 2017). Zimmet and Alberti (2016) reported that more children, teenagers, and young adults have type 2 diabetes. In addition, many psychological conditions can be seen in this disease such as depression, anxiety, eating disorders, and serious mental disorders (de Groot et al., 2016). The social environment of an individual produces psychosocial stress factors that contribute to this disease (Agardh et al., 2018; Li et al., 2013) and some individuals already had stressful situations in their lives before the illness (Rane & Gafvels, 2017).

The purpose of this quantitative study was to analyze type 2 diabetics that used foot reflexology to type 2 diabetics who did not use foot reflexology. The study searched for differences in self-report HbA1c, sense of coherence, perceived stress, and coping ability. Comparison of the variables were conducted with type 2 diabetes respondents from a small sample size. The independent variable was foot reflexology with dependent variables of HbA1c (latest report from doctor), sense of coherence, perceived stress, and

coping. This study was designed to investigate how type 2 diabetics can be helped through foot reflexology by those type 2 diabetics already receiving this natural therapy.

A similar theory-based stress management intervention for type 2 diabetics was evaluated for effectiveness by Zamani-Alavijeh et al. (2018). In this study, pretest groups showed no difference in scores on perceived stress, blood sugar levels, coping inventory, coping self-efficacy, or perceived social group. The posttest results in the experimental group showed a significant improvement in scores on all aspects (Zamani-Alavijeh et al., 2018). The results of this experiment are important for educators and diabetics. Other tailored inventions that "reduce stress levels, increase recovery levels, and promote healthy sleep habits play a key role in weight management and glycemic control in T2DM" (Mussa et al., 2019, p. 991).

The current literature points to chronic stressors through psychosocial factors for the development of type 2 diabetes. Chronic stressors can lead to inflammatory markers and poor mental health, which is seen in the development of type 2 diabetes as explained though the PSR and cognitive action theory (Kelly & Ismail, 2016; Wallace, 2016). Psychosocial factors of depression, diabetes distress, psychological state of being, and bad social support influence diabetes (Guo et al., 2018). Childhood experiences of abuse or neglect increase the risk of type 2 diabetes in adulthood (Hackett & Steptoe, 2017). Additionally, psychological stress, poor coping abilities, fear of being judged, financial concerns, guilty feelings, and self-care concerns have been shown to affect diabetics (Rasmussen et al., 2016). Blood sugar levels are also affected by community stress factors such as socioeconomic deprivation, food availability, and fitness accessibility

affect (Hirsch et al., 2018). Furthermore, stressful psychosocial factors from socioeconomic position, smoking, drinking, body mass index (BMI), physical inactivity, marital status, education, social relationships, and employment status play significant roles in this illness (Agardh et al., 2018; Li et al., 2013).

There are several psychosocial factors in diabetes. For example, depression appeared in 13.8% and diabetes distress present in 44.6% of participants (Nicolucci et al., 2013). The QoL was rated as poor or very poor in 12.2% participants (Nicolucci et al., 2013). In addition, 20% of type 2 participants reported diabetes affected their family/friend relationships. The researchers found physical health affected 62.2% and 40% reported medication interfered with life activities (Nicolucci et al., 2013). Furthermore, psychosocial factors also play a significant role in self-care or management of blood sugar levels and requires a belief in self-efficacy (Cosansu & Erdogan, 2014).

The management of type 2 diabetes is through self-care. Self-care is the most important aspect and can be done by improving coping skills and having social support (Karlsen et al., 2011), which develops a sense of coherence or perceived control. Managing this illness leads to medical adherence and controlled blood sugar levels (Gonzalez et al., 2015), whereas poor blood sugar control has been seen to lead to more complications (Giambrone & Dunbar-Jacob, 2016). Therefore, complications lead to a decrease in QoL (Timar et al., 2016). The QoL components are reflected in the biopsychosocial model as physical, mental, psychological, and social (Trikkalinou et al., 2017). Coping strategies are important because they connect the sense of coherence and

the mental aspect of the QoL in chronic disease as explained in the theoretical foundation of this study (Kristofferzon et al., 2018).

Chronic stress imposed on the physiological stress response mechanism (PSR) produces inflammatory markers. Inflammatory markers are also seen in mental health conditions, social isolation, social rejection, and relational stress. Research on type 2 diabetes identified psychosocial factors (variables) and how they may affect blood sugar levels. Chronic stress research endeavored to explain the cyclical biological and psychological response connection to type 2 diabetes (Kelly & Ismail, 2015).

The preview of Chapter 2 covered research strategies, literature on type 2 diabetes, literature on foot reflexology, conceptual framework, modified Engel's model, and biopsychosocial model. Foot reflexology was defined, and its effectiveness with psychosocial factors. The biopsychosocial model was defined and how it relates to psychosocial factors. The chapter's conceptual framework and theoretical foundation section explained the theory of stress and coping, the cognitive activation theory of stress, and the sense of coherence theory.

Literature Search Strategy

The literature review includes peer-reviewed journals and databases from Walden University library and other health-related journals that report on complementary or alternative therapies. Booleans were used in searching the database in the title of the article and abstract. Not using the Booleans in the context of articles helped to omit articles that did not have a study conducted on the topic. The databases were researched between January 2012 and November 2019.

There were five searches in each database. The first search was for *psychosocial factors and type 2 diabetes*. The second search addressed *foot reflexology* studies with any foot reflexology studies that included any of the psychosocial variables presented in type 2 diabetes research. The third search was performed for *foot reflexology and type 2 diabetes* to see if there were any current studies. The fourth search was conducted for *biopsychosocial* and *foot reflexology*. Finally, the fifth search was completed for *stress theories* and its connection to type 2 diabetes.

The following are omitted Booleans that were not in line with the topic. All variations of foot reflexology were omitted such as foot massage, zone therapy and reflex therapy, Thai massage, massage, metabolic syndrome, and reflex zone therapy. All diabetic articles that were directed at type 1 diabetes were omitted. Any long-term complications of the disease such as neuropathy, blindness, amputations, and any complications were omitted. The following databases and journals were accessed for literature search for years between 2014 and 2020.

I explored all of Walden University's databases that pertained to medical/nursing and psychology, and academic and open access databases, including Thoreau, Medline, BioMed, Sage, and ProQuest. These databases had a rich supply of type 2 diabetes and psychosocial factor studies. As I was in one database searching for type 2 diabetes, I would examine the same Booleans to cover studies on foot reflexology as well. After I searched the appropriate databases for my topic, I searched other journals such as *Health Psychology, Holistic Nursing, Diabetes Medicine, and Evidence-based Complimentary &*

Alternative, just to name a few. I examined organizations associated with my topic including the ADA, WHO, CDC, and NIDDK.

Conceptual Framework

Type 2 diabetes is a multidimensional illness with many contributing factors of causation, development, management, and progression. The theoretical foundation is a conceptual framework based on three theories: Lazarus and Folkman's (1984) theory of stress and coping, Ursin and Eriksen's (2004) cognitive activation theory of stress (CATS), and Antonovsky's (1979) salutogenesis sense of coherence (SOC). These theories together can best explain tyle 2 diabetes from beginning to end. Perceived stress may be the one construct that happens first in triggering the psychology and physiology of a disease and carries those processes throughout the disease progression because stress never ceases. Stress and disease are studied in health psychology and psychoneuroimmunology. Stress is a general term used to describe events people find demanding. Stress is seen throughout the research literature as an interactive construct with psychosocial factors, mental health conditions, obesity, blood sugar levels, distress, sleep, and quality of life.

Theory of Stress and Coping

The first theory is Lazarus and Folkman's (1984) theory of stress and coping. This is a psychological theory based on adjustment to situations through appraisal and management of emotions, which is a motivator behind coping with stress (Kristofferzon et al., 2018). Folkman (2010) defined "stress as a situation that is appraised by the individual as personally significant and as having demands that exceed the person's

resources for coping" (p. 901). In this definition, the word appraised means what is significant to the person and why. Beliefs, values, and goals are primary appraisals. The secondary appraisal is assessing coping options. The psychological action of appraising produces emotions (Folkman, 2010). For example, a person may feel or cognitively appraise that they are in control of the situation, and all is well with the environment (Folkman, 1984).

Coping is an important aspect of dealing with stress. Folkman (2010) defined coping as "thoughts and behaviors used to manage internal and external demands of stressful events" (p. 902), and that has been appraised as exceeding resources (Folkman et al., 1986). Coping has two main goals: dealing with the problem causing stress and regulating emotions (Folkman et al., 1986). There are three basic forms of coping: problem-focused coping, emotion-focused coping, and meaning-focused coping. Meaning-focused coping contains positive and negative emotions that coincide with stressful periods. These three coping strategies are interactive and contains one more element, hope. Hope is defined as a "yearning and a positive goal-related motivational state" (Folkman, 2010, p. 902). Folkman went on to say that hope and psychological stress have things in common. They both are assessment-based, grow and fade, circumstantial, and are complicated. In basic terms, hope is a belief that you have control over your circumstance or situation (Folkman, 2010). If the ability to cope through a stressful event is sustained, then hope is also there for a desired positive outcome. For example, a medical diagnosis initiates the psychological stress of coping with uncertainties and a shift in known reality (Folkman, 2010).

Cognitive Activation Theory of Stress

Ursin and Eriksen (2004) developed the cognitive activation theory of stress in which they defined four stress activation systems. CATS and Han Selye's general adaptation theory (Tan & Yip, 2018) has similar stages, therefore, both theories will be discussed. CATS explained that the stress response happens on a biopsycho level, with allostatic load causing inflammation and weight gain. The four activation parts include the stimuli, the stress experience, non-specific general stress response, and the stress response. The stressor arouses the *homeostatic system* creating a *neurophysiological activation* (Ursin & Eriksen, 2004, p. 569), which is known as the alarm stage in Han Selye's general adaptation theory (Tan & Yip, 2018). The nonspecific stress response measures what is expected and what can be handled (coping ability). The stress response and the level of stress load should be equal (coping mechanism or homeostasis), or what Selye called the resistance stage (Tan & Yip, 2018). If the stress response is prolonged, it will create what is called an allostatic load on the individual's physiological processes (Ursin & Eriksen, 2004) which Selye called the exhaustion stage (Tan & Yip, 2018).

There are adaptive mechanisms in the body for adjusting to inner and outer environmental changes or stress. Homeostasis has narrow adaptation parameters that are needed for survival such as pH, temperature, and oxygen (Berger et al., 2018; Tiedt & Brown, 2014). Adaptation is conducted by other physiological processes known as allostasis. Allostasis helps maintain homeostasis by fluctuating blood pressure, blood sugar levels, and visual acuity through the sympathetic nervous system (Tiedt & Brown, 2014). On a cellular level, hormones and neurotransmitters are mediators/communicators

for the adaptation process such as “cortisol that leads to pro-inflammatory cytokines, oxidative stress, and mitochondrial dysfunction” (Berger et al., 2018, p. 36). In addition, allostatic load (AL) develops when adaptation is not adequate, and the stress response is consistently activated (Tiedt & Brown, 2014). High AL is linked to death and cognitive decline as seen in mental disorders (Berger et al., 2018).

Lane (2014) explained how biopsychosocial processes function with an illness as proposed in CATS theory. The psychological and social expectations are both facilitated by the brain. The medial prefrontal cortex in the brain has several functions including interrupting the current events to past events, biological motion, and regulation of vagal tone on the sympathetic nervous system connection to organ systems (Lane, 2014). Biological pathways of molecular communication connect “social events, psychological processes, brain mechanisms, autonomic, neuroendocrine, immune mediators, and organ-specific disease mechanism” (Lane, 2014, p. 3). Most importantly, the physiological changes from a stressor can increase the risk of disease (Lane, 2014). Furthermore, type 2 diabetics with psychological conditions (depression and anxiety) have been connected to poor glycemic control or elevated blood sugars caused by the lack of self-care and poor coping skills (de Groot et al., 2016).

Like Lane’s (2014) explanation, Kelly and Ismail (2015) described the changes in the physiological stress response (PSR) as it pertains to the development of type 2 diabetes. Psychosocial factors such as stressful work environments, trauma incidents, depressive moods, characteristic traits, mental problems, and low social and economic status (SES) will increase disease risks due to the chronic activation of the PSR (Kelly &

Ismail, 2015). The PSR involves the sympathetic-adreno medullary system and the hypothalamic pituitary adrenal axis (HPA). Both systems maintain psychological homeostasis. During psychological stress, the sympathetic-adreno medullary axis and the pituitary gland increase catabolic hormones and suppress anabolic hormones (Edes & Crews, 2017; Shayeghian et al., 2015). Chronic stress will also over activate the HPA and increase inflammation (Kelly & Ismail, 2015). Elevated levels of inflammatory markers forecast the onset of type 2 diabetes. Type 2 diabetes is considered an inflammatory disease (Kelly & Ismail, 2015; Slavish et al., 2015). Furthermore, stress will result in behavioral activities that increase blood sugar levels, such as comfort food eating, decreased physical activity, and alcohol consumption (Hales et al., 2020). Elevated AL parameters seen in type 2 diabetes included blood fasting glucose, HbA1c, BMI, waist-hip ratio, body-fat percentage, and blood pressure (Macit & Acar-Tek, 2020).

Allostatic load resulting from the stress response is associated with changes in grey matter that oversees behavior, reward processing, and cognition. Allostatic load index has 15 biomarkers that include leptin, pro-inflammatory IL-6, and c-reactive protein which measures inflammation (Ottino-Gonzalez et al., 2017) and somatic damages (Edes & Crews, 2017). Stress affecting caloric intake and fat accumulation is interactive with overweight biomarkers resulting in cognitive decline, brain atrophy, and mental disorders (Ottino-Gonzalez et al., 2017). Furthermore, a connection has been found between inflammasomes, microbial homeostasis, and chronic disease including obesity, fatty liver, and type 2 diabetes (Flavell, 2015; Kohut et al., 2014).

Ursin (2009) explained allostatic load brings about a negative response called helplessness. The individual will feel they have no control over the situation, which has been seen in perceived stress and diabetes distress (Gonzalez et al., 2015; Smallbeer & Dietrich, 2019). Additionally, learned helplessness is when a person has failed at many attempts to manage, change, or improve the outcomes resulting in diminished expectations and motivation (Smallbeer & Dietrich, 2019). When all responses yield a negative result, the individual moves into hopelessness (Ursin, 2009). The cognitive process from stimuli to response is a learned mechanism for knowing what is expected in each situation. Belief in a negative outcome and poor coping skills are predictors of poor life projection (Ursin, 2009).

Salutogenesis and the Sense of Coherence

The third theory is Antonovsky's (1979) theory of salutogenesis and the concept of a sense of coherence (SOC). Antonovsky's theory of salutogenesis focuses on what promotes health as opposed to what promotes illness (Antonovsky, 1987). Salutogenesis looks at health as a continuum from good health to ill health and the degree of variation on this scale throughout life depends on internal and external resources (Antonovsky, 1996). As a medical sociologist, Antonovsky's (1996) standpoint was to ask, "How can this individual be helped to progress toward better health?" written in 1992 for the WHO seminar on the theory of health promotion, research, and practice (Antonovsky, 1996; Kalra et al., 2018). There are three main staples to salutogenesis: comprehensibility, manageability, and meaningfulness. The SOC is the use of coping resources to maintain

health that is obtained in life experiences (Perez-Botella et al., 2014). Those individuals that can develop a strong SOC have a longer and happier life (Lindstrom, 2018).

Apers et al. (2016) stated, “SOC has been recognized as an internationally meaningful concept to focus on in patients with chronic conditions” (p. 1748). Additionally, SOC has a direct and indirect influence on mental QoL facilitated by a combination of coping styles (Kristofferzon et al., 2018). A chronically ill individual with a good SOC will use few but effective coping strategies to obtain a good mental QoL (Kristofferzon et al., 2018). The degree of an individual’s self-control is a central theme that surpasses self-concept, social environment, daily activities, life events, disease turning point, stress and coping, and illness integration (Apers et al., 2016). All theories are held in high regards in the fields of psychology, psychiatry, and medical sociology.

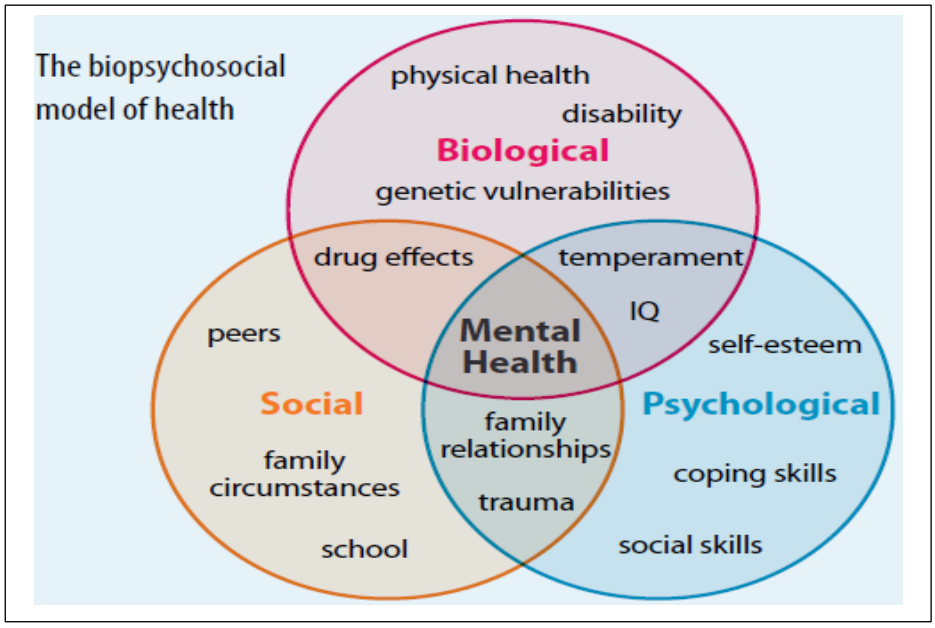
Biopsychosocial Model

Engel’s (1977) biopsychosocial model’s (BPS) main purpose is to bridge understanding of all interacting aspects of an individual that create changes in biology, mental aspects, and physical aspects. The BPS model is a comprehensive approach for treating chronic illness that involves the interaction of stressors, psychosocial functions, coping efficacy, and immune and neuroendocrine processes (Sperry, 2008). The BPS model is instrumental in the fields of health psychology and psychoneuroimmunology (Havelka et al., 2009). Furthermore, the BPS model is beneficial to the medical community to help with patient-centered interviewing and assist researchers in conducting demanding studies (Smith et al., 2013). The American Psychological Association and the American Board of Psychiatry and Neurology have approved Engels’

biopsychosocial model as a “model of health and illness for clinical practice and research for psychologists, nurses, physicians, and social workers” (Habtewold et al., 2016, p. 75). Habtewold et al. (2016) modified Engel’s biopsychosocial model illustrates the risk factors involved in type 2 diabetes. See Figure 1 for a description of the BPS model.

Figure 1

Engel’s Biopsychosocial Model of Health.



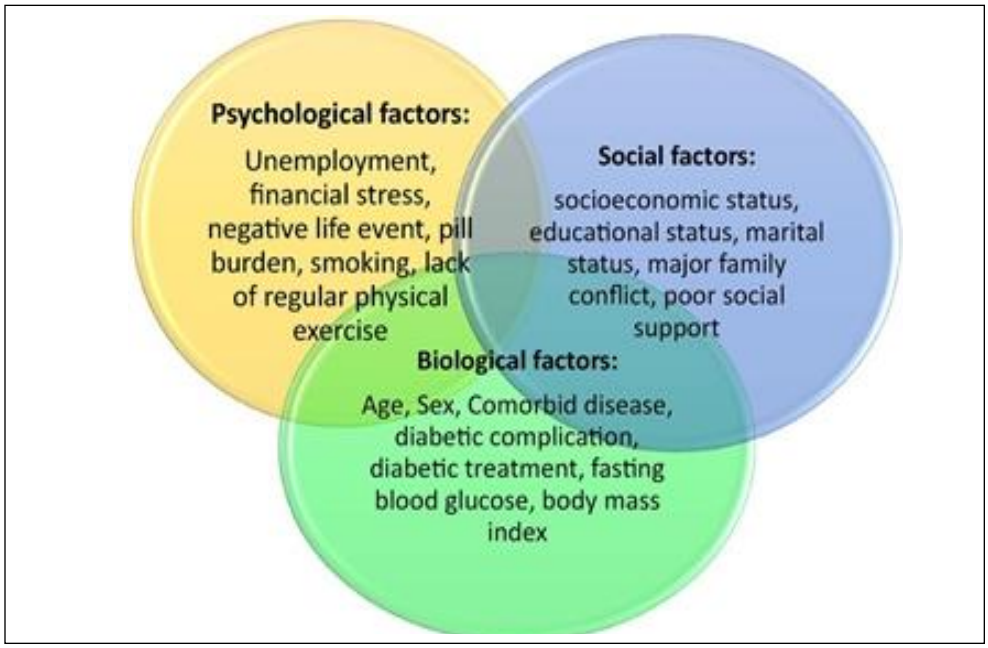
Note. This figure represents the psychosocial factors and how they interact creating a holistic view of health. Free download from Bing images.

The illness of type 2 diabetes is considered a “biopsychosocial challenge” with psychological conditions of depression, anxiety, eating disorders, and serious mental illness (de Groot et al., 2016, p. 552). Engel’s biopsychosocial model and the modified Engel’s model (See Figure 2) were used to illustrate the multidimensional aspects and risk factors of this chronic disease. The biopsychosocial model was developed by Engel

(1977) to explain the multidimensional interaction between mental, biological, and social factors that affect the disease state and progression in the individual (Epstein, 2014; Havelka et al., 2009; Sperry, 2008; Suls et al., 2013). The biopsychosocial model and the modified version of Engel's model developed by Habtewold et al. (2016) will give a better understanding how psychosocial factors involving stress can affect the regulation of blood sugar levels (Lane, 2014).

Figure 2

Modified Engel's Biopsychosocial Model



Note. This modified biopsychosocial model displays the risk factors that are responsible for the development and progress of type 2 diabetes and are reflected in the literature review. Any combination of the above risk factors can begin the cognitive activation of stress as explained by Ursin and Eriksen (2004). Reprinted with permission, Appendix A.

Literature Review Related to Key Variables

The literature review consisted of four topic searches in the databases. First, I conducted a search on type 2 diabetes. The second search was on foot reflexology and psychosocial factors. Third, I researched the biopsychosocial model with chronic illness. Finally, I researched stress and coping theories, including salutogenesis.

Type 2 Diabetes

Type 2 diabetes is the most diagnosed form of diabetes according to the American Diabetes Association (ADA, 2022). Type 2 diabetes happens when the body does not use insulin properly causing too much sugar remaining in the blood. The symptoms of type 2 diabetes are frequent urination, being very thirsty, feeling fatigued, blurry vision, and wounds that may not heal quickly. More symptoms of having diabetes are tingling in the hands or feet and weight loss. Type 2 diabetic individuals tend to be middle age, overweight, and sedentary (NIDDK, 2016). Obesity is a big predictor of developing type 2 diabetes. Being overweight and having stress has been linked to allostatic load and inflammation. These two conditions create major changes in the body and brain with behavior and cognitive functions (Ottino-Gonzalez et al., 2017). Obesity and depression have been linked together through studies on stress eating and sleep problems in lower income communities (Yu et al., 2016). There have been several studies on type 2 diabetes examining psychosocial factors negative impact and their effect on poor QoL (e.g., Glover et al., 2016; Guo et al., 2018; Hernandez et al., 2014; Sexton et al., 2015; Zhu et al., 2016; Zurita-Cruz et al., 2018).

Psychosocial Factors

Stress from psychosocial factors can begin a biological/physiological reaction making stress a biopsychosocial construct that leads to disease if proper coping strategies are not used according to the cognitive activation theory of stress (Ursin & Eriksen, 2004). The cognitive activation theory of stress states that psychosocial stress affects the central nervous system and the HPA that contribute to diabetes and increases BMI (Ursin, 2014; Wallace, 2016). Ursin (2014) called this "brain sensitization" or "a non-associative learning process of repeated stimuli (stress) resulting in a progressive amplification of a response" (pp. 134–135). Psychosocial factors such as "anxiety, depression, perceived control, hostility and anger, emotional distress, quality of life, fatigue, and pain" (Smallbeer & Dietrich, 2019, p. 251) are associated with learned helplessness, as explained in CATS.

Psychosocial factors as seen in the modified BPS model by Habtewold et al. (2016) play a significant role in self-efficacy or belief in the ability to manage the situation (Cosansu & Erdogan, 2014). Stress from psychosocial factors produce salivary inflammatory markers (Slavish et al., 2015) and were found to affect self-care (Guo et al., 2018; Hernandez et al., 2014). In addition, depression was shown associated with BMI, glycemic control, and diabetes quality of life (Li et al., 2013). Longitudinal studies found other emotional states that are listed as risk factors in type 2 diabetes such as stress, anxiety, hostility, and sleep problems (Novak et al., 2013). These emotional states can activate psychological mechanisms like the HPA, and inflammation from the stress

response (Novak et al., 2013) as discussed in CATS (Ursin & Eriksen, 2004) and the PSR explained by Kelly and Ismail (2015).

Psychosocial factors affecting type 2 diabetics were studied in a variety of populations. These factors accounted for 14% to 33% of variance in self-care areas for African Americans (Hernandez et al., 2014). The Chinese population had poor psychological well-being at 7.5% significance with depression affecting 5.4% of diabetic patients, and diabetes-related distress was found in 44.9% of diabetics (Guo et al., 2018). In contrast, the factor of social support helped improve the quality of life and had a positive effect on self-management in Danish-Americans (Rasmussen et al., 2016). Poor health behaviors and depression in Pacific-Islanders and Asian Americans were associated with higher BMI, glycemic control, and QoL (Li et al., 2013). Furthermore, misconceptions and low self-efficacy affected self-care behaviors in the Philippines (Ku & Kegels, 2014). Ethnic groups or people living in low economic areas are at greater diabetic and mental illness risk. These populations will feel the extra burden of self-management from society and the surrounding environment (de Groot et al., 2016). Psychosocial situations such as socioeconomics, living conditions, health care systems, family adjustments, and partner's support affect behavior and can lead to adherence issues (Pereira et al., 2014).

Psychosocial Factors and Blood Sugar Levels

Psychosocial factors have a major physiological and psychological impact on type 2 diabetics. Distress, stress, depression, and social support was found to affect type 2 individuals' blood sugar levels. Lifestyle changes including the daily stress of finger

pricking will influence blood sugar levels (Morris et al., 2011). Psychosocial factors of coping style, social support, and self-care activities can modulate blood sugar levels (Shayeghian et al., 2015). NiniShuhaida et al. (2019) found an association with unemployment, poor social support, and disease interference with daily activities to poor glycemic control. In addition, challenging environments and social status may also affect blood sugar levels (Hirsch et al., 2018). Environmental surroundings including communities dealing with socioeconomics deprivation (community poverty, unemployment rate, and population density) have higher psychosocial stress levels, which results in higher HgbA1c levels (Hirsch et al., 2018). Some of the stress factors that affect blood sugar levels are loss of job, divorce, death of a loved one, daily deadlines, traffic, family, and having to manage an illness (Morris et al., 2011).

Cuschieri and Grech, (2019) studied a group of individuals at high-risk for poor blood sugar levels in correlation to socio-demographics, lifestyle, family history of diabetes, as well as body mass index, and blood pressure. Additionally, their goal was to see if there is a link between diabetes awareness and diagnosis. Their findings showed that although full awareness was present, most participants were obese, had high blood pressure, and were diagnosed with type 2 diabetes.

On the flip side, patients who had adequate control of their blood sugar levels had high self-efficacy (belief in the ability to manage situations) and rated higher with psychosocial factors of income, education, employment, and marital status (Elissen et al., 2017). High self-efficacy also showed positive effects on social support, outcome

expectancies, perceived interference, educational level, self-care, and blood sugar levels (Cosansu & Erdogan, 2014).

Stress

Stress is responsible for 80% of the development of any disease (Embong et al., 2015). Diabetes-related stress happens when a person's perception of diabetic demands exceeds their perception of resources to cope (Morris et al., 2011). The inability to cope with these demands negatively effects blood sugar control (Morris et al., 2011; Rook et al., 2016). In addition, not coping well invokes poor behavioral habits such as not checking blood sugar levels regularly, not taking medication as prescribed, drinking alcohol, not eating healthy, and not exercising (Hales et al., 2020). The longer the impact of stress and inflammation continues, the more complications possible, and the higher the cost as reviewed in the PSR by Kelly and Ismail, (2015). Zaidi et al. (2017) found stress is adversely linked to age and clearly linked to gender in type 2 diabetics. Women and early adults showed more stress than males.

Stress is recognized as an interruption of homeostasis (de Permentier, 2016). Homeostasis is defined as internal functioning or processes that remains within range and not intended for adaptation (Tiedt & Brown, 2014). Adaptation is overseen by the sympathetic nervous system mechanism called allostasis. Allostasis allows for internal changes within a set range such as blood pressure, blood sugar levels, visual alertness, and hormone regulation. Allostatic load refers to the overload of the stress response where the body is kept in an alert state and is referred to as chronic stress (Tiedt & Brown, 2014). Allostatic load reflected in type 2 diabetes as insulin resistance does not

let the body return to normal levels. Furthermore, fatty acids from adipose cells travel to the liver and stop the breakdown of insulin (Tiedt & Brown, 2014).

The cognitive activation theory of stress in type 2 diabetes explains how stress can change physiology. Long-lasting activation of the HPA from psychological stress leads to dysregulation of cortisol production and the malfunction of neuroendocrine processes leading to type 2 diabetes (Hackett & Steptoe, 2017; Wallace, 2016). Endocrine imbalances from chronic stress increases belly fat (Lloyd et al., 2006) and biomarkers are detected in overweight individuals (Sagui & Levens, 2016). Stress will imprint itself in the HPA axis and in visceral fat. Wallace mentioned that psychosocial and workplace stress have the same effect. Stress facilitates calorie intake and being overweight creates low-grade inflammation (Ottino-Gonzalez et al., 2017). The triple condition of stress, overweight, and inflammation formulates ill health conditions such as disease and mental illness. Allostatic load promotes change in the gray matter in the brain for behavior, reward processing, and cognition (Ottino-Gonzalez et al., 2017). The condition of stress/overweight/inflammation gets worse from stressful psychosocial factors.

Stressful events may be the precursor for developing diabetes in those already predisposed (Lloyd et al., 2006). For instance, early-life stressors from low socioeconomic environments or childhood maltreatment produce an inflammatory response (allostatic load) carried into adulthood that can lead to type 2 diabetes or other diseases (Fagundes & Way, 2014). Furthermore, workplace stress and death of a loved one have been known to onset diabetes. Stressful events and anxiety, depression, and

sleep disruption were linked to higher blood sugar levels in pregnant women creating gestational diabetes (Glover et al., 2016).

Stress from a diabetes diagnosis may create emotional problems in some and crisis reactions in others (Rane & Gafvels, 2017). Multiple stressors of having type 2 diabetes includes managing blood sugar levels with daily finger pricks, dietary changes, and increasing physical activities. Another stress factor is oral medication or, if necessary, insulin injections (Morris et al., 2011). Chronic stress will increase stress eating and sleep problems that have been found to mediate the connection between obesity and depression (Yu et al., 2016).

Uncontrollable and unpredictable stress factors present feelings of "helplessness, behavioral changes, and slow cortical potential" (Havranek et al., 2016, p. 54) and relates to the cognitive activation theory of stress and hopelessness. Havranek et al. (2016) found that uncontrollable stress factors lead to depression and unpredictable stress factors lead to anxiety.

Workplace stress places an allostatic load on workers and increases their risk of type 2 diabetes. In a 12-year follow-up on stress in the workplace, factors included "increased role overload, increased role insufficiency, increased physical environmental stressors, decreased self-care, and decreased rational coping" (Lian et al., 2018, p. 457). The risk factors for developing type 2 diabetes were increased task stressors and decreased coping resources.

Perceived Stress

The fear or perceived stress in type 2 diabetes of future comorbidities and developing poor physical conditions may add more stress (Morris et al., 2011) and produce imbalances in homeostasis. Perceiving that a situation is stressful can be evaluated through a biopsychosocial viewpoint because the perception of stress itself can influence emotional, behavioral, and psychological stress reactions (Baumgartner et al., 2018). In addition, overweight or obese individuals having higher perceived stress and lower coping ability had a higher incidence of type 2 diabetes (Sagui & Levens, 2016). Novak et al. (2013) completed a self-perceived stress study with a 35-year follow-up that showed 42.6% of individuals in a permanent stress baseline group developed type 2 diabetes. Perceived stress was a predictor of poorer Diabetic Specific QOL (Glover et al., 2016). Perceived stress is also linked to inflammation and is associated with pain and fatigue (Hirsch & Sirois, 2016).

Inflammation and Stress

Stress is the underlining mechanism throughout all factors of type 2 diabetes stated in the literature that activates inflammation. Stress creates inflammation that initiates disease explained in the cognitive action of stress theory (Ursin and Eriksen, 2004). It is known that chronic stressors make inflammatory markers (Kelly & Ismail, 2015; Wallace, 2016), which explains why psychological stress affect diabetics (Rasmussen et al., 2016). In addition, blood sugar levels are affected by community stress factors such as socioeconomic deprivation, food availability, and fitness accessibility affect (Hirsch et al., 2018). Furthermore, stressful psychosocial factors from

socioeconomic position, smoking, drinking, BMI, physical inactivity, marital status, education, social relationships, and employment status play significant roles in this illness (Agardh et al., 2018; Li et al., 2013). Any one of these influences can over activate the HPA and will increase inflammation (Kelly & Ismail, 2015).

Diabetes distress is another form of cognitive stress that can create inflammation (Carpenter et al., 2017). A relationship between inflammatory biomarkers and depression with newly diagnosed type 2 diabetics was found (Herder et al., 2017). Diabetes and depression show HPA dysfunction and inflammatory markers such as C-reactive protein, TNF-α, and cytokines (Holt et al., 2014). Furthermore, depression and sleep disturbances are linked to inflammation that can lead to cardiovascular disease and cancer (Irwin, 2015).

Stress and inflammation are linked to depression, obesity, and sleep problems (Yu et al., 2016). Again, the hypothalamic system is the central key to sleep and stress by regulating hormones and neurotransmitters for both functions (Han et al., 2012). Lack of sleep produces pro-inflammatory markers (AlDabal & BaHammam, 2011). Inflammation is considered a causation for accelerated aging, illness, and death (Abbas et al., 2017).

Mugabo et al. (2010) calls type 2 diabetes “an inflammatory atherothrombotic condition” (p. 27). C-reactive protein is an inflammatory biomarker seen in diabetic patients and predicts the possibility of cardiovascular events (Mugabo et al., 2010). Stress will imprint itself in the HPA axis and in visceral fat, as discussed in CATS (Wallace, 2016), which explains how stress can increase weight and low-grade inflammation

(Ottino-Gonzalez et al., 2017). Sharma and Singh (2020) advocated targeting the psychological stress response to restore glucose balance.

Quality of Life and Psychosocial Factors

Quality of life is seen as an outcome and varies depending on how a person perceives coping strategies (Kristofferzon et al., 2018). There is a process of adjustment that people go through with a chronic condition leading to good or poor QoL (Hammond & Hirst-Winthrop, 2018). Some of the components that determine the of quality of life are age, length of disease, number of symptoms, number of comorbid illnesses, blood glucose levels, and the number of non-pharmacological measures (Patel et al., 2014). Antonovsky's sense of coherence can predict coping and QoL as, "A higher sense of coherence was related to a higher QoL" (Kristofferzon et al., 2018, p. 1856). In other words, those that have a sense of comprehensive, manageability, and meaningfulness of the illness have a better life outcome.

There are several definitions of QoL found in the literature. Ventegodt et al. (2003) stated for any physical ailment that creates stress in the body, the QoL for those individuals change. QoL is defined as a "concept consisting of a number of social, environmental, psychological and physical values" (Theofilou, 2013, p. 150). QoL can be defined by its four parts: physical, mental/cognitive, psychological, and social (Trikkalinou et al., 2017) as pictured in the BPS model. Theofilou (2013) defined QoL as a measurement that describes life's quality in terms of satisfaction from an individuals' perception and those of others. Another definition of the QoL is described as an "entire range of human experience, states, perceptions, and spheres of thought concerning the

life of an individual" (Megari, 2013, p. 141). Any one of these definitions can describe why stress affects the person's QoL and the many contributing factors that are being studied.

A chronic disease, such as diabetes, affects the individual's QoL through a variety of psychosocial factors. When a person has a chronic disease, they view their QoL differently (Timar et al., 2016). The psychosocial factors that modify the QoL were age, sex, occupation, marital status, years with type 2 diabetes, comorbidities, and depression (Zurita-Cruz et al., 2018). Other psychosocial factors affecting QoL were poor social support, comorbid depression, and perceived stress (Glover et al., 2016).

Diabetes Distress

Diabetes distress (DD) is defined as a group of worries, concerns, and fears that are explicit to diabetes and its management (Burns et al., 2016: Tanenbaum et al., 2016). Another definition described DD as elevated levels of cognitive stress from living with diabetes (Carpenter et al., 2017). These definitions relate to the cognitive activation of stress theory and DD adds psychological pressure that produce sleeplessness, depression, and anxiety. Distress is a reaction to a chronic stressor and is a part of the whole disease (Fisher et al., 2014; Morris et al., 2011).

The problems linked to DD are self-care, social support, disease burden, and medical care (Chew et al., 2016). Distress is associated with high blood sugar levels, poor self-care, low self-efficacy, and poor QoL (Fisher et., 2014; Gonzalez et al., 2015). Patients with high blood sugar levels tend to measure higher on DD scales and have more

medical complications. These individuals used more insulin and have more problems with normal activities, anxiety, and physical functioning (Elissen et al., 2017).

Hood et al. (2018) listed four distinct kinds of distress: emotional burden, regimen distress, interpersonal distress, and physician distress. Hood et al. (2018) found moderate levels of regimen distress and emotional burden being the most damaging. Emotional distress is defined as a response to the patients' perception of health threats versus coping resources (Fisher et al., 2014). Emotional distress, just by itself, can create elevation in blood sugar levels (Rook et al., 2016). A person's sense of control mediates the connection between regimen distress and blood sugar levels (Martinez et al., 2018).

DD can be addressed by improving self-management, self-efficacy, resilience, social support, and empowerment (Wang et al., 2016). A decrease in distress was seen by increasing resilience and self-efficacy (Wang et al., 2016), and by improving coping skills and social support (Karlsen et al., 2011). Wang et al. (2016) found self-empowerment and self-management are both needed to significantly decrease DD. Perceived social support was found to have a lowering effect on DD levels (Karlsen & Bru, 2014). Furthermore, perceived control or ability to manage type 2 diabetes influences the course of the disease and the distress it causes (Gonzalez et al., 2015). A sense of coherence, as discussed in the theoretical foundation, helps to cope with stress by promoting health and will affect health status (Galletta et al., 2019).

Carpenter et al. (2017) completed a study on diabetes related distress that showed participants viewed diabetes as a challenge but still appraised it as a threat or harm. Appraisal is defined by how a person constantly evaluates what happens in accordance

with their well-being (Carpenter et al., 2017) and was explained in the stress and coping theory (Lazarus & Folkman, 1984). A relationship has been found between diabetes-related stress and depression symptoms (Carpenter et al., 2017; Chew et al., 2016; Shah et al., 2012).

Depression

Depression is often overlooked in diabetes and has been found to be 10%–15% higher in people with diabetes (Holt et al., 2014) and depression may influence the development of type 2 diabetes (Penckofer et al., 2014). Helping those individuals with both conditions remains difficult as anti-depressants can affect blood sugar control (Holt et al., 2014). Furthermore, depressed individuals have a 32% higher risk of developing type 2 diabetes (Yu et al., 2015). Type 2 diabetes research showed symptoms of depression are seen more in females, overweight patients, and patients with a long duration of the illness who are taking a combination of medicines (Guruprasad et al., 2012). Type 2 diabetes is called a social disease and the heavy load to cope with the stress may result in depression and anxiety to those already predisposed (Sobol-Pacyniak et al., 2014). Herder et al. (2017) observed a relationship between inflammatory biomarkers and depression with newly diagnosed type 2 diabetics. According to the CATS, a stress response will result in poor coping outcomes leading to hopelessness and helplessness.

There is a strong psychosocial association between depression and diabetes that can lead to a negative effect on adherence to medications, dietary measures, QoL, and rate of mortality (Bogner et al., 2012). People who are depressed have the same lifestyle

factors as those with diabetes such as poor diet and not exercising (Holt et al., 2014). In addition, diabetes and depression are more commonly found together and share the same the same biological and psychosocial pathways (Holt et al., 2014). Depressive symptoms were also linked to poor self-management that leads to higher blood sugar levels (Schmitt et al., 2017). Furthermore, depression was more profound in the female population with poor coping strategies that affected self-care (Parildar et al., 2015).

The relationship between depression, distress, and anxiety has been researched with uncontrollable and unpredictable stress (Havranek et al., 2016). Unpredictable stress, with or without threat, created physiological stimulation and more attentional awareness. Uncontrollable stress exhibited similar physiology resulting in feelings of helplessness (Havranek et al., 2016), as explained in CATS (Ursin & Eriksen, 2004) and the PSR (Kelly & Ismail, 2015).

Diabetes and depression may follow the same brain function pathways (Holt et al., 2014). Diabetes has a negative effect on the hippocampus and contributes to mood variations as MRIs have shown atrophy in this area (Holt et al., 2014). Both diabetes and depression show HPA axis dysfunction and inflammation (Holt et al., 2014). Holt et al. reported an increase of inflammatory markers, such as C-reactive protein, TNF-α, and cytokines, are noticed in diabetes and depression. Certain factors like childhood trauma, poor environment, poverty, poor physical wellness, poor diet, and poor social support can predispose a person to diabetes and depression (Holt et al., 2014). Furthermore, Herder et al. (2017) found inflammation and endothelial activity was linked to depressive symptoms.

Depressive symptoms are significantly increased due to biopsychosocial risk factors such as occupation, marital status, poor social support, diabetes complications, and negative life events in the past 6 months (Habtewold et al., 2016). Additionally, comorbid depression in type 2 individuals puts them at risk for macrovascular and microvascular complications and death (Hackett & Steptoe, 2017). Forty-five percent of individuals with comorbid mental illness and severe psychological distress are barely diagnosed nor treated (Habtewold et al., 2016). Psychosocial interventions can help with depression in type 2 individuals and should also be used in diabetes education for self-care (Xie & Deng, 2017).

Sleep and Stress

Sleep is needed for the body to restore and replenish vital energy (Reutrakul & Van Cauter, 2018). Lack of sleep puts the body under stress, decreases immune activity, and produces pro-inflammatory markers (AlDabal & BaHammam, 2011). Irwin (2015) from the Cousins' Center for Psychoneuroimmunology studied sleep disturbances. Sleep problems can initiate the innate and adaptive immune system, including cytokines regulation, risk of infections, and increased inflammation. Sleep disturbances and inflammation increase the risk of cardiovascular disease, risk of cancer, and depression (Irwin, 2015).

The National Sleep Foundation (2019) noted that too little sleep can increase the risk for developing type 2 diabetes. Disturbed sleep is associated with higher HbA1c levels (Lee, Ng, et al., 2017). Type 2 diabetics that had sleep trouble, sleep disruptions, and daytime function problems were at risk for poor blood sugar control (Zhu et al.,

2014). The HPA releases more glucocorticoid that will promote increase in glucose production while decreasing intake (Zhu et al., 2014) and is supported by the CATS theory by Ursin and Eriksen (2004). Furthermore, poor sleep also contributes to poor daytime and nighttime eating behaviors (Tan et al., 2018). Fatigue, disturbed sleep, and diabetes distress have been linked to emotional eating in type 2 diabetics (Zhu et al., 2019).

The amount of sleep under six hours or over nine hours per night are risk factors for both obesity and type 2 diabetes (Tan et al., 2018). In fact, obesity increases 31% in individuals with too little sleep and 38% in individuals with too much sleep. Plus, for every hour under six hours of sleep per night, the risk of type 2 diabetes increases by 9% and for every hour over nine hours per night, type 2 diabetes risk increases by 14% (Shan et al., 2015; Tan et al., 2018). Longer sleeping hours predicted type 2 diabetes incidents along with higher inflammation, poorer lipid profile, and reduced adiponectin levels (Maskarinec et al., 2018).

Disrupted sleep, as seen in obesity and type 2 diabetes, have many physiological consequences. The National Foundation of Sleep (2019) stated that with continued sleep loss, less insulin is released after eating and there is an increase of stress hormone cortisol that increases wakefulness. Disrupted sleep will cause an impairment of insulin mediated glucose disposal from the blood (Tan et al., 2018). Lack of sleep over time, as seen in insomnia, leads to an increased risk of type 2 diabetes (Green et al., 2017) and cardiovascular occurrences (AlDabal & BaHammam, 2011). Additionally, arterial wall thickening markers were seen in type 2 diabetics who had poor blood sugar control and

decreased REM sleep (Yoda et al., 2015). Type 2 diabetics with comorbid heart failure have a greater sleep deficit, greater symptom burden, and poorer QoL (Fritschi & Redeker, 2015). Sleep deprivation also leads to an increase of cortisol and ghrelin along with decreases in leptin and glucose metabolism (AlDabal & BaHammam, 2011; Lee, Ng, et al., 2017; Reutrakul & Van Cauter, 2018).

Stress affects the quality of sleep that will also affect well-being. Stress is linked to depression, obesity, and sleep problems, especially in low-income populations (Yu et al., 2016). The hypothalamic system is the central key to sleep and stress by regulating hormones and neurotransmitters for both functions (Han et al., 2012). Sleep is responsible for emotional regulation and can lead to mood disorders if inadequate sleep is persistent over time (Weinberg et al., 2016). Lack of sleep is linked to depression and obesity in type 2 diabetics (Lee, Chang, et al., 2017; Reutrakul & Van Cauter, 2018; Yu et al., 2016) and has "been shown to increase insulin resistance" (Holt et al., 2014, p. 495). Inadequate quality sleep, diabetic complications, depression, and anxiety symptoms, all contribute to poor diabetic-specific QoL (Lou et al., 2015).

Obesity & Stress

Obesity is considered a major contributor in the development of type 2 diabetes (Zurita-Cruz et al., 2018). Obesity and type 2 diabetes have a lot in common. They are both metabolic disorders and are related to stress and socioeconomical position (Razzoli & Bartolomucci, 2016). Obesity risk factors are the same as type 2 diabetes which includes heart disease and strokes. In addition, perceived psychosocial stress, as seen in type 2 diabetes, aids the mental processing of unhealthy eating and inactivity seen in

overweight individuals (Mathieu et al., 2018; Razzoli & Bartolomucci, 2016). Psychosocial stress can produce changes in behaviors in the workplace, relationships, life situations, and finances (Razzoli & Bartolomucci, 2016). Obese individuals may have less skills to cope with change and weight loss and this may increase the risk for anxiety (Sardeli et al., 2017). Furthermore, psychosocial factors are responsible for sleep problems, which are connected to depression and obesity, especially in underprivileged communities (Yu et al., 2016). Obesity, inactivity, and poverty are seen together. Unfortunately, the countries with the greatest poverty have the highest diabetes rates (Levine, 2011). Low SOC in the meaningful scale was seen in obese women that displayed lower values than normal weight women (Sardeli et al., 2017).

Obesity and inflammation were linked some years ago by the inflammatory cytokine TNF-α in obese rats, which contributes to insulin resistance (Wellen & Hotamisligil, 2005). Fat cells, or adipocytes, are considered an endocrine organ that releases hormones. As an individual gains weight, these cells enlarge, and dysfunction ensues. Macrophages gather inside and inflammation results (Greensburg & Obin, 2006). Stress response and inflammatory cells are most abundant in adipocytes in obese animals (Wellen & Hotamisligil, 2005). Adipocytes, like inflammatory cytokines, can regulate the immune response (Wellen & Hotamisligil, 2005). Obesity and inflammation lead to accelerated aging and is seen in the telomeres (Abbas et al., 2017).

Coping Ability

Coping is the thoughts and behaviors used to manage the emotional and logistical demands of situations that are judged as stressful (Burns et al., 2016). Perchtold et al.

(2018) stated that it is the judgment of the situation and not the situation itself that is first in the emotional stress response. Ursin (2014) defined coping as an expectancy for a response outcome. If the individual feels that he/she cannot change the outcome, then helplessness is felt, as in a diabetes diagnosis. According to CATS, if the diabetic person continues to get negative results in efforts to cope with the illness, then hopelessness is felt. Ursin (2014) further explained that attention and thoughts related to fears promote the activation of the cognitive stress network.

The diagnosis of diabetes is a life changing event and psychosocial factors such as anxiety, depression, stress, and diabetes distress will affect coping styles (McCoy & Theeke, 2019). Trying to cope with a chronic disease can lead to unhealthy behaviors, such as smoking, drinking alcohol, drug use, overeating, or eating comfort food, to mask the feelings from stress and anxiety (Park et al., 2018). Diabetes is a self-managed disease and patients are required to manage 99% of their own care (Ishak et al., 2017). This heavy burden of self-care may create fear or perceived stress and diabetes distress (Morris et al., 2011). Therefore, the largest part of coping depends upon the ability to believe (self-efficacy) in managing the perceived stress (Perchtold et al., 2018). It has been shown that the absence of social support and self-efficacy is associated with learned helplessness in patients after acute myocardial infarction and seen in other diseases (Smallbeer & Dietrich, 2019).

Coping with type 2 diabetes is difficult due to lifestyle changes, the stress of complications, and daily life stressors (Morris et al., 2011). Coping strategies are most important to offset stress and improve blood sugar levels (Morris et al., 2011). A coping

strategy should include acceptance, motivation, empowerment, and the building of resources. In addition, social and psychological aspects should be considered when developing a strategy to cope with life-long diabetes (Sobol-Pacyniak et al., 2014). Without good coping strategies, there is a risk of mental health conditions such as depression, anxiety, distress, poorer QoL, and decrease in physical functions (Burns et al., 2016).

Lazarus and Folkman (1984) found problem-focused coping had the best outcomes as compared to emotional-focused coping (McCoy & Theeke, 2019). Problem-focused coping is linked to improved well-being, psychological health, and improved physical health results (McCoy & Theeke, 2019). This can be seen as a sense of coherence acquired in foot reflexology. Negative coping styles are linked to protest, or isolation resulting in poorer QoL, and avoidance coping styles increased depression symptoms and diabetes distress (McCoy & Theeke, 2019). A means of good coping is to have social support in place to help with distress and stress (McCoy & Theeke, 2019; Rook et al., 2016).

Social Support

Social support is beneficial in coping with problems, adherence to regime, and buffering against future problems (Stopford et al., 2013). Social support can help with decreasing distress (Rook et al., 2016), reducing stress (Zamani-Alavijeh et al., 2018) and improving QoL (Rasmussen et al., 2016; Shayeghian et al., 2015). Positive social support has a positive impact on blood sugar levels (Rook et al., 2016), but negative beliefs toward family situations affected diabetic self-care (Pereira et al., 2014). Furthermore,

Baek et al. (2014) found that for diabetics, the burden of taking insulin was associated with low social support. Social support can help lower emotional distress and blood sugar levels, improving health and function in older adults (McCoy & Theeke, 2019). However, those diabetics who had low spousal support and high emotional distress had higher blood sugar levels (Rook et al., 2016).

Positive or good social support has a buffering effect on self-care and blood sugar levels (Shayeghian et al., 2015). The diabetic will have a smooth psychological transition with lifestyle changes and medication adherence with a positive family or partner support (Baek et al., 2014; Pereira et al., 2014). In addition, positive support plays an important part in the self-management of diabetes (Rasmussen et al., 2016; Rook et al., 2016; Zamani-Alavijeh et al., 2018). Stopford et al. (2013) found diabetic females tend to receive support through friends and family, whereas diabetic males tend to receive support through their spouse.

Organizational support in the workplace acts as a buffer against type 2 diabetes. Workplace stress from long hours and additional demands predicted a risk for health problems including type 2 diabetes and weight gain (Wolff et al., 2018). The risk of type 2 diabetes in the workplace is associated with “low coping resources, increased workload, increase physical environment stressors, decreased self-care, and decreased rational coping” (Lian et al., 2018, p. 453). Workers who had perceived organizational support, not coworkers’ support, had lower risk scores for diabetes (Wolff et al., 2018).

Social support through bonding has shown a reduction in hormones from stress (Wittig et al., 2016) as seen in the use of foot reflexology (Zhen et al., 2003).

Chimpanzees that interacted or were close to their bond partner have lower urinary glucocorticoids after a stressful event (Wittig et al., 2016). This means that the hypothalamus-pituitary-adrenocortical axis (HPA) can be mediated by daily supportive bonding (Wittig et al., 2016).

Nonadherence Factors

Type 2 diabetes is a self-managing condition with healthcare offering education, treatment, and support (Ishak et al., 2017). Good self-care behaviors are the most important undertaking for a diabetic. An individual's outcome expectation or attitude is equal to self-care behaviors (Cosansu & Erdogan, 2014; Lou et al., 2014). Self-care behavior is a result from the individual's perceived self-efficacy with internal and external pressures (Ku & Kegels, 2014). Adherence to self-care is a severe problem for diabetic patients. Risk factors and interventions need to be found for nonadherence to a treatment regime which contributes to the global health problem (Howren & Gonzalez, 2016). Nonadherence to medication was related to forgetfulness, lack of finances, and disappearances of symptoms. Other factors related to nonadherence were age, educational level, duration of diabetes, alcohol consumption, and insulin therapy (Aminde et al., 2019). Another crucial factor in nonadherence is the individual's belief in the use of medication (Pereira et al., 2014). Situations or conditions that can compromise adherence are marital status, family support, family's coping styles, stress, and conflicts (Pereira et al., 2014).

Lifestyle change becomes more difficult when compounded with daily stressors (Rook et al., 2016). Hales et al. (2020) pointed to stress as a major factor in

nonadherence, such as not eating proper food, drinking alcohol, and not exercising. In fact, stress can lead to comorbidity conditions and future complications (Pereira et al., 2014).

Optimal management of a chronic condition entails effective adaptation or good psychosocial modification including physical and emotional functioning that need to be developed (Hammond & Hirst-Winthrop, 2018). The biopsychosocial view of "managing type 2 diabetes consists of psychosocial, relational, and structural factors" (Rodriguez et al., 2019, p. 857) that are interrelated. Positive health behaviors, such as receiving foot reflexology, need to be considered in managing type 2 diabetes. Positive health behaviors can directly affect BMI, blood sugar control, and QoL (Li et al., 2013). Rodriguez et al. (2019) found those with social support from friends and family relations are likely to improve their self-care behavior or skills. Furthermore, a person's psychosocial attitude about their illness affects their health care behavior as well (Lou et al., 2014).

Foot Reflexology

Foot reflexology is a touch modality that is well known as a complementary and alternative medicine (CAM) in the health psychology field. Thirty-eight percent of adults in the United States use CAM therapies (Attias et al., 2018). Inpatients at several of medical centers reported using CAM with a 57% positive response to the therapy. Some cancer clinics may have an integrated health department that offers foot reflexology, such as St. Luke's Medical Center (Hart, 2015).

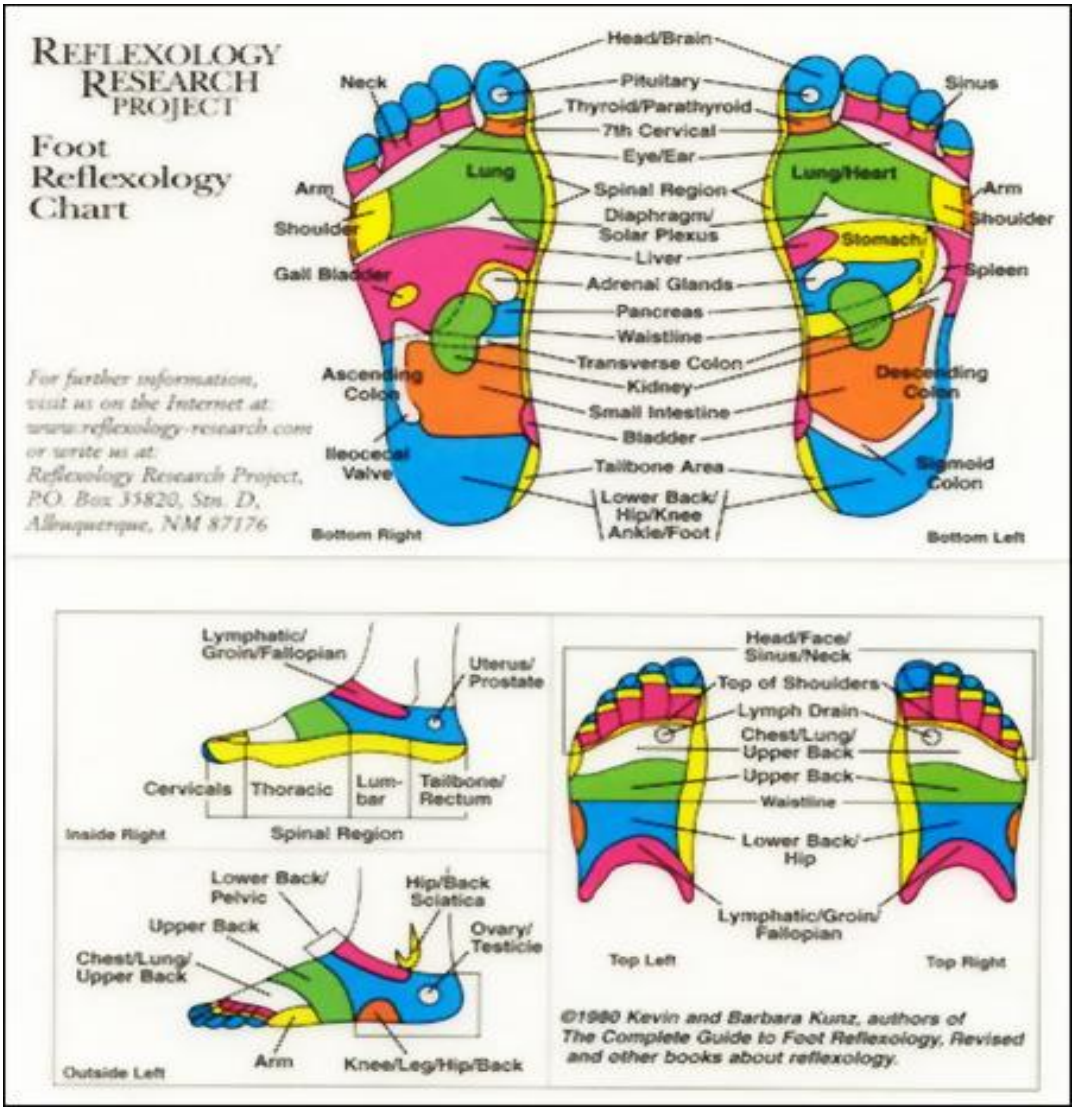
There are several theories that explore why foot reflexology improves conditions. Embong et al. (2015) explained a few energy theories. Energy theories support that the

body communicates with electromagnetic lines that run from head to toe, extending down a person's arms to their fingertips. Energy lines may get blocked, and pressure imposed on a reflex point will reopen the communication. Another energy theory states that reflex pressure can break up lactic acid crystals that build up in feet that can interrupt energy flow, thus bringing the organs and body back into balance (Embong et al., 2015). The hemodynamic theory states that reflex point stimulation on the hands, feet, or ears, improves blood flow to the matching organ or body part (McCullough et al., 2014). Moreover, nerve impulse theory proposes that stimulation of the reflex point will boost nerve communication to that body part. See Figure 3 for a free download of a foot reflexology chart mapping the points corresponding to an organ from the Reflexology Research Project (n.d.).

The autonomic nervous system (ANS) function is unconscious regulation of breathing, heart rate, blood sugar, and blood pressure, which are sensitive to stressors causing fluctuations. This fluctuation is under vagal watch to modulate sympathetic changes, to calm, and to control the stress response of flight or fight. Foot reflexology's hands-on technique disrupts the stress cycle and helps to release natural pain-relieving chemicals called endorphins which increase well-being (Embong et al., 2015). The main purpose of a foot reflexology treatment is to stabilize the body's systems by relieving tension and reducing stress. Foot reflexology modulates the ANS by stimulating the reflex points that will improve nerve conductivity and blood supply throughout the body (Hughes et al., 2011).

Figure 3

Reflexology Chart



Foot Note. Foot reflexology is applied by digital pressure on bottom of the foot, also hands or ears, to help re-establish balance in all organs and is often used alongside stress management (Dalal et al., 2014).

The physiological and biochemical effects of foot reflexology treatments have been studied. In a meta-analysis system review of foot reflexology outcomes, McCullough et al. (2014) found significant impacts on blood pressure, heart rate, cardiac index, and salivary amylase. The biochemical results of foot reflexology decreased cortisol significantly, but melatonin or progesterone showed no significance. One study showed an increase in CD25+ cells for cancer cell death (McCullough et al., 2014). In another meta-analysis, foot reflexology was found to have relieved somatic and psychological symptoms in premenstrual syndrome with longer treatments demonstrating better results (Hasanpour et al., 2019). Foot reflexology reduced pain level, respiratory rate, heart rate, and blood pressure in post-operative patients after appendectomy (Khorsand et al., 2015). In contrast, Silva et al. (2018) did not find any changes in evaluating foot reflexology on capillary blood glucose, tissue temperature, and plantar pressure in 45 type 2 diabetics assessed. However, foot reflexology was able to reduce HbA1c levels and increase ankle brachial index with older type 2 diabetics (Yodsirajinda et al., 2016).

Medical technology is being used to verify the reflexology points that can aid in foot reflexology treatment and validate specific points. Dalal et al. (2013) found evidence for applying pressure to appropriate reflexology point by using a swept-source-optical coherence tomography to locate the lumbar vertebra of patients with pain. Discoloration and tenderness to touch in the reflexology area (RA) on the foot for lumbar vertebrae was noticed. Surface skin color and texture have a correlation to structure and function of internal body anatomy. In addition, another study using functional magnetic resonance

imaging showed pressure applied to the eye reflex point on the foot did stimulate the middle postcentral gyrus and the point stimulation was lateral to the body (Miura et al., 2013). Furthermore, an electroencephalogram was used to measure brain waves in reflexology and showed an increase in beta and gamma waves (Unal et al., 2018). Yodsirajinda et al. (2016) used an ARRAY high performance liquid chromatography and doppler ultrasound to evaluate foot reflexology and ankle brachial index.

Foot reflexology may empower the individual with a sense of coherence that will reduce nonadherence to medical advice, develop self-efficacy, and add support. A sense of coherence includes comprehensibility or "understanding health and ill health," manageability or take "measures to maintain or increase health," and meaningfulness is "finding meaning in the experience" (Kalra et al., 2018, p. 169). Riopel (2019), described SOC as an individual's positive cognition and understanding of the situation, having resources available to solve the problem, and knowing that life has emotional meaning.

Stress

"Stress contributes up to 80% for the development of any illness and 20% of stress contribute to other conditions" (Embong et al., 2015, p. 198). Predisposition of anxiety and depression in type 2 patients determined the strategy in coping with stress (Sobol-Pacyniak et al., 2014). Foot reflexology as a coping mechanism can interrupt the stress response, bring about homeostasis, and offer stress reduction, safety, and effectiveness (Embong et al., 2015). Foot reflexology can improve depression and QoL (Elissen et al., 2017; Rane & Gafvels, 2017). For example, anxiety, stress, and depression were decreased in a comparison study with reflexology and relaxation, both creating

results for patients with multiple sclerosis (Soheili et al., 2017). Stress and neuropathy pain were significantly decreased after a foot reflexology intervention for chemotherapy patients (Khazaei et al., 2018). Heart rate, respiration, blood pressure, stress, pain, and anxiety from mechanical ventilation weaning time was addressed with foot reflexology and was found to be significantly effective (Ebadi et al., 2015). Low back and pelvic pain and pregnancy related stress were reduced with foot reflexology treatments (McCullough et al., 2018).

Foot reflexology may be an effective and simplistic approach to reduce psychological stress that creates inflammation as explained in CATS (Ursin & Eriksen, 2004). Madhu et al. (2019) found this to be true in a study on 500 newly detected type 2 diabetics before diagnosis. This study found "chronic stress and a low sense of coherence were associated with a higher risk of type 2 diabetes" (Madhu et al., 2019, p. 18).

Social Support

Social support is important to the physical, mental, and emotional aspects of wellness and is integrated in a foot reflexology treatment. First, on the physical aspect of treatment with foot reflexology is human touch. Touching the feet aids the connection to the autonomic nervous system by stimulation and releasing blocks (Zhen et al., 2003), as seen in reduction of blood pressure and heart rate (Ebadi et al., 2015; Hughes et al., 2011; Korhan et al., 2014; McCullough et al., 2014). In addition to lowering blood pressure and heart rate, foot reflexology increases vagal tone and decreases sympathetic tone (Lu et al., 2011). Secondly, on the mental aspect, touching in foot reflexology is a psychological comfort and support (Zhen et al., 2003) as seen with patients receiving diagnostic

procedures that produce anxiety and physiological distress (Abbaszadeh et al., 2018; Shahsavari et al., 2017). Lastly, on the emotional side, foot reflexology helps to reduce pain and promote relaxation (Zhen et al., 2003), reducing pain and stress in cancer patients (Khazaei et al., 2018; Unlu et al., 2018) and reducing pain and enhancing sleep in rheumatoid arthritis patients (Bakir et al., 2018). Additionally, the biopsychosocial factors addressed in foot reflexology have been studied in palliative care to improve emotional, physiological, and spiritual health (Embong et al., 2015). Foot reflexology was able to relieve physical and psychological symptoms in premenstrual syndrome (Hasanpour et al., 2019).

Social support has been shown to improve emotional distress as seen in type 2 diabetics (McCoy & Theeke, 2019). Foot reflexology requires the hands of the therapist touching the individual's feet. Human touch creates physiological and psychological changes and is a supportive gesture that promotes safety and relaxation (Maratos et al., 2017). Social support through touch develops a sense of coherence in the receiver for comprehending, managing, and giving meaning to type 2 diabetes.

Quality of Life

Quality of life is a summation of interaction of psychosocial factors as seen in the biopsychosocial model. Dalal et al. (2014) studied foot reflexology and diabetic neuropathy patients taking normal medication. The variables measured were pain (visual analogue scale), glycosylated hemoglobin (greater than 6.5), nerve conductivity, thermal and vibrational sensitivities, and QoL. Abnormal tissue was observed, and tomography images recorded. Improvements were seen in all variables including QoL (Dalal et al.,

2014). Another study on foot reflexology was found to decrease menopausal symptoms of hot flashes and night sweats, along with improving QoL in physical, psychosocial, and sexual arenas (Gozuyesil & Baser, 2016).

Sleep

Sleep and stress were researched with type 2 diabetes. Foot reflexology studies have examined sleep and fatigue in relation to different medical conditions. Foot reflexology, when compared to back massage, was more significant at reducing fatigue and improving quality of sleep with hemodialysis patients (Unal & Akpinar, 2016). Foot reflexology was successful at reducing pain and fatigue and improving sleep quality in lymphoma patients (Rambod et al., 2019) and improved shortness of breath and fatigue in patients with chronic obstructive pulmonary disease (COPD; Polat & Erguney, 2016). Reduced pain and improved quality of sleep was seen by using foot reflexology with rheumatoid arthritis patients (Bakir et al., 2018).

Participants receiving a foot reflexology session tend to fall asleep or go into a deep relaxation state. Such behaviors have been investigated to show four different reactions: eye movement, spontaneous muscle movement, jaw, and head movement. These movements were recorded to analyze the sleep and deep relaxation state observed from the receiver (Esmel-Esmel et al., 2016). Further investigation was done with a polysomnogram, and a gradual transition was seen in the first and second stages of sleep (Esmel-Esmel et al., 2017).

Anxiety and Distress

Anxiety and diabetes distress were well noted in type 2 diabetic literature and can be addressed with foot reflexology. Anxiety enhances the sympathetic nervous system which increases heart rate and respiration, blood pressure, cardiac load, and myocardial oxygen demand (Ramezanibadr et al., 2018). Additionally, anxiety is also responsible for cardiac arrhythmias, and thrombosis formation by stimulating catecholamine release, damaging vein walls, and impairing platelet function (Ramezanibadr et al., 2018). Foot reflexology was able to help patients after coronary artery bypass graft surgery to reduce anxiety, heart rate, systolic and diastolic pressure, and mean arterial pressure (Abbaszadeh et al., 2018). Foot reflexology was also able to decrease anxiety in labor and postpartum women, which improved labor experience, baby bonding, and safeguarded mental health (Erkek & Aktas, 2018).

Anxiety is known to increase physiological functions and create mental anguish during medical testing (Ramezanibadr et al., 2018). Anxiety is common in 50% of the patients that are receiving a coronary angiography procedure used in detecting cardiovascular disease. Applying foot reflexology 1 hour after treatment reduced anxiety symptoms (Ramezanibadr et al., 2018). In another study, foot reflexology was applied to patients receiving mechanical ventilation and was able to reduce anxiety, improve sleep, and lower the level of sedation. Results also showed lowered heart rate, systolic and diastolic pressure, and respiration (Korhan et al., 2014). Furthermore, foot reflexology was found to reduce anxiety and lower physiological responses to a diagnostic procedure

called bronchoscopy (Shahsavari et al., 2017). Foot reflexology also reduced nausea in hemodialysis patients (Naseri-Salahshour et al., 2019).

Depression

Depression is associated with type 2 diabetes. Foot reflexology can help depression seen in many illnesses including type 2 diabetes. As an example, depression has been identified in women with overactive bladders, who felt isolated, lacked self-confidence, had limited social activities, and had negative results on their professional life, sexual life, and well-being (Aydin et al., 2016). Foot reflexology significantly lowered frequency and incontinence occurrences, which increased QoL and decreased depression (Aydin et al., 2016). Depression and anxiety were also reduced by using foot reflexology in hospitalized older females with acute coronary syndrome (Bahrami et al., 2019).

Coping Ability

Lazarus and Folkman's theory of stress and coping describe coping as a psychological process of cognitive and behavioral efforts to manage stressful situations and is based on the person's interpretation of the situation (Kristofferzon et al., 2018). A coping mechanism would need to be employed to counteract the cognitive activation of stress and the physiological processes it creates. A coping mechanism or intervention tool seen in the literature of foot reflexology could induce salutogenesis.

Salutogenesis

Galletta et al. (2019) discussed Antonovsky's sense of coherence (SOC) concept from his salutogenesis theory. Individuals are constantly coping with challenges that may

lead them away from good health. Individuals that navigate through life's stressors and stay healthy can identify and use coping resources. Galletta et al. (2019) further stated that Antonovsky's SOC contains three main components. Comprehensibility means making sense out of life's events and understanding that situation so one can face difficulties easier. Manageability means having internal and external resources that are enough to satisfy needs and feeling a sense of control. Meaningfulness is defined as the idea that life has emotional meaning, problems are seen as a challenge, and demands are worthy of engagement (Galletta et al., 2019; Kristofferzon et al., 2018). Both research groups found SOC supported psychological processes in mental health and positively associated to physical health and is related to health related QoL.

Salutogenesis' concept of foot reflexology would create a "maternal infantile bonding through a combination of conversation and bodywork" (Ventegodt et al., 2011, p. 415) and is a successful global QoL intervention. Ventegodt et al. (2011) stated this type of intervention helped 30%–90% of the chronically ill individuals with a variety physical and mental health issues, within one year. Odajima and Sumi's (2018) study of SOC with type 2 diabetics reported a main effect on the Problems Areas in Diabetes survey and patient's characteristics with an indirect effect on HbA1c. Age was seen as a component that influenced the SOC. A direct effect was shown for SOC to reduce the burden of diabetes, with an indirect effect on decreasing the HbA1c (Odajima & Sumi, 2018). The SOC and physical health related QoL mental component were examined by Galletta et al. (2019) in patients with chronic illness (diabetes, thyroid disorders, or cancer). Correlations were seen with SOC and the mental component reflecting that there

is a psychological process that impacts mental health leading to physical health. Galletta et al. (2019) suggested increasing the patient's SOC will produce better physical health and QoL outcome.

Health Psychology Discipline

The field of health psychology recognizes type 2 diabetes as a multidimensional disease. Health psychology studies the problems in multimorbidity or multi-conditions existing in chronic diseases (Suls & Green, 2019). The health psychology field strives to understand the psychology and behavior in health, illness, and healthcare (Johnson & Acabchuk, 2018). The BPS model in health psychology reflects the interaction of biology, psychology, and social factors (Johnson & Acabchuk, 2018). This model has directed interventions designed for reducing stress and coping with stressors that will improve mental and physical health. Health psychologists believe that behavior is a major key in making lifestyle changes in chronic disease and reducing healthcare burden (Johnson & Acabchuk, 2018). The self-management of a chronic disease should contain education on self-managing, self-confidence as self-efficacy, and social support (Barley & Lawson, 2016). The authors noted that when self-management improves so does self-efficacy leading to better attitude, behavior, and QoL. Health psychologists can help with illness perception that plays a role in adherence, self-management, and illness outcomes (Barley & Lawson, 2016). Chronic stress can contribute to chronic disease directly or indirectly, involving the PSR, feelings, behavior, and the environment which reconnects to the biopsychosocial model (Johnson & Acabchuk, 2018). A field under health

psychology is psychoneuroimmunology that intensively studies stress effects on the immune system, biomarkers, and allostatic load (Gonzalez-Diaz et al., 2017).

Health psychology and CAM acknowledge the therapeutic use of foot reflexology and its benefits. The literature review for the benefits of foot reflexology stated several studies on conditions such as overactive bladders, lymphoma, cancer, post-surgery, testing procedures, multiple sclerosis, neuropathy, mechanical ventilation weaning time, chemotherapy, and acute coronary syndrome. In these conditions, foot reflexology was found to be safe and effective in reducing or improving anxiety/distress, depression, coping, stress, sleep, and quality of life.

This study will expand knowledge in the field of health psychology, medicine, and CAM. This study will fill the literature gap for foot reflexology, type 2 diabetes, and the biopsychosocial model being studied together. Foot reflexology may be offered as part of a biopsychosocial intervention program. This study may establish foot reflexology as a sense of coherence method for promoting health by managing and coping with type 2 diabetes.

The main gap in the literature review is the lack of research studies conducted on foot reflexology and type 2 diabetes. The secondary literature gap was examining a biopsychosocial model with foot reflexology and type 2 diabetes to identify psychosocial factors that influence the progress of the illness. Yet a third literature gap was a lack of studies on foot reflexology and the sense of coherence as a coping mechanism with type 2 diabetes. The gaps in the literature will be covered by the study methodology and results.

Summary and Conclusion

In the past five years, little research was seen on the following topics: BPS model and foot reflexology, foot reflexology with psychosocial factors, and foot reflexology with type 2 diabetes. There were no articles found with a combination that consisted of type 2 diabetes testing foot reflexology's effect on blood sugar levels, psychosocial factors, the QoL, and using the BPS model. What does appear in type 2 diabetes literature is stress and its processes of inflammation in the body, simply stated: cause and effect.

The literature review pinpoints many factors affecting blood sugar levels. Most of them are psychosocial stressors (Morris et al., 2011; Shayeghian et al., 2015), including diabetes-related stress (Elissen et al., 2017), perceived stress, diabetes distress (Fisher et., 2014; Gonzalez et al., 2015), depression (Glover et al., 2016; Li et al., 2013; Schmitt et al., 2017), and disturbed sleep (Glover et al., 2016; Lee et al., 2017; Zhu et al., 2014). As the theory of stress and coping has explained, challenging environments that have socioeconomic deprivation such as community poverty, unemployment rate, and population density have higher psychosocial stress levels, obesity, type 2 diabetes, and higher HbA1c levels (Hirsch et al., 2018). Shayeghian et al. (2015) show coping style, social support, and self-care activities can modulate blood sugar levels. Furthermore, psychosocial factors, depression, and poor sleep increases obesity (Zhu et al., 2014) and obesity will affect blood sugar levels (Tan et al., 2018). Low spousal support and high emotional distress predicted higher blood sugar levels (Rook et al., 2016). According to the CATS theory, different stressors follow the same psychological and physiological pathways (Ursin & Eriksen, 2004). The PSR is activated in the body/mind from

perception of the stressor (Kelly & Ismail, 2015). Additionally, a complex relationship in type 2 diabetes has been found with stress, obesity, eating patterns, and coping (Park et al., 2018).

The biopsychosocial model components are important to identify in developing coping mechanisms that slow down the progression of type 2 and for the development of intervention programs (Jing et al., 2018). Four main factors that progress type 2 diabetes are stress, sleep disturbances, weight gain, and blood sugar levels. Once stress and sleep problems are reduced, weight management and blood sugar levels can be controlled and that can be accomplished through personalized interventions (Mussa et al., 2019).

Foot reflexology literature shows substantial evidence as to the therapeutic benefits in improving type 2 diabetics' biopsychosocial factors and QoL. Foot reflexology can reduce stress from biopsychosocial factors, improve sleep, and help with the mental anguish/psychological health resulting in lower blood sugar levels. Furthermore, foot reflexology would be a good salutogenic tool in managing and coping with type 2 diabetes. Foot reflexology is a touch modality that offers support through conversation and bodywork (Maratos et al., 2017) promoting the feelings of being cared for. In salutogenesis, type 2 diabetes is viewed as a challenge, and foot reflexology can give a SOC with clear and simple treatment as a management tool and develop a relevant meaning of life with diabetes which will improve QoL (Ventegodt et al., 2011).

In conclusion, type 2 diabetes is considered a chronic multifaceted disease containing biological, psychological, and social aspects represented in the biopsychosocial model. Type 2 diabetes literature points to a steady stream of stress that

initiates the physiological changes with inflammation that continues to progress the disease for years. Foot reflexology has the potential to touch all aspects of this disease as seen in the biopsychosocial model for improved quality of life and a sense of coherence tool used for coping and managing type 2 diabetes.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to analyze type 2 diabetics that used foot reflexology compared to type 2 diabetics who did not use foot reflexology. In this study, I searched for differences in a sense of coherence, blood sugar levels, perceived stress, and coping ability. Comparison of the variables was conducted with respondents from a small sample size. The independent variable was foot reflexology. The dependent variables were HbA1c (latest report from doctor), perceived stress, coping ability, and a sense of coherence. This study was designed to investigate how type 2 diabetics can be helped through foot reflexology by those type 2 diabetics already receiving this natural therapy.

This chapter will describe the quantitative design study and why it is important. The methodology section will describe targeted population, sampling size, and sampling procedures. The chapter will review the study's procedures for recruitment, data collecting, and participation. The instruments for the quantitative survey will be discussed. The type 2 diabetes literature variables will be defined and how they were used in the test instruments. The hypothesis and null hypothesis will be listed, and the purpose of the study will be discussed**.** The analysis plan will be described in detail. Ethical procedures and any threats to validity will be reviewed. The chapter will end with a concise summary.

Research Design and Rationale

In the present study, the dependent variables were HbA1c (self-report), perceived stress, coping ability, and the sense of coherence. Foot reflexology was the independent variable. The research design was to analyze differences in the variables from the type 2 diabetes population with some respondents using foot reflexology and others that were not using this therapy. Stress is a perceived thought that activates biopsycho mechanisms (Lazarus & Folkman, 1984; Ursin & Eriksen, 2004). A sense of coherence is a concept that includes coping with resources to make the illness manageable, comprehendible, and meaningful (Antonovsky, 1996).

Research Questions and Hypotheses

RQ1: How do type 2 diabetics regularly using foot reflexology differ in their HbA1c, in perceived stress, and a sense of coherence from type 2 diabetics who do not use foot reflexology to manage their illness?

H_{A1}: Type 2 diabetics regularly using foot reflexology differ in their HbA1c from type 2 diabetics who do not use foot reflexology.

H_{01}: Type 2 diabetics regularly using foot reflexology do not differ in their HbA1c from type 2 diabetics who do not use foot reflexology.

H_{A2}: Type 2 diabetics regularly using foot reflexology differ in their sense of coherence from type 2 diabetics who do not use foot reflexology.

H_{02}: Type 2 diabetics regularly using foot reflexology do not differ in their sense of coherence from type 2 diabetics who do not use foot reflexology.

H_{A3}: Type 2 diabetics regularly using foot reflexology differ in their perceived stress levels from type 2 diabetics who do not use foot reflexology.

H_{03}: Type 2 diabetics regularly using foot reflexology do not differ in their perceived stress levels from type 2 diabetics who do not use foot reflexology.

H_{A4}: Type 2 diabetics regularly using foot reflexology differ in their coping ability levels from type 2 diabetics who do not use foot reflexology.

H_{04}: Type 2 diabetics regularly using foot reflexology do not differ in their coping ability levels from type 2 diabetics who do not use foot reflexology.

The study design was an online survey consisting of two instruments that substantiated the research questions: the Perceived Stress Scale-10 (PSS-10), and the Sense of Coherence-13 (SOC-13). The instruments used were in line with the study's conceptual framework of Lazarus and Folkman's (1984) theory of stress and coping, Ursin and Eriksen's (2004) CATS theory, and Antonovsky's (1979) sense of coherence from his salutogenesis theory. There were no time or resource constraints to this study. The survey took about 7 minutes to answer from a computer anywhere and there was no follow-up.

Type 2 diabetes is a multidimensional disease which requires management of glycemic control for better long-term outcomes (Kalra et al., 2018). A great amount of knowledge is known in the type 2 diabetes literature about psychosocial factors, quality of life, stress, and obesity. In the current study, the research design investigated foot reflexology benefits that had not been thoroughly investigated with type 2 diabetes. Foot reflexology may reduce perceived or real stress thought processes described in Lazarus

and Folkman's stress and coping theory and Ursin and Eriksen's CATS. In addition, it was theorized that foot reflexology created a sense of coherence that would help with comprehension, management, and meaningfulness.

This study was a quantitative survey consisting of four sections. Section 1 contained the participation consent form. Section 2 presented participants' demographics of age, gender, marital status, if they received foot reflexology, the last reported HbA1c, how long ago the last HbA1c levels were taken (self-report), and if they had any other medical conditions. Section 3 contained the PSS-10 with 10 questions. Section 4 contained the SOC-13 with 13 questions. There was a total of 30 questions including demographics.

The purpose of this study was to determine if foot reflexology had any effect on type 2 diabetes in blood sugar levels, perceived stress, coping ability, or a sense of coherence. If the results were significant, this study may improve the quality of life for many people affected by diabetes. This study contributed to positive social change by enabling the diabetic with a sense of coherence/therapeutic tool to manage their illness that would reduce the societal cost of current and future complications. This study brought awareness to the effectiveness of foot reflexology therapy.

Methodology

The study had type 2 diabetics using foot reflexology and type 2 diabetics not using reflexology and was divided upon collection of data. The study ran on a research survey website until the minimum sample size was reached. The rationale for the study

being an online self-report questionnaire was feasibility and appropriate for studying foot reflexology (a touch modality) and type 2 diabetics (human participants).

Population

The targeted population was English speaking, adult, type 2 diabetics. The inclusion criteria were that respondents needed to be type 2 diabetics diagnosed within the past year, speak English, male or female, married or not, and could be any nationality. The exclusion criteria were if respondents could not speak English or not have computer access. Furthermore, type 2 diabetics that had additional health conditions, such as high blood pressure, syndrome X, and heart disease, were included to participate.

Sampling and Sampling Procedures

I conducted inferential statistics on a sample size of 10 adult type 2 diabetics who have received foot reflexology and 31 adult type 2 diabetics who have not received foot reflexology. I compared the probability (*p* value) with the alpha value to find significance with non-parametric test.

Procedures for Recruitment, Participation, and Data Collection

The IRB approved the study (approval # 05-26-21-0192526) and the survey was uploaded to SurveyMonkey. The recruiting process began with invitation letters sent to the Walden University participant pool, social media/snowballing ads and videos, and members of the Florida Association of Reflexologists were contacted. The online survey was conducted on SurveyMonkey anonymously. Consent letter, demographics, and questionnaires are listed below. Results from the surveys were downloaded from SurveyMonkey into the IBM Statistical Product and Service Solutions software (SPSS

Statistics). There were no follow-up procedures. The structure and flow of the survey is listed in the next section.

Instrumentations

Two instruments were chosen that aligned with the theories and literature review findings. The two published instruments that were used are the PSS-10, and SOC-13. The survey took about 7 minutes to complete. The study analyzed type 2 diabetics for foot reflexology usage, self-report HbA1c, sense of coherence, perceived stress, and coping ability. The online survey had four sections. The study began with a consent form followed by demographics of the participants.

Section 1: Participation Consent Form

The consent form was provided from Walden's resources.

Section 2: Demographics

The demographics for this study were age, gender, marital status, how long ago was HbA1c reported, current HbA1c levels, any other medical condition, and if receiving foot reflexology.

Section 3: Perceived Stress Scale–10 items (PSS)

The Perceived Stress Scale (PSS-14) was developed by Cohen et al. (1983) from Lazarus' coping theory. The PSS was designed to determine the extent to which situations are assessed as stressful. This instrument was used to help a person understand how situations affect feelings and perceived stress. In their landmark article, Cohen et al. (1983) outlined three studies, two on college students and one with participants in a smoking cessation program. The studies submitted evidence of the PSS-14 reliability and

validity, plus good consistency with Cronbach's alpha of a .86. After running an exploratory factor analysis, four items were dropped from the PSS by Cohen and Williamson (1988), making the PSS a ten-item instrument (Taylor, 2014).

The appropriateness to the current study for choosing PSS-10 included the three stress theories, and a means of analyzing the diabetic factor of perceived stress and coping ability. PSS-10 compares type 2 diabetes individuals using or not using foot reflexology as a coping tool to decrease stress levels. PSS-10 is a two-factor model measuring distress and perceived stress that can affect health outcomes. The two-factor analysis showed lifeview as unpredictable, uncontrollable, and overloaded appraisals with the other lifeview showing confidence in managing a coping response (Lehman et al., 2012). Lazarus posited that "people actively interact with their environments, appraising potentially threatening or challenging events in the light of available resources" (Cohen et al., 1983, p. 386). Agreeing with Lazarus' approach, Cohen et al. (1983) stated that stress would only occur when a situation is appraised as a threat and an insufficient coping mechanism available. Ursin and Eriksen (2004) stated that cognitive action of stress creates psychological processes culminating in physiological changes than can result in hopelessness and helplessness.

Lee's (2012) review of 19 studies using the PSS-10 reported internal consistency, factorial validity, and hypothesis validity. When examining the PSS-10 with 1,236 midlife adults, Taylor (2014) found the two factors scale was a good fit with negatively framed questions reflecting helplessness and positive framed questions showing self-efficacy. Cohen et al. (1983) aligned PSS with CATS when considering that cognitive

appraisal process in objective and subjective stress can determine health outcomes. Cohen et al. (1983) stated that a "psychometrically sound measure of perceived stress could provide valuable additional information about the relationship between stress and pathology" (p. 385). In addition, the perceived stress scale can determine factors such as social support, a psychosocial factor in diabetes. The PSS questionnaire was designed to help the participant find to what degree their lives were unpredictable, uncontrollable, and overloading, indicating the central components of stress (Cohen et al., 1983).

Reliability and validity values are reflected in different populations. The psychometric properties of the PSS-10 were evaluated in a study with 305 accountants by Smith and Emerson (2014) who found the PSS-10 had reliability coefficients, with valid item-total correlation factors and coefficient alphas. Further investigation was done with the PSS-10 factor structure and factorial invariance for English and Spanish with 5,176 members of the Hispanic/Latino population. The internal consistency was reported from .68 to .78 and supported reliable variance. Convergent validity was also confirmed in perceived stress factor and reverse worded factor (Perera et al., 2017). In switching to a Greek version, PSS-10 was analyzed with a sample of 320 adults for unidimensional or bidimensional scaling. The two-factor structure displayed negative framed items as stressful thoughts and feelings resulting in anxiety and depression. Positive framed items reflected self-efficacy or the ability to cope with stress. In the Korean version, PSS-10 was evaluated with patients with chronic disease. The two-factor model was a good fit with item convergent and discriminant validity at 100% scaling and Cronbach's alpha exceeded .70 (Lee, Chung, et al., 2015). Furthermore, researchers studied PSS-10 with

the Danish National Health Survey of 32,374 citizens to find the two-dimensional model as a valid construct (Nielsen et al., 2016). The Persian version of the PSS-10 was given to women experiencing infertility to evaluate reliability and validity. The results reported the confirmatory factor analysis (CFA) showed data fit for the two-factor model with internal consistency and subscales rated good, and significant correlations were seen in anxiety and depression for satisfactory convergent validity (Maroufizadeh et al., 2018).

The following are studies with the PSS-10 showing different populations and different conditions. The PSS-10 examined 60 women with breast cancer receiving chemotherapy to evaluate stress and pain levels after foot reflexology. Stress and pain both were significantly lower in the experimental group after foot reflexology (Khazaei et al., 2018). Rahim et al. (2020) gave the PSS-10 to 168 participants in a fishing community in Malaysia where prediabetes and diabetes was a concern. The stress scale reported the majority (57.3%) had moderate stress. In Poland, the PSS-10 was applied to see if a connection existed between stress and insomnia with 264 university students. Results showed higher stress was seen in chronically ill students and those who smoked. Insomnia levels were connected to the strength of perceived stress (Średniawa et al., 2019). Furthermore, India has the highest rate of diabetes in the world. The PSS-10 was used along with family functioning in 250 diabetics and 250 nondiabetics. Perceived stress was higher in the diabetic group and was found to influence glycemic levels. A relationship existed with psychosocial factors and blood sugar control. Family functioning was better performed for problem solving by the diabetic group (Bhandary et al., 2013). Finally, the permission letter to use Cohen's PSS-10 instrument was given on

7-25-2020 through Carnegie Mellon University website with his letter and signature and can be found in Appendix B.

Section 4: Sense of Coherence–13 items (SOC–13)

Antonovsky's concept of salutogenesis and the sense of coherence began in 1979. The Orientation to Life-SOC-29 questionnaire was first developed in 1987, and the SOC-13 is a shorter version (Eriksson & Mittelmark, 2017). Antonovsky's (1993) article on structure and properties on SOC-13 scale showed the alpha of 16 studies from 0.74 to 0.91 with the test-retest indicating stability. Criterion validity that came from data correlation was statistically significant.

The SOC-13 showed reliability and validity in various populations. Eriksson and Lindstrom's (2005) systematic review of the SOC questionnaire showed face validity being used with 49 languages in 48 countries and at least 15 versions. The construct validity factorial structure was multidimensional and produced a positive outcome over time. The SOC scale was shown to be a dependable, valid, and a good cross-cultural instrument (Eriksson & Lindstrom, 2005). The SOC measurement scale was found psychometrically sound by using Rasch analysis with 623 healthy adults but shortening the scale to five categories would be better. In addition, 12 out of 13 questions displayed goodness-to-fit and 43% in variance of principal components (Holmefur et al., 2014). Sardeli et al. (2017) used the SOC-13 scale to measure gender and obesity for stress management with 250 individuals visiting cosmetic centers in Attica, Greece. Overweight women had lower values on meaningfulness compared to normal weight females, therefore, requiring psychological intervention to deal with stress during weight loss.

Odajima et al. (2017) used the SOC-13 in an educational program study conducted with 40 type 2 diabetes hospital admitted patients in Japan. The results showed improvement of comprehensibility and management subscales with lower scores in meaningfulness.

Kristofferzon et al. (2018) found a direct and indirect effect from the SOC-13 scale on mental QoL in 292 patients with chronic diseases. The study showed self-perceived effective coping strategies was the mediating factor and clarified 39% variance in mental QoL, indicating validity in Lazarus and Folkman's (1984) stress and coping theory. In addition, Galletta et al., (2019) analyzed the SOC-13 on physical health-related QoL in 209 Italian chronic patients with various illnesses. Results revealed the SOC-13 correlated to the mental component directly and was indirectly linked to the physical component. The SOC is a psychological process influencing patient's mental health, thus effected physical health.

Another study did not find significance in family SOC as a protective factor against obesity in low-income households (Speirs et al., 2016). In a qualitative study analyzing 12 young people with congenital heart disease, the SOC-13 found personal control was a predominant factor above all other psychosocial factors (Apers et al., 2016). Furthermore, Saravia et al. (2014) analyzed the psychometrics of the SOC-13 on 488 Peruvian college students. Internal consistency construct showed a reliability of Cronbach's alpha of .80. Confirmatory factor analysis and the multidimensional scaling showed three-factor scaling was a better fit for this population. The criterion validity had a positive and significant correlation to the mental health component. Comprehensibility and manageability were stronger than meaningfulness, but all showed positive

correlations. Thus, the purpose for using the SOC-13 is to compare the three-factor scale with type 2 diabetics using and not using foot reflexology as a coping tool.

The appropriateness of the SOC-13 in the current study can be seen in all three theories, and the biopsychosocial model. Lazarus and Folkman's (1984) stress and coping theory expressed the importance of coping skills. Coping is a psychological process on the person's own perception of the situation. The SOC-13's three dimensions of comprehensibility, manageability, and the meaningfulness are part of developing self-efficacy for coping (Kristofferzon et al., 2018). Coping efficiency was found to connect the sense of coherence to mental health quality of life in chronic disease which supports the stress and coping theory (Kristofferzon et al., 2018). In type 2 diabetes, coping skills that diminish diabetes distress coincided with manageability and meaningfulness, thus improving QoL (Kalra et al., 2018).

CATS (Ursin & Eriksen, 2004) explained how psychological stress changes the physiological function of the brain and body which can lead to feelings of helplessness and hopelessness. The biopsychosocial model by Engel (1977) helped to bridge the psychological part of health with the biomedical parts of disease and treatment introducing a way to manage chronic disease (Kalra et al., 2018). The SOC-13 has three components that reflect a biopsychosocial process of comprehensibility through cognition, manageability through behavior, and meaningfulness through emotion/motivation (Lee, 2012). These three components add to the psychological aspect of health. Furthermore, interventions such as foot reflexology can induce salutogenesis

and successfully improve QoL by combining talk therapy and bodywork (Ventegodt et al., 2011).

The permission letter to use SOC-13 was granted on 7-20-2020 from the Society for Theory and Research on Salutogenesis (STARS). The permission letter can be found in the Appendix C.

Operationalization for Each Variable

All data were processed through SPSS Statistics. The two instruments were applicable for use on SPSS Statistics software. The PSS-10 measured the variables of perceived stress and coping ability. The answers were on a 5-point, Likert scale 0-4. Six of the questions had a negative content as a general distress scale. The other four questions were positively framed to reflect coping ability. The positive scores were reversed on Questions 4, 5, 7, and 8. On the survey, questions 11, 12, 14, and 15 were reversed. After reversing, all points were added together. A higher score indicated higher perceived stress (Smith & Emerson, 2014).

The Orientation to Life questionnaire SOC-13 scale had 13 questions that could be answered from 1–7 (1 = *very seldom or never* to 7 = *very often or always*). This instrument measured if the foot reflexology group had developed a sense of coherence about having type 2 diabetes, giving them a health-oriented outlook on the future. There was reverse scoring with this scale for Questions 1, 2, 3, 7, and 10. On the survey, the questions to reverse were located as Questions 18, 19, 20, 24, and 27.

Data Analysis Plan

Data from the respondents were downloaded into SPSS from SurveyMonkey. Data cleaning is the process of identifying incomplete, incorrect, and inaccurate data from a record set. Data that were detected and considered corrupt or inaccurate were removed. Screening procedures to determine participant eligibility was accomplished through the study's description and requirements for participation.

I conducted a Welch *t* test for uneven variances to analyze four dependent variables reflected in the research questions including HbA1c, perceived stress, coping ability, and a sense of coherence. Foot reflexology was the independent variable. I compared the null and the alternative hypothesis in all variables. I calculated and presented descriptive statistics, Welch's *t* test, Mann-Whitney-Wilcoxon, and Chi-square for any assumptions.

Threats to Validity

External validity is concerned with generalization. It answers the question if the sample's results can be related to the larger population. External validation threats were controlled through my research design. There was no pretest to interfere with reaction or interaction of the participant known as testing reactivity. The interaction effects of selection and experimental variables threat may have occurred because the online survey was only accessible to adults who knew how to use the internet and had access to a computer. The reactive effects of experimental arrangement threat may have been where participants accessed a computer and distraction may have occurred from the survey. There was no multiple-treatment interference.

Quantitative research internal validity threats can undermine the confidence in stating there is a relationship between the dependent and independent variable. Internal validity means differences seen in the dependent variable are from the independent variable and not from other sources (Flannelly et al., 2018). Threats of history or maturation were not a concern due to any events or conditions changing during the brief time frame. The two instruments took little time to answer. The threat of statistical regression was not noticed as all instruments had been evaluated as dependable and valid. This was a onetime survey and was not subject to pretest or posttest differences. The testing did not put participants at a disadvantage. The instrumentation took place online at the participant's own place and time frame with no cut off points. The amount of time to answer the questions was about seven minutes according to the test instrument's instructions. The mortality of the survey took six and a half months. The design contamination threat was not a concern because one group did not know there is another group.

The study was for all type 2 diabetics, even with other medical conditions, that spoke English, and could use a computer. The question of receiving foot reflexology was addressed as a yes or no answer. The survey may have exerted a little anxiety for it examined the cognitive element of having type 2 diabetes. Demoralization threat did not exist because this was not an experimental intervention. There was no carryover from a previous experiment for the threat of multiple-treatment interference to be a factor.

Construct validity measures what the test was to measure (Middleton, 2020). For example, the PSS-10 measured perceived stress levels and coping ability as proposed by

Lazarus and Folkman's (1984) theory of stress and coping. The SOC-13 measured the amount of sense of coherence of comprehensible, manageable, and meaningful levels from foot reflexology as proposed by Antonovsky's (1979) salutogenesis theory. In construct validity, the test is symbolic of what was measures, and face validity shows the test to be true to the targets (Middleton, 2020). Each test instrument mentioned above fit into those defined validity requirements.

In analyzing the effects of foot reflexology, this study did not have a labeling issue because it evaluated two groups independently, therefore testing was not part of the treatment. Restricted generalization was avoided by defining any results that foot reflexology produced. To avoid confounding constructs, I was careful not to label that one treatment created the same result for everyone. Hypothesis guessing was avoided because the experimental group already had foot reflexology and all participants were given a description of the research testing beforehand. Another threat to construct validity is evaluation apprehension and that was avoided from this online survey, as there was no pressure to have to be involved or finish, no competition to out preform, and the survey was anonymous. The last threat is experimenter expectancies, and it was avoided because the researcher did not have any contact with participants.

Ethical Procedures

The IRB approved the study (approval # 05-26-21-0192526). Participation was voluntary, anonymous, and computer accessed online. Type 2 diabetics had the right to participate or not. The respondents had a right to stop at any time they wished and were not coerced. Only adults over 18 participated. Any survey that was not fully completed

was cleaned out of data. The demographics and questionnaires took approximately seven minutes to answer. If the respondent had any emotions that arose from the questions in the survey, they were directed to call the American Diabetes Association at 1-800-DIABETES (800-342-2383) or askada@diabetes.org or to check out the Diabetes Foundation at https://www.diabetesfoundation.org. No names, phone numbers, or addresses were included on any of the forms. Each respondent was anonymous and divided into a group of foot reflexology users or non-foot reflexology users, put on a flash drive, and will be destroyed five years. I did not use incentives, nor did I do the survey at a workplace, and I had no conflict of interest.

The Belmont principles of privacy, beneficence, and justice are addressed in this survey. I conducted the online survey through SurveyMonkey, and I downloaded the anonymous survey forms to my computer into SPSS. Data were on a flash drive until the desired sample size was reached. I retrieved data and excluded incomplete surveys. Recruitment was done online through foot reflexology associations, individual reflexologists, and social media. This study included individuals from different nationalities, with type 2 diabetes, who spoke English, and who could use a computer. This research was justified by improving the lives of type 2 diabetics in health outcomes and lowering the heavy cost to society from detrimental outcomes.

Summary

The current study investigated foot reflexology with type 2 diabetics for blood sugar levels, perceived stress, coping ability, and a sense of coherence. Foot reflexology may reduce perceived or real stress thought processes described in Lazarus and

Folkman's (1984) stress and coping theory and CATS. In addition, it was theorized that foot reflexology created a sense of coherence that will help with comprehension, management, and meaningfulness. This study was a quantitative survey with a quasi-experimental design. The survey consisted of two testing instruments, the PSS-10, and the SOC-13, along with demographics, self-report of HbA1c, and consent form. There was a total of 30 questions. The convenience sample size was 41 respondents, and the survey ran 6.5 months to secure clean data for analysis. Recruitment was through foot reflexology associations, individual reflexologists, and social media. The respondents were anonymous and there was no conflict of interest. This study was not done in my working environment. Data collection was downloaded from SurveyMonkey site to SPSS on a secured computer.

Type 2 diabetes is an illness with many causational and ongoing factors. A multidimensional approach is required to cover the whole scope of this illness as seen in the literature review for enhancing psychosocial health outcomes and decreasing cost utility. The PSS-10 examine perceived stress and coping ability and the SOC-13 examined respondents for feelings of comprehensibility, manageability, and meaningfulness toward a healthier long-term outcome.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to compare type 2 diabetics already receiving foot reflexology to type 2 diabetic not receiving foot reflexology. This study explored if type 2 respondents receiving foot reflexology had a sense of coherence, improvements in blood sugar levels, reduced perceived stress, and improved coping ability. Responses from 41 respondents (10 had received foot reflexology and 31 did not) were used.

The foundational research question was: How do type 2 diabetics regularly using foot reflexology differ in their HbA1c, sense of coherence, perceived stress, and coping ability from type 2 diabetics who do not use foot reflexology? Hypotheses were as follows:

H_{A1}: Type 2 diabetics regularly using foot reflexology differ in their HbA1c from type 2 diabetics who do not use foot reflexology.

H_{01}: Type 2 diabetics regularly using foot reflexology do not differ in their HbA1c from type 2 diabetics who do not use foot reflexology.

H_{A2}: Type 2 diabetics regularly using foot reflexology differ in sense of coherence from type 2 diabetics who do not use foot reflexology.

H_{02}: Type 2 diabetics regularly using foot reflexology do not differ in sense of coherence from type 2 diabetics who do not use foot reflexology.

H_{A3}: Type 2 diabetics regularly using foot reflexology differ in perceived stress from type 2 diabetics who do not use foot reflexology.

H_{03}: Type 2 diabetics regularly using foot reflexology do not differ in perceived stress from type 2 diabetics who do not use foot reflexology.

H_{A4}: Type 2 diabetics regularly using foot reflexology differ in their coping ability from type 2 diabetics who do not use foot reflexology.

H_{04}: Type 2 diabetics regularly using foot reflexology do not differ in their coping ability from type 2 diabetics who do not use foot reflexology.

Data Collection

The type 2 diabetes/foot reflexology survey was established on SurveyMonkey in June 2021. The time for data collection was expected to be two months starting in August of 2021, after the IRB approval. The invitation letter described the recruitment requirements. I contacted the American Diabetes Association three separate times and different departments but received the same answer that they do not help with surveys. The Florida Association of Reflexology (FAR) sent invitation letters to their therapists. FAR also sent my invitation to the Reflexology Association of America. The International Institute of Foot Reflexology could not help with survey invitation to therapists but referred me to their referral list of over 200 reflexologists. I received a few respondents from contacting foot reflexologists. Some reflexologists were working and some were not due to the COVID-19 pandemic, and some numbers were not in service. Most of the therapists that were working had no type 2 diabetes clients. One of the reflexologists had type 2 diabetes clients, but they did not trust SurveyMonkey and felt unsure about being anonymous. My social media and Facebook ads with video were used three separate times over 6 months and gathered the most responses. I am not aware of

any responses from Walden University's participation pool. Participants were slow to accumulate due to COVID-19 restrictions, and original number values were not reached.

While investigating the results that I had received, I noticed that respondents were not staying online long enough to finish the whole survey. I informed my chair Dr. Stadtlander, and I shortened the survey by taking out the QoL questionnaire. The original survey was 46 questions with PSS-10, AQoL-8D, and SOC-13, and it took about 15 minutes to complete. The G power for 300 expected participants with seven variables was changed to 60 expected respondents with four variables. I also added type 2 diabetics aged 65 and older and if respondents had other medical conditions were able to participate. The revised survey and invitation were approved through the IRB and contained 23 questions and approximately seven minutes to take.

I made corrections to my proposal, and I collected data for 6 months. All forms: content, invitation, and survey were approved through the IRB. After data collection and clean up, the numbers were too low to analyze. I ran the survey for another 2 weeks. After clean-up, I had 31 type 2 diabetics not receiving foot reflexology and 10 type 2 diabetics that had received foot reflexology.

The discrepancies or problems with data collection was mostly from trying to obtain respondents. As discussed above, the survey had to be shortened, amended, and approved. The COVID-19 pandemic restrictions and the strands that followed stopped hands-on therapists from practicing. The following locations had stopped offering type 2 diabetes support groups: YMCA Healthy Living Center, Diabetes Treatment Center Sarasota Memorial Hospital, BayCare Healthcare, Hanson Diabetic Care, and St.

Antony's Nutrition and Diabetic Center. I was not able to obtain assistance from the American Diabetes Association. The McHugh Internal Medicine Clinic did not reply to my email or invitation flyer. The amended survey, allowing respondents who were past 65 years of age, and adding other medical conditions as acceptable for participation, were beneficial for reaching more respondents, but it also opened analysis problems. For example, I could not use the mean but used the median because of the unknown age in the last age bracket. Other medical conditions with type 2 diabetes may have steered the respondents to choose a different answer when thinking about his condition. In addition, I failed to ask the type 2 diabetic foot reflexology respondents how many sessions they had received.

The assumptions were evaluated with the following test instruments and the findings were charted. Baseline descriptive and demographic characteristics of the sample can be seen in Table 1 as it displays the frequency counts for the 41 survey respondents. There were more females in the sample (63.4%) than males (36.6%). Ages ranged from 20 to 30 years old (2.4%) to 61 and older (43.9%) with the median age being *Mdn* = 55.5 years. Forty-four percent were married. Ten in the sample (24.4%) had received at least one foot reflexology treatment for their Type 2 diabetes. Forty-nine percent of the sample had an HbA1c level between 140–180 and 68.3% had that blood test within the last 3 months. Thirty-seven percent had at least one other medical condition besides type 2 diabetes (see Table 1).

Table 1

Frequency Counts for Selected Variables

Variable	Category	*n*	%
Gender			
	Male	15	36.6
	Female	26	63.4
Age group	20–30	1	2.4
	31–40	3	7.3
	41–50	6	14.6
	51–60	13	31.7
	61 and older	18	43.9
Married	Yes	18	43.9
	No	23	56.1
Received foot reflexology for Type 2 diabetes			
	Yes	10	24.4
	No	31	75.6
Last reported HbA1c (blood sugar) levels			
	140–180	20	48.8
	181–220	8	19.5
	221–260	3	7.3
	261–300	1	2.4
	I don’t know	9	22.0
How long ago was the last HbA1c you reported above?			
	Less than 3 months	28	68.3
	3 to 6 months	11	26.8
	6 to 9 months	2	4.9
Other medical conditions besides Type 2 diabetes			
	Yes	15	36.6
	No	10	24.4
	No other condition	16	39.0

Note. $N = 41$.

Table 2 displays the psychometric characteristics for the three summated scale scores. Cronbach's alpha reliability coefficients were calculated. Coefficients were considered acceptable for coping (α = .86), stress (α = .89), and coherence (α = .84).

Table 2

Psychometric Characteristics for the Summated Scale Score

Scale score	Items	*M*	*SD*	Low	High	*a*
Coping from type 2 diabetes	4	3.15	0.76	1.25	5.00	.86
Perceived stress	6	2.43	0.75	1.00	3.83	.89
Coherence	13	4.49	1.04	2.23	6.08	.84

Table 3 displays the Chi-square test examining the HbA1c level with foot reflexology care. The Chi-square test is a nonparametric test and "measures group differences when the dependent variable is measured at status or nominal level" (McHugh, 2013, p. 143). Chi-square was followed by Cramer's-V for strength. Cronbach's alpha measures the instruments' reliability for internal consistency and both scales, PSS-10 and the SOC-13 have reliability (Tavakol & Dennick, 2011; see Table 3).

Table 3

Chi-Square Test for HbA1c Level Based on Foot Reflexology Care

	Foot treatments $n = 10$		No treatments $n = 31$	
HbA1c level	*n*	%	*n*	%
140–180	5	50.0	15	48.4
181–220	2	20.0	6	19.4
221–260	1	10.0	2	6.5
261–300	0	0.0	1	3.2
I don't know	2	20.0	7	22.6

Note. $N = 41$. $\chi^2 (4, N = 41) = 0.48$, $p = .98$. Cramer's $V = .11$.

Table 4 displays the relevant Welch's *t* tests and Mann-Whitney tests. The Welch's *t* test is used when the assumption of everything being equal (homogeneity of variance) is not met and is a better manager of Type 1 error (Delacre et al., 2017). The Mann-Whitney test compares the median of two unequal distributed groups (*p* = value; Hart, 2001; see Table 4).

Table 4

Welch's t Test and Mann-Whitney Test for Scale Scores Based on Foot Treatment

					Welch's		Mann-Whitney	
Scale score	Treatment	*n*	*M*	*SD*	*t*	*p*	*z*	*p*
Coherence					0.28	.60	0.21	.83
	Yes	10	4.62	0.80				
	No	31	4.45	1.12				
Perceived stress					1.36	.26	0.93	.35
	Yes	10	2.23	0.54				
	No	31	2.49	0.81				
Coping from type 2 diabetics					0.75	.40	0.80	.42
	Yes	10	3.33	0.71				
	No	31	3.10	0.78				

Note. $N = 41$.

Answering the Research Question

How do type 2 diabetics regularly using foot reflexology differ in their HbA1c, perceived stress, coping ability, and a sense of coherence from type 2 diabetics who do not use foot reflexology? This research question had four related hypotheses.

Research Hypothesis 1 was, H_{A1}: Type 2 diabetics regularly using foot reflexology differ in their HbA1c from type 2 diabetics who do not use foot reflexology. To address this hypothesis, Table 3 displays the chi-square test for the HbA1c level based on foot reflexology care. No difference in blood sugar level was found between the two groups, χ^2 (4, N = 41) = 0.48, p = .98, Cramer's V = .11. These findings provided support to retain the null hypothesis (see Table 3).

Research Hypothesis 2 was, H_{A2}: Type 2 diabetics regularly using foot reflexology differ in sense of coherence from type 2 diabetics who do not use foot reflexology. To address this hypothesis, Table 4 displays the relevant Welch's *t* test and Mann-Whitney test. The Mann-Whitney test was included for statistical verification purposes due to the differences in subsample sizes between the groups (n = 10 versus n = 31). No significant between group differences were found using either the Welch's *t* test (p = .60) or the Mann-Whitney test (p = .83). These findings provided support to retain the null hypothesis (see Table 4).

Research Hypothesis 3 was, H_{A3}: Type 2 diabetics regularly using foot reflexology differ in perceived stress from type 2 diabetics who do not use foot reflexology. To address this hypothesis, Table 4 displays the relevant Welch's *t* test and Mann-Whitney test. No significant between group differences were found using either the

Welch's *t* test ($p = .26$) or the Mann-Whitney test ($p = .35$). These findings provided support to retain the null hypothesis (see Table 4).

Research Hypothesis 4 was, H_{A4}: Type 2 diabetics regularly using foot reflexology differ in their coping from type 2 diabetics who do not use foot reflexology. To address this hypothesis, Table 4 displays the relevant Welch's *t* test and Mann-Whitney test. No significant between group differences were found using either the Welch's *t* test ($p = .40$) or the Mann-Whitney test ($p = .42$). These findings provided support to retain the null hypothesis (see Table 4).

Summary

In summary, this quantitative study included survey data from 41 respondents to evaluate type 2 diabetics already receiving foot reflexology compared to type 2 diabetics not receiving foot reflexology. Research Hypothesis 1 (differences in HbA1c) was not supported (see Table 3). Research Hypothesis 2 (differences in sense of coherence) was not supported (see Table 4). Research Hypothesis 3 (differences in stress) was not supported (see Table 4). Research Hypothesis 4 (differences in coping ability) was not supported (see Table 4). In the final chapter, these findings will be compared to the literature, conclusions and implications will be drawn, and a series of recommendations will be suggested.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative study was to analyze type 2 diabetics who used foot reflexology to type 2 diabetics who did not use foot reflexology. Type 2 diabetes is considered a global high-level illness and is plagued with numerous psychosocial factors that keep the individual stressed. The complications get worse and more costly as the illness progresses with age. The intent of this study was to obtain a small population sample to analyze the variables in the hypothesis statements.

The nature of this study was to use a biopsychosocial approach with foot reflexology to address risks and psychosocial factors that may help the type 2 diabetic manage and control the outcome of this illness. Foot reflexology is considered a complementary alternative medicine and type 2 diabetes is out of control worldwide. The study design consisted of two questionnaires to evaluate the hypothesis. The survey included the PSS-10 (see Cohen et al., 1983) and the SOC-13 (see Antonovsky, 1979). The dependent variables were HbA1c, a sense of coherence, perceived stress, and coping ability. Foot reflexology was the independent variable.

The summary of the findings in this study show that foot reflexology did not show evidence of any difference between type 2 diabetics using foot reflexology and those not using the foot reflexology in their HbA1c, a sense of coherence, perceived stress, and coping ability, with a .05 alpha, and 95% confident level. The null results that were obtained might be replicated in a larger controlled study.

Interpretation of Findings

The following paragraphs explain the findings as they pertain to the literature of type 2 diabetes and foot reflexology on the variables of HbA1c, sense of coherence, perceived stress, and coping ability.

HbA1c Self-report

Limited previous research agreed with my findings of which may be due to the small sample size. Silva et al. (2018) did not find any changes in evaluating foot reflexology on capillary blood glucose, tissue temperature, and plantar pressure in 45 type 2 diabetics assessed. Other research has reported different results from my findings. For example, Glover et al. (2016) reported that blood sugar levels are affected by stressful events and anxiety, depression, and sleep disruption. Distress, stress, depression, and social support affects blood sugar levels (Morris et al., 2011). Morris et al. (2011) also found the daily stress of finger pricking will influence blood sugar levels. Madhu et al.'s (2019) study on 500 newly detected type 2 diabetics before diagnosis found "chronic stress and a low sense of coherence were associated with a higher risk of type 2 diabetes" (p. 18).

Additionally, psychosocial factors of coping style, social support, and self-care activities can modulate blood sugar levels (Shayeghian et al., 2015). Challenging environments and social status (Hirsch et al., 2018) and environmental surroundings, such as communities dealing with socioeconomics deprivation (e.g., community poverty, unemployment rate, population density), have higher psychosocial stress levels which results in higher HgbA1c levels (Hirsch et al., 2018). Some of the stress factors affecting

blood sugar levels are loss of job, divorce, death of loved one, daily deadlines, traffic, family, and having to manage an illness (Morris et al., 2011). Furthermore, allostatic load from physical and mental stress affects blood sugar levels (Hales et al., 2020) and foot reflexology reduced HbA1c levels and increase ankle brachial index with older type 2 diabetics (Yodsirajinda et al., 2016).

Sense of Coherence

The findings confirmed the work of Speirs et al, (2016), that SOC was not significant as a protective factor against obesity in low-income households. The findings are contrary to previous research which may be due to the small sample size. The other research studies have reported different results, such as Elissen et al.'s (2017) study that found patients who had adequate control of their blood sugar levels had high self-efficacy (belief in the ability to manage situations) and rated higher with psychosocial factors of income, education, employment, and marital status. High self-efficacy also showed positive effects on social support, outcome expectancies, perceived interference, educational level, self-care, and blood sugar levels (Cosansu & Erdogan, 2014).

Perceived Stress

Limited previous literature that agrees with this study's findings as seen in Sheikhy et al. (2018) study. Stress conditions after open heart surgery treated with foot reflexology massage had no effect on the feeling of comfort. The article did not state if this was original foot reflexology or massage therapy. However, other research literature that disagrees with type 2 diabetes and foot reflexology findings is found with studies on MS, chemotherapy, ventilation weaning, and pregnancy related stress. Anxiety, stress,

and depression were decreased in a comparison study with reflexology and relaxation, both creating results for patients with multiple sclerosis (Soheili et al., 2017). Stress and neuropathy pain were significantly decreased after a foot reflexology intervention for chemotherapy patients (Khazaei et al., 2018). Heart rate, respiration, blood pressure, stress, pain, and anxiety from mechanical ventilation weaning time were addressed with foot reflexology and found to be significantly effective (Ebadi et al., 2015). Low back and pelvic pain, and pregnancy related stress were reduced with foot reflexology treatments (McCullough et al., 2018).

Coping Ability

The findings are contrary to previous research which may be due to the small sample size. Other research studies that disagreed with this study's findings were Morris et al. (2011) and Rook et al. (2016) who found the inability to cope with stress negatively effects blood sugar control. Hales et al. (2020) reported that not coping well invokes poor behavioral habits such as not checking blood sugar levels regularly, not taking medication as prescribed, drinking alcohol, not eating healthy, and not exercising. In addition, Sobol-Pacyniak et al. (2014) found that anxiety and depression determined the strategy in coping with stress in predisposed type 2 patients. Foot reflexology is a good coping mechanism that can interrupt the stress response, bring about homeostasis, and offer stress reduction, safety, and effectiveness Embong et al. (2015).

Peer-Reviewed Literature Described in Chapter 2

The peer-reviewed literature that I described in this study showed clear and concise evidence that type 2 diabetes is at pandemic levels with many affecting factors.

Extra measures need to be taken to help this population and decrease the economic burden. Even though this study showed no significance in any of the variables examined, the literature review and the theoretical framework pointed to potential exploration into chronic stress and psychosocial factors of type 2 diabetes and the benefits of foot reflexology.

Findings as to Conceptual Framework

The conceptual framework consisted of three theories. Two theories explained causation and continuation of type 2 diabetes with stress effects on the mind/body. The third theory offered a coping solution from a sense of coherence with mind/body. The findings showed no difference with HbA1c, perceived stress, coping ability, or a sense of coherence. It could be that all the respondents had the same level of stress, or possible that a larger sample may have been able to reach levels of significance. The 10 participants may have had foot reflexology a couple times and not have seen full benefits yet. It is possible that the respondents did not understand the meaning of a sense of coherence and did not answer the questions, resulting in a rejected survey entry. Even though no evidence was seen in the findings, the theories have a valid foundation according to the literature.

Limitations of the Study

The limitation of this study was low participation due to COVID-19 pandemic restrictions resulting in a small sample size (31 non-foot reflexology and 10-foot reflexology type 2 diabetics), therefore this sample may not represent the type 2 diabetes population of 29.1 million, thus, the sample is not generalizable. Sample size is

significantly important to standard error and the treatment effect (Schumm et al., 2013). As Gravetter and Wallnau (2009) stated, “Larger samples produce a bigger t effect and more likely to produce significant results” (p. 295). There were questions about foot reflexology that were not asked, such as, how many treatments they received, and if they were going to a licensed foot reflexologist. The expansion of the last active survey allowed type 2 diabetics to participate if they had other medical conditions besides type 2 diabetes and to raise the age past 65. The reasoning for this was to attract more participants to the study; however, this created problems with analysis. I could not use the mean but had to use a median because the last age question was open-ended, and I did not know exactly how old the participants were after 65 years. Other medical conditions were allowed into the survey, which may have altered the participants perception on condition and their answer was skewed.

Recommendations

There are several recommendations for future research and the literature. This research study should be replicated using a bigger sample size, with age cutoff, and no other medical conditions. A clinical trial may be implemented with type 2 diabetics randomly assigned to treatment or control. More ways of reaching a wider part of this population should be found. A study should include length of time receiving foot reflexology (e.g., just once, 6 months to 1 year, 2 years, 3 years) and should accept only those 6 months or more because the number of treatments may be important to outcome. For example, someone who has been receiving foot reflexology for a year may notice more benefits than someone who has had two treatments. Other medical conditions

should be excluded because it interferes with how the participants perceive the questions of stress and coping. Having medical conditions more than type 2 diabetes may change their outlook.

Future studies should include more of the psychosocial variables that were previously researched, like sleep. Future researchers may ask *why* respondents received foot reflexology using multiple choice one-word answers (e.g., stress, relaxation, lower HbA1c, better sleep, manageability). Another question to be asked is if other alternative therapies are being used. For instance, are they receiving acupuncture, taking herbal medicine, CBD, essential oils, or practicing Tai Chi and mindful meditation? Perceived Stress Scale -24 may have provided a difference response. More research needs to be conducted to fill in the gap on type 2 diabetes and foot reflexology that include the HbA1c, some of the psychosocial factors listed, and a sense of coherence or self-efficacy.

Implications

This study has several implications for social change. I would start out as a scholar-practitioner by empowering type 2 diabetics with information about foot reflexology and a sense of coherence. This study will be instrumental in bringing an awareness on type 2 diabetes psychosocial factors, stress response, and foot reflexology. As a scholar-practitioner, I can use this study to educate and inform so better decisions can be made for more people by uplifting the family and loved ones through awareness of how vitally important they are as a support to the type 2 diabetics. In addition, as a scholar-practitioner, I will connect with organizations, and associations. I can facilitate trained therapists in foot reflexology to educate them about this illness, applied special

techniques, help them build their type 2 diabetic clients, plus teaching them to educate and inform their clients. Furthermore, as a scholar-practitioner I can work with state and national government officials in new legislation to include alternative therapies into the healthcare system. Type 2 diabetes pandemic levels should encourage lawmakers to focus on an ideal future with therapies that increase quality of life and decrease utility costs of diseases. The Medicare system on the national level could easily put benefits into place like they do Silver Sneakers, accessible to everyone.

The theoretical implications would be to reinforce the conceptual framework for understanding type 2 diabetes in all aspects. CATS (Ursin & Eriksen, 2004), and the psychological stress response (PRS) by Kelly and Ismail (2015) did well at explaining the "why" in causation and progression. The theory of a sense of coherence explained the importance of having good coping skills to lead a resilient life. Literature advancements in the fields of health psychology, CAM, and type 2 diabetes can continue to grow by replicating this study with a larger sample size to further explore the potential of foot reflexology. A biopsychosocial checklist should be developed and a way to implement it. Furthermore, a psychologist can help patients with type 2 diabetes manage their disease by addressing stress, depression, and other psychosocial factors, as mentioned in this study (Massey, et al., 2017).

Conclusion

There are 28.7 million people diagnosed with diabetes and 8.5 million undiagnosed, with another 96 million prediabetic in the United States from the National Diabetes Statistics Report and type 2 diabetes constitutes 90-95% of those numbers

(CDC, 2022). Diabetes health care cost in the United States is $327 billion as of 2017 (ADA, 2022). This is a global pandemic, and a holistic approach should be investigated. A gap in the literature was found in researching the problem of type 2 diabetes and the CAM of foot reflexology. The literature review on type 2 diabetes revealed many psychosocial factors that are plagued by stress that progresses this illness. These same psychosocial factors were also found in the literature on foot reflexology with other illnesses ending with positive results after treatment.

The foundational basis of this study and the conceptual framework was built on three theories: the stress and coping theory, the cognitive activation theory of stress, and the sense of coherence theory. The purpose of this study was to compared type 2 diabetics using foot reflexology to type 2 diabetics not using foot reflexology to see if there was a difference in HbA1c (self-reported), perceived stress, coping ability, and a sense of coherence. The findings from this study were to initiate positive social change by empowering the type 2 diabetic with a means of managing their illness (sense of coherence), which may decrease future complications, and lower societal cost.

The WHO, in April 2021, conducted a Global Diabetes Compact in response to type 2 diabetes global pandemic, that focuses on sustained enhancements for prevention and care as well as supporting low-and middle-income countries. This initiative is to bring together governments, educational institutions, private sector individuals, and altruistic foundations. In May of 2021, the World Health Assembly converged on a Resolution for action in the areas of increasing access and regulatory requirements to insulin, other medicines, health products, and to setup of a web-based tool. The WHO

listed prevention as lifestyle measures. On the national level, in 2010 CDC launched the National Diabetes Prevention Program. By 2017, 50 states were offering DPP-intervention programs and have reached diverse participants with lifestyle behavioral interventions (Ackermann, 2017). Although, I agree that the diet, exercise, weight control, and non-smoking are important to prevent or delay the onset of type 2 diabetes. Perceived stress and the psychological stress response in type 2 diabetics should not be disregarded or overlooked nor should the sense of coherence in managing this illness.

In conclusion, Awad et al. (2018) wrote that global awareness on type 2 diabetes will require that each nation put significance focus on "preventive and therapeutic interventions" and its risk factors (Awad et al., 2018, p. 100). The researchers' concluded that awareness alone does not motivate the individual to make behavioral changes. They suggested, and I agree, that community diabetes screening programs should focus on psychosocial factors like the "environment, social gradient, and cultural norms while engaging in preventive interventions", such as foot reflexology (Cuschieri & Grech, 2019, p. 1739). Furthermore, policymakers should employ coping mechanisms into the healthcare systems that includes biopsychosocial interventions such as foot reflexology which is cost effective and therapeutically sound. Therefore, empowering the type 2 diabetic with a sense of coherence in coping and controlling this illness leading to a better quality of life.

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Appendix A: Permission to Use Modified Biopsychosocial Model

Tesfa Dejenie
Wed 9/4/2019 9:18 AM
To:
Hello Margie,
You can use it with proper citation.

with regards,
Tesfa

On Wed, Sep 4, 2019 at 2:50 PM Margaret Vance <Email> wrote:
Hello.

My name is Margie Vance, and I am a graduate student in psychology at Walden University. I am writing my dissertation on type 2 diabetes and foot reflexology.

I would like to ask permission to be able to use the biopsychosocial model adaptation from your excellent article Comorbidity of depression and diabetes: an application of biopsychosocial model in the International Journal of Mental Health System dated 2016 10:74

Thank you for your swift reply.

Very Grateful
Margie Vance LMT MS

Tesfa D. Habtewold /MSc, C-RN, PhD student/

University of Groningen

University Medical Center Groningen | University Center for Psychiatry | Rob Giel Research Centre

SHARE Research Institute | Life Course Epidemiology

Department of Epidemiology | Digestive System Diseases Unit

Groningen, The Netherlands.

Appendix B: PSS-10 Permission Letter

PERMISSION FOR USE OF THE PERCEIVED STRESS SCALE

I apologize for this automated reply. Thank you for your interest in our work.

PERMISSION FOR USE BY STUDENTS AND NONPROFIT ORGANIZATIONS: If you are a student, a teacher, or are otherwise using the Perceived Stress Scale (PSS) without making a profit on its use, you have my permission to use the PSS in your work. Note that this is the only approval letter you will get. I will not be sending a follow-up letter or email specifically authorizing you (by name) to use the scale.

PERMISSION "FOR PROFIT" USE: If you wish to use the PSS for a purpose other than teaching or not for profit research, or you plan on charging clients for use of the scale, you will need to see the next page: "Instructions for permission for profit related use of the Perceived Stress Scale".

QUESTIONS ABOUT THE SCALE: Information concerning the PSS can be found at https://www.cmu.edu/dietrich/psychology/stress-immunity-disease-lab/index.html **(click on scales on the front page)**. Questions about reliability, validity, norms, and other aspects of psychometric properties can be answered there. The website also contains information about administration and scoring procedures for the scales. Please do not ask for a manual. There is no manual. Read the articles on the website for the information that you need.

TRANSLATIONS: The website (see URL above) also includes copies of translations of the PSS into multiple languages. These translations were done *by other investigators*, not by our lab, and we take no responsibility for their psychometric properties. If you translate the scale and would like to have the translation posted on our website, please send us a copy of the scale with information regarding its validation, and references to relevant publications. If resources are available to us, we will do our best to post it so others may access it.

Good luck with your work.

Sheldon Cohen
Robert E. Doherty University Professor of Psychology
Department of Psychology
Baker Hall 335-D
Carnegie Mellon University
Pittsburgh, PA 15213

Appendix C: SOC-13 Permission Letter

Permission to use the SOC scale is granted through Society for Theory and Research on Salutogenesis (STARS).

I hereby grant permission to use the 13-item version of the Sense of Coherence (Orientation to Life) Questionnaire, originally found in Unraveling the mystery of health: How people manage stress and stay well, by Aaron Antonovsky (Jossey-Bass Publishers, 1987), for use in your study described above. Permission to use the questionnaire for future studies requires a separate permission request.

The permission is granted upon fulfillment of the following conditions:

1. You may not redistribute the questionnaire (in print or electronic form) except for your own professional or academic purposes and you may not charge money for its use. If administered online (on a secured web site only), measures should be taken to insure that (a) access to the questionnaire be given only to participants by means of a password or a different form of limited access, (b) the questionnaire should not be downloadable, and (c) access to the questionnaire should be time-limited for the period of data collection, after which it should be taken off the server or secured web site. Distributing the questionnaire to respondents via email is not permitted.
2. The questionnaire is intended for research purposes only, in a study that has been approved by the relevant Ethics or Helsinki Committee and may not be used for diagnostic or clinical purposes. By "diagnostic or clinical" it is meant that the SOC score cannot be the basis of any kind of physical, mental, cognitive, social or emotional diagnosis, assessment or treatment of the respondent, and cannot direct therapeutic or medical decisions of any kind.
3. You may not reprint the questionnaire in any publication. You may quote 3-4 items as examples with reference to the abovementioned source.
4. The copyright of the Sense of Coherence Questionnaire, in all languages and versions, remains solely in the hands of Dr. Avishai Antonovsky.

By clicking "I agree" you agree to the aforementioned terms and are aware that violating them may be an infringement of international copyright laws.

If possible, please send a copy of any forthcoming paper concerning the study in which the SOC questionnaire has been used to:

STARS Society
Wed 9/23/2020 7:11 AM

Dear Margaret,

Thank you for your email. The permission you obtain by filling out the form before you download the scale. No further permission is required, you are only required to provide a reference for the scale in the reference list of your study.

Best regards,
Martin