THESIS

EXPLORING THE RELATIONSHIP AMONG OCCUPATIONAL FUNCTIONING FACTORS IN ADULTS WITH TYPE TWO DIABETES MELLITUS

Submitted by

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ABSTRACT

EXPLORING THE RELATIONSHIP AMONG OCCUPATIONAL FUNCTIONING FACTORS IN ADULTS WITH TYPE TWO DIABETES MELLITUS

Type two diabetes mellitus (T2DM) is a common diagnosis among the U.S. population, however many individuals struggle to effectively control their glycemic levels. T2DM can have an impact on individuals physically and psychosocially with worse outcomes in low social economic status (SES) populations. Several physical and psychosocial factors have been found to influence self-management behaviors in individuals with T2DM. Researchers have not examined self-efficacy, locus of control (LoC), quality of life (QoL), activity (a set of tasks consisting of goal directed actions), and mood simultaneously to better understand the multitude of factors that can influence diabetes control (HbA1c). Additionally, self-efficacy has not been evaluated as composed of various constructs related to diabetes self-management. The Occupational Functioning Model facilitates conceptualization of: self-efficacy, LoC, QoL, activity, mood, and HbA1c; and their possible relationships.

The primary purpose of this study was to determine the predictor effect of the occupational functioning factors of self-efficacy, LoC, QoL, activity, and mood on HbA1c. The secondary purpose is to determine the predictor effect of the occupational functioning factors of self-efficacy, LoC, QoL, mood, and HbA1c on activity.

Occupational functioning factors were assessed using validated questionnaires. Seventy-six individuals with T2DM who are patients at a safety-net primary care facility participated in the study. Correlational analyses, factor analysis, and hierarchical regression were conducted.

Factor analyses determined that the self-efficacy measure was composed of two constructs related to diet and T2DM management. Several occupational functioning factors were found to have significant and moderate to strong relationships. Self-efficacy for diet (-0.50, $p < 0.001$) and T2DM management (0.24, $p < 0.05$) explained 17.80% variance of HbA1c. Self-efficacy for T2DM management (0.31, $p < 0.01$) and LoC attributed to chance (-0.26, $p < 0.05$) explained 29.4% of the variance in activity.

According to the study results, having a strong sense of self-efficacy for diet predicts better diabetes control in adults with T2DM and low SES. However, participants who perceived a greater ability to recognize when and how to care for T2DM-related problems (self-efficacy for T2DM management) experienced higher HbA1c levels. Adults with strong self-efficacy for T2DM management and low attribution of diabetes outcomes to chance engaged more frequently in activities (including domestic, work/leisure, and outdoor activities). Considering specific aspects of self-efficacy (i.e. diet and T2DM management) seems to be an important area of assessment in determining individuals at risk for poor diabetes control and reduced activity. Future research may explore how T2DM self-management behaviors relate to occupational functioning, and whether they predict HbA1c and activity. Future studies should also determine how circumstances associated with low SES, such as food insecurity and limited healthcare resources, impact the relationship among self-efficacy, LoC, activity, and diabetes control. The results from the present study may be used to inform assessment and intervention in experimental research with the goal to improve self-management behaviors and diabetes control in individuals with T2DM.

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Introduction

Type Two Diabetes Mellitus

The prevalence of diabetes mellitus has been increasing worldwide, with the proportion of the population being diagnosed nearly doubling from 4.7% to 8.5% between 1980 and 2014 (WHO, 2016). Over thirty million adults in the U.S. (9.4% of the population) are diagnosed with diabetes mellitus, and 90-95% of these cases are attributed to type two diabetes mellitus (T2DM) (CDC, 2017). Additionally, T2DM has a detrimental economic impact on individuals, families, health systems, and national economies by way of medical costs, and loss of work hours and wages (WHO, 2016). Recent annual costs of diabetes mellitus in the US have been estimated at $176 billion in direct medical costs, and an additional $69 billion in indirect costs, including disability payment, work loss, and premature death (CDC, 2014). Accordingly, reducing health complications, premature mortality, and health-related costs as a result of T2DM has become a priority (WHO, 2016).

T2DM is a chronic disease that occurs when blood sugar, or glucose, is not well regulated (ADA, 2004; WHO, 2016). This is due to the body's inability to effectively use insulin, a hormone produced by the pancreas that regulates glucose (ADA, 2004; WHO, 2016). This can result in excess glucose in the blood stream, causing serious health problems, including: heart disease and stroke; vision loss; kidney failure; nerve damage; and lower-limb amputation (ADA, 2004; CDC, 2014; Klein & Klein, 1998; WHO, 2016). Effective control of T2DM is essential because consistently high or low levels of blood glucose can increase the risk for health-related complications (CDC, 2014; Klein & Klein, 1998; WHO, 2016). HbA1c is considered the optimal method for measuring glycemic levels, and therefore control of T2DM (WHO, 2016). Management of T2DM (and therefore HbA1c) has generally taken a biomedical and health education approach (CDC, 2014; Siminerio et al., 2006). Patient education aims to improve self-management strategies, or the actions and behaviors an individual takes to control HbA1c, and often focuses on: basic healthy lifestyle choices, and medication management (CDC, 2014; Siminerio et al., 2006). For example, patients may receive brief counseling with health care providers; or patients may be referred outside of the primary care office for general T2DM education delivered to a group in the community (WHO, 2016; Siminerio et al., 2006). However, the conventional self-management approach appears inadequate as achievement of T2DM management goals is reportedly low in primary care settings, where the bulk of diabetes healthcare is delivered (Putzer et al., 2004; Pyatak, 2011). This may be especially true for individuals with low socioeconomic status (SES), due to a greater risk of experiencing poor health, health disparity, and unstable life circumstances (i.e. fewer financial resources, poorer physical environment, sense of helplessness, etc.) (Fritz, 2014; Pyatak et al., 2013). The resulting additional medical and psychosocial challenges may further complicate the diabetes experience, including burden of care and health-related outcomes (Pyatak et al., 2013).

Literature Review

Models and Theories Informing the Present Study

The Occupational Functioning Model. We have chosen to use The Occupational Functioning Model to guide our data analysis and interpretation of our results. According to Latham (2014), the Occupational Functioning Model helps in determining the interrelatedness of a person's: characteristics (i.e. diabetes and its physical and psychosocial impacts); environment; occupation (which are everyday activities that provide meaning and purpose in an individual's life); and quality of life. Many factors within these constructs have been found to impact T2DM, as described below. This model was chosen because it helps to describe and conceptualize an array of factors that contribute to occupational functioning with consideration for physical, psychosocial, and environmental aspects. By using the Occupational Functioning Model approach to guide the following study, we gain an understanding of the bigger picture of many facets involved in living with T2DM.

The factors of the Occupational Functioning Model are intended to guide occupational therapy evaluation and treatment of people with physical impairment to move toward competence in occupational performance and ensuing feelings of self-efficacy and satisfaction (Latham, 2014). Information regarding the various levels of the Occupational Functioning Model can be found in Figure 1. This hierarchical model suggests that people experience greater self-efficacy, self-esteem, and life satisfaction when they are competent in their life roles (Latham, 2014). Successful performance in life roles, and activities strengthen self-efficacy (Latham, 2014). While performance in these roles and activities is dependent on a person's abilities and capacities, which may be impacted by the presence of physiological impairment (Latham, 2014). The Occupational Functioning Model defines context (such as objects, situations, and surroundings) as a factor that enables or inhibits occupational functioning through interactions between people and their surroundings. Latham (2014) theorizes that the hierarchical structure of the Occupational Functioning Model implies that status at one level (i.e. organic substrates) is related to status at another level (i.e. self-efficacy), and this is strongest when levels are adjacent. The metaphor of a chain has been used to describe the causal relationship among factors, in which one link leads to the next (e.g. higher life satisfaction is usually related to better activity performance, but it is not directly related to physical impairment) (Dijkers, 1999; Latham, 2014).

We define "occupational functioning" consistent with the Occupational Functioning Model presented by Latham (2014), as factors that comprise a person's sense of self-empowerment for his/her performance in life roles, activities, and tasks that are impacted by their abilities, capacities, and physiological well-being. For the purpose of this research, occupational functioning is a construct that follows a hierarchy guided by Occupational Functioning Model ideology, and consists of the factors of: self-efficacy; locus of control (LoC); quality of life (QoL); activity (a set of tasks consisting of goal directed actions); mood; and diabetes control, for individuals in the context of low SES. Our conception of the occupational functioning hierarchy can be found in Figure 1, and depicts the following order of occupational functioning factors. Self-efficacy, found at the top of the model, is the self-perception that one can successfully carry out a behavior to achieve a desired outcome. LoC follows self-efficacy in the hierarchy, as it is indicative of a person's sense of empowerment or control in life situations. QoL is a person's satisfaction with his physical, social, and emotional well-being. Next, activity represents the frequency of everyday activities within the context of daily life, at home and in the community (Pyatak, 2011). Mood indicates symptoms associated with depression and anxiety as influencing abilities and skills during interactions with the physical and social environments (Latham, 2014). Last, diabetes control is indicated by HbA1c, a physiological marker of T2DM.

Modified Social Learning Theory. The Modified Social Learning Theory is also a useful theory when studying T2DM self-management. Modified Social Learning Theory states that the potential for an individual to engage in health-related behaviors (such as T2DM self-management) is the result of the interaction between the value a person places on his health, and perceived control over health (Nugent et al., 2016; Wallston et al., 1992). Perceived control over health is composed of health-related self-efficacy and health-related locus of control. Modified Social Learning Theory proposes that individuals will experience better health-management behavior if they believe the following: first, the individual's own health-related behavior determines his health outcomes; second, the individual is capable of doing the behavior; and third, having good health is important (Nugent et al., 2016; Wallston et al., 1992). This theory helps to inform the relationship between self-efficacy and LoC, and therefore helped us understand and interpret our results for these factors.

While the occupational functioning factors we studied (self-efficacy, LoC, QoL, activity, mood, and HbA1c) have been studied in diabetes-related literature, there have been inconsistencies regarding the role of these factors in explaining diabetes control in the research findings, and most of these studies have not been conducted in a population with low SES. Occupational functioning needs to be examined because there are negative health consequences (i.e. poor control of blood glucose), associated with an array of constructs (i.e., self-efficacy, LoC, mood, and environmental stress) that could be studied in relation to each other using a structured multi-factorial model like the Occupational Functioning Model (Anderson, Freedland, Clouse, & Lustman, 2001; Besen, Günüşen, Sürücü, & Koşar, 2016; Delamater et al., 2001;

Nugent & Wallston, 2016). However, the Occupational Functioning Model has not previously been employed to study the inter-relatedness and predictive strength of a variety of occupational functioning constructs on T2DM self-management. Furthermore, to our knowledge, no researchers have looked at the predictive relationship of this specific set of factors in predicting HbA1c in a population with low SES. In the following sections, we will define the occupational functioning factors included in this study, and discuss the existing research.

Previous Research Relating T2DM and Aspects of Occupational Functioning

Implications of T2DM may not only impact physiological outcomes (e.g. stroke, heart disease, vision loss, etc.), but also several aspects of occupational functioning (Delamater et al., 2001; Fritz, 2014). Researchers suggests that T2DM self-management is more psychologically and behaviorally demanding than other chronic medical conditions (Cox, & Gonder-Frederick, 1992; Ciechanowski, Katton & Russo, 2000). This is likely due to the burden of T2DM treatment or self-management, including: monitoring of glycemic levels multiple times throughout the day; the recommendation for lifestyle modifications (i.e. diet and exercise); as well as medical complications that can result from poor self-management of T2DM (i.e. heart disease, stroke, neuropathy, etc.). Furthermore, patients who perceive greater burden associated with treatment for managing glucose levels are less likely to adhere to treatment recommendations, including pharmacological and non-pharmacological (i.e. diet) recommendations (Vijan, Hayward, Ronis, & Hofer, 2005).

Researchers show that individuals with T2DM who experience challenges associated with psychosocial aspects of occupational functioning (self-efficacy, LoC, and mood) are also more likely to experience negative health and behavioral effects associated with T2DM (Anderson, Freedland, Clouse, & Lustman 2001; Ciechanowski, Katon, Russo, & Hirsch, 2003; Delamater et al., 2001; Rubin & Peyrot, 1999). For example, individuals experience: poorer physical and mental functioning (Ciechanowski, Katon, Russo, & Hirsch, 2003); an increased risk for poor glycemic control and medical complications associated with T2DM (Ciechanowski, Katon, Russo, & Hirsch, 2003; Delamater et al., 2001); inadequate adherence to medication regimen, diet and exercise; and reduced QoL (Delamater et al., 2001). Nugent & Wallston (2016) found that the simultaneous occurrence of low self-efficacy and an internal LoC is associated with having the fewest diabetes self-management behaviors, which are often indicative of diabetes control. Surprisingly, the reverse did not hold true, as individuals with high levels in the two constructs did not necessarily possess the highest diabetes self-management behaviors. The relationship among these factors of occupational functioning and self-management behavior could potentially result in both short-term and long-term T2DM-related complications (Rubin and Peyrot, 1999; Polonsky et al.,1995). For example, self-efficacy and mood impairments can impact diabetes self-management to the extent that health and QoL may suffer (Rubin & Peyrot, 1999).

Psychosocial-related factors within occupational functioning, particularly depression, are also stronger predictors of hospitalization and mortality compared to physiologic and metabolic measures of T2DM management (Davis, Hess, & Hiss, 1988; Rubin & Peyrot, 1999). This indicates that HbA1c, the usual standard for determining diabetes severity and control, may not be the best measure, or warning sign, of an individual in need of self-management support (Davis, Hess, & Hiss, 1988). Therefore, adults with chronic conditions, like T2DM, who are at risk for decline in health and well-being, should be identified by other means (Seeman & Chen, 2002). Although these previous studies have explored links between aspects of occupational functioning and T2DM self-management, there are inconsistencies in the literature regarding some factors, like self-efficacy and LoC, in explaining health behavior, and diabetes control (Nugent and Wallston, 2016).

Self-efficacy. Self-efficacy is the “conviction that one can successfully execute the behavior required to produce the outcomes” (Bandura, 1977, p. 193). Behavior is influenced by self-efficacy in several ways: if an individual believes that she has the capacity to follow a course of actions to achieve a certain outcome, she is more likely to follow that course (Bandura, 1977). Bandura hypothesized that level of self-efficacy can predict whether an individual will initiate coping behaviors, the amount of effort she will put forth, and how long she will persist in the face of aversive experiences (Bandura, 1977). Accordingly, individuals with T2DM who have strong self-efficacy may be more likely to persist in efforts to self-manage their T2DM and meet health recommendations (i.e. healthy HbA1c levels).

Ratzon, Futeran, & Isakov (2010) found that self-efficacy predicted performance in instrumental activities of daily living (IADL) and work participation in individuals with T2DM. More specifically, a low portion of participants worked, and this was suggested to be attributed to insufficient feelings of control over their T2DM (Ratzon, Futeran, & Isakov, 2010). Similarly, Williams and Bond (2002) found that self-efficacy was positively associated with increased self-care performance in diet, exercise, and blood glucose testing. Interventions that incorporate strategies for behavior change and self-empowerment have resulted in improved self-efficacy and self-care behaviors, which consequently improved glycemic control, and reduced diabetes-related hospitalizations and healthcare costs (Delamater et al., 2001).

In a study of 107 adults with T2DM who were insulin-dependent, Nugent and Wallston (2016) found a significant correlation between diabetes self-efficacy and diabetes self-management behaviors. Their research suggests that individuals with high self-efficacy regarding their T2DM are more likely to self-report healthy behaviors, including following a T2DM specific diet, testing blood glucose, exercising and caring for their feet regularly (Nugent & Wallston, 2016). Additionally, participants with low levels of diabetes self-efficacy were more likely to have poor control of their diabetes, as indicated by HbA1c levels (Nugent & Wallston, 2016).

Given that self-efficacy is a broad construct, our study will add to current literature as we intend to explore specific areas of self-efficacy of T2DM self-management including diet and T2DM management. This is important to understand, because having a strong sense of self-efficacy for particular T2DM self-management areas may have varying effects on HbA1c. Additionally, having a greater understanding of the relationship between aspects of self-efficacy, occupational functioning, and diabetes control may help therapists choose assessments to target individuals with low self-efficacy, who are at risk for poor diabetes control. This study also explored the relationship between self-efficacy and frequency of participation in daily living activities, which have been suggested to potentially impact diabetes control (Garvey, Connolly, Boland, & Smith, 2015; Hwang, Truax, Claire, & Caytap, 2009). Studying this relationship, in a population with low SES may elucidate differences in the effects of particular aspects of self-efficacy, given the occupational disadvantages associated with this population (Fritz, 2014).

Locus of control. LoC is the degree to which a person perceives that a reward or consequence is the result of, or is dependent on her own behavior and attributes, as opposed to the reward or consequence of being controlled by forces outside and independent of herself (Rotter, 1966). External LoC manifests when the reinforcement or consequence follows an individual's action but is not entirely contingent upon this action, and is attributed to luck, chance, fate, or due to the control of powerful others (Rotter, 1966). Conversely, an individual is presumed to have an internal LoC if she attributes outcomes of an event to be the result of her own behaviors or characteristics (Rotter, 1966).

Besen, Günüşen, Sürücü, and Koşar, (2016) studied the effects of LoC on self-care activities and HbA1c levels in individuals with T2DM. Results indicated the following: participants age 65 years and older tended to have greater internal LoC compared to younger participants; men were significantly more likely to have higher internal LoC scores; individuals with comorbid chronic disease were more likely to have higher internal LoC scores; and there was a significant difference in LoC scores depending on the method of diabetes treatment, with those who use insulin having more internal LoC (Besen, Günüşen, Sürücü, & Koşar, 2016). There was a weak, but statistically significant relationship that suggested that with stronger internal LoC, individuals self-report better adherence to a diabetes regimen, particularly within the self-care subdomains of diet, exercise, and blood sugar testing (Besen, Günüşen, Sürücü, & Koşar, 2016). These are contrary to results from a study by Nugent and Wallston (2016), who found that high internal LoC was not correlated with diabetes self-management behavior. However, low internal LoC was associated with self-management behavior, and was possibly mediated by how much a patient values their health (Nugent and Wallston, 2016). Therefore, individuals with low internal LoC who do not value health may be at risk for poor regimen adherence and health-related behaviors (Nugent and Wallston, 2016; O'Hea et al., 2005). Studies also indicated that there was no direct relationship found between LoC and HbA1c levels (Besen, Günüşen, Sürücü, & Koşar, 2016; Nugent and Wallston, 2016).

Although LoC may not influence health-related behavior directly, the interaction among internal and external LoC, as well as with other variables may be better predictors of self-management ability (O'Hea et al., 2005). LoC very likely could be associated with other occupational functioning factors, such as self-efficacy, that have been shown to be related to self-management abilities, and therefore diabetes control. This study intends to further explore this relationship in order to determine how LoC relates to diabetes control when considering other occupational functioning factors. There currently is limited research on external LoC. Given that researchers have found inconsistent results regarding the impact of high and low levels of internal LoC on T2DM self-management, this study intends to determine whether external LoC is a better indicator of diabetes control. Knowing this information can help therapists understand possible underlying causes for poor self-management to inform assessment choice and develop targeted interventions.

Quality of life. QoL is a person's perception of his physical, emotional, and social well-being with consideration for cognitive and emotional influences (Rubin & Peyrot, 1999). Health-related quality of life (HR-QoL) specifically considers a person's subjective health as determined by his/her self-perception of health and satisfaction with life (Wandell, 2005; Rubin & Peyrot, 1999). This includes the impact of an individual's health status, diagnoses, and other health-related factors. QoL is an important factor to consider when discussing an individual's health status, possible interventions and health outcomes (Rubin & Peyrot, 1999).

A review of articles on HR-QoL found that individuals with T2DM reported several differences in HR-QoL when compared to individuals without diabetes (Wandell, 2005). Lower levels of HR-QoL were most strongly associated with a comorbid diagnosis of macrovascular disease, particularly coronary heart disease, and non-vascular disease (Wandell, 2005). Individuals with psychotic disorders, specifically depression, were also at risk for poorer HR-QoL, whereas individuals with good continuity of care experienced higher levels of HR-QoL (Wandell, 2005). These findings indicate that although QoL is jeopardized in people with

T2DM, given that this population is more likely to experience comorbid conditions and mood disturbance, there are known supports (i.e. good continuity of care) to improve poor QoL.

Several factors commonly associated with a diagnosis of T2DM have been attributed to influencing QoL. First, diabetes-related complications and the burden of care associated with diabetes threatens HR-QoL in individuals with T2DM (Rubin & Peyrot, 1999; Wandell, 2005). Conversely, individuals with better glycemic control tend to have higher QoL, as poor glycemic control is frequently a precursor for diabetic complications, including heart disease and vision loss (Rubin & Peyrot, 1999; CDC, 2014; WHO, 2016). Additionally, individuals who have the ability to control glycemic levels may experience lower levels of stress and negative psychosocial impacts (i.e. self-efficacy, depression, etc.) associated with burden of care, and therefore have higher levels of QoL. QoL appears to influence several factors within occupational functioning. However, there is inconclusive evidence as to whether T2DM itself directly causes disturbances in QoL.

According to the Occupational Functioning Model, impaired QoL can negatively impact self-care (which would include diabetes self-management). To this end, patients with low QoL may exhibit poorly controlled HbA1c. This study will determine if that is the circumstance. This study will also investigate how QoL in this population relates to other factors of occupational functioning in individuals with T2DM, as this has not previously been studied. Garnering information about this relationship may give light to how people with T2DM can gain a better self-perception of their well-being, despite their illness.

Activity. T2DM may not only have consequences on physiological factors, but also on occupational functioning (Delamater et al., 2001; Fritz, 2014). Generally, activity is considered as a set of tasks consisting of goal directed actions (Latham, 2014). Occupational therapy is founded in the belief that engagement in occupation, or meaningful activities, is a source of health promotion; and lack of engagement or unhealthy engagement in occupation is a source of health-related problems (Backman, 2010; Hocking, 2014). T2DM can, potentially, result in an inability to engage in meaningful occupations. There are significant time demands associated with T2DM self-management related to planning, preparing and organizing daily activities while accounting for T2DM care, such as: following a healthy diet; checking blood glucose; exercising, taking medications; and managing the psychological impact of the disease (Fritz, 2014). Additionally, disease management is embedded within daily activities, with the individual needing to make disease-related decisions and carry out self-management activities in the context of everyday life (Pyatak, 2011).

Understandably, T2DM self-management tasks can affect an individual's ability to engage in meaningful daily activities, and vice-versa. A study of low-income women found that routines, particularly daily habits and life situations, must be changed in order to better support diabetes self-management, including the participants' ability to develop better self-management skills (Fritz, 2014). Individuals with more stable, predictable, and balanced daily routines report less T2DM self-management burden (Fritz, 2014). Structuring of time use throughout the day impacts individuals' ability to develop skills and tend to diabetes self-management needs. In addition to time restraints, participation in daily activities (i.e. work) can impact the availability of resources needed for effective diabetes self-management (i.e. money for healthy meals, transportation to/from the grocery store or pharmacy, etc.) (Fritz, 2014). Community dwelling older adults with diabetes may also be at risk for decreased participation in daily activities and less balanced routines, as they report experiencing the greatest functioning difficulties in the areas of work and leisure (Hwang, Truax, Claire, & Caytap, 2009). Furthermore, individuals with T2DM and another chronic condition are more likely to experience overall lower levels of functioning, financial problems, challenges in work performance, limitation in leisure and social activities, and more frequent healthcare utilization (Garvey, Connolly, Boland, & Smith, 2015).

Given its potential to affect several areas of daily functioning, we must better develop our understanding of the relationship between T2DM and occupational functioning, and its impact on activity. This study aims to further elucidate this relationship. As previously described, individuals with T2DM are at an increased risk to encounter problems related to psychosocial aspects of occupational functioning (Delamater et al., 2001; Fritz, 2014). Therefore, knowing how occupational functioning can additionally affect an individual's ability to self-manage their disease and participate in meaningful daily activities is important. Individuals with impaired occupational functioning in areas of self-efficacy, QoL, mood, etc., may represent a population facing even greater challenges as a result of limited ability to participate in their daily lives (i.e. home-management, work, leisure, etc.). Also, this study will add to the existing research on the relationship between occupational functioning and diabetes control in a low SES population.

Depression and anxiety. There is a higher prevalence of depression and anxiety in adults with T2DM as compared to those without diabetes (Delamater et al., 2001; Peyrot & Rubin, 1997). In a study of 702 adults with T2DM, Golden et al. (2017) found that 13.9% of participants were experiencing or had previously experienced minor depressive disorder; and 17% were experiencing or had previously experienced major depressive disorder. Anderson, Freedland, Clouse, & Lustman (2001) reported that individuals with diabetes are twice as likely to also experience comorbid depression as compared to a non-diabetic comparison group. Additionally, there is a high co-occurrence of anxiety disorders among individuals with T2DM and depression (Golden et al., 2017). Forty-two percent of individuals who currently meet criteria for minor depressive disorder also experience anxiety; and 8.1% of individuals who currently meet criteria for major depressive disorder also experience anxiety (Golden et al., 2017).

The presence of depression may impact an individual with T2DM behaviorally and physiologically in a manner that affects their ability to control glycemic levels (Anderson, Freedland, Clouse, & Lustman 2001). Delamater et al., (2001) found that individuals with T2DM who met criteria for depression and anxiety demonstrated poorer glycemic control. Depression is also associated with hyperglycemia and greater risk for secondary complications, while treating depression has led to improved glycemic control (Anderson, Freedland, Clouse, & Lustman, 2001). However, some researchers have found inconclusive evidence as to whether depression and anxiety are directly associated with glycemic control. For example, Golden et al, (2017) report that HbA1c levels were not significantly different among individuals with minor depressive disorder, major depressive disorder, and no depressive disorder. Similarly, in a meta-analysis there was variation among studies regarding the effects of anxiety on treatment compliance, resulting in an unclear relationship between the two factors (DiMatteo, Lepper, & Croghan, 2000). Given the variation in research outcomes, the relationship between depression and anxiety, and diabetes control is unresolved thus far. Our study intends to clarify this relationship, and add to the literature by studying a low SES population.

Depression and anxiety in individuals with T2DM are also associated with other health-related complications and increased functional impairments (i.e. home management, community mobility, medication management, etc.) (Lyness et al., 1999). One in three individuals with diabetes experiences depression to the extent that functioning, QoL, adherence to medical regimen, glycemic control, and health outcomes may be impaired (Anderson, Freedland, Clouse, & Lustman 2001). DiMatteo, Lepper, & Croghan, (2000) hypothesize that individuals with mood disorders, including anxiety and depression, who experience secondary effects such as lack of cognitive focus, energy, and motivation, may simultaneously display less inclination and/or ability to adhere to medical and health recommendations. This was supported by a study that found individuals with T2DM and depressive symptoms were more likely to experience low adherence to diet and exercise recommendations, more impaired physical functioning, and report more negative symptoms associated with diabetes, such as polyuria, fatigue, and blurred vision (Ciechanowski, Katon, Russo, & Hirsch, 2003).

These functional and health related complications can have confounding effects on individuals with T2DM, as the probability of experiencing depression or anxiety significantly increases as the number of diabetes-related complications increases (Peyrot & Rubin, 1997). Researchers conducted a study with Irish adults who were age 50 years and older. They found that multi-morbidity, including a diagnosis of T2DM, was a significant predictor of depression (Foran, Hannigan, & Glynn, 2015). Additionally, as the number of conditions increased so did the likelihood of depression (Foran, Hannigan, & Glynn, 2015). Patients with poorly controlled T2DM were more likely to have mild depression than individuals with well-controlled T2DM (Foran, Hannigan, & Glynn, 2015). The incidence of depression, especially when co-occurring with multiple chronic conditions, may indicate that an individual with T2DM is at risk for poor compliance with medication, diet, and exercise recommendations, (DiMatteo, Lepper, & Croghan, 2000).

As the above-described research indicates, individuals with T2DM are at an increased risk for depression and anxiety, and having this dual diagnosis can have negative consequences on health and functioning. However, the implications of this dual diagnosis on occupational functioning are not well defined in individuals with T2DM. Understanding this information can inform occupational therapy assessment. This study will look more specifically at components of occupational functioning in individuals with T2DM, and their relationship with depression and anxiety.

Purpose of this Study

Research often focuses on intervention outcomes related to glycemic control and other physiological measures (Delamater et al., 2001). However, as previously described, occupational functioning factors may be better predictors of health and well-being in individuals with T2DM than physiological markers (Delamater et al., 2001; Fritz, 2014). Therefore, the purpose of this study is to offer a more complete picture of living with T2DM, by assessing a variety of occupational functioning factors, that may relate to diabetes control when living in low SES. Understanding strengths and challenges in these areas may be indicative of an individual's capacity and motivation to achieve better diabetes control and health-related outcomes. No study has examined the interaction between occupational functioning (as composed of: self-efficacy; LoC; QoL; activity; and mood) and HbA1c. With such information, we can potentially identify individuals at risk for poor T2DM control, by determining areas in which they are experiencing impairment within occupational functioning. The information gathered can inform important areas for assessment that are not a part of usual practice when working with individuals with T2DM. Furthermore, this study is unique in that we worked specifically with individuals with T2DM who are of low SES. This will add to existing research about disadvantaged populations with T2DM who are at an increased risk for poor disease management (Pyatak et al., 2013). This is important in order to identify additional reasons (i.e. occupational functioning) for poor health and the decreased ability to self-manage chronic conditions associated with this population (Pyatak et al., 2013).

To achieve these goals, this study explored the relationship among occupational functioning factors and HbA1c in adults with T2DM and low SES. These factors were measured through a battery of well-established assessments. Assessments measured: self-efficacy, LoC, QoL, participation in daily activities, depression and anxiety, and HbA1c. The study aims to do the following: 1) Explore the relationship among occupational functioning factors (self-efficacy, locus of control, quality of life, activity, mood, and diabetes control) in individuals with T2DM, and low SES. 2) Determine if occupational functioning factors predict HbA1c in individuals with T2DM, and low SES. 3) Determine if occupational functioning factors predict activity in individuals with T2DM, and low SES.

Hypotheses

In regards to the first aim of the study, this is an exploratory hypothesis to see what relationships will exist between variables. Also, in concurrence with the Occupational Functioning Model, we would like to see if adjacent levels of occupational performance will have stronger relationships than non-adjacent levels. We predict that the outcomes of the analyses conducted to answer the second research question will demonstrate that the factors within the highest levels of occupational functioning and the neighboring level (i.e. mood) will best predict HbA1c as compared to other levels. Last, we predict that the outcomes of analyses conducted to answer the third research question will demonstrate that the factors within the highest levels of occupational functioning and the neighboring levels (i.e. quality of life and mood) will best predict activity as compared to other levels.

Methods

This study is a quantitative correlational research design of data collected in a cross-sectional study. This study investigated the relationship among occupational functioning factors and HbA1c in people with T2DM, as a component of a larger diabetes management research project (Taking on Diabetes to Advance You; TODAY). The TODAY investigation entails administration of a comprehensive battery of assessments to participants with T2DM in order to gather information regarding psychological and cognitive factors, daily activities, and health (See Table 1 for assessments used and their properties). The current study examined the relationship among variables of occupational functioning and how the variables interact with diabetes control in this population.

The TODAY project was conducted at the University of Colorado Health Family Medical Center (UCHealth-FMC), which is a safety-net primary care facility, i.e. it serves individuals who are at or below the poverty level and/or are under-insured or un-insured. A convenience-sample of 93 participants was recruited from UCHealth-FMC by medical staff working with patients with T2DM. Participants were then referred to Colorado State University occupational therapy research assistants for assessment.

Participants were included in the TODAY study if they met the following criteria: (1) diagnosed by a physician with T2DM; (2) aged 18 years and above; and (3) a patient at UCHealth-FMC. Participants were excluded if they met any of the following: (1) below sixth grade reading level, (2) unable to understand written or verbal instructions regarding questionnaires, and (3) non-English speaking. Further inclusion criteria for the present study was availability of HbA1c markers available in medical records.

This study was approved by the Institutional Review Board (IRB) of Colorado State University, as well as the IRB of UCHealth. All participants provided written informed consent.

Procedures and Measures

Following consent, participants completed questionnaires designed to assess mood, health-related self-efficacy, health-related LoC, health-related QoL, daily activities, and health status. Data were gathered in a quiet exam room at UCHealth-FMC. Participants were given 10 questionnaires to complete, including: the Diabetes Self-Efficacy Scale; the Multidimensional Health Locus of Control (MHLC); the World Health Organization Quality of Life Assessment – Brief Version (WHOQOL-BREF); the Frenchay Activities Index (FAI); and the Hospital Anxiety and Depression Scale (HADS). Some participants were unable to complete the assessments on their own, i.e. due to health related or other issues (i.e. visual impairments), in which case assessments were verbally administered by the research assistant. All personal identifying data was removed prior to analysis. Participants who completed the study received a $25 stipend.

Self-efficacy. Health related self-efficacy was measured using The Diabetes Self-Efficacy Scale (Lorig, Ritter, Villa, & Armas, 2009). This is an eight item self-report questionnaire that measures how confident a person feels doing certain activities that pertain to diabetes self-management. For example, confidence is rated regarding: choosing and preparing T2DM appropriate meals; exercising; controlling and monitoring blood sugar; and engaging in meaningful activities despite T2DM. Participants rate their answers on a ten-point scale with one being not confident at all and ten being totally confident. The score of the scale is the mean of the eight items. This measure has demonstrated strong internal consistency ($\alpha = .85$) and test-retest validity ($r = .80$) (Lorig, Ritter, Villa, & Armas, 2009).

Locus of control. Health-related locus of control was measured using The MHLC. Health locus of Control is used to describe where a person's control over their health is situated (Wallston, Stein, & Smith, 1994). A person has an internal locus of control if they believe they have control over their health, whereas an external locus of control is associated with the actions of others or chance. Eighteen items are measured on a six-point scale to determine whether participants attribute their ability to control their health to others/surroundings or to themselves/their own actions. LoC is assessed by whether control is attributed to: internal, chance, and powerful others (i.e. doctors). The assessment may be adapted to use regarding any health or medical condition, and data that informed the initial validation of the measure included patients with diabetes. The MHLC has demonstrated good internal consistency within each of the four domains (α = .70 - .87) (Wallston, Stein, & Smith, 1994). Additionally, the measure has shown good construct validity and concurrent validity (Wallston, Stein, & Smith, 1994).

Quality of life. WHOQOL-BREF was used to measure health-related quality of life. The unabbreviated assessment measures "an individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards and concerns" (WHO, 1998, p. 1570). These constructs can be influenced by the individual's physical and psychological health, level of independence, social relationships, and the environment (WHO, 1998). The abbreviated version contains twenty-six items that are scored on a five-point Likert scale. The items produce scores in four domains: physical health, psychological health, social relationships, and environment (WHOQOL Group, 1998). The WHOQOL-BREF has shown good internal consistency (α = .66-.84), as well as good discriminant validity, construct validity, and test-retest reliability (WHOQOL Group, 1998). The measure has been used in research on patients with T2DM and has been validated with this population (Rose et al., 2002).

Activity. The FAI is a 15-item measure that has been used to indicate functional status by measuring frequency of participation in IADLs (Schuling, de Haan, Limburg, & Groenier, 1993). Self-report is used to determine activity level at home and outside of the home. The FAI provides a single summary score, as well as three sub-category scores, including domestic, leisure/work and outdoors. The FAI was initially formulated to measure functional status in stroke patients, however it has been used in research with a range of patient populations, including adults with chronic conditions (Garvey, Conolly, Boland, & Smith, 2015; O'Toole, Connolly, & Smith, 2013). Among the stroke patient population, The FAI has demonstrated substantial internal consistency (α = .83) and criterion and construct validity (Schuling, de Haan, Limburg, & Groenier, 1993). Additionally, the FAI has shown to have good test re-test reliability (r = .96) in the general population age 16 and older (Turnbull et al., 2000).

Mood. Mood was assessed using the HADS. The HADS is a self-report questionnaire used to screen for the presence and severity of anxiety and depression (Foran, Hannigan, Glynn, 2015; Snaith, 2003). The HADS consists of 14 items, seven within the anxiety subscale (HADS-A) and seven within the depression subscale (HADS-D), with the later focusing particularly on anhedonia (Snaith, 2003). Each question is answered on a four-point scale (0-3), contributing to a possible 21 points within each domain. Outcomes, as measured by total score within each domain, fall within a range of normal, mild, moderate or severe anxiety/depression. The HADS has been established as a valid and reliable measure in hospital settings with somatic and psychiatric patients, as well as in primary care patients and the general population (Bjelland, Dahl, Haug, & Neckelmann, 2002; Snaith, 2003). The HADS-D and HADS-A have demonstrated good to very good concurrent validity (r = .60 and .80 respectively) in relation to several anxiety and depression questionnaires, including Becks Depression Inventory, Spielberger's State-Trait Anxiety Inventory, Clinical Anxiety Scale and Symptom Checklist-90. Internal consistency (HADS-A α = .80-.93 and HADS-D α = .81 - .90) is also moderate to strong (Herrmann, 1997).

Diabetes control. Diabetes control was determined by HbA1c, a physiological marker of T2DM. HbA1c is the optimal method for measuring glycemic levels, and therefore diabetes control, in T2DM (WHO, 2016). This is measured as a percentage that indicates the concentration of blood glucose over the previous 2-3 months (Cox, & Gonder-Frederick, 1992; WHO, 2016). Recommended levels should be at or below 7% (ADA, 2017; Cornell, 2017). The HbA1c level of greater than 7% indicates impaired fasting glucose and is the usual goal cutoff point, and therefore will be used as the threshold for impaired control (ADA, 2017; Cornell, 2017; Inzucchi et al., 2015). HbA1c was collected from patient medical charts.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS version 24.0 statistical software (IBM, 2016). Descriptive statistics, including mean and standard deviation; and frequency and proportions, were used to report the demographic information of the population (See Table 2 for information on participant characteristics). Descriptive statistics, including mean with standard deviation were used to report data for the occupational functioning outcome measures (See Table 3 for descriptive statistics on occupational functioning measures). Due to concerns regarding the normality of the data, Z scores were computed for all variables to check for outliers. Participants with a Z score greater than 3.29 on any of the occupational functioning measures were removed from the data set (n = 1). Participants who did not complete all occupational functioning measures were also excluded from the sample (n = 2). Some participant's did not have HbA1c scores available in their medical records and therefore these individuals were removed from the sample (n = 14). The resulting sample size was 76.

A factor analysis was conducted to determine the internal consistency of the items within the diabetes self-efficacy measure. See Figure 2 for more information on the components of self-efficacy adapted from the Diabetes Self-Efficacy Scale. We conducted a factor analysis because several items within the assessment report on similar constructs (i.e. ability to manage diet). Being that we used hierarchical regression to analyze the data, reducing the number of factors entered into the model lower the chances of overfitting the model given the sample size (n = 76). Additionally, previous researchers have studied self-efficacy as a broad construct. By conducting a factor analysis we could analyze specific aspects of self-efficacy to more definitively inform future assessment and intervention areas. Items one through four on the diabetes self-efficacy measure (see Figure 2) were found to be related and pertain to an individual's perception of their ability to carry out diet and exercise related behaviors for T2DM self-management. In a test of reliability, these four items had acceptable reliability (Cronbach alpha = .743), while removing item four resulted in good reliability (Cronbach alpha = .802). Therefore, component one, self-efficacy for diet, is composed of questions one through three, all of which pertain to an individual's perception of their ability to carry out diet related behaviors for T2DM self-management. Items six and seven were related and pertain to an individual's perception of their ability to recognize how to care for T2DM-related problems. In a test of reliability, items 6 and 7 had good reliability (Cronbach alpha = .865). Therefore, component two, self-efficacy for T2DM management, is composed of questions six and seven. The remaining items on the diabetes self-efficacy measure did not demonstrate internal consistency, and therefore were not included in the study. These items were concerning: preventing blood sugar drops during exercise; and preventing T2DM from interfering with activities.

Answers to the first primary research question regarding the relationship among occupational functioning factors in individuals with T2DM, and low SES was determined using relational statistics, reported as correlation coefficients. A Pearson correlation was used to determine the association among scores on each of the occupational functioning measures: the Diabetes Self-Efficacy Scale, MHLC, WHOQOL-BREF, FAI, HADS, and HbA1c). Significance was set at α=.05. We consider a correlation of $r = 0.1$ to 0.29 to be weak; $r = 0.3$ to 0.49 to be moderate; and $r = 0.5$ to 1.0 to be strong (DePoy & Gitlin, 2015).

In order to answer the second research aim, a hierarchical linear regression model was applied to the assessment data to determine the extent to which the factors that compose occupational functioning (self-efficacy, LoC, QoL, activity, and mood) predict the criterion variable, diabetes control (HbA1c). The predictor variables were entered into the model in blocks using a top-down approach, as described by Latham (2014). We believe that the strongest predictors of HbA1c will be those at the top of the Occupational Functioning Model. Therefore, a hierarchical regression is appropriate given that the strongest predictor is put in the equation first, followed by additional variables in a stepwise order to be tested as contributing to additional variance in explaining the criterion variable beyond what has already been explained by the previous variables. Using the top down approach, factors that compose each variable (self-efficacy, LoC, QoL, activity, and anxiety and depression) were entered into the regression using this stepwise process. On the first hierarchical level the factors of the Diabetes Self-efficacy Scale were entered (self-efficacy for diet and self-efficacy for T2DM management). On the second through fifth hierarchical levels the domains of each assessment were entered in the following order: the MHLC (LoC chance, LoC internal, and LoC significant others); the WHO-QoL (QoL physical health, QoL psychological health, QoL social relationships, and QoL environment); the FAI (participation in domestic activities, participation in work/leisure activities, and participation in outdoor activities); and the HADS (anxiety and depression). Significance was set at $\alpha = .05$.

To answer the secondary research aim, the same hierarchical regression approach was used. The criterion variable was activity, as determined by total score on the FAI. Predictor variables were entered using the top down approach according to the Occupational Functioning Model (Trombly Latham, 2014). On the first hierarchical level the factors of the Diabetes Self-efficacy Scale were entered (self-efficacy for diet and self-efficacy for T2DM management). On the second through fifth hierarchical levels the domains of each assessment were entered in the following order: the MHLC (LoC chance, LoC internal, and LoC significant others); the WHO-QoL (QoL physical health, QoL psychological health, QoL social relationships, and QoL environment); the HADS (anxiety and depression); and HbA1c. Significance was set at $\alpha = .05$.

Results

The 76 participants were average age 58.7 years with approximately equal numbers by gender. The majority of participants were white (89%) and non-Hispanic (71%). Participants on average had three comorbid conditions and were taking nine medications. The majority of our sample population had higher than normal body weight, with 31.6% considered to be over the normal weight, and 57.9% considered to be obese, as indicated by their body mass index (a weight to height index commonly used to classify overweight or obese status) (WHO, 2017) . See Table 2 for more information on participant characteristics.

The bivariate correlations among assessment variables of adjacent levels of performance according to the Occupational Functioning Model can be found in Table 4. As Table 4 shows, among the occupational functioning measures, diabetes self-efficacy for diet and T2DM management correlated significantly and moderately strong with QoL for physical(r = 0.36, 0.36 respectively), psychological (r = 0.35, 0.45 respectively), social relationships (r = 0.30, 0.33 respectively), and environment (r = 0.34, 0.32 respectively) domains in a positive direction. Whereas, self-efficacy for diet and T2DM management correlated significantly and moderately strong with anxiety (r = -0.23, -0.38 respectively) and depression (r = -0.40, -0.49 respectively) in a negative direction. Self-efficacy for T2DM management demonstrated a moderately strong, significant, and positive correlation with activity(r = 0.43). QoL for physical (r = 0.41), psychological (r = 0.39), social relationships (r = 0.32), and environment (r = 0.35) domains also tended to be significantly and positively correlated with total activity with moderately strong relationships, while QoL was negatively correlated with mood, with QoL for physical (anxiety: r = - 0.60, depression: r = - 0.60), psychological (anxiety: r = - 0.63, depression: r = - 0.74) and environment (anxiety: r = - 0.49, depression: r = - 0.50)domains demonstrating strong relationships. Likewise, total activity tended to be significantly correlated with mood in the negative direction with moderate to strong relationships (depression: $r = -0.54$). The only factor significantly correlated with HbA1c was self-efficacy for diet ($r = -0.39$), demonstrating a moderate relationship in the negative direction.

The results of the hierarchical regression analysis with HbA1c as the dependent variable are given in Table 5. As the table shows, self-efficacy variables significantly predicted HbA1c in individuals with T2DM and low SES, with models one through five being significant ($p < .05$), however, change in variance (ΔR^2) was not significant in models two through five. In models two through five, the remaining occupational functioning measures (LoC, QoL, activity, and mood) did not significantly influence HbA1c beyond the influence of self-efficacy, and therefore there was no incremental variance explained beyond model 1 in the respective steps. In the final model, model one, both factors for self-efficacy, diet and T2DM management, significantly predicted HbA1c, and together explained 17.8% of the variance in HbA1c. Higher self-efficacy for diet tended to predict lower HbA1c levels. On the contrary, higher self-efficacy for T2DM management tended to predict higher HbA1c levels.

The results of the hierarchical regression analysis predicting activity are given in Table 6. As the table shows, self-efficacy for T2DM and LoC attributed to chance being significant predictors of activity in individual with T2DM and low SES, with models one through three being significant ($p < .001$). Although depression in models four and five was significant, it did not account for variance beyond the models in the respective previous steps, as evidenced by the non-significant ΔR^2. Models four and five did not result in a significant change from model three, therefore no other occupational functioning factors explained incremental variance in the criterion beyond these two predictors (self-efficacy for T2DM management and LoC chance) significantly. In the first model, self-efficacy for T2DM management significantly predicted activity, and explained 17% of the variance in activity (adjusted $R^2 = 0.172$). Higher self-efficacy for T2DM management tended to predict higher activity levels. Among LoC factors, attributing chance to T2DM SM was a unique predictor for reduced activity in models two and three beyond the influence of SE for T2DM management. Self-efficacy for T2DM management and LoC chance produced significant change from the previous steps ($R^2 = .087$; $R^2 = .098$ respectively). In the final model, model 3, self-efficacy for T2DM management and LoC significantly ($p < .001$) predicted activity, and together explained 29.4% of the variance in activity.

Discussion

Research Aim One: Exploring the Relationship Among Occupational Functioning Factors

The present study found that we were correct in our hypothesis that there are significant relationships (varying from weak to strong) among occupational functioning factors, many of which follow the Occupational Functioning Model in this population. Strong significant relationships were found between depression and anxiety and QoL, particularly the factors of physical and psychological health. With the exception of LoC and HbA1c, occupational functioning factors were (for the most part) moderately, significantly correlated with neighboring variables. These statistical results help to validate the theory of the Occupational Functioning Model in which relationships between adjacent levels may be stronger than the relationship between high and low level factors (Trombley Latham, 2014).

Relationships between HbA1c and Occupational Functioning Model levels. Self-efficacy for diet was negatively and moderately correlated with HbA1c. Individuals who experience a greater sense of competence for making proper meal and snack decisions to accommodate recommendations for a healthy T2DM diet are more likely to have lower HbA1c levels, which indicates better glycemic control. Self-efficacy for diet may be significantly related to HbA1c because being competent with appropriately managing T2DM dietary intake is a task that has a major influence on glycemic levels. Lee et al. (2016) also examined self-efficacy in adults with T2DM and found that self-efficacy directly influenced self-care behaviors (including following a healthy diet); and self-care behaviors directly and inversely influenced HbA1c. The authors concluded that improving self-efficacy is crucial to enhance T2DM health-related behaviors, and therefore improve diabetes control. Building on Lee et al.'s (2016) study, our findings indicate, more specifically, that self-efficacy for diet is an important factor to consider in assessing an individual's likelihood to control T2DM.

Self-efficacy was not related to LoC. This finding is contrary to what would be expected based on Modified Social Learning Theory, which suggests that health-related behaviors are, in part, determined by perceived control over health (Nugent et al., 2016). Perceived control over health is composed of two constructs: health-related self-efficacy and health-related LoC. Despite the finding that self-efficacy was not related to LoC, self-efficacy was found to be significantly correlated with many other factors of occupational functioning. This is congruent with the Occupational Functioning Model, as taking a top down approach leads us to believe that self-efficacy is the most influential component contributing to competence, satisfaction and self-empowerment with activities and roles related to T2DM (Trombley Latham, 2014). Experiencing self-efficacy is the consequence of and cause for competence in effective performance (Trombley Latham, 2014). This may be the case with the population we studied, as people tend to feel greater self-efficacy as a result of past accomplishments in similar situations (i.e. controlling HbA1c levels). Success in past accomplishments can then lead to the development of better judgment for applying those skills in new situations (i.e. making health related decision during activity) (Trombley Latham, 2014). Therefore, our results indicate favorable connections with having self-efficacy to better outcomes in several areas of occupational functioning, such as quality of life, activity, and mood.

The present study adds to the literature that LoC is not directly significantly related to HbA1c (Besen, Günüşen, Sürücü, & Koşar, 2016; Nugent and Wallston, 2016). Many existing studies examined LoC and self-management behaviors in individuals with T2DM. Researchers have found that internal LoC may impact an individual's adherence to T2DM self-management behaviors (Besen, Günüşen, Sürücü, & Koşar, 2016; Nugent and Wallston, 2016). Although we did not include measures or interventions for self-management in our study, and although LoC could potentially signal whether a person will adhere to recommended health-related behaviors, such as diet and exercise, our results indicate that this does not necessarily indicate the individual will do so to a degree in which it impacts their glycemic control.

We found that components of self-efficacy (diet and T2DM management) and QoL (physical, psychological, social, and environmental) did not tend to be related to components of LoC. Other researchers have found that LoC plays a role in prediction of adjustment (physical and psychological) to chronic disease (Wallston, 1992). Similarly, in a qualitative study of adults with insulin treated T2DM, Nugent et al. (2016) found that participant descriptions of their everyday life indicated an interaction between LoC, self-efficacy, and the value a person places on their health as contributing to their health-related behaviors in attempt to control T2DM. Our results may differ because we explored different contributing factors, including QoL and mood. Contrary to the study conducted by Nugent et al. (2016), we did not examine health value, which may be a necessary component in understanding the relationship among LoC, self-efficacy, and T2DM self-management. Additionally, having a population of low SES may influence LoC as described below (research aims two and three). These individuals may experience different challenges associated with resources for healthcare and diet, which as a result may lead to reduced perception of control over self-management related tasks.

QoL was not significantly related to HbA1c. However, QoL was significantly correlated with several other occupational functioning factors (self-efficacy, activity, and mood). In accordance with the Occupational Functioning Model, QoL was significantly correlated with activity. Based on our findings, individuals who report greater satisfaction with their perceived physical, emotional, social and environmental well-being are more likely to participate more frequently in activities (domestic, work/leisure, outdoors). QoL was also strongly and negatively correlated with mood. Other researchers have found that individuals with T2DM, especially individuals with two or more chronic conditions, are more likely to experience clinical symptoms of depression and/or anxiety, which in turn indicates greater likelihood to experience a reduced QoL (Rubin & Peyrot, 1999; Wandell, 2005).

Activity was not significantly correlated with HbA1c. While some researchers have found that activity impacts an individual's ability to perform self-management behaviors (Fritz, 2014; Pyatak, 2011), our results indicate that this may not translate to an individual's capacity to effectively control their diabetes. Because we did not look specifically at self-management behaviors, we cannot determine whether this is a statistically significant relationship. Although our results indicate that frequency of activity does not have a direct relationship with HbA1c, research has found that activity can impact areas such as healthcare utilization, and medication management (Garvey et al., 2015). Both healthcare utilization and medication management are critical components to T2DM self-management, and therefore influence ability to achieve healthy HbA1c (Garvey et al., 2015). Thus, in our study, activity deficits may have had an indirect impact on HbA1c, through their negative influence on healthcare utilization or medication management, which we did not assess.

As anticipated, activity was significantly, negatively correlated with mood. Individuals who experience symptoms associated with depression and anxiety are more likely to have reduced frequency of activity. In accordance with previous findings, individuals with T2DM who experience symptoms associated with depression and anxiety are more likely to experience increased functional impairments, which may include home management and community mobility (Lyness et al., 1999). Although our analyses indicate that this does not appear to be directly impacting HbA1c, these factors are likely negatively contributing to the individual's capacity for and satisfaction with occupational functioning.

Depression and anxiety were not significantly correlated with HbA1c. This study adds to available literature suggesting that although depression and anxiety may affect other aspects of a person's occupational functioning, it is not necessarily a direct link to determining whether a person is able to control their glycemic levels (Golden et al., 2017).

The only component of occupational functioning that was significantly correlated with HbA1c was self-efficacy for diet. Given that 38.2% of our population had HbA1c levels above 7.0%, this validates that having a particular physiological disease (in this case T2DM) does not ensure a person will experience impairment or disability in progressively higher levels of the hierarchy (Trombley Latham, 2014). A person can be successful in his/her performance and participation and feel satisfied/competent in other areas despite the presence of illness, injury or disease (i.e. HbA1c > 7.0%). As such, for individuals with T2DM, HbA1c may not be the ideal indicator of a person's overall well-being and occupational functioning. As previously described, other occupational functioning variables, such as depression, have been indicated as stronger predictors of medical outcomes, including hospitalization and mortality (Davis, Hess, & Hiss, 1988; Rubin & Peyrot, 1999). The results of the correlational data analysis suggest that there is a more complex makeup to the diabetes experience and outcomes than is portrayed by the typical physiological marker alone, i.e., HbA1c.

Research Aim Two: Determining Which Occupational Functioning Factors Predict HbA1c

The highest factor within the Occupational Functioning Model, self-efficacy, predicted HbA1c, as inferred in our hypotheses. In concurrence with Nugent and Wallston (2016), self-efficacy was the only significant predictor of better health outcomes. We anticipated that adjacent levels, particularly mood, would also explain incremental variance in diabetes control. However, we did not find that any other occupational functioning factors contributed to predicting diabetes control. The finding that mood does not predict HbA1c helps to clarify the relationship between anxiety and depression, and diabetes control, which has previously been unresolved. In concurrence with Golden et al. (2017), our results found that depression and anxiety are not directly associated with glycemic control. We do however suspect that depression and anxiety may impact HbA1c through their confounding effect on self-management behaviors, as researchers have found that depression has adverse effects on T2DM related self-care; physical and mental functioning; and adherence to medical regimen (Anderson, Freedland, Clouse, & Lustman 2001; Ciechanowski, Katon, Russo, & Hirsch, 2003; DiMatteo, Lepper, & Croghan, 2000). Accordingly, participants in our study who report depression and anxiety may experience poorer glycemic control, but this is mediated by factors that we did not examine, such as mental and physical ability to carry out necessary T2DM health-related behaviors.

Self-efficacy for diet and diabetes control. Self-efficacy for diet predicted HbA1c. Individuals who better perceived their ability to follow a T2DM diet were more likely to have lower HbA1c. The finding that self-efficacy for diet predicts HbA1c substantiates our assumption that there is systematic influence of a person's perception of their ability to manage a T2DM diet on his/her actual ability to control diabetes, indicated by HbA1c.

Self-efficacy for diet is a strong predictor of HbA1c as self-efficacy for diet reflects performance of the complex process of knowing how much and when to eat, and the effects particular foods have on glycemic levels. In a qualitative study of eight adults with diabetes, researchers found a prevalent theme to be the impact of diet on a person's ability to self-manage their T2DM (Thompson, 2014). Participants in this study reported challenges associated with counting carbohydrates, following medically advised diets when in the community, and resisting unhealthy foods (Thompson, 2014). Foss et al. (2015) conducted a meta-synthesis of the literature on the experiences of people with T2DM who receive community-based self-management support. The researchers likewise found that a challenge for people with diabetes is anticipating and carrying out dietary needs in the context of everyday life in order to control their disease (Foss et al., 2015). Given that meeting T2DM dietary needs are considered to be such a complex and burdensome task, individuals in our study who have achieved perceived competence and self-empowerment (indicated by self-efficacy for diet) in dietary management are more likely to be effectively controlling their T2DM.

In addition to dietary management being a complicated process, living in low SES may further influence how self-efficacy for diet predicted HbA1c. Living in low SES may attribute to difficulty attaining healthy food options that meet the recommended criteria for a T2DM friendly diet. Low SES populations are vulnerable to living in conditions in which they must continuously choose between: paying medical bills; buying high quality, healthy food; and purchasing prescriptions (Foss et al., 2015). According to the USDA (2017), food insecurity is the uncertainty of having, or inability to acquire enough food, or healthy food, to meet the needs of members of the household due to insufficient money or other resources needed to obtain food. Individuals with diabetes who experience food insecurity report lower overall dietary quality, as well as lower consumption of healthy foods (Silverman et al., 2015). Rates of food insecurity are higher than the national average in low income households (USDA, 2017). Silverman et al., (2015) found that individuals with low income who experience food insecurity had significantly higher average HbA1c levels than individuals who did not experience food insecurity, even after controlling for: sex; age; race; marital status; BMI; insulin use; depression; diabetes distress; and low medication adherence. Although this variable was not measured in the current study, this could be a potential contributor to reduced feelings of self-efficacy for following a T2DM diet. People with food insecurity have limited control over what they eat, leading to decreased feeling of empowerment or confidence in ability to eat snacks and meals that follow physician dietary recommendations, and therefore impairing diabetes control (Silverman et al., 2015).

Self-efficacy for T2DM management and diabetes control. Researchers have found that diabetes-related self-efficacy is often associated with better self-management behaviors (following a healthy diet, exercising regularly, and testing blood glucose appropriately), which therefore results in more controlled HbA1c levels (Delamater et al., 2001; Nugent & Wallston, 2016; Williams and Bond, 2002). There have not been any studies specifically studying individuals' self-efficacy for knowing when and how to take action when blood glucose levels are high or low, as indicated by our variable self-efficacy for T2DM management. Unexpectedly, we found that participants who perceived a greater ability to recognize when and how to T2DM management for T2DM-related problems experienced higher HbA1c levels.

Given the inverse relationship between self-efficacy for T2DM management and diabetes control, we may be missing a critical component that explains the disconnect between self-efficacy for T2DM management and diabetes control in our results. In his theory of self-efficacy, Bandura cautioned that important considerations to take into account regarding behavior include: an individual's capabilities to perform in the given task; and the incentive associated with performing the task (Bandura, 1977). Although we have insight into the person's perception of their performance, this does not necessarily reflect their capability to carry out the necessary means to control their diabetes. Future research should therefore account for individuals' actual self-management behaviors, including their ability to seek necessary and appropriate health-care services. This may be due to a variety of reasons, including varying levels of motivation and/or the availability of resources (i.e. money, health insurance, etc.).

Individuals who experience inconsistency between self-efficacy for T2DM management and diabetes control may know when and how to obtain diabetes related help from others when needed, but fail to carry through with necessary care on their own. Patients who fail to reach a satisfactory metabolic control tend to rely on significant others, trusting in the physicians' skills or on the efficiency of the health-care system. Self-esteem, a similar construct to self-efficacy, was found to be lower in adults with type one diabetes who were unable to reach a target glycemic level (Nuccitelli et al., 2017). These participants also tended to rely on others, including physicians and the health-care system for diabetes control (Nuccitelli et al., 2017). The findings that lower self-esteem is associated with less independence with self-management translates to the present study as individuals with high self-efficacy for T2DM management may believe they know when and how to obtain and perform diabetes related care, but rely on others to actually (help to) control HbA1c. By doing so, they are not effectively managing T2DM on their own, and may be receiving inconsistent care. In response to this, Nuccitelli et al. (2017) argue for strategies to increase self-efficacy in personal ability to control diabetes, rather than reliance on significant others.

This strategy would benefit individuals who may try to perform the necessary care behaviors when appropriate, but struggle to do so within the context of their own daily routines. Individuals with T2DM may also experience difficulty with application of learned materials to everyday life, therefore resulting in poor diabetes control despite having the knowledge available. Some people with T2DM have reported difficulty with glycemic control as a result of the tendency for physicians to take a “disease oriented view” (Foss et al., 2015, p. 677). This form of patient education is challenging for the patient to translate and apply in the context of everyday life outside of the physician’s office, therefore negatively impacting their self-efficacy development (Foss et al., 2015). This approach has led to patient alienation and discouragement for T2DM self-management behaviors as the patient’s priority to live life above and beyond their disease appears devalued by the physician (Foss et al., 2015).

Yet other individuals may experience different challenges with applying physician recommendations due to limited available resources, such as: money for prescriptions; health-care coverage; and quality food. Financial constraints appear to be a significant contributing factor to patients’ concern about their ability to control glycemic levels in the literature (Foss et al., 2015; Silverman et al., 2015). Patient’s with poor diabetes control often recognize that barriers to carrying out physician recommendations include inability to pay for, obtain coverage, or receive reimbursement for healthcare services, including: foot care; glucose test strips; prescribed medications; etc. (Foss et al., 2015). Such circumstances leave patients having to make trade-offs between healthcare, medication, and purchasing quality food, on top of everyday living expenses. Despite these challenges, Foss et al. (2015) report that vulnerable populations, (i.e. low SES) rarely raise these concerns with their physicians. This, likely, creates further disconnect between a physician’s T2DM disease management recommendations and the patient’s ability to apply this within the context of everyday life in order to successfully control diabetes. Given that the clinic where our data was collected serves mostly low income individuals these findings may explain our outcomes. Limited available resources and ineffective communication with physicians and healthcare providers may explain the disconnect between a person's perceived ability to recognize how to care for T2DM-related problems and their diabetes control.

Research Aim Three: Determining Which Occupational Functioning Factors Predict Activity

While we anticipated both components of self-efficacy would be significant predictors, only self-efficacy for T2DM management was significantly predictive of activity. Our hypothesis that neighboring Occupational Functioning Model levels would better predict activity was not supported by our findings. Neither QoL nor mood predicted activity. Model three was significant with self-efficacy for T2DM management and LoC chance explaining the greatest degree of variance in activity.

Other researchers have also found that self-efficacy predicted performance in IADL and work participation in individuals with T2DM (Ratzon, Futeran, & Isakov, 2010). In a qualitative study of adolescents with type I diabetes, some participants reported that knowing how and when to test and manage their diabetes led to a sense of security; prevented them from experiencing unnecessary anxiety; and enabled them to continue to engage in meaningful occupation (Pyatak, 2011). White et al. (2013) describe a reciprocal relationship between self-efficacy and occupational engagement in which living with a chronic condition forced participants to accept and learn how to respond to (and manage) their illness during everyday activities. Participation in occupations was a means to facilitate learning how to respond to factors associated with their illness (White et al., 2013). This, in turn, led to a greater sense of empowerment for knowing how to make disease-related decisions in the context of everyday activities. Our results indicate that participants who perceived that they had the ability and capacity to address diabetic needs, and seek care when necessary, likely felt more confident to participate in daily activities more frequently.

While participation in everyday activities can foster a sense of self-efficacy for T2DM management as people experience success and learn from mistakes, for others, it can pose health-related risks that result in decreased feelings of empowerment for diabetes-related care (Pyatak, 2011; White 2013). There are possible contributing factors that explain why individuals who lack self-efficacy for making health-related decisions and seeking appropriate care experience negative impacts on the frequency of their activity. Individuals who experience difficulty accessing appropriate healthcare and making treatment decisions may be less likely to feel confident and comfortable engaging in activities that require them to make disease related decisions in the middle of an activity or while in the community (Pyatak, 2011). For example, an individual who uses insulin injections must keep track of times and amounts of food eaten within the context of everyday activities. Burden associated with dietary tracking may lead to decreased feelings of control and self-efficacy for being able to make disease-related decisions within various situations and environments. Additionally, the need to inject insulin during activities or while in the community may create feelings of discomfort due to social stigma against using needles in public or inability to find a private location.

Yet, other individuals may experience difficulty managing their occupational engagement while living with diabetes due to barriers in the patient/healthcare provider relationship. In a qualitative study, Pyatak (2011) found that ineffective communication with healthcare providers led to poor understanding of how to make disease-related decisions in the context of everyday activities. For individuals with reduced self-efficacy for T2DM management, there likely is tension between being able to participate in everyday activities and being able to keep track of complex factors associated with diabetes while making disease-related healthcare decisions. Without feeling competent and confident to do so, individuals may be submitted to reduced activity at home and in the community.

Within the context of low SES individuals with T2DM may experience cumulative stress that impacts their self-efficacy for T2DM management, and therefore the frequency of their activity. As described by Pyatak (2014), the impact of poverty may result in a lack of structure and organization in everyday life, difficulty developing and maintaining habits and routines, and inability to plan for the future. The experience of living in poverty often leads to a sense of helplessness, hopelessness, and limited control of one's life, further complicating the reciprocal relationship between developing self-efficacy for T2DM management and engaging in daily activities (Pyatak, 2014). The facility where we collected our data serves mostly low SES populations, and living in low SES has been associated experiencing reduced structure and organization within everyday life and feelings of discouragement (Pyatak, 2014). Our participants who experience these circumstances in the context of everyday life may make it a challenge for our participants to manage the complexities of T2DM and make disease related decisions during activity in the context of daily life.

To our knowledge, researchers have not explored the relationship between LoC chance and activity in the T2DM population. There are several possible explanations for our finding that individuals who attribute diabetes control to chance participate in activities less frequently. First, LoC chance may predict activity because activities (i.e. exercise) can result in fluctuations in glucose levels (Colberg et al., 2010). As such, individuals may avoid activity so as not to provoke HbA1c changes and have to navigate, and resolve situations that require action to manage those HbA1c changes (i.e. taking medications or eating an appropriate snack).

Additionally, many activities (outdoors, and leisure/work) require individuals to be away from home, or in an environment where they may feel uncomfortable and unable to perform T2DM related health behaviors. For example, an external LoC (as indicated by chance) may attribute to: feeling less confident and less in control of one's ability to eat meals regularly (i.e. every 4-5 hours or as consistent with their blood sugar levels); a presumed inability to make disease related decisions in the context of activities; trouble making decisions about sharing foods with others, outside of the house, such as at restaurants with people who do not have T2DM; and not knowing when/how to access snacks or medications in accordance with blood sugar levels. Engaging in activities may create a sense of inconsistent, unpredictable, unstructured, and/or uncontrolled environments further complicating the need to schedule, plan ahead, and have snacks and medications accessible (Pyatak 2011; Thompson, 2014). Accordingly, people with LoC chance may be less likely to engage in activities due to complications that can arise during activity, that lead to further feelings in lack of control for T2DM related behaviors.

Limitations

The results of this study offer an initial framework for understanding the influence of self-efficacy on occupational functioning for individuals with low SES and T2DM. Occupational functioning is a vast construct that can include an infinite number of factors to describe and explain the diabetes experience. The occupational functioning factors we chose to include are not exhaustive and could be extended in future studies. There are several key pieces of information needed to fill the gaps to create a more complete picture of the diabetes experience and occupational functioning. Greater attention should be given to the factors that appear to mediate diabetes control and activity. For example, the present study did not measure self-management behaviors (i.e. following a healthy diet, exercising regularly, checking blood sugar levels, etc.). The ability to perform these necessary and critical tasks and the frequency at which they are performed is likely a contributing factor to: self-efficacy, diabetes control, and activity.

Given that our results indicate self-efficacy to be the most influential component in predicting diabetes control and activity participation, we relied considerably on the outcomes of the Diabetes Self-efficacy scale. However, there are some known issues with assessing perceived competence through self-report that leads us to question whether self-report is an accurate depiction of self-efficacy. Self-report measures can be influenced by other variables, including: response bias (i.e. social desirability bias); tendencies for people to over-estimate their abilities; and participant attitude, mood, personality, etc. (Keefer, 2015). While self-report measures provide unique and important information, including a measure of overt self-management behavior would help us to examine how self-perception of performance affects subsequent behavior. This would also provide us with a more objective indicator to inform the validity of self-efficacy self-report for self-management behavior.

Other limitations are that this study was conducted with only 76 participants at one healthcare center in Colorado which creates concern for generalizability to the wider T2DM population. The typical population served at this clinic are at or below the poverty level and/or are under-insured or un-insured. However, data for household income, family size, and food insecurity were not available. Having these data could have provided greater detail and understanding into how SES may be impacting self-efficacy for diet and care; and therefore how self-efficacy for diet and T2DM management may be impacting occupational functioning for individuals with T2DM. For example, this lack of information leaves us wondering whether individuals who report high self-efficacy for T2DM management are more likely to experience poor diabetes control because they do not have the health insurance coverage or cannot afford to obtain the care they need. Or, whether this is an inflated sense of confidence and ability.

Unfortunately, HbA1c is the only measure of glycemic control obtained from participants. While this physiological measure is considered the gold standard within the medical field for measuring glycemic levels, it does not provide us with a complete picture of diabetes control (WHO, 2016). HbA1c is an average concentration of blood glucose over the previous two to three months, so people may have fair HbA1c levels, but may still experience acute hypo or hyperglycemic attacks that are not indicated in this long-term, mean measure (Sartore et al., 2012). HbA1c also tends to identify states of sustained hyperglycemia, but is a poor indicator of sustained hypoglycemic states (Sartore et al., 2012). Therefore, HbA1c may not provide an accurate picture of individuals who are successfully controlling their T2DM. This information contributes to our argument that HbA1c may not be the best indicator of an individual in need of assistance with controlling their T2DM. Rather, our results indicate that factors, such as self-efficacy may be indicative of a person in need of T2DM-related assistance. As described in

Future Directions, below, given our results and previous research findings, there may be other markers, which we did not explore, such as self-management behaviors, that may better explain an individual's T2DM self-management.

Another limitation is that we did not collect data on how long participants have had a T2DM diagnosis. Other researchers have shown that the longevity of a T2DM diagnosis can impact self-management behaviors and attitudes, including: becoming indifferent about health; attributing poor health to age versus self-management behaviors; and feeling apathetic toward healthcare provider advice due to steady blood glucose levels (Nugent et al., 2015). Our results regarding self-efficacy for diet and management therefore could have been impacted by the length of time a person has been living with T2DM.

Future Directions

This study provides evidence to support the notion that self-efficacy is the most significant predictor of T2DM control (Nugent and Wallston, 2016). These outcomes can inform assessment to identify individuals who may be at risk for poor diabetes control. With a better understanding of the specific areas in which individuals stand to gain confidence, empowerment, and self-esteem (i.e. for care and diet) we can better tailor evaluation methods and treatment approaches. According to the Occupational Functioning Model the goal of treatment is to enable competent engagement in valued life roles (Trombley Latham, 2014). As such, occupational therapy intervention may target self-efficacy, and confidence in self-care and diet management, while aiming to increase knowledge, coping, and problem solving for T2DM management and diet decision making and taking appropriate action within daily activities. Future research should include aspects of T2DM self-management. Such research may help to determine whether self-efficacy problems lie in this populations' perceptions of their ability to carry out key diet and T2DM management components, or whether the problem is with carrying out diet and T2DM management components. Including self-management measures will give a more complete picture of the diabetes experience and the impact of T2DM on occupation functioning.

Researchers have found that a common problem for people who experience poor diabetes control is developing the ability to incorporate diabetes self-management, including health care and diet concerns, within the lived experience (Foss et al., 2015; Pyatak, 2011). In response, there has been a call to move beyond prescriptive advice towards focusing on internal and external barriers that patient's encounter in their daily lives (Foss et al., 2015). Currently, patients commonly report a lack of effective communication and collaboration with healthcare providers (Foss et al., 2015). Given the difficulty of translating educational advice to real world follow through (particularly with diet) there is a need to focus on individual circumstances and abilities with the goal being to empower individuals to feel competent and confident in controlling their T2DM and engaging fully in meaningful occupation.

Occupational therapy is appropriate to fill this role, as the profession is trained to evaluate the context (i.e. SES, the individual's lived experience, etc.) using client-centered approaches. Occupational therapists have the skillset to adapt health-related conversations and education into more understandable language that meets the needs of clients and makes them feel more empowered and capable to control their T2DM.

There is little evidence for occupational therapy's role in assisting individuals manage their T2DM in everyday contexts, despite knowledge that daily functioning is compromised in this population. Treatment burden may account for a significant amount of the population's difficulty to adhere to treatment recommendations (Pyatak, 2011). Lifestyle modifications are often necessary to accommodate living with T2DM (Pyatak, 2011). However, few interventions have demonstrated significant positive outcomes in lifestyle modifications to effectively assist in T2DM self-management (Pyatak, 2011), suggesting the need for new treatment approaches. As experts in treating the person, the environment, and the occupation, occupational therapists have the skillset to have a positive impact in making sustained lifestyles changes that can result in improved self-efficacy, diabetes control, and activity. Occupational therapy needs to become involved in the research for living with T2DM. The results of this study can inform further research that includes self-efficacy as a critical component to understanding occupational functioning, while also including measures of self-management behaviors in individuals with low SES and T2DM. Furthermore, this research can inform experimental studies to ascertain effective intervention strategies that target self-efficacy while tailoring treatment to the individual's unique circumstances and needs in the context of their everyday life, including living in low SES. Ideally, occupational therapy interventions will demonstrate efficacy in providing patients with the skills to control their T2DM, through improved self-efficacy, while enabling them to engage more fully in daily life activities.

Table 1
Occupation Functioning Assessment Characteristics

Assessment	# of Questions	Scale Used	Outcome Measured & Score Range
The Hospital Anxiety And Depression Scale (HADS)	14	4 pt.	normal (0-7) mild (8-10) moderate (11-14) severe (15-21)
The Diabetes Self-Efficacy Scale (DSES)	8	10 pt.	mean score
The World Health Organization Quality of Life Assessment – Brief Version (WHOQoL-BREF)	26	5 pt.	computed score in 4 domains: physical (0-100) psychological (0-100) social relationships (0-100) environment (0-100)
Multidimensional Health Locus of Control (MHLC)	18	6 pt.	sum score of 3 domains: internal (6-36) chance (6-36) Powerful others (6-36)
The Frenchay Activities Index (FAI)	15	4 pt.	total sum score (0-45) & sum score in 3 domains: domestic activities (0-15) work/leisure activities (0-15) outdoor activities (0-15)

Table 2
Summary of Participant Characteristics

	N	Mean (SD)	Frequency (%)
Age (years)	76	58.72 (10.87)	
Sex			
Female			39 (51.30%)
Male			37 (48.70%)
Race			
Hispanic/Latino			21 (27.60%)
Non-Hispanic/Latino			54 (71.10%)
Decline to answer			1 (1.30%)
Ethnicity			
2 +			6 (7.90%)
American Indian/ Alaska Native			2 (2.60%)
Black			1 (1.30%)
White			66 (86.80%)
Decline to answer			1 (1.30%)
Number of Comorbid Conditions	76	2.97 (2.01)	
Number of Medications	76	8.80 (5.38)	
Body Mass Index	75	33.1 (7.87)	
Under (< 18.5)			1 (1.30%)
Normal (< 25)			6 (7.90%)
Over (25-29.9)			24 (31.60%)
Obese (> 30)			44 (57.90%)
Missing Data			1 (1.30%)

Table 3

Descriptive Statistics for Occupational Functioning Factors

	Mean (SD)	Frequency(%)
Blood Glucose Level		
A1c	7.09 (1.56)	
Normal (≤ 7.0%)		47 (61.80%)
Prediabetes & Diabetes (> 7.0%)		29 (38.20%)
The Hospital Anxiety and Depression Scale		
Anxiety (score out of 21)	7.12 (3.81)	
Depression (score out of 21)	5.47 (3.55)	
The Diabetes Health Self-Efficacy Scale		
Self-efficacy: Diet (score out of 10)	7.73 (2.57)	
Self-efficacy: T2DM management (score out of 10)	7.25 (2.40)	
The World Health Organization Quality of Life Assessment – Brief Version		
Physical (score out of 100)	54.25 (21.23)	
Psychological (score out of 100)	69.79 (18.99)	
Social Relationships (score out of 100)	63.87 (23.86)	
Environment (score out of 100)	73.21 (16.24)	
The Multidimensional Health Locus of Control Scale		
Internal (scores range 6-36)	25.70 (6.48)	
Chance (scores range 6-36)	16.46 (6.64)	
Doctors & Others (scores range 6-36)	23.53 (3.92)	
Frenchay Activities Index		
Total Score (score out of 45)	28.63 (8.17)	
Domestic Domain (score out of 15)	11.53 (3.37)	
Work & Leisure Domain (score out of 15)	7.46 (3.30)	
Outdoors Domain (score out of 15)	9.64 (3.10)	

Note. N = 76

Table 4

Correlations Between Components of Occupational Functioning

N = 76

	1		2			3				4				5	
	A	B	A	B	C	A	B	C	D	A	B	C	D	A	B
1. Self-Efficacy															
A. Diet															
B. T2DM Management															
2. LoC															
A. Internal	0.15	-0.02													
B. Chance	0.00	0.04													
C. Others	-0.17*	0.03													
3. QoL															
A. Physical	0.36*	0.36*	-0.05	0.08	-0.15										
B. Psychological	0.35*	0.45*	-0.04	0.16	0.02										
C. Social	0.30*	0.33*	0.06	0.02	0.05										
D. Environment	0.34*	0.32*	0.02	0.05	-0.03										
4. Activity															
A. Total	0.26	0.43*	0.17	-0.24*	-0.09	0.41*	0.39*	0.32*	0.35*						
B. Domestic	0.22	0.39*	0.23*	-0.19	-0.07	0.30*	0.28*	0.18	0.16						
C. Work/Leisure	0.19	0.31*	0.07	-0.23	-0.03	0.33*	0.36*	0.28*	0.42*						
D. Outdoors	0.26*	0.38*	0.13	-0.19	-0.14	0.40*	0.35*	0.34*	0.29*						
5. Mood															
A. Anxiety	-0.23*	-0.38*	0.08	-0.06	-0.04	-0.60*	-0.63*	-0.31*	-0.49*	-0.27*	-0.11	-0.35*	-0.22		
B. Depression	-0.40*	-0.49*	0.02	-0.10	-0.01	-0.60*	-0.74*	-0.45*	-0.50*	-0.54*	-0.46*	-0.44*	-0.45*		
6. Diabetes Control															
A. HbA1c	-0.39*	0.03	-0.05	0.03	0.03	-0.11	-0.02	0.06	-0.07	-0.07	0.03	-0.12	-0.09	0.19	0.18

Note. *indicates p < .05

Table 5

Hierarchical Regression Analysis Predicting Diabetes Control (HbA1c)

		B	SE	β	ΔR^2	F
Model 1	Step 1: Self-Efficacy				0.20***	9.14***
Self-efficacy	Diet	-0.32	0.08	-0.50***		
	T2DM management	0.15	0.07	0.24*		
Model 2	Step 2: Locus of Control				0.007	3.67**
Self-efficacy	Diet	-0.34	0.08	-0.53***		
	T2DM management	0.16	0.07	0.26*		
Locus of control	Internal	0.01	0.03	0.06		
	Chance	0.01	0.03	0.04		
	Powerful others	-0.03	0.05	-0.09		
Model 3	Step 3: Quality of Life				0.032	2.32*
Self-efficacy	Diet	-0.35	0.08	-0.54***		
	T2DM management	0.14	0.08	0.24		
Locus of control	Internal	0.01	0.03	0.05		
	Chance	0.01	0.03	0.05		
	Powerful others	-0.05	0.05	-0.11		
Quality of life	Physical	-0.01	0.01	-0.08		
	Psychological	0.002	0.02	0.02		
	Social relationships	0.02	0.01	0.23		
	Environment	-0.01	0.02	-0.09		
Model 4	Step 4: Activity				0.032	1.97*
Self-efficacy	Diet	-0.35	0.09	-0.54***		
	T2DM management	0.14	0.09	0.23		
Locus of control	Internal	0.01	0.03	0.04		
	Chance	0.00	0.03	0.004		
	Powerful others	-0.05	0.05	-0.19		
Quality of life	Physical	-0.004	0.01	-0.06		
	Psychological	0.003	0.02	0.04		
	Social Relationships	0.02	0.10	.24		
	Environment	-0.004	0.02	-0.04		
Activity	Domestic	1.54	1.31	0.17		
	Work/leisure	-0.06	0.07	-0.13		
	Outdoors	-0.08	0.08	-0.15		
Model 5	Step 5: Mood				0.049	2.07*
Self-efficacy	Diet	-0.38	0.09	-0.52***		
	T2DM management	0.17	0.09	0.28*		
Locus of control	Internal	0.003	0.03	0.01		
	Chance	-0.02	0.03	-0.06		
	Powerful others	-0.03	0.05	-0.07		
Quality of life	Physical	0.01	0.01	0.07		
	Psychological	0.02	0.02	0.30		
	Social relationships	0.01	0.01	0.15		
	Environment	-0.002	0.02	-0.23		
Activity	Domestic	1.40	1.34	0.16		
	Work/leisure	-0.04	0.07	-0.08		
	Outdoors	-0.07	0.08	-0.15		
Mood	Anxiety	0.093	0.07	0.23		
	Depression	0.11	0.09	0.25		

Note. N=76. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 6
Hierarchical Regression Analysis Predicting Activity

		B	SE	β	ΔR^2	F
Model 1	Step 1: Self-Efficacy				0.194***	8.80***
Self-efficacy	Diet	0.30	0.40	0.09		
	T2DM Management	1.26	0.37	0.39***		
Model 2	Step 2: Locus of Control				0.087*	5.48***
Self-efficacy	Diet	0.18	0.40	0.03		
	T2DM Management	1.37	0.36	0.43***		
Locus of control	Internal	0.17	0.14	0.13		
	Chance	-0.27	0.13	-0.22*		
	Powerful others	-0.24	0.23	-0.12		
Model 3	Step 3: Quality of Life				0.098*	4.48***
Self-efficacy	Diet	-0.21	0.40	-0.06		
	T2DM Management	0.98	0.37	0.31**		
Locus of control	Internal	0.19	0.13	0.15		
	Chance	-0.31	0.13	-0.26*		
	Powerful others	-0.22	0.22	-0.10		
Quality of life	Physical	0.08	0.05	0.20		
	Psychological	0.06	0.07	0.15		
	Social relationships	0.003	0.05	0.01		
	Environment	0.04	0.07	0.07		
Model 4	Step 4: Mood				0.052	4.42***
Self-efficacy	Diet	-0.39	0.39	-0.11		
	T2DM Management	0.87	0.37	0.27*		
Locus of control	Internal	0.22	0.13	0.17		
	Chance	-0.21	0.13	-0.17		
	Powerful others	-0.25	0.22	-0.12		
Quality of life	Physical	0.07	0.05	0.17		
	Psychological	-0.02	0.09	-0.42		
	Social Relationships	0.01	0.05	0.02		
	Environment	0.05	0.07	0.10		
Mood	Anxiety	0.29	0.29	0.13		
	Depression	-0.88	0.38	-0.38*		
Model 5	Step 5: Health				0.002	4.02***
Self-efficacy	Diet	-0.48	0.44	-0.14		
	T2DM Management	0.92	0.39	0.29*		
Locus of control	Internal	0.22	0.13	0.17		
	Chance	-0.21	0.13	-0.17		
	Powerful others	-0.26	0.22	-0.12		
Quality of life	Physical	0.07	0.05	0.17		
	Psychological	-0.01	0.09	-0.03		
	Social relationships	0.01	0.05	0.03		
	Environment	0.05	0.07	0.10		
Mood	Anxiety	0.32	0.30	0.15		
	Depression	-0.85	0.39	-0.37*		
Health	HbA1c	-0.28	0.59	-0.54		

Note. N=76. *p < 0.05; **p < 0.01; ***p < 0.001

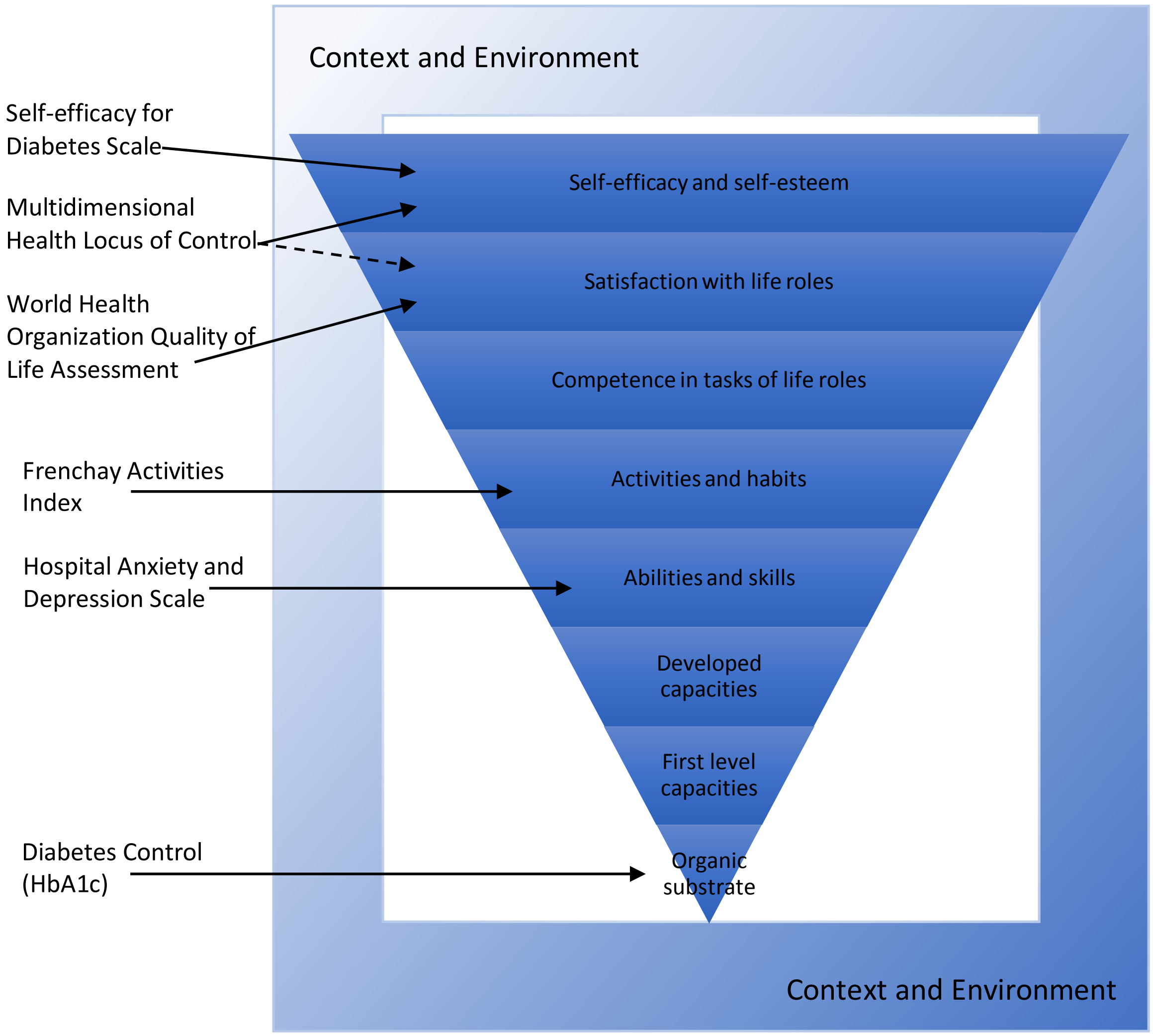

Figure 1. The Occupational Functioning Model with respective occupational functioning assessments. Adapted from *Occupational Therapy for Physical Dysfunction*, by M.V. Radomski, & C. A. Latham (Eds.), 2014. Philadelphia, PA: Lippincott Williams & Wilkins. Copyright 2014 by Lippincott Williams & Wilkins.

Figure 2. Results of factor analysis of Self-efficacy for Diabetes Scale. Adapted from *Self-Efficacy for Diabetes*, by The Self Management Resource Center, 2009. Palo Alto, CA: Self Management Resource Center. Copyright 2017 by Self Management Resource Center.

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Appendix

Study Summary

Type II diabetes (T2DM) is a problem because many people in our country are diagnosed with the disease and face challenges with successfully self-managing it. Self-management requires a lot of lifestyle changes, including incorporating: diet and exercise; blood sugar monitoring; and managing medications according to blood sugar levels into everyday life. This is further confounded by difficult life circumstances experienced by people living in low socio-economic status (SES). Regardless, most physicians emphasize achieving healthy physiologic outcomes, often indicated by HbA1c levels for all people with T2DM. Our study provides a more complete picture, and a better understanding of the areas in which people with T2DM experience challenges. We measured a wider range of factors, from the physiological measure HbA1c, to frequency of activity, to self-efficacy, with the goal of determining what predicts diabetes control in populations with T2DM and low SES. We found that self-efficacy, or a person's perceived competence in his ability to self-manage T2DM, is the most influential component to a person being able to control their diabetes and engage more frequently in daily life activities. We can use this information in the future to identify individuals with low self-efficacy (using assessment measures that are currently not standard practice) who are at an increased risk for poor diabetes control. Intervention and treatment approaches should then aim to empower individuals to feel more confident and competent in engaging in self-management behaviors related to T2DM.