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Peer Support, Self-Efficacy, and Diabetes Self-Management in Veterans Living with Diabetes

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This dissertation, "Peer Support, Self-Efficacy, and Diabetes Self-Management in Veterans Living with Diabetes," by Michael Smart was prepared under the direction of the candidate's dissertation committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Nursing in the Byrdine F. Lewis College of Nursing and Health Professions, Georgia State University.

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ABSTRACT

PEER SUPPORT, SELF-EFFICACY, AND DIABETES SELF-MANAGEMENT IN VETERANS LIVING WTIH DIABETES

BY

MICHAEL J. SMART

Type 2 diabetes is a significant problem among veterans in the United States, affecting about 25%. Informal peer support, a type of support that is provided by someone who also has diabetes, may be a useful adjunct to interventions targeting diabetes self-management behaviors in this population. The purpose of this study was to explore informal peer support among veterans living with diabetes, its impact on behaviors and self-efficacy related to diabetes self-management, and glucose control.

A cross-sectional, correlational design was used to evaluate relationships between variables of interest. Non-random sampling was used, and participants were recruited mostly through social media sites. Data were collected using self-report surveys administered via Qualtrics. Data were analyzed using descriptive statistics, correlations, independent sample t-tests, and PROCESS macro.

Participants (*N*=165) had a mean age of 41.5 (SD=11.27) years, were mostly African American (49.7%), had bachelor's degrees (58.8%) and were married (76.4%). Most participants had been living with diabetes for less than 10 years (59.4%) and HbA_{1C}'s of the sample were 7-7.9% (29.7%), 8-8.9 (24.8%), and 9-9.9 (20%). The majority reported having a peer supporter (98.2%). On average, participants had moderate levels of informal peer support, engagement

in self-management behaviors, and self-efficacy. Informal peer support was positively associated with diet (r=.48, p<.001), self-management behaviors (r=.52, p<.001), and HbA_{1C} (τ_b= .26 p<.001). Self efficacy was found to mediate the relationship between informal peer support and diet (B=.21, 95% CI [.11, .31]) as well as a global measure of self-management behaviors (B=.14, 95% CI [.04, .24] , but not medication adherence or glucose control. Those who described their informal peer supporter as a veteran had higher (M=39.06, SE=.75) self-management scores than those described them as non-veterans (M=35.72, SE=1.11), t(159) = 2.59, p=.01).

Veterans need additional support to manage diabetes and control blood glucose, given that survey results were overall moderate, and participants reported suboptimal glucose control. Informal peer support was associated with self-management behaviors which may influence better glucose control. Future research is needed to further explore these relationships and how informal peer support may be used to enhance existing interventions that target peer support and diabetes management for veterans.

TITLE PAGE

PEER SUPPORT, SELF-EFFICACY, AND DIABETES SELF-MANAGEMENT IN VETERANS LIVING WITH DIABETES

by

MICHAEL SMART

A DISSERTATION

Presented in Partial Fulfillment of Requirements for the Degree of Doctor of Philosophy in Nursing in the Byrdine F. Lewis College of Nursing and Health Profession, Georgia State University

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ARMS	Adherence to Refills and Medications Scale
IPAQ	International Physical Activity Questionnaire
S4-MAD	Social Support Scale for Self-Care in Middle-Aged Patients with Type 2 Diabetes Scale
SCT	Social Cognitive Theory
SDCAM	Summary of Diabetes Self-Care Activities Measure
SED	Self-Efficacy for Diabetes
PDAQ	Perceived Dietary Adherence Questionnaire
PTSD	Post-Traumatic Stress Disorder

CHAPTER I.

INTRODUCTION

Type 2 diabetes is a common disease in the United States (US). It affects approximately 37.3 million people or about 11.3% of the total US population (Center for Disease Control, 2022). Type 2 diabetes is a chronic, lifelong disease and is associated with significant morbidity and mortality. Poor control of diabetes is associated with damage to essentially all organ systems resulting in cardiovascular disease, kidney disease, neurovascular disease leading to stroke, and eye disease among many others (Zheng et al., 2018). Therefore, managing diabetes and obtaining optimal glucose control is crucial in reducing the future risk of developing complications.

The veteran population, which is defined as those who have served in the US military, is at high risk of developing diabetes and experiencing related complications. The cause of this is likely multifactorial, including aging demographics of the veteran population (Pascucci et al., 2010), exposure to agent orange for those who served in Vietnam (National Academy of Sciences, 2018), use of psychotropic medications that treat diseases such as post-traumatic stress disorder (PTSD) that contribute to metabolic syndrome and diabetes (Trivedi et al., 2015), and impaired mobility due to joint pain. Although diabetes care is offered through the Veteran's Administration facilities, these

services and ongoing support for diabetes management are not available uniformly across the country, particularly in rural areas where about 25% of veterans reside (Office of Rural Health, 2021). In order to improve the care and optimize outcomes in veterans living with diabetes, more information on community-based, informal peer support for diabetes management for veterans is needed.

Background of the Problem

Diabetes affects approximately 25% of veterans (Hsu et al., 2014) which is significantly higher than the civilian population. The cause of this disparity between the prevalence of diabetes in the civilian population and the military population is likely related to several social determinants of health and other health outcomes. The aging veteran population tends to have a higher number of comorbidities (Eibner et al., 2016; Pascucci et al., 2010; RANDHealth, 2015), in addition to a diagnosis of diabetes. Exposure to agent orange, a herbicide commonly used by veterans during the Vietnam war, has been associated with diabetes in several epidemiologic studies (National Academies of Sciences, Engineering, and Medicine, 2018). Furthermore, the prevalence of mental illness including PTSD, substance use disorder, anxiety, depression, among others, are highly prevalent in this population, around 25.7% (Trivedi et al., 2015). Medications that are used to treat these psychiatric disorders, including antidepressants and antipsychotics, are associated with weight gain, metabolic syndrome, and diabetes (Llorente & Urrutia, 2006), which contribute to the overall burden of diabetes within this population.

The disproportionate burden of diabetes in this population is compounded by poor self-management behaviors. Failure to engage in self-management behaviors, which are defined as behaviors that an individual engages in to control their diabetes (Miller et al., 2015), is viewed as the primary cause of poorly controlled or uncontrolled diabetes (Peimani et al., 2018). Well-managed or controlled diabetes is defined by the American Diabetes Association (2021) as an HbA_{1C} of less than 7% without significant hypoglycemic episodes for most adults (with the exception of pregnant women, those with significant comorbidities, as well as individuals with a limited life expectancy).

Peer support among veterans living with diabetes may provide a useful resource to improve diabetes self-management. Peer support is defined as support from an individual who has experiential knowledge in a specific behavior and shares similar characteristics and diagnosis as the person for who they are providing support (Dale et al., 2012). Peer support can be further defined as formal peer support, which occurs within a structured setting (i.e. hospital), or informal, which occurs organically such as support from others in the community. While there is significant evidence that supports formal peer support programs within the veteran population (Arney et al., 2018; Heisler, 2010; Heisler et al., 2019; Long et al., 2012; Lott et al., 2019), there is limited evidence for informal peer support and its association with diabetes related outcomes. Informal peer support may provide a cost-effective resource that improves diabetes control and management in this population by improving self-efficacy of self-management behaviors in those living with diabetes.

Informal peer support may be particularly useful in older veterans with diabetes who live alone, putting them at higher risk of social isolation. Loneliness and social isolation are significant problems in military veterans (Wilson et al., 2018). Loneliness and social isolation have been associated with depression (Cacioppo et al., 2006), as well as poor health outcomes including in those living with diabetes (Tomaka et al., 2006). Informal peer support may not only improve self-efficacy related to diabetes self-management behaviors but may also reduce the burden of social isolation and loneliness experienced by these veterans. This may indirectly lead to improved self-management behaviors and improved glucose control. However, further evaluation is needed to understand and explore the impact of informal veteran peer support in those living with diabetes and its impact on glucose control.

Purpose Statement

The purpose of this study is to explore informal peer support among veterans living with diabetes, its impact on self-efficacy related to diabetes self-management behaviors, as well as glucose control.

Theoretical Framework

The Social Cognitive Theory (SCT) was used as a guiding framework to explore informal peer support within the veteran population living with diabetes. This theory is useful in examining the relationships between specific concepts and constructs including informal peer support, self-efficacy, and self-management.

The SCT postulates that learning is a dynamic process that occurs between the individual, the environment in which they are living, and their behavior (Somsak & Chawapon, 2019). The SCT contains five main constructs: knowledge, perceived self-efficacy, outcome expectations, goal formation, and socio-structural factors (DiClemente et al., 2019). According to this theory, knowledge related to a behavior must first be known before the behavior change can occur. Self-efficacy, or the individual's perception of their own ability to engage in a specific behavior, must also be present, in that the individual must believe that they can engage in the behavior. The individual must also have the behavioral capacity to complete or execute the specific behavior. Finally, the individual must believe or have an expectation, referred to as an outcome expectation, that their successful execution of a behavior will result in the intended outcome.

The SCT and its constructs can be applied to this study examining the relationships of informal peer support, self-efficacy, and diabetes self-management behaviors. Specific knowledge related to self-management behaviors may come from informal peer supporters who have diabetes. This may include knowledge of behaviors related to medication adherence (such as discovering new ways to remind oneself to take medication) or ways to improve dietary choices (such as help reading nutrition labels or navigating meal choices when eating out).

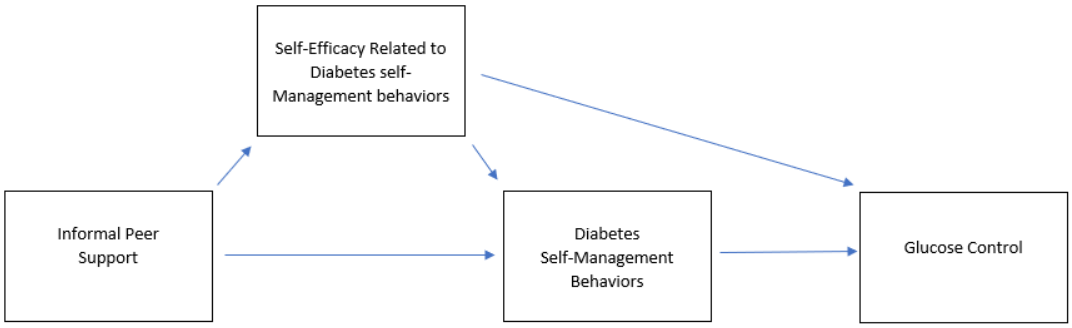
In addition, having an informal peer supporter who has diabetes and is engaging in self-care behaviors to improve their own disease may improve the

other individual's own perceived self-efficacy. Improvement in self-efficacy may occur through a variety of methods. The individual may be verbally persuaded that they too can engage in positive self-management behaviors to manage their diabetes. Perhaps more importantly, the vicarious experience or observational learning that occurs between the individual and the informal peer supporter may be the most useful method of improving self-efficacy (DiClemente et al., 2019). Learning may be maximized when one sees or observes someone similar to themselves successfully executing a specific health behavior (Bandura, 2008).

The SCT provides a framework of variables and relationships that allow for a mediation analysis within the context of informal peer support, self-efficacy, and glucose control in those living with diabetes. Informal peer supporters, particularly those who are successful in managing their diabetes, may influence the expectations that self-management behaviors have on glucose control. If an individual sees that their peer is successfully engaging in positive self-care behaviors, such as being adherent to medication and diet, and ultimately has a good outcome such as good glucose control, it may influence the perception of self-efficacy of that individual to engage in these behaviors as well, set goals for glucose control, and likewise improve glucose control. The following diagram in Figure 1 depicts self-efficacy as a mediator between peer support, self-management behaviors, and glucose control.

Figure 1

Theorized Mediation Effect of Self-Efficacy



Note. Representation of the theorized mediation effect of self-efficacy related to diabetes related self-management behaviors between informal peer support and engagement in self-management behaviors.

Specific Aims and Hypotheses

The primary aim of this exploratory, cross-sectional study is to examine the possible associations between informal veteran peer support, self-efficacy related to diabetes self-management behaviors, diabetes self-management behaviors, and glucose control. Scientific research questions that are related to the primary aim of this study are:

1. Is informal peer support associated with diabetes self-management behaviors and glucose control?

2. Does self-efficacy related to diabetes self-management behaviors mediate the relationships between informal veteran peer support and diabetes self-management behaviors and glucose control?

3. Is the presence of peer support associated with increased measurements in self-efficacy, engagement in diabetes related self-management behaviors, and glucose control when compared to those without peer support?

The hypotheses for the study are:

1. The presence of informal veteran peer support will be positively associated with diabetes self-management behaviors as well as glucose control.

2. Self-efficacy related to diabetes self-management will mediate the relationships between the presence of informal veteran peer support and diabetes self-management behaviors and glucose control.

3. The presence of peer support is associated with increased measurements of self-efficacy, engagement in diabetes related self-management behaviors, and glucose control compared to those who do not have or engage with a peer supporter.

Conceptual Definitions and Terms

Peer Supporters and Informal Peer Support

Peer supporters are defined as individuals who provide support to others who have similar characteristics and experience the same disease as the individual to whom they are providing support to (Dennis, 2003). Peer supporters

may share similar characteristics that may include social, race/ethnic, or socioeconomic background, among others. In the context of peer supporters in the healthcare setting, peer supporters can be defined as supporters who have experiential knowledge in the disease for which they are providing support (Dennis, 2003). Peer supports then, as it relates to this study, are conceptually defined as individuals with diabetes who are providing support to others living with diabetes (Fisher et al., 2012). For this study, 'support' is primarily limited to diabetes, including health promotion related to diabetes self-management.

Informal peer support is a specific type of peer support that occurs outside of the formalized health care setting (Gandy-Guedes et al., 2016). In essence, informal peer support occurs organically. This is opposed to formal peer support programs which occurs in a structured setting. Examples of formal peer support may include instances where two individuals are paired to provide support with each other in a structured setting facilitated by a healthcare organization. As previously mentioned, this study will instead focus on informal peer support, which occurs outside of a formalized setting.

Self-Efficacy

Self-efficacy is a concept developed by the psychologist Albert Bandura and can be defined as an individual's judgement of their own capability to organize and execute a specific action or behavior (Bandura, 1987). Self-efficacy can influence the effort that an individual devotes towards a behavior, as well as the persistence of maintaining or continuing to engage in the specific behavior (Bandura, 1987). Characteristics of self-efficacy that are specifically related to

diabetes include having the cognitive ability to engage and complete specific skills related to diabetes, having confidence in one's ability to successfully execute specific behaviors or tasks related to diabetes, and most importantly sustain these self-management behaviors (Liu, 2012).

Self-Management Behaviors

Self-management behaviors related to diabetes are behaviors that an individual engages in to manage their diabetes (Miller et al., 2015). Self-management behaviors have also been conceptualized as the actions that one takes that is related to treatment compliance of the disease, management of events related to the disease, safety, and lifestyle management in order to achieve adequate glucose control, defined as an HbA_{1C} of less than 7% for most individuals (American Diabetes Association, 2021). Self-management behaviors are observable and measurable (Unger & Buelow, 2009), and include behaviors such as glucose monitoring, medication adherence, and engagement in physical activity.

Study Assumptions and Potential Limitations

There are several assumptions of this study and they are as follows:

- Veterans engage in sharing advice related to diabetes self-management with others who also have diabetes.
- Barriers to engagement in self-management behaviors related to diabetes is a result of a limited perception of one's own self-efficacy.
- Behaviors are learned by observing others.

This study has several potential limitations. The first is that data used for the study were from a convenience sample and may not be representative of all veterans living with diabetes. This may limit the generalizability of the findings. Self-reported data were used, including self-identification as a veteran, self-reported blood glucose control data, as well as reports on engagement in diabetes related self-care behavior. While other measures such as verification of veteran status, chart reviews, accelerometer data for physical activity, and medication refill data would be preferable, it is not feasible for this study due to the lack of access to medical records and financial constraints.

Finally, decisions about engagement in self-management behaviors, whether passive or active, are complex. While this study does not seek to complete an exhaustive study of self-management behaviors, it does seek to evaluate the associations of peer support, self-efficacy, and diabetes related self-management behaviors, which could have potential implications for the development of future peer support interventions.

Summary

Diabetes is a prevalent disease within the veteran population, and novel interventions that impact diabetes management and outcomes are needed. Informal peer support may offer a potential avenue in which to target interventions to improve outcomes in those living with diabetes. However, first understanding the associations among informal peer support, diabetes self-efficacy, diabetes self-management behaviors, and glucose control is needed.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter provides a review of the current literature relating to peer support and the benefits of peer support in the veteran and non-veteran population. Additionally, the review includes literature examining characteristics that facilitate peer support relationships as well as studies that have evaluated moderators and mediators within peer support relationships in those living with diabetes.

Peer Support: Background & Benefits

Individuals who share similar experiences often find it natural to share advice and practical recommendations for approaching specific problems with others who may be unaware of that particular problem solving strategy (Okoro, 2017). In this way, peer support is believed to contribute to improved disease self-management as well as treatment adherence (Walker & Peterson, 2021). Peer support, defined as support from an individual who has experiential knowledge in a specific behavior or stress who also shares similar characteristics as the person to whom they are providing support (Dale et al., 2012), has been shown to provide many benefits in those living with diabetes, both for those receiving and providing support (Fisher et al., 2012). It may also be a useful adjunct in populations that are difficult to reach, including those who are

physically distant from healthcare facilities (Sokol & Fisher, 2016). Peer support in chronic disease management has even been endorsed by the World Health Organization as an effective means for health promotion and disease management (Okoro, 2017).

Peer support may be particularly useful in the veteran population. The military culture encourages team work to achieve a common goal (Drebing et al., 2018). Additionally, the shared experiences of veterans who were in combat together may help strengthen peer relationships. Furthermore, veterans may view their peers as trustworthy and may seek out others that share a similar disease for information and support (Hundt et al., 2015)

Peer support interventions are not a new concept, and have even been evaluated among a variety of settings and diseases within the veteran population including in those with PTSD (Jain et al., 2016), cardiovascular disease including hypertension (Nelson et al., 2018), obesity (Wittleder et al., 2021), and depression (Nelson et al., 2018) among many others. However, interventions utilizing peer supporters have not, until recently, gained wider appreciation in the medical community.

The first reports of using peer support in the literature occurred in the 1980's when a peer support program was implemented and tested for those living with osteoarthritis (Lorig et al., 1985). In this study, the researchers found that those who received a peer support intervention had improvements that were sustained in self-management behaviors related to osteoarthritis and pain symptoms (Lorig et al., 1985). Subsequent peer support interventions and their

impact on self-management behaviors have been studied in multiple populations and in different settings (Helen et al., 2019; Huang et al., 2020; Ingram et al., 2020; Jacqueline et al., 2021; Khodneva et al., 2021; Kidd et al., 2021; Kyaw et al., 2021).

Peer support may be a useful adjunct to medical treatment in those living with diabetes. Following lifestyle recommendations for diabetes is an important component of self-management of type 2 diabetes, and requires behavioral changes related to diet, exercise, and medication management. Improper disease self-management is seen as the primary obstacle to glucose control in those living with diabetes (Peimani et al., 2018). Peer supporters may be in a unique position to help other peers integrate these behavioral changes because they have already integrated these self-management behaviors into their own lives to successfully manage their disease.

The peer relationship between those providing support and those receiving support is often reciprocal (Dale et al., 2012). In addition to the peer receiving the support, the peer providing the support may benefit from gaining new knowledge, receiving social approval, and having an improved feeling of competence. Furthermore, providing guidance and support to someone with a similar medical condition may encourage a sense of empowerment, mastery over behavioral tasks, and ultimately improve the peer supporter's self-efficacy related to diabetes self-management (Dale et al., 2012).

Veterans may be particularly receptive and benefit from peer support. Veterans have higher rates of social isolation and loneliness when compared to

the non-military population(Campbell et al., 2021), which may contribute to poor disease self-management (Arney et al., 2020). Low self-efficacy, maladaptive coping mechanisms, depression, and limited social support have also been identified as contributors to barriers to self-management in those living with diabetes (Kwan et al., 2017). Therefore, peer support related to disease management could potentially reduce feelings of loneliness and isolation in addition to providing information and encouraging self-management behaviors that can improve health and well-being (Paul et al., 2007).

Informal Peer Support

Although the presence of informal peer support has been documented in the literature (Surkan et al., 2019), there is limited research that evaluates the extent that informal peer support occurs in those living with diabetes. Existing research has shown that the presence of social support (i.e. from family or friends without diabetes) is a predictor of engagement in self-management behaviors such as exercise and medication adherence (Surkan et al., 2019) and has been associated with positive diabetes related outcomes (Lee et al., 2018); however not everyone with diabetes may be able to access this type of social support. In one qualitative study by Bech et al. (2019), researchers found that individuals living with diabetes may not access family and friends (those without diabetes) for support for several different reasons including having a lack of family and friends, dysfunctional relationships, as well as not wanting to burden already fragile relationships.

It is unclear the extent to which informal peer support impacts diabetes outcomes in those living with diabetes. Qualitative studies have evaluated some common themes that occur within information exchanges within informal peer relationships. Interviews of those living with diabetes have shown that informal peer supporters encouraged others to accept and implement advice given by healthcare providers, as well as advice related to maintaining consistency of diabetes self-management behaviors (i.e. blood glucose monitoring) (Brown et al., 2020). Qualitative interviews in those receiving informal peer support have found that sharing the experience of having diabetes with someone like themselves is less isolating and lonely (Ekenhorst et al., 2019).

Therefore, further research is needed examining the effect that informal peer support has on diabetes related outcomes, including its impact on self-management behaviors including medication adherence, self-monitoring of blood glucose, adherence to dietary and physical activity recommendations, and ultimately control of blood glucose.

Formal Peer Support in Veterans Living with Diabetes

While there is a limited examination of informal peer support in veterans living with diabetes, formal peer support (defined as support occurring through an organized structure) within the veteran population has been studied. Multiple studies have examined how formal peer support programs have resulted in improved glucose control.

Heisler et al. (2010) compared diabetes related outcomes between peer support dyads and interventions by a nurse educator. The researchers found that

those who were in the peer support arm of the study had a 58% greater reduction in HbA_{1C} compared to the nurse education arm (p= .004). Furthermore, those who had poorly controlled diabetes (defined as those with an HbA_{1C} of greater than 8%) had an even greater improvement in HbA_{1C} when compared to the nurse education group (0.88% vs 0.07%). Peer supporters within this study had formal training in communication skills and were paired with an age-matched peer. This pairing was based on certain shared characteristics of participants such as age that may have contributed to the success of the program.

In another study by Heisler et al. (2019), researchers evaluated a randomized peer support intervention that compared two different formal peer support interventions: one standard support intervention group and another group that utilized a web-based tool within the peer dyad to improve and enhance support. While there was not a significant difference between the groups in terms of glucose control, both groups had about a 0.6% improvement in their HbA_{1C} ($p < .001$) that was sustained over a twelve-month period.

Another study compared peer support with financial incentives to improve glucose control (Long et al., 2012). In this study, peer supporters were recruited if they had previous poor glucose control and later had good control (defined as an HbA_{1C} of less than 7.5%). Peer supporters were provided with formal training in motivational interviewing to help facilitate better glucose control. The other intervention arm, the financial incentive group, received between $0 to $200 depending on whether they improved their HbA_{1C} without a peer supporter, but with other available resources (i.e. dietician, nursing care). The study found that

while those in the control arm of the study and financial incentive arm of the study had no improvement in glucose control, those who were in the peer support arm had a significant improvement in their HbA_{1C} of 1.07% (95% CI [-1.84 to -0.31]). This study demonstrates that peer support interventions may have a significant impact on glucose control.

It is important to note that in the studies by Heisler et al. (2010) and Long et al., (2012), both groups received formal training in communication. The study by Heisler (2010) reported formal communication training, however it's unclear what was included in the content of the skills training. Long et al. (2012) reported that the peer supporters were provided with motivational interviewing-based communication training. However, it is unclear the degree to which the peer supporters utilized these skills and the direct impact that the skills training ultimately had on participant glucose control outcomes.

Qualitative studies have also been performed to evaluate veterans' perceptions of peer support programs (Arney et al., 2020; Lott et al., 2019). Researchers found that veterans perceived peer support interventions as beneficial. Veterans reported that peer supporters helped them to improve their self-confidence in managing diabetes, held them accountable for managing their diabetes (i.e. through diet, medication adherence, medical office visits) which ultimately resulted in their self-reported improvement in self-efficacy related to diabetes self-management (Arney et al., 2020). Furthermore, the peer supporters reported that their experience of being a peer supporter was viewed as an

altruistic experience and reported that the experience of providing peer support to others with diabetes was overall beneficial (Lott et al., 2019).

Characteristics that Facilitate Successful Peer Support Relationships in Military Veterans

When compared to studies examining peer support in those living with diabetes, studies that examine peer support among veterans tend to have better outcomes when compared to peer support interventions in the civilian population. These differences in outcomes may be in part due to the unique characteristics of the military population. The military culture that veterans are entrenched in emphasizes mutual support and encourages members to work together to achieve a common goal (Drebing et al., 2018). For those that served in combat zones, the shared experience of actively being at war may also help to strengthen and improve the peer relationship (Nelson et al., 2018). Veterans may view their peers, including their peer supporters, as more trustworthy than VA providers and other clinicians, and have also reported a greater sense of understanding from other veterans as it relates to living and coping with the disease (Hundt et al., 2015),

Moderators and Mediators in Those with Diabetes Peer Support

Various aspects of peer support have been evaluated as moderators and mediators within peer support interventions on several different outcomes (Mizokami-Stout, 2021; Piette et al., 2013). In one study, researchers evaluated different mediators and moderators that were thought to impact glucose control and diabetes distress within a peer support intervention (Mizokami-Stout, 2021).

Using data from a prior research study by Heisler et al. (2019) that compared two peer support interventions within the veteran population (one technology-mediated peer support intervention and another non-technology mediated peer support intervention) researchers examined multiple variables as mediators and moderators of diabetes distress on HbA_{1C}. Variables that were evaluated for their mediator effects included goal setting, perceived competence, decisional conflict, as well as intrinsic motivation. Variables that were evaluated for their moderating effects included the participants' race, age, education, employment status, health literacy, duration of diabetes, insulin use, current HbA_{1C}, diabetes-specific social support, as well as depression. The individuals perceived competence as well as use of goal setting were found to mediate improvements in both HbA_{1C} as well as diabetes distress. The participants race (β=0.03, p=.002) and use of insulin (β=0.02, p= .02) were found to be relatively small, but statistically significant moderators of diabetes distress and HbA_{1C}. In other words, race and insulin were found moderate the effects of reduced diabetes distress on improved glycemic control, however these effects were small.

Moderators and mediators were evaluated through a secondary analysis of another study by Heisler et al. (2010) that compared a formal peer support program to standardized support from a nurse (Piette et al., 2013). Mediators of the intervention that were evaluated for their effect on the HbA_{1C} included perceived diabetes social support as well as insulin uptake. The researchers found that the change or use of insulin mediated the effect of the peer support

intervention on glucose control as measured by the $HbA_{1C,}$ mediating about 49% of the relationship (95% CI [0.30, 0.80]).

Interestingly, only Mizokami-Stout et al. (2021) evaluated perceived competence as a mediator of the intervention on blood glucose control. Perceived competence was measured by the Perceived Competence Scale in the original study (Heisler et al., 2019), which is described as the extent to which a participant feels confident and capable of meeting the challenges of diabetes self-management, a similar to the concept of self-efficacy by Bandura (Bandura, 1987).This finding supports the investigation into the evaluation of self-efficacy as a mediator between informal peer support and glucose control.

Summary

While there has been a significant amount of investigation into formal peer support interventions and its impact on outcomes related to blood glucose control, there is limited evidence that informal peer support influences diabetes self-management. Understanding the impact that informal peer support has on diabetes self-management, and ultimately blood glucose control, could provide other avenues of intervention. Before other potential interventions could be considered, further investigation is necessary. In order to understand how informal peer support influences diabetes self-management behaviors, self-efficacy related to self-management behaviors will be evaluated as a mediator between informal peer support and self-management behaviors.

CHAPTER III

METHODOLOGY

This chapter presents the methodology of this study on informal peer support, self-efficacy for self-reported diabetes self-management behaviors and glucose control in a veteran population. The design of the study, inclusion and exclusion criteria, measurement tools, study procedures for recruitment and data management and analysis are included.

Study Design

This study was a cross-sectional, correlational design to evaluate associations between the presence of informal peer support, self-efficacy, and behaviors related to diabetes self-management in the veteran population. This design was appropriate for the study given that data were collected at one point in time, and the intent of the study was to examine relationships between the concepts of interest.

Specific self-management behaviors related to diabetes were measured by examining medication regimens, diet, blood glucose monitoring, and physical activity. Additionally, a mediation analysis was completed to evaluate self-efficacy as a mediator between informal peer support and diabetes self-management behaviors as well as glucose control. The association between diabetes self-management and self-reported diabetes glucose control was also explored.

Sample and Inclusion and Exclusion Criteria

This study used both a convenience and snowball sampling to recruit participants. Inclusion criteria included individuals who (a) self-identified as a veteran, (b) self-identified as having a diagnosis of type 2 diabetes, (d) were over the age of 18, (d) and were able to speak the English language. Having an identified peer supporter was not required of the participant. Exclusion criteria included (a) those that had type 1 diabetes, gestational diabetes, or prediabetes. If a participant was unable to read or write the English language and therefore unable to complete the written or electronic survey, then the option of completing the survey via the phone was available.

The sample for the study included both men and women who identified as veterans that served in the United States military. Given the barriers of establishing veteran status and the feasibility of the study, participants were not required to prove or verify their veteran status. However, recruitment occurred in venues (online and physical locations) that cater to the veteran population, such as veteran service organizations (i.e. Veterans of Foreign Wars, American Legion).

Participants were not limited to combat veterans and included any veteran who had served in the US military in any capacity including the reserves. As previously stated, participants self-reported as having a history of type 2 diabetes. Although verification of the diagnosis of diabetes from medical records would be preferable, research has documented the consistency between self-

reported diagnosis of diabetes and the actual presence of the disease (Okura et al., 2004).

Participant Incentives

In order to facilitate recruitment, a $10 dollar gift card to Walmart was initially offered to participants. This amount was later increased to $20 dollars. Gift cards were sent electronically to the participant's email. For those who did not have access to email or preferred a physical gift card, there was an option to have it mailed to their preferred address.

Setting

Sampling and recruitment occurred from both organizations and online platforms that catered to the veteran population. Physical recruitment occurred in organizations including the American Legion and Veterans of Foreign Wars within the metro Atlanta area primarily with the use of flyers. Recruitment also occurred from online platforms such as Facebook that cater to the veteran population.

Sample Size

The sample size of the study was estimated from a publication by Fritz and Mackinnon (2007) that provided information on calculating the necessary sample sizes for multiple types of power analyses and different effect sizes for mediation analyses. In consultation with a statistician, a decision was made to use the pre-calculated sample size given the complexity of calculating the effect size that considers multiple effects, including indirect effects. Additionally, there

was a lack of existing research on the effects of informal peer support, which did not allow for effect size projections.

Process MACRO (Hayes, 2017), which utilizes a random sampling process called bootstrap sampling for mediation analysis, was used for mediation analysis. Therefore, per Fritz & MacKinnon (2007), the sample size for this study was estimated to be 162, based on a power analysis with a .80 power to detect an effect size of .26. There was little literature to guide the determination of the effect size for testing self-efficacy as a mediator between peer support and diabetes self-management. The projected sample size was deemed to be adequate using the planned recruitment strategies to achieve a small effect size.

Procedures

Participant recruitment occurred at physical locations including veteran service organizations, as well as from online platforms that catered to veterans. Recruitment in physical locations in the metro Atlanta area included Veterans of Foreign Wars, Georgia State Department of Veterans Services, AMVETS, the American Legion, Paralyzed Veterans of America, and the Disabled American Veterans organizations. In person recruitment methods at physical locations included posters and flyers that described the study and provided the contact information of the researcher. Online recruitment primarily occurred via posting information about the study on veterans' groups accessed on Facebook.

In order to facilitate and streamline communication, a dedicated phone line and email address was advertised so that potential participants were able to use to contact the researcher. Information and questions about the study were

communicated through these channels. Veteran status, presence of diabetes, in addition to other inclusion and exclusion criteria was determined via a phone call to screen potential participants.

Additionally, information about the concept of peer support, including informal peer support, was given to participants to provide some context of the study to the veteran. During the initial phone call to determine eligibility, participants were asked if they could obtain their most recent HbA_{1C} value (within the prior six months) from their medical provider or online portal before beginning the survey. However, they were told that obtaining the HbA_{1C} was not obligatory, and not a requirement to participate in the study.

If the veteran qualified for the study, they were able to choose between completing the study online via an online survey, via paper copy sent through mail, or via the telephone with the researcher. A link to complete the survey was sent through the web-based application Qualtrics, available from Georgia State University research services. The survey process included notification to the participant if a response to a question is missed before completing the next section online survey data was protected by a high-end firewall system. All online data was encrypted. Unique usernames and passwords for participants were generated. Survey data was anonymous, and only aggregate data from the results is presented.

If a participant did not have access to the internet or unable to access Qualtrics, participants had the option of having a paper survey mailed to them with a pre-postage return envelope. Mail correspondences would have occurred

through a P.O. box at a local post office. However no respondents chose this method.

The veteran also had the option to complete the survey over the phone. In this case, the researcher would have read the items from each survey, and the participants would have given a verbal response. Verbal responses would have been recorded on paper surveys, and saved in a secure, locked drawer. However, no participants chose this method.

If missing data occurred, the researcher attempted to contact the participant and obtain responses via email. If unable to contact participants with missing survey items, and surveys had less than 20% of missing items, mean item replacement was used to replace missing values (Aycock & Hayat, 2020). Participants with 20% or more items missing on a survey would not have been included in the final analysis, however all surveys were completed in their entirety or had less than 20% of missing items.

Protection of Human Subjects

Institutional review board approval was obtained through Georgia State University. Participants were informed of the purpose of the study, their potential contribution in participating in the study, and the voluntary nature of the study. Participants were made aware of their ability to withdraw from the study at any point. Consent was obtained both verbally via the phone, as well as electronically prior to the individual starting the survey.

Survey data was de-identified and each survey was identified by a random, numerical ID. A master copy of numerical ID and patient data was

stored on a password protected server. Paper surveys were stored in a locked file cabinet. De-identified data was uploaded into SPSS for statistical analysis and stored on a password protected server. Only grouped, aggregated data was reported in the final analysis.

Participants were made aware that their responses to the questions would be de-identified, and their information and responses would not be shared with others. Consent for participation was obtained by the researcher during the initial phone call after eligibility had been determined, as well as electronically before beginning the survey. The burden on the participants was minimal. The time for completion of the study was approximately 45 minutes.

Study Measures

Demographic & Diabetes Related Information

Participant demographic information was obtained through a questionnaire. Demographic information included the participant's age, race and ethnicity, level of education, living situation (living with family/significant other or alone), employment status, income, marital status, and time spent in the military. Other information related to diabetes included the length of time that they had been diagnosed with the disease and the type of medications used to treat diabetes (oral vs injectable medication). Additional information related to the number of oral antidiabetic medications was collected. If participants reported taking insulin, they were asked the number of times per day they were prescribed to take their insulin. Comorbid conditions were asked about and included the diagnosis of hypertension, obesity, mental health conditions (including but not

limited to depression, anxiety, PTSD, bipolar disorder), chronic pain, heart failure, stroke, coronary artery disease, peripheral arterial disease, chronic kidney disease, and diabetic retinopathy. Information regarding their peer supporter included their relationship to the peer support person and whether the peer was also a veteran.

Informal Peer Support- Social Support Scale for Self-Care in Middle-Aged Patients with Type 2 Diabetes (S4-MAD)

The S4-MAD is a 30-item questionnaire evaluating social support related to diabetes self-care behaviors including foot care, nutrition, blood glucose monitoring, physical activity, and smoking (Naderimagham et al., 2012). The S4-MAD was used to collect information about the study participant's perception of informal peer support. Items were answered on a five-point Likert scale. There were 5 subscales, and scores were obtained by averaging the scores from each subscale including those related to nutrition (9-items), physical activity (5-items), blood glucose self-monitoring (7-items), foot care (6 items), and smoking (3-items). Final scores from each subscale were added together and then divided by the total number of items. Final scores can have a range between 1-5. Higher scores represented higher levels of social support related to diabetes self-management.

This scale has not yet been tested within the veteran population, however tests for validity and reliability have been performed within a cohort of middle-aged adults with diabetes (Naderimagham et al., 2012). Construct validity was evaluated using exploratory factor analysis on a total of 204 individuals living with

diabetes. Factor loadings that were .4 or higher were considered appropriate for inclusion. The internal consistency for this instrument was found to be .94, which is adequate (Nunnally & Bernstein, 1994).

Diabetes Self-Management Behaviors

Self-management behaviors related to diabetes are defined as behaviors that individuals engage in to manage their diabetes (Miller et al., 2015). Self-management behaviors that were considered for this study included engagement in physical activity, diabetes diet, blood glucose monitoring, and adherence to a prescribed medication regimen. These self-management behaviors were measured through several different patient reported measurement tools as described below.

Self-Management Behavior: Perceived Dietary Adherence Questionnaire (PDAQ). The PDAQ is a nine-item questionnaire that was used to measure the participants consumption of certain types of foods over the previous seven days related to nutrition recommendations for individuals with diabetes (Asaad et al., 2015). The instrument identifies intake of certain food groups including fruits and vegetables, foods with low glycemic index, foods with a high glycemic index, high fiber foods, foods high in omega-three fatty acids and monounsaturated oils, and animal products with high animal fat. Participants provide responses related to how many days out of the prior seven days that they had consumed types of foods or eaten a diet that corresponds with national nutritional recommendations. Items 4 (consumption of foods with low glycemic index) and 9 (foods with high animal fat) were reverse scored to calculate the

final score. Total scores range from 9-72. Higher scores on the scale reflect healthier food choices consistent with a diet recommended for individuals with diabetes.

The internal consistency and the stability of the instrument were evaluated in a sample of individuals living with diabetes. The Cronbach's alpha for the PDAQ was α=.79 and the reliability of the test was found to be stable over repeated measurements with a Pearson's correlation coefficient of r=.76 (Asaad et al., 2015). Validity was measured by comparing the measurement tool to three repeated 24-hour dietary recalls, comparing the consumption of certain foods to answers by participants on the PDAQ. There was significant variation in the correlation between individual items on the PADQ and associated answers from the 24-hour recalls (correlations ranged from r=.11-46), which ranged in significance but overall were small to moderate and suboptimal. Although higher correlations would have been preferable, there were limited measurement tools that evaluate diet specifically for those living with diabetes.

Self-Management Behavior: Adherence to Refills and Medications Scale (ARMS). The ARMS is a 12-item scale that measures both medication adherence as well as medication refills (Kripalani et al., 2009). The scale contains two subscales, one 8-item subscale that measures the individual's adherence to taking the medication, and another 4-item scale that assesses the individual's ability to refill medications. Items were answered on a four-point Likert scale from 1 to 4, representing 'none,' 'some,', 'most,' or 'all' of the time. Reponses were changed to a numerical score and added. Item 12 was reverse

coded. Total scores ranged from 12-48. Lower scores indicated better adherence to the medication regimen (Kripalani et al., 2009).

Although this scale was not designed specifically to measure adherence in those living with diabetes, approximately half of the participants that the scale was tested in for validity and reliability were living with diabetes. The internal consistency of the scale was evaluated within that sample and was α=.81 (Kripalani et al., 2009). Test-retest reliability was evaluated and found to be sufficient, r= .69. The scale was evaluated for criterion validity by comparing the scales to the Morisky Medication Adherence, which is one of the most commonly used scales to measure medication adherence and found to have correlation coefficient r= .65. Although a correlation coefficient of r=.65 is suboptimal, other measures such as obtaining refill data or use of the original Morisky Medication Adherence tool would not be feasible due to prohibitive costs and logistical barriers.

Self-Management Behavior: Physical Activity Questionnaire (IPAQ). Engagement in physical activity was assessed with the 31-item IPAQ (Craig et al., 2003). The IPAQ measures different types of activity that may occur throughout the day as well as the individual's perceived intensity or exertion during the activities. Several activity domains are measured including activity related to leisure time dedicated to physical activity, work related physical activity, transport-relate physical activity, and domestic house working and gardening/yard activities (Craig et al., 2003). Participants were asked about their self-reported physical exertion during these activities (moderate or vigorous) and

asked about the amount of time they engaged in these activities. The IPAQ measures self-reported activity that has occurred in the prior seven days. Responses were calculated by multiplying the number of minutes that the participant engaged in the activity by the number of days that they engaged in the activity to obtain the minutes per week that they engaged in the activity. Activities were grouped by walking, moderate exertion, and vigorous exertion, and multiplied by the responding metabolic equivalent (MET) coefficient. The MET is defined as the rate of energy expended during an activity compared to the rate of energy expended at rest. Higher MET scores are associated with higher levels of exertion. Total MET-minutes per week were calculated by adding all the MET minutes per week. Final scores were calculated as a continuous variable of MET minutes/week.

The stability of the test was found to be stable over a prior of ten days, with a test-retest reliability of r=.96 from a sample within the United States (Craig et al., 2003). The self-reported instrument was compared with actual activity with the use of accelerometers (for walking/running), and found that the criterion validity was approximately r=.70 (Craig et al., 2003), which is acceptable (Nunnally & Bernstein, 1994)

Self-Management Behavior: Blood Glucose Monitoring. Participants were asked about the frequency with which they checked their blood glucose and its range with a survey developed by this writer. Blood glucose monitoring has been associated with improved glucose control in those with type 2 diabetes, both in those on an oral regimen as well as an insulin regimen (Xu et al., 2019).

Participants were asked whether they checked their blood glucose levels (yes or no) and if so, how often it was checked (more than once per day, daily, several times per week, weekly, or less than once per week). Participants also provided their average range of their blood glucose readings over the previous week. In order to provide further context to their reported readings, particularly in those that check their blood sugars multiple times per day, participants were asked about their average readings during different times of the day (morning, noon, evening, or bedtime).

Self-Management Behavior: The Summary of Diabetes Self-Care Activities Measure (SDCAM). The Summary of Diabetes Self-Care Activities Measure (SDCAM) is an 11-item self-report instrument that measures the frequency an individual engages in activities related to diabetes self-management (Toobert et al., 2000). This tool is a broad measure of diabetes self-care activities and provides additional validation of self-reported, self-management activities when compared to the other scales that individually measure each behavior.

The tool contains five subscales that measure diet, exercise, blood glucose testing, foot care, and smoking (Toobert et al., 2000). Adherence to a prescribed medication regimen was not measured. Each response was measured on a scale of 0-7, indicating the number of days within the past week that the participant engaged in those behaviors. Scores were calculated for each domain or subscale by calculating the mean number of days that the individual engaged in the behavior, ranging from 0-7. An aggregate, total score for all items

was not recommend by the authors given the multidimensionality of self-management related to diabetes care and their recommendations to assess each behavior separately. However, for the purposes of this study in an effort understand how informal peer support is associated with diabetes self-management behaviors and complete the statistical analysis, a total composite score was used.

The scale that was used was the revised version of the SDCAM. Psychometric properties were evaluated on the original SDCAM, and changes to the scale were based on those findings. Although there is no psychometric data evaluating the revised scale, seven studies have been conducted that evaluate the psychometric properties of the original scale (Feil et al., 2000; Glasgow et al., 1999; Glasgow et al., 1997; Glasgow et al., 2000; Glasgow & Toobert, 2000; Glasgow et al., 1992; Wagner et al., 2001), and included both intervention and observational studies. The mean age of those sampled for the studies were between 45 and 67. All participants had type 2 diabetes and were adults. The stability of the instrument was evaluated in several of the studies and ranged from r=.25-.67 for the diet subscale, r= .42-.55 on the exercise subscale, r=.30-.78 for the blood glucose testing subscale. Overall, these coefficients of stability are suboptimal. The stability for the medication adherence subscale was very low and not statistically significant in the studies that measured it and was removed from the revised version.

The internal consistency as measured by the inter-item correlation (Cronbach's alpha was not calculated) was measured across seven different

studies and found to range from *r*= .07-.71 for the diet subscales, *r*=.47-.80 for the exercise subscale, and *r*=.69- .75 for the blood glucose testing subscale.

Criterion validity was measured in several studies comparing the subscales to preexisting instruments. Specifically, the diet subscale was compared to the Block Fat Screener (Glasgow et al.; 1992; Feil et al., 2000), Kristal Food Habits Questionnaire (Fiel et al., 2000, Glasgow et al., 1998), and were not found to be statistically significant utilizing an alpha of .05. Criterion validity was evaluated in the exercise subscale with comparison to several exercise measures (Stanford Recall, Attendance, and Exercise Self-Monitoring Scale), and was weakly to moderately correlated with these scales, *r*=.20-.58.

Self-Efficacy: Self-Efficacy for Diabetes (SED)

The Self-Efficacy for Diabetes is an eight-item scale that evaluated an individual's self-efficacy related to diabetes-related self-management behaviors (Lorig et al., 2009). The tool asks the individual how confident they were with their food intake and diet selection related to diabetes, engagement in exercise, and overall control of diabetes. Items were scored based on the participants self-reported confidence in engagement in the behaviors with a Likert type scale, which the choice to choose a response from 1-10 ('not at all confident' – 'totally confident'). Responses of items are added together to compute the final score, ranging from 8-80. A higher score on the scale represents higher perceived self-efficacy, while a lower score represents lower self-efficacy.

The psychometric data of the instrument was evaluated using a secondary analysis of data for an intervention to improve self-efficacy among a population of

adults living with diabetes (Ritter et al., 2016). The scale was tested on a total of 1,146 adults, both in person and online (Ritter et al., 2016). The scale had a Cronbach's alpha of α=.84 for the in-person group and α=.87 for the online group. The stability of the instrument was tested and found to be r=.80. Criterion validity, through comparison with other scales, was not performed.

Diabetes Outcome: Self-Reported HbA_{1C} & Blood Glucose Readings

Participants were asked about their recent $HbA_{1C,}$ as well as their recent blood glucose readings, a marker of blood glucose control. Recent HbA_{1C} was self-reported given the limitations and inability to corroborate HbA_{1C} responses with medical record reviews. However, during the initial phone call to the participant to determine eligibility, participants were asked to obtain their recent HbA_{1C} from their medical provider or online web portal. However, obtaining the HbA_{1C} was not obligatory for the patient to participate.

The survey included a question on whether the participant knew their most recent HbA_{1C} within the previous six months. Those who reported that they did not know the value were not asked to guess. Those that report that they knew their HbA_{1C} or obtained it from their record or medical provider were asked to report its value (less than 7%, 7-7.9%, 8-8.9%, 9-9.9%, 10-10.9%, 11-11.9%, 12% or greater). Self-reported HbA_{1C} has been found to be accurate when participants remember their HbA_{1C} (Trivedi et al., 2017).

Participants were also asked about their average range of their blood glucose readings over the previous week. In order to provide further context to their reported readings, particularly in those that check their blood sugars

multiple times per day, participants were asked about their average readings during different times of the day (morning, noon, evening, or bedtime).

Data Analysis

Descriptive statistics were used to describe the study participants demographic characteristics, as well as diabetes related characteristics including recent HbA_{1C} (if available), and type and number of medications taken (injections, insulin, and oral regimens), and their frequency. Statistical tests of correlation, including Pearson's and Kendall's test of correlation, were used to answer the first research question relating to whether informal peer support is associated with diabetes self-management and glucose control. PROCESS macro, as described by Hayes (2017) was used to examine self-efficacy as a mediator between the presence of informal peer support, diabetes self-management and glucose control. Independent t-tests were used to compare differences between those who reported that they had informal peer support and those who do not with scores of self-efficacy, self-management behaviors, and glucose control.

The independent variable for the study included measures of informal peer support in those living with diabetes (S4-MAD). Dependent variables included those related to self-management with medication for diabetes (ARMS), physical activity (IPAQ), diet (PADQ), and blood glucose monitoring, as well as self-reported glucose control. Self-efficacy (SED) was also examined as the intermediate variable or mediator between the independent and dependent variables.

Data were analyzed using SPSS version 28. Survey data were evaluated for missing data before the analysis. Survey items with more than 20% of missing data points were not included for the final analysis. Surveys with less than 20% of items missing had items substituted with values calculated using mean item replacement. Statistical significance was determined by an alpha level of .05.

Summary

This study used a cross-sectional, correlational design to assess the relationships between the presence of informal peer support, self-efficacy related to diabetes self-management behaviors, and engagement in self-management behaviors and glucose control in the veteran population. After obtaining IRB approval, individuals were recruited from veteran organizations within the community as well as online. Descriptive statistics, self-reported data, and six instruments were used to capture the data and measure the concepts. Finally, statistical analyses were completed to examine associations between the measured concepts, as well as an evaluation of self-efficacy as a mediator between informal peer support, self-management behaviors, and glucose control.

CHAPTER IV

RESULTS

Chapter 4 provides the findings of this cross-sectional study. An overview of the demographic characteristics of the sample and data to answer the research questions about the relationships between peer support, self-efficacy, and self-management behaviors related to diabetes, as well as diabetes outcomes including HbA_{1C} are described.

Data collection occurred between April 2022 and July 2022. Participants were recruited online using flyers posted to social media platform groups that were specifically for veterans. Flyers also were posted at local veteran affiliated agencies. There were 167 individuals who contacted the student PI by telephone with interest in participating in the study. After screening for eligibility, two individuals were excluded, one for their non-veteran status and the other did not have diabetes. A total of 165 individuals meeting the eligibility criteria were sent a unique, one-time
use Qualtrics link by email to access the informed consent and study surveys.

Of the 165 who were sent the link, 155 completed all survey items in their entirety. There were 10 participants who had missing items on surveys. There were five missed items from participants for peer support using the S4-MAD (Social Support Scale for Self-Care in Middle Aged Patients with Type 2 Diabetes), three missing items on the scale measuring diet with the use of the

PDAQ (Perceived Dietary Adherence Questionnaire for People with Type 2 Diabetes), and three missing items on the scale broadly measuring engagement in self-management behaviors with the SDCAM (The Summary of Diabetes Self-Care Activities Measure), There was not a clear pattern of missing items when they were observed. In total, less than 20% of items were missing on each survey. Missing items were replaced using the mean item replacement method. Therefore, all surveys from these 10 participants were included in the analyses.

Demographic Information

Demographic information collected from the participants is included in Table 1. The average age of the participants was 41.53 (*SD*=11.27), with a range of age between 26 and 67 years. The majority of participants self-identified as being Black or African American or white or Caucasian, and had at least a bachelor's degree. Additionally, 76% of the sample was married, and 72% lived with family, 65% were employed full time or part time, and about 80% reported a personal annual income of $50,000 or greater. Regarding their military service, half reported serving in the Army, followed by the Navy (16%), Marines (10%), and Air Force (10%). Over 60% of the sample had spent greater than six years in the military.

Table 1.

Sample Demographics

Variable		***N*=165**
Age (Mean, SD)		41.53 (11.27)
Ethnicity (n, %)	Black or African American	82 (49.7%)
	White	72 (43.6%)
	Asian	5 (3.0%)
	American Indian or Alaska Native	3 (1.8%)
	Hispanic or Latino or Spanish	2 (1.2%)
	Origin Native Hawaiian or other Pacific Islander	1 (0.6%)
Highest level of education completed (n, %)	Middle School or the 8th Grade	3 (1.8%)
	Some High School	1 (0.6%)
	High School Graduate	17 (10.3%)
	Some College	8 (4.8%)
	Trade/Technical/Vocational Training	6 (3.6%)
	Associates Degree	11 (6.7%)
	Bachelor's Degree	97 (58.8%)
	Master's Degree	20 (12.1%)
	Doctorate Degree	2 (1.2%)
Living Situation (n, %)	Living with Family	119 (72.1%)
	Living Alone	29 (17.6%)
	Living with a Non-Family Member	15 (9.1%)
Employment Status (n, %)	Full-Time	78 (47.3%)
	Part-Time	31 (18.8%)
	Retired	47 (28.5%)
	Unemployed	5 (3.0%)
	Disabled	3 (1.8%)
Personal Income (n, %)	$1-$9,999	11 (6.7%)
	$10,000-$24,999	6 (3.6%)
	$25,000-$49,999	12 (7.3%)
	$50,000-$74,999	39 (23.6%)
	$75,000-$99,999	48 (29.1%)
	$100,000-$149,999	35 (21.2%)
	$150,000 and Greater	13 (7.9%)
	Prefer not to answer	1 (0.6%)
Marital Status (n, %)	Married	126 (76.4%)
	Divorced/Separated	23 (13.9%)
	Single	15 (9.1%)
Branch of the Military Service (Includes Reserves) (n, %)	Army	84 (50.9%)
	Navy	27 (16.4%)
	Marine Corps	17 (10.3%)

Variable		*N*=165
	Air Force	16 (9.7%)
	National Guard	10 (6.1%)
	Coast Guard	3 (1.8%)
	Space Force	3 (1.8%)
Length of Military Service (n, %)	Less than 1 year	3 (1.8%)
	1-5 years	44 (26.7%)
	6-10 years	51 (30.9%)
	11-15 years	31 (18.8%)
	16-20 years	25 (15.2%)
	Greater than 20 years	11 (6.7%)

Diabetes and Peer Support Related Information

Almost half (45.5%) of the participants reported being diagnosed with diabetes for an average of 3-5 years. Regarding treatment, their diabetes was controlled primarily by oral medications (40.6%), followed by a combination of insulin and non-insulin injectable medications (i.e. GLP -1 Agonists) (27.9%). For those taking oral medications (*n*=67), the majority (82%) were taking 2-3 oral diabetic medications. Few participants (16.4%) reported not taking any medications for their diabetes. Detailed information related to diabetes and its management by the participants is provided in table 2.

Only three participants reported not having a peer supporter. The rest of the participants (*n*=162) reported having a peer supporter. The majority of these peer supporters were described as being a friend who also was a veteran (46.1%), followed by a non-veteran family member (21.2%). Only one participant described their peer supporter as being online or virtual. When asked about the frequency of peer-support interactions related to diabetes, most indicated

interacting with the peer supporter several times a week (38.8%) or weekly (28.5%).

Of the 155 (94%) participants who reported checking their blood glucose, 7.9% checked several times per day, 23.6% checked daily, 41% checked several times per week, 19.4% checked approximately once a week, and 1.8% checked less than once per week. Participants were not asked how often they were asked to check their blood glucose by their provider to provide more context to their answers. Self-reported glucose was collected, however HbA_{1C} is reported as the outcome measure.

The HbA_{1C} was reported by 88.5% of the sample, with 11.5% not knowing their recent HbA_{1C} in the past six months. Only 9 (5.5%) participants reported their HbA_{1C} as being less than 7% which is traditionally considered to be controlled for most individuals (American Diabetes Association, 2021). In contrast, 48 (28%) participants reported their most recent HbA_{1C} being 9% or greater, which is generally considered to be significantly uncontrolled.

Table 2.

Diabetes and Peer Support Related Information

Variable	Response	Number (%)
Length of Time Since Diabetes Diagnosis	Less than one year	2 (1.2%)
	1-2 years	37 (22.4%)
	3-5 years	75 (45.5%)
	6-10 years	48 (29.1%)
	Greater than 10 years	3 (1.8%)
Diabetes Management Regimen	Diet and Exercise Only	27 (16.4%)
	Oral medications	26 (40.6%)
	Non-Insulin Injectable medications	13 (7.9%)
	Insulin Only	12 (7.3%)
		46 (27.9%)

Variable	Response	Number (%)
	Combination of Insulin and Non-Insulin Medications	
Number of Different Types of Oral Medications Used	None	98 (59.4%)
	One	7 (4.2%)
	Two	33 (20.0%)
	Three	22 (13.3%)
	Four	5 (3.0%)
Peer Supporter and Description of Supporter	No peer supporter	3 (1.8%)
	Friend (non-Veteran)	30 (18.2%)
	Friend (Veteran)	76 (46.1%)
	Family member (non-Veteran)	35 (21.2%)
	Family member (Veteran)	20 (12.1%)
	Online or virtual peer supporter	1 (0.6%)
Frequency of Peer Supporter Interactions Related to Diabetes	Daily	23 (13.9%)
	Several times per week	64 (38.8%)
	Weekly	47 (28.5%)
	Several times per month	23 (13.9%)
	Once in the past 6 months	7 (4.2%)
	More than 6 months	1 (0.6%)
Comorbid Conditions	Mental health condition	52 (31.5%)
	Hypertension or high blood pressure	48 (29.1%)
	Diabetic retinopathy	43 (26.1%)
	Overweight or obesity	36 (21.8%)
	Chronic pain	35 (21.2%)
	Chronic kidney disease	6 (3.6%)
	Peripheral vascular disease	5 (3%)
	Congestive heart failure	5 (3%)
	Stroke	5 (3%)
	Coronary artery disease	4 (2.4%)
Participants reporting Checking Blood Sugars	Yes	155 (93.9%)
	No	10 (6.1%)
Recent HbA_{1C}	Do not have access or do not know	19 (11.5%)
	Less than 7%	9 (5.5%)
	7-7.9%	49 (29.7%)
	8-8.9%	41 (24.8%)
	9-9.9%	33 (20.0%)
	10-10.9%	13 (7.9%)
	11-11.6%	1 (0.6%)
	12% or Greater	0 (0%)

Results of Study Instruments

A summary of the scales used to assess social support, diabetes self-management and self-efficacy are described in the following section. Descriptive statistics of instrument scores are provided in Table 3 along with the internal consistency reliability of the instruments. The results of the internal consistency tests of the instruments were sufficient and adequate for use for the subsequent analyses.

Peer Support

Informal peer support was measured by the S4-MAD. The peer support scores ranged from 1.9 to 5.0 with a mean of 3.58 (*SD*=0.66) which indicates a moderate level of perceived support. Scores for individual items were highest for those related to assistance with diet (item 11- 'somebody who reminds me repeatedly about the necessity of continuing my diet') ($\overline{x}$= 3.85), and lower for questions related to smoking cessation (item 29: 'somebody who registers me in a smoking cessation class') ($\overline{x}$= 3.17). Participants were not asked about their smoking status in the demographic section and therefore data on the smoking status of the participants was not available to provide more context to responses from this question.

Diabetes Related Self-Management Behaviors

An evaluation of diabetes self-management behavior was completed by assessing behaviors individually, and then globally. Individual self-management behaviors included diet, medication adherence, physical activity, and glucose

monitoring. The general or global measure of self-management behaviors was used to examine all of these behaviors within one scale. The results of these scales are provided in table 3.

Diabetes-Related Diet. The Perceived Dietary Adherence Questionnaire (PDAQ) was used to evaluate the participants' consumption of foods over the previous seven days as related to nutrition recommendations specific to individuals living with diabetes. The scale had a less than optimal internal consistency reliability (α=.65). Further analysis of the scale was completed, and deleting item four (On how many of the last seven days did you eat foods high in sugar such as cakes, cookies, desserts, candies) resulted in a higher Cronbach's alpha of α=.70, and deletion of item nine (On how many of the last seven days did you eat foods high in fat such as high fat dairy products, fatty meat, fried foods, or deep fried foods) resulted in a Cronbach's alpha of α=.75. For the analyses, items were not deleted, and all items were used, and final scores for the scale was used for the final analysis. The range of dietary adherence scores was 20 to 62 with a total mean score of 41.18 (SD=7.74), which is above the midpoint of the scale. Higher scores on the scale reflect healthier food consumption consistent with a diet recommended for individuals with diabetes. Participants scored highest (i.e. better management) on item 1 which asked about following a healthy diet plan as recommended by the US dietary guidelines ($\bar{x}$=5.53) and lowest on the more specific diet items that asked about eating foods high in sugar ($\bar{x}$=3.37) and in fat ($\bar{x}$=3.33). Overall, the results suggest their diets

were moderately consistent with the recommendations for individuals with diabetes.

Medication Adherence. Medication adherence was measured using the Adherence to Refills and Medications Scale (ARMS). The mean score was 21.99 (*SD*= 5.83) with a range of 12 to 39. The average score was below the midpoint of the scale and lower total scores reflect greater adherence. Overall, mean individual item scores were similar, except for item 12, which asked about planning ahead for refills for medications before they ran out ($\overline{x}$=2.56). Participants did this activity less frequently, with corresponding answers between 'some of the time' and 'most of the time'. The ARMS scores suggest that participants were moderately adherent to their medication regimen.

Physical Activity. Scores from the Physical Activity Questionnaire (IPAQ), when viewed together, were extreme (e.g. the average score of participants was 17195.26 MET minutes per week, which is approximately 30 times the recommended MET minutes of physical activity recommended per week). These extreme scores were likely inaccurate and inconsistent with possible scores for physical activity calculated in MET-minutes. MET-minute scores were recalculated from the answers of the respondents and still found to be likely inaccurate. Therefore, the decision to not use data from the IPAQ was made.

However, individual items from the SDCAM which asked about physical activity may provide some insight into the physical activity patterns of the sample. Calculated from individual item mean scores from the scale, participants on

average reported engaging in at least 30 minutes of physical activity about 5 days out of the week (item 5- ‘On how many of the last seven days did you participate in at least 30 minutes of physical activity’) (answers included: 2.4% 0 days, 2.8% 1 day, 12.7% 2 days, 36% 3 days, 18.8% 4 days, 23% 5 days, 6.1% 6 days, and 10.3% 7 days) and participated in specific physical activity exercises 4.5 days of the week (item 6- ‘on how many of the last seven days did you participate in a specific exercise session’). However, individual item scores were not used in any further analyses specifically for physical activity given the lack of granularity in the responses of these items (i.e. frequency, intensity, and length of physical activity).

Diabetes Self-Management Behaviors Composite Scale. The Summary of Diabetes Self-Care Activities Measure (SDCAM) was used to evaluate diet, physical activity, and blood glucose monitoring related to diabetes self-management (Toobert et al., 2000). The range of total scores for the sample SDCAM was 22-60, with a mean of 37.58 (*SD*=8.18), suggesting moderate engagement in self-management behaviors.

Participants scored lowest on item 4 that asked about consumption of high fat foods ($\bar{x}$=3.89), which can be interpreted as participants consuming foods high in fat about 4 days a week. The highest score was on item 1, which asked about how many days in the week participants followed a healthful eating plan ($\bar{x}$= 5.65). This can be interpreted as participants self-reporting they followed a healthful eating plan between 5 and 6 days of the week.

Self-Efficacy related to Self-Management Behaviors

The SED scale was used to evaluate participants' self-efficacy related to diabetes self-management behaviors. The mean score for the sample was 52.47 (*SD*= 13.29) with a range of 19-80. The average total scores from the sample suggest that participants had moderate levels of self-efficacy related to diabetes related self-management behaviors.

Table 3.

Summary of Study Instruments Results

Instrument Name	M	SD	Range of Scores	Range of Possible Scores	Cronbach's α
S4-MAD- Social Support	3.58	0.66	1.90-5	1-5	.959
PDAQ-Diet	41.18	7.74	20-62	9-72	.649
ARMS-Medication Adherence	21.99	5.83	12-39	12-48	.864
SDCAM-Diabetes Self Care	37.58	8.18	22-60	8-64	.730
SED -Self-Efficacy	52.47	13.29	19-80	8-80	.909

Study Question 1. Is informal peer support associated with diabetes self-management behaviors and glucose control?

Only three participants reported not having a peer supporter, which limited the ability to evaluate and analyze differences between those who reported having a peer supporter and those who reported not having a peer supporter. Therefore, instead of examining presence of peer support, (yes versus no), scores from the S4-MAD, which measured the amount of perceived peer support by the participant, was used. The bivariate relationships between level of peer

support and diabetes self-management behaviors and glucose control were examined using correlation analyses. Specifically, Pearson's R and Kendall's Rank tests were used to evaluate bivariate associations between peer support (S4-MAD) and diabetes self-management measures (PADQ, ARMS, SDCAM) and peer support (S4-MAD) and glucose control (HbA_{1C}) (See Table 4).

All variables (S4-MAD, ARMS, IPAQ, and the SDCAM) were continuous, except for the self-reported HbA_{1C}, which was ordinal. Continuous variables were evaluated for normality. Evaluated variables were also checked for linearity through scatter plots, as well as for outliers. Pearson's correlation coefficient was used to assess associations between peer support and the self-management behavior variables. Kendall's tau coefficient was used to evaluate relationships between peer support and glucose control as measured by HbA_{1c}, from which answers were provided in ordinal level data. Two-tailed tests were used for all tests of correlation.

Table 4.

Results of Tests of Correlation Between Variables

First Variable (Informal Peer Support)	**Second Variable**	**Test used for Correlation**	**Correlation Coefficient (p-value)**
S4-MAD	PADQ	Pearson's R	r= .48 (p<.001)
S4-MAD	ARMS	Pearson's R	r= -.15 (p=.055)
S4-MAD	SDCAM	Pearson's R	r= .52 (p<.001)
S4-MAD	HbA_{1c}	Kendall's Rank Coefficient	τ_b= .26 (p<.001)

Table 5.

Correlations between Variables

Variable	1.	2.	3.	4.	5.
1. S4-MAD	1.0				
2. PADQ	.48*	1.0			
3. ARMS	-.15	-.32*	1.0		
4. SDCAM	.52*	.62*	-.26*	1.0	
5. Self Efficacy	.57*	.52*	-.22*	.46*	1.0

**p< .05, two tailed*

Peer support related to diabetes self-management was positively correlated with diabetes related diet (*r*=.48*, p*=<.001*),* as well as scores from the global measure of self-management behaviors (*r*=.52, p=<.001). These correlation results indicated that a higher level of peer support (S4-MAD) was significantly associated with greater diet self-management behaviors and better overall self-management behaviors at a moderate intensity. Peer support related to diabetes self-management behaviors also was positively correlated with glucose control (τ_b= .26, p=<.001), however this correlation was not as strong. The results indicate that higher levels of peer support were significantly associated with better glucose control or lowerHbA_{1c}. The relationship between peer support and medication adherence was not statistically significant (*p*=0.055).

Study Question 2. Does self-efficacy related to diabetes self-management behaviors mediate the relationships between informal veteran peer support and diabetes self-management behaviors as well as glucose control?

In order to answer this research question, PROCESS Macro, a program developed to evaluate mediation effects between variables, was used (Hayes et al., 2021). This program was used to evaluate the indirect effect, or mediation, of self-efficacy between the independent variable of peer support related to diabetes self-management behaviors and four dependent variables which included diet adherence (PADQ), medication adherence (ARMS), a global measure of diabetes related self-management behaviors (SDCAM), as well as self-reported HbA_{1C}. Mediation analysis utilized model 4 as described by Hayes et al. (2021) in diagram 2. Bootstrapping statistics were used with 5,000 bootstraps, and the confidence interval was set at 95%.

A total of four mediation models were evaluated; (1.) Diet, (2.) Medication adherence, (3.) Global Measure of Diabetes Self-Management, and (4.) HbA_{1C} (see table 6). There were two models, (2.) Medication Adherence and (4.) HbA_{1C} that did not have significant relationships among all the variables and therefore the results of the mediation model are not provided in this discussion. Specifically, there was not a significant relationship between peer support (S4-MAD) and medication adherence (ARMS) (p=.68), as well as self-efficacy and HbA_{1C} (p=.68).

Model 1, which evaluated the indirect effects of self-efficacy between peer support and intake of diet recommended for those living with diabetes (PADQ),

was significant (β=.21, SE= .05, 95% CI [0.11, 0.31]). Model 3, which evaluated the indirect effects of self-efficacy between peer support and the global measure of diabetes related self-management behaviors (SDCAM) was also significant (β=.14, SE= .05, 95% CI [0.04, 0.24]. These two models suggest that self-efficacy related to diabetes self-management behaviors mediates the relationship between peer support and diet and self-management behaviors related to diabetes.

Table 6.

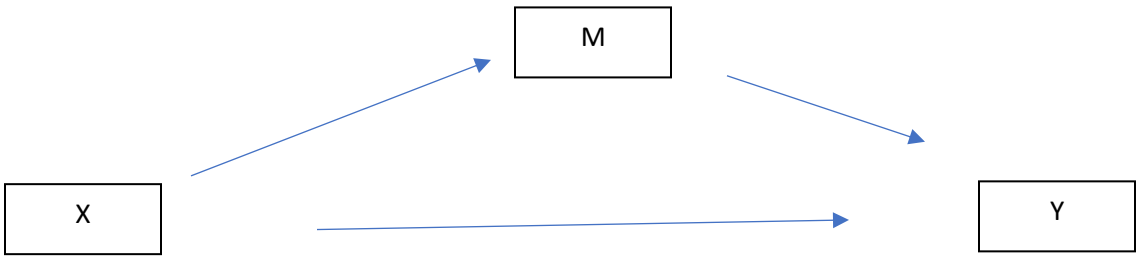
Mediation Models

Model Number	**X**	**M**	**Y**	**Indirect Effect/β**	**Standard Error Estimate**	**Confidence Interval**	**p-value**
1	S4-MAD	SED	PADQ	.2106	.0518	.1061, .3104	<.001
2	S4-MAD	SED	ARMS	-	-	-	.68
3	S4-MAD	SED	SDCAM	.1395	.0500	.0425, .2383	<.001
4	S4-MAD	SED	HbA_{1C}	-	-	-	.69

Note. Effect sizes and confidence intervals were standardized

Figure 2.

Mediation Model



Study Question 3. Is the presence of peer support associated with increased levels in self-efficacy, engagement in diabetes related self-management behaviors, and glucose control when compared to those without peer support.

This research question could not be answered with the available data. In the sample, only three respondents answered that they did not have a peer supporter. This resulted in an insufficient number to analyze differences between those who reported having a peer supporter and those who reported not having a peer supporter.

To further explore those participants who did have a peer supporter in regard to their self-efficacy for managing diabetes, characteristics of the peer supporter were evaluated. An independent sample t-test was used to evaluate differences in self-efficacy and a global measure of diabetes-related self-management behaviors (SDCAM) scores between (1.) those who described their peer supporter as being a veteran versus a non-veteran and (2.) those who described their peer supporter as being a friend versus a family member.

Those who reported their peer supporter as being a veteran (*n*=96) had significantly higher mean diabetes self-management scores (M=39.06, SE=.75) compared to those who described their peer supporter as a non-veteran (n=65; *M*=35.72, *SE*=1.11), *t* (159) = 2.59, *p*=.011). However, there was no significant difference in mean scores for self-efficacy between those who described their peer supporter as being a veteran (*M*=54.30, *SE*= 1.22) compared to those who

described their peer supporter as being a non-veteran (*M*=51.03, *SE*=1.74; *t* (159) = 1.592, *p*=.113).

Scores for the SDCAM were evaluated for differences between those who described their peer supporter as being a friend (*n*=106) and those who described their peer supporter being a family member (*n*=55) using an independent sample t-test. There was not a significant difference between the two groups (Friend: *M*=37.55, *SE*=.83), (Family member: *M*=38.04, *SE*=1.08), (*t* (159) =-.35, *p*=.73).

Scores for the SED (self-efficacy) were evaluated for differences between those who described their peer supporter as being a friend (n=106) and those who described their peer supporter as being a family member (n=55) using an independent sample t-test. There was not a significant difference between the two groups (Friend: *M*=52.03, *SE*=1.32), (Family member: *M*=54.82, *SE*= 1.49), *t*(159)=-1.31, *p*=.19.

CHAPTER V

DISCUSSION

This chapter provides a discussion of the findings of the analyzed data to include the demographic data, theoretical and clinical variables of interest, and research questions. Strengths as well as limitations of the study are discussed. Recommendations for practice and for future research are provided.

Demographic Characteristics of the Sample

In this study exploring informal peer-support and diabetes self-management among veterans, recruitment was obtained over a short period of time, 3 months. The majority of the participants were relatively young (41.5 years), college educated, and had incomes greater than $50,000 per year. These characteristics may have resulted from the participants' veteran status and the recruitment strategy. Veterans typically have a lower unemployment rate than the non-veteran population, (US. Bureau of Statistics, 2022), have pensions and annual earnings on average $11,000 above the national average ($65,000) (Hill and Ponton, 2021), and have access to tuition assistance for college.

Despite these higher levels of education and income, the sample had less than optimal blood glucose control as self-reported by their HbA_{1C}. Further exploration into why this was and how informal peer support is discussed in subsequent sections of this chapter, however these findings highlight that despite

having economic and educational advantages which may result in increased resources to manage their disease, participants in this study had sub-optimal blood glucose control.

The majority of the sample (88.5%) reported knowing their recent HbA_{1C}. This may have also been a function of the participant characteristics as well as instructions to participants prior to participation in the study. Participants were asked, although not required, to obtain their most recent HbA_{1C} result if they did not know it from their online patient portal or to contact their provider prior to starting the survey. Additionally, the higher education for this sample may also be associated with a higher level of health literacy (which was not assessed in this study), which may have facilitated an increased awareness and knowledge of their disease including their HbA_{1C} as a marker of control of diabetes.

The sample was relatively young, with participants being on average 41.5 years old. The recruitment method may have inadvertently recruited a younger sample of participants. Most participants were recruited from online social media platforms (i.e. Facebook), which are most often used by younger individuals. The average age of this sample is younger than those of other samples evaluating formalized peer support interventions, which had samples with an average age between 60 and 62 (Heisler et al., 2019; Kaselitz et al., 2019, Long et al., 2012).

The younger age of the sample of the participants is important. The rates of diabetes have increased in persons less than age 40 years (Lascar et al., 2018), early-onset diabetes is associated with increased risk for chronic complications. The average age of participants in this study was 41, and average

responses on how long they had been living with diabetes suggests that they likely had been initially diagnosed with diabetes in their 30's. Therefore, this study provides unique insight into how informal peer support may impact self-management behaviors, and in turn affect diabetes related outcomes.

Overall, the majority of the sample reported having a peer supporter. All but three participants reported having a peer supporter. Again, given the sampling method, this is not an unexpected finding. Recruitment occurred predominately on social media platforms, primarily through social media groups that centered on veterans living with diabetes. Participants who had seen these posts for the study had presumably joined these groups seeking support or information related to diabetes. Additionally, the sampling method for this study also employed snowball sampling, and many participants reported that they were referred by a friend who was a veteran living with diabetes.

In summary, the sample for this population included a primarily younger sample that were college educated with moderate incomes and reported that they had a peer supporter that assisted them with their self-management of diabetes. Additionally, the sample appeared to have higher HbA_{1C} than what would be expected for their ages. Further evaluation into how peer support may affect and influence their self-management behaviors will be explored.

Discussion of Responses Related to Measures of Informal Peer Support

The scores from the S4-MAD measuring peer support showed that participants in this study perceived having a moderate level of peer support. The average score for peer support related to diabetes self-management behaviors

(3.58 (*SD*=0.67)) indicated a moderate level of support. This is the first study to use the S4-MAD (measure of peer support) within the veteran population. When compared with other studies that used the S4-MAD in non-veteran populations, the scores on the S4-MAD in this study evaluating peer support in the veteran population are significantly higher than other scores in other studies: total average score of 2.57 in one study, and less than 3 in individual subscales in another study (Ampofo et al., 2022; Cieminska & Kobos, 2020). However, it should be noted that other samples that used the S4-MAD were different patient populations, non-US veterans, of different nationalities, and likely had access to different resources.

Within items on the S4-MAD, participants perceived receiving the most support for self-management behaviors related to diet such as being reminded about the need to follow a diet. Participants reported the least support related to smoking cessation as well as providing economic support in relation to physical activity (i.e. buying gym membership or buying home exercise equipment). The cause of these low scores for support related to smoking cessation is unclear, it may be that there were few smokers in the sample, therefore no support was needed and not provided. Participants smoking status was not included on the questionnaire or asked in the SDCAM to provide further context and understanding to the results of this item in the survey.

Discussion of Responses related to Self-Management Behaviors

Self-management behaviors were evaluated in two ways: by using individual scales that measured individual behaviors and by using a global scale

that measured all self-management behaviors within one scale. Overall, responses from participants indicated that they consumed a diet that was moderately consistent with a diet recommended for individuals with diabetes, had moderate adherence to their medication regimen and checked their blood glucose regularly.

When all self-management behaviors were evaluated on the same scale with the global measure of self-management behaviors (SDCAM), the average score 37.58, which also suggests moderate engagement in self-management behaviors. It is important to note that the scales for the individual behaviors have not been compared to the global measure of self-management behaviors (SDCAM) in prior studies, but did show some positive, mild to moderate correlations when results were compared to scales measuring diet (PDAQ) and medication adherence (ARMS).

There were several similarities between the PDAQ which measured consumption of foods related to nutrition recommendations specific to individuals with living with diabetes to individual items on the global measures, SDCAM, that were related to diet. Scores that asked about the number of days in the week that participants followed a healthful eating plan on the SDCAM ($\overline{x}$=5.65) were similar to those measured on the PDAQ ($\overline{x}$=5.53). However, it should be noted that most of these questions on the measurement tools asked more general questions about diet (i.e. number of days that foods were consumed) and did not ask more specific questions about diet, such as frequency (i.e. how many times a day) and amount of food consumed. These types of general questions about diet may not

be as accurate as more specific questions or 24-hour recalls. Therefore, future studies should be specific about the types, quantities, and frequencies of foods and drinks consumed. Furthermore, healthcare providers should consider asking more detailed questions about diet to understand what resources and interventions may be most beneficial for their patients.

The scale measuring physical activity (IPAQ) was not used in the final analysis of the data given the improbable scores on the scale. However, several items from the SDCAM did measure ask about physical activity. On average, most participants did engage in at least 30 minutes of physical activity most days of the week. This may be because veterans may continue to be physically active and focus on physical fitness after leaving their military careers.

Overall, the scores related to self-management behaviors from participants reflect moderate engagement in self-management behaviors. There are potentially several reasons for these scores. Former service members who leave the military may be eligible for healthcare benefits, both within and outside of the VA, which may reduce cost associated barriers to obtaining medications, resulting in improved adherence to their medication regimen. This access to healthcare and healthcare benefits may also help with obtaining needed supplies to check blood sugars (i.e. test strips and glucometer devices). Additionally, veterans may also have access to specific education related to diabetes, including diabetes education classes and dieticians which may help improve their self-efficacy related to self-management behaviors as well as engagement in self-management behaviors.

Discussion of Diabetes Related Outcomes Including HbA_{1C}

The majority of participants reported their most recent HbA_{1C} being between 7-9%. About 30% of the sample reported that their A1C was 9% or greater. Given the young age of the sample, it would be assumed that the majority of the participants HbA_{1C} goal should be 7% or less (ADA, 2021). However only 5.5% of the sample reported their HbA_{1C} as being in this range. There are several potential reasons for these HbA_{1C} levels that were not at goal in this sample. The first is that although they had moderate scores on scales measuring diet, medication adherence, and self-efficacy, participants may have been overly confident or positive in how they remembered their diet, medication adherences, as well as reported measures for self-efficacy. This potential response bias may not have captured these actual behaviors, and therefore, the reported HbA_{1C} was higher than expected.

Participants also may have had incorrect recall of their most recent HbA_{1C}. However, participants were not ‘forced’ to guess, and there was an option for patients to select that they did not know their most recent HbA_{1C} result. Another potential reason for these relatively high HbA_{1C} values despite moderate measures of self-reported self-management behaviors is that possibly providers who were managing their diabetes did not institute changes in the individual’s medications despite not achieving their goal HbA_{1C} result (therapeutic inertia).

Discussion of Results of Study Questions 1: Associations Between Informal Peer Support and Diabetes Self-Management Behaviors

The hypothesis that peer support was associated with self-management behaviors was partially supported. Peer support related to diabetes self-management behaviors was moderately correlated with the global measure of self-management behaviors and diet, weakly associated with HbA_{1C}, and not significantly correlated with medication adherence.

Unlike other studies, this study found that informal peer support was significantly and moderately correlated (r=.52) with the global measure of self-management behaviors (SDCAM). In one study evaluating social support, self-management behaviors (measured by SDCAM) the researchers did not find any statistically significant association between social support and self-management behaviors (El-Radad et al., 2022). Another study found small, but statistically significant correlational relationships between peer support and various measures of self-management behaviors including diet and exercise in individuals with type 2 diabetes (r= .24-.22) (Chan et al., 2020). Therefore, the finding that informal peer support is significantly and moderately correlated with self-management behaviors in the veteran population is an important finding.

In this study, informal peer support (measured by the S4-MAD) was not statistically associated with medication adherence. This was a surprising finding. Medication adherence has been associated with social support (although not informal peer support) in the literature (Gomes-Villas Boas et al., 2012; Gu et al., 2017; Huang et al., 2021). The reason for this discrepancy between the findings

in this study and others in relation to support and medication adherence is unclear. It is possible that that the discrepancy is due to this study evaluating informal peer support, while other studies measured social support, which are similar but different concepts. It is also possible that medication adherence may be more complex, and peer supporters and the individual providing support may not be treated with the same medications or regimens, making providing support for medication adherence difficult. Further studies are needed to understand this discrepancy.

Discussion of Results of Study Questions 2: Self-Efficacy as a Mediator between Peer Support and Diabetes Self-Management and HbA_{1c}

Study question 2 evaluated self-efficacy as a mediator between peer support and diabetes self-management behaviors. Of the four models that were tested, only two models were significant and included those that evaluated: self-efficacy mediating the effect between peer support and diet; and self-efficacy mediating the relationship between peer support and the global measure of self-management behaviors.

The finding that self-efficacy mediated the relationship between peer support and the global measure of self-management behavior is not surprising. Peer support was hypothesized to improve the individual's self-efficacy or belief that they can engage in self-management behaviors This model supports this hypothesis. However, what is surprising, is that again the individual measure of self-management behaviors was not supported by this model.

Self-efficacy did not mediate the effect between peer support and self-reported HbA_{1C}. The reason for this is unclear. It is possible that a person's self-efficacy for engaging in a behavior does not translate into a sufficient amount of engagement in the actual behavior to effectively improve their HbA_{1C}. In other words, participants may overestimate their ability to engage in self-management behaviors, which does not result in sufficient self-management behavior change, and therefore does not result in adequate HbA_{1C} control.

Discussion of Results of Study Questions 3: Differences in Self-Efficacy and Diabetes Self-Management by Characteristics of Peer Supporters

Differences in self-efficacy and diabetes self-management by characteristics of peer supporters (i.e. veteran versus nonveteran and friend versus family) was examined rather than presence of a peer supporter due to only three respondents indicating they did not have a peer supporter.

Participants who described their peer supporter as a veteran had an average 5-point higher scores related diabetes related self-management behaviors than those who defined their peer supporter as a non-veteran. It is possible that that those who described their peer supporter as being a veteran had interactions and exchanges of information and advice that was followed by the individual receiving the support given their shared military background.

The reason for these results is unclear. Future studies could explore the dose effect and time of interaction between individual and peer supporter and its effect on diabetes related self-management behaviors and diabetes related outcomes.

Strengths

There are important strengths of this study that should be acknowledged. This is the first study to this investigator's knowledge evaluating the role of peer supporters on self-efficacy related to diabetes self-management, self-management behaviors, as well as glucose control within the veteran population. Studies such as this one is important in understanding how informal peer support may influence an individual's engagement in diabetes self-management behaviors, as well as diabetes related outcomes.

Another strength of this study is that it had an adequate sample size based on the power analysis conducted to allow for detection of significant effect sizes for the mediation analysis between peer support, self-efficacy, and diabetes related self-management behaviors. This is important for discovering small, but significant, effect sizes that informal peer support has on diabetes related outcomes.

Limitations

This study had weaknesses that should be considered when interpreting the findings. The first is that all data were self-reported including veteran status, engagement in self-management behaviors, as well as HbA_{1C} results. Therefore, the results of the study must be viewed in the context of the self-reported data.

Additionally, data for this study were collected from a convenience sample of predominantly online participants, as well as through snow-ball sampling. This sampling or recruitment bias may have excluded those do not use the internet or have social media, such as older adults. For example, the mean age of the

sample for this study is 42, and the majority of those living with diabetes is between the age of 45-65 years of age (CDC, 2022). Therefore, the results may not be representative of the larger population of veterans, and not representative of those who seek support outside of online forums. This may significantly reduce the generalizability of these findings.

It should also be noted that online recruitment was done through social media groups that specifically targeted veterans with diabetes. This is important to note because veterans who join these groups are presumably attempting to gain information form their peers, effectively engaging in or attempting to engage in informal peer support related behaviors such as the informal exchange of information that occurs within these groups and may be responsible for the relatively high scores of peer support measured by the S4-MAD when compared to other studies. This recruitment method introduced a significant amount of sampling bias, and findings of this study should be viewed within this context.

Furthermore, almost all, except for three, participants in this study reported that they had an informal peer supporter. Levels of peer support were so high that the original study question three regarding differences of levels of self-efficacy and self-management could not be analyzed given the disproportionately high levels of peer support. Although statistics and prevalence of informal peer support in the general population is lacking, it’s unlikely that within the population of those living with diabetes that nearly all individuals have or receive informal peer support. Therefore, this sample of participants with high

levels and presence of informal peer supporters may not be representative of the population and also limits the generalizability of the findings.

Another limitation of this study was that some scales functioned less than optimally and were not used for the final analysis. Scores from the IPAQ were not used in any analysis for this study. When the scores were analyzed, the scores were too high to seem plausible. This was an unexpected finding because the IPAQ has been consistently used and validated in the literature. A possible cause of these implausibly high measures may be from reporting errors from the participants, or potential misunderstandings of the wording of the questions on the survey. However, self-reported physical activity questionnaires may provide responses that overestimate physical activity and underestimate reported inactivity (Martins et al., 2017). Future research assessing informal peer support and physical activity may include more objective measures of physical activity including the use of accelerometers.

Additionally, scores from the PDAQ had less than optimal scores when the internal consistency measured by the Cronbach's alpha was evaluated. Despite the less-than-ideal score on the scale, it was used for subsequent analyses for this study.

Another limitation of the study was that there was key information, including demographic information, that was not asked about that would have helped to provide more context to answers within different subscales. For example, participants were not asked about behaviors related to tobacco consumption that would have helped to clarify and further understand their

answers related to perceived peer support related to tobacco cessation. Presumably if participants did not smoke, they did not receive peer support related to smoking cessation, and therefore listed low scores on these items. Additionally, participants were not asked how often they were asked by their provider to check their blood glucose, so it's unclear to what extent they should have been and were actually checking their blood glucose. Similarly, other important demographic information such as gender of the participant, was not asked. Having this information would have been helpful to better understand the sample.

Recommendations for Clinical Practice

It is normal for individuals to ask others who share their condition for advice and insight into the condition as well as management of the condition. Similarly, individuals with diabetes likely engage with other peers with diabetes in informal settings to discuss management of their condition. Providers should be aware that this information exchange occurs. Similarly, when healthcare members of the team meet with people living with diabetes, addressing informal peer support may be a useful adjunct in understanding the individuals' social resources and their interpretation of information that they receive.

However, it is unclear how informal peer support can be integrated within the healthcare setting. By its definition, informal peer support is 'informal,' and likewise exists outside of a structured setting. However, further understanding informal peer support, particularly within the veteran population, may provide

additional avenues for interventions to improve the care within the veteran population.

Recommendations for Future Research

Further investigation is warranted to evaluate how informal peer support affects self-efficacy, diabetes related self-management behaviors, and outcomes related to diabetes (e.g. HbA_{1C}) in other veteran populations outside of an online setting. Understanding how informal peer support affects the individual as well as their self-management of diabetes in important to effectively develop interventions that target informal peer support.

Understanding the content and the quality of the information exchange that occurs between the informal peer supporters and the people that they support may be helpful. Individuals may engage in different type of support as well as perceive support differently. Therefore, having a clearer understanding of the content of these exchanges would be beneficial to further understand this informal peer support in individuals living with diabetes.

Conclusion

This cross-sectional study evaluated survey data from veteran participants in a convenience sample of predominantly online participants. Participants answered survey questions related to informal peer support, self-efficacy related to diabetes self-management behavior, questions related to self-management behaviors, as well as diabetes related outcomes including HbA_{1C}. The analysis found that there were significant relationships between some, but not all, self-management behaviors and informal peer support. Additionally, self-efficacy was

found to mediate the relationship between informal peer support related to diabetes and engagement in self-management behaviors related to diabetes, however the results of this were not consistent between scales that measured individual behaviors altogether. Further evaluation is needed to explore the effects of informal peer support on diabetes related self-management behaviors and outcomes within the veteran population.

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APPENDICES

Appendix A- Informed Consent

Title: Peer Support, Self-Efficacy, and Diabetes Self-Management in Veterans Living with Diabetes

Principal Investigator: Dr. Dawn Aycock (Faculty Advisor)

Student Principal Investigator: Michael Smart (Student Investigator)

Introduction and Key Information

You are invited to take part in a research study. It is up to you to decide if you would like to take part in the study. The purpose of this study is to understand informal peer support in those living with diabetes. We seek to understand how informal peer support is associated with the individual's belief that they can manage their own diabetes, as well as how informal peer support is associated with diabetes related outcomes.

Your role in the study will last approximately 45 minutes over one day. You will be asked to do the following: complete an online survey or paper survey or survey over the phone.

Purpose

The purpose of the study is to understand how informal peer support is associated with an individual's self-efficacy of engaging in diabetes related self-management behaviors as well as diabetes outcomes including glucose control. We are also interested in examining differences between those who have a peer supporter and those do not have a peer supporter in their self-efficacy, self-management behaviors, and glucose control. There is no intervention in this study, we are only examining relationships between the concepts of self-efficacy, peer support, engagement in self-management behaviors, and glucose control. You are invited to take part in this research study because you are a veteran who has diabetes. A total of 162 people will be invited to take part in this study.

Procedures

If you decide to take part, you will be invited to complete a total of 9 surveys either online via an electronic survey, or paper surveys that will be mailed to you, or over the phone, whichever you prefer. The total time that it will take to complete all the surveys is approximately 45 minutes.

Online Surveys

- If you decide to complete the survey online, a link that contains the survey will be sent to your preferred email.
- You will complete a total of nine-surveys
- Surveys can be completed on any device that has an internet connection (smart phone, tablet, or computer).
- Surveys can be completed anywhere, even in your own home.

Paper Surveys

- If you decide to complete paper surveys, the surveys will be sent to the address that you provide.
- You will complete the surveys
- After the surveys are completed, you will return the completed surveys to the researcher in a prepaid envelope with the address.
- You will need to deliver the prepaid, preaddressed envelope with the surveys inside to the post-office to be mailed back to the researcher.

Telephone Surveys

- If you decide to complete surveys over the phone, the researcher will read the surveys to you, and you will be provided answers to choose from for each question.
- The telephone survey can be completed anywhere, even in your own home.

Future Research

Researchers will not use or distribute your data for future research studies even if identifiers are removed.

Risks

In this study, you will not have any more risks than you would in a normal day of life. No injury is expected from this study, but if you believe you have been harmed, contact the research team as soon as possible. Georgia State University and the research team have not set aside funds to compensate for any injury.

Benefits

This study is not designed to benefit you personally. Overall, we hope to gain information about how informal peer support is associated with self-efficacy related to diabetes self-management behaviors as well as glucose control.

Alternatives

The alternative to taking part in this study is to not take part in the study.

Compensation

You will receive a $20 electronic gift certificate to Walmart delivered to your email or in the mail for participating in this study.

Voluntary Participation and Withdrawal

You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time.

You may refuse to take part in the study or stop at any time. This will not cause you to lose any benefits to which you are otherwise entitled.

Confidentiality

The following people and entities will have access to the information you provide:

- Michael Smart, Melissa Faulkner, Dawn Aycock
- GSU Institutional Review Board
- Office for Human Research Protection (OHRP)

We will use a study number rather than your name on study records. The information you provide will be stored in a locked cabinet if you complete the paper survey, or a firewall-protected computer if you complete the electronic survey. A key or code sheet will be used identify the research participant and will be stored separately from the data to protect privacy.

When we present or publish the results of this study, we will not use your name or other information that may identify you.

- The key or code sheet will be destroyed 3 years after the research has been completed.
- Although online data will be encrypted and stored on a firewall protected computer, you should be aware that data sent over the internet may not be secure.
- We will not collect IP addresses for online surveys.
- Information gained from this study may be used in future publications or presentations. However, only aggregate data will be used. Individuals will not be identified.
    - We will keep your personal information private. Your privacy will be kept to the extent allowed by law.

Contact Information

Contact

- Michael Smart (404-321-6841, msmart3@student.gsu.edu) or
- Dr. Dawn Aycock (404-413-1205, daycock@gsu.edu) or
- Dr. Melissa Faulkner (404-413-1194, mfaulkner@gsu.edu)
    - If you have questions about the study or your part in it
    - If you have questions, concerns, or complaints about the study

The IRB at Georgia State University reviews all research that involves human participants. You can contact the IRB if you would like to speak to someone who is not involved directly with the study. You can contact the IRB for questions, concerns, problems, information, input, or questions about your rights as a research participant. Contact the IRB at 404-413-3500 or irb@gsu.edu.

Appendix B- Demographic Form

1. How old are you?	_____ years
2. How would you best describe yourself?	□ Black or African American □ White □ American Indian or Alaska Native □ Asian □ Native Hawaiian or other Pacific Islander □ Hispanic or Latino or Spanish Origin
3. What is your highest level of education you have completed?	□ No schooling □ Middle school or the 8th grade □ Some high school □ High school graduate □ Some college □ Trade/Technical/Vocational Training □ Associates Degree □ Bachelor's Degree □ Master's Degree □ Doctorate Degree
4. How would you describe your living situation?	□ Living Alone □ Living with non-family member □ Living with Family
5. How would you describe your employment status?	□ Full Time □ Part Time □ Retired □ Disabled □ Unemployed
6. Which of the following best describes your personal income over the last year?	□ $0 □ $1-$9,999 □ $10,000-$24,999 □ $25,000-$49,999 □ $50,000-$74,999 □ $75,000-$99,999 □ $100,000-$149,999 □ $150,000 and Greater □ Prefer not to answer
7. Which of the following best describes your marital status?	□ Single □ Married □ Divorced/Separated

8. Which of the following best describes the length of time that you have been diagnosed with type 2 diabetes?	□ Less than one year □ 1-2 years □ 3-5 years □ 6-10 years □ Greater than 10 years
9. Which of the following best describes your medication regimen to manage your diabetes?	□ Diet and Exercise Only- Medications not recommended by your provider □ Oral medications □ Injectable medications (not insulin) □ Insulin Only □ Combination of Insulin and Non-Insulin Medications
10. If you take **oral medications for your diabetes**, how many different **types of medicines** for diabetes do you take?	□ One □ Two □ Three □ Four □ Five
11. Do you take an **injection medication** that is **not insulin** to manage your diabetes?	□ Yes □ No
12. If you take **insulin** to manage your diabetes, approximately **how many times are you supposed to give yourself insulin in a day, if needed**?	□ One time □ Two times □ Three times □ Four times
13. A **peer supporter** is a **person who also has diabetes**, who is **NOT** a doctor or nurse or part of your healthcare team, who provides you with support related to your diabetes (such as tips on how to manage your diabetes through diet, taking medications, and exercise).	□ I do not have a peer supporter □ Friend (non-Veteran) □ Friend (Veteran) □ Family member (non-Veteran) □ Family member (Veteran) □ Online or virtual peer supporter

14. If you identified a peer supporter in the previous question, which statement best describes **how often** you've discussed managing your diabetes **in the past six months**?	□ Daily □ Several times per week □ Weekly □ Several times per month □ Monthly □ A fewer than six times in the past six month □ Once in the past six months □ It has been more than six months since I have spoken with a peer supporter about my diabetes
15. Do you have or have been diagnosed with any of the following diseases?	□ Hypertension or high blood pressure □ Overweight or obesity □ Mental health condition (anxiety, depression, PTSD, bipolar disorder) □ Chronic pain □ Heart failure or congestive heart failure □ Stroke □ Coronary artery disease □ Peripheral vascular disease □ Chronic kidney disease or reduced kidney function □ Diabetic retinopathy or eye disease caused by diabetes
16. What branch of the military did you serve in?	□ Air Force & Reserves □ Army & Army Reserves □ National Guard □ Navy & Reserves □ Marine Corps & Reserves □ Coast Guard and Reserves □ Space Force
17. How long did you serve in the military?	□ Less than 1 year □ 1-5 years □ 6-10 years □ 11-15 years □ 16-20 years □ Greater than 20 years

Appendix C: Social Support Scale for Self-Care in Middle-Aged Patients with Type II Diabetes

This questionnaire deals with perceptions that you have about receiving peer support from your family with diabetes, friends with diabetes and important others with diabetes for your nutrition, physical activity, self-monitoring of blood glucose. For each question, circle the number in front of the answer that best describes your beliefs or feelings. Please answer all questions.

1.	Somebody who encourages me to keep the diet recommended by my physician or nutritionist.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
2.	Somebody who shows how happy she/he is when I keep the diet recommended by my physician or nutritionist.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
3.	Somebody who buys the necessary ingredients to cook appropriate foods for diabetics.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
4.	Somebody who helps me to schedule for eating meals and snacks.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
5.	Somebody who cooks appropriate foods for a diabetic patient for me.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
6.	Somebody who warns me when I eat more or less than of my eating plan.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
7.	Somebody who eats the foods that I can eat so that I do not have any temptation and can go on my diet.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always

8.	Somebody who –before any meal or snack- tells me the ingredients of that food are appropriate for me or not.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
9.	Somebody who reminds me repeatedly about the necessity of continuing my diet.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
10.	Somebody who encourages me to have physical activity regularly.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
11.	Somebody who reminds me about various methods of physical activity (exercise, job or household activities).	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
12.	Somebody who pays the cost of registering in a gym or buying equipment for physical activity.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
13.	Somebody who reminds me that I must have more physical activity when I am lazy.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
14.	Somebody who asks me to join him/her for exercise.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
15.	Somebody who always asks me about the result of my blood glucose test.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
16.	Somebody who pays attention and reads the amount of my blood glucose from the glucometer while self-monitoring of blood glucose.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always

17.	Somebody who helps me to monitor the glucose of my blood by glucometer when I'm not strong enough.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
18.	Somebody who reminds me about the time of blood glucose test in laboratory every 3 months.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
19.	Somebody who checks all the necessary equipment to perform Self-Monitoring of Blood Glucose.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
20.	Somebody who encourages me to perform Self-Monitoring of Blood Glucose independently	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
21.	Somebody who pays attention to the signs of hypoglycemia in me.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
22.	Somebody who gives me educational materials (CD, book and etc.) about foot care in diabetics.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
23.	Somebody who reminds me of the daily foot care	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
24.	Somebody who encourages me to perform daily foot care.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
25.	Somebody who performs daily foot care for me when I am not strong enough.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always

26.	Somebody who always makes sure that all necessary things for foot care such as warm water and mild soap are available.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
27.	Somebody who helps me with foot care.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
28.	Somebody who helps and encourages me to quit smoking.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
29.	Somebody who registers me in a smoke-cessation class.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
30.	Somebody who gives me educational materials (CD, book and etc.) about smoking and its effects on diabetics.	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always

Appendix D: Perceived Dietary Adherence Questionnaire

Directions: For each question, circle the corresponding number of days.

1.	On how many of the last SEVEN DAYS have you followed a healthful eating plan such as the US Dietary Guidelines (i.e. MyPlate) with appropriate serving sizes?	0 1 2 3 4 5 6 7
2.	On how many of the last SEVEN DAYS did you eat the number of fruit and vegetable servings you are supposed to eat based on US Dietary Guidelines (i.e. MyPlate)?	0 1 2 3 4 5 6 7
3.	On how many of the last SEVEN DAYS did you eat carbohydrate-containing food with a low glycemic index? (example: dried beans, lentils, barley, pasta, low fat dairy products)	0 2 3 4 5 6 7
4.	On how many of the last SEVEN DAYS did you eat foods high in sugar such as cakes, cookies, desserts, candies, etcetera?	0 1 2 3 4 5 6 7
5.	On how many of the last SEVEN DAYS did you eat foods high in fiber such as oatmeal, high fiber cereals, and whole grain breads?	0 1 2 3 4 5 6 7
6.	On how many of the last SEVEN DAYS did you space carbohydrates evenly throughout the day?	0 1 2 3 4 5 6 7
7.	On how many of the last SEVEN DAYS did you eat fish or other foods high in omega-3 fats?	0 1 2 3 4 5 6 7
8.	On how many of the last SEVEN DAYS did you eat foods that contained or was prepared wit canola, walnut, olive, or flax oils?	0 1 2 3 4 5 6 7
9.	On how many of the last SEVEN DAYS did you eat foods high in fat (such as high fat dairy products, fatty meat, fried foods, or deep fried foods)?	0 1 2 3 4 5 6 7

Appendix E: Adherence to Refills and Medication Scales

1	How often do you forget to take your medicine?	None	Some	Most	All of the time
2	How often do you decide not to take your medicine?	None	Some	Most	All of the time
3	How often do you forget to get prescriptions filled?	None	Some	Most	All of the time
4	How often do you run out of medicine?	None	Some	Most	All of the time
5	How often do you skip a dose of your medicine before you go to the doctor?	None	Some	Most	All of the time
6	How often do you miss taking your medicine when you feel better?	None	Some	Most	All of the time
7	How often do you miss taking your medicine when you feel sick?	None	Some	Most	All of the time
8	How often do you miss taking your medicine when you are careless?	None	Some	Most	All of the time
9	How often do you change the dose of your medicines to suit your needs (like when you take more or less pill than you're supposed to)?	None	Some	Most	All of the time
10	How often do you forget to take your medicine when you are supposed to take it more than once a day?	None	Some	Most	All of the time
11	How often do you put off refilling your medicines because they cost too much money?	None	Some	Most	All of the time
12	How often do you plan ahead and refill your medicines before they run out?	None	Some	Most	All of the time

Appendix F: Physical Activity Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous and moderate activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal

Part 1. Job Related Physical activity

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1.	Do you currently have a job or do any unpaid work outside your home?	☐ Yes ☐ No- SKIP TO PART 2: TRANSPORTATION
2.	During the last **7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.	_____ days per week If no vigorous job-related physical activity, skip to question 4
3.	How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?	_____ hours per day _____ minutes per day
4.	Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads	_____ days per week If no moderate job-related physical activity → Skip to question 6

	as part of your work? Please do not include walking.	
5.	How much time did you usually spend on one of those days doing moderate physical activities as part of your work?	_____ hours per day _____ minutes per day
6.	During the last 7 days, on how many days did you walk for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to or from work.	_____ days per week If no job-related walking, SKIP TO PART 2: TRANSPORTATION
7.	How much time did you usually spend on one of those days walking as part of your work?	_____ hours per day _____ minutes per day
Part 2: Transportation Physical activity These questions are about how you traveled from place to place, including to places like stores, movies, and so on		
8.	During the last 7 days, on how many days did you travel in a motor vehicle like a train, bus, car, or tram?	_____ hours per day If no traveling in a motor vehicle → SKIP TO QUESTION 10
9.	How much time did you usually spend on one of those days traveling in a train, bus, car, tram, or other kind of motor vehicle?	_____ hours per day _____ minutes per day
Now think only about the bicycling and walking you might have done to travel to and from work, to do errands, or to go from place to place.		
10.	During the last 7 days, on how many days did you bicycle for at least 10 minutes at a time to go from place to place?	_____ hours per day If no bicycling from place to place → SKIP TO QUESTION 12
11.	How much time did you usually spend on one of those days to bicycle from place to place?	_____ hours per day _____ minutes per day
12.	During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?	_____ hours per day If no walking from place to place → SKIP TO PART 3: HOUSEWORK, HOUSE

	MAINTENANCE, AND CARING FOR FAMILY
13. How much time did you usually spend on one of those days walking from place to place?	_____ hours per day _____ minutes per day

Part 3: Housework, House Maintenance, and Caring for Family

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**?	_____ days per week If no vigorous activity in the garden or yard → Skip to question 16
15. How much time did you usually spend on one of those days doing vigorous physical activities in the garden or yard?	_____ hours per day _____ minutes per day
16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking in the garden or yard?	_____ days per week If no moderate activity in the garden or yard → Skip to question 18
17. How much time did you usually spend on one of those days doing moderate physical activities in the garden or yard?	_____ hours per day _____ minutes per day
18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?	_____ days per week If no moderate activity inside home → Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY
19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?	_____ hours per day _____ minutes per day

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20.	Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?	_____ days per week If no walking in leisure time → Skip to question 22
21.	How much time did you usually spend on one of those days **walking** in your leisure time?	_____ hours per day _____ minutes per day
22.	Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?	_____ days per week If no vigorous activity in leisure time → Skip to question 24
23.	How much time did you usually spend on one of those days doing vigorous physical activities in your leisure time?	_____ hours per day _____ minutes per day
24.	Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis in **your leisure time**?	_____ days per week If no moderate activity in leisure time → Skip to PART 5: TIME SPENT SITTING
25.	How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?	_____ hours per day _____ minutes per day

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26.	During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?	_____ hours per day _____ minutes per day
27.	During the **last 7 days**, how much time did you usually spend sitting on a **weekend day**?	_____ hours per day _____ minutes per day

Appendix G- Blood Glucose Monitoring

1.	Do you check your blood sugar levels?	□ Yes □ No (Please proceed to the next survey)
2.	How often do you check your blood sugar levels?	□ Several times per day □ Daily □ Several times per week □ About once a week □ Less than once a week
3.	Over the past 7 days, what is your average blood sugar level when you check it in the morning?	□ I don't check my blood sugar level in the morning □ Less than 100 □ 100-149 □ 150-199 □ 200-249 □ 250-299 □ 300-349 □ 350-399 □ 400 or greater
4.	Over the past 7 days, what is your average blood sugar level when you check it around lunch?	□ I don't check my blood sugar level at lunch time □ Less than 100 □ 100-149 □ 150-199 □ 200-249 □ 250-299 □ 300-349 □ 350-399 □ 400 or greater
5.	Over the past 7 days, what is your average blood sugar level when you check it in the evening?	□ I don't check my blood sugar level in the evening □ Less than 100 □ 100-149 □ 150-199 □ 200-249 □ 250-299 □ 300-349

		☐ 350-399 ☐ 400 or greater
6.	Over the past 7 days, what is your average blood sugar level when you check it at bedtime?	☐ I don't check my blood sugar level at bedtime ☐ Less than 100 ☐ 100-149 ☐ 150-199 ☐ 200-249 ☐ 250-299 ☐ 300-349 ☐ 350-399 ☐ 400 or greater

Appendix H: The Summary of Diabetes Self-Care Activities Measure

The questions below ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last 7 days that you were not sick.									
1.	How many of the last SEVEN DAYS have you followed a healthful eating plan?	0	1	2	3	4	5	6	7
2.	On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?	0	1	2	3	4	5	6	7
3.	On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?	0	1	2	3	4	5	6	7
4.	On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?	0	1	2	3	4	5	6	7
5.	On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).	0	1	2	3	4	5	6	7
6.	On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?	0	1	2	3	4	5	6	7
7.	On how many of the last SEVEN DAYS did you test your blood sugar?	0	1	2	3	4	5	6	7
8.	On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider?	0	1	2	3	4	5	6	7

Appendix I- Self-Efficacy for Diabetes

We would like to know how confident you are in doing certain activities. For each of the following questions, please choose the number that corresponds to your confidence that you can do the tasks regularly at the present time.

1	How confident do you feel that you can eat your meals every 4-5 hours every day, including breakfast, every day?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
2	How confident do you feel that you can follow your diet when you have to prepare or share food with other people or share food with other people who do not have diabetes?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
3	How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
4	How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
5	How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
6	How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
7	How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident
8	How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?	Not at all confident	1 2 3 4 5 6 7 8 9 10	Totally Confident

Appendix J: Self-Reported HbA_{1c}

1.	Was your A1C check by your doctor in the past 6 months	□ Yes □ No or do not know
2.	Do you remember what your last A1C was that was completed in the last 6 months?	□ Yes □ No or do not know
3.	If you remember or have access to your last **A1C result** in **the last six months**, what was it?	□ Do not have access or do not know □ Less than 7% □ 7-7.9% □ 8-8.9% □ 9-9.9% □ 10-10.9% □ 11-11.9% □ 12% or greater
4.	How did you know your previous A1C result?	□ I did not know it □ I remembered the result from my last medical visit □ I called the office to find out specifically for this study □ I reviewed my medical records on the internet to find my recent A1C result