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Philadelphia College of Osteopathic Medicine  
School of Professional and Applied Psychology  
Department of Clinical Psychology

DIABETES TRAINING CAMP: A BRIEF INTERVENTION TO IMPROVE SELF-  
MANAGEMENT AND PHYSICAL ACTIVITY IN ADULTS WITH TYPE 1  
DIABETES

By David Charny

Submitted in Partial Fulfillment of the Requirements for the Degree of

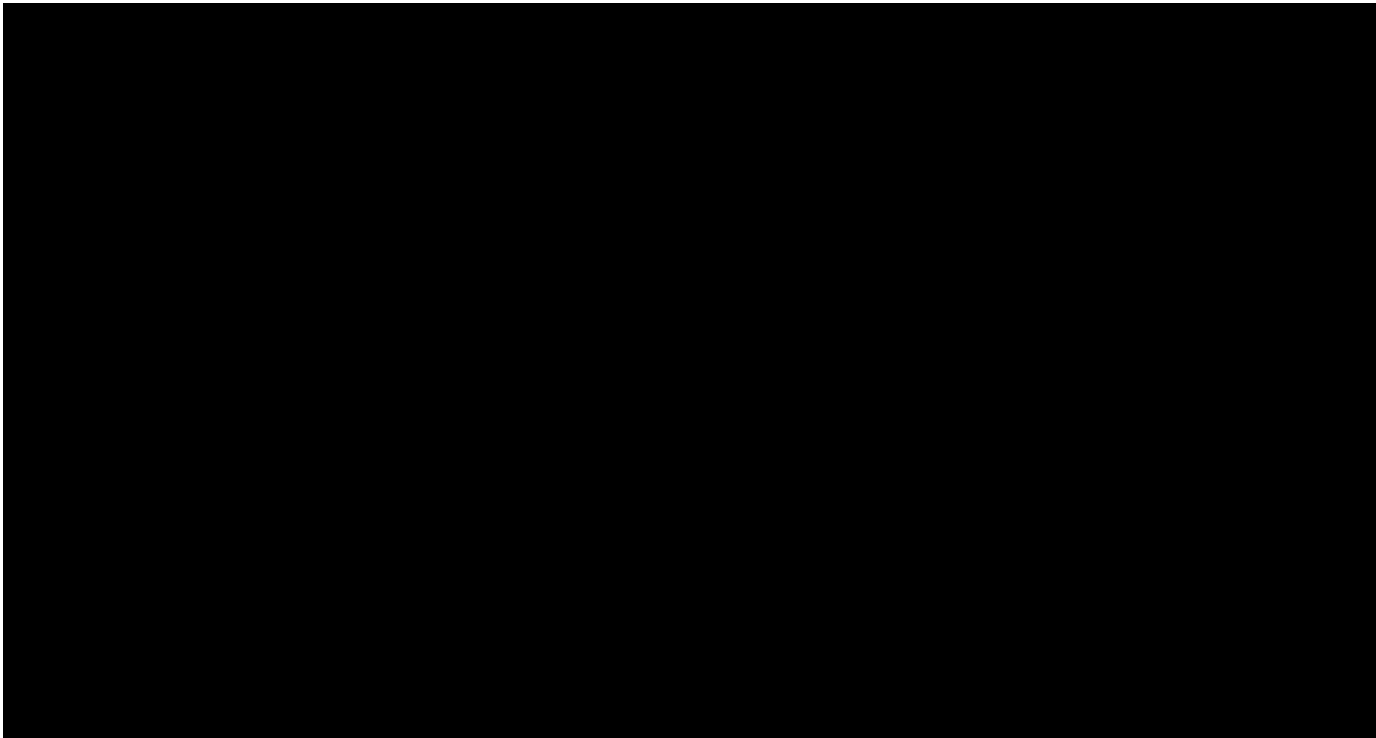
Doctor of Psychology

May 2020

## DISSERTATION APPROVAL

This is to certify that the thesis presented to us by David Charny on the 12<sup>th</sup> day of May, 2020, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

### COMMITTEE MEMBERS' SIGNATURES



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### **ABSTRACT**

Type 1 Diabetes (T1D) is less common than Type 2 Diabetes (T2D); however, its growing incidence, chronic prognosis, and increased self-management burden, produce unique psychosocial challenges for this population. Specifically, these individuals are at risk for poor diabetes self-efficacy, and poor glycemic control, which can contribute to diabetes-specific mood alterations, or diabetes distress (DD), and an overall reduction in diabetes-specific health-related quality of life. This study evaluated the effectiveness of the Diabetes Training Camp (DTC) 1-week intervention in mitigating psychosocial distress utilizing a repeated measures design to evaluate the impact of participation on measures of DD, diabetes quality of life (DQOL) and diabetes self-efficacy from baseline to 6-week follow-up. Statistically significant improvements in DQOL were found to be associated with participation in the DTC intervention. Similar improvements were not found in measures of DD or diabetes self-efficacy. Additionally, there was not a significant relationship demonstrated between improvements in DQOL and diabetes self-efficacy. These results may partially be attributed to the demographics of the sample. Specifically, many participants indicated high levels of physical activity and glycemic control prior to participation, which likely contributed to higher baseline levels of diabetes self-efficacy. Similarly, self-selection bias in our sample, may have contributed to lower levels of DD prior to participation. DTC is a self-pay program and generally only accessible to individuals with higher SES. DTC and similar psychosocial interventions require further study to evaluate potential benefits and contributions to improving overall health outcomes and relieving psychosocial burden for adults with T1D.

## CHAPTER 1: INTRODUCTION

### Statement of the Problem

Diabetes mellitus (DM) is a chronic disorder of the pancreas inhibiting or severely compromising the production of insulin, therefore causing inefficient glucose metabolism. DM has an estimated prevalence of 29.9 million Americans (Center for Disease Control and Prevention, 2014). In 2015, 1.5 million patients age 18 and older were newly diagnosed. DM is also very costly; in 2012, the estimated cost of diabetes care for U.S. patients was \$245 billion (Hunter et al., 2017). Most adults with DM suffer from at least one other comorbid chronic disease (Druss et al., 2001). An estimated 65% of DM-related deaths are caused by heart disease or stroke (Writing Group Members, 2012). DM complications are generally seen as microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular (cardiovascular) (Maahs, et al. 2010). Risk factor data from 2011-2014 suggested, that smoking, obesity, physical inactivity, high blood pressure, high cholesterol, and high blood glucose all individually posed an increased risk in incidence of DM diagnosis and complications (CDC, 2014). Therefore, since self-care plays a critical role in the treatment and maintenance of DM, there is a significant mental health burden related to living with DM (Chiang et al., 2014).

The two most common types of diabetes are referred to as Type I Diabetes (T1D) and Type II Diabetes (T2D). T1D is a result of the pancreas no longer producing insulin, while in T2D, the pancreas either does not make enough insulin or the body develops a resistance to it (National Institute of Diabetes and Digestive Kidney Disease, 2020). While T2D is the more common type; the incidence of T1D has been growing over the last couple of decades, affecting 1 in 300 individuals prior to the age of 18 in the United

States (Maahs et al., 2010). Due to the destruction of insulin-producing pancreatic  $\beta$  cells, these patients generally have a lifetime dependency on exogenous insulin (Atkinson et al., 2014). There is promise, however; that some combination of improvements in biotechnology and preventative medicine may eventually lead to a cure. However, until that time, there is a significant burden placed on these individuals to self-manage their condition. Stressors related to self-management of DM pose unique and specific challenges to a patient's psychosocial well-being and may manifest itself in difficult emotions.

Diabetes distress (DD) is a condition which refers to the unique psychosocial distress experienced by individuals living with DM. DD is not a complication of T1D; rather, it is an emotional response to the challenges of disease management. The symptoms of DD include emotional distress, physician-related distress, regimen-related distress and interpersonal distress (Fisher et al., 2012). DD presents increased risk for poor diabetes self-management, which could lead to poor glycemic control and increased likelihood of harmful complications (Joenson et al., 2013). A variety of factors contribute to the onset and severity of DD. These factors may include: negative emotional reactions to DM diagnosis, the threat of complications, self-management demands, unresponsive providers, and/or unsupportive interpersonal relationships (Gonzalez et al., 2011). DD significantly impacts the ability of a patient to engage in necessary self-care behaviors and negatively effects overall quality of life (Fisher et al., 2012).

Quality of life (QOL) refers to a person's total physical, mental, and social well-being. Most aspects of QOL and well-being either directly or indirectly affect health outcomes (Guyatt et al., 1993). Therefore, a person's health-related quality of life



(HRQOL) can be a critical factor in disease treatment and control (Burroughs et al., 2004). Research evidence suggests that individuals with DM have a lower QOL than non-patients (Schram et al., 2009). The necessity of adherence to a rigid health care regimen likely contributed to the observed differences on QOL measures for these patients (Burroughs et al., 2004). Diabetes quality of life (DQOL) seems to hinge on the ability to find a balance between adequate self-management without being overcome by stress caused by those responsibilities (Burroughs et al., 2004). However, when complications arise, QOL in these patients tends to sharply decline (Jacobsen et al., 1994). Therefore, DQOL is highly associated with a patient's ability to engage in self-care behaviors that keep complications at bay (Wallston et al., 2007).

Self-management behaviors are critical for this population to maintain strong glycemic control, and avoid significant medical complications (Atkinson, et al., 2014). The literature strongly suggests a positive relationship between self-efficacy, health-related behaviors and overall outcomes for this population (Wallston et al., 2007). Bandura (1977) coined the term self-efficacy to refer to an individual's beliefs about their own competence and ability to perform behaviors needed to obtain intended outcomes. When it comes to diabetes self-management, the patient's perception, or self-efficacy often has significant impact on overall medical outcomes as well as psychological well-being. Furthermore, patient perception of competence with health-related information and/or numerical data, like those obtained from blood glucose readings, has been shown to predict greater diabetes self-efficacy (Osborn et al., 2010). The relationship between diabetes self-efficacy and better glycemic control and less complications is mediated by the findings that suggest diabetes self-efficacy leads to increased diabetes self-

management behaviors (Nouwen et al., 2009). Therefore, perceived diabetes self-management may be a strong predictor of DQOL and DD in patients with T1D.

Many interventions have been developed to combat the psychosocial distress of diabetes self-management. The goal of many of these interventions is to improve health outcomes related to improved glycemic control through psychological skills training and support (Ismail et al., 2004). Self-management interventions have shown significant success increasing QOL by reducing distress and increasing self-efficacy (Cochran & Conn, 2008). The summer camp model of DM care, which began in 1925, has become increasingly popular for children with T1D. Current estimates suggest that 15,000-20,000 patients attend such camps each summer (American Diabetes Association, 2007). The camp model aims to provide a safe environment to help patients increase physical activity, and reduce extreme hypoglycemic and hyperglycemic events (Diabetes Control and Complications Trial Research Group, 1993). Brief summer camp interventions for youth patients with T1D has demonstrated a consistent positive impact on glycemic control (Wang et al., 2008). Camp interventions are far less common for adults with DM. The present study will evaluate the efficacy of a specific camp intervention, Diabetes Training Camp (DTC), for adults with T1D.

### **Purpose of the Study**

Patients with T1D are subjected to a unique burden for self-care that can lead to DD and contribute to a diminished DQOL. The purpose of this pilot study was to assess the impact of the DTC week-long camp intervention on the perceived self-management of diabetes, also known as diabetes self-efficacy in adults with T1D. The DTC intervention is a multi-disciplinary approach to helping these individuals increase or

optimize physical activity while enhancing glycemic control. As a result of participation in this comprehensive intervention, individuals are expected to experience improved DQOL, reduced DD, and increased diabetes self-efficacy. This intervention is meant to fill a void in the healthcare services available for adults with T1D, specifically the lack of emphasis on practical interventions for maintaining an active lifestyle, and T1D specific psychosocial concerns in traditional doctor-patient relationships. Managing the impact of psychosocial distress on one's ability to manage chronic, dynamic physiological processes often necessitates additional resources outside of the medical office setting. The DTC intervention represents a potential model for filling this void.

### **Research Questions**

1. Does the Diabetes Training Camp (DTC), a week-long integrated diabetes intervention, improve the DQOL (as measured by the Diabetes Quality of Life-Brief Clinical Inventory) of adult participants with T1D?
2. Does participation in the DTC reduce the DD (as measured by the Diabetes Distress Scale) of adult participants?
3. Does participation in the DTC increase the diabetes self-efficacy (as measured by the Perceived Diabetes Self-Management Scale) of adult participants?

### **Hypothesis**

1. DQOL (as measured by Diabetes Quality of Life-Brief Inventory) will be significantly improved following participation in the DTC.
2. DD (as measured by the Diabetes Distress Scale) will be significantly reduced following participation in the DTC.

3. Diabetes self-efficacy (as measured by the Perceived Diabetes Self-Management Scale) will be significantly increased following participation in the DTC.
4. DQOL (as measured by the Diabetes Quality of Life-Brief Clinical Inventory) will be positively associated with diabetes self-efficacy (as measured by Perceived Diabetes Self-Management Scale).
5. DD (as measured by the Diabetes Distress Scale) will be negatively associated with diabetes self-efficacy (as measured by the Perceived Diabetes Self-Management Scale).

## CHAPTER 2: REVIEW OF THE LITERATURE

DM is a chronic metabolic disorder which inhibits the ability of the pancreas to produce adequate insulin to regulate blood sugar. In the United States, 29.1 million people (9.3% of the adult population), are estimated to have DM (Hunter et al., 2017). There are two major types of DM: T1D and T2D. T1D is considered an autoimmune disorder characterized by the destruction of pancreatic beta-cells, resulting in absolute insulin deficiency. T2D is characterized by significant resistance to endogenous insulin and/or inadequate compensation for diminished insulin secretion (Maahs et al., 2010). While about 95% of DM patients are diagnosed with T2D, T1D deserves increased attention for a variety of reasons (CDC, 2014).

The onset of T2D can be prevented or at least delayed through intensive lifestyle interventions targeting behaviors related to weight loss and physical activity (Dall et al., 2009). Additionally, T2D can be reversible through the normalization of beta cell function by reducing dietary energy intake (Lim et al., 2011). T1D, on the other hand, currently has no cure. Therefore, treatment efforts focus on managing glycemic control and disease-related complications (Atkinson et al., 2014).

While T1D only accounts for 5-10% of DM diagnoses worldwide, it accounts for more than 85% of all DM cases in patients twenty years old or younger. Not all T1D patients are diagnosed in childhood. A quarter of patients with T1D are diagnosed as adults, while an increasing amount of youth are diagnosed with T2D (Maahs et al., 2010). However, the average age of T1D diagnosis worldwide seems to be trending toward younger ages of onset (Van Belle et al., 2011). It is often challenging to differentiate adults diagnosed with T2D from adults with T1D. Some researchers have suggested that

around 5-15% of adults diagnosed with T2D are misdiagnosed and demonstrate the autoimmune response observed in individuals with T1D (Atkinson et al., 2014).

Therefore, the actual number of T1D patients may be vastly underestimated (Atkinson et al., 2014).

The etiology of T1D is complex and not fully understood. Twin studies strongly suggest that a genetic predisposition is necessary for environmental triggers to cause the autoimmune response seen in patients with T1D (Van Belle et al., 2011). In the United States, the incidence of T1D has shown a steady increase over the past couple of decades (Maahs, et al., 2010). While global incidence and prevalence rates vary greatly between nations and age groups, in 2014, it was estimated that the global incidence for T1D would double in the next 10 years (Atkinson et al., 2014). The rising incidence of T1D further suggests the influence of environmental triggers. However, identifying and understanding the specific triggers that cause the autoimmunity that leads to T1D has proven challenging. Recent attention has been given to the role of childhood diets, vitamin D and its constituents, gut microbiota, and viruses in the onset of T1D (Atkinson et al., 2014). T1D is generally diagnosed based on symptoms suggestive of insulin deficiency like excessive thirst, urination and hunger. In addition, elevated blood glucose (hyperglycemia) or the more extreme, diabetic ketoacidosis (DKA) are also indications of T1D (Chiang et al., 2014). The autoimmunity responsible for insulin deficiency in the pancreas can predate chronic hyperglycemia by months or even years. Therefore, identifying the causal factor(s) that trigger the cascade of pathophysiology that lead to the disorder has proven increasingly difficult (Van Belle et al., 2011). As a result, much of the focus for treatment of these patients is directed toward management as opposed to

prevention. Maintaining stable glycemic control is associated with less disease-related complications (Joenson et al., 2013).

Complications are classified as macrovascular or microvascular. Macrovascular complications refer to cardiovascular diseases including; coronary heart disease, cerebrovascular disease, and peripheral artery disease. Microvascular complications generally refer to retinopathy, nephropathy and neuropathy (Chiang et al., 2014). In developed countries, like the U.S., much of DM-related healthcare costs can be attributed to these complications (Scully, 2012). In 2012, the United States spent an estimated \$245 billion on direct and indirect healthcare costs of diagnosed DM (CDC, 2014). T1D accounts for a larger economic burden per case and a higher prevalence of complications than T2D (Dall et al., 2009). In addition, diabetes-related complications can be potentially deadly. While mortality rates are significantly better in developed nations, there were still approximately 180,000 deaths from diabetes-related causes in the U.S. in 2011 (Scully, 2012). In 2015, it was estimated that DM was the seventh leading cause of death in the United States (American Diabetes Association, 2018). In addition to complications, there are several comorbid conditions that are prevalent in patients with T1D. The most common comorbid conditions are; celiac disease, thyroid disease, hypertension, and dyslipidemia (Chiang et al., 2014). While primary prevention of T1D is not well understood, there are multiple ways to intervene through treatment to prevent worsening condition and poor health outcomes.

### **Treatment**

Much of the focus for treatment of T1D is directed toward management as opposed to prevention. Although patients with T1D often maintain a low degree of

endogenous insulin production, the administration of exogenous insulin is the cornerstone of a strong DM management plan (Chiang et al., 2014). Despite improving health technologies, there continues to be a large emphasis placed on the individual patient to self-manage insulin therapy, often through multiple daily injections (Cefalu et al., 2015). Successful treatment plans must be tailored to the individual needs and lifestyle of the patient. Therefore, it is very important that the physician and patient collaborate to develop the most appropriate treatment plan (Chiang et al., 2014).

Insulin and its analogues, as well as, the administration methods, have continued to evolve over the years. Conventional insulin therapy usually involves a long-acting insulin analogue (basal insulin) and a rapid acting insulin (bolus insulin) administered before meals (Atkinson et al., 2014). To ensure optimal metabolic stabilization, significant self-management responsibilities are necessary. These include self-checking blood glucose levels and monitoring carbohydrate intake. Intensive insulin therapy has become increasingly popular and refers to a closed loop system of continuous glucose monitoring (CGM) and continuous subcutaneous insulin infusions (CSII; insulin pumps) (Atkinson et al., 2014). Longitudinal studies suggest that intensive insulin therapy can help reduce the risk and onset of complications (Nathan et al., 2009). However, exogenous insulin replacement does not provide a perfect solution for long-term glycemic control. While these advances may relieve some burden of self-monitoring, overall glycemic control has not shown to be significantly better than multiple daily injections and self-checking blood glucose (Atkinson et al., 2014). Intensive insulin therapies pose an increased risk for severe hypoglycemic events. Severe hypoglycemia or low blood glucose can result in loss of consciousness, seizures or even death (Nathan,



2009). Fear of hypoglycemia is a significant psychosocial symptom in patients responsible for long-term management of T1D (Chiang et al., 2014).

Insulin therapy, both conventional and intensive, relies heavily on the patient to adjust and coordinate infusions with dietary intake and physical activity. The daily self-management responsibilities for patients with T1D to maintain optimal glycemic control include: coordinating amount and timing of insulin administration with results of frequent blood glucose monitoring, nutrient makeup and overall amount of dietary intake as well as the frequency, duration and intensity of physical activity. The level of self-management necessary for optimal glycemic control leaves plenty of room for human error. Nonadherence, both intentionally and unintentionally, to the treatment plan laid out by physicians leads to poor glycemic control and increased risk for disease-related complications. Therefore, it is important that clinicians work with patients to come up with a treatment plan that is sustainable and realistic for each individual patient and their families (Hood et al., 2009).

The National Standards for Diabetes Self-Management Education (DSME) and Support (DSMS) are critical in helping individuals better self-manage DM and prevent disease-related complications (Haas et al., 2012). The goal of DSME and DSMS is to facilitate the knowledge, skills and abilities needed for adequate DM self-care. It is important for patients and families to have education on the impact their diet and exercise have on blood glucose and how food and insulin interact to prevent complications and maintain glycemic control (Chiang et al., 2014). Successful DM self-management interventions must specifically target psychosocial and behavioral factors like DD, DQOL, and diabetes self-efficacy (Haas et al., 2012). Health-related self-efficacy, in

particular has demonstrated a large impact on health outcomes dependent on self-management (King et al., 2010).

### **Self-efficacy theory**

Self-efficacy, or a person's beliefs about their own capabilities to perform a task is an important part of DM self-management (Bandura, 1977; King et al., 2010).

Bandura's (1977) self-efficacy theory suggests that these beliefs are a critical part of human agency. There is little motivation to act unless a person believes in their ability to achieve desired effects (Bandura, 1997). Self-efficacy theory is a unified theory of perceived competence in the face of dynamic challenges and situations. In social cognitive theory, self-regulation, and goal-directed behaviors, derive from expectancies based off of the dynamic interaction between the individual and their environment. The mechanism of action by which self-efficacy works is through its influence on self-regulation. This connection between beliefs and behavior represents the importance of evaluating self-efficacy when it comes to health. Research on self-efficacy suggests a significant impact on almost every relevant positive health behavior (Maddux & Kleiman, 2016). Additionally, self-efficacy is indicative of overall better health outcomes (Bandura, 1997).

Kassavou and colleagues (2014) explored the mechanisms that predicted maintenance in a structured exercise program, in this case walking groups. The theory supporting this study came from The Health Action Process Approach (HAPA) which claims that self-efficacy is a primary component of sustained health behavior change (Schwarzer, 2008). HAPA differentiates between maintenance self-efficacy, the beliefs of an individual about their ability to sustain behavior change despite challenges, and

recovery self-efficacy, beliefs about one's ability to bounce back from relapse or failure to engage in health behaviors (Kassavou et al., 2014). Maintenance was assessed in 114 walkers from the attendance records during a 13-week walking program. Maintenance self-efficacy and recovery self-efficacy were assessed using previously validated items from past research on these HAPA constructs. In addition, data from the walkers were collected to identify satisfaction with expected outcomes, using items developed by Baldwin and colleagues (2009). Additionally, approach to habit was assessed using the Self-Report Habit Index (SRHI; Verplanken & Orbell, 2003). The results revealed that satisfaction with health outcomes and recovery self-efficacy predicted maintenance while none of the other constructs including maintenance self-efficacy had a significant effect (Kassavou et al., 2014). Research supporting the importance of self-efficacy in health behaviors like exercise, diet and medication compliance have direct implications for DM self-management (Maddux & Kleiman, 2016).

Diabetes self-efficacy or one's beliefs about their capacity for DM self-management has been associated with positive health behaviors specifically in regards to diet, exercise and overall better glycemic control (Wallston et al., 2007). The responsibility of patients with T1D to actively engage in self-management behaviors highlights the importance of diabetes self-efficacy in overall outcomes. Self-efficacy expectancies derive from comparing knowledge and skills to challenges. When patients believe they are lacking the capacity to perform the task at hand, their self-efficacy is significantly reduced. An important component of self-efficacy or perceived competency, is a patient's health literacy and numeracy. Health literacy, often used as an umbrella term that includes health numeracy, is defined as "the capacity of an individual to obtain,

process, and understand basic health information and services needed to make appropriate health decisions (US Department of Health and Human Services, 2018). Osborn and colleagues (2010) explored the role of self-efficacy as a key component in the link between health literacy and glycemic control. The study examined 615 adults in primary care clinics and DM specialty clinics from diverse backgrounds in respect to age, race/ethnicity, and socioeconomic status. In this study, numeracy and literacy were measured as separate constructs. Individuals were administered the Rapid Estimate of Adult Literacy in Medicine (REALM) as a measure of health literacy (Davis et al., 1991). The Wide Range Achievement Test, 3<sup>rd</sup> edition (WRAT-3R) was used as a measure of numeracy (Wilkinson, 1993). Diabetes self-efficacy was measured using the Perceived Diabetes Self-Management Scale (PDSMS) (Wallston et al., 2007). The results of this study suggested that health literacy and numeracy had a direct effect on patients' self-efficacy, with numeracy having a more significant effect than literacy. Health literacy and numeracy had an indirect effect on glycemic control, measured using the patient's most recent hemoglobin A1C. These findings demonstrate the importance of addressing and improving patients' knowledge and skills in regards to DM self-management (Osborn et al., 2010).

Problem-solving and decision-making skills have been frequently targeted by DM self-management interventions. In a systematic review of problem-solving skills based interventions, 88% of studies addressed psychosocial outcomes. The most commonly assessed psychosocial construct was diabetes self-efficacy, which reported a significant positive effect in 57% of the studies in which it was addressed. Additionally, the other studies found no effect of the intervention on self-efficacy (Fitzpatrick et al., 2013).

The relationship between DSME/DSMS and overall better health outcomes for patients with T1D is mediated by diabetes self-efficacy (Abubakari et al., 2016). Chih and colleagues (2010) assessed the direct effect of diabetes self-efficacy on glycemic control goals for 52 adolescent patients in Taiwan between ages 12-20. Diabetes self-efficacy was quantified using the Perceived Diabetes Self-Management Scale (PDSMS). Glycemic control was determined using HbA1c data and used equal to or less than 7% as a cutoff for healthy control. Results showed a negative association between PDSMS scores and HbA1c level, supporting the well-founded relationship between self-efficacy and positive health outcomes (Chih et al., 2010).

### **Diabetes Distress**

In addition to improved DM control, self-efficacy has shown a significant impact on other psychosocial components of chronic disease management like those seen in patients with T1D (Nouwen et al., 2009). DD is a condition which refers to the unique psychosocial distress experienced by individuals living with any type of DM. The symptoms of DD include emotional distress, physician-related distress, regimen-related distress and interpersonal distress (Fisher et al., 2012). DD presents increased risk for poor DM self-management leading to poor glycemic control and the likelihood of complications (Joenson et al., 2013). A variety of factors contribute to the onset and severity of DD.

Fisher and colleagues (2015) identified 7 contributing factors to DD in patients with T1D. The first is *powerlessness*, or the feeling of helplessness that occurs from the cognitive appraisal of blood sugar numbers as beyond the patient's control. Next, is *negative social perception*, that is likely a result of fear regarding the way others will

treat them when they are forced to make significant lifestyle changes or because they carry the disease label. *Physician distress* implies a dissatisfaction with healthcare providers. *Friend/Family distress*, refers to dissatisfaction regarding the level of attention paid to the patient's plight by their close relations. *Hypoglycemia distress*, refers to the fear and uncertainty these patients feel towards potentially life-threatening hypoglycemic events. *Management distress*, refers to negative self-evaluations of a patients' self-care regimen. *Eating distress*, patients often become dissatisfied with the amount of time they spend thinking about food and/or negative self-evaluations about their ability to control these behaviors. Patients may suffer from any combination of these categories at any one point in time. The overall distress experienced by a patient is not dependent on distress in all 7 categories (Fisher et al., 2015).

High levels of DD are common and persistent in individuals with T1D. Fisher and colleagues (2016) found that in a sample of 224 patients with T1D, a prevalence of 42.1% and tracking over a 9-month period found a new incidence rate of 54.4%. Moderate levels of DD have been associated with poor glycemic control, poor self-care, low diabetes self-efficacy and poor quality of life (Fisher et al., 2012). The relationship between DD and behavioral health factors related to DM self-management is maintained when controlling for clinical levels of depression, and rarely do depressive symptoms of DD meet full criteria for Major Depressive Disorder (MDD) (Gonzalez et al., 2011). In their position paper, the American Diabetes Association (ADA) recommended that psychosocial assessment be included for effective DM management (Chiang et al., 2014). It follows that positive identification of DD would inform evidence-based psychosocial interventions.

Friis and colleagues (2015) studied the relationship between self-compassion, psychosocial pathologies and glycemic control in 110 adult patients with DM between the ages of 18-70. The sample included 67 (61%) patients with T1D. The PHQ-9 was used as a measure of MDD. DD was quantified using the Diabetes Distress Scale (DDS-2) which is a psychometrically sound abbreviation of a longer measure of DD. Self-compassion was assessed using The Self Compassion Scale (SCS) (Neff, 2003). Results suggested that as self-compassion increased, DD and MDD decreased. Additionally, DD demonstrated a significant relationship with metabolic control while MDD did not. Therefore, self-compassion interventions may be positively associated with metabolic control mediated by reducing DD (Friis et al., 2015). DD significantly impacts the ability of a patient to engage in necessary self-care behaviors and negatively effects quality of life (Fisher et al., 2012).

### **Quality of Life**

HRQoL is a multidimensional construct based on patient self-report. A comprehensive review of the literature identified the following domain areas: 1) Physical, 2) Psychological, 3) Economic, 4) Social, and 5) Spiritual. HRQoL also refers to disease and/or treatment-related symptoms. Researchers also emphasized the importance of recognizing the positive aspects of HRQoL. (Mishra et al., 2012).

Bize and colleagues (2007) conducted a systematic review of the literature on physical activity and HRQoL; 14 studies including 13 different methods of physical activity were analyzed. The results showed a consistently positive relationship between self-reported physical activity and HRQoL (Bize et al., 2007).

A person's HRQOL can be a critical factor in DM treatment and control (Burroughs et al., 2004). Research suggests that individuals with DM have a lower overall quality of life than non-patients (Schram et al., 2009). In many cases, intensive therapies that generally have better metabolic outcomes are not concurrent with improvements in DQOL for patients with T1D. DQOL seems to hinge on the ability to find a balance between adequate self-management without becoming overly stressed by the burden of responsibility (Burroughs et al., 2004). However, when complications arise, DQOL in these patients sharply declines (Jacobsen et al., 1994). Therefore, DQOL is highly associated with a patient's ability to engage in self-care behaviors that keep complications at bay (Wallston et al., 2007).

Cochran and Conn (2008) conducted a meta-analysis of QOL outcomes from DM self-management interventions, assessing 20 different intervention studies across 1892 subjects. Overall QOL was improved by interventions designed to improve DM self-management. The relationship between DQOL and DM self-management may be mediated by diabetes self-efficacy, which is increasingly included in these types of interventions due to its observed impact on health outcomes (Cochran & Conn, 2008).

### **Interventions**

Many interventions have been developed to combat the psychosocial distress of DM self-management. The goal of many of these interventions is to improve health outcomes related to improved glycemic control by providing psychological interventions (Ismail et al., 2004). Self-management interventions have demonstrated significant success increasing QOL by reducing distress and increasing self-efficacy (Cochran & Conn, 2008). The summer camp model, which began in 1925, has become increasingly



popular for children with T1D. Current estimates suggest that 15,000-20,000 patients attend such camps each summer (American Diabetes Association, 2007). The camp model aims to provide a safe environment to help patients increase physical activity and reduce extreme hypoglycemic and hyperglycemic events (DCCT Research Group, 1993). Wang and colleagues (2008) studied the effects of a 20-day diabetes camp on adolescents (12-18 years) with T1D compared to their counterparts who did not attend the camp. Glycemic control was assessed using HbA1c levels. Psychological screeners were given to parents and their kids. Participants were given the Beck Depression Inventory, 2<sup>nd</sup> edition as a measure of depressive symptoms and a self-reported adherence questionnaire. In turn, parents were asked to complete the Personal Adjustment and Role Skills Scale III (PARS-III) (Walker et al., 1990), as well as an adherence questionnaire. Data was collected at three time points, 3 months prior to camp (T1), 3 months after camp (T2), and an average of 7 months after camp (T3). Patients in the camp group showed significant improvements in HbA1c from T1 to T2 compared to controls. In addition, this study found that parent-reported adherence was significantly improved compared to controls, although patient-reported adherence was not. The participants in the camp group did not show significant improvements on the BDI-II or the PARS compared to controls (Wang et al., 2008).

Camp interventions are far less common for adults with T1D. There are examples of studies on camps that included adults, however they were generally outliers with the mean age of study participants falling within the adolescent age group (Ly et al., 2015; Santiprabhob et al., 2008). Many adults with T1D have lived with the responsibility for diabetes self-management for long periods of time. However, there is evidence to suggest

the utility of DSME and DSMS refreshers and ongoing interventions (Chiang et al., 2014). The success of the camp model in helping children and adolescents increase self-efficacy and improve glycemic control has promising implications for an adults-only self-management intervention using the camp format (Winsett et al., 2010).

Due to the currently irreversible and incurable nature of T1D, considerable maintenance is necessary to avoid disease progression and complications (Atkinson, et al., 2014). While more prevalent, patients with T2D experience less complications than patients with T1D (Dall et al., 2009). A major reason for this is the nature of T1D and the heavy burden on individuals to maintain their own glycemic control by remaining almost constantly vigilant of the complicated balance between insulin treatments, physical activity, and diet (Cefalu, 2015). Technology that has led to lower self-management burden like CGM may help reduce some of the subsequent distress, however; there is still not enough evidence to suggest that it leads to overall better health outcomes (Atkinson, et al, 2014). Therefore, the burden still mainly lands on the patient. This can produce considerable psychosocial distress. DD can interfere with optimal diabetes self-management and lead to worse health outcomes and subsequent lower HRQoL (Joenson et al., 2013). Mitigating the psychosocial burden of T1D self-management through intensive short-term residential interventions like camps, demonstrates promise for enduring positive impact on overall health outcomes and population health (Winsett et al., 2010).

The purpose of this pilot study is to assess the impact of the Diabetes Training Camp (DTC) week-long intervention on the perceived self-management of diabetes in Type 1 adults. The DTC intervention is a multi-disciplinary approach to helping these

individuals increase physical activity and improve glycemic control. It is hypothesized that due to participation in this comprehensive intervention, individuals will experience improved quality of life and reduced diabetes distress because of increased self-efficacy to self-manage the disease. The relationship between chronic physiological processes and psychosocial distress necessitates additional resources. There is a void in the healthcare services available to adults with T1D. The purpose of the study is to evaluate the ability of the Diabetes Training Camp to provide a resource to fill this void.

### CHAPTER 3: METHOD

The purpose of this pilot study was to assess the impact of the DTC week-long intervention on DQOL, DD, and diabetes self-efficacy. A within-subjects pretest-posttest design utilizing three separate t-tests was used to evaluate changes in these three constructs and overall effect size (80% power, .05 level). A Bonferroni correction ( $.05/3 = .02$ ) was used to decrease the risk of a false positive based on multiple comparisons. The results violated the assumption of normality. Therefore, a Related-Samples Wilcoxon Signed-Rank was administered for each questionnaire to provide a non-parametric test of significance ( $p < .05$ ). A correlation analysis was administered to evaluate the relationship between changes in DQOL from pre-to post-test and its impact on diabetes self-efficacy at 6-week follow-up.

#### **Participants**

Data for this study were taken from an archival data set from a larger study on DTC with IRB approval through Stockton University in Galloway Township, N.J. Participants were recruited from two iterations of DTC delivered in Lancaster, PA in June and August 2016. Baseline data collection took place at intake prior to beginning the week-long camp. A total of 47 campers opted to participate in our study at baseline. From this group a total of 34 participants completed the 6-week follow-up survey. Eligible participants were between the ages of 18-64, fluent in English, and had a diagnosis of T1D. Campers were excluded from the current study if they were diagnosed with T2D.

## Measures

*Diabetes Distress Screening Scale (DDS-17)* (Polonsky et al., 2005).

The DDS-17 is a 17-item self-report measure of a group of stressors that constitute DDS. The DDS-17 has been utilized in studies evaluating the relationship between the construct of DD and negative health outcomes. Responses are given on a 6-point rating scale ranging from 1 (Not a problem) to 6 (A Very Serious Problem). The DDS-17 is a valid and reliable measure of DD (Polonsky et al., 2005). A significant curvilinear relationship has been shown between scores on the DDS-17 with all of the following; Hba1c, self-efficacy, diet, and physical activity (Polonsky et al., 2005).

This scale has four subscales: 1) Emotional burden (EB), 2) Physician-related distress (PD), 3) Regimen-related distress (RD) and 4) Diabetes-related interpersonal distress (ID). Item 3 showed the strongest correlation (0.804) with EB, “*Feeling angry, scared, and/or depressed when I think about living with diabetes.*” Item 9 showed the strongest correlation (0.842) with PD, “*Feeling that my doctor doesn’t take my concerns seriously enough.*” Item 12 showed the strongest correlation (0.829) with RD, “*Feeling that I am not sticking closely enough to a good meal plan.*” Item 17 showed the strongest correlation (0.877) with ID, “*Feeling that friends or family don’t give me the emotional support that I would like*” (Polonsky et al., 2005).

The DDS-17 has strong internal consistency (Cronbach’s alpha = .92). The psychometrics of this measure have been extensively evaluated. Construct validity was inferred from a significant negative association with the Diabetes Empowerment Scale-Short Form (DES-SF,  $r = -0.55$ ) and QOL using the World Health Organization Quality of Life-BREF (WHOQoL-BREF,  $r = -0.42$ ; Joenson et al., 2013). Additionally,

predictive and concurrent validity was demonstrated by positive associations with depressive symptomology on the Center for Epidemiological Studies Depression Scale (CESD,  $r = 0.56$ ), poorer adherence to meal planning ( $r = 0.30$ ) and lower levels of exercise ( $r = 0.13$ ) (Polonsky et al., 2005). Higher scores on the DDS-17 were also associated with higher HbA1c, a measure of glycemic control ( $r = 0.24$ ; Joenson et al., 2013).

***Perceived Diabetes Self-Management Scale (PDSMS)*** (Wallston et al., 2007).

The PDSMS is an 8-item self-report measure of a patients' perceived competence or self-efficacy regarding their ability to engage in DM self-management. Self-efficacy regarding health-related behaviors has demonstrated a significant relationship with overall health outcomes (Wallston et al., 2007). Responses are given on 5-point rating scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Given the brief amount of items in this scale, there were no subscales. Total scores range from 8-40, with higher scores indicating higher levels of confidence in ability to self-manage the DM. There are two items reverse scored (Items 2 and 6). Item 6 showed the strongest corrected item-total correlation, "*Typically, my plans for managing my diabetes don't work out well*" (Wallston et al., 2007).

The PDSMS was validated by a large study of patients with both T1D and T2D who were referred from primary care, and internal medicine endocrinology clinics. The PDSMS is a valid and reliable measure (Cronbach's alpha = .83). Predictive validity was demonstrated by the negative correlation found with HbA1c ( $r = -0.38$ ) and average blood glucose readings ( $r = -0.32$ ), Construct validity was demonstrated by the weak to no impact of demographic variables on PDSMS scores in this study (Wallston et al., 2007).

*Diabetes Quality of Life Inventory (DQOL-BCL)* (Burroughs et al., 2004).

The DQOL-BCL is a 15-item self-report measure of total HRQoL specific to patients with DM. This measure has been utilized to predict DM self-care behaviors and satisfaction with DM care (Burroughs et al., 2004). Responses are given on two different 5-point rating scales; the first ranging from 1 (Very Satisfied) to 5 (Very Dissatisfied) and the second ranging from 1 (Never) to 5 (All of the Time). A combination of 498 patients with T1D and T2D were surveyed to help narrow down 26 items to 15 items using a principal components analysis. The 15-item brief inventory, was found to be equal to or better at predicting self-care behaviors and satisfaction with DM control than the 60-item version for individuals with T1D. Using a regression analysis, six items were found to be predictors of satisfaction with DM control and nine items were found to be predictors of self-care adherence (Burroughs et al., 2004).

The DQOL-BCL is a valid and reliable measure (Cronbach's alpha = .85; Burroughs et al., 2004). The scores of patients with T1D on this measure showed a negative association with both the mental component scale (MCS;  $r = -0.53$ ), and physical component scale (PCS;  $r = -0.38$ ) of the RAND Short-Form 12 (SF-12), another measure of HRQoL (Jiang et al., 2013). More predictive validity research is needed on this instrument, however; an adjusted version for adolescents, the DQOL Measure for Youth, showed a significant association between poor QoL scores and more hospital admissions in the last 6 months ( $P = 0.006$ ), higher levels of depression ( $P < 0.001$ ), poor self-esteem ( $P < 0.001$ ), and poor self-efficacy ( $P < 0.001$ ) (Abolfotouh et al., 2011).

### **Procedure**

Researchers at the Stockton University School of Social and Behavioral Sciences in the Psychology Department in conjunction with DTC administrators identified themselves via email and obtained electronic informed consent from participants to participate in the study. Following informed consent, participants were given an intake survey containing a demographic questionnaire, an intake interview and the following three measures: *Perceived Diabetes Self-Management Scale (PDSMS)*, *Diabetes Distress Screening Scale (DDS-17)* and, *Diabetes Quality of Life Inventory (DQOL-BCL)*. Participants then took part in the DTC 1-week intervention geared towards increasing self-management skills and physical activity levels through coaching and education. Participants were sent the same three measures via mail 6 weeks following camp. The data was entered into a de-identified file and analyzed using SPSS.



## CHAPTER 4: RESULTS

Participants from two separate week-long DTCs held in Summer 2016, completed demographic questionnaires, provided health history information, and completed further surveys assessing for diabetes self-efficacy, DD and DQOL. Data were compiled and analyzed to better understand the impact of participation in DTC on these DM-specific constructs that are thought to characterize the broad range of psychological symptomology often seen in this population.

### Demographics

Between the two camps held in the Summer 2016 (June and August), a combined 47 participants signed informed consents to participate in the study and completed baseline measures. Of the total participants, 34 completed the follow-up in an average of 10.5 weeks (73.9 days) from the last day of camp. Which means that individuals completed the follow-up survey on average 4.5 weeks after receiving it. One participant was excluded from the final data analysis because they did not have T1D.

**Table 1**

*Demographic Data*

	<i>n=33</i>
Sex	
Male	9
Female	24
Age	
Mean Age	45
Median Age	44
Youngest	22
Oldest	74
Mean Age at Diagnosis	24.8
Youngest	3
Oldest	62
Mean Most Recent Hba1c	7.6
Lowest	5.8
Highest	10.5

In total, 23 individuals (70%) reported that they currently have a continuous glucose monitor (CGM). Participants were asked to rate their overall health on a scale of 1-5; 0= Poor, 1= Fair, 2=Good, 3= Very Good, 4= Excellent. Results suggested that 46.9% indicated they thought they were in “Good” health, 43.7% “Very Good”, 6.3% “Fair”, 3.1% “Excellent” and 0% thought they were in “Poor” health. Participants exercised for at least 30 minutes an average of 3.75 days in the past week, with 2/3 of people exercising between 2-5 days in the past week. Participants were asked how often they experience symptoms when experiencing hypoglycemia. Fifty percent indicated “Always”, 34.4% “Usually”, 15.6% “Occasionally”, and 0% “Never”.

### **Hypotheses Results**

This study utilized three separate paired t-tests to compare the effects of pre-camp scores with 6-week follow-up on the following three scales: (1) Diabetes Distress Scale; DDS-17, (2) Diabetes Quality of Life-Brief Inventory; DQOL-BCL, and (3) Perceived Diabetes Self-Management Scale; PDSMS. The results violated the assumption of normality. Therefore, a Related-Samples Wilcoxon Signed-Rank was administered for each questionnaire to provide a non-parametric test of significance ( $p < .05$ ). A correlation analysis was administered to evaluate the relationship between changes in DQOL from pre-to post-test and its impact on diabetes self-efficacy at 6-week follow-up.

**Table 2**

*Paired Samples Statistics*

		<i>M</i>	<i>N</i>	<i>SD</i>	<i>Standard Error Mean</i>
Pair 1	DQOL Baseline	37.64	28	7.93	1.50
	DQOL Follow-Up	35.29	28	7.82	1.48
Pair 2	PDSMS Baseline	27.90	29	5.93	1.10
	PDSMS Follow-Up	29.69	29	5.78	1.07
Pair 3	DDS Baseline	38.03	33	15.42	2.68
	DDS Follow-Up	37.79	33	15.11	2.63

**Table 3**

*Paired Samples Test*

	<i>t</i>	<i>Df</i>	<i>Sig. (2-tailed)</i>
Pair 1: DQOL baseline- DQOL follow-up	2.220	27	.035*
Pair 2: PDSMS Baseline- PDSMS follow-up	-1.906	28	.067
Pair 3: DDS baseline- DDS follow-up	.131	32	.896

\*Statistically significant ( $p < .05$ ).

***Diabetes Quality of Life***

DQOL as measured by the Diabetes Quality of Life-Brief Inventory (DQOL-BCL; Burroughs et al., 2004) was administered at baseline and 6-week follow-up and expected to show improvements related to participation in DTC. For those individuals who completed the 6-week follow-up measure a statistically significant relationship with

a medium effect size was demonstrated between participation and positive changes in DQOL.

***Diabetes Distress***

DD as measured by the Diabetes Distress Scale (DDS-17; Polonsky et al., 2005) was administered at baseline and 6-week follow up and expected to show improvements related to participation at DTC. For those individuals who completed the 6-week follow-up measure, results did not yield a statistically significant relationship between participation and reduction in DD.

***Diabetes Self-efficacy***

Diabetes self-efficacy as measured by the Perceived Diabetes Self-Management Scale (PDSMS; Wallston et al., 2007), was administered at baseline and 6-week follow up and expected to show improvements related to participation at DTC. For those individuals who completed the 6-week follow-up measure, results did not yield a statistically significant relationship between participation and improvement in diabetes self-efficacy.

**Table 4**

*Related Samples Wilcoxon Signed-Rank Test*

	<i>Total (N)</i>	<i>Significance (p)</i>	<i>Effect Size (r<sup>2</sup>)</i>
DQOL-BCL (Baseline- 6-Week Follow-Up)	28	.049*	-0.373**
DDS-17 (Baseline- 6-week Follow-Up)	33	.853	-0.322
PDSMS (Baseline- 6-week Follow-Up)	29	0.63	0.345

\*Statistical significance ( $p < .05$ ). \*\*Results showed a negative effect size because on the DQOL-BCL higher scores indicate lower DQOL.

***Relationship between Diabetes Quality of Life and Diabetes Self-Efficacy***

Previous research suggested that significant improvements in DQOL would be associated with increases in diabetes self-efficacy. Results from a correlation analysis did not show a significant relationship between improvements in DQOL and diabetes self-efficacy, ( $r(31) = .23, p = .12$ ).

***Relationship between Diabetes Distress and Diabetes Self-Efficacy***

Previous research suggested that significant changes in DD would be associated with changes in diabetes self-efficacy. Results from this study observed no significant changes in DD and therefore, no change score could be calculated to assess for its impact on the outcome of diabetes self-efficacy.

## CHAPTER 5: DISCUSSION

### Interpretation and Implications

Despite being the less common type of DM, the growing incidence of T1D and the higher cost of care due to a higher prevalence of complications necessitates an increased focus on the treatment of this chronic condition (Dall et al., 2009). In addition to medical complications, T1D poses unique psychosocial challenges, which can lead to emotional distress, diminished QOL, and reduced health management behaviors further complicating medical presentation (Chiang et al., 2014). This continuous feedback loop between chronic medical complications and mental health issues may be addressed best by an integrated approach to care, taking a biopsychosocial view of the patient and their disease.

Medical treatment of T1D focuses on improving glycemic control through a variety of methods. In contrast to T2D, there is currently no cure and no known viable primary prevention methods. The hallmark of T1D treatment is administration of exogenous insulin. As young patients age into adulthood, increasing responsibility for self-managing insulin therapy lands on the patient. Multiple daily injections or infusions of insulin are either self-administered (traditional insulin therapy) or provided through a closed loop system using a CGM and insulin pump (intensive insulin therapy; Cefalu et al., 2015). Despite relieving some of the personal burden of self-checking and monitoring, intensive insulin therapies have not shown to be significantly better at overall glucose control (Atkinson et al., 2014). Both methods of treatment, intensive and traditional, rely on patients to self-manage their dietary intake and physical activity with constant vigilance. Naturally there can develop psychological fatigue and mood

disturbance that accompanies this burden and can affect one's ability to self-manage their disease. These psychosocial and behavioral factors should be primary targets of T1D treatment plans due to their relationship with health outcomes (Haas et al., 2012)

Diabetes self-efficacy refers to an individual's beliefs about their ability to self-manage their disease (Wallston et al., 2007). The goal of this study was to assess whether participation in a 1-week camp intervention had an impact on diabetes self-efficacy. The results in our sample did not show a significant increase in diabetes self-efficacy from pre-camp to 6-week follow up. However, participants in the DTC intervention demonstrated a significant increase in DQOL. While we did not find an association in our sample between diabetes self-efficacy and DQOL, there is research to suggest that improved DQOL has an impact on diabetes self-management (Burroughs et al., 2004). One reason for our finding may be that baseline levels of diabetes self-efficacy in our sample were already high in a large percentage of the participants. This can be observed in results of the demographic questionnaire, which demonstrated that 90.6% of participants felt they were in "Good" or "Very Good" health prior to starting camp and that a majority (70%) were supported by CGM. Additionally, most people reported participating in consistent physical activity.

Similarly, the finding that participation did not show a significant effect on DD may also be related to the fact that a large portion of our sample were not experiencing a high level of psychosocial distress at baseline. DTC is a self-pay program, therefore it is likely that there would be some access issues for people below a certain SES level (despite growing availability of scholarships). There is reason to believe that there may be a higher level of DD in the general population due to factors like social determinants

of health, and health literacy (Fisher et al., 2015). Social determinants of health refer to environmental factors out of the individual's control like upbringing, cultural values, education, socioeconomic status, gender and culture of public health (Hill et al., 2015). Based on SES level inferred by self-selection bias, it is fair to say that our sample likely experienced lower than average amounts of DD related to social determinants.

A systematic review and meta-analysis of exercise interventions for adults with T1D showed promise but lacked clarity on the relationship with glycemic control (Yardley et al., 2014). Other self-management interventions for this population have directly targeted glycemic control through DSME and DSMS. These interventions have moderate success but have demonstrated a tipping point in the level of intensity used to manage blood glucose before it begins to be a detriment to psychosocial functioning (Santiprabhob et al., 2008). This point further emphasizes ADA recommendations to individualize insulin regimens while simultaneously targeting psychosocial factors (Chiang et al., 2014). Camp interventions have shown the ability to impact these factors, however; the research has been almost primarily with children and adolescents (Wang et al., 2008). Studies that have targeted psychological factors in adults with T1D have had mixed or no result (Winkley et al., 2006). This pilot study on a novel camp intervention for adults with T1D that targeted both glycemic control, nutrition and psychosocial well-being, demonstrates a promising new model of care delivery for this population.

The primary finding of this study furthered the current literature on the impact of DM self-management interventions on improving DQOL. A diagnosis of T1D can be challenging and confusing. A psychoeducational intervention like DTC, that increases DQOL, may fill a void for individuals at early onset of the disease as a secondary



prevention point for health promotion. It's clear from the research that psychosocial distress impacts overall health outcomes. Interventions directed towards these issues may help prevent disease progression overall by improving overall emotional well-being.

### **Limitations**

As this study benefited from an archival data set from a larger study on DTC, there were areas of interest that were left unexplored at this time. These areas include cognitive and social variables that may have impacted the results. For example, the ability to socialize and connect with other patients with T1D may have been an individual's first contact with someone of their "tribe". The positive affective component of these unstructured interactions likely had some effect on the overall impact of participating in DTC. Additionally, there is some evidence that suggests cognitive processes like styles, and beliefs may mediate the relationship between the psychosocial burden of T1D and glycemic control (Farrell et al., 2004). Cognitive appraisal, or the way in which one makes sense of their situation, in the context of self-managing T1D, likely weighs heavily on the emotional health and QOL of these individuals. More specific mental skills interventions like those administered in cognitive-behavioral therapy (CBT) that address cognitive contributors to perception and experience of psychosocial burden may increase the impact of DTC and other similar brief interventions.

Including physiological measures in future research could help amplify the benefits of the DTC intervention by demonstrating the well-founded relationship between diabetes self-efficacy and positive health outcomes (For example, measures like HbA1c, and blood glucose testing frequency). Additionally, the impact of participation in DTC would be further delineated in future studies which utilize a comparison group of some

kind. It is notable that there was considerable attrition in our sample from baseline to follow-up. It would be interesting in future studies to analyze what components led to drop-out (ie. Lack of CGM, Diabetes Self-Efficacy).

Economic diversity was limited by payment structure. DTC is not currently covered by insurance, and so only those with disposable income can participate. However, efforts have been made by the organization to re-distribute funding towards scholarships for those in need. Furthermore, this pilot study of the DTC intervention analyzed a small but significant sample size, but lacked important items often included in demographic questionnaires evaluating the race/ethnicity of participants. Racial/ethnic disparities in this population are fluid and factors contributing to disease progression and psychosocial distress are not completely understood. T1D incidence and prevalence rates are highest in non-Hispanic Whites, however; there have been significant increases in all race/ethnicity subgroups other than American Indians (Dabalea et al., 2014). Additionally, it has become increasingly difficult to make differential diagnoses between T1D and T2D in children due to growing obesity rates, which disproportionately effect racial/ethnic minorities (Willi et al., 2015). Future research on contributing factors to disparities in care for racial/ethnic minorities with T1D may contribute to alterations in this intervention in order to be more inclusive. Increased inclusivity of lower SES participants will depend on the continued success of the DTC foundation and its funders, as well as the overall shift in healthcare delivery and payment structures from fee for service to value-based care.

### **Future Directions**

In future studies, researchers may benefit from assessing the impact of social interaction with peers and cognitive factors like the tendency towards cognitive distortions. Cognitive distortions refer to predictable and identifiable errors in thinking that lead to the dysfunctional processing of information (Beck, 1967). The impact of cognitive distortions on mood may contribute to DD, and subsequent poor DM self-management. Additionally, correlating psychosocial measures with physiological measures like HbA1c, would demonstrate a more direct health outcome of participation in camp. Furthermore, comparing participants to a sample who did not participate in camp would strengthen the generalizability of future findings. This study opens the door for future analysis of DTC and similar brief interventions that fill an important void in caring for patients with T1D. Further studies on this intervention could help to elucidate mechanisms of action so that camp directors can fine-tune the approach to increase positive health outcomes.

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