Walking as a Standardized Intervention in Type 2 Diabetes Mellitus: A Quality Improvement Project within the Primary Care Setting

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Abstract

Introduction/Purpose

Type 2 diabetes mellitus (T2DM) is a multifaceted disease. Implementing interventions focused on physical activity (PA) can aid in reducing the risk of developing devastating complications. The objective of this project was to evaluate the effectiveness of an educational and PA intervention on activity levels, weight, BMI, and weekly average blood sugar levels.

Methods

The quality improvement (QI) project provided consented participants with a 15-minute educational presentation via printed handouts tailored from the American Diabetes Association toolkit. Participants then began a six-week walking intervention of 30-minutes, five days a week and received weekly phone reminders. The International Physical Activity Questionnaire-Short Form (IPAQ-SF), weight, height, BMI, and participants' report of average weekly blood sugar level were collected pre- and post-intervention.

Results

The results of the dependent t-test (n = 7) did not show a statistical difference in the participants report of physical activity between pre-intervention (M = 6109.9, SD = 5934.4) and post-intervention (M = 4812.9, SD = 5337.4) IPAQ-SF survey scores, $t(0.5768) = 6$, $p < 0.5850$. However, the average results of post-intervention weight, BMI, and BS level (224.7, 35.4, and 118 respectively) showed a 2%-5% decrease compared to pre-intervention results (228.7, 36.1, and 122).

Discussion

In clinical practice, achieving optimal glycemic control on a long-term basis is challenging, since the reasons for poor control in T2DM are multifaceted. ("Factors that Correlate with Poor

Glycemic Control in Type 2 ... - ophrp") In view of this, interventions aimed at PA using evidence-based guidelines must be initiated at time of diagnosis to reduce the severity of disease and prevent complications.

Keywords: exercise, physical activity, obesity, T2DM

Walking as a Standardized Intervention in Type 2 Diabetes Mellitus: A Quality Improvement Project within the Primary Care Setting

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar) that occurs when the body becomes resistant to insulin or does not make effective use of the insulin it produces (World Health Organization, 2023). It is a multifaceted disease that can affect many organs within the body such as the eyes, kidneys, and heart which can further lead to the development of chronic kidney disease, heart disease, stroke, blindness, and lower-limb amputations, among other conditions. The clinical signs and symptoms vary in severity and depend on the degree and duration of hyperglycemia (G. & Flyvbjerg, 2023). Primary care providers are often the first healthcare professionals to screen, diagnose, and treat diabetes through lab testing, physical exams, education of lifestyle changes, and by providing medication prescriptions. Early detection and intervention are fundamental to reduce the risk of developing devastating complications related to diabetes. Education on lifestyle modifications remains one the most promising interventions health care providers can implement to help patients self-manage their disease (CDC, 2023; WHO, 2023).

Background

With the prevalence of T2DM rising at an alarming rate not only worldwide but in the U.S., greater focus on evidence-based interventions are needed to address this vulnerable population. Worldwide, in 2021, approximately 537 million adults (20-79 years) were living with diabetes and is projected to rise to 643 million by 2030 and 783 million by 2045 (Diabetes Research Institute Foundation, 2023). It has been estimated that four in five adults with diabetes live in low- and middle-income countries and that one in two (240 million) adults living with diabetes are undiagnosed. As alarming as these statistics are, there are another 541 million adults

worldwide who are at an increased risk of developing T2DM. It is also estimated that one in six pregnancies worldwide are associated with hyperglycemia (Alejandro et al., 2020). In the North American and Caribbean Region, which includes the U.S., it is estimated that 51 million adults have diabetes with 1 in 4 people living with diabetes being undiagnosed. This region has the second highest prevalence of all regions at 14% and accounts for the highest diabetes related expenditure (USD 415 billion) associated with diabetes. The International Diabetes Federation (2021) reports diabetes caused 6.7 million deaths in 2021, with one death occurring every 5 seconds. Diabetes was also responsible for an estimated 966 billion USD in global health expenditure, with the North American and Caribbean region accounting for 43% of the entire global expenditure (International Diabetes Federation, 2021). This global expenditure represents a 316% increase over the last 15 years.

Although there are several types of diabetes, T2DM remains the most common form and accounts for 90-95% of those diagnosed with this devastating disease (Centers for Disease Control and Prevention (CDC), 2023). With various theories existing to explain why this happens, several factors increase a person's risk for developing diabetes including having prediabetes; being overweight; being 45 years of age or older; having a parent, brother, or sister with type 2 diabetes; being physically active less than 150 minutes a week; and/or had gestational diabetes or given birth to a baby who weighed more than 9 pounds (CDC, 2023). Diabetes is more common in people having a racial or ethnic background that is African American, Hispanic/Latino American, American Indian, Asian American, or Pacific Islander. T2DM is also associated with many complications affecting various organs due to the damage it causes in large and small vessels. Chronic diabetic complications affect quality of life and/or life

expectancy and increases the burden not only for the individual patient but also for society at large, through increased costs for health care and loss of productivity (Rolandsson et al., 2012).

As obesity is a major risk factor for T2DM, the growing prevalence of both obesity and T2DM signifies a major health crisis worldwide. Obesity has been defined by the World Health Organization (WHO) (2021) as excessive fat accumulation that presents a risk to health and notes that more people are obese than underweight in every region except sub-Saharan Africa and Asia. The primary cause of obesity has been described as an imbalance between calories consumed and calories expended with many people consuming foods that are high in fat and sugars. As the issue of obesity has grown to epidemic proportions, it is estimated that more than 1.9 billion adults, 18 years and older, are overweight (WHO, 2021). Body mass index (BMI) is a measure commonly used to quantify body fat based on height and weight and provides a useful measure of overweight and obesity in both males and females of all ages. Given the relationship between diabetes and obesity, a high proportion of people diagnosed with diabetes in the US are overweight [body mass index (BMI) ≥ 25 kg/m^2] or have obesity (87.5%; BMI ≥ 30 kg/m^2) (Bin Rakhis et al., 2022). Diabetes and obesity are inextricably linked. Weight reduction remains beneficial in both the prevention and management of T2DM.

T2DM is a chronic metabolic disorder that results in microvascular and macrovascular complications. Maintaining glycemic control is essential in preventing complications. The most commonly used test to diagnose diabetes and the gold standard for the estimation of glycemic control is the hemoglobin A1C (HgbA1c) test, which measures a person's average blood sugar levels over the past three months. According to the CDC (2022), normal HgbA1c is defined as a level below 5.7%, with a level of 5.7%-6.4% indicating prediabetes, and a level of 6.5% or greater indicating diabetes. The goal for most people with diabetes is a HgbA1c level of 7% or

less. Uncontrolled diabetes or poor glycemic control leads to many complications that can reduce quality of life, reduce life expectancy, and increase the healthcare cost of the disease (Bin Rakhis et al., 2022). Poor glycemic control results in microvascular complications such as retinopathy, neuropathy, nephropathy, and macrovascular complications such as stroke, coronary artery disease, and peripheral vascular disease. In clinical practice, achieving optimal glycemic control on a long-term basis is challenging, since the reasons for poor control in T2DM are multifaceted and related to both patient and health care provider-related factors (Haghighatpanah et al., 2018).

Diabetic management is complex due to the various adjustments patients must make in their daily lives. Many patients feel overwhelmed with the necessary lifestyle changes that are needed to control their disease. Several studies report that psychological factors such as self-efficacy, social support, and attitude also influence the behavior and lifestyles of people diagnosed with diabetes (Karimy et al., 2018). Diabetes stigma is another strong factor oftentimes not considered by primary care providers in self-management. It is defined as the negative attitude, judgment, discrimination, or prejudice against someone with diabetes and comes from the false idea that people with diabetes made unhealthy food and lifestyle choices that resulted in their diagnosis (CDC, 2022b). Although risk factor control has improved over the past several decades, substantial gaps remain between the current treatment recommendations and the quality of care received by patients diagnosed with diabetes (Selvin et al., 2018).

Problem Statement

Around 90% to 95% of people diagnosed with diabetes in the U.S. have T2DM according to the CDC (2022a). Several strategies and initiatives have been established by the ADA, CDC, and WHO to bring awareness to diabetes and the many complications that can arise with small success. Due to the inconsistencies in diabetes education, many providers continue to rely on

previously learned knowledge instead of current evidence-based guidelines. Further exacerbating this issue is the lack of standardized approaches when providing physical (PA) activity education to those with T2DM. These inconsistencies in educating the patient with T2DM lead to negative outcomes and reduction of quality of life while raising the overall healthcare cost.

The American Academy of Family Physicians characterizes primary care as the patients first point of entry into the health care system and as the continuing focal point for all needed health care services (HRSA, 2022). Evidence shows that a solid foundation of primary care yields better health outcomes overall, greater equity in health care access and outcomes, and lower per capita health costs (FitzGerald et al., 2022). Primary care providers have an opportunity to facilitate improved health outcomes and promote self-management through the use of a standardized approach applying evidence-based guidelines.

Organizational Gap Analysis

The project site is an independent primary care practice with two providers who care for a multitude of patients daily and includes a physician and a nurse practitioner. In the current setting, there are no standardized approaches to educating the diabetic patient on lifestyle modifications, specifically exercise. A gap in practice was identified as each individual provider relies on previous knowledge when providing education, instead of evidence-based practice guidelines. This lack of evidence-based protocols and standardized approaches to providing care to the patient with T2DM leads to poor patient compliance, increased risk of complications, and negative health outcomes, as the patient may not understand or remember the education provided. Due to the growing number of patients seeking care, providers oftentimes must also provide education in a limited amount of time and with limited resources. Having a standardized approach to educating the patient with T2DM on the need for lifestyle modifications provides the

patient with clear and concise instructions, improves health outcomes, and increases provider time management.

Review of Literature

A systematic literature review was conducted in PubMed and CINAHL to gather current evidence-based practice guidelines and best practices for exercise in the diabetic patient. The last five (2018-2023) years were used to gather the most recent data. The search strategy included using the MeSH terms “type 2 diabetes, t2dm, diabetes mellitus, physical exercise, fitness, and physical activity” and had to be in English. There were 86 articles identified using the initial search criteria. Free full text was applied, which narrowed the search to 51 articles. Only meta-analysis, randomized controlled trials, and systematic reviews were included in the search, which further narrowed the search to include only 21 articles. Inclusion criteria were articles within the last five years, English language, full free text, randomized control trials, meta-analysis, and systematic reviews. Articles older than five years, not located in the U.S., and languages other than English were excluded from the review. Of the 21 articles, ten articles were excluded. Finally, there was one duplicate article which was also removed. Therefore, 10 articles were examined for this literature review.

Exercise

T2DM has become a major health problem worldwide and is accompanied by a range of modifiable risk factors. With the multifaceted nature of T2DM etiology, several articles conducted for review indicate obesity, physical inactivity, and sedentary lifestyle as major indicators for the development of diabetes (Li et al., 2022; Tinsley, 2023; Holzer et, al., 2021; Chien et al., 2022). Research in exercise science confirms that PA can help prevent type 2 diabetes, as well as help patients manage its effects (Kanaley et al., 2022).

Within the last five years, systematic reviews, meta-analyses, and randomized clinical trials have been published with a goal to understand which exercises induce the greatest benefits on glucose metabolism in people with T2DM. Studies show significant health benefits related to exercise which include improved mental health, managing weight, reducing the risk of disease, strengthening of bones and muscles, and improving one's ability to complete activities of daily living (CDC, 2022a). Ten articles included in the review focused on different exercise modalities that included aerobic exercises, resistance training (RT), walking, qigong, tai chi, yoga, power-cycling, and sandbagging exercises. Several studies included in this review acknowledge exercise interventions as a valuable tool in the prevention and management of T2DM, however, all agree the optimal exercise prescription to maintain or improve the health status of this population remains unknown (Li et al., 2022; Tinsley, 2023; Holzer et, al., 2021; Chien et al., 2022).

High- and Moderate-Intensity Interval Training

High- and moderate-intensity interval training (HIIT and MIIT) is a broad term used for workouts that involve short periods of intense exercise alternated with low-intensity recovery periods (Tinsley, 2023). The specific amount of time that one exercises and recovers varies based on the activity that is chosen but typically lasts 10-30 minutes in duration. HIIT exercises target 80%-90% of a person's maximum heart rate whereas MIIT exercises target 55%-75% of a person's maximum heart rate. RT, power cycling, walking, and sandbagging are considered high- to moderate-intensity exercises.

The most recent review and meta-analysis, conducted by Li et al. (2022), investigated the effects of different exercise intensities, namely, HIIT and moderate-intensity continuous training (MICT), on body composition, heart and lung fitness, and blood glucose, and blood pressure

indices in patients with T2DM, using power cycling. The results indicated applying both low-volume HIIT and MICT in power cycling improved health-related indicators in subjects with T2DM. However, a study conducted by Holzer et al. (2021) which focused on three 20-min moderate-intensity exercise sessions after breakfast found there were no notable differences between the effects of the different types of exercise on glucose levels, especially when comparing values over a longer period of time. Another review conducted by Kourek et al. (2023) also investigated the effectiveness of HIIT but in response to cardiorespiratory fitness and endothelial function in patients with T2DM through a systematic literature review. The study found that although aerobic exercise remains the mainstay treatment option, HIIT was found to be beneficial but remained under investigation as the number of studies included in the systematic review of literature were limited.

In the patient with T2DM, Chien et al. (2022) investigated the benefits of progressive sandbag exercises to enhance muscle strength and control blood sugar levels. Sandbagging exercises include the use of dumbbells, barbells, or kettlebells during exercise. The study indicated that participants showed improved levels of HbA1c, upper extremity strength, and muscle mass, and had better sit-to-stand performance and quality of life. Jarvie et al. (2019) focused on aerobic exercise and adherence to guideline recommendations of PA in ambulatory patients with Type 2 Diabetes. The study found that almost 50% of participants did not meet minimum PA recommendations despite lifestyle recommendations being the foundation for treating T2DM. The study further concluded that stronger efforts were needed to promote greater adherence to guidelines as the foundation of T2DM treatment. In contrast, Jansson et al. (2022) investigated the effect of RT on glycosylated hemoglobin (HbA1c) in adults with T2DM. The systematic review and meta-analysis provided evidence that RT was an effective strategy in

reducing HbA1c in adults with T2DM. Furthermore, the study also found RT interventions that were geared toward muscular strength were more effective in reducing HbA1c than those that were not.

Low-Intensity Interval Training

Low-Intensity Interval Training (LIIT) consists of low-impact exercises performed in intervals followed by a slower-paced recovery period (Cleveland Clinic, 2023). Studies show that 40-60 minutes are needed to reap the benefits of LIIT. LIIT workouts primarily target 60%-80% of a person's maximum heart rate. Exercises such as walking at a casual pace, light jogging, and swimming laps are examples of LIIT.

Wibowo et al. (2022) studied the effects of yoga to address the challenging cycle of physical inactivity, impaired health-related fitness, and T2DM conditions. Yoga has been described as an ancient practice that focuses on mind and body with the aim of building strength and flexibility through various physical postures, breathing techniques, and meditation. Although studies show that regular yoga promotes endurance, strength, calmness, flexibility, and wellness, Wibowo et al. (2022) concluded there was low quality of evidence to support the use of yoga in improving glycemic control. It further proposed the need for high-quality randomized control studies to provide a higher quality of evidence to support the use of yoga. Li et al. (2020) also evaluated another ancient and traditional practice of wellness called qigong and tai chi in middle-aged and older adults with T2DM. Both Qigong and Tai Chi sessions incorporate a wide range of physical movements, including slow, meditative, flowing, dance-like motions. In addition, they both can include sitting or standing meditation postures as well as either gentle or vigorous body shaking (Jahnke et al., 2010). Li et al. (2020) indicated that target qigong exercises might have a better effect on patients with a longer duration, while tai chi might be risky for people with

central obesity.

Moghetti et al. (2020) evaluated the effects of walking in the patient with T2DM, as walking is considered the most ancestral form of PA in humans and easily applicable to daily life. Through the systematic review of literature, Moghetti et al. (2020) concluded there was considerable evidence to recognize regular walking improved glucose control in subjects with T2DM, with favorable effects on cardiorespiratory fitness, body weight, and blood pressure.

Influence of Gender on Exercise

Prat-Luri et al. (2022) aimed to analyze the physiological sex differences response to PA programs in adults with T2DM. Per Prat-Luri et al. (2022), the current guidelines for the management of T2DM do not consider sex, yet there is moderate evidence pointing to biological and psychosocial differences between males and females in regard to the pathogenesis, progression, and complications of T2DM. The study concluded that due to the limited number of studies, there were no particular evidence suggesting significant differences between males and females in regard to PA in the management of T2DM.

Gaps between studies and current recommendation for physical activity

There is compelling evidence showing that regular exercise is capable of: a) increasing glucose uptake at the peripheral and systemic level, b) improving insulin sensitivity, and c) improving the known hyperbolic curve of glucose tolerance (Prat-Luri et al., 2022). Traditionally, aerobic exercise has been considered the gold standard for the management of T2DM, however over the past decade, there has been an increase in the number of studies demonstrating the benefits of several exercise modalities outside of just aerobic exercise. Although each study evaluated the efficacy of exercise in improving glycemic control and

decreasing complications, significant gaps remain in regard to which exercise will promote the greatest effect on glucose metabolism.

Currently the ADA (2022) and CDC (2022c) recommend diabetic patients should engage in 150 minutes of moderate- to vigorous-intensity aerobic activity per week, spread over at least 3 days/week, with no more than two consecutive days without activity. Those in particular with T2DM should also engage in 2-3 sessions/week of RT. Even though the American College of Science and Medicine (ACSM) incorporated guidance from the ADA, further recommendations were provided. Those recommendations included 150-300 minutes a week of moderate-intensity, or 75-150 minutes a week of vigorous-intensity aerobic PA with muscle-strengthening activities of moderate or greater intensity that involve all major muscle groups on 2 or more days per week (Kanaley et al., 2022). Though recommendations have been developed by the ADA, CDC, and ACSM in regard to PA, the number of providers and organizations that utilize these guidelines to implement exercise as a lifestyle modification for T2DM remains unknown.

Evidence-based Practice: Verification of Chosen Option

With the increasing prevalence of T2DM and the pressure that is placed on healthcare systems worldwide, greater efforts are needed to promote lifestyle changes as a mainstay of diabetes management. T2DM has been identified as one of the most challenging chronic illnesses to manage due to its complexity (Carpenter et al., 2019). Since the management of diabetes is mainly accomplished by patients and families, self-management has become the center of diabetes care. Although lifestyle modifications encompass a wide range of changes a patient must consider and choose to make, this project focused on PA.

Walking is one of the most popular forms of exercise worldwide and does not require expensive equipment or special skills. It provides a wide range of health benefits and can be

completed in many different environments. A cohort study of runners and walkers conducted by Williams & Thompson (2013), found that after six years of follow-up, when expending an equal amount of energy, walking offered similar benefits as running in reducing the risk of high blood pressure, high cholesterol, and diabetes. Moghetti et al. (2020) also identified considerable evidence to promote walking as a therapeutic tool to improve glucose control in subjects with T2DM. The study noted favorable effects on cardiorespiratory fitness, body weight, and blood pressure.

As most patients are diagnosed in primary care, the facility this project took place in currently utilizes an evidence-based standardized approach to educating and implementing an exercise regimen in the patient with T2DM. With exercise affecting various metabolic responses that control blood glucose, the quality improvement project sought to answer the PICOT question: In patients with T2DM, does a targeted educational presentation followed by a prescribed walking regimen compared to no education or walking regimen effect physical activity levels and improve weight, BMI, and average weekly blood sugar levels over a six-week period?

Theoretical Framework or Evidence-based Practice Model

The Health Promotion Model (HPM) (Appendix A) was chosen as the theoretical framework since it is directed at improving self-care and well-being as related to a person's behavioral habits. It was developed by Nola J. Pender and focuses on three areas: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcomes (Petiprin, 2023). The HPM aims to explain the factors underlying motivation to engage in health-promoting behaviors and focuses on people's interactions with their physical and interpersonal environments during attempts to improve health (Laranjo, 2016). It also emphasizes the active

role that a person has in initiating and maintaining health-promoting behaviors, and in shaping their own environment to support health-promoting behaviors. (“Health Promotion Model - an overview | ScienceDirect Topics”)

The individuals’ characteristics and prior experiences with exercise was evaluated through a pretest to determine the knowledge base and current level of PA. As prior experiences influence behavior-specific cognitions and affect, the patient’s perception of benefits and barriers of exercise can facilitate or impede behavior change. Through interpersonal influences such as family, peers, and healthcare providers, an increase in patient commitment to action was the driving force leading to changes in behavior outcomes.

Rouholamini et al. (2020) conducted a RCT with the aim to determine the effect of a training program based on HPM on PA in women with T2DM. The control group received routine clinical training while the intervention group received four training sessions of 60-90 minutes, twice weekly, using the lecture and question and answer methods. The HPM questionnaire designed by the research team included 69 questions in 9 subscales of perceived feelings related to behavior (8 questions), perceived benefits (13 questions), perceived barriers (10 questions), perceived self-efficacy (10 questions), interpersonal influences (6 questions), situational influences (4 questions), immediate demands and preferences (5 questions), commitment to action (8 questions), and previous related behaviors (5 questions). The questions were scored on a 5-point Likert scale ranging from 1 to 5. The study findings indicated that applying a training program based on HPM empowered diabetic women in terms of PA performance and saw an increase in PA scores involving both the control and intervention group. In addition, Rouholamini et al. (2020) also noted positive changes in patients’ viewpoints about the benefits of PA but recommended a need for extensive educational interventions to be

designed and implemented to encourage patients to conduct PA to further address complications associated with DM.

Goals, Objectives, and Expected Outcomes

The project utilized ADA clinical guidelines for T2DM exercise management, which outlined education and goals. The project used SMART (Specific, Measurable, Assignable, Realistic, and Time-Specific) goals for project objectives and expected outcomes. The SMART goal for the T2DM patient was to perform 30 minutes of moderate to vigorous walking five days per week (150 minutes) for six weeks. The objective of this project was to evaluate the effectiveness of an educational and PA intervention on activity levels, weight, BMI, and weekly average blood sugar levels. The outcomes expected upon completion of the educational and PA intervention were an increase in activity, a decrease in baseline weight, a reduction in BMI, and a decrease in average weekly blood sugar levels. It was anticipated that participants would continue after the project completion to be active with recommended guidelines for PA set by the ADA. The SMART goals for this project were:

Goal 1: To increase the participant's PA as assessed by the IPAQ-SF and minutes spent walking.

Goal 2: To improve weekly average blood sugar levels as assessed by patient report of fasting blood sugar levels pre- and post-intervention.

Goal 3: To decrease weight as measured by a standard weighing scale.

Goal 4: To decrease BMI as measured by height and weight.

Setting facilitators and barriers

Factors that promoted favorable project outcomes include supportive facility staff, existing evidence-based guideline recommendations for exercise in T2DM, and clearly defined clinical roles with competent clinical staff. Factors that play a role in barriers to diabetes self-

management practices include lack of provider knowledge on evidence-based recommendations for exercise, lack of patient participation and engagement, resistance to change, and time constraints (Appendix B).

Methods

The quality improvement (QI) project evaluated the use of walking by the patient with T2DM as an intervention for self-management. Based on the literature review and gap analysis of the project site, a need for a standardized approach to exercise in the patient with T2DM was identified. A QI project was the best approach for evaluating the efficacy of an exercise program in a primary care setting as primary care providers are the first to diagnose, treat, and manage the patient with T2DM.

Engagement with stakeholders including clinic providers and staff occurred via a PowerPoint presentation at the clinical site to discuss the problem and provide results from the gap analysis, literature review, and the current ADA guidelines. Participants for the study were identified with the assistance of the provider at the clinical site through the clinical providers scheduled visits. To obtain consent, the PI explained the objective, intervention, and measurable outcomes before asking the participant to consent verbally to participate. The University of Alabama Informed Consent template was used for written consent.

The Intervention

Preintervention

The PI provided a 15-minute educational presentation via printed handouts tailored from the ADA toolkit to the participant with a question-and-answer opportunity provided during session. The IPAQ-SF (Appendix C), which is a free survey and one of the most widely used self-report questionnaires to assess PA, was administered as a written questionnaire to evaluate

PA over the past seven days. The PI obtained participants' weight by the use of a standard weighing scale and BMI was calculated from the weight and height of each participant. The PI also obtained participants' report of average weekly blood sugar level. Each participant was provided with a notebook to log days and time spent walking. Participants were provided with instructions to begin the intervention at the conclusion of the educational presentation. A 6-week follow-up visit was scheduled before the participant left the clinical site.

Intervention

Participants began a six-week walking intervention of 30-minutes, five days a week. Weekly calls were placed to each participant to provide encouragement and support, as well as answer any further questions participants may have.

Post-Intervention

Data was collected at the conclusion of each participants' 6-week intervention that was scheduled on the day of the educational presentation. The IPAQ-SF was given as a written questionnaire. Weight, BMI, walking log, and patients report of current weekly average blood sugar level were also obtained.

Project Design

The DNP project was a QI project to determine the effectiveness of an evidence-based intervention that included an educational and PA component to decrease weight, BMI, and estimated average blood sugar levels in the patient with T2DM. The project's site was a primary care site located in Alabama and did not have an IRB department; therefore, a letter of approval was obtained from the administration department of the facility.

The Health Promotion Model was utilized to guide project implementation since it was directed at improving self-care and well-being as related to a person's behavioral habits.

Participants for the study were recruited with the assistance of the provider through scheduled clinic visits. Patients were considered for study participation based upon inclusion and exclusion criteria. Patients who met inclusion criteria were introduced to the PI by the provider. The PI explained the objective, intervention, and measurable outcomes of the study before asking the participant to consent verbally to participate. Once participants verbally consented, written consent was obtained.

The PI provided a 15-minute educational presentation developed from the educational materials available from the ADA as well as guidelines with recommendations for exercise to reduce sedentary behavior (Appendix D). The educational presentation was tailored to include "Understanding Type 2 Diabetes" and "Making Physical Activity a Part of Your Routine".

Descriptive statistics were collected to be utilized for demographic information including age and gender. The IPAQ-SF was administered as a written questionnaire pre- and post-intervention. Weight as calculated by a standard weighing scale and BMI as calculated from the weight and height of each participant were obtained pre- and post-intervention. Participants report of average weekly blood sugar level was also obtained pre- and post-intervention. Notebooks given at time of educational intervention were collected post-intervention.

Project Site and Population

This quality improvement project setting was a well-established primary care practice located in Sylacauga Alabama (AL). According to World Population Review (2023), the city of Sylacauga, Alabama (AL) is comprised of 12,040 residents and is the 59th largest city in AL. Spanning over 20 miles, Sylacauga has a population density of 595 people per square mile and a poverty rate of 32.23%. Per the latest statistics, Sylacauga is currently in a state of decline at a rate of -1.35% annually and its population has decreased by -4.01% since 2020. The four largest

ethnic groups are White (Non-Hispanic) (64.7), Black or African American (Non-Hispanic) (29.5%), Two+ (non-Hispanic) (1.58%), and White (Hispanic) (1.37%) (Deloitte & Datawheel, 2020). The city of Sylacauga has several outdoor walking paths accessible to the community that encompasses green spaces including a new community garden.

The primary care practice, which has served the community of Sylacauga since 2010, has two providers, two medical assistants, one office manager, one receptionist, and one billing specialist. The average daily census is 20-25 patients per provider who deliver care to a variety of patients throughout the lifespan. The practice offers routine physicals, immunizations, preventive care, and wellness screenings. They also diagnosis, manage, and treat common illness and chronic conditions such as common colds, influenza, hypertension, and diabetes.

The stakeholders in this project were the patients, providers, and clinic staff. Patients were the most important stakeholders as they were the individuals that received care. Effectively engaging patients in their care is essential to improving their health outcomes through decision-making, health behavior changes, and chronic disease management (Krist et al., 2017). Providers and clinic staff have a stake in maintaining the health status of their patients through health promotion and reduction of risk factors that may lead to a number of complications. By improving satisfaction with the care experience, providers can build a trusting relationship with the patient, provide quality care, and reduce healthcare cost through the reduction of hospital admissions and re-admissions. Please see Appendix E for letter of support.

The inclusion criteria were native English speakers over the age of 18 years, diagnosed with T2DM, BMI greater than 25, and HbA1c greater than 6.5%. Individuals were excluded if they were under the age of 18 years old, did not have a diagnosis of T2DM, were not a native English speaker, and/or were not allowed to participate in the PA intervention by the primary

care provider. The desired sample size was 10-15 participants due to practice scheduling and time constraints.

Measurement Instruments

To measure the outcomes of the project the following instruments were used: IPAQ-SF, weight, BMI, minutes spent walking, and average blood glucose levels. The outcome measures of IPAQ-SF, BMI, weight, and estimated average blood sugar were collected pre-implementation and post-implementation. The days and minutes spent walking log was collected at the conclusion of each participant's 6-week intervention.

1. The International Physical Assessment Questionnaire-Short Form: The IPAQ-SF is a free survey and one of the most widely used self-report questionnaires to assess PA. It was developed by the International Consensus Group in 1998 and is publicly available with no permissions required to use (*DAPA Measurement Toolkit* 2023). It consists of seven questions to capture the average daily time sitting, walking, and engaging in moderate and vigorous PA over the last seven days (Lavelle et al., 2020). Dinger et al. (2006) examined the validity and reliability of the IPAQ-SF in college students. Spearman correlation coefficients and intraclass correlation coefficients (ICC) were calculated to examine criterion validity and stability reliability, respectively. Criterion validity correlation coefficients ranged from 0.15 to 0.26 for total weekly time spent in PA from the IPAQ and values from the accelerometer and pedometer. The ICCs between the two administrations of the IPAQ ranged from 0.71–0.89. The results of this study indicate that the validity indices of the questionnaire were similar to other self-report PA questionnaires and the stability reliability of the questionnaire was acceptable. Please see Appendix C for IPAQ-SF questionnaire.

2. BMI measurement: For calculating the BMI, weight and height measurements will be obtained using a standard regular weighing machine and a measuring tape.
3. Weight: For calculating weight, a standard weighing machine will be used.
4. Minutes spent walking log: For calculating the minutes spent walking, minutes daily will be added and divided by 5.
5. Estimated average blood sugar levels as reported by participant pre-intervention and post-intervention.

Data Collection Procedures

Data was collected at two time points, before the intervention and after the completion of the intervention. The goals and intervention planning were based on the most recent guidelines developed by the ADA. All points of data was entered into an excel spreadsheet for data management.

Preintervention

After obtaining written consent, the PI provided a 15-minute educational presentation via printed handouts tailored from the ADA toolkit to the participant with a question-and-answer opportunity provided during session. The IPAQ-SF was administered as a written questionnaire as it is the most widely used self-evaluation questionnaire to evaluate PA over the past seven days. The PI obtained the participants' weight by the use of a standard weighing scale and BMI as calculated from the weight and height of each participant. The PI also obtained the participants' report of average weekly blood sugar level. Each participant was provided with a notebook to log days and time spent walking. Participants were provided with instructions to begin intervention at the conclusion of the educational presentation. A 6-week follow-up visit was scheduled before the participant left the clinical site.

Postintervention

Data was collected at the conclusion of each participants' 6-week intervention that was scheduled on the day of educational presentation. The IPAQ-SF was given as a written questionnaire. Weight, BMI, walking log, and patients report of current weekly average blood sugar level were obtained. The project evaluated a change from pre- and post-intervention IPAQ-SF, the patients reported average weekly blood sugar level, BMI, and weight.

Data Analysis

The numerical values of the average weekly blood sugar level, BMI, and weight were described using quantitative statistics (mean score and percentages). Descriptive analysis was utilized to find mean values within the data. The items in the IPAQ-SF were structured to provide separate scores on walking, moderate-intensity, and vigorous-intensity activity and were compared pre- and post-intervention using a dependent T test. Computation of the total score for the short form requires summation of the duration (in minutes) and frequency (days) of walking, moderate-intensity, and vigorous-intensity activities (Appendix F).

Cost-Benefit Analysis/Budget

According to the CDC (2022d), current estimates show 1 in 3 Americans will develop diabetes sometime in their lifetime and is the most expensive chronic condition in the U.S. With an annual cost of $327 billion, it is estimated $1 out of every $4 in U.S. health care costs were spent on caring for people with diabetes and 48% to 64% of lifetime medical costs were related to diabetic complications. By the year 2030, the estimated annual cost of diabetes is expected to reach $622 billion (Rowley et al., 2017). Aggressive diabetes health measures focused on lifestyle modifications could prevent or delay the progression of T2DM, thus decreasing medical and societal costs related to diabetes.

The resources that were utilized in this project include the use of educational materials, time, and financial expenses. The educational materials developed by the ADA as well as the pre- and post-intervention survey (IPAQ-SF) were printed on a home printer; home printer ink cartridges (black and color) to be used were priced at approximately $37 per bundle. The notebooks that were used to log time spent walking were purchased from Amazon by the PI. The cost of the Alittle Small Notebooks (spiral notepads 3x5) cost 23.99 for a bulk pack of 25. No external funding was required.

Timeline

The timeline for the project was essential to ensure all activities were identified and completed. The table for the timeline (Appendix G) provided visual reference points that allowed the reader to understand the flow of steps necessary to complete the project on time. Initially, time was spent gathering background data on T2DM and primary care, performing a literature review, writing project proposal, and collaborating with the stakeholders.

After IRB approval was granted, data was gathered at the clinical site. The project plan was implemented over a six-week time period. The pre-intervention phase consisted of a PowerPoint presentation to the provider and staff at the clinical site to discuss the problem and provide results from the gap analysis, literature review, and the current ADA guidelines. The PI then began collaborating with the clinical provider to identify participants for the project from the provider's scheduled clinic visits during week 1-2. The intervention phase consisted of obtaining written consent, providing a 15-minute educational presentation, collecting biometrics (weight, height, BMI) and participants report of average weekly blood sugar levels, and administering the IPAQ-SF during week 3-4. The post-intervention phase occurred six weeks after each individual participant's starting date. It consisted of collecting the written log of days

and time spent walking, the re-administration of the IPAQ-SF, the collection of biometrics (weight, height, BMI), and the participants' self-report of average weekly blood sugar level. The final phase of the project was devoted to evaluation of data collected and project completion to evaluate if changes occurred.

Ethical Considerations/Protection of Human Subjects

The University of Alabama (UA) Institutional Review Board (IRB) approval was obtained prior to initiating the project. The PI utilized the informed consent template to develop the written consent form that was approved by the UA IRB. All participants and their relevant health information was protected by the Health Insurance Portability and Accountability Act (HIPAA) which, among other guarantees, protected the privacy of patients' health information (Modifications to the HIPAA Privacy, Security, Enforcement, and Breach Notification Rules, 2013). Additionally, Standards of Care for practice in a primary care office were carefully followed. All information collected as part of evaluating the impact of this project was aggregated data from the project participants and did not include any potential patient identifiers.

The risks to patients participating in this project were no different from the risks of patients receiving standard primary care. Participant confidentiality was assured by coding the participants using alpha numerical individual patient identifiers created by using the participants initials and date of birth on paper copies. The list of participants and their identifying numbers were kept in locked filing cabinets in the practice office, only accessible to the PI. All information collected as part of evaluating the impact of this project was aggregated data from the project participants and did not include any potential patient identifiers. All electronic files containing identifiable information was stored on the HIPPA secure UA Box.

Results

The DNP project was a quality improvement project to evaluate the effectiveness of a standardized approach to PA in the patient with T2DM. Data was collected during two time points, pre- and post-intervention and results were summarized using mean (M) and standard deviation (SD) values. Pre-intervention the PI collected the results of BMI, weight, average BS level and the IPAQ-SF survey. Participants were presented with a 15-minute educational in-service and instructed to start a 6-week walking intervention that consisted of 30-minutes a day for five days. Post-intervention, the PI collected the results of the IPAQ-SF, weight, BMI, average BS level, and walking log. To examine the differences in pre-intervention and post-intervention survey scores, the PI used a dependent t-test, which compared the sample means to verify if there was a change in scores from one measurement to the other. Statistical analysis was also completed on average weight, BMI, and BS level to determine the value of the project intervention. The IPAQ-SF pre- and post-intervention results were represented using a double bar graph chart (Table 1). A double bar graph was also used to visually depict the outcomes of average weekly blood sugar levels, BMI, and weight (Figure 2).

The pre- and post-intervention IPAQ-SF were collected from seven participants and the demographic disposition showed a ratio of 5:2, with 71.4% being female and 28.6% being male (Figure 1). The average age of participants was 45 years. Using a dependent t-test ($n = 7$) with an alpha valve set at 0.05, no statistical difference was noted in the participants report of physical activity between pre-intervention ($M = 6109.9$, $SD = 5934.4$) and post-intervention ($M = 4812.9$, $SD = 5337.4$) IPAQ-SF survey scores, $t(0.5768) = 6$, $p < 0.5850$ (Table 1). However, the average results of post-intervention weight, BMI, and BS level (224.7, 35.4, and 122 respectively) showed a 2%-5% decrease compared to pre-intervention results (228.7, 36.1, and 118). The average minutes spent walking per participants was 44.07 minutes per day (Figure 2).

Figure 1

Gender

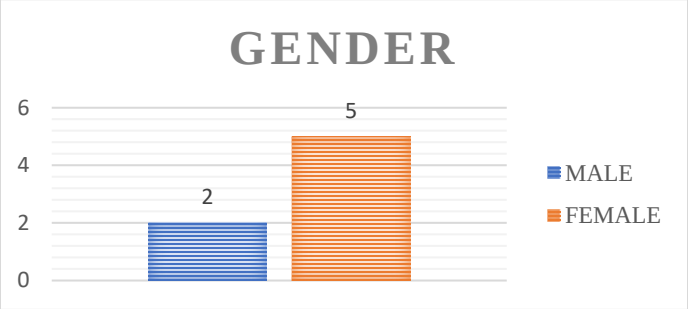

Figure 2

Biometrics

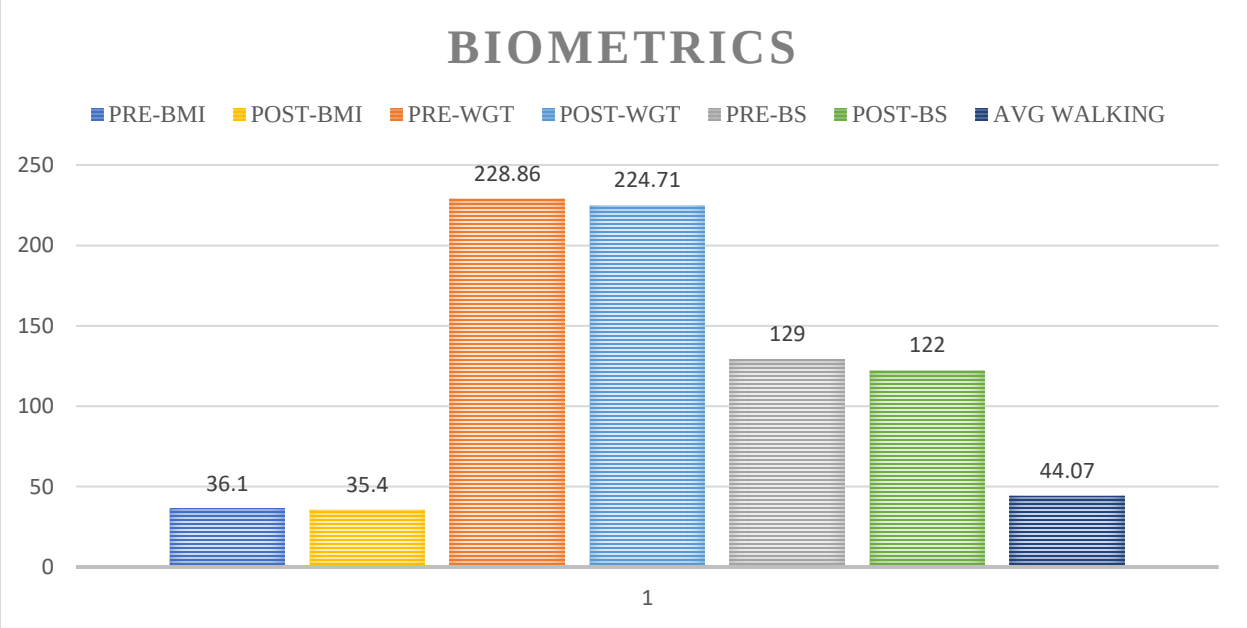

Table 1

Dependent T-test: Pre- and Post IPAQ-SF

	Mean	N	df	Std. Deviation	Std. Error Mean	T-value	P-value
Pre-Survey	6109.9	7	6	5934.4	2239.4		
Post-Survey	4812.9	7	6	5337.4	2014.1	0.5768	<0.585

Interpretation

After analyzing the data, the results of the IPAQ-SF showed no statistically significant impact in the participants report of PA. The IPAQ-SF is a self-report survey used to gauge the participants PA and sedentary behavior over the past seven days with participants having to recall what activities they completed for the week, including the frequency and duration. The difference in score is only a reflection of the last 7 days pre- and post-intervention which did not capture the entirety of the project duration. Although there was not a significant difference in survey scores, further analysis of average weight, BMI, and BS level showed a 2%-5% decrease when compared to preintervention results. This improvement in scores showed the benefits to the overall health of the patient using walking as an intervention.

To empower each participant to become an active participant in their own health care, weekly phone calls were placed. The weekly phone calls served two purposes, to provide guidance and offer emotional support as each participant worked to improve their health. By effectively engaging patients in their care, the PI and each participant engaged in a collaborative partnership which was essential in reinforcing positive health behaviors for change. Positive reinforcement not only boosted the confidence of the participants but helped to strengthen the positive behavior to continue after the projects end.

As the project's overall aim was to evaluate the effectiveness of walking in the reduction of weight, BMI, and BS level, the results of the project aligned with the project goals and current literature. The project was further supported by a study conducted by Moghetti (2020), who showed through his research there was significant evidence to recognize regular walking increased glucose control in patients with T2DM, with promising effects on blood pressure, cardiorespiratory fitness, and body weight.

Discussion

In clinical practice, reaching optimal glycemic control on a longstanding basis is difficult since the reasons for poor control in T2DM are complex and related to both patient and health care provider-related factors. As primary care settings are the initial point of entry into the heath system and the ongoing focal point for all needed health services, further research is needed utilizing a larger sample size to evaluate if a standardized approach to exercise in the patient with T2DM improves patient outcomes and reduces complications. Several resources in this study have shown incorporating evidence-based practice guidelines for PA in the patient with T2DM can significantly reduce the severity of the disease, prevent complications, and decrease financial and health-related hardships. Findings in this project contributed to the literature by expanding our understanding of PA and by providing an intervention that encourages PA for this population group.

Project Guidance

The Health Promotion Model was selected as the theoretical framework because it was directed at improving self-care and well-being as related to a person's behavioral habits. Health promotion activities such as exercise seek to encourage individuals to engage in health-promoting behaviors while improving quality of life. In theory, changing behavior, whether focused solely on setting up new actions or displacing unwanted actions, takes an estimated two months. As there are several factors to consider when trying to influence behavior modifications such as socioeconomic status, educational level, environmental circumstances, patient readiness, and emotional/social support, each participant were asked to explore past behaviors and perceived barriers to engaging in exercise during the question and answer part at the end of the educational presentation.

Since diabetes is the most difficult chronic illness to manage due to its multifariousness, many patients struggle when trying to self-manage their disease. As an individual's level of confidence has an impact on their ability to engage in health-promoting behaviors, participants received weekly phone calls to provide encouragement and to reinforce the assumed health benefits of exercise. Subsequently when participants received positive encouragement in regard to exercise, their level of confidence rose, resulting in positive reassurance. Consistent reinforcement also increased the probability that the participant would continue with exercise.

Significance for Practice

The DNP project served as an important example to assess and improve diabetic outcomes, decrease complications, and help providers succeed in a value-driven healthcare environment. The project equally showed that ongoing education in diabetic patients is an important aspect of care to help patients understand their disease, recognize how they can improve their care, and become more aware of the complications that can arise. The quality improvement project likewise helped the clinic providers that this project took place in, integrate evidence-based practice guidelines using a standardized approach in PA to improve health outcomes while reducing hospitalization from complications. Additional recommendations to help improve compliance with PA include the provision of dedicated resources to support patient transition, exploring alternative exercise routines, and integrating approaches to address patient engagement and barriers.

Strengths and Limitations

The project had several strengths and limitations. The strengths of the project included having a supportive clinical staff, increasing provider knowledge of evidence-based guidelines, and improving the health and knowledge base of the study participants. The projects' limitations

included sample size and patient engagement. Despite aggressive recruitment, patient engagement was poor with only seven participants consenting to take part. Patient barriers such as time constraints, resistance to change, and lack of disease awareness played a huge role in recruitment. Although several of the barriers were anticipated, further analysis of each potential barrier is needed in order to develop a more effective strategy to improve engagement and recruitment.

Conclusion

The importance of research in the field of physical activity in the T2DM patient must continue to grow to reduce the risk of complications. Due to normalizing a sedentary lifestyle and an increase in obesity rates worldwide, lifestyle changes are still the cornerstone of diabetic care. Although outcomes for patients have significantly improved over the years, research efforts are still needed to understand the contributing factors and the drivers of increased risk in individuals to better individualize care. Though recommendations have been developed by the ADA, CDC, and ACSM in regard to PA, further research is needed to determine if a lack of a standardized approach to PA plays a role in preventing, controlling, and treating T2DM.

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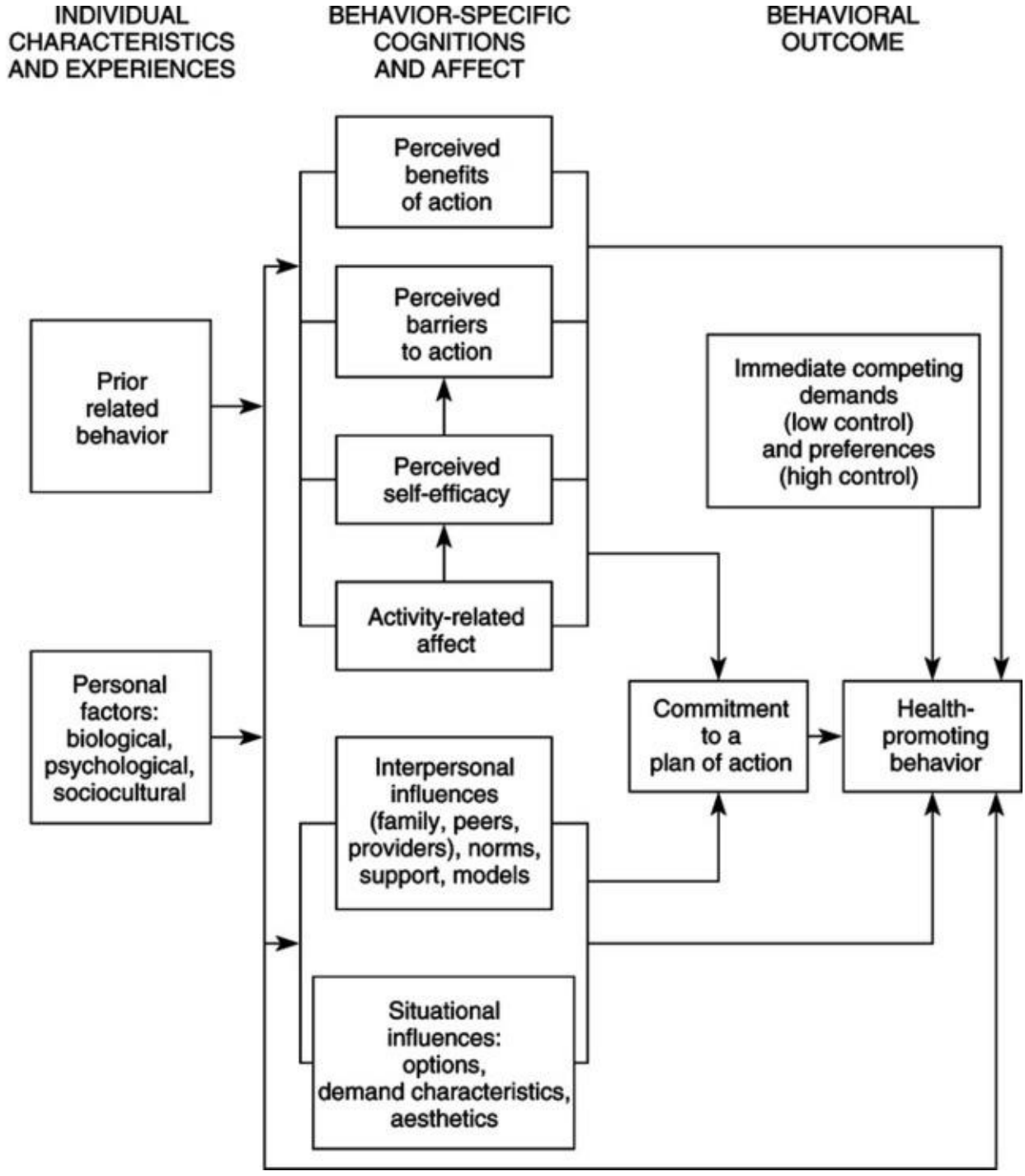
Appendix A



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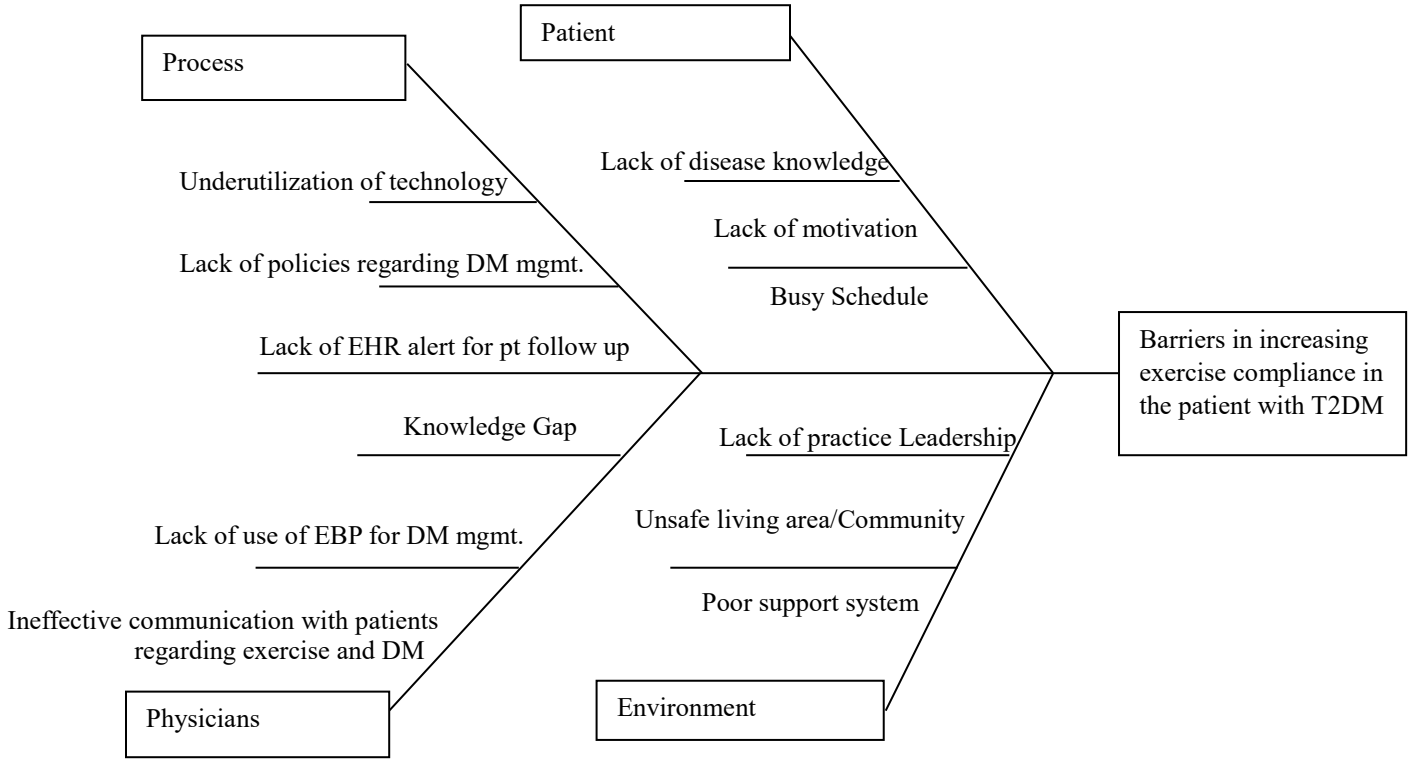
Appendix B

Project Site Facilitator and Barriers



Appendix C

INTERNATIONAL 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** 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. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**
   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

   _____ **hours per day**
   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

   _____ **days per week**

   ☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

   _____ **hours per day**
   _____ **minutes per day**

   ☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent 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.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

   _____ **hours per day**
   _____ **minutes per day**

   ☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

Appendix D

American Diabetes Association. Connected for Life | Diabetes Advisor

Understanding Type 2 Diabetes

What is Diabetes?

Diabetes is a condition that causes blood sugar (blood glucose) levels to rise higher than normal. Hyperglycemia is the term doctors use to describe high blood sugar.

When you eat, your body breaks food down into glucose and sends it into the blood. Insulin, a hormone made in your pancreas, helps move the glucose from your blood into your blood cells as fuel for energy. Your pancreas is an organ in your abdomen (stomach).

There are three types of diabetes: type 1, type 2, and gestational diabetes (diabetes you have when you're pregnant).

What is type 2 diabetes?

In type 2 diabetes, your body has trouble using the insulin it's making. This is called insulin resistance and it causes your blood sugar to rise higher than normal. At first, your pancreas makes more insulin to make up for this. But over time, it isn't able to keep your blood sugar levels in a normal range. When blood sugar levels stay high for long periods of time, it increases your risk of other medical problems like heart attacks, kidney disease, blindness, and nerve pain.

What treatments are used for type 2 diabetes?

The goal of treatment is to help you feel good and prevent long term problems caused by diabetes. To meet these goals, your health care team will work with you to create a care plan that includes lifestyle changes and medications. Your care plan will help you reach your treatment goals. The best way to reach these goals is to:

- Have an eating plan that meets your needs and helps you reach your goals. What you eat, how much you eat, and when you eat are all important.
- Stay physically active and get regular exercise.
- Take your medications (both pills and injected medications) as prescribed by your doctor.

Type 2 diabetes changes over time. At first, healthy eating and physical activity may be enough to reach your targets. But most people end up needing medications, including insulin, at some point to manage their blood sugar, no matter how hard they work to reach their targets.

Needing to take medication, including insulin, to manage your type 2 diabetes does not mean you failed.

Taking medication is simply part of good diabetes management. The most important thing you can do to stay healthy with diabetes is manage your blood sugar well—and that means taking medication on schedule and making healthy lifestyle choices.

Diabetes Advisor® American Diabetes Association®

Making Physical Activity a Part of Your Routine

8

What is physical activity and what can it do for me?

Physical activity includes anything that gets you moving, such as walking, dancing, or working in the yard. You can earn the benefits of being physically active without going to a gym, playing sports, or using fancy equipment. When you're physically fit, you have the strength, flexibility, and endurance needed for your daily activities. **Being physically active helps you feel better physically and mentally.**

What you can learn from this brochure:

- the benefits of physical activity
- how to plan a fitness routine that suits your preferences and your schedule
- how to get started and stay motivated

Physical activity can lower your blood glucose (sugar), blood pressure, and cholesterol. It also reduces your risk for heart disease and stroke, relieves stress, and strengthens your heart, muscles, and bones. In addition, regular activity helps insulin work better, improves your blood circulation, and keeps your joints flexible. If you're trying to lose weight, a combination of physical activity and wise food choices can help you reach your target weight and maintain it. All of these benefits can be yours even if you haven't been very active before.

What kinds of physical activity should be part of my routine?

A comprehensive physical activity routine includes three kinds of activities:

- aerobic exercise
- strength training
- flexibility exercises

Real-Life Stories from People with Diabetes

These people with diabetes all decided to add physical activity to their daily routine. Here's why:

Darlene S.: My little girl wanted me to walk with her to the playground. When I told her I couldn't walk that far, she said we should start walking a little each day so I'll be healthy and live a long time.

Charlie M.: After my heart attack, I started walking almost every day but I didn't keep it up. I remember how great I felt—I had lots of energy. I'd like to get back into that routine so I can feel that great again.

Rosita S.: The day I couldn't fit into my size 14 pants, I said to myself, "That's it! It's time for me to lose weight."

Sadie F.: I want to set a good example for my grandson so he won't get diabetes. He's only 9 but he's already heavy and the kids make fun of him. Maybe we can go for walks together.

How about you? Do you have a reason to become more active? Write it here:

_____

_____

Aerobic exercise

Aerobic exercise increases your heart rate, works your muscles, and raises your breathing rate. For most people, it's best to aim for a total of about 30 minutes a day, at least 5 days a week. If you haven't been very active recently, you can start out with 5 or 10 minutes a day and work up to more time each week. Or split up your activity for the day—try a brisk 10-minute walk after each meal. If you're trying to lose weight, you may want to exercise more than 30 minutes a day.

Here are some examples of aerobic exercise. Check the ones you'd like to try:

❒ taking a brisk walk (outside or inside on a treadmill)

❒ dancing

❒ taking a low-impact aerobics class

❒swimming or doing water aerobic exercises

❒taking a bicycle ride outdoors or using a stationary bicycle indoors

❒ice-skating or roller-skating

❒playing tennis

❒running

What are some other ways you could get aerobic exercise?

_____

_____

_____

Strength training

Strength training, done 2 to 3 times a week, helps build strong bones and muscles and makes everyday chores like carrying groceries easier for you. Strength training can also help to prevent weight gain. Here are some ways to do it:

❒Lift light weights at home.

❒Join a class to do strength training with weights, elastic bands, or plastic tubes.

What are some ways you could do strength training?

_____

_____

_____

Flexibility exercises

Flexibility exercises, also called stretching, help keep your joints flexible. Gentle stretching for 5 to 10 minutes makes aerobic activities such as walking or swimming more comfortable. Your health care team can provide information on how to stretch.

What are some ways you could do flexibility exercises?

_____

_____

_____

Being active throughout the day

In addition to formal exercise, there are many opportunities to be active throughout the day. Being active helps burns calories. The more you move around, the more energy you'll have. These strategies can help you increase your activity level:

❒Walk instead of drive whenever possible.

❒Take the stairs instead of the elevator.

❒Work in the garden, rake leaves, or do some housecleaning every day.

❒Park at the far end of the shopping center lot and walk to the store.

What are some other ways you could be active during the day?

_____

_____

_____

What should I do to get started on a physical activity routine?

These steps will help you get ready for a routine that's safe and enjoyable.

- **Find out which activities will be safe for you.** Talk to your health care team about which activities will be safe for you depending on the condition of your heart, blood vessels, eyes, kidneys, feet, and nervous system. They may recommend that you have an exercise stress test to see how your heart reacts to exercise. If the tests show signs of disease, ask what physical activities will help you without making your conditions worse.
- **Choose what you'll do and make detailed plans.** Think about what activities are realistic for you and choose the ones you think you can do. Start slowly. Your activity should be somewhat challenging but not overly difficult. Write down exactly what you'll do, where and when you'll do it, how often, and for how long. Plan how you'll reward yourself for your efforts. For example, some people treat themselves to a movie when they meet their goal for the week.

Ask the Diabetes Advisor

Question: I know that regular physical activity would help me take better care of my diabetes and prevent heart disease. But I really don't have time to go to a fitness center. I put in a lot of overtime at the store and then, once I get home, I want to spend time with my wife and the kids or just relax. How can I fit in exercise? What's the minimum time I need to spend to get the benefits?

Jim J., age 49 • type 2 diabetes

Answer: You'll get major benefits from 30 minutes a day of physical activity most days of the week. If you're pressed for time, think about ways to accumulate your half-hour in 10-minute bursts. For example, take an activity break mid-afternoon and go for a short walk. When you have more time on the weekends, choose an activity the whole family can enjoy—play ball or take a hike.

How do I get past the barriers to being physically active?

If you're not active, it's likely that you have at least one reason why. Perhaps you've never been very active. Maybe you're afraid your blood glucose will go too low. Think about what's keeping you from being active and then look into ways to overcome the barriers.

Barriers	Solutions
❒I've never been active.	Don't discount your everyday activities. You may do more than you realize, such as housekeeping or mowing the lawn. Remember—being active is more than "exercise."
❒I don't have time to exercise for 30 minutes a day.	Do as much as you can. Every step counts. If you're just starting out, start with 10 minutes a day and add more little by little. Work up to 10 minutes at a time, three times a day.
❒I'm too tired after work.	Plan to do something active before work or during the day.
❒I don't have the right clothes.	Wear anything that's comfortable as long as you have shoes that fit well and socks that don't irritate your skin.
❒I'm too shy to exercise in a group.	Choose an activity you can do on your own, such as following along with an aerobics class on TV or going for a walk.
❒I don't want to have sore muscles.	Exercise shouldn't hurt if you go slowly at first. Choose something you can do without getting sore. Learn how to warm up and stretch before you do something active and how to cool down afterward.
❒I'm afraid I'll get low blood glucose.	If you're taking a medication that could cause low blood glucose, talk to your health care provider about ways to exercise safely.
❒Walking hurts my knees.	Try chair exercises or swimming.
❒It's too hot outside.	If it's too hot, too cold, or too humid, walk inside a school or a shopping center.
❒It's not safe to walk in my neighborhood.	Find an indoor activity, such as an exercise class at a community center.
❒I'm afraid I'll make my condition worse.	Get a checkup before planning your fitness routine. Learn what's safe for you to do.
❒I can't afford to join a fitness center or buy equipment.	Do something that doesn't require fancy equipment, such as walking or using cans of food for weights.
❒Exercise is boring.	Find something you enjoy doing. Try different activities on different days. Try exercising with a friend.

What are your barriers?	What are some possible solutions?
_____	_____
_____	_____
_____	_____

Be flexible with your plan so you don't get discouraged. For example, you could plan to get off the bus one stop earlier, most days of the week. Don't be too hard on yourself if you can't. For example, if it's raining, you may not want to walk outside. On those days, choose a different activity. It's more important to reach your long-term goal than to follow the plan from day to day.

- **Learn your blood glucose response to exercise.** Everyone's blood glucose response to exercise is different. Checking your blood glucose before and after exercise can show you the benefits of activity. You also can use the results of your blood glucose checks to prevent low blood glucose or high blood glucose.

If your blood glucose is high before you exercise (above 300 mg/dl), physical activity can make it go even higher, so be cautious about doing something active. For those with type 1 diabetes, if your fasting glucose level is above 250 mg/dl and you have ketones in your urine, it's best to avoid physical activity.

- **Learn how to avoid low blood glucose or hypoglycemia.** Keep in mind that low blood glucose can occur during or long after physical activity. Low blood glucose is most likely if you:
  - take insulin or certain diabetes pills
  - skip a meal
  - exercise for longer than usual
  - exercise strenuously

  If low blood glucose is interfering with your exercise routine, eating a snack before you exercise or adjusting your medication may help. Talk to your health care team about what's right for you.

Treating Low Blood Glucose

During activity, check your blood glucose if you notice symptoms such as hunger, nervousness, shakiness, or sweating. If your blood glucose is 70 mg/dl or below, have 2 to 5 glucose tablets, 1/2 cup (4 ounces) of fruit juice, or 1/2 cup of a regular soft drink to raise your blood glucose. After 15 minutes, check your blood glucose again. If it's still below 70 mg/dl, have another serving and repeat these steps until your blood glucose is at least 70 mg/dl.

- **Plan to have water and snacks handy during activity.** Drink plenty of water before, during, and after activity. If you are at risk for low blood glucose, always carry a source of carbohydrate so you'll be ready to treat low blood glucose.
- **Wear a medical identification bracelet,** necklace, or a medical ID tag to protect yourself in case of emergency.
- **Wear shoes that fit well and socks that do not irritate your feet.** Don't forget to check your feet every day.
- **Decide how you'll keep track of your progress.** You may find it motivating to write down what physical activity you've done each day. For example, you can make a note of what you did and how long you did it. Some people enjoy using a step counter, also called a pedometer, to see how far they've walked. Ask your health care team where to get one.

For More Information

To get more information about diabetes, contact the American Diabetes Association:

- Call 1–800–DIABETES (342–2383). Ask for free copies of Diabetes Advisor, Number 5: *Checking Blood Glucose: What It Can Do for You* and other brochures in the Diabetes Advisor series.
- Ask for a free copy of the "I Have Diabetes" outcomes card, order code 5984–02. It's a wallet-sized card you can use to record your targets and track your progress.
- Go to www.diabetes.org.

My health care professional

American Diabetes Association.

1–800–DIABETES (342–2383)
www.diabetes.org

Appendix E

At A Glance
IPAQ Scoring Protocol (Short Forms)

Continuous Score

Expressed as MET-min per week: MET level x minutes of activity/day x days per week

Sample Calculation

MET levels	**MET-minutes/week for 30 min/day, 5 days**
Walking = 3.3 METs	3.3*30*5 = 495 MET-minutes/week
Moderate Intensity = 4.0 METs	4.0*30*5 = 600 MET-minutes/week
Vigorous Intensity = 8.0 METs	8.0*30*5 = 1,200 MET-minutes/week
	TOTAL = 2,295 MET-minutes/week

Total MET-minutes/week = Walk (METs*min*days) + Mod (METs*min*days) + Vig (METs*min*days)

Categorical Score- three levels of physical activity are proposed

1. **Low**

   - No activity is reported **OR**
   - Some activity is reported but not enough to meet Categories 2 or 3.

2. **Moderate**

   Either of the following 3 criteria
   - 3 or more days of vigorous activity of at least 20 minutes per day **OR**
   - 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day **OR**
   - 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-minutes/week.

3. **High**

   Any one of the following 2 criteria
   - Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week **OR**
   - 7 or more days of any combination of walking, moderate- or vigorous-intensity activities accumulating at least 3000 MET-minutes/week

Please review the full document "Guidelines for the data processing and analysis of the International Physical Activity Questionnaire" for more detailed description of IPAQ analysis and recommendations for data cleaning and processing [www.ipaq.ki.se].

Revised November2005 13

Appendix F

P (256)245-6700
F (256)245-6002

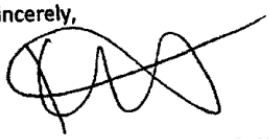
11 N Norton Avenue
Sylacauga, AL 35150

July 31, 2023

To Whom It May Concern:

This letter serves to express support from Marble City Family Care for Rebecca Harrison being able to complete her Doctor of Nursing Practice Capstone Project in our office. We agree that her project on walking as a standardized intervention in type 2 diabetes can be beneficial to our patient population.

Sincerely,



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Appendix G

Timeline of DNP project