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Factors that Influence Participation in Physical Activity in Adults with Nonalcoholic Fatty Liver Disease

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ACCEPTANCE

This dissertation, FACTORS THAT INFLUENCE PARTICIPATION IN PHYSICAL ACTIVITY IN ADUTLS WITH NON-ALCOHOLIC FATTY LIVER DISEASE by MACY MOSHER was prepared under the direction of the candidate's dissertation committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Nursing in the Byrdine F. Lewis College of Nursing and Health Professions, Georgia State University.

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ABSTRACT

FACTORS THAT INFLUENCE PARTICIPATION IN PHYSICAL ACTIVITY IN ADULTS WITH NONALCOHOLIC FATTY LIVER DISEASE

by

MACY MOSHER

Nonalcoholic fatty liver disease (NAFLD) is a progressive spectrum of disorders leading to hepatic steatosis is present with no secondary cause of liver disease. NAFLD is one of the leading cause of chronic liver disease in the United States and the prevalence of this chronic disease is increasing globally. Despite advances in science and treatment, providers rely on lifestyle choices and emphasis on physical activity as a main component of the treatment plan for NAFLD. Physical activity has been well documented in improving liver function tests and reduces the level of intrahepatic adipose tissue. Despite the known benefit, persons with NAFLD do not consistently participate in PA. To date, there are no known studies examining factors that influence level of physical activity in those with NAFLD. The purpose of this study was to examine fatigue, depression, perceived illness severity, exercise-self efficacy, and exercise benefits and barriers as potential factors that may predict level of physical activity in individuals with NAFLD. A cross-sectional, predictive, correlational study was performed. Ninety-eight study participants were recruited from a hepatology clinic in Atlanta, Georgia and data were analyzed to examine predictors of physical activity. Exercise benefits and barriers were found to be significant predictors of level of physical activity in those with NAFLD. Additionally, exercise self-efficacy demonstrated a mediator effect on the relationship between exercise benefits and physical activity. Overall, this research study further

advances the understanding of symptom burden associated with NAFLD and factors that may influence level of physical activity.

FACTORS THAT INFLUENCE PARTICIPATION IN PHYSICAL ACTIVITY IN ADULTS WITH NONALCOHOLIC FATTY LIVER DISEASE

by

MACY MOSHER

A DISSERTATION

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"I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well."

Psalm 139:14

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LIST OF ABBREVIATIONS

NAFLD	Nonalcoholic Fatty Liver Disease
PA	Physical Activity
HBM	Health Belief Model
PROMIS	Patient-Reported Outcomes Measurement Information System
EBBS	Exercise Benefits/Barriers Scale
Brief IPQ	Brief Illness Perception Questionnaire
ESES	Exercise Self-Efficacy Scale
CPAQ	Concise Physical Activity Scale

CHAPTER I

INTRODUCTION

Nonalcoholic fatty liver disease (NAFLD) is a growing phenomenon globally and is associated with other chronic comorbidities. This chronic condition has many negative disease outcomes including worsening of comorbid metabolic disorders. Treatment guidelines have evolved to include an emphasis on lifestyle modifications. Individuals with NAFLD are tasked with modifying nutritional habits, increasing levels of physical activity, and enhancing weight loss strategies. Despite evidence suggesting that physical activity can improve both physiologic and psychological outcomes that are commonly associated with NAFLD (Katsagoni et al., 2016; Chalassani et al., 2012; Mlynarsky et al., 2016) there remains a gap in knowledge regarding determinants that effect participation in regular physical activity. This study examined depression, fatigue, benefits/barriers, perceived illness severity, and self-efficacy as possible factors that may influence physical activity in persons with NAFLD.

Overview of Nonalcoholic Fatty Liver Disease

Significance of NAFLD

NAFLD is a leading cause of chronic liver disease in the United States and the prevalence of this chronic disease is increasing world-wide (Younossi et al., 2016). NAFLD is defined as hepatic steatosis in which there are no secondary causes of liver disease with no significant alcohol consumption (Chalassani et al., 2012). The threshold of significant alcohol use is considered to be less than 21 drinks per week for men and

less than 14 drinks per week in women (Sanyal et al., 2011). The occurrence of NAFLD is increasing with an estimated global prevalence of 25% and an estimate prevalence of 24% in the U.S. (Younossi et al., 2016; Chalassani et al., 2018). Despite the increase in estimated prevalence of NAFLD, there remains an under-reporting of this chronic disease on death certificates which leads to an international underestimation of NAFLD (Kim et al., 2018). Long-term outcomes associated with NAFLD include progressing hepatic fibrosis (Chalassani et al., 2018) worsening of metabolic syndrome (Younossi et al., 2016) cardiovascular disease (Azzam & Malnick, 2015) and hepatocellular carcinoma (HCC) (Chalassani et al., 2018).

Physical Activity and NAFLD

Obesity is estimated to occur in 50% of individuals with NAFLD (Chalassani et al., 2012; Harrison et al., 2021). Along with obesity and visceral steatosis that are known metabolic risk factors (Chalassani et al., 2012) NAFLD is associated with metabolic comorbidities related to obesity such as hypertension, diabetes, insulin resistance, and hyperlipidemia (Chalassani et al., 2018; Younossi et al., 2012). Lifestyle modifications such as diet, physical activity, and weight loss are included in the treatment guidelines for individuals with NAFLD (Chalassani et al., 2018). Physical activity (PA) is a main component of treatment of NAFLD and is recommended by the American Association for the Study of Liver Diseases (Chalassani et al., 2018).

A growing amount of evidence suggests that PA improves histologic components of NAFLD (Chalassani et al., 2012; Katsagoni et al., 2016). Physical activity is associated with decreased visceral adipose tissue (Katsagoni et al., 2016) and a decrease in transaminase levels and intrahepatic lipid levels (Chalassani et al., 2012). The U.S.

Department of Health and Human Services (2018) recommends at least 150 minutes to 300 minutes of moderate-intensity activity per week or 75 to 150 minutes per week of vigorous-intensity aerobic activity per week in the general population. Several small non-randomized trials have examined the effect of PA on NAFLD and have focused on a variety of components of PA including aerobic or resistance training, low, moderate, and vigorous intensity, diet modification and PA, and duration and frequency of PA (Katsagoni et al., 2016). Out of the 12 studies included in a meta-analysis on the effects of exercise on outcomes for individuals with NAFLD (Katsagoni et al., 2016) exercise alone in individuals with NAFLD improved serum liver lab results and an emphasis on exercise and diet improved both body mass index and waist circumference. However, large randomized controlled trials examining the dose effect of PA in NAFLD are lacking (Chalassani et al., 2018). Currently, there are no universally accepted recommendations for dose, frequency, or intensity of PA in individuals with NAFLD.

The American Association for the Study of Liver Diseases (AASLD) acknowledges that moderate-intensity physical activity with weight loss improves hepatic steatosis, however, they have not made recommendations on the intensity, duration, or frequency of physical activity (Chalassani et al., 2018). The Korean Association for the Study of the Liver (KASL) guidelines recommend exercising for at least thirty minutes twice per week to reduce the lipid-associated inflammation of the liver (KASL, 2013). The European Association for the Study of the Liver (EASL) recommends moderate-intensity aerobic physical activity to total 150-200 minutes per week in addition to resistance training (EASL, 2015). Ultimately, PA recommendations should be

individually tailored based on health status, preference, and clinical characteristics (EASL, 2015).

Background of the Problem

Despite the evidence to support the benefit of PA on outcomes related to NAFLD, individuals with NAFLD do not consistently participate in PA. Fifty-four percent of individuals with NAFLD reported an activity level of inactive and 57% of those who reported being inactive did not spending any time in recreational activities (Kistler et al., 2011). Additionally, in a self-reported analysis, only 20% of individuals with mild and moderate steatosis related to NAFLD reported meeting the Surgeon General's report guidelines for PA (Krasnoff et al., 2008). It is estimated that about one-half of U.S. adults in the general population are meeting recommendations for physical activity to prevent chronic disease (CDC, 2019). The benefits of PA include lowering blood pressure, reducing risk of stroke and cardiovascular disease, improving mental health, and preventing weight gain (CDC, 2019).

Increasing PA in individuals with NAFLD can be beneficial. However, there remains a gap in the evidence of factors influencing the decision to participate in PA in this chronic disease population. Barriers and benefits for regular PA in individuals with NAFLD should be considered to enhance participation in PA and improve outcomes. Determining perceived benefits and barriers to PA should be used in developing interventions that will be most effective to improve PA levels in individuals with NAFLD.

Previously documented barriers to PA in other populations of chronic illness include lack of motivation (Veldjuijzen van Zanten et al., 2015) fatigue (Blake et al.,

2015; Egerton et al., 2016; Veldjuijzen van Zanten et al., 2015) and depression (Roshanaei-Moghaddam et al., 2009). Individuals with NAFLD are at a higher risk of significant depression (Bianchi et al., 2005) and fatigue (Assimakopoulos et al., 2018) which may impact the decision to participate in PA. Perceived benefits of PA in individuals with a chronic illness include improvement in mood, decrease in fatigue, overall improvement in body functioning, and improvement in overall health (Rehm & Konkle-Parker, 2016).

In addition to psychosocial factors and benefits/barriers, exercise self-efficacy and perceived illness severity may impact the decision to participate in PA in individuals with NAFLD. Enhancing self-efficacy has demonstrated a positive association with impacting the decision to participate in PA (Klompstra et al., 2018; Veldjuijzen van Zanten et al., 2016). The individual's perception of the severity of illness may also impact levels of PA. In a study of individuals with chronic lung disease, a higher perceived severity of illness correlated with a reduced level of PA (Zoeckler et al., 2014). Psychosocial variables, benefit/barriers, exercise self-efficacy, and perceived severity of illness were examined in the current study to determine their effect on levels of PA participation.

Statement of Purpose

Although evidence suggests that PA improves the physiologic impact of NAFLD and is now considered part of the treatment guidelines, no studies were found that discussed factors associated with PA in individuals with NAFLD. Through exploring similar factors that have been associated with participating in PA in other population of chronic illness that include fatigue (Egerton et al., 2016) depression (Roshanei-

Moghaddam et al., 2009) self-efficacy (Veldjiuijzen van Zanten et al., 2016) and perceived severity of illness (Zoeckler et al., 2014).

The purpose of this study is to gain an understanding of their impact, as well as benefits and barriers on PA participation in individuals with NAFLD. The potential mediating effect of self-efficacy on the relationships between benefits or barriers and PA was also be examined. Information obtained in this research will inform the development of targeted innovative interventional strategies to improve PA in this population.

Study Design and Specific Aims

A cross-sectional, correlational study design was used to gain a more comprehensive understanding of key factors that influence current participation in PA by individuals with NAFLD. The possible effect of exercise self-efficacy on perceptions of benefits or barriers to current level of physical activity was also examined. Accordingly, the following research questions were investigated in individuals with NAFLD.

1) Do symptoms of fatigue or depression, perceptions of level of illness severity or benefits and barriers to physical activity predict the amount of self-reported physical activity?
2) Does exercise self-efficacy mediate the relationship between perceptions of benefits or barriers for physical activity and self-report physical activity?

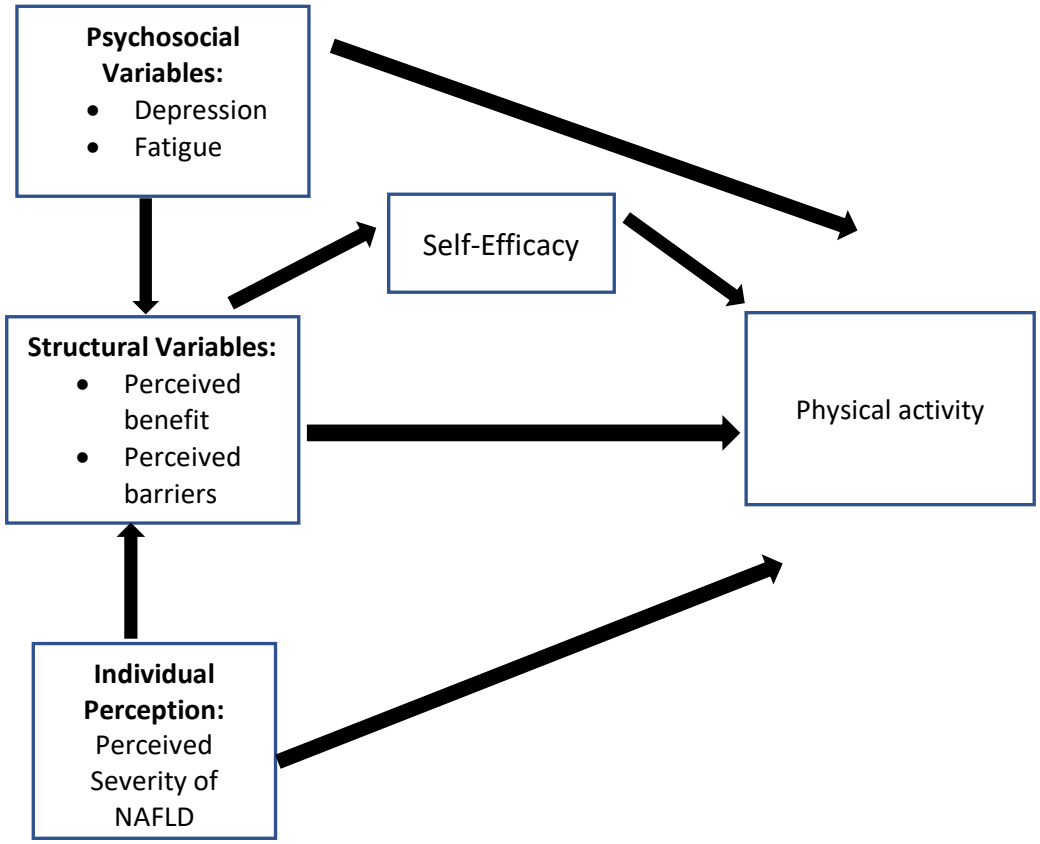
Theoretical Framework

This study was guided by the Health Belief Model (HBM), a well-established theory that grew out of a group of independent concepts of public health interest in the U.S. between the 1950's and 1960's (Rosenstock, 1974). The HBM is an expectancy theory which postulates that an individual will decide to act based on the perceived threat

of disease, the evaluated benefit of the proposed health action, and an internal or external stimulus that triggers the individual to participate in the appropriate health behavior (Maiman & Becker, 1974). The HBM is one of the most widely used theoretical frameworks in understanding health behaviors (Painter et al., 2008). The five major theoretical concepts of the HBM include: 1) perceived severity, 2) perceived susceptibility, 3) perceived benefits/barriers, 4) cues to action, and 5) self-efficacy.

The HBM examines an individual's assessment to engage in a health behavior and is based on the perspective of the individual (Maiman & Becker, 1974). The HBM theorizes that in order for an individual to decide to participate in the health behavior, they must feel as though they are vulnerable to the health condition that would impact their individual quality of life (Rosenstock, 1974). The HBM can be summarized into three main components which include 1) perceived severity or threat of the health condition, 2) modifiable risk factors such as psychosocial, structural, and triggers, and 3) the commitment to engage in the health behavior of interest.

Figure 1: The modified Health Belief Model (Rosenstock, 1974) for physical activity in individuals with nonalcoholic fatty liver disease.



Perceived Threat

Perceived threat is a major theoretical concept of the HBM that can be described as the individual's perception of the threat, susceptibly, and severity of the disease (Rosenstock, 1974). The perceived threat is subjective and varies based on the individual's perception of the risk of disease (Rosenstock, 1974). In individuals with NAFLD, their perceived threat of this disease process may vary based on symptomatology, severity of disease, other comorbidities, and knowledge of the disease process. NAFLD without significant liver failure is reported to not have an association

with perceived illness (Mlynarsky et al., 2016). This may indicate that an individual does not have a significant perceived threat of NAFLD and thus may choose not to participate in PA. This study assessed perceived severity of NAFLD with the HBM theoretical framework to determine its relationship to level of PA.

Modifiable Risk Factors

The HBM framework includes sociopsychological and structural variables and aims to examine the relationship between these variables and the decision to engage in the proposed health behavior. The current study examined depression and fatigue as two sociopsychological variables that may impact the decision to participate in PA. These variables were included due to the documented increase in risk for depression and fatigue in individuals with NAFLD (Assimakopoulos et al., 2018; Bianchi et al., 2005). Additionally, fatigue and depression are both considered modifiable and have previously demonstrated a correlation with reduced activity levels in other populations (Egerton et al., 2016; Roshanaei-Moghaddam et al., 2009).

Self-efficacy is theorized as an individual's belief that they are able to implement the proposed health behavior (Bandura, 1977). Self-efficacy was examined in this proposed study as a mediator variable that may impact the relationship between perceived benefit/barriers of PA and participation in PA. An increased perceived self-efficacy has been correlated with an increased level of PA (Mo et al., 2011). Lastly, perceived benefits and barriers to participation in PA were measured to determine the effect of these variables on participation in PA, the targeted health behavior and study outcome. Physical activity is a priority outcome due to the positive effects on metabolic processes

associated with NAFLD and the current evidence that individuals with NAFLD are not physically active.

Application of the HBM to NAFLD

The HBM was originally developed to understand behaviors in regards to prevention of chronic illness (Champion, 1984) however, the application of HBM to understand secondary health prevention behaviors has evolved to include studies about PA (Mo et al., 2016), infectious disease practices (Padchasuwan et al., 2016), nutrition behavior (Jeong & Ham, 2018; Kim et al., 2012) dental hygiene (Lee et al., 2018), medication adherence (Obirikorang et al., 2018) and substance use (Mona et al., 2014). Additionally, the HBM has been studied in many populations of chronic illness including congestive heart failure (Baghianimoghadam et al., 2013) osteoarthritis (Ang et al., 2008) hypertension (Obirikorang et al., 2018) and diabetes mellitus (Koch, 2002). The HBM has been applied and critiqued in a variety of populations and health behaviors and has been well documented in research focusing on PA. The application of the HBM aided in explaining factors that affected a significant increase in PA (Hoseini et al., 2014). Based upon the strong evidence of the applicability of the HBM to health behaviors in persons with chronic illnesses, the model is well justified to guide the examination of the possible relationships of the variables of interest in this proposed investigation (see Figure 1).

Summary

This study examined the modifiable factors of perception of fatigue, depression, illness severity and benefits or barriers for engaging in physical activity, as well as the mediating effect of self-efficacy between benefits or barriers and PA. A better understanding of the determinants of PA in NAFLD will help to yield new discoveries in

enhancing this lifestyle modification, impact therapeutic strategies, and improve overall health status of this chronic disease population. This proposal provides valuable resources for the larger scientific community to pursue additional studies on PA and liver disease.

CHAPTER II

REVIEW OF THE LITERATURE

The goal of this study was to examine the factors that influence participation in physical activity (PA) in individuals with non-alcoholic fatty liver disease (NAFLD). This chapter contains a review of the literature related to the Health Belief Model as a theoretical framework selected to guide this study examining fatigue, depression, benefits/barriers, perceived severity, and self-efficacy and the impact of these factors on self-reported level of PA. The Cumulative Index to Nursing & Allied Health Literature (CINAHL), PubMed, Medline, and ProQuest databases were used to conduct this review. Numerous search terms were used in this review including: NAFLD, physical, fatigue, depression, benefits, barriers, perceived severity, Health Belief Model, and self-efficacy.

Physical Activity

Current treatment guidelines for the management of NAFLD include recommendations for diet modifications, PA, and weight loss (Chalassani et al., 2018). Physical activity is a major component of management and prevention of NAFLD. Physical activity has demonstrated an improvement in the histological components of NAFLD, however, there are no universal recommendations for dose, frequency, or intensity of PA in individuals with NAFLD. Despite the guidelines emphasizing the importance of PA in treatment of NAFLD, only 20% of individuals with NAFLD reported being active (Krasnoff et al., 2018). When compared with a healthy control group, individuals with NAFLD spent an extra thirty minutes per day being sedentary and

walked 18% fewer steps per day (Hallsworth et al., 2015). This study aimed to examine constructs established in the theoretical foundation of the health belief model that impact participation in PA in individuals with NAFLD.

Factors Associated with Physical Activity

Fatigue

The concept of fatigue is dynamic and complex and there is not a standardized definition (Engberg et al., 2017). Lower levels of fatigue have been traditionally reported in individuals who self-reported better overall health (Egerton et al., 2017). Despite the wide array of methods used to assess fatigue, there is no universally accepted methodology (Engberg et al., 2017). The estimated prevalence of fatigue in the U.S. workforce is 37.9% and is found to be significantly higher in individuals who reported two or more health conditions (Ricci et al., 2007). In populations of chronic illness, fatigue is a commonly reported symptom. For example, 68% of individuals with diabetes mellitus reported having fatigue (Jain et al., 2015). Fatigue was reported in 52.5% of individuals with thyroid cancer and was inversely correlated with level of PA ($r=.265$, $p<.001$) (Alhashemi et al., 2017). Additionally, feelings of fatigue were reported in 67% of surveyed adults with chronic congestive heart failure in addition to impairments in level of activity (Kraai et al., 2016). Fatigue is a common barrier to PA and was reported by 13% of individuals with colorectal cancer (Fisher et al., 2016).

Fatigue was correlated with lower levels of PA in an international group of adults and those with significant fatigue were associated with 1,150 less steps per day, a 17% reduction, than those who did not report fatigue (Egerton et al., 2016). Fatigue was also higher in women (Egerton et al., 2017)25 advanced age, and was more common in those

that were obese (Egerton et al., 2016). Participation in leisure activity demonstrated a significant association with lower levels of fatigue, and longer times of sitting correlated with higher overall fatigue scores (Egerton et al., 2017).

Similar to findings with persons experiencing other chronic illnesses, fatigue is a commonly reported symptom associated with chronic liver disease across etiologies including NAFLD (Assimakopoulos et al., 2018; Dwight et al., 2000). Individuals with NAFLD experience a significantly higher level of fatigue when compared with those without liver disease (Newton et al., 2008) and this is reported to be a main reason for not participating in PA in 12.9% of persons with NAFLD (Mlynarsky et al., 2016).

The unique physiologic pathway of fatigue in individuals with NAFLD is not fully understood. It is hypothesized that the role of the liver in regulating the storage and release of energy and the inflammatory mechanisms associated with NAFLD are directly related to fatigue in this population (Gerber et al., 2019). Individuals with NAFLD that had higher levels of fatigue demonstrated lower levels of activity and more prominent somatic symptomatology (Assimakopoulos et al., 2018; Newton et al., 2008). Fatigue was inversely correlated with steps per day in individuals with NAFLD compared to those without NAFLD, and those with NAFLD also took significantly fewer steps per day (Newton et al., 2008). Fatigue did not demonstrate a relationship with severity of histological markers of NAFLD (Newton et al., 2008) or severity of liver disease (Dwight et al., 2000). Physical activity with weight loss demonstrated an improvement in fatigue scores amongst individuals with NAFLD (Tapper & Lai, 2015).

Depression

Fatigue and depression frequently co-exist in individuals with chronic liver disease (Dwight et al., 2000). Individuals with chronic illness, such as liver disease, are at a higher risk of significant depression and the severity of their depression commonly impacts their level of PA. In persons with depression, every one-point increase as measured by depression in the Montgomery-Asberg Depression Rating Scale (MADRS) (Montgomery & Asberg, 1979) is reported to have a 2.4-minute reduction in average activity measured via accelerometer (Helgadottir et al., 2015). Higher levels of depression are found to be negatively associated with time spent in physical activity in persons with other chronic disease, such as heart failure (Haedtke et al., 2017) and cancer (Liu et al., 2017).

In other research examining depression and PA, persons with chronic pulmonary disease that reported meeting PA guidelines were less likely to have major depression than those who did not meet PA guidelines (OR =.41, 95%, CI: 0.18-0.94) (Loprinzi et al., 2013). Interestingly, PA was inversely related to depression in a dose-response manner (Loprinzi et al., 2013). This may suggest that the amount or dose of PA may serve as an intervention to improve overall depression. The positive effect of PA as an intervention for depression was also evident in populations with chronic illness including arthritis (Kelley et al., 2015), systemic lupus erythematosus (O'Dwyer et al., 2017) and myeloproliferative neoplasms (Eckert et al., 2017). However, there is a paucity of research that examines the effect of depression severity on the level of PA in individuals with NAFLD.

Of particular concern is the prevalence of depression in persons with chronic liver disease that are 2.2 times more likely to have major depression when compared with the general population (Bianchi et al., 2005). Depression has been independently associated with a diagnosis of NAFLD (Elwing et al., 2006). In a sample of 156 participants with mixed liver disease etiology, 56.7% of the participants had scores that indicated clinical depression (Youssef et al., 2013). In a review of a large clinical database of individuals with NAFLD, 67% of individuals had either clinical or subclinical depression (Weinstein et al., 2011).

Individuals with NAFLD are at a higher risk of depression than those with Hepatitis B (Elwing et al., 2006). Adults with NAFLD and comorbid depression are more likely to have more severe steatosis (Nardelli et al., 2016; Youssef et al., 2013). Individuals with NAFLD and depression are less likely to respond to cardiometabolic risk factor reductions strategies and can be resistant to standard treatment (Nardelli et al., 2016). These issues persist because little is known about the etiology of depression in persons with NAFLD and there are no current recommendations for depression screenings in this population (Chalasani et al., 2018). Along with depression, research indicates NAFLD is associated with an overall decrease in quality of life (Fabregas et al., 2013; Gallegos-Orzoco et al., 2003; Santos et al., 2012). The current state of the evidence suggests that NAFLD is directly associated with an increased risk of depression.

Perceived Illness Severity

Perceived illness severity has a significant impact on adaptation to chronic illness and should be considered in research focusing on improvement of chronic health status (Groarke et al., 2004). Previous empiric evidence has demonstrated an inverse

relationship between perceived severity of illness and level of PA (Zoeckler et al., 2014). For example, in individuals with rheumatoid arthritis, a higher perceived disease severity was found in those with high levels of depression and pain and a lower perceived disease severity was associated with good physical function, lower levels of pain, and lower depression scores (Groarke et al., 2004).

In a cross-sectional study, 57.2% of individuals with NAFLD reported not fully understanding NAFLD, 53.6% identified NAFLD as a chronic condition, and 60% believed that NAFLD is considered a major health concern (Zelber-Sagi et al., 2017). Additionally, only 53.4% of individuals with NAFLD reported anticipating a medical complication related to NAFLD (Zelber-Sagi et al., 2017). The perceived cause of NAFLD varied, however, 6.3% of study participants reported the cause of NAFLD to be lack of PA (Zelber-Sagi et al., 2017). These data suggest inconsistent perceptions of the seriousness of NAFLD and that those with NAFLD may not perceive a high severity of this chronic disease.

Benefits/Barriers

An individual's perception of benefits and barriers to participation in PA may influence their participation in consistent activity. Thus, examining the relationship between benefits/barriers and level of PA and specific benefits/barriers reported by populations of interest may be beneficial in improving activity level. Improving fitness, improving overall health, and maintaining or losing weight are commonly reported benefits of PA (Fisher et al., 2016). Almost all participants with multiple myeloma responded that PA improves overall health and also aided in enjoyment of life and social interaction (Craike et al., 2013). Participation in a PA intervention improved anxiety,

fatigue, motivation, and general body aches in adults with acute leukemia (Bryant et al., 2017). Individuals with multiple sclerosis reported that the improvement in physical performance and feelings of personal accomplishment were the greatest perceived benefit of PA and that physical exertion and lack of access to exercise facilities were the greatest barriers to (Stroud et al., 2009). Liu et al. (2017) found that the degree of perceived benefit of PA was correlated with improvement in level of PA.

Age, general musculoskeletal aches, difficulty breathing, and lack of time are commonly reported barriers to PA (Fisher et al., 2016). Additional barriers to PA in individuals with multiple myeloma included fatigue, pain, low interest in PA, low self-efficacy, and concern about symptoms of chronic illness and side effect of treatment (Craike et al., 2013). Physical symptom burden is also a commonly reported barrier to PA (Bryant et al., 2017). Individuals who reported any barrier to PA were significantly less likely to participate in PA then those who did not report any barriers (Fisher et al., 2016).

In individuals with NAFLD, 32.9% reported avoiding PA (Mlynarsky et al., 2016). Total time spent participating in PA was twice as high in individuals without NAFLD when compared to those with NAFLD (Mlynarsky et al., 2016). The most common barriers reported in individuals with NAFLD in participating in PA were boredom, no available time, and fatigue (Mlynarsky et al., 2016).

Self-Efficacy

Perceived self-efficacy is a major determinant in participation in behavioral activities, how much effort will be spent in achieving the activity, and how long the effort will be sustained (Bandura, 1977). Individuals tend to avoid situations where they feel incapable of managing their coping skills in threatening situations, however, they decide

to participate in an activity they feel they are capable of managing (Bandura, 1977). Self-efficacy has consistently demonstrated a positive association with level of activity in a variety of populations (Blake et al., 2016; Kasser & Komo, 2012; Zelber-Sagi et al., 2017). Self-efficacy has demonstrated a strong correlation with PA ($r=.40$, $p<.01$) and is a predictor of the level of PA (Blake et al., 2016; Kasser & Kosmo, 2012). Individuals with higher perceived self-efficacy experienced fewer barriers to exercise (Kasser & Kosmo, 2012). This may indicate that enhanced self-efficacy can help individuals overcome barriers to exercise, thus, having higher levels of PA.

Limited research has focused on self-efficacy in persons with NAFLD. In a study by Zelber-Sagi and colleagues (2017) they found that a moderate to high level of self-efficacy was associated with healthy eating habits and a positive perception of treatment effectiveness. However, self-efficacy specific to physical activity was not measured. A high perception of self-efficacy may positively influence the commitment to participation in PA. Thus, a high perceived self-efficacy may impact the relationship between perceived benefits and overall level of PA. Alternatively, a low perceived self-efficacy may influence the relationship between perceived barriers and PA.

Summary

This chapter provided an examination of the current state of the literature in regards to evidence supporting the use of PA in treatment of NAFLD. Additionally, the Health Belief Model was the guiding theoretical framework for this study due to its relevance to the variables of interest, compatibility with current state of the literature, and its extensive use in studying factors that may influence participation in PA. Depression, exercise benefits and barriers, perceived illness severity, and fatigue have all been studied

in other chronic health conditions as potential factors influencing PA. Additionally, individuals with NAFLD are at increased risk of these disease symptoms. Through evaluating PA level guided by the constructs of the Health Belief Model researchers may be better able to tailor future interventions to improve health outcomes.

CHAPTER III

STUDY METHODOLOGY

A cross-sectional, correlational study design was used to examine the relationships among fatigue, depression, illness perception or benefits or barriers on the level physical activity (PA) in individuals with nonalcoholic fatty liver disease (NAFLD). Additionally, exercise self-efficacy was examined as a potential mediator of the effect of exercise benefits or barriers on the level of PA in this population. This chapter includes the procedural aspects of this study including subject recruitment, enrollment, consent procedures, process for data collection, data management, as well as data analysis. The specific research questions for the study are:

1) Do symptoms of fatigue or depression, perceptions of level of illness severity or benefits and barriers to physical activity predict the amount of self-reported physical activity?
2) Does exercise self-efficacy mediate the relationship between perceptions of benefits or barriers for physical activity and self-reported physical activity?

Setting

The setting for the study recruitment occurred at the Piedmont Transplant Hepatology Clinic in Atlanta, Georgia. This hepatology clinic services patients from all over the Southeastern region of the United States that include the states of Georgia, Alabama, and South Carolina. The clinic serves patients with a variety of hepatology related concerns including an estimated 30 individuals per week with NAFLD.

Sample

This study included both female and male participants with NAFLD with equal numbers to minimize variability of findings based upon sex. Inclusion criteria includes individuals (a) between the ages of 18-75, (b) diagnosed with NAFLD documented by a clinical diagnosis and recorded on the medical record, and (c) are able to speak, read and write in English. Exclusion criteria includes (a) other significant medical diagnoses, (b) etiology of liver disease other than NAFLD, (c) any previously diagnosed mental health disorder, (d) currently taking prescribed medication for depression (or within previous three months), (e) active alcohol or substance use (f) mobility limitations (current use of walker, cane, or wheelchair), and (g) any person that has been seen in the clinic for less than three months.

Sample Size

A power analysis was conducted apriori utilizing G*Power (Faul et al., 2009) for multiple regression with six predictors, F-squared effect size of .15, alpha of .05, and a power of .80 to determine recommended total sample size. The sample sized is estimated at 98. Over-recruitment of study participants was considered to control for possible incomplete data sets. The estimated total sample size included 105 participants.

Protection of Human Subjects

Prior to data collection, this study proposal was approved by the Georgia State University Institutional Review Board and the Piedmont Healthcare Institutional Review Board. Potential study participants were informed of the aims of the study and were voluntarily enrolled. Written informed consent and HIPAA authorization forms were obtained from each study participant by the investigator prior to participant enrollment.

All participants were notified of their right to withdraw from the study at any point without penalty. Information regarding the study was provided to each study participant by the investigator. Information regarding the right to confidentiality was provided to each study participant. An introductory meeting with each participant was held with the primary investigator to complete informed consent, voluntary enrollment and to receive information on the right to withdraw and study instructions. Potential study participants were assured that their decision to participation in the research study would have no impact on their medical care. There were no financial costs to study participants other than the use of their time to complete study instruments.

Due to the design of this research, there were minimal expected risks to study participants. The burden of completing study instruments could have led to research fatigue and was assessed on an ongoing basis. Additionally, if scores on the PROMIS depression scale were indicative of moderate or severe depression, study participants were referred for additional treatment. Collaboration with the Piedmont Healthcare psychiatric mental health nurse practitioner was conducted prior to data collection. This collaboration served as a point of referral as needed for individuals that scored greater than 60 on the PROMIS depression 8a scale. Data were monitored every 48 hours by the primary investigator to identify participants that scored above the cutoff score. These individuals were referred to the Piedmont psychiatric nurse practitioner for additional screening and treatment as needed. This referral to the psychiatric mental health nurse practitioner was made by the primary investigator on an as needed based on PROMIS depression data.

Procedures

Hepatology providers at Piedmont Hepatology Clinic were made aware of the proposed research topic, eligible study participants, ineligibility criteria, and were provided contact information for the lead nurse researcher. The primary investigator made weekly visits to the hepatology clinic to engage with the staff at the clinic to answer research-related questions and to screen for potential study participants.

Data collection occurred at a standard outpatient hepatology clinic appointment. Data were collected utilizing printed self-reported study instruments. Participants were provided a private space to complete the study instruments. It is estimated that it took each study participant around 25-30 minutes to complete all study instrument items. Prior to the self-administration of the instruments, the study participants met briefly with the primary investigator to provide instruction on data collection and to answer any research-related questions. Study participants were asked to self-administer the instruments without family or social support input. Data collected from the study instruments were de-identified using study ID numbers for each participant and entered directly into SPSS statistical software.

Instruments

PROMIS Depression Scale

The Patient-Reported Outcomes Measurement Information System (PROMIS) depression short form 8a was used to measure depression in this proposed study. This instrument assesses depression through self-reported feelings of sadness, guilt, self-criticism, worthlessness, loneliness, interpersonal alienation, and loss of interest (PROMIS Health Organization, 2019a). This depression scale was developed for

universal implementation and is not disease-specific (PROMIS Health Organization, 2019a). This PROMIS tool is intended for adults over the age of 18 and assesses depression over the past 7-day period (PROMIS Health Organization, 2019a). The short form was chosen due to the brevity of administration and participants were instructed to answer all of the instrument items. The most recent version, 8a, was chosen due to the recommendation by the instrument developers to use the highest or more recent version number.

The PROMIS depression short form 8a is an 8-item questionnaire with a five-point Likert response option ranging from "never" to "always" (PROMIS Health Organization, 2019a). The raw score on this depression scale ranges from 8-40, with a higher score indicating more significant clinical depression (PROMIS Health Organization, 2019a). Raw scores can be applied to the score conversion table to establish a T-score (https://www.healthmeasures.net/images/PROMIS/manuals/PROMIS_Depression_Scoring_Manual.pdf). A final score is represented by a T-score which indicates the overall standardized score. The T-scores range from 38.2-81.3 and the mean T-score is 50 with a standard deviation of 10 (PROMIS Health Organization, 2019a). A T-score less than 55 is considered normal, 55-60 mild depression, 60-70 moderate depression, and greater than 70 is indicative of severe depression (PROMIS Health Organization, 2019a). The mean or calibrated scores were developed for this depression scale through screening of a general population. The PROMIS depression short from 8a scale has been used previously for data collection via paper or online tools (PROMIS Health Organization, 2019a).

This PROMIS instrument assesses self-reported perception of depression and has been widely used and accepted in both the general population and populations with chronic illness (Flynn et al., 2015). The Cronbach's alpha for the depression short form in a population of persons with heart failure awaiting transplant was 0.91 and construct validity was established by comparing correlations between this PROMIS form and other measures of depression (PHQ-2) (Flynn et al., 2015). Additionally, a significant correlation was found between administration of the computer-adapted version and the short form highlighting the validity of the short form (Flynn et al., 2015). While no studies were found that discuss the reliability of PROMIS measures in persons with NAFLD, PROMIS depression measures were studied in individuals with liver cirrhosis (Bajaj et al., 2011). Lastly, test-retest reliability in persons with cirrhosis identified an interclass correlation range from 0.759-0.985 when the PROMIS depression measure was administered 12 days apart (Bajaj et al., 2011).

PROMIS Fatigue Scale

The concept of fatigue was measured using the Patient Reported Outcome Measurement Information System (PROMIS) fatigue short form 8a. The PROMIS fatigue scale assesses fatigue through self-reported symptoms including tiredness, sense of exhaustion, frequency, duration, and intensity of fatigue, and the impact of fatigue on daily activities (PROMIS Health Organization, 2019b). The PROMIS fatigue short form 8a is designed for adults over the age of 18, has been universally developed, and is not disease specific (PROMIS Health Organization, 2019b).

The PROMIS fatigue scale is an 8-item self-reported instrument with a five-point Likert response ranging from "not at all" to "very much" (PROMIS Health Organization,

2019b). The raw scores on the PROMIS fatigue short form 8a range from 8-40 (PROMIS Health Organization, 2019b). The raw scores are converted into T-scores based on a conversation table (https://www.healthmeasures.net/images/PROMIS/manuals/PROMIS_Fatigue_Scoring_Manual.pdf). The T-scores of this scale range from 33.1-77.8 with a mean T-score of 50 and standard deviation of 10 (PROMIS Health Organization, 2019b). This instrument assess fatigue over the past 7 days and higher T-score is representative of more severe fatigue (PROMIS Health Organization, 2019b). A T-score of 55-60 is considered mild fatigue, 60-70 moderate fatigue, and greater than 70 is indicative of severe fatigue (PROMIS Health Organization, 2019b).

The PROMIS fatigue short form 8a has demonstrated appropriate reliability and validity in a variety of patient populations including those with chronic illness (Ameringer et al., 2016). A secondary data analysis reviewed the psychometric data of the PROMIS fatigue short form 8a in five sample populations of persons with fibromyalgia, sickle cell disease, cardiometabolic risk, pregnancy, and healthy controls (Ameringer et al., 2016). The Cronbach's alpha reliability coefficient in these persons with chronic illness ranged from .72 to .86 (Ameringer et al., 2016). Additionally, concurrent validity was measured between the PROMIS fatigue scale and the Brief Fatigue Inventory (BFI) and correlations ranged from r=.60 to .85. While no studies were found that examined the use of the PROMIS fatigue scale in persons with NAFLD, the PROMIS fatigue scale demonstrated acceptable reliability, Cronbach alpha > .87 in a cohort study of individuals with liver cirrhosis (Evon et al., 2017).

Exercise Benefits/Barriers Scale

Individual perceptions of benefits and barriers to PA were measured using the Exercise Benefits/Barriers Scale (Sechrist et al., 1987). The Exercise Benefits/Barriers Scale (EBBS) is a 43-item instrument with a four-point Likert scale option ranging from "strongly agree" to "strongly disagree" (Sechrist et al., 1987). While the EBBS is one instrument, it is subdivided into two subscales including a benefits and a barriers scale (Sechrist et al., 1987). Scores are summed for each subscale to create a total score. The total score for the benefits scale ranges from 29 to 116 and the total score for the barriers scale is 14 to 56 (Sechrist et al., 1987). A higher total score indicates an overall positive perception of the benefits of PA (Sechrist et al., 1987). All items on the barriers scale were reverse coded since subscales were used to better understand both benefits and barriers (Sechrist et al., 1987).

The standardized Cronbach's alpha for the EBBS in a northern U.S. general adult population was .95 with a test-retest reliability of .89 (Sechrist et al., 1987). The Cronbach's alpha for the 29-item benefit subscale was .954 and the 14-item barriers subscale was .866 in the same population (Sechrist et al., 1987). Confirmatory factor analysis revealed a two-factor solution that included a benefits and barriers factor (Sechrist et al., 1987). Additionally, the EBBS has been used in a young adult cohort. In a population of college students, a significant negative correlation was identified between benefits and barriers ($r = -.46$, $p<.05$) (Brown, 2005). Reliability was confirmed in this population of college students with a Cronbach's alpha of .80 on the barriers subscale and .92 on the benefits subscale (Brown, 2005). Although no studies were found in which the EBBS was applied to individuals with NAFLD, the EBBS has been used in populations

of chronic illness such as women with osteoarthritis (Shin et al., 2004) persons with HIV (Rehm & Konkle-Parker, 2016), and individuals with multiple sclerosis (Stroud et al., 2009).

Brief Illness Perception Questionnaire

The subjects' perceptions of severity of illness related to NAFLD were measured using the Brief Illness Perception Questionnaire (Brief IPQ) (Broadbent et al., 2006). The Brief IPQ is a nine-item instrument established to concisely measure the cognitive and emotional response related to a chronic illness (Broadbent et al., 2006). Five of the instrument items were developed to assess the cognitive burden of illness, two items measure emotional burden of illness, and one item assesses comprehension of illness (Broadbent et al., 2006). Each item on the Brief IPQ is assessed on a scale from 0 to 10 where higher scores are indicative of a stronger perception of the dimension (Broadbent et al., 2015). The instrument items assess perceived consequences, timeline, personal control, treatment control, identity, concern, and coherence of illness and emotional representation (Broadbent et al., 2015). While each dimension can be examined separately, a total score can also be calculated by reverse scoring items 3, 4, and 7 and adding these to items 1, 2, 5, 6, and 8. Total scores can range from 0 to 80 with a higher total score reflecting a higher perceived threat of illness (Broadbent et al., 2015).

The initial psychometric data were tested in six groups of individuals with chronic illness including myocardial infarction, renal disease, diabetes, and asthma (Broadbent et al., 2006). Concurrent validity was demonstrated through comparing data from the Brief IPQ and the previously established IPQ-revised in which 82% of items could be categorized into the causal items from the IPQ-revised scale (Broadbent et al., 2006).

Discriminant validity was examined to determine variation of illness perception based on disease. As expected, those with more severe chronic illness such as myocardial infarction had longer perceived illness timelines than those with reoccurring colds (Broadbent et al., 2006). The Brief IPQ has been used in a variety of populations including persons with cancer, metabolic disease, mental health disorders, neuromuscular disorders, respiratory disease, and infectious disease (Broadbent et al., 2015). The Brief IPQ has been used internationally in 36 countries and translated into 26 languages (Broadbent et al., 2015).

Exercise Self-Efficacy Scale

Self-efficacy was measured in this study through the use of the Exercise Self-Efficacy Scale. The Exercise Self-Efficacy Scale (ESES) is a 10-item instrument that measures three components of self-efficacy in subscales including task efficacy, coping efficacy, and scheduling efficacy (Rodgers et al., 2002). Each item is scored on a 10-point Likert scale ranging from "1" (not at all confident) to "10" (completely confident) (Rodgers et al., 2002). A total score is calculated by summing the responses of each item with a possible range of scores from 10 to 100 (Rodgers et al., 2002). A higher total ESES score indicates a higher perceived exercise self-efficacy.

Initial validation data were collected in a random population of 203 adults (Rodgers et al., 2002). Strong internal reliability was demonstrated through a Cronbach alpha ranging from .72-.86 for each of the three subscales of the ESES. The reliability of the ESES tool was also demonstrated in a general population of adults (n=56) with a Cronbach alpha ranging from .77-.89 on the three subscales of the ESES (Rodgers et al., 2002). Rodgers et al. (2008) performed a series of three studies to examine the exercise

self-efficacy scale and included an exploratory factor analysis, confirmatory factor analysis, and a 12-week intervention study. In the exploratory factor analysis with a sample of 395 undergraduate college students, a direct oblimin technique was used and three factors were extracted (task self-efficacy, scheduling self-efficacy, and coping self-efficacy) (Rogers et al., 2008). A confirmatory factor analysis in sample of 470 community-based participants yielded an acceptable model supporting the three-factor model from the exploratory factor analysis (Rodgers et al., 2008). Lastly, a 12-week exercise intervention study in an adult general population was conducted to discern whether the ESES observed change in self-efficacy with an increase in activity level (Rodgers et al., 2008). All three domains of the ESES demonstrated change over time with the exercise intervention indicating that the ESES is an appropriate multidimensional tool to assess exercise self-efficacy (Rodgers et al., 2008).

Concise Physical Activity Questionnaire

Level of physical activity was measured by the self-reported Concise Physical Activity Questionnaire. The Concise Physical Activity Questionnaire (CPAQ) is a 4-item instrument that measures the average self-reported participation in PA per week over the past month (Sliter & Sliter, 2014). CPAQ items measured PA based on intensity and include light aerobic, moderate aerobic, vigorous aerobic activity, and muscle-strengthening activity (Sliter & Sliter, 2014). Response options are scored on a 5-point Likert scale including options from “0” (Physically unable/not medically allowed to do this or chose not to do this) to 4 (6-7 times per week) (Sliter & Sliter, 2014). A total score is calculated by summing the unweighted responses to items 1, 2, and 4 and the weighted response to item 3 (multiple the individual response x 2.5) (Sliter & Sliter, 2014). The

possible scores on the CPAQ instrument range from 0 to 24 with a higher score indicative of more time spent on average in PA per week within a one-month timeframe (Sliter & Sliter, 2014). The CPAQ was developed to provide a short, simple, self-report measure of PA that would be easy for researchers to score and simple for respondents to complete (Sliter & Sliter, 2014). The brevity of the CPAQ instrument is considered a strength in this study as the CPAQ is part of a larger battery of study instruments.

Initial testing of the validty of the CPAQ was collected in a population of college students (Sliter & Sliter, 2014). During initial validation, CPAQ scores were found to be inversely correlated with health problems ($r = -.19$, $p < 0.01$), BMI ($r = -.32$, $p < 0.001$), and resting heart rate ($r = -.28$, $p < 0.01$) (Sliter & Sliter, 2014). Furthermore, CPAQ scores were positively associated with verification of gym attendance ($r = .52$, $p < 0.001$) (Sliter & Sliter, 2014). The CPAQ has also been utilized in a population of firefighters to determine the potential impact of PA on burnout (Sliter & Sliter, 2014). Although the CPAQ has not been used in persons with NAFLD, the preliminary findings from this tool provide evidence for use of the CPAQ in other populations.

Demographic Intake Form

A structured questionnaire was developed by the investigator to obtain demographic data from each study participant. The demographic intake form included information regarding age, ethnicity, marital status, employment, disease specific characteristics (i.e., duration of NAFLD, pre-cirrhosis vs cirrhosis), rating of current pain perception (0-10 scale; no pain to worse pain possible), current prescription medications, alcohol use history, and substance use.

Data Analysis

Data collected during this study were entered into IBM SPSS Statistics software version 23.0 for data analysis and interpretation. All data were checked for completeness and accuracy by the primary investigator. Frequency distributions were examined to identify outliers or potential data entry errors. Statistical significance was determined by using an alpha of $p < 0.05$. Descriptive statistics were used to describe the study participants. The first research question listed below was analyzed using a multiple regression model. The final research question was analyzed using the PROCESS macro function described by Hayes (2009). This function assesses for mediation between the independent and dependent variables.

1) Do symptoms of fatigue or depression, perceptions of level of illness severity or benefits and barriers to physical activity predict the amount of self-reported physical activity?
2) Does exercise self-efficacy mediate the relationship between perceptions of benefits or barriers for physical activity and self-report physical activity?

Summary

This chapter provided an overview of the cross-sectional correlational study, sample, data collection, procedures, human protection strategies, and data analysis. Data collection occurred at the outpatient Piedmont Hepatology and Transplant Clinic in Atlanta, GA. Exclusion and inclusion criteria were set prior to the study conduction and all study procedures were approved by both Georgia State and Piedmont Healthcare Institutional Review Boards. An informed consent and HIPAA agreement form were explained in detail to each study participant and signed by the participant prior to data

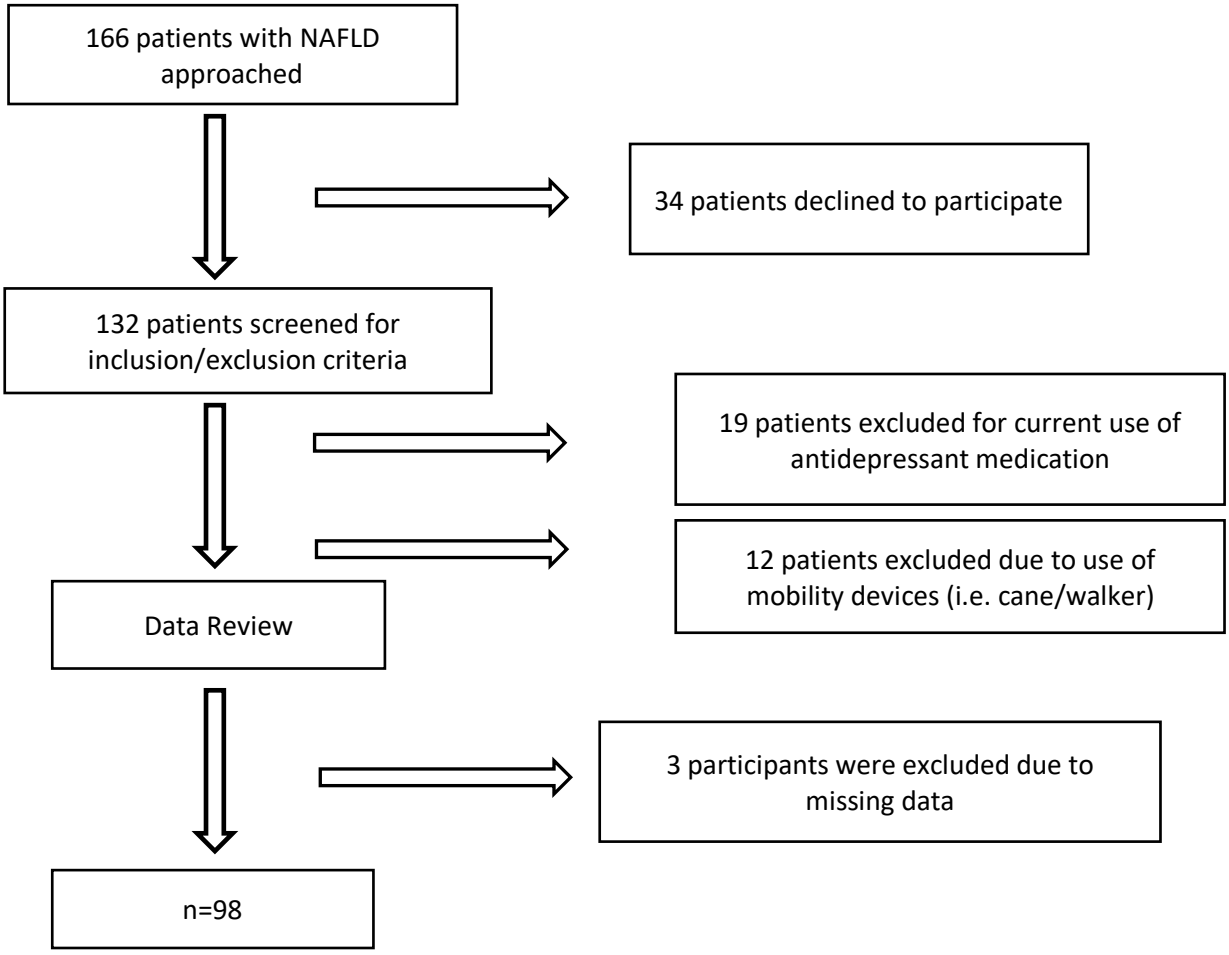
collection. A total of six study instruments and a demographic intake form were collected. Data were then manually entered into SPSS for data analysis.

CHAPTER IV

STUDY RESULTS

The results from this cross-sectional, correlational study examining the relationships of fatigue, depression, perceived illness severity, benefits and barriers to physical activity on the self-reported level of physical activity are presented in this chapter. A description of the study sample characteristics and findings are included. Data were collected between October 2020 and May 2021 at a large hematology and transplant clinic in Atlanta, GA. A total of 166 patients, reflected in Figure 2, were approached regarding their interest in participating in the study and 34 declined to participate. The remaining 132 patients were screened for eligibility and 19 were excluded due to current use of antidepressant medication. Of the remaining study participants, data from three participants were incomplete due to missing greater than 50% of the data points. These three participants were excluded from data analysis. Participants that used either a cane or walker for mobility (n=12) were also excluded from this study. After all exclusions, 98 study participants were included in the data analysis with no missing data points.

Figure 2. Study participant screening, eligibility, and inclusion



Description of Study Sample

Demographic information was collected from study participants and this information is summarized in Table 1. The majority of study participants were over the age of 50 with ages ranging from 23-75 and the mean age was 58.56 ± 9.1 years. Forty-three study participants were male and the remaining 55 were female. The vast majority of study participants were White/Non-Hispanic (n=80), with 16 participants identifying as Black/Non-Hispanic, and 2 participants identifying as Hispanic. A large majority of participants completed either a high school diploma or a bachelor's degree with only 13

participants with higher levels of education. Variation in household income was noted with a range of less than $20,000 to greater than $100,000 annually.

Table 1. Study Participant Demographics

Sample Characteristic		n=98
Sex		
	Male	43
	Female	55
Age		
	<39	1
	30-39	1
	40-49	12
	50-59	31
	60-70	45
	>70	8
Ethnicity		
	Black/Non-Hispanic	16
	Hispanic/Latino	2
	Non-Hispanic/White	80
Education		
	High school diploma	35
	Bachelor's Degree	50
	Master's Degree	8
	Doctorate Degree	5
Household Income		
	Less than $20,000	2
	$20,000-$39,000	12
	$40,000-$59,000	31
	$60,000-$79,000	35
	$80,000-$99,000	11
	Greater than $100,000	7

Table 2 demonstrates health demographics surveyed from all study participants including body mass index (BMI), length of time since diagnosis, and current level of pain. The average BMI of the participants was 32.98 ± 8.90 with a range of 14.64 to 61.88. The average duration of the diagnosis of NAFLD was for approximately two and a half years (30 months), with this ranging from as little as six months to 20 years (241

months). Pain was assessed on a numeric scale from 0-10, with the mean pain score of 0.998 ± 1.995.

Table 2. Health Demographics for Study Participants

	N	Minimum	Maximum	Mean	Std Deviation
BMI	98	14.64	61.88	32.98	8.90
Length of time since diagnosis of NAFLD (months)	98	6	241	30.32	36.69
Pain (0-10)	98	0	10	0.998	1.995

Reliability of Study Instruments

The internal consistency of all study instruments were analyzed using Cronbach's coefficient alpha. The coefficient alphas of each instrument are reported in Table 3. The exercise self-efficacy and exercise benefit/barrier scales were analyzed according to their separate subscales. The coefficient alphas of the study instruments ranged from .645 to .987 which is indicative of good internal reliability with the exception of the Concise Physical Activity Scale (CPAQ). The Cronbach alpha for the CPAQ scale in this population was .505 which is lower than desired. Initial testing of the CPAQ tool was positive, however, this testing was done in a young, healthy population. The lower alpha in this study population is attributed to the chronic nature of NAFLD, which may have affected the reliability of this study instrument.

Table 3. Internal Consistency of Study Instruments

Study Instrument	Number of Items	Cronbach Alpha
PROMIS Fatigue Scale	8	$\alpha = .927$
PROMIS Depression Scale	8	$\alpha = .987$
Brief Illness Perception Questionnaire	8	$\alpha = .645$
Concise Physical Activity Scale	4	$\alpha = .505$
Exercise Self Efficacy Scale		
Task Efficacy Subscale	4	$\alpha = .706$
Coping Subscale	3	$\alpha = .927$
Scheduling Subscale	3	$\alpha = .970$
Benefit Subscale	29	$\alpha = .951$
Barrier Subscale	14	$\alpha = .823$

Data Analysis Results

Descriptive Statistics for Major Study Variables

Six study instruments and a demographic intake form were used to collect data regarding the variables of interest. Prior to data analysis, a thorough screen of all data for data entry errors and missing data was performed. Additionally, a pre-analysis screen of outliers, multicollinearity, homoscedasticity, normality, and linearity was performed. Data normality was assessed by analyzing box plots and histograms and no outlying data were found. All variables were normally distributed. Correlations were examined to ensure adequate variance in the data set and to assess for multicollinearity between independent variables. Multicollinearity was also assessed by examining the variance inflation factor and a Durbin-Watson test was performed to assess for independent errors. Table 4 demonstrates an overview of the descriptive statistics of each study instruments. .

Table 4. Descriptive Statistics of Study Instruments

	N	Minimum	Maximum	Mean	Std. Deviation
Depression	98	8	32	11.47	4.73
Fatigue	98	8	40	19.25	10.18
Total Barrier Subscale	98	14	42	33.98	4.27
Total Benefit Subscale	98	29	110	75.60	12.37
Total Exercise Self-Efficacy	98	10	100	52.48	22.19
Total Brief Illness Perception	98	4	71	33.68	12.91
Total Concise Physical Activity	98	0	18	3.60	3.77

Depression

Depression was measured using the Patient-Reported Outcomes Measurement Information System (PROMIS) depression short form 8a. Raw scores and total scores were analyzed for the study population. The total scores for this study population ranged from 8-32 with a mean depression total score of 11.47 ± 4.73. In addition to examining raw total scores, data were converted to T-scores for review. Out of all study participants, 77 had scores less than 55 and was considered normal, 18 had mild depression, 3 with moderate depression, and none with severe depression. A total of 3 study participants scored above the cut-off score of 60 and were provided with referral information to a psychiatric mental health practitioner for evaluation of depressive symptoms.

Fatigue

Fatigue was measured using the Patient Reported Outcome Measurement Information System (PROMIS) fatigue short form 8a. Raw scores and total scores were

examined for the study population. The total fatigue scores for this population ranged from 8-40 with a mean score of 19.25 ± 10.18. In addition to examining total scores, data were converted into T-scores. Out of all study participants, 60 had PROMIS scores indicating a normal response, 12 with mild fatigue, 20 with moderate fatigue, and 6 with severe fatigue.

Exercise Self-Efficacy

Individualized self-exercise related to exercise was measures using the Exercise-Self-Efficacy Scale. Items were summed to create a total score representing the overall perceived exercise self-efficacy. The total scores of this instrument ranged from 10-100 with a mean score of 52.48 ± 22.19. On average, individuals with NAFLD reported a moderate level of exercise self-efficacy. Study participants were most confident that they could follow directions from an exercise instructor (mean = 6.44, ± 2.625, but least confident that they could exercise when they don't have time (mean=4.32 ± 2.452).

Exercise Benefits and Barriers

Perceived benefits and barriers to exercise were measured utilizing the Exercise Benefits and Barriers scale. This study instrument is subdivided into two different subscales, and data were further examined in benefits and barriers. A higher score on this subscale represents a higher perceived level of barriers to participating in physical activity. The total scores of the barrier scale ranged from 14 to 42 with a mean score of 33.98 ± 4.27. The highest scoring barrier to exercise was that "exercise tires me" (mean = 3.15 ± 0.664) and that "I am fatigued by exercise" (mean = 3.14 ± 0.642). The lowest scoring barrier on this scale was that "my spouse does not encourage exercising" (mean = 2.0 3 ± 0.564). The total scores of the benefit scale ranged from 28 to 108 with a mean

score of 75.60 ± 12.37. Participants felt most strongly that exercise would prevent hypertension (mean = 3.05 ± 2.098) and heart attacks (mean = 2.93 ± 0.389).

Illness Perception

The individualized perception of illness was measured through the use of the Brief Illness Perception Questionnaire (Brief IPQ). Study items were summed to calculate total scores. Scores on this study instrument ranged from 4 to 71, with a mean score of 33.68 ± 12.91. Respondents scored the highest on "how concerned are you about your illness" (mean 6.48 ± 2.847) and "how long do you believe that your illness will continue" (mean = 5.32 ± 2.798). However, respondents identified that they believe that treatment does help their illness (mean 6.48 ± 2.19) and that their overall understanding of NAFLD was high. The overall scoring of participants in this study indicates that persons with NAFLD perceive a moderately high level of illness (mean = 33.68 ± 12.92).

Physical Activity

Physical activity was assessed using the Concise Physical Activity Questionnaire. A total score was calculated by adding the unweighted responses to question 1, 2, and 4 and the weighted response to item 3. Total scores of this study instrument ranged from 0 to 18 with a mean score of 3.60 ± 3.773. These data suggests that the individuals with NAFLD in this study are relatively inactive. The most common form of physical activity was light aerobic activity (mean = 2.80 ± 2.328) and the least common form of physical activity was vigorous aerobic activity with only one study participant participating in aerobic activity. Only one study participant reported regularly participating in aerobic

physical activity. Twenty-five study participants (25.5%) reported participating in no regular physical activity.

Research Question One

1) Do symptoms of fatigue or depression, perceptions of level of illness severity or benefits and barriers to physical activity predict the amount of self-reported physical activity?

A simultaneous multiple linear regression model was used to answer research question one using the Enter method in SPSS. Table 5 provides correlational data for independent study variables as a check for multicollinearity. The variation inflation factor (VIF) for each variable is presented in Table 6 and was also used to assess multicollinearity. All VIF values for independent variables indicated no multicollinearity. The Durbin-Watson statistics for this model was 2.052, thus, meeting the model assumption for independent errors and no autocorrection.

Table 5. Descriptive & Correlational Data for all Major Study Variables (n=98)

Variable	1	2	3	4	5	6	7
1. Barriers	---						
2. Benefits	.31**	---					
3. Depression	-.11	.27**	---				
4. Fatigue	-.11	.45**	.41**	---			
5. Physical Activity	.21**	.52**	.25**	-.31**	---		
6. Exercise Self-Efficacy	-.11	.41**	.40**	.55**	.50**	---	
7. Perceived illness severity	.02	.39**	.47**	.46**	-.29*	.42**	---

Table 6. Multicollinearity Diagnostics

Variable	Variance Inflation Factor (VIF)
Barriers	1.146
Benefits	1.471
Depression	1.385
Fatigue	1.506
Perceived Illness Severity	1.572

The overall model summary is presented in Table 7.

Table 7. Linear Regression Model Summary

	R	R square	Adjusted R square	Std. Error of the Estimate
Model	.667	.445	.415	2.90293

This multiple linear regression model included exercise benefits and barriers, depression, fatigue, and illness perception as the independent variables of interest. A multiple linear regression model was calculated to predict physical activity based on the independent variables. A significant regression equation was found with the collective module using exercise barriers, exercise benefits, depression, fatigue, perceived illness severity, $F(5,90) = 14.454$, $p < .000$ with an R^2 of .445 and adjusted R^2 of .415. The individual predictors were examined more in depth and the exercise benefit ($p < .000$) and barrier scale ($p < .000$) were the only significant predictors of PA in this model. Table 8 presents additional details on the coefficients and significance of model variables.

Table 8. Model Coefficients

	B	Coefficient Std. Error	Standardized Coefficients Beta	t	Sig
Barriers	-.377	.074	-.426	-5.07	.000
Benefits	.184	.029	.599	.480	.000
Depression	-.108	.073	-.136	-1.47	.145
Fatigue	-.024	.036	-.066	-.682	.497
Illness Perception	.014	.029	.047	.480	.250

Research Question Two

2) Does exercise self-efficacy mediate the relationship between perceptions of benefits or barriers for physical activity and self-report physical activity?

To investigate this research question, a mediation analysis was performed using PROCESS macro in SPSS. This PROCESS method described by Hayes (2009) was chosen to test this complex model and to assess indirect effect through the proposed mediator. Bootstrapping statistics were used to provide a resampling of datasets to provide standard errors, confidence intervals, and to allow for hypothesis testing (Hayes, 2009). This analysis utilized a model number 4, confidence interval (CI) of 95%, and 5000 bootstraps.

The outcome variable for this analysis was physical activity. Two mediation models were examined using the predictor variables of exercise benefits and exercise barriers and the mediation variable was exercise self-efficacy. The indirect effect was tested using non-parametric bootstrapping technique. In the first model summarized in Figure 3,the indirect effect of exercise self-efficacy on exercise barriers and PA did not have a statistically significant effect.

The indirect effect, summarized in Table 9, was negative (IE -.0460), but non-significant: 95% CI (-.1355, .0329) and reflects the indirect effect of self-efficacy on

exercise barriers and physical activity. In this model, the lower limit CI was -.0135 and the upper limit CI was .002. Since zero falls within the range of the CI in this model, the null hypothesis was maintained.

Figure 3. Mediation Model for Exercise Barriers, Exercise Self-Efficacy, and Physical Activity

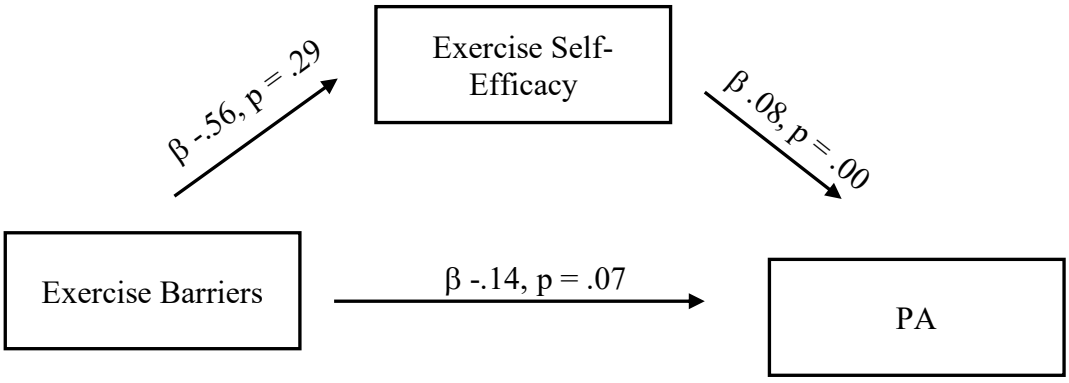


Table 9. Indirect Effect of Self-Efficacy on Exercise Barrier and Physical Activity

	Effect	BpptSE	BootLLCI	BootULCI
Self-Efficacy	-.0460	.0424	-.1355	.0329

A second model shown in Figure 4 was analyzed to determine if there was an indirect effect produced by exercise self-efficacy on exercise benefits and level of PA. The indirect effect in this model was tested using a non-parametric bootstrapping method. This model did produce a statistically significant model in which the indirect effect is inferred to be non-zero. Table 10 demonstrates the indirect effect data which shows the lower limit CI was .0172 and the upper limit CI was .0783. Thus, the indirect effect (IE = .0436) was statistically significant (p .001): 95% CI = (.0172, .0783).

Figure 4. Mediation Model for Exercise Benefits, Exercise Self-Efficacy, and Physical Activity

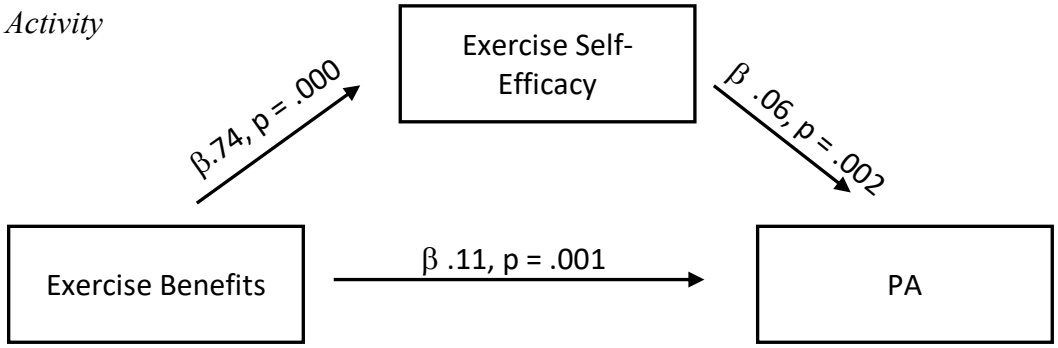


Table 10. Indirect Effect of Self-Efficacy on Exercise Benefit and Physical Activity

	Effect	BpptSE	BootLLCI	BootULCI
Self-Efficacy	.0436	.0158	.0172	.0783

Summary

Six study instruments and a demographic intake forms were used to collect data regarding dependent variables of interest in 98 individuals with nonalcoholic fatty liver disease. Two research questions were developed to examine factors that influence physical activity in persons with liver disease. Additionally, data were collected to examine a potential mediation effect of exercise self-efficacy on overall physical activity. Data were collected and analyzed through a simultaneous linear regression model. The model was statistically significant and accounted for a total of 41.5% of the total variance of the dependent variable. Perceived benefits and barriers to physical activity was found to be statistically significant in this model for predicting physical activity. Additionally, the mediation indirect effect was examined by using a bootstrap model. Exercise self-efficacy was not found to cause a significant mediation effect between exercise barriers

and PA. However, a significant indirect mediating effect of exercise self-efficacy was found between exercise benefits and PA.

CHAPTER V

RESULTS

The purpose of this to chapter is to present the interpretation of the findings regarding the effects of perceptions of fatigue, depression, illness severity, exercise benefits or barriers on the level of physical activity in individuals with NAFLD. This chapter also provides an in-depth review of study findings in relation to existing literature and the study framework, study strengths and limitations, implications for clinical practice, and suggestions for future research. The data examined in this research study adds to the body of research regarding individuals with non-alcoholic fatty liver disease (NAFLD), their perceived symptom burden, and how factors associated with this illness may impact their level of physical activity.

Discussion and Conclusions

While physical activity has been well-established as a main treatment component of NAFLD (Chalassani et al., 2018) there remains a gap in understanding how to best improve overall activity level in this population. Data from this study suggest that persons with NAFLD are relatively inactive. Approximately 25% of this current population reported participating in no physical activity. This finding is similar to previous findings of PA in persons with NAFLD (Hallsworth et al., 2015; Krasnoff et al., 2018). This is clinically significant because PA is a main treatment guideline for persons with NAFLD and if not being followed accordingly there is concern for the worsening continuum of NAFLD to cirrhosis (Chalassani et al., 2018). To our knowledge, this is

the first study assessing depression, fatigue, illness perception, exercise benefits or barriers and the relationship of these variables to physical activity in persons with NAFLD. This study assessed the perceived illness burden, symptomatology, and level of activity in an under-researched population and highlights the need for continued work in this area.

Fatigue and Depression

In this study, the level of fatigue in persons with NAFLD was clinically significant. Using the PROMIS fatigue scores, 38 participants had mild, moderate, or severe fatigue which is approximately 38% of the study population (n=98). Data from this study further supports current evidence (Assimakopoulos et al., 2018; Dwight et al., 2000; Newton et al., 2008) that individuals with NAFLD have high levels of fatigue. Although fatigue was not a significant predictor of PA in this study, previous data suggests that higher levels of fatigue were correlated with reduced levels of PA in persons with NAFLD (Mlynarsky et al., 2016).

In regards to additional symptomatology, there was variability in individual reports of depression with approximately a fifth of participants scoring mild or higher on the depression rating scale. Three study participants scored above the cutoff range for the depression rating scale, which was indicative of severe depression. These three participants were retained in the study since there had not received any previous treatment. However, they were referred for additional screening and possible treatment of depressive symptoms. A growing body of evidence suggest that depression and fatigue commonly co-exist in individuals with chronic liver disease (Assimakopoulos et al.,

2018; Dwight et al., 2000; Gerber et al., 2019) and the data from this study helps to support this evidence.

Perceived Illness Severity

Perceived illness severity has been well documented as having a significant impact on persons with chronic illness (Groarke et al., 2004) and is inversely related with level of PA (Zoeckler et al., 2014). This study further supports this as a negative correlation was found between perceived illness severity and level of PA ($r = -.29$, $p = .003$). Despite respondents feeling as though treatment plans were helping their illness, the overall scoring of participants in this study indicates that persons with NAFLD perceive a moderately high level of illness.

Factors Predicting the Level of Physical Activity

Perceptions of depressive symptoms, fatigue, illness severity and benefits or barriers were considered as potential factors influencing the current level of PA for persons with NAFLD. The overall model demonstrated that 41.5% of the variance of the level of PA was explained by the significant, independent variables. Standardized beta coefficients were analyzed to better under the strength to which each independent variable impacted the dependent variable.

Within the model itself, exercise benefits and exercise barriers were the only two statistically significant variables predicting physical activity. This suggests that the overall perception of benefit of exercise or barriers to exercise best predicted level of activity. The perceived benefits of PA were a positive, moderate predictor of level of PA while perceived barriers of PA were a negative, moderate predictor of PA.

Exercise Self-Efficacy as a Potential Mediator of Benefits or Barriers to Physical Activity

Self-efficacy has been well described as a major determinant of behavioral activity change and is defined as the individual's belief that they can successfully implement the proposed behavior change (Bandura, 1977). Improved levels of self-efficacy have been correlated in prior studies to increased level of PA (Mo et al., 2011). Exercise self-efficacy was examined as a potential mediator of the relationships between perceived benefits or barriers and the current level of PA. Additionally, self-efficacy and its impact on level of activity has also been studied in many groups of chronic illness (Blake et al., 2016, Kasser & Komo, 2012; Zelber-Sagi et al., 2017). However, there have been no studies specifically examining exercise self-efficacy in persons with NAFLD.

Two mediation models were analyzed to determine if exercise self-efficacy mediates the relationship between exercise benefits or barriers and PA. A bootstrapping method was used to assess the role of self-efficacy as a mediator variable between exercise benefits or barriers and level of PA. Bootstrapping generates a multitude of samples through random repeated resampling through replacement (Hayes, 2009). In this model, a bootstrapping of 5000 was completed to assess 5000 samples and to create confidence intervals to answer the research question. Bootstrapping methods have had an increased use in the past decade due to the use of additional analytical dashboards through SPSS. The MACRO process method was used for this study due to its ability to assess bootstrapping and the reduction of computational burden (Hayes, 2009). The use

of bootstrapping methods also allows for more generalizability of study data due to the resampling of data sets (Hayes, 2009). Although low levels of self-efficacy have been described as a potential barrier to level of PA (Craike et al., 2013) the mediation model analyzing the indirect effect of exercise self-efficacy on barriers was not statistically significant. Thus, self-efficacy did not mediate the relationship between perceived barriers and level of PA. However, the model examining exercise benefits and level of PA was significant. This model suggests that the indirect effect of exercise self-efficacy was significant on the effect of exercise benefits and level of PA. This may be attributed to self-efficacy being viewed as a benefit of physical activity. As an example, an increased level of exercise-self efficacy, may cause patients to have an increased perception of the benefit of PA, thus, increasing level of activity.

Relationship to Theory

This study utilized the theoretical foundation of the Health Belief Model (HBM) to examine relationships of study variables. The HBM is a widely used theory to examine factors associated with behavioral changes (Rosenstock, 1974). The HBM has also been widely used to study physical activity as a variable of interest (Hoseini et al., 2014). In this study, the concept of perceived threat was measured by assessing the perceived illness severity. Additionally, depression and fatigue were examined as potential psychosocial risk factors in this theoretical model. The concept of benefit of action was assessed by the exercise benefits scale and self-efficacy was also examined. The underpinnings of this theory easily supported the analysis of study variables in relationship to one another. Despite the theoretical framework, self-efficacy did not mediate the relationship between exercise barriers and engagement in the health behavior.

Also, fatigue and depression were not statistically significant in predicting level of physical activity. Therefore, the research model was only partially supported by study findings.

Limitations of Study

Several limitations of this study have been identified. First, this study utilized a convenience sample population. Although the Piedmont clinic serves a large geographic area, study participants were selected from this facility based on convenience for the student PI. This should be evaluated to determine the possible effect of generalizing study findings to a larger population. On average, it took study participants approximately twenty minutes to complete all data collection. A limitation of this study would be the respondent burden needed to collect all six study instruments. While exercise benefits/barriers did prove to be a statistically significant finding in this study, this questionnaire is lengthy and was skipped completely by three study participants presumably due to its length. The reliability of the physical activity instrument used in this study is lower than desired. The concise physical activity questionnaire (CPAQ) was chosen due to its brevity and concern for respondent burden. Initial testing of the CPAQ instrument seemed positive, however, the initial psychometric testing was performed in a healthy population. The Cronbach alpha in this study population may be lower due to the chronic nature of NAFLD which may change the reliability of this instrument. Another limitation of this study was the self-reported nature of analyzing physical activity. In similar studies, the use of biometric data or step technology have been used. Self-reported data was chosen for the use of this study due to funding restrictions. Due to the higher acuity care provided by this Metro Atlanta clinic, patients may have a higher

understanding of their disease process than patients in other more rural areas. The potential impact of this should be considered when assessing for generalizability. Lastly, all data collection occurred during the COVID-19 pandemic and researchers should examine the possibility of this impacting study results due to gym closures, public health concerns in crowded areas such as parks and recreational areas, and government orders for quarantine. The COVID-19 pandemic may have impacted several study variables including level of PA, depression, and fatigue.

Strengths of Study

The data collected in this research study has helped to extend the knowledge regarding persons with NAFLD and factors that impact their participation in physical activity. Additionally, information regarding symptom burden of those with NAFLD was collected to better understand this population as a whole. This is the first known study to examine the relationship between depression, fatigue, exercise benefits and barriers, exercise self-efficacy, and perceived illness severity and level of physical activity. There were limited missing data and the study instruments were found to have adequate internal reliability. The study was conducted on the well-established theoretical foundation of the Health-Belief Model (HBM). The HBM was used to assess relationships of study variables. Lastly, a strength of this study was the ability to assess study variables in varying degrees of liver illness. Variability of length of time since onset of illness was identified with some participants having been affected for as little as six months and other for over 20 years. Due to the progressive nature of NAFLD, the ability to assess length of time since illness onset is a strength of this study. Lastly, the use of exercise self-

efficacy as a mediator variable instead of a structural variable of the HBM provided an innovate approach.

Implications of Findings on Clinical Practice

Physical activity is one of the main treatment strategies in managing NAFLD (Chalassani et al., 2012). However, routine guidelines on intensity and duration of activity are lacking and the overall level of activity of persons with NAFLD is low. Clinical providers should continue to emphasize the importance of physical activity in disease treatment and must consider an individualized approach to operationalizing physical activity in this diverse population. Due to the percentage of persons with NAFLD experiencing depression and fatigue (Gerber et al., 2019) routine recommendations are needed on appropriate screening and treatment guidelines. NAFLD has been described as the hepatic manifestation of metabolic disease and should be considered by clinical providers when treating patients with other metabolic disorders. Lastly, a better understanding of barriers to physical activity is needed to best guide clinical practitioners on how to get their patients to better engage in regular activity.

Recommendations for Future Research

Due to the high prevalence of comorbid NAFLD and fatigue, recommendations of future research are needed. Gerber et al. (2019) suggest the possible inclusion of biomarker data in assessing fatigue in individuals with NAFLD. This could include measuring pro-inflammatory cytokines or other objective physical performance markers (Gerber et al., 2019). Findings from this research study provide additional details on gaps in our current understanding of individuals with NAFLD, their symptom burden, and their participation in physical activity. Since the overall data suggests that this study

population was relatively inactive, a continued focus on variables associated with poor levels of physical activity should be considered. Additional studies examining physical activity using step technology or biometric data should be studied. Due to the current lack of guidance on duration, intensity, and frequency of PA in this population of chronic illness, future research should be considered to provide guidance. Since the perceived benefit of exercise was the only significant predictor of physical activity, planning interventional studies on improvement the overall perception of the benefit of activity should be considered. Future studies may benefit from using a different measurement of physical activity and should consider using biometric measurements for both fatigue and physical activity. Exercise self-efficacy should be considered in future research to promote level of PA in individuals with NAFLD. Additionally, the inclusion of NAFLD in metabolic disease studies may be crucial to better understanding overall health in this disease continuum.

Study Summary

This study sought to examine the effects of depression, fatigue, perceived illness, exercise benefits or barriers on the level of physical activity in individuals with nonalcoholic fatty liver disease (NAFLD) and if exercise self-efficacy mediated the effects of benefits or barriers on current activity. Data collected from this study provided additional evidence to support that persons with NAFLD are not participating in regular physical activity. Data suggest that the overall perceived benefits or barriers of exercise were the only study variables that significantly predicted physical activity, with a stronger effect related to barriers. Exercise self-efficacy had a relatively small mediational effect on the relationship between benefits and the current level of physical

activity in persons with NAFLD. Greater emphasis is needed on assessing barriers for physical activity and identifying strategies for promoting exercise self-efficacy in persons with NAFLD.

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APPENDIX A

Nonalcoholic Fatty Liver Disease and Factors Influencing Physical Activity Demographic Intake Form

Appendix A

Nonalcoholic Fatty Liver Disease and Factors Influencing Physical Activity Demographic Intake Form

1. Which of the following best describes your ethnicity/race? (Please check one)
    - Asian/Pacific Islander
    - African American/Black
    - Hispanic/Latino
    - Non-Hispanic/White
2. What is your highest level of education? (Please check one)
    - Less than high school
    - High School Diploma
    - Bachelor's Degree
    - Master's Degree
    - Doctorate Degree
3. What is the estimated total annual income for your household? (Please select one)
    - Less than $20,000
    - $20,000-$39,000
    - $40,000-$59,000
    - $60,000-$79,000
    - $80,000-$99,000
    - Greater than $100,000
4. What is your current level of pain on a scale from 0-10 (ten being the worst pain you can imagine)?

    _____
5. Do you use any equipment to help move around? (Examples: wheelchair, cane, etc.)

    Yes No

APPENDIX B

Fatigue – Short Form 8a

Appendix B

PROMIS Fatigue Form 8a can be obtained from

www.healthmeasures.net

APPENDIX C

Emotional Distress – Depression – Short Form 8a

Appendix C

PROMIS Depression Form 8a can be obtained from

www.healthmeasures.net

APPENDIX D

Exercise Benefits/Barriers Scale

Appendix D

The Exercise Benefits/Barriers Scale can be obtained from:

Sechrist, K. R., Walker, S. N., & Pender, N. J. (1987). Development and psychometric evaluation of the exercise benefits/barriers scale. *Research in Nursing & Health*, *10*(6), 357-365.

APPENDIX E

Concise Physical Activity Questionnaire CPAQ

Appendix E

PsycTESTS®

doi: http://dx.doi.org/10.1037/t36189-000

Concise Physical Activity Questionnaire CPAQ

Items

Directions

Please think about the **past month**. During that time, approximately how many days per week did you engage in each of the following types of physical activity for **at least 20 consecutive minutes**?

Example 1. If you walk to work and it takes you 10 minutes each way, that would NOT count because the minutes were not consecutive.

Example 2. If you walk to work and it takes you 20 minutes each way, then that would count as performing light physical activity that day. You walked for at least 20 *consecutive* minutes that day.

Items

1. Light aerobic activity (Ex: shopping, housework, leisurely walking)

2. Moderate aerobic activity (Ex: brisk walking, bicycling, tennis)

3. Vigorous aerobic activity (Ex: jogging/running, swimming laps, jumping rope)

4. Muscle-strengthening activity (Ex: lifting weights, pilates, yoga)

APPENDIX F

Brief Illness Perception Questionnaire

Appendix F

PsycTESTS®

doi: 10.1037/t10379-000

Brief Illness Perception Questionnaire

Items

For the following questions, please circle the number that best corresponds to your views:

How much does your illness affect your life?

0	1	2	3	4	5	6	7	8	9	10
no affect at all										severely affects my life

How long do you think your illness will continue?

0	1	2	3	4	5	6	7	8	9	10
a very short time										forever

How much control do you feel you have over your illness?

0	1	2	3	4	5	6	7	8	9	10
absolutely no control										extreme amount of control

How much do you think your treatment can help your illness?

0	1	2	3	4	5	6	7	8	9	10
not at all										extremely helpful

How much do you experience symptoms from your illness?

0	1	2	3	4	5	6	7	8	9	10
no symptoms at all										many severe symptoms

How concerned are you about your illness?

0	1	2	3	4	5	6	7	8	9	10
not at all concerned										extremely concerned

How well do you feel you understand your illness?

0	1	2	3	4	5	6	7	8	9	10
don't understand at all										understand very clearly

PsycTESTS®

doi: 10.1037/t10379-000

Brief Illness Perception Questionnaire

Items

How much does your illness affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)

0	1	2	3	4	5	6	7	8	9	10
not at all affected emotionally										extremely affected emotionally

Please list in rank-order the three most important factors that you believe caused your illness.
The most important causes for me:

1. _____
2. _____
3. _____

APPENDIX G

Exercise Self-Efficacy Scale

Appendix G

PsycTESTS®

doi: 10.1037/t19246-000

Exercise Self-Efficacy Scale

Items

Task Efficacy

How confident are you that you can . . .

(1) pace yourself to avoid overexertion?

(2) perform all the required movements?

(3) follow directions from an instructor?

(4) check how hard your activity is making you work?

Coping

How confident are you that you can exercise when you are . . .

(1) tired?

(2) in a bad mood?

(3) feel you don't have time?

Scheduling

How confident are you that you could . . .

(1) overcome obstacles that prevent you from participating regularly?

(2) make up times you missed?

(3) exercise regularly no matter what?

Note . Items were rated on 10-point Likert-type scales anchored with 1 = *not at all confident* and 10 = *completely confident* .