Perceived and Performance Fatigability in Older Adults

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Fatigue is the state of being tired or inability to maintain an expected force. Fatigability is a measure of how fast someone gets tired and defined as susceptibility to fatigue a tendency to get tired or lose strength. Research shows that normal aging in older adults is associated with increased performance fatigability including loss of muscle, reduced endurance, worsened typical gait pattern, deteriorated typical healthy walking strides, and reduced maximal oxygen capacity compared to younger adults. Increased performance fatigability often leads to increased perceived fatigability that is associated with increased mental cost of completing normal activities of daily living. Assessing perceived and performance fatigability becomes useful when evaluating older adult healthiness because it shows potential early onset of chronic disease states with normal aging. Research shows performance fatigability is related to morbidity, mortality, hospitalizations, slower gait speed, worse six-minute walk distance, and functional decline in older adults. Veterans at VA Pittsburgh Gerofit health promotion program often report tiredness and fatigue that interfere with activities of daily living such as work-related duties, grocery shopping, yard and house work. Presented here is a needs assessment of Veterans perceived and performance fatigability with implications for Gerofit program future inquiry and practice to better address Veterans health concerns.

Table of Contents

List of Tables

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1.0 Introduction

1.1 Problem Area

Fatigue is one of the most common complaints in the older adult population when seeing a primary care physician and is often an early indicator of the aging process or underlying medical conditions such as heart disease, cancer, chronic lung disease, and multiple sclerosis. Patients entering the Veterans Affairs Gerofit health promotion program often complain of symptoms such as tiredness, exhaustion, being fatigued and these symptoms will be used as perceived fatigability. Functional capacity is an important aspect of health especially in the older adult population and is associated with mobility limitations that hinder individual's ability to be independent and complete activities of daily living without assistance. Gait speed and six-minute walk distance are common indicators of mobility and are strong predictors of ability to complete activities of daily living independently and functional capacity and these measures will be used as performance fatigability. Many Gerofit program participants performance fatigability measures with preferred gait speed and six-minute walk distances results are associated with higher rates of morbidity and mortality which is deeply troubling (Richardson, 2009). Patients enter the Gerofit health promotion program with variable levels of fitness, health conditions, and education. Research shows that higher levels of fatigability are associated with lower levels of functional capacity and much work still needs done on improving the perceived and performance fatigability in older adults. Older adults who cannot perform their activities of daily living without compensating with rest time, or with needing assistance from others to complete tasks cannot live and function independently and this perceived or performance fatigability is associated with a disability.

1.2 Problem of Practice

Clinical exercise physiologists working in Gerofit health promotion program are tasked with utilizing scientific literature to implement and supervise exercise therapy, and modifiable risk factor modification that is shown to have a clinical benefit to patients. Although Gerofit health promotion program seems like supervised exercise therapy as the main role, it is more of a diver for risk factor reduction which is the main affair that clinical exercise physiologists are tasked with. Risk factor reduction is any modifiable risk factor behavior including heart healthy eating, regular exercise, stress management, or medication adherence. As patients are referred and evaluated in our Gerofit health promotion program clinic, many aspects of what led them to us are dissected including physical activity limitations, how much stress or anxiety they currently have, and all comorbidities that can influence their health status. There is a large gap observed between what the average veteran entering the Gerofit health promotion program understands, and what they need to know to manage underlying conditions from knowledge of disease, stress management, and exercise self-efficacy. This needs assessment was taken upon with focus on suggesting improvements to address perceived and performance fatigability in older adult veterans in the Gerofit health promotion program.

2.0 Literature Review

Fatigability is defined as the tendency to get tired or lose strength and weakness the property of lacking perceived or performance strength. Research shows that as we age this is a common phenomenon and is associated with age related muscle loss and reduced aerobic capacity. For the purpose of this paper fatigability will not only look at fatigue as a functional of muscular endurance but as a whole person construct in their ability to complete activities of daily living. Performance fatigability will look at scores in gait speed and six minute walk distance while perceived fatigability will utilize reporting of symptoms such as tiredness, fatigue, and lack of motivation or ability to complete tasks. Fatigue, perceived fatigability, and performance fatigability are all connected and this literature review will attempt to show the correlative relationship these associated topics.

2.1 Gait Speed and survival in older adults

Studenski (2011) researched the relationship between gait speed and survival in older adults. Studenski (2011) looked at 9 cohort studies completed between 1986 and 2000 using available data from 34485 community dwelling older adults over the ages of 65 that were followed between 6 and 21 years. Survival rate and life expectancy was measured. Lower gait speed was associated with higher risks of morbidity and mortality. Each .1 meter per second increase or decrease, respectively, was associated with an increase or decrease in morbidity and mortality in older adults

2.2 Fatigue may contribute to reduced physical activity among older adults

Fatigue is one of the most commonly reported symptoms that older adults experience that is an overwhelmingly distressing experience that affects older adults in activity and social participation. Self-reported fatigue is multi-factorial with little known about the causes and impacts in older adults. Egerton (2016) wanted to look at the relationship between fatigue and measured physical activity. Using cross sectional data, they researched 980 community living older adults that were 70-77 years old. The associations between fatigue and physical activity measures by accelerometry were utilized. 9 percent of the participants reported fatigue and those who reported fatigue had 1150 fewer steps per day, 9 minutes less of moderate to vigorous activity, and 12 minutes less of daily activity. Having higher BMI and increased comorbidities attenuated the effect of the fatigue. This study concluded that fatigue was associated with reduced clinically significant measures of physical activity in older adults.

Moreh (2010) wanted to look at fatigue, which is common amongst elderly adults, but little is known concerning its relationship with mortality and function over extended periods of time among the very old. Moreh (2010) evaluated the association of fatigue with health, functional status, and mortality in older adults ages 70–88 years. They researched mortality data from ages 70–88 years and both health and functional status at age 70, 78, and 85 years were assessed among a representative community-dwelling cohort from the Jerusalem Longitudinal Study. Moreh (2010) found that at age 70, 78, and 85, fatigue prevalence was 29 percent, 53 percent, and 68 percent with increased prevalence among women. Fatigue was associated with poorer health, function, and psychosocial parameters at all ages and greater likelihood to deteriorate in subsequent self-rated health, functional status, loneliness, depression, and physical activity level.

Fatigue at age 70 predicted poor subsequent self-rated health, difficulty in activities of daily living, reduced levels of physical activity, and poor sleep satisfaction.

Avlund (2001) wanted to analyze whether self-reported tiredness in daily activities at age 75 is an independent determinant of incident hospitalization and use of home services 5 years later. This study was prospective and included 275 adults 75 years old and 80 years old at follow up. Avlund (2001) split the older adults into four subgroups which included whether participants had been hospitalized or used home care in the year before the baseline study and whether they were disabled at the time. The key predictor variables were measured by two scales about tiredness in daily activities. The results showed that nondisabled individuals who felt tired in their daily activities had about twice the risk of being hospitalized and of being users of home help 5 years later. Avlund (2001) concluded that tiredness in daily activities is related to subsequent hospitalization and use of home help, and it should be taken seriously in preventive services among elderly adults.

Hardy (2008) wanted to evaluate the association between fatigue and survival over 10 years in a population of older community-dwelling primary care patients in a prospective study. This study measured 572 community dwelling primary care older adults over the age of 65 years old. Hardy (2008) measured fatigue as feeling tired most of the time and this was assessed at baseline. Mortality was ascertained from the National Death Index. Covariates included demographics, comorbidity, cognitive function, depressive symptoms, body mass index, self-rated health, functional status, and gait speed. Mortality rates at 10 years were 59 percent for older adults with fatigue, versus 38 percent for those without fatigue. After adjustment for multiple potential confounders, participants who were tired at baseline had a greater risk of death than those who were not. There are two conclusions in this study. The first shows that asking a single simple

question ‘‘Do you feel tired most of the time?’’ identifies older adults with a higher risk of mortality. The second conclusion demonstrates that the fatigue among the elderly adults has a significant negative impact on health status, function, and mortality, and may be related to the complex relationship of fatigue with depression and levels of physical activity.

Avlund (2006) wanted to analyze whether tiredness in daily activities is associated with subsequent disability among nondisabled older adults and whether this association is mediated by walking limitations. This study was cross sectional and included 419 nondisabled older adults aged 75 years. Avlund (2006) measured onset of disability by a validated scale based on seven items: combing hair, washing upper body, washing lower body, using the toilet, dressing upper body, dressing lower body, and cutting fingernails. Tiredness was measured by a validated scale based on the following items: using the toilet, washing and dressing lower body, and cutting toenails. Maximal walking speed was assessed by a 10-meter test. The results of this research shows that tiredness in daily activities was significantly associated with subsequent disability when adjusted for walking limitations. Avlund (2006) concluded that it is important to take it seriously when older adults complain about tiredness, as these people are at higher risk of onset of disability.

Simonsick (2008) evaluated mobility limitations that are prevalent, potentially reversible precursors to mobility loss that may go undetected in older adults. This study evaluated standardized administration of an endurance walk test for identifying unrecognized and impending mobility limitation in community elders. This study included 3056 older adults ages 70-79 years old with no reported mobility limitation participating in the Health, Aging and Body Composition study who were administered the Long-Distance Corridor Walk. Walk performance was examined to determine unrecognized mobility deficits at baseline and predict new self-recognition of mobility limitation within 2 years. Simonsick (2008) found that on testing, 23 percent and 36

percent of men and women evidenced mobility deficits defined as a contraindication to exertion, meeting stopping criteria or exceeding 7 minutes to walk 400 m. Unrecognized deficits increased with age and were more prevalent in blacks, smokers, obese individuals, and infrequent walkers. Within 2 years, 21 percent and 34 percent of men and women developed newly recognized mobility limitation; those with baseline unrecognized deficits had higher rates, 40 percent and 54 percent. For each additional 30 seconds over 5 minutes needed to walk 400 m, likelihood of newly recognized mobility limitation increased by 65 percent and 37 percent in men and women independent of age, race, obesity, smoking status, habitual walking, reported walking ease, and usual gait speed. This research concluded that a sizable proportion of older adults who report no walking difficulty have observable deficits in walking performance that precede and predict their recognition of mobility limitation. Endurance walk testing can help identify these deficits and provide the basis for treatment to delay progression of mobility loss.

Mänty (2012) wanted to look at fatigue as it is an important early marker of functional decline among older adults. This study was cross sectional and included 523 older adults with 292 that also completed a 5 year follow up. They assessed standardized assessments which included self-report measures of mobility-related fatigue (score range 0–6) and medical history, as well as performance-based assessment of walking speed and maximal isometric strength of knee extension, body extension, and handgrip. The results of this research shows that one unit increase in fatigue score was associated with 0.03 meters/second and 0.05 meters/second slower maximum walking speed among women and men. Among women, muscle strength accounted up to 21 percent and among men up to 24 percent for the association. In the prospective analysis, fatigue at baseline was predictive of change in walking speed among men but not among women. Among

men, muscle strength accounted up to 15 percent for the association between baseline fatigue and change in maximum walking speed.

Vestergaard (2009) researched fatigue in a population of older adults which is a common complaint amongst older adults, but the functional consequences of this symptom are not clear or understood. Their research evaluated fatigue and its association with measures of physical function and disability in a representative sample of the older adults. This study measured 1055 older adults ages 65 and older. Vestergaard (2009) evaluated whether participants felt that " everything was an effort " and/or they " could not get going " on three or more days in the past week. They measured physical function by handgrip strength, the Short Physical Performance Battery, and 400-m walking speed. Disability was defined as the inability to complete the 400-m walk test, and self-reported difficulty in activities of daily living and instrumental activities of daily living. Vestergaard (2009) found that the prevalence of fatigue was higher in women (29 percent) than in men (15 percent), fatigued men and women had weaker handgrip strength, lower SPPB score, slower walking speed, and higher mobility, and activities of daily living and instrumental activities of daily living disability than non-fatigued persons. They found that fatigue is significantly associated with Short Physical Performance Battery score, walking speed, and mobility and instrumental activities of daily living disability in older adults.

Mueller-Schotte (2016) research continued two previous cross-sectional studies and was a prospective study that investigated self-reported non-task-specific fatigue as a long-term risk factor for instrumental activities of daily living limitations and/or mobility performance in older adults after 10 years. This study measured 534 adults ages 40-79 years old. Fatigue was measured by asking "Did you feel tired within the past 4 weeks?" (males) and "Do you feel tired?" (females). Self-reported instrumental activities of daily living limitations were assessed at baseline and

follow-up. Mobility was assessed by the 6-minute walk test. A total of 18.6 percent of males and 28.1 percent of females were fatigued. Fatigued males walked 39.1 m shorter distance than those non-fatigued. For fatigued females, the distance was 17.5 m shorter compared to those non-fatigued. This research suggests that self-reported fatigue may be a long-term risk factor for instrumental activities of daily living limitations and mobility performance in older adult males but possibly not in older adult females.

2.3 Perceived and Performance Fatigability

Marrelli (2018) looked at fatigue in clinical populations and showed that it should have subsections such as perceived fatigability and performance fatigability. The study looked at how perceived fatigability indicates the subjective state of the individual and thus involves the individual's subjective measure of fatigue, and how performance fatigability should be measured through clinical and laboratory-based assessments that quantify the functional decline in performance (Marrelli 2018). Marrelli (2018) evaluated fatigability in a population of adults affected by rheumatoid arthritis. This study reviewed the literature on fatigue and how it affects how the assessment of it is currently more complex than required due to the inconsistent and vague way its defined. Performance fatigability is measured over time with factors that led to measurable decline in functional status or muscle activation. Self-reports are insufficient when looking at performance fatigability and validated measures should be utilized. Perceived fatigability in this research indicated a subjective state of the individual relating to psychological factors and deviation from homeostasis. Marrelli (2018) work indicated a need for future research to attempt

to correlate objective and subjective measures of fatigue as there exists a limited clinical studies that have done both.

Schnelle (2012) wanted to evaluate and document the stability, concurrent validity, and clinical correlates of fatigability severity measures as recommended by the American Geriatrics Society. This research was cross sectional and included 43 older adults between the ages of 79 and 91 years old. Schnelle (2012) measured perceived fatigability severity which was quantified by directly asking participants to report change in energy after a standardized 10-minute walk at a self-selected pace. Performance fatigability severity was defined as a ratio of change in walking speed to total distance walked. The walk test was repeated within 2 weeks to assess stability. Total daily physical activity was measured over 7 consecutive days using a waist-worn accelerometer. Frailty was measured using the Vulnerable Elders Survey interview scale, and gait speed was measured using a standardized 25-feet walk test. The results showed that perceived and performance fatigability severity measures were significantly correlated and stable over two assessments. Both fatigability severity measures were significantly correlated with physical activity level, frailty and gait speed in older adults.

Buchowski (2013) researched increased fatigue as a predictor of morbidity and mortality in older adults. Perceived fatigability defines a change in performance or self-reported fatigue in response to physical activity. The relationship of perceived fatigability to physical activity and physical activity-related energy expenditure is unknown. Changes in performance, fatigue, and energy expenditure were measured in 17 older adults between 74–94 years old. They performed eight standardized physical activity measures with various energy expenditure requirements in a whole room indirect calorimeter. Change in performance was objectively measured using a physical activity movement monitor and change in fatigue was self-reported on a seven-point scale

for each task. Performance and perceived fatigability severity scores were calculated as a ratio of change in performance and fatigue, respectively, and physical activity energy expenditure. Buchowski (2013) found that change in both objective performance and self-reported fatigue were associated with energy expenditure on a task requiring relatively high level of energy expenditure. The performance and perceived fatigability severity scores were significantly correlated on this task. This work was a pilot study that showed that both perceived and performance fatigability severity scores are related to physical activity energy expenditure induced fatigue on a task requiring relatively high level of energy expenditure in older adults.

Simonsick (2016) evaluated perceived and performance fatigability as a predictor of meaningful functional decline in non-mobility limited older adults. This study was a longitudinal analysis from the Baltimore Longitudinal Study of Aging that included 540 older adults 60-89 years old with concurrent perceived fatigability and functional assessments and follow-up functional assessment within 1 to 3 years. They measured perceived and performance fatigability which was ascertained using the Borg rating of perceived exertion after 5 minutes of treadmill walking at 1.5 miles per hour. Functional assessments included usual and fast gait speed, the Health, Aging and Body Composition physical performance battery and reported walking ability. Simonsick (2016) found that meaningful decline was defined as 0.05 meters/second per year for usual gait speed, 0.07 meters/second per year for fast gait speed. The results of this research shows that over a mean 2.1 years, 20–31 percent of older adults declined across functional assessments. Perceived and performance fatigability was associated with a 13–19 percent greater likelihood of meaningful decline in all measures per 1-unit RPE increase. After considering tiredness and energy level separately, findings were essentially unchanged, and neither was associated with gait speed or physical performance decline. In contrast, each separately predicted decline in reported walking

ability independent of fatigability. Simonsick (2016) concluded that routine assessment of perceived and performance fatigability may help identify older adults vulnerable to greater-than expected functional decline.

Richardson (2015) looked at 36 adults who were between 70-89 years old and were separated into slow or fast walking groups based on 400 m median gate speed. They measured performance fatigability by VO2 peak and VO2 in a treadmill test walking 5 minutes at 0.72 meters/second. They assessed perceived fatigability by the Situational Fatigue Scale and the Borg rating of perceived exertion. Preferred gait speed was 1.34 meters/second for fast walker and 1.05 meters/second for slow walkers. During the standard paced treadmill test the slow walkers used a higher percent of VO2 peak compared to slow walkers. At preferred walking pace the slower walking groups used more energy for the distance walked, rated the test at higher levels on the Borg rating of perceived exertion chart, and greater overall fatigue on the Situational Fatigability Scale. Slower walking is associated with reduced aerobic capacity, greater energetic cost, and greater performance fatigability in older adults (Richardson, 2015).

Simonsick (2014) evaluated the criterion validity of two measures of fatigability defined as performance deterioration or perceived effort to perform a standardized task. This research was cross sectional analysis from the Baltimore Longitudinal Study of Aging that included 605 older adults ages 65 to 97 years old. Performance fatigability was assessed using completion status and lap times from a 400-m walk performed “as quickly as possible” and perceived exertion rating using the Borg scale rating of perceived exertion chart after 5 minutes of treadmill walking at 1.5 miles per hour (0.67 meters/second). Perceived Fatigability measures included self-report of tiredness, level of weakness and energy in past month, and walking ability and objective measures of usual and fast gait speed, time to complete 10 chair stands, and grip strength. Simonsick (2014)

found that 23 percent exhibited performance deterioration (slowed or stopped) during the 400-m walk, and one-third reported more than very light exertion after a 5-minute slow walk. Slowing was strongly associated with self-reported fatigue and walking ability. High perceived exertion was associated with tiredness, weakness, as well as reported and observed mobility deficits. The conclusion showed in seemingly healthy and motivated individuals, that fatigue and perceived fatigability were common and may affect socially meaningful mobility behaviors. Assessment of perceived fatigability in well-older adult examinations may help identify threats to independent functioning earlier in the decline.

2.4 Perceived Fatigability in Older Adults

Eldadah (2010) wanted to evaluate fatigue which is believed to be a common complaint among older adults and in a survey of 754 nondisabled adults over 70 years old the primary reason for restricting activity was 'fatigue'. In this study fatigue doubled the next most common complaint for restricting activity which was pain or stiffness. Tiredness was a strong predictor of hospitalization and need for home care, institutionalization functional disability, or death in the years following the study. Eldadah (2010) found that perceived fatigability may be measured by combining self-report measures of fatigue with performance of physical or cognitive activities, provided that the work of the activity is known or can be standardized. Increased perceived and performance fatigability with aging may arise from a variety of factors including age-related changes in energy production or utilization, and inflammatory mechanisms. Eldadah (2010) reports that fatigue may represent a physiological warning sign which is the bodies warning signal representing underlying disease or chronic conditions.

2.5 Performance Fatigability in Older Adults

Murphy (2010) studied 40 older adults with knee or hip osteoarthritis and 20 healthy controls. Fatigue was measured by ecological momentary assessment several times a day along with continuous measurement of physical activity using a wrist-worn accelerometer. Performance fatigability was measured as the fatigue increase after a period of high activity. Compared with the healthy controls, the osteoarthritis participants were more likely to have more fatigue. Reported fatigue was most strongly associated with reported physical function, pain, and vitality, whereas performance fatigability was most strongly associated with body mass index, osteoarthritis severity, and knee strength. It is estimated that 34 percent of older adults are affected by osteoarthritis and this study shows that having this condition may increase the biomechanical demands of activities of daily living. Measuring performance fatigability may help discern how symptoms are related to activities of daily living in older adults.

2.6 Validated Measurement of Fatigability in Older Adults

Glynn (2015) research looked at evaluation and measurement tools for fatigability. The work described the development of the Pittsburgh Fatigability Scale and established its reliability, concurrent, and convergent validity against performance measures. This study was cross sectional and included 483 older adults ages 60 and over from the Baltimore Longitudinal Study of Aging. This scale was developed to measure Baltimore Longitudinal Study of Aging participants self-administered initial 26-item perceived fatigability scale. Baltimore Longitudinal Study of Aging participants also completed measures of performance fatigability which included perceived

exertion from a standard treadmill task and performance deterioration from a fast-paced long-distance corridor walk, a 6-minute usual-paced corridor walk, and five timed chair stands. Glynn (2015) found that principal components analysis with varimax rotation reduced the 26-item scale to the 10-item Pittsburgh Fatigability Scale. The Pittsburgh Fatigability Scale showed strong internal consistency and excellent test–retest reliability. In the validation sample, Pittsburgh Fatigability Scale scores, adjusted for age, sex, and race, were greater for those with high performance fatigability, slow gait speed, worse physical function, and lower fitness, with differences between high and low fatigability ranging from 3.2 to 5.1 points. This research concluded that the 10-item Pittsburgh Fatigability Scale physical fatigability score is a valid and reliable measure of perceived fatigability in older adults and can serve as an adjunct to performance-based fatigability measures for identifying older adults at risk of mobility limitation in clinical and research settings.

Simonsick (2018) looked at further validation of the Pittsburgh Fatigability scale. This research looked at 579 mobility intact older adults ages 60-89 enrolled in the Baltimore Longitudinal Study of Aging. It followed patients with concurrent Pittsburgh Fatigability Scale scores and had follow up performance and functional assessments within 1-4 years. Simonsick (2018) showed that 20.5 percent-37.7 percent of participants had experienced meaningful decline in performance fatigability assessments which they defined as reduction of 0.5 meters/second in gait speed. This research shows that scores in the Pittsburgh Fatigability Scores were consistently associated with greater decline in performance fatigability measures including usual gait speed, chair pace, and reported walking ability. Simonsick (2018) also showed how the Pittsburgh Fatigability Scores were superior to fatigue symptoms alone such as tiredness and energy level in predicting performance decline. Routine administration of the Pittsburgh Fatigability Scale on

individuals at risk for mobility decline may help identify older adults who become vulnerable to functional decline.

Carlozzi (2019) looked at further validating the Pittsburgh Fatigability scale in patients affected by multiple sclerosis, fibromyalgia, and healthy adults. 215 participants completed the Pittsburgh Fatigability Scale and other self-report measures. This validation research shown that the Pittsburgh Fatigability Scale was able to distinguish between healthy participants and those affected by chronic conditions such as multiple sclerosis and fibromyalgia. Carlozzi (2019) demonstrated that the Pittsburgh Fatigability Scale had reliability and validity and supports the clinical usage of this tool in patients at high risk for fatigue.

2.7 Performance Assessments for Measuring fatigability

Simonsick (2001) looked at The Health ABC Long Distance Corridor Walk which was designed to extend the testing range of self-paced walking tests of fitness for older adults by including a warm-up and timing performance over 400 meters. This study compares performance on the Long-Distance Corridor Walk and 6-minute walk to determine whether the Long-Distance Corridor Walk encourages greater participant effort. Simonsick (2001) evaluated subjects who were administered the Long-Distance Corridor Walk and 6-minute walk during a single visit. Test order alternated between subjects, and a 15-minute rest was given between tests. The Long-Distance Corridor Walk, consisting of a 2-minute warm-up walk followed by a 400-meter walk and a 6-minute walk test were administered using a 20-meter long course in an unobstructed hallway. Heart rate and blood pressure were recorded at rest, and after all walks. Simonsick (2001) found all 20 subjects walked a faster pace over 400 meters than for 6 minutes, in which the mean

distance covered was 402 meters. Walking speed was faster and ending heart rate and systolic blood pressure were greater for the 400-meter walk than for the 6-minute walk. Results were independent of test order and subject fitness level. The conclusion was that providing a warm-up walk and using a target distance instead of time encouraged subjects to work closer to their maximum capacity. This low-cost alternative to treadmill testing can be used in research and clinical settings to assess fitness and help identify early functional decline in older adults.

Simonsick (2006) researched criterion validity of the 400- m walk component of the Long-Distance Corridor Walk and develop equations for estimating peak oxygen consumption from 400-m time and factors intrinsic to test performance including heart rate and systolic blood pressure response in older adults. This study was a cross-sectional validation study which included 102 older adults ages 60-91 years old. The long-distance corridor walk consisted of a 2-minute walk followed immediately by a 400-m walk ‘‘done as quickly as possible’’ over a 20-m course administered the day after maximal treadmill testing. Heart rate, systolic blood pressure, activity level, perceived effort, and stride length were measured. The results of this study were VO2 peak ranged from 12.2 to 31.1 mL oxygen/kg per minute, and 400-m time ranged from 2 minutes 52 seconds to 6 minutes 18 seconds. Correlation between 400-m time and peak VO2 was 0.79. The conclusion of this research by Simonsick (2006) shown that a 400-m walk performed as part of the long-distance corridor walk provides a valid estimate of VO2 peak in older adults.

2.8 VA Setting

Veterans Affair Pittsburgh Health System (VAPHS) is a large government run hospital and health care systems for United States Veterans of all military branches. Pittsburgh VAPHS serves Veterans healthcare needs throughout the tri-state area of western Pa, West Virginia, and eastern Ohio. Pittsburgh VAPHS serves all healthcare needs of veterans including liver and renal transplant centers, a regional cardiac surgery center, a bariatric referral center, an oncology referral center, dialysis center, and in the last few years has opened an outpatient cardiac rehabilitation clinic and the Gerofit health promotion program. Clinical exercise physiologists working in Gerofit health promotion program are tasked with utilizing scientific literature to implement and supervise exercise therapy, and modifiable risk factor modification that is shown to have a clinical benefit to patients. Clinical exercise physiologists in the Gerofit health promotion program are tasked with assessing physical activity limitations, how much stress or anxiety they currently have, and all comorbidities that can influence their health status. Veterans have increased comorbidities compared to the general population, and this increase is associated with worse health outcomes in addition to increased health costs. Management of comorbidities becomes an area where healthcare costs and health outcomes can be enhanced. Clinical exercise physiologist in the Gerofit health promotion program then are assigned with managing the underlying comorbidities and health conditions from knowledge of disease, healthy eating, stress management, and exercise self-efficacy.

A typical day for the Gerofit health promotion program participants starts with the blood pressure checks after 3-4 minutes of rest in a seated position. Structured group classes including strength, balance, and flexibility are next after participants warm-up, and the group classes end with stretching and cool downs. After the group classes the area opens to a typical gym setting

with usage of the machines and equipment at the patient's preference with cardiovascular equipment including treadmills, nu-steps, arm-ergometers, stationary bikes, and dumbbells. The participants are monitored throughout their session to ensure safe exercise is accomplished. Participants exercise level is progressed as tolerated with a goal of increasing time and intensity. Functional assessments are completed every three months for the first year and yearly after and include six-minute walk test, gait speed, upper and lower extremity strength, balance, and agility tests.

The National Gerofit health promotion program for older adults aligns patients with the American College of Sports Medicine exercise guidelines for each component of fitness. All sites program participants in cardiovascular training, strength training, balance training, and functional training. Each participants is assessed at baseline and follow up using standardized validated functional tests used to assess gait speed with the 10 meter walk test, cardiovascular fitness with the 6 minute walk test, lower body strength with the timed sit to stand test, balance and mobility with the timed up go and tandem stand, SF-36 (Physical subscale),global health scale, and comorbidities (Appendix E).

3.0 Methods

3.1 Inquiry Questions:

The inquiry questions that guided this study were:

1. What was the perceived level of fatigability amongst older adult veterans?
2. What was the performance level of fatigability amongst older adult veterans?
3. What was the relationship between older adult veterans perceived and performance fatigability?

3.2 Inquiry Design

This inquiry was a needs assessment of Veterans participating in the Pittsburgh Gerofit health promotion program assessing level perceived and performance fatigability in older adult veterans.

3.3 Inquiry Setting

Gerofit health promotion program is an established, evidence-based exercise and health promotion program for older Veterans at high risk for institutionalization by physical limitations that are modifiable with exercise intervention. The Gerofit health promotion program began in

Durham, North Carolina in 1986 and has expanded to 15 VA sites nationally. Pittsburgh Gerofit participants are 70.5 years old on average when entering this program, mostly male at 92.4 percent, and mostly Caucasian at 67.4 percent. Majority of Veterans entering the program are marginalized and of lower socio-economic status, many experience mental health disorders, substance use disorders, post-traumatic stress, and commit suicide at a rate higher compared to their civilian counterparts. This vulnerable marginalized population of Veterans typically rate their quality of life lower and have higher rates of mortality compared to their civilian counterparts. The Gerofit program is a new program that patches together a lot of old equipment and lack of space to make a health promotion program work. Currently the Gerofit program is using a modified temporary space that is approximately 1/3 the size needed for group exercise classes and open gym exercise class space. One of the recent issues that the Gerofit participant faced, to most accurately describe the space the Veterans who enroll, was window replacement. Windows were replaced because the old ones were so dirty you could barely see out of them but only a portion of the windows were actually replaced because the government ran out of money to complete the job. There is currently a mix of windows that are brand new and windows that cannot be cleaned because the filth is on the inside of the window in the same room, yet the expectation is to make health promotion program changes to improve health status.

Gerofit health promotion program aligns patients with the American College of Sports Medicine evidence-based exercise guidelines for each component of fitness. Patients participate in cardiovascular training, strength training, balance training, and functional training. Exercises are individually tailored to functional impairments and patient directed goals, with no time limit on duration of participation. A multi-disciplinary team assesses each participant at intake using standardized validated functional tests used to assess gait speed, cardiovascular fitness, upper and

lower body strength, balance and mobility. From the results of this assessment, the patients' exercise prescription is created. Patients are monitored and reassessed at regular intervals (3, 6, 12 months, and then annually) (Appendix E Complete Gerofit health promotion program Assessment). The average participation rate for the Gerofit Health promotion program is 6 months, which aligns with other dropout rates researched in health promotion programs Rivera-Torres (2019). Adjustments to the exercise prescription are progressive as appropriate. Primary care providers are kept informed of progress via the electronic medical record where results of assessments are documented. Gerofit health promotion program participants have achieved significant improvements in functional measures, reduction in cardiovascular risk factors, improved well-being and satisfaction with care. Compared to non-adherers, long-term participants experienced a five-year delay of decline in physical performance and a 25 percent lower mortality rate. The Gerofit program has no end point for the veterans enrolled and they follow an annual re-assessment schedule after their first year in the program. The primary investigator of this inquiry is a without compensation employee at VA Pittsburgh, and working as the Gerofit program manager in addition to the cardiac rehabilitation department.

Gerofit health promotion program does have exclusion criteria which include the following: unable to perform activities of daily living, cognitive impairment; unable to function independently without assistance, unstable angina, proliferative diabetic retinopathy, oxygen dependent, unwilling to commute and/or not able to provide own transportation to Gerofit, volatile behavioral issues or unable to work successfully in a group environment/setting, incontinence, open wounds, active substance abuse or homelessness, and participants must get medical clearance from their primary care physician.

3.4 Participants

The work was proposed as 50 subjects who were older adult veterans that were participating in or will newly enroll in the Gerofit health promotion program. 39 subjects were eligible looking at the inclusion and exclusion criteria and 16 consented. The average Veteran participating in the Gerofit health promotion program served in the Vietnam era, and is more likely to be male based on demographic data collected. During the Vietnam era there were far less women serving than men, and women only served in non-combat roles during that time. Out of the 16 participants who consented only 1 was female. Veterans enter the Gerofit health promotion program via a consult from their primary care provider. All Veterans age 65 and over who meet eligibility criteria are invited to participate in the program and can continue to participate if the facility provides Gerofit health promotion program services. Implementation models are based on the Durham Gerofit health promotion program, the gold standard in facility-based exercise interventions. For Veterans living outside an easy commute to a facility-based program, whether rural or urban, each facility-based Gerofit health promotion program devotes effort towards development and testing outreach programs.

3.5 Instrument

The first instrument used was the 10-meter walk test (Appendix A). This test measured gait speed and is measured in meters per second. Two 10-meter walk tests were completed with best score utilized at normal walking pace. Studenski (2011) looked at gait speed and survival rate in

older adults. This research looked at the relationship between gait speed and survival in older adults. Studenski (2011) looked at 9 cohort studies completed between 1986 and 2000 using available date from 34485 community dwelling older adults over the ages of 65 that were followed between 6 and 21 years. Survival rate and life expectancy was measured. Lower gait speed was associated with higher risks of morbidity and mortality. Each .1 meter per second increase or decrease, respectively, was associated with an increase or decrease in morbidity and mortality in older adults. In the Gerofit Program Gait speed is categorized into 'extremely fit' which is greater than or equal to 1.3 m/s and at risk which is 1.29 m/s and below which is based of work in older adults by Van Kan (2009). Gait speed cut points exist between .8 m/s and 1.29 m/s for healthy older adults and more at risk older adults but the previous cut points mentioned are part of the Gerofit program standard. Gait speed assessments are commonly used in geriatric research settings.

The second instrument used was The Six Minute Walk Test (Appendix B). The Six Minute Walk Test was a measure of endurance when patients are asked to walk as many yards as they can in six minutes. Crapo (2002) shown how the six-minute walk test provides information that may be a better index of the patient's ability to perform daily activities than is peak oxygen uptake, and correlates better with formal measures of quality-of-life measures. The six-minute walk test is most commonly used in clinical settings to assess the severity of heart or lung disease. In the Gerofit health promotion program the six-minute walk test is utilized to assess functional status and as a measure of morbidity and mortality. Changes in six-minute walk distance after therapeutic interventions correlate with subjective improvement in dyspnea. The six-minute walking distance outcomes percentages are based on work by Rikli (1999) and functional fitness normative scores for older adults which is used as the Gerofit program standard. The Six Minute Walk Test is

commonly used in clinical, research, and outpatient setting where advanced equipment for maximal stress testing may not be available.

The third instrument used was the Global Health Scale Question #9 (Appendix C). The PROMIS fatigue item banks assess a range of self-reported symptoms, from mild subjective feelings of tiredness to an overwhelming, debilitating, and sustained sense of exhaustion that likely decreases one's ability to execute daily activities and function normally in family or social roles. Fatigue is divided into the experience of fatigue (frequency, duration, and intensity) and the impact of fatigue on physical, mental, and social activities. The fatigue short forms are universal rather than disease-specific. All assessed fatigue over the past seven days. Promis Global Health Scale Question #9 is scored on a 1-5 scale corresponding to 1 Very Severe, 2. Severe, 3. Moderate, 4. Mild, and 5. None.

The fourth Instrument used was the Pittsburgh Fatigability Scale (Appendix D). The Pittsburgh Fatigability Scale measured mental and physical fatigability. The Pittsburgh Fatigability Scale is a self-administered, 1-page assessment of expected physical and mental fatigue with a score ranging from 0 (no) to 5 (extreme) associated with performing 10 activities scored (0–50), with higher scores associated with clinically meaningful decline in usual and fast gait speed, chair stand pace, and reported walking ability. Physical and mental fatigability are scored separately from 0-50 with higher scores indicating more mental or physical fatigability. The work described the development of the Pittsburgh Fatigability Scale and establish its reliability and concurrent and convergent validity against performance measures. This study was cross sectional and included 483 older adults ages 60 and over from the Baltimore Longitudinal Study of Aging. This scale was developed to measure Baltimore Longitudinal Study of Aging participants self-administered initial 26-item perceived fatigability scale. Baltimore Longitudinal

Study of Aging participants also completed measures of performance fatigability which include perceived exertion from a standard treadmill task and performance deterioration from a fast-paced long-distance corridor walk, a 6-minute usual-paced corridor walk, and five timed chair stands. Glynn (2015) found that principal components analysis with varimax rotation reduced the 26-item scale to the 10-item Pittsburgh Fatigability Scale. The Pittsburgh Fatigability Scale showed strong internal consistency and excellent test–retest reliability. In the validation sample, Pittsburgh Fatigability Scale scores, adjusted for age, sex, and race, were greater for those with high performance fatigability, slow gait speed, worse physical function, and lower fitness, with differences between high and low fatigability ranging from 3.2 to 5.1 points. This research concluded that the 10-item Pittsburgh Fatigability Scale physical fatigability score is a valid and reliable measure of perceived fatigability in older adults and can serve as an adjunct to performance-based fatigability measures for identifying older adults at risk of mobility limitation in clinical and research settings. The Pittsburgh Fatigability Scale is used in geriatric research settings.

3.6 Data Collection

As part of the Gerofit health promotion program functional outcome baseline data was collected and the Pittsburgh Fatigability Scale (Appendix E page 58) was added. Data collection was initiated on November 1, 2020. Gerofit health program participants who completed a functional assessment on or after September 1, 2019 will be contacted and asked to fill out the Pittsburgh Fatigability Scale. Data collection ceased on February 1, 2021 with 16 Gerofit

participants consenting who had a functional assessment and completed the Pittsburgh Fatigability Scale. Patients participated in cardiovascular training, strength training, balance training, and functional training. A multi-disciplinary team assessed each participant at intake using standardized validated functional tests used to assess gait speed with the 10-meter walk test, cardiovascular fitness with the 6-minute walk test, lower body strength with the timed sit to stand test, balance and mobility with the timed up and go and tandem stand. The Gerofit health promotion program patients are monitored and reassessed at regular intervals 3, 6, and 12 months, then annually for all the above tests. In this needs assessment outcome measures were assessed in gait speed, six-minute walk distance, Global Health Scale, and Pittsburgh Fatigability Scale. Several outcome measures were obtained but will be excluded including side by side, semi-tandem stand, and tandem stand, bicep arm curl, chair stand, timed up and go, SF 36 (Subscale Physical Function), and Co-morbidity index.

3.7 Data Analysis

Data obtained from the current Gerofit health promotion program for older adults was analyzed looking at the central tendencies with measures including ten-meter walk test (gait speed), six-minute walk test, global health scale question #9, Pittsburgh Fatigability Index, age, gender, race, and body mass index. All participants were assigned unique ID numbers and de-identified. All patient identifiable information was separated and de-identified and exported into excel software. The data was checked for errors and cleaned for accuracy. As data continues to be collected in this work future analysis might include using T-test correlations to compare perceived

and performance fatigability. Data analysis of descriptive statistics in demographic variables such as age, gender, race, body mass index were used for further group comparisons.

4.0 Findings

4.1 Outcomes

To qualify for this quality improvement project, participants must have been: a) enrolled in the Gerofit Health and Wellness program; b) Veteran's age 65 years of age and older and were referred by their Pittsburgh VA primary care provider; medically stable and able to function independently in a group setting; Further, participants must have had a recent standard functional Gerofit assessment which included the 1) six-minute walk test, 2) gait speed, 3) and the Global Health Question #9. The Gerofit Health and Wellness program included the following exclusion criteria: a) Unable to perform ADLs; b) Unstable angina; c) Proliferative diabetic retinopathy; d) Open wounds; e) Incontinence; f) Active substance abuse or current homelessness; g) Unwillingness to commute and/or not able to obtain own transportation to Gerofit; h) Cognitive impairment with a related inability to function without assistance; i) Volatile behavioral issues or unable to work successfully in a group environment/setting; and j) Resides outside of a 30 mile radius.

There were 39 participants who were eligible to participate in the study after applying the inclusion and exclusion criteria. All 39 participants were contacted and 16 participants consented, completed the Pittsburgh Fatigability Scale, and the requisite Gerofit standard functional assessment. The 16 participants demographic characteristics are included in Table 1. The participants were 94 percent men and 6 percent women. Since the sample size included only 1 female, the data was analyzed based upon Race/Ethnicity and BMI. Because of the small sample size age was not used as a factor for analysis in this work. The mean age of the sample was 73.75

years with a range of 66-88 and a standard deviation of 5.5 years. The demographics collected in this work are very similar to the overall makeup of the Gerofit program participants where mean age was 70.5 when entering this program, and mostly male at 92.4 percent. The race/ethnicity distribution included 56 percent who identified as White and 44 percent as Black or African American. The demographics collected in this work are very similar to the overall makeup of the Gerofit program participants were more likely to be White at 67.4 percent.

The BMI of the participants was as follows: 19 percent normal weight, 31 percent overweight, and 50 percent obese (Table 1). By Race/ethnicity group, 44 percent of Whites and 29 percent of Black or African Americans were normal weight or overweight and 56 percent of Whites and 71 percent of Black or African Americans were obese (Table 1). Upon further analysis, the data showed most of the group is overweight or obese, at 81 percent (Table 1) .

Table 1 Sample Demographics by Characteristics

Table 1 Sample Demographic Characteristics N=16	
Gender	
Male	15 (94%)
Female	1 (6%)
Race/Ethnicity	
White	9 (56%)
Black or African American	7 (44%)
BMI	
Normal Weight 18.5-24.9	2 (19%)
Overweight 25.0-29.9	4 (31%)
Obese ≥30.0	10 (50%)

Table 2 BMI by Race

Table 2 BMI by Race N=16			
Race	**Normal Weight BMI 18.5-24.9**	**Overweight 25.0-29.9**	**Obese BMI 30.0- and above**
White (n=9)	1	3	5
Black or African American (n=7)	1	1	5

The 16 participant's functional assessments included six-minute walk tests and gait speed (Tables 3, and 4). The six-minute walk test mean distance was 436.3 yards (σ= 96.6 yards)(Table 3). This group scored from the lowest 5th quartile to 60th quartile. Eighty Two percent of the participants scored at or below the 25th quartile, and 19 percent scored at the 26th quartile or greater. Eighty-nine percent of Whites and 71 percent of Black or African Americans scored in the lowest 25th quartile, while 11 percent of Whites and 29 percent of Black or African Americans scored in the 26th quartile or higher. Both Black or African Americans at 71 percent and Whites at 89 percent ranked in the lowest 25th quartile.

Table 3 Six-Minute Walk Test by Race

Table 3 Six Minute Walk Test Mean Distance by Race (N=16)			
Race	**Six Minute Walk Test Mean Distance**	**Six Minute Walk Test Distance lowest 25th Percentile**	**Six Minute Walk Test Distance 26th Percentile and Higher**
Total sample N=16	$\bar{X}$ = 436.3 yards (153 – 584 yards) N= 16 (σ= 96.6 yards)	$\bar{X}$ = 414.7 yards (153 – 487 yards) N= 13 (σ= 94.4 yards)	$\bar{X}$ = 530 yards (423 – 584 yards) N= 3 (σ= 96.6 yards)
White N=9	$\bar{X}$ = 395 yards (153 – 487 yards) N= 9 (σ= 98.6 yards)	$\bar{X}$ = 392 yards (153 – 487 yards) N= 8 (σ= 104.9 yards)	$\bar{X}$ = 423 yards (423 yards) N= 1 (σ= 0 yards)

Black or African American N=7	$\bar{X}$ = 489.4 yards (153 – 487 yards) N= 7 (σ= 67.2 yards)	$\bar{X}$ = 451.8 yards (421 – 487 yards) N= 5 (σ= 57.8 yards)	$\bar{X}$ = 583.5 yards (583 – 584 yards) N= 2 (σ= 0.7 yards)

The mean gait speed for the sample was 1.29 meters per second (σ= 0.28 m/s) (Table 4). The group results in gait speed are more likely at 63 percent to be in the lowest risk category that is related to lower risk of death, hospitalization, institutionalization, and falls based on previous work by Studenski (2011). Consequently, the group's outcomes of 38 percent in the highest risk category that is related to higher risk of death, hospitalization, institutionalization, and falls based on previous work by Studenski (2011). By Race, 56 percent of Whites and 14 percent of Black or African Americans scored in the at-risk category for gait speed, and 44 percent of Whites and 86 percent of Black or African Americans scored in the extremely fit category. Eighty-six percent of Black or African Americans were far more likely to score in the extremely fit category compared to Whites at 56 percent. The group average gait speed ranks high in the extremely fit category.

Table 4 Gait Speed by Race

Table 4 Gait Speed by Race N=16			
Race	**Mean Gait Speed**	**Mean Gait Speed: at-Risk**	**Mean Gait Speed: Extremely Fit**
Total sample N=16	$\bar{X}$ = 1.29 m/s (.7 – 1.6 m/s) N= 16 (σ= 0.28 m/s)	$\bar{X}$ = 1.01 m/s (.7 – 1.28 m/s) N= 6 (σ= 0.24 m/s)	$\bar{X}$ = 1.46 m/s (1.3 – 1.6 m/s) N= 10 (σ= 0.11 m/s)
White N=9	$\bar{X}$ = 1.16 m/s (.7 – 1.5 m/s) N= 9 (σ= 0.3 m/s)	$\bar{X}$ = 0.96 m/s (.7 – 1.2 m/s) N= 5 (σ= 0.24 m/s)	$\bar{X}$ = 1.41 m/s (1.2 – 1.6 m/s) N= 4 (σ= 0.11 m/s)
Black or African American N=7	$\bar{X}$ = 1.45 m/s (1.2 – 1.6 m/s) N= 7 (σ= 0.14 m/s)	$\bar{X}$ = 1.2 m/s (1.2 m/s) N= 1 (σ= 0 m/s)	$\bar{X}$ = 1.49 m/s (1.3 – 1.6 m/s) N= 6 (σ= 0.10 m/s)

The 16 participants' fatigue and fatigability outcomes are included in Tables 5, 6, and 4.7. The responses of the group on Promis Global Health Scale Question #9 had the following outcomes: Overall, there was a mean score of 3.9 (σ= 0.81)(Table 5). No participants indicated fatigue that was severe or very severe, with most of the group at 63 percent scoring 'mild' or less related to their fatigue. By Race, both Black or African Americans at 57 percent and Whites at 67 percent rank 'mild' or less related to their fatigue score. These results indicate that the entire group (Table 5) average of 63 percent leans towards less fatigue by the Promis Global Health Question #9. White participants are slightly more likely to have 'mild' or no fatigue compared to their Black or African American counterparts (Table 5).

Table 5 Promis Global Health Question #9 by Race

Table 5 Promis Global Health Question #9 by Race N=16			
Race	**Mean Global Health: Total Score**	**Mean Global Health: Mild or less**	**Mean Global Health: moderate or greater**
Total Sample N=16	$\bar{X}$ = 3.9 (3-5) N= 16 (σ= 0.81)	$\bar{X}$ = 4.4 (4-5) N= 10 (σ= 0.5)	$\bar{X}$ = 3 (3) N= 6 (σ= 0)
White N=9	$\bar{X}$ = 4 (3-5) N= 9 (σ= 0.87)	$\bar{X}$ = 4.5 (4-5) N=6 (σ= 0.5)	$\bar{X}$ = 3 (3) N= 3 (σ= 0)
Black or African American N=7	$\bar{X}$ = 3.7 (3-5) N= 7 (σ= 0.76)	$\bar{X}$ = 4.25 (4-5) N= 4 (σ= 0.5)	$\bar{X}$ = 3 (3) N= 3 (σ= 0)

The results of the Pittsburgh Fatigability Scale are included Table 6 and Table 7. The mean perceived physical fatigability (PFS Physical score) was 23.3 (σ= 6.56)(Table 6). Fifty-six percent of participants scored in the most severe, 38 percent in the moderately severe, and 6 percent in the least severe category of PFS Physical scores. PFS Physical scores ranged from the lowest score of

9, and highest score of 32. The mean perceived PFS Mental scores was 18.9 (σ= 8.07) (Table 7). Fifty-six percent of participants scored in the most severe, 25 percent in the moderately severe, and 19 percent in the least severe category of PFS Mental scores. PFS Mental scores ranged from the lowest score of 1, and highest score of 27. Results of PFS Physical scores by Race are also included in Table 6. Fifty-six percent of Whites scored in the most severe, 44 percent moderately severe, and 0 percent in the least severe. Fifty-seven percent of Black or African Americans scored in the most severe, 29 percent moderately severe, and 14 percent in the least severe of PFS Physical scores. Results of PFS Mental scores by Race are also included in Table 7. Fifty-six percent of participants scored in the most severe, 25 percent moderately severe, and 19 percent in the least severe. Sixty-seven percent of whites scored in the most severe, 22 percent scored moderately severe, and 11 percent scored in the least severe category of PFS Physical scores. Forty-three percent of Black or African Americans scored in the most severe, 29 percent moderately severe, and 29 percent scored in the least severe category of PFS Mental scores.

Table 6 PFS Physical Scores Race

Table 6 PFS Physical Scores by Total group and Race (N=16)				
Race	**Physical Fatigability**	**Less Physical Fatigability <=14 or less**	**Moderate Physical Fatigability >=15 and <=24**	**Most Severe Physical Fatigability >= 25 or greater**
Total Sample N=16	$\bar{X}$ = 23.3 (9-32) N= 16 (σ= 6.56)	$\bar{X}$ = 9.0 (9) N= 1 (σ= 0)	$\bar{X}$ = 18.5 (15-23) N= 6 (σ= 2.9)	$\bar{X}$ = 28.1 (25-32) N= 9 (σ= 2.6)
White N=9	$\bar{X}$ = 23.4 (15-31) N= 9 (σ= 5.64)	N= 0 (σ= 0)	$\bar{X}$ = 18.0 (15-20) N= 4 (σ= 2.2)	$\bar{X}$ = 27.8 (25-31) N= 5 (σ= 2.6)
Black or African American N=7	$\bar{X}$ = 23.1 (9-32) N= 7 (σ= 8.07)	$\bar{X}$ = 9 (9) N= 1 (σ= 0)	$\bar{X}$ = 16 (16-23) N= 2 (σ= 4.9)	$\bar{X}$ = 28.5 (25-32) N= 4 (σ= 2.9)

Table 7 PFS Mental Scores by Race

Table 7 PFS Mental Scores by Total Group and Race (N=16)				
Race	**Mental Fatigability**	**Less Mental Fatigability <=12 or less**	**Moderate Mental Fatigability >=13 and <=19**	**Most Severe Mental Fatigability >= 20 or greater**
Total Sample N=16	$\bar{X}$ = 18.9 (1-28) N= 16 (σ= 8.07)	$\bar{X}$ = 6.0 (1-10) N= 3 (σ= 4.58)	$\bar{X}$ = 18.0 (18-19) N= 4 (σ=0.82)	$\bar{X}$ = 23.6 (20-28) N= 9 (σ=2.79)
White N=9	$\bar{X}$ = 20.8 (10-28) N= 9 (σ= 5.31)	$\bar{X}$ = 10.0 (10) N= 1 (σ= 0)	$\bar{X}$ = 17.5 (17-18) N= 2 (σ=.07)	$\bar{X}$ = 23.7 (20-28) N= 6 (σ=2.73)
Black or African American N=7	$\bar{X}$ = 16.4 (1-27) N= 7 (σ= 9.16)	$\bar{X}$ = 4 (1-7) N= 2 (σ= 4.24)	$\bar{X}$ = 18.5 (18-19) N= 2 (σ= 0.71)	$\bar{X}$ = 23.3 (20-27) N= 3 (σ= 3.51)

The 16 participants' functional assessments were next compared to outcomes in relation to BMI for six-minute walk test and gait speed (Tables 8, and 9). Mean six-minute walk distance for the total group was 436.3 yards (σ=96.6 yards). The six-minute walking distance outcomes percentages are based on work by Rikli (1999) and functional fitness normative scores for older adults which is used as the Gerofit program standard. This group scored from the lowest 5th quartile to 60th quartile. Eighty-Two percent of the participants scored at or below the 25th quartile, and 19 percent scored at the 26th quartile or greater. One-Hundred percent of normal weight, 100 percent of overweight, and 67 percent of obese of the participants scores in the lowed 25th quartile, while 0 percent of normal weight, 0 percent of overweight, and 33 percent of obese of the participants scores in the 26th quartile or higher.

Table 8 Six-Minute Walk Distance by BMI

Table 8 Six Minute Walk Distance by BMI N=16			
BMI	**Six Minute Walk Distance Group Mean**	**Six Minute Walk Distance lowest 25th Percentile**	**Six Minute Walk Distance 26th Percentile and Higher**
Total sample N=16	$\bar{X}$ = 436.3 yards (153 – 584 yards) N= 16 (σ=96.6 yards)	$\bar{X}$ = 414.7 yards (153 – 487 yards) N= 13 (σ=94.4 yards)	$\bar{X}$ = 530 yards (423 – 584 yards) N= 3 (σ=96.6 yards)
Normal Weight N= 2	$\bar{X}$ = 472 yards (427 – 429 yards) N= 2 (σ=21.21 yards)	$\bar{X}$ = 472 yards (427 – 429 yards) N=2 (σ=21.21 yards)	$\bar{X}$ = N= 0 (σ=0 yards)
Overweight N= 5	$\bar{X}$ = 411.6 yards (346 – 429 yards) N=5 (σ=37.01 yards)	$\bar{X}$ = 411.6 yards (346 – 429 yards) N= 5 (σ=37.01 yards)	$\bar{X}$ = N= 0 (σ=0 yards)
Obese N= 9	$\bar{X}$ = 442.1 yards (153 – 584 yards) N= 9 (σ=126.61 yards)	$\bar{X}$ = 398.2 yards (153 – 487 yards) N= 6 (σ=123.54 yards)	$\bar{X}$ = 530 yards (423 – 584 yards) N= 3 (σ=92.67 yards)

The mean gait speed for the total group was 1.29 meters per second (σ=0.28 m/s) (Table 9). The group results in gait speed are more likely at 63 percent to be in the lowest risk category that is related to lower risk of death, hospitalization, institutionalization, and falls based on previous work by Studenski (2011). Consequently, the group's outcomes of 38 percent in the highest risk category that is related to higher risk of death, hospitalization, institutionalization, and falls based on previous work by Studenski (2011). By Race in relation to gait speed, the group's outcomes are 44 percent at risk, and 56 percent extremely fit category. By BMI, 0 percent of normal weight, 40 percent of overweight, and 56 percent of obese participants scored in the at-risk category for gait speed, and 100 percent of normal weight, 60 percent of overweight, and 44 percent of obese participants scored in the extremely fit category.

Table 9 Gait Speed by BMI

Table 9 Gait Speed by BMI N=16			
BMI	**Gait Speed Group Mean**	**Gait Speed at Risk**	**Gait Speed Extremely Fit**
Total sample N=16	$\bar{X}$ = 1.29 m/s (.7 – 1.6 m/s) N= 16 (σ=0.28 m/s)	$\bar{X}$ = 1.01 m/s (.7 – 1.28 m/s) N= 6 (σ=0.24 m/s)	$\bar{X}$ = 1.46 m/s (1.3 – 1.6 m/s) N= 10 (σ=0.11 m/s)
Normal Weight N= 2	$\bar{X}$ = 1.4 m/s (1.42 – 1.46 m/s) N= 2 (σ=0.2 m/s)	N= 0 (σ=0 m/s)	$\bar{X}$ = 1.4 m/s (1.42 – 1.46 m/s) N= 2 (σ=0.2 m/s)
Overweight N= 5	$\bar{X}$ = 1.3m/s (0.7 – 1.6 m/s) N= 5 (σ=0.2 m/s)	$\bar{X}$ = 1.0 m/s (.8 - 1.2 m/s) N= 2 (σ=0.3 m/s)	$\bar{X}$ = 1.5 m/s (1.4 – 1.6 m/s) N= 3 (σ=0.1 m/s)
Obese N= 9	$\bar{X}$ = 1.3 m/s (0.7 – 1.5 m/s) N= 9 (σ=0.3 m/s)	$\bar{X}$ = 1.2 m/s (.7 - 1.3 m/s) N= 5 (σ=0.3 m/s)	$\bar{X}$ = 1.5 m/s (1.3 – 1.6 m/s) N= 4 (σ=0.1 m/s)

Results for participants; fatigue and fatigability scores are included in tables 10, 11, and 12. The responses of the group on Promis Global Health Scale Question #9 had the following results: Overall, there was a mean score of 3.9(σ=0.81). No participants indicated fatigue that was severe or very severe, with most of the group at 63 percent scoring ‘mild’ or less related to their fatigue. When examining mean fatigue score by BMI categories, 0 percent of normal weight, 100 percent of overweight, and 56 percent of obese participants scored mild or less. One-Hundred percent of normal weight, 0 percent of overweight, and 44 percent of participants scored moderate or greater related to their fatigue score.

Table 10 Promis Global Health Question #9 by BMI

Table 10 Promis Global Health Question #9 by BMI N=16			
BMI	**Global Health Total Sample**	**Promis Global Health Mild or less**	**Promis Global Health moderate or greater**
Total Sample N=16	$\bar{X}$ = 3.9 (3-5) N= 16 (σ=0.81)	$\bar{X}$ = 4.4 (4-5) N= 10 (σ=0.5)	$\bar{X}$ = 3 (3) N= 6 (σ=0)
Normal Weight N= 2	$\bar{X}$ = 3 (3) N= 2 (σ=0)	N= 0 (σ=0)	$\bar{X}$ = 3 (3) N= 2 (σ=0)
Overweight N= 5	$\bar{X}$ = 4.5 (4-5) N= 5 (σ=0.5)	$\bar{X}$ = 4.5 (4-5) N= 5 (σ=0.5)	N= 0 (σ=0)
Obese N= 9	$\bar{X}$ = 3.8 (3-5) N= 9 (σ=0.5)	$\bar{X}$ = 4.4 (4-5) N= 5 (σ=0.5)	$\bar{X}$ = 3 (3) N= 4 (σ=0)

The results of the Pittsburgh Fatigability Scale are included Table 11 and Table 12. The mean PFS Physical scores was 23.3 (σ= 6.56)(Table 11). Fifty-six percent of participants scored in the most severe, 38 percent moderately severe, and 6 percent in the least severe. PFS Physical scores ranged from the lowest score of 9, and highest score of 32. The mean PFS Mental scores was 18.9 (σ= 8.07) (Table 12). Fifty-six percent of participants scored in the most severe, 25 percent moderately severe, and 19 percent in the least severe of PFS Mental scores. PFS Mental scores ranged from the lowest score of 1, and highest score of 27. Outcomes of Pittsburgh Fatigability Scale PFS Physical scores by BMI, 100 percent of normal weight scored in the most severe and 0 percent in the moderate or least severe category. Sixty percent of overweight scored in the most severe, and 40 percent moderately severe, and 0 percent in the least severe category of

PFS Physical scores. Forty-four percent of obese participants scored in the most severe, 44 percent moderately severe, and 11 percent in the least severe category of PFS Physical scores.

Outcomes of Pittsburgh Fatigability Scale PFS Mental scores by BMI, 0 percent of normal weight scored in the most severe, 100 percent moderately severe, and 0 percent in the least severe category of PFS Physical scores. Sixty percent of overweight scored in the most severe, and 20 percent moderately severe, and 20 percent in the least severe category of PFS Mental scores. Sixty-seven percent of obese participants scored in the most severe, 11 percent moderately severe, and 22 percent in the least severe category of PFS Mental scores.

Table 11 PFS Physical Scores by BMI

Table 11 PFS Physical Scores by BMI N=16				
BMI	**Physical Fatigability**	**Less Physical Fatigability <=14 or less**	**Moderate Physical Fatigability Score >=15 and <=24**	**Most Severe Physical Fatigability >= 25 or greater**
Total Sample N=16	$\bar{X}$ = 23.3 (9-32) N= 16 (σ= 6.56)	$\bar{X}$ = 9.0 (9) N= 1 (σ= 0)	$\bar{X}$ = 18.5 (15-23) N= 6 (σ= 2.9)	$\bar{X}$ = 28.1 (25-32) N= 9 (σ= 2.6)
Normal Weight N= 2	$\bar{X}$ = 9.0 (25-28) N= 2 (σ= 0)	N= 0 (σ= 0)	N= 0 (σ= 0)	$\bar{X}$ = 26.5 (25-28) N= 2 (σ= 0)
Overweight N= 5	$\bar{X}$ = 23.0 (15-29) N= 5 (σ= 6.56)	N= 0 (σ= 0)	$\bar{X}$ = 16.5 (15-18) N= 2 (σ= 2.1)	$\bar{X}$ = 27.3 (26-29) N= 3 (σ= 1.53)
Obese N= 9	$\bar{X}$ = 22.8 (9-32) N= 9 (σ= 6.56)	$\bar{X}$ = 9.0 (9) N= 1 (σ= 0)	$\bar{X}$ = 19.5 (16-23) N= 4 (σ= 2.9)	$\bar{X}$ = 29.5 (25-32) N= 4 (σ= 3.11)

Table 12 PFS Mental Scores by BMI

Table 12 Mental Fatigability by BMI N=16				
BMI	**Mental Fatigability**	**Less Mental Fatigability <=12 or less**	**Moderate Mental Fatigability Score >=13 and <=19**	**Most Severe Mental Fatigability >= 20 or greater**
Total Sample N=16	$\bar{X}$ = 18.9 (1-28) N= 16 (σ= 8.07)	$\bar{X}$ = 6.0 (1-10) N= 3 (σ= 4.58)	$\bar{X}$ = 18.0 (18-19) N= 4 (σ=0.82)	$\bar{X}$ = 23.6 (20-28) N= 9 (σ=2.79)
Normal Weight N= 2	$\bar{X}$ = 18.0 (17-19) N= 2 (σ= 8.07)	N= (σ= 0)	$\bar{X}$ = 18.0 (17-19) N= 2 (σ= 1.4)	N= 0 (σ= 0)
Overweight N= 5	$\bar{X}$ = 19.8 (20-25) N= 5 (σ= 8.07)	$\bar{X}$ = 10.0 (10) N= 1 (σ= 0)	$\bar{X}$ = 18.0 (18) N= 1 (σ= 0)	$\bar{X}$ = 23.7 (23-25) N= 3 (σ=1.15)
Obese N= 9	$\bar{X}$ = 18.6 (1-28) N= 9 (σ= 8.07)	$\bar{X}$ = 4 (1-7) N= 2 (σ= 4.2)	$\bar{X}$ = 18.0 (18) N= 1 (σ= 0)	$\bar{X}$ = 23.5 (20-28) N= 6 (σ= 3.45)

Overall, there was a mean score of 3.9 (σ=0.81) (Table 5, Table 10) for the Promis Global Health indicating for the group that the perceived level of fatigue at 63 percent was mild or none, with no participants indicating fatigue that was severe or very severe. Looking at the overall scores with the Promis Global health scales relating to Race (Table 5), 66 percent of Whites and 57 percent of Black or African Americans reported they had mild or no fatigue. Looking at the overall scores with the Promis Global health scales relating to BMI (Table 10) normal weight participants were more likely at 100 percent compared to overweight participants at 0 percent, and 44 percent of obese participants to have scores indicating moderate fatigue. Zero percent of normal weight participants, 100 percent of overweight participants, and 56 percent of obese participants indicating mild or no fatigue. The PFS Physical scores mean was 23.3 (σ= 6.56) (Table 7, Table 11, 13), with 56 percent of participants scoring in the highest category of PFS Physical scores with

the lowest score of 9, and highest score of 32. The PFS Mental scores mean was 18.9 (σ= 8.07) (Table 7, Table 12, 13), with 56 percent of participants scoring in the highest end of PFS Mental scores with the lowest score of 1, and highest score of 27. Looking at overall PFS Physical scores relating to Race (Table 6), 56 percent of Whites and 57 percent of Black or African Americans scored in the highest category. Looking at overall PFS Mental scores by Race (Table 7), 67 percent of Whites and 43 percent of Black or African Americans scored in the highest category. Looking at the PFS physical and PFS mental scores related to gait speed (Table 13) the PFS scores of moderate to severe did not match up with extremely fit gait speed scores in this sample with more participants by percentage scoring extremely fit but also being in the moderate to severe PFS physical categories. Lastly, looking at the PFS physical and mental scores six-minute walk distance (Table 13) the PFS scores of moderate to severe was more closely aligned by percentage with scores in the lowest 25th quartile in this sample.

Table 13 PFS Mental and Fatigability Gait Speed and Six-Minute Walk Distance

Table 13 PFS Mental and Fatigability by Gait Speed and Six-Minute Walk Distance N=16				
PFS Scores	**Less Physical Fatigability <=14 or less**	**Moderate to Most Severe Physical Fatigability Score >=15**	**Less Mental Fatigability <=12 or less**	**Moderate to Most Severe Mental Fatigability Score >= 13 or greater**
Total Sample N=16	$\bar{X}$ = 9.0 (9) N= 1 (σ= 0)	$\bar{X}$ = 24.27 (15-32) N= 15 (σ= 5.52)	$\bar{X}$ = 6.0 (1-10) N= 3 (σ= 4.58)	$\bar{X}$ = 21.85 (18-28) N= 13 (σ=3.53)
Gait Speed	**Extremely Fit**	**At Risk**	**Extremely Fit**	**At Risk**
Total Sample N=16	$\bar{X}$ = 9.0 (9) N= 1 (σ= 0)	$\bar{X}$ = 22.86 (16-31) N= 7 (σ= 5.07)	$\bar{X}$ = 6.0 (1-10) N= 3 (σ= 4.58)	N= 0 (σ= 0)
	At Risk	**Extremely Fit**	**At Risk**	**Extremely Fit**
	N= 0 (σ= 0)	$\bar{X}$ = 25.8 (15-32) N= 8 (σ= 5.07)	N= 0 (σ= 0)	$\bar{X}$ = 21.85 (18-28) N= 13 (σ=3.53)
Six-Minute Walk Distance	**Six Minute Walk Distance lowest 25th Percentile**	**Six Minute Walk Distance 26th Percentile and Higher**	**Six Minute Walk Distance lowest 25th Percentile**	**Six Minute Walk Distance 26th Percentile and Higher**
Total Sample N=16	$\bar{X}$ = 9.0 (9) N= 1 (σ= 0)	$\bar{X}$ = 24.67 (23-26) N= 3 (σ= 1.53)	$\bar{X}$ = 5.5 (1-10) N= 2 (σ= 6.36)	$\bar{X}$ = 5.5 (1-10) N= 2 (σ= 6.36)
	Six Minute Walk Distance 26th Percentile and Higher	**Six Minute Walk Distance lowest 25th Percentile**	**Six Minute Walk Distance 26th Percentile and Higher**	**Six Minute Walk Distance lowest 25th Percentile**
	N= 0 (σ= 0)	$\bar{X}$ = 24.17 (15-32) N= 12 (σ= 6.19)	$\bar{X}$ = 7 (7) N= 1 (σ= 0)	$\bar{X}$ = 22.18 (18-28) N= 11 (σ= 3.51)

5.0 Discussion

5.1 Conclusions

Looking at the various conclusions that emerged the outcomes are not well predicted from the literature. Considering all the findings, four overall conclusions may be made for the total group. The first conclusion for this study concerns fatigue and perceived fatigability. None of the participants scored in the worst categories of fatigue as measured by the Promis Global Health Scale Question #9, which were severe or very severe. These results indicate according to past research done by Schnelle (2012) that these groups outcomes should be associated with physical activity levels in six minute walk distance and gait speed that are moderate to favorable. Based on the group's PFS Physical scores and PFS Mental scores the overall group by percentage is likely to be in the most severe category of both. Based on scores in six minute walk distance compared to both PFS Physical scores, and PFS Mental scores by percentage was a better predictor of worse outcomes in six-minute walk distance (Tables 3, 6, 7, 9, 11, and 12) While no participants scored in severe or very severe for their answer to Promis Global Health Question #9 the PFS Physical scores and PFS Mental scores was a more sensitive measure of fatigability and more of the group by percentage scored in the moderate or severe categories of this tool in relation to the worst outcomes for six-minute walk distance. Fatigability measured sensitivity did not match PFS Physical scores and PFS Mental scores for results in gait speed and the Promis Global Health Question #9 results by percentage aligned more closely with results showing less severe rated fatigue and better outcomes in gait speed (Table 4, 5, 9, 10). Further results indicate that in this group the normal weight participants are more likely by percentage to have rated their fatigue

moderate or worse while overweight participants were more likely by percentage to rate their fatigue mild or none by the Promis Global Health Question#9. Past research in the three perceived fatigability questions cited in this work by Moreh (2010), Eldadah (2010), Buchowski (2013), have been linked to poorer health outcomes and reduced or worse clinically significant measures of physical activity in older adults that were used in this study like gait speed and six minute walk distance.

The second conclusion to this study is related to the relationship between six-minute walk distance and BMI score. Although the sample was small, outcomes in six minute walk distance had results that did not follow patterns of previous literature Larsson (2008). Interestingly, those participants that had the highest mean scores for six-minute walk distance were obese, while the overall results of the total group showed a large proportion in the lowest 25th quartile by age and sex Rikli (1999). These surprising outcomes were based upon my assumptions and previous research by Larsson (2008) where obese patients typically scored worse than their normal weight or overweight counterparts. There were also several participants in the sample who scored below the 5th quartile, which indicates that they are the most at-risk for functional decline that impacts daily life. Past work by Simonsick (2018) has shown that endurance walking test are predictors of unrecognized and impending mobility limitation. These results by outcome percentage indicate that the entire group ranks poorly, and White participants are at increased risk by outcome score percentage compared to their Black or African American counterparts results in six-minute walk distance. In the six-minute walk test, the overall group by percentage is more likely to be in the Lowest 25 percent which is the highest at risk category by age and sex Rikli (1999), although obese participants were most likely by outcome percentage to score in the highest categories by age and sex Rikli (1999). In general, I would not have predicted that participants with average

scores by outcome percentage in the highest at-risk categories in the six-minute walk distance would also have the lowest risk by outcome percentage in gait speed. Looking at the overall scores by percentage in the six-minute walk distance related to BMI (Table 8), 100 percent of normal weight, 100 percent of overweight, and 67 percent of obese participants scored in the lowest 25th quartile based on age and sex indicating there was little difference between BMI groups in this sample.

The third conclusion that can be made from the results of this study is that findings varied when participants achieved extremely fit gait speed and higher at-risk scores in the six-minute walk distance. Overall, there was a mean score of 1.29 m/s (Table 4, Table 9) for Gait Speed indicating that the sample averaged very close to extremely fit. There were differences in findings by race, with more Black or African Americans scoring as 'extremely fit' than Whites by percentage. In gait speed, the overall group is more likely by percentage to score in the extremely fit category with Black or African Americans most likely by percentage to score extremely fit. The following groups including Black or African Americans, normal weight, and overweight were more likely by outcome percentage to have gait speed outcomes more likely to be extremely fit, while White and obese participants only were more likely to score in the at-risk category by outcome percentage. According to Studenski (2011), gait speed is a significant indicator in morbidity and mortality, and a higher portion by percentage scored in the most at risk category. This finding conflicted with past research by Blanco (2012) where Whites were more likely to have scored better in gait speed outcomes compared to Blacks or African Americans. The group average across normal weight leans by percentage towards those of normal weight having better scores in gait speed at 100 percent of participants. The group average for overweight and obesity analyzed ranks more evenly across at risk and extremely fit categories.

The fourth conclusion is that PFS Mental scores outcomes for the participants were more likely to be in the moderately high and severe category by percent. The prevalence of PFS Mental scores, again although a small sample, were higher with the mean score of 18.9 (Table 7). than previous research Cohen (2021). Fifty-six percent of participants scored in the most severe, 25 percent in the moderately severe, and 19 percent in the least severe category of PFS Mental scores. PFS Mental scores ranged from the lowest score of 1, and highest score of 27 (Table 7). The prevalence results for PFS mental scores in Cohen (2021) were markedly lower on average compared to results in this study by the age brackets of 5.9 between 60-69 years old, 6.8 between 70-79 years old, and 11.6 between 80-89 years old. Although this work was not looked at by age and only included 1 participants between 80-89 years old the mean age is 73.75 years old and prevalence scores in Cohen (2021) were 6.8 while the mean scores in this work were 18.9 (Table 7). These results while markedly higher by score follow patterns of well documented worse health outcomes in the Veteran population Agha (2000). Large differences in sociodemographic status, health status, and subsequent resource use exist between the VA and the general patient population exist Agha (2000) and this may account for the markedly worse scores in the PFS mental scores seen in this study.

Comparing all the outcomes several interesting trends become apparent for the group. Looking at the six-minute walk distance the group at 81 percent averages in the lowest 25th percentile by age and sex, at 63 percent in the extremely fit category, at 63 percent in the mild or less Promis Global Health Scale question #9, at 56 percent scoring 24 or greater in the PFS Physical scores, and at 63 percent scoring 19 or greater on the PFS Mental scores. First, looking at the predictors of fatigue and fatigability in this sample related to the six-minute walk distance functional assessment the Promis Global Health Question #9, PFS Physical scores, or PFS Mental

scores the Pittsburgh Fatigability Scale was very sensitive to measures of fatigability in worse outcomes in the six-minute walk distance. Next, looking at predictors or fatigue and fatigability in this sample related to gait speed these scores were matched to low scores in the Promis Global Health Scale question #9, and associated to some of the scores in the PFS Physical scores and PFS Mental scores by outcome percentage, but not all. In general, I would not have predicted average scores at 81 percent in the lowest 25th quartile for the six-minute walk distance yards while also averaging at 63 percent gait speed scores in the extremely fit category. These results may show extremely fit gait speed scores, but lack of endurance training by six-minute walk distance results. I also would not have predicted the group not having any participants who scored in the highest ranges in the Promis Global Health Scale Question #9 while scoring in the most severe category of the PFS Physical scores and PFS Mental scores.

5.2 Limitations

Due to the COVID pandemic and social distancing protocols and shut-downs, recruitment was negatively affected. Anticipated recruitment was 50 and only 16 participants were able to be recruited and enrolled in the current study. Only participants who had already completed a functional assessment were able to participate in this study as remote pandemic assessments did not include gait speed or six-minute walk distance, meaning no new participants met the inclusion criteria. Additional delays in the protocol were experienced after becoming a remote study following the shut-down and the VA's IRB was slowed with approving changes.

Another limitation that is directly related to study needs were that perceived and performance fatigability were not measured longitudinally. While measuring aspects of perceived and performance fatigability at only one time point provides important information, longitudinal data would allow us to answer these same questions over a longer time period, leading to richer knowledge in perceived and performance fatigability measures. A possible solution is the Gerofit program functional assessments are completed every 3 months and these ongoing timepoints would be ideal for measuring change over time. Measuring change over time could help see potential relationships between changes in functional assessments of gait speed and six-minute walk distance tests with measures of fatigue and fatigability.

A third limitation includes using previously collected functional assessments in relation to current participant perceived and performance fatigability. While performance fatigability measures do not change drastically over a short-given period, a reduction in access to fitness options in Gerofit facilities and reduction in exercise may have attenuated with the lack of movement. Only Gerofit participants who had access to technology were able to continue regularly exercising with the Gerofit program. This limitation extends into other aspects of the measures, such as weight, where patients were measured on the same scale but are using older results. Using older assessments of this measure could have changed the obesity group the participants were classified into, and during the pandemic with a generalized lack of physical activity would be predicted to be worse.

The final limitation is related to the Pittsburgh Fatigability Scale. There were a few questions that the older adult participants who are 65 and older in the Gerofit program were by percentage more unlikely to complete according to their answers including: heavy gardening and outdoor work, moderate to high intensity strength training, and high intensity activity for 30

minutes. Although the PFS is used as perception tool working directly with participants there is additional layers of knowledge in regular assessments of lower and upper extremity strength that help better translate like the repeated curl test or sit to stand test and how they relate to heavy gardening and outdoor work, moderate to high intensity strength training, and high intensity activity for 30 minutes. In the Pittsburgh Fatigability Scales it may be feasible to separate moderate and high intensity activities by adding a question for each option 1. Moderate and 2. High intensity. Although I would not define high intensity strength training as a blanket statement of 5+ pounds as is in the Pittsburgh Fatigability Scale. The ACSM guidelines for older adult high intensity strength training would be more closely related to high intensity interval training, which is not a practice followed in the Gerofit national standard of practice. Future iterations and improvements to this scale could separate these two topics as low and moderate intensity and high intensity using ACSM guidelines.

5.3 Implications for future inquiry

Drawn from this inquiry are four future inquiry implications. The first inquiry implication is ongoing perceived fatigability measures in participants be coupled with performance fatigability measures. In the Gerofit program for older adults, regular functional assessments including gait speed and six-minute walk distance were measured. Longitudinal assessments would allow practitioners measuring change over time to evaluate and measure improvement and decline of the aging participants. Measuring the sensitivity of change over time will be useful to see how changes in measures such as gait speed and six-minute walk distance are related to measures in fatigue and fatigability. There are already models for predicting morbidity and mortality using these measures,

and adding sensitivity to change in the same manner that Studenski (2011) found with gait speed would be very useful for researchers and practitioners alike.

The second future inquiry implication concerns the use of the Pittsburgh Fatigability Scale vs the Global Health Scale. In this inquiry the Pittsburgh Fatigability Scale is much more likely to predict worse outcomes in the six minute walk distance. Potentially for those participants who are unable to complete a six minute walk distance test outcomes from the Pittsburgh Fatigability Scale could be more related to their risk stratification when this type of outcome data is not available.

The third future inquiry implication is only obese patients scoring in the highest category of six-minute walk distance are out of line with research by Larsson (2008). Although regular physical activity contributes to reduced levels of obesity, health status benefits could be derived independent of obesity levels. While it is interesting that normal and overweight outcomes are out of line with past research, I do not think this inquiry needs to be expanded to understand this effect as a large body of evidence has already looked at it.

The fourth implication drawn from this inquiry for future inquiry is the outcomes of Black or African American patients scoring in the highest category of gait speed are out of line with research by Blanco (2012). which suggests that Black or African Americans tend to have slower gait speed compared to Whites. Some key questions that could be explored in future research include: Does program participation and regular physical activity negate some of the other confounders of slower gait speeds that have been seen in previous research. Does program participation characteristics (e.g., cost, engagement) improve some of the differences in outcomes between Whites and Black or African Americans?

5.4 Implications for future practice

Two implications for future practice are recommended. First individualized exercise prescriptions that focus on the worst functional assessment outcomes. In this inquiry, more participants by percentage scored in the lowest 25th quartile by age and sex in the six-minute walk distance test Rikli (1999). Gerofit participants are given safe exercise parameters to exercise within, but being a group program, it is challenging to prescribe exercise individually with each participant as needed. This task would increase labor needs, but the benefit to greatly enhance functional outcomes could perhaps justify the increased costs. As feasible, each participant will have a specific exercise prescription that includes exercise time at Gerofit and outside of Gerofit that meets Physical Activity Guidelines For Americans(older adult 65+ recommendations match guidelines for adults but look to ensure older adults are selecting the types and amounts of physical activity appropriate for their own abilities). Physical Activity Guidelines For Americans for older adults include the following: Adults should do at least 150 minutes to 300 minutes a week of moderate-intensity, or 75 minutes to 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Preferably, aerobic activity should be spread throughout the week. These goals can be tied into the participants goals and be tailored for each individual participant ability.

The second practice implication drawn from the study is to collect repeated fatigability measures to look at sensitivity of the Pittsburgh Fatigability Scale and Fatigue and how they change over time with Perceived and Performance Fatigability. This data will have meaningful impact to participants and to leadership. This work was pursued because of a common complaint of fatigue in the Gerofit program setting and continuing to monitor and analyze these outcomes will help guide future exercise prescriptions, program direction, and benefit of participation. These

outcome measurements could help identify potential weaknesses in program administration, offerings and where to focus additional class time and probable focused areas of improvement using participant surveys, focus groups, and interviews for feedback and recommendations.

5.5 COVID reflections for future inquiry and practice

The needs assessment occurred during the pandemic. One consequence of the pandemic was I had time to reflect on the program participants' needs. Drawn from my reflections are two additional implications. The first is to build incentives into the program that encourage long-term participation. Gerofit participants have a high dropout rate between six and twelve months of participation. These incentives can be symbiotic with other facets of healthcare with reducing and eliminating co-pays or trinkets like Gerofit program shirts. Gerofit program participation shirts have been used in the past for Gerofit wellness initiatives with great success. These incentives could be set up individually and help participants overcome any barriers or roadblocks that are keeping them from achieving improved exercise goals. Lastly, in setting up goals using behavioral motivation to also strive for intrinsic goals like feeling better and learning to enjoy exercise as opposed to looking at it like a chore. Using already established programs and integrating personal health plans which are utilized at VA Pittsburgh with established intrinsic goals would help focus participants to continue to push themselves to meet these aspirations.

The second implication is to form local partnerships with fitness facilities as the one size offering at Pittsburgh VA does not fit all participants needs. With limited Gerofit offerings there is a need to ensure our operating times does not exclude those participants who are not available

during open hours. Having these partnerships would allow focused instruction with the participants taking what they learned and utilizing other facilities. Many Vets have a low socio-economic status. Even the low cost of potential facilities like Planet Fitness at less than twenty dollars per month could possibly be too much. To meet ACSM guidelines for exercise and strength training, Gerofit needs to have more available days and times. Currently, Gerofit is only meeting remotely due to continued COVID-19 restrictions, and when Gerofit was operating normally the open hours were 3 days 2 hours per day. The benefit of offering additional hours and using partnerships could be immense as these changes would impact potential options for Gerofit program participants.

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Appendix A Ten Meter Walk Test

The first thing we are going to do is measure your usual walking speed. I want you to walk from here to (fill in the blank) at your normal walking speed. (Demonstrate the course) You can begin when you are ready. Keep walking until I say stop. (The person should be aligned 2 feet before the start line and should walk at least 2 feet past the stop line.)

Perform two trials and record the best of those trials. (No practice tests.)

Do you have any questions?

You may begin when you are ready.

Using a stopwatch, begin timing when the subject's foot crosses the start line, and stop when the first foot crosses the finish line. Allow the subject to continue walking so that he/she is not slowing down at the finish line.

Was an assistive device used for this task? If yes, describe.

You did great! Now we are going to do some balance tasks.

Appendix B Six Minute Walk Test

The last task we are going to do is called the **6 Minute Walk**. This task will measure your endurance. Your goal is to cover as much distance as you can in six minutes. . Here is the starting point and this is how the course is laid out. Describe the course. I will walk behind you to make sure you set the pace. I will give you prompts every minute and at the last 30 seconds. I will tell you "1 minute down, 5 more to go", 2 minutes down, 4 to go etc. so you can judge how much time you have left. Remember your goal is to cover as much distance as you can. If you start out too fast you can stop and rest but the clock will keep going. If you need to sit down, the task is over. If you go to slow and you come towards the end of the task you can pick up your pace but you cannot jog. If I see you jogging I tell you "no jogging".

Do you have any questions?

Begin when you are ready

At 3 minutes check to see "3 minutes down, three minutes to go, how are you doing?" "Remember cover as much distance as you can"

Don't stop abruptly. At the end of 6 minutes tell them to slow down but keep walking, you can tell them the task is over but you want them to cool down. Walk with them and offer positive feedback.

Cool-down: walk slowly for a minute or two. Scoring: Record the distance walked in yards.

Was an assistive device used for this task? If yes, describe.

Appendix C Global Health Scale Question #9

		None	Mild	Moderate	Severe	Very Severe
9.	**How would you rate your fatigue on average?**					

Appendix D Pittsburgh Fatigability Index

The Pittsburgh Fatigability Scale will be administered with the following instructions.

Pittsburgh Fatigability Scale

The following questions ask you to indicate the level of physical and mental fatigue (i.e., tiredness, exhaustion) you expect or imagine you would feel immediately after completing each of the ten listed activities.

For each activity (a-j) please circle responses for both physical and mental fatigue between 0 and 5, where "0" equals no fatigue at all and "5" equals extreme fatigue.

In the last column indicate if you have done the activity in the past month. If you answer "No", please make your best guess for the fatigue questions (see Example 2 below). **Please fill out all three columns for every activity even for those that you do not do**. Also pay careful attention to the duration (e.g., 30 minutes) and intensity (e.g., moderate, brisk) of each activity.

Examples:	Physical Fatigue No Fatigue 0 ⟷ 5 Extreme Fatigue	Mental Fatigue No Fatigue 0 ⟷ 5 Extreme Fatigue	Have you done this activity in the past month?
Example Activity 1	0 1 2 (3) 4 5	(0) 1 2 3 4 5	(Yes) No
Example Activity 2	0 1 2 3 (4) 5	0 (1) 2 3 4 5	Yes (No)
	Physical Fatigue No Fatigue 0 ⟷ 5 Extreme Fatigue	Mental Fatigue No Fatigue 0 ⟷ 5 Extreme Fatigue	Have you done this activity in the past month?
a. Leisurely walk for 30 minutes	0 1 2 3 4 5	0 1 2 3 4 5	Yes No
b. Brisk or fast walk for 1 hour	0 1 2 3 4 5	0 1 2 3 4 5	Yes No

c. Light household activity for 1 hour *(cleaning, cooking, dusting, straightening up, baking, making beds, dishwashing, watering plants)*	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
d. Heavy gardening or outdoor work for 1 hour *(mowing (push), raking, weeding, planting, shoveling snow)*	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
e. Watching TV for 2 hours	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
f. Sitting quietly for 1 hour	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
g. Moderate- to high-intensity strength training for 30 minutes *(hand-held weights or machines greater than 5 lbs., push-ups)*	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
h. Participating in a social activity for 1 hour *(party, dinner, senior center, gathering with family/friends, playing cards, bridge)*	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
i. Hosting a social event for 1 hour *(not including preparation time)*	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No
j. High-intensity activity for 30 minutes *(jogging, hiking, biking, swimming, racquet sports, aerobic machines, dancing, Zumba)*	0	1	2	3	4	5	0	1	2	3	4	5	Yes	No

Pittsburgh Fatigability Scale Scoring Instructions

Physical Fatigability Score: Calculated by summing the physical fatigue rating for each activity (a-j). Score range (0-50) with higher score=greater physical fatigability.

Mental Fatigability Score: Calculated by summing the mental fatigue rating for each activity (a-j). Score range (0-50) with higher score=greater mental fatigability.

Appendix E Complete Functional assessment

Tester needs: A folding chair (17in), stopwatch, tape measure, cone, the Measure Master*, masking tape or colored tape, a dark colored marker, clipboard, pencil/pen, & PA data form.

Get blood pressure, weight and height (if baseline or annual test) before the assessment.

VITAL SIGNS

BP: _____/_____ WEIGHT: _____ HEIGHT: _____

WAIST CIRCUMFERENCE: ___ __.__ / ___ __.__ Centimeters

Waist circumference is measured in centimeters using a soft measuring tape held directly on the skin around the narrowest point on the participant's torso, usually about an inch above the belly button. Instruct participants to relax their shoulders and with their arms at their sides, and take a deep breath and let it out. The measurement is noted mid-way through the out-breath. Repeat the test. If the difference between the two measurements is greater than a centimeter, a third measurement is taken and the closest two are used. Record to the nearest 10th of a centimeter.

Patient Satisfaction

"Overall, how satisfied are you with the Gerofit program?"

0= Extremely Dissatisfied

1= Somewhat Dissatisfied

2= Neutral

3= Somewhat Satisfied

4= Highly satisfied

Patient Satisfaction

"Overall, how satisfied are you with the Gerofit facility?"

0= Extremely Dissatisfied

1= Somewhat Dissatisfied

2= Neutral

3= Somewhat Satisfied

4= Highly satisfied

Fear of falling? Yes 0No 0 Fallen since last assessment? Yes 0No 0

If yes, number of falls / date(s) _____

Before we start our functional assessment we are going to warm-up for about 5 minutes to get your muscles ready. Perform movements involving large muscle groups and simple stretches for upper and lower body or ride stationary bike or walk on treadmill for about 5 minutes at easy pace.

Explain procedure: You are going to do series of tasks that will help us understand how you function physically. There are tasks that represent different components of fitness you might typically do throughout the day, like walking or getting out of a chair. The entire procedure will take about 15 minutes.

TASK # 1**10 Meter Walk**

The first thing we are going to do is measure your usual walking speed. I want you to walk from here to (fill in the blank) at your normal walking speed. (Demonstrate the course) You can begin when you are ready. Keep walking until I say stop. (The person should be aligned 2 feet before the start line and should walk at least 2 feet past the stop line.)

Perform two trials and record the best of those trials. (No practice tests.)

Do you have any questions?

You may begin when you are ready.

Using a stopwatch, begin timing when the subject's foot crosses the start line, and stop when the first foot crosses the finish line. Allow the subject to continue walking so that he/she is not slowing down at the finish line.

Was an assistive device used for this task? If yes, describe.

You did great! Now we are going to do some balance tasks.

Task # 2**Short Physical Performance Battery Standing Balance Battery**

Side-by-side Stand

I will show you the first movement. (Demonstrate) I want you to try to stand with your feet together, side-by-side, for 10 seconds. You may use your arms, bend your knees, or move your body to maintain your balance, but try not to move your feet. Try to hold this position until I tell you to stop.

Stand next to the participant to help him/her into the side-by-side position. Supply just enough support to the participant's arm to prevent loss of balance. When the participant has his/her feet together, ask,

"Are you ready?"

Then let go and begin timing as you say, "Ready, begin."

Stop the stopwatch and say "Stop" after 10 seconds or when the participant steps out of position or grabs your arm. If the participant is unable to hold the position for 10 seconds, record result and go to the next task. Otherwise go on to the next balance task.

Semi-Tandem Stand

Now I will show you the second balance task. (Demonstrate) I want you to stand with the side of the heel of one foot touching the big toe of the other foot for 10 seconds. You may put either foot in front, whichever is more comfortable for you. You may use your arms, bend your knees, or move your body to maintain your balance, but try not to move your feet. Try to hold this position until I tell you to stop.

Stand next to the participant to help him/her into the semi-tandem position. Supply just enough support to the participant's arm to prevent loss of balance. When the participant has his/her feet together, ask, "Are you ready?"

Then let go and begin timing as you say, "Ready, begin."

Tandem Stand

Now I will show you the third balance task. (Demonstrate) I want you to stand with the heel of one foot in front of and touching the toes of the other foot for 10 seconds. You may put either foot in front, whichever is more comfortable for you. You may use your arms, bend your knees, or move your body to maintain your balance, but try not to move your feet. Try to hold this position until I tell you to stop.

Help the participant into position then let go and begin timing as you say, "Ready, begin."

Stop the stopwatch and say, "Stop" after 10 seconds or when the participant steps out of position, or grabs your arm.

Please take a seat in this chair.

The next four tasks are tasks where I will ask you to push yourself as much as you can. For these tasks, I have just one instruction: Your goal is to do the very best you can on all the tasks but never to push yourself to the point of exhaustion or beyond what you think is safe for you. I am going to encourage you but you are in charge of setting the limits.

For each task I am going to explain what it is for, tell you how to do it, show you how to do it, and then have you practice it before we do it. I will always use the same prompt. I will say, "READY - SET – GO" and at the word "GO" we will start the task. We will finish when I say, "STOP". I will also ask you if you have any questions.

Explain and demonstrate each task simultaneously. As you demonstrate, be sure your chair is turned at an angle where the subject can see the position clearly.

Correct their performance during each practice.

Task #3**Arm Curl**

The next task is the Arm Curl. It measures your upper body strength. Decide which of your arms are stronger. You are going to do as many curls as you possible can in 30 seconds using your full range of movement. Hold the dumbbell in a handshake grip at your side. Curl your arm while rotating you palm towards your chest.

Let's practice once. Keep your hand on the patient's bicep to feel for a full range of motion of lower arm.

Do you have any questions?

Ready, set, go.

Halfway into the task prompt: “as fast as you can”. More than halfway up at the end of 30 seconds counts as a full curl. Use 8 pound dumbbell for men and a 5 pound dumbbell for women. Note which arm was used.

TASK # 4**Chair Rise Task (Repeated Chair Stand**)

(BRACE CHAIR – ARMS BEHIND/AROUND PATIENT)

Always use the same chair for this test

We will collect two scores in this one test. The first is the number of seconds it takes to complete 5 stands, and the number of stands completed in 30 seconds.

The next task is the Chair Stand, which measures your lower body strength. For this task, you are going to sit in the middle of the chair, bend your knees to a 90-degree angle with your feet flat on the floor (and hip/shoulder width apart), and arms across your chest. With your arms across your chest, you are going to get up and down as many times as you can as fast as you can for 30 seconds.

Let’s practice once. (Never have them do more than one practice stand; if a correction needs to be demonstrated you should do it for them.)Support the chair against the wall and correct performance.

Remember, you must stand up all the way as well as sit down completely in order for the repetition to count. (Emphasize this on your practice demo.)

Any questions? Remember, do it as fast as you can.

Ready, set, go. (COUNT OUT LOUD)

Halfway into the task prompt: “as fast as you can”. (say it loudly because sometime patients think you are telling them to stop and they hesitate. Scoring: Score the total number of stands completed in 30 seconds. More than halfway up at the end of 30 seconds counts as a full stand. If they cannot do 1, you may use “adapted” score if they have to use hands on knees or the chair: 0/14 (14 being the “adapted” score). They may also use can or walker, but NOTE any adaptation. Brace chair….STOP if there is pain.

TASK # 5**8 Foot Up and Go**

The next task is called the 8-Foot Up and Go. It will measure your balance and mobility (agility and dynamic balance). Sit in the middle of the chair with one foot slightly in front of the other and your hands on your knees/thighs (and lean slightly forward). When I say GO, get up and walk as fast as you can around the cone and then come back and have a seat. The clock goes from the time I say Go until the time your buttocks (I always say butt) hit the chair.

Let’s practice once slowly. Support the chair against the wall and correct performance. (Observe the patient walking around the cone. This practice trial is intended to make sure the patient understands the task but also to determine whether the tester needs to spot the patient throughout the entire walk. Most people don’t need spotters but some people with very poor balance will need to be followed closely throughout the task)

Do you have any questions? (Tester stand between chair and cone as spotter)

All right. READY. SET. GO. Be sure to start the timer on GO.

After the first trial you will say "Excellent!!! Let's try that one more time to see if you can beat your score – remember go as fast as you can".

Repeat the task.

Scoring: Record the best time to the nearest 1/10th (or 1/100th?) of a second. Time from "GO" to seated.

Was an assistive device used for this task? If yes, describe.

TASK # 6**6 Minute Walk**

The last task we are going to do is called the **6 Minute Walk**. This task will measure your endurance. Your goal is to cover as much distance as you can in six minutes. . Here is the starting point and this is how the course is laid out. Describe the course. I will walk behind you to make sure you set the pace. I will give you prompts every minute and at the last 30 seconds. I will tell you "1 minute down, 5 more to go", 2 minutes down, 4 to go etc. so you can judge how much time you have left. Remember your goal is to cover as much distance as you can. If you start out too fast you can stop and rest but the clock will keep going. If you need to sit down, the task is over. If you go to slow and you come towards the end of the task you can pick up your pace but you cannot jog. If I see you jogging I tell you "no jogging".

Do you have any questions?

Begin when you are ready

At 3 minutes check to see "3 minutes down, three minutes to go, how are you doing?" "Remember cover as much distance as you can"

Don't stop abruptly. At the end of 6 minutes tell them to slow down but keep walking, you can tell them the task is over but you want them to cool down. Walk with them and offer positive feedback.

Cool-down: walk slowly for a minute or two. Scoring: Record the distance walked in yards.

Was an assistive device used for this task? If yes, describe.

SF-36

Physical Function SUBSCALE (SF-36)

"The following items are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much? (Circle the best answer).

1). <u>Vigorous Activities,</u> such as running, lifting heavy objects, participating in strenuous sports.

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

2) Moderate Activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

3) Lifting or carrying groceries

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

4). Climbing several flights of stairs.

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

5). Climbing One flight of stairs

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

6). Bending, kneeling, and stooping

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

7). Walking more than a mile.

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

8). Walking several blocks

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

9). Walking One Block

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

10). Bathing and Dressing Yourself

1. Yes, limited a lot.
2. Yes, limited a little.
3. No, not limited at all.

Global Health Scale

	Please respond to each item by checking one box per row	Excellent	Very good	Good	Fair	Poor
1.	In general, would you say your health is:					
2.	In general, would you say your quality of life is:					
3.	In general, how would you rate your physical health?					
4.	In general, how would you rate your mental health, including your mood and your ability to think?					
5.	In general, how would you rate your satisfaction with your social activities and relationships?					
6.	In general, please rate how well you carry out your usual social activities and roles. (This includes activities at home, at work and in your community, and responsibilities as a parent, child, spouse, employee, friend, etc.)					
		Completely	Mostly	Moderately	A Little	Not At All
7.	To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?					
	In the past 7 days	Never	Rarely	Sometimes	Often	Always
8.	How often have you been bothered by emotional problems such as feeling anxious, depressed or irritable?					
		None	Mild	Moderate	Severe	Very Severe
9.	**How would you rate your fatigue on average?**					

Co Morbidities

Do you have any of the following illnesses or conditions at the present time?

YES	NO		YES	NO	
		Glaucoma			**Muscular Dystrophy**
		Cataracts			**Effects of Polio**
		Other problems with vision			**Thyroid or other glandular disorders**
		Problems hearing			**Skin disorders such as pressure sores, leg ulcers or severe burns**
		Asthma			**Recent surgery (last six months)**
		Emphysema or chronic bronchitis			**Osteoporosis**
		Tuberculosis			**Amputation**
		High blood pressure			**Joint replacement/fused bones**
		Heart trouble			**Broken bones**
		Circulation trouble in arms or legs			**Arthritis or rheumatism (Upper body)**
		Effects of stroke			**Arthritis or rheumatism (Lower body)**
		Diabetes			**Sleep problems**

		Ulcers (of the digestive system)			**Depression, anxiety, emotional problems**
		Other stomach or intestinal disorders or gall bladder problems			**Problems with memory**
		Liver disease			**Pain**
		Kidney disease			**Feel tired much of time**
		Other urinary tract disorders **(including prostate trouble)**			**Muscle weakness**
		Cancer or Leukemia			**Dizziness/lightheaded**
		Anemia			**Shakiness/trembling**
		Parkinson's Disease			**Balance problems**
		Epilepsy			**Fear of falling**
		Cerebral Palsy			**Numbness or tingling**
		Multiple Sclerosis			

All measures are standardized evidence-based obtained as standard of care in Gerofit health promotion program they will be excluded to reduce bias in outcome data and to limit to the scope of the needs assessment.

Jones (1990) measured the criterion of a 30 second chair stand as a measure of lower body measure in adults over 60 years of age. 76 community dwelling adults were included in the study with a mean age of 70.5 years of age. Jones (1990) found a strong correlation between the chair stand performance and maximum weight adjusted leg press performance for both men and women. This result allows for an easy way to assess the differences between various age and activity levels groups of adults lower body strength ability. In general, across age decades of the adults tested a functional decline in lower body strength was observed. Podsiadlo (1991) looked at The Timed ”Up & Go”: A Test of Basic Functional Mobility for Frail Elderly Persons. 60 patients referred to a geriatric day hospital were evaluated for this study with a mean age of 79.5 years. The patients were observed completed a stand from an armchair, walking 3 meters, turning, walking back to the chair and sittings. The results from the work indicate a strong correlation with the Berg Balance Scale and Barthel Index of ADL and predict a patient’s ability to go outside and alone safely. The timed up and go test has also been a useful tool in tracking mobility change over time.

The SF-36 is measure that relies upon patient self-reporting and is now widely utilized by managed care organizations and by Medicare for routine monitoring and assessment of care outcomes in adult patients. SF-36 is a set of generic, coherent, and easily administered quality-of-life measure that has been continuously updated and validated by RAND. Ware (1992) published the original looking at the MOS 36 item Short -Form Health Survey (SF36). This original work was designed for use in clinical practice, health policy evaluations, and general population surveys.

s. The SF-36 includes one multi-item scale that assesses eight health concepts: 1) limitations in physical activities because of health problems; 2) limitations in social activities because of physical or emotional problems; 3) limitations in usual role activities because of physical health problems; 4) bodily pain; 5) general mental health (psychological distress and well-being); 6) limitations in usual role activities because of emotional problems; 7) vitality (energy and fatigue); and 8) general health perceptions for use in people ages 14 and older.

Borg (1990) looked at Psychophysical scaling with applications in physical work and the perception of exertion. Their work validated the use of Psychophysical scaling with applications in physical work and the perception of exertion. In research and in exercise settings it is important to assess various subjective symptoms, complaints, and annoyances. To measure such symptoms, psychophysical ratio scales may be used, as along with simpler category rating scales. In this paper some of the basic concepts and methods of psychophysics have been described. In the field of heavy physical work and the perception of effort and exertion, one of the most popular methods is the rating of perceived exertion.

The PROMIS Global Health Scale consists of 10 items that assess general areas of health and functioning including overall physical health, mental health, social health, pain, fatigue, and overall perceived quality of life. The 10 questions of the Global Health Scale have largely been adapted from other frequently used "legacy" measures such as the SF-36 and EQ-5D. The scoring of the PROMIS Global Health Scale allows each of the individual items to be examined separately to provide specific information about perceptions of physical function, pain, fatigue, emotional distress, social health and general perceptions of health. Cella (2010) originally developed the Patient-Reported Outcome Measurement Information System looking at adult health outcomes from 2005-2008. There lacked a standardization with patient reported outcomes when evaluating

new treatments in healthcare. The models that existed lacked precision, standardization, and a way to compare studies across diseases. 14 items pools were tested in the United States general population and in clinical settings. 11 items banks were created using item response theory from a sample of 21,113 measuring self-reported physical, mental, and social health, along with a 10-item global health scale. These scales were validated and reliable among generic symptoms and functional reports. As part of the PROMIS the global health assessment tool that allows measurements of symptoms, functioning, and healthcare-related quality of life for a wide variety of chronic diseases and conditions. The global health scale is a common measurement in geriatric research to measure generic, rather than disease specific, physical, mental, and social health.

Appendix F Informed Consent

Study Title for Study Participants: **Perceived and Performance Fatigability in Older Adults**

If you choose to take part in this study, you will be asked to fill out a form called the Pittsburgh Fatigability Scale which ask you to indicate the level of physical and mental fatigue (i.e., tiredness, exhaustion) you expect or imagine you would feel immediately after completing each of the ten listed activities. Researchers will use this information to learn more about how level of physical and mental fatigue affects Gerofit participants.

Risks & Benefits: There are no foreseeable risks to participating in the study. It is not possible to know at this time of the direct benefit to you, but we do think the study will make a contribution to understanding the level of physical and mental fatigue in the Gerofit program. If you decide not to participate in this study you can continue participating in the VA Pittsburgh Gerofit health promotion program.

If you have any questions or concerns about this study or want to report side effects or injuries, please call James Kostra MS, Principal Investigator, 412-360-262.

STUDY SPONSOR:
There are no study sponsors.

PURPOSE OF THE RESEARCH STUDY:
The purpose of this research study is a needs assessment of perceived and performance fatigability in Gerofit.

You are being asked to participate in this research study because you are newly enrolled or a current Gerofit participant.

This is a single site study located at the VA Pittsburgh Healthcare System. 50 participants will be recruited into this study.

If you take part in this study, data collected may be used for secondary analysis by external investigators (not related to this study) in the VA healthcare system. Only deidentified data will be provided. Data will be stored and maintained at VA Pittsburgh until its destruction. The University of Pittsburgh will not have any of your identifiable information, only coded data will be provided to the external investigators; all identifiable information will remain in the VA facility.

DESCRIPTION OF THE RESEARCH STUDY:
The Gerofit program collects the following clinical information as part of its baseline and follow up functional assessment which includes the SF-36, PROMIS Global Health Scale, comorbidity index, gait speed, sit to stand, timed up and go, bicep curl, and six minute walk test.

Added will be the Pittsburgh Fatigability Scale which is mental and physical fatigability questionnaire.

RISKS AND BENEFITS:
If you chose to take part in this study, there may be adverse events or side effects that are currently unknown and certain of these unknown risks could be permanent, severe or life threatening.
The risks from study procedures include the following:

- Questionnaires: The additional questionnaire, The Pittsburgh Fatigability Scale, requires people to answer questions about their mental and physical fatigability and could be a source of emotional distress or annoying. You have the option to not answer any question if you don't feel comfortable answering.

- Data collection: Includes a potential risk of loss of confidentiality regarding personal health information. However, all research staff are trained to protect the privacy of research subject.

ALTERNATIVES TO PARTICIPATION:
You have the alternative not to participate in this research study. If you choose not to participate, you will continue with your usual Gerofit program as recommended by your PCP.

VOLUNTARY PARTICIPATION/RIGHT TO WITHDRAW:
Your participation in this study is voluntary. Your refusal to participate will involve no penalty or loss of VA or other benefits to which you are entitled. If you decide to stop or not continue in the study, please notify the study Primary Investigator: you will not lose any legal rights.

MEDICAL TREATMENT:
In the event that you sustain injury or illness as a result of your participation in this VA approved research study, conducted under the supervision of one or more VA employees, all medical treatment (emergent as well as medical treatment beyond necessary emergent care) will be provided by the VA. Except in limited circumstances, the necessary medical care must be provided in VA medical facilities.

However, if such injury or illness occurred as a result of your failure to follow the instructions for this study, you may not be eligible for free care unless you have independent eligibility for such care under Federal Law.

FINANCIAL COMPENSATION:
If you sustain an injury or illness as a result of participating in this research study, please notify the study Primary Investigator, you may be eligible to receive monetary compensation for your damages pursuant to applicable federal law. If you believe that you are injured as a result of participation in this study, please contact the Primary Investigator. If compensation is available the Primary Investigator will provide you with an explanation as to what that compensation consists of, or where you can obtain further information regarding it.

COST AND PAYMENTS:
You or your insurance will not be charged for any costs related to the research. However, if you are receiving medical care and services from the VA that are not part of this study, and you are a veteran described in federal regulations as a "category 7" veteran, you may be required to make co-payments for the care and services that are not required as part of this research study.

There is no compensation for this study.

RECORD RETENTION:
Your research records will be retained in accordance with the Veterans Health Administration (VHA) Records Control Schedule, or longer, if required by other Federal regulations.

CONFIDENTIALITY AND USE AND DISCLOSURE OF DATA:
There are rules to protect your private health information. Federal and State laws and the Federal medical law, known as the HIPAA Privacy Rule, also protect your privacy. By signing this form, you provide your permission called your 'authorization', for the use and disclosure of information protected by the HIPAA Privacy Rule.

The research team working on the study will collect information about you. This includes things learned from the procedures described in this consent form. They may also collect other information including your name, address, date of birth, and information from your medical records such as:

- Information from your Health Records such as diagnoses, progress notes, and height.
- Specific information concerning:
    - Demographic Information such as name, age, race.

The research team may also need to disclose your health information and the information it collects to others as part of the study progress. Others may include the:

- Non-VA Institutional Review Board (IRB) who will monitor the study: University of Pittsburgh
- Study Sponsor and Authorized Agents/Funding Source (e.g., a VA or non-VA person or entity who takes responsibility for; initiates, or funds this study): N/A
- Academic Affiliate (e.g., has a relationship with VA in the performance of this study – provide institution/name/employee/department): University of Pittsburgh
- Compliance and Safety Monitors (e.g., advises the Sponsor or PI regarding the continuing safety of this study): N/A

- Other (e.g., name of contractor and specific purpose): VA Pittsburgh will be the data center and University of Pittsburgh will receive only de-identified data.

In addition, Institutional Review Board, Office of Human Research Protections (OHRP), the VA Office of Research Oversight (ORO), and the Government Accountability (GAO) may have access to your research records. Your health information disclosed pursuant to this authorization may no longer be protected by Federal laws or regulations and may be subject to re-disclosure by the recipient.

Finally, you consent to the publication of the study results or release of the data when published, so long as the information about you is anonymous and/or disguised so that your identity will not be disclosed

Confidentiality risks and precautions to decrease risk:
Every effort will be made to make sure that the information about you obtained from this study will be kept strictly confidential. As private information is collected about you as part of this study, there is a risk to your privacy and confidentiality. The research staff will take every precaution to protect your identity and the confidentiality of the information collected about you.

Information collected as part of this study will be stored in a combination of paper and electronic records only staff associated to this study will have access to the data.

Your information will be stored in a locked cabinet or in a password-protected file on the limited access drive on a password-protected computer in a locked room that only approved study staff have access to.
Hard copies will be stored in locked file cabinets in locked rooms. Your data will be provided to the University of Pittsburgh without any identifiable information. Any identifiable information collected will remain within the VA.

Revocation:
You can revoke this authorization, in writing, at any time. To revoke your authorization, you must write to the Principal Investigator at the address below. Your request will be valid when the Release of Information Office receives it. If you revoke this authorization, you will not be able to continue to participate in the study. This will not affect your rights as a VHA patient to treatment or benefit outside of the study.
James Kostra, MS (mail stop 151G)
VA Pittsburgh Healthcare System
University Drive C
Pittsburgh, PA 15240

Treatment, payment or enrollment/eligibility for benefits cannot be conditioned on you signing this authorization. This authorization will expire at the end of the research study unless revoked prior to that time.

RESEARCH SUBJECTS' RIGHTS:

You have read or have had read to you all of the above. James Kostra or his authorized representative has explained the study you and answered all of your questions. The risks, discomforts, and possible benefits of this research study, as well as alternative treatment choices, have been explained to you.
A description of the study has been provided to you, including an explanation of what this study is about, why it is being done, and the procedures involved. You have the right to ask questions related to this study or your participation in this study at any time. You should be giving your consent only under conditions in which you have sufficient opportunity to carefully consider whether or not to participate in this study. Your consent should not be given under conditions that pressure you or try to influence your decision in any way.

Your rights as a research subject have been explained to you, and you voluntarily consent to participate in this research study. You will receive a copy of this signed consent form.

If you have any questions about your rights as a participant in this study, or wish to speak more about the study with someone not associated with the research study, you can call the Associate Chief of Staff for Research and Development at (412) 360-2394.

As long as the study is renewed as required by the IRB, your signature on this document is valid for the duration of the entire research study. Should any changes occur during the course of the study that may affect your willingness to participate, you will be notified.

By signing this form, you agree to participate in this research study.
Print Patient's Name:

_____ _____

Subject' SignatureDate Time

_____ _____

Investigator/Person Obtaining Consent* Date Time

*If person other than the Primary Investigator is obtaining consent, he/she must be approved by the IRB to administer informed consent.