DEVELOPMENT OF PEDALING FOR HEALTH:

A SOCIAL EXERCISE PROGRAM

A Thesis submitted to the faculty at Stanbridge University in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy

By

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September 2020

Certification of Approval

I certify that I have read Pedaling for Health: A Social Exercise Program by Sydney Hoang, Audrey Jenkins, Alexis Lopez, and Madison Wright, and in my opinion, this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy at Stanbridge University.

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Abstract

Due to age-related physical changes and social isolation, adults 65 and older are at high risk for falls (Centers for Disease Control and Prevention, 2015, 2017; Hwang, Wang, Siever, Del Medico, & Jones, 2019). A literature review revealed that aerobic exercise such as biking can help mitigate the decline in quality of life (QoL) experienced by older adults (Hamar, Coberley, Pope, & Rula, 2013; Daly et al., 2015). In addition, it was found that meaningful social connection supports QoL by decreasing feelings of loneliness and social isolation in older adults (Yoo, Kim, Oh, Hwang, & Lee, 2019; Hwang et al., 2019). There is ample research that the QoL of adults over the age of 65 benefits from exercise or social participation. However, no research has yet addressed the integration of physical activity along with social participation. We developed Pedaling for Health: A Social Exercise Program to fill this gap in the research, one that integrates physical activity with social participation. This exercise program is intended for physical trainers, occupational therapists, and other healthcare professionals to use with older adults who are 65 years and older. Meaningful connections and a reduced risk for falls are the expected outcomes of implementing Pedaling for Health with older adults 65 years and older.

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Pedaling for Health: A Social Exercise Program

The Centers for Disease Control and Prevention (CDC) has estimated that US adults 65 or older will more than double to 71 million by 2030 (2015). The CDC also forecasts that more than one in four of these adults will fall annually, resulting in numerous hospitalizations and deaths (CDC, 2015, 2017). In addition to the increased occurrence of falls and the associated injuries, older adults have also been reported to be at a higher risk for social isolation (Yoo, Kim, Oh, Hwang, & Lee, 2019; Hwang, Wang, Siever, Del Medico, & Jones, 2019). The literature reports the benefits of incorporating regular physical activity into daily routines as well as the protective features of regular social interaction for older adults separately in studies, but no current studies have assessed the benefits of integrating social participation into exercise programs (Hamar, Coberley, Pope, & Rula, 2013; Daly et al., 2015).

Cycli™ is a Bluetooth enabled and portable cycle with a smartphone application that allows for social exercise in various settings. Through the utilization of Cycli™, social engagement can be possible even for those who are home-bound or in a community setting away from their friends and family members. Pedaling for Health: A Social Exercise Program was developed based on research that suggests cycling to be the most beneficial exercise to reduce fall risk among older adults, through strengthening muscle groups like quadriceps where are involved in balance and gross movements (Wainwright, Immins, & Middleton, 2016; Ikpeze, Glaun, McCalla, & Elfar, 2018; Harvey, Rissel, & Pijnappels, 2018; Zhao, Bu, & Chen, 2019). The program's frequency has been chosen based on a study conducted by Hamar et al. (2013) which found that five to seven days of exercise a week were most favorable based on survey responses filled

out by adults 65 or older. The duration for the whole program and each session was determined based on the success of prior exercise programs for older adults which implemented thirty minute sessions for six to twelve weeks (Karahan et al., 2015; Karssemeijer, Bossers, Aaronson, Kessels, & Olde Rikkert, 2017). Using these studies as a framework, Pedaling for Health is a thirty-minute social exercise program held five times a week, for nine weeks.

Statement of the Problem

According to The World Health Organization (WHO), falls are a public health issue and about 37.3 million falls require medical attention each year (WHO, 2019). In the United States, 20-30% of older adults will have falls that cause severe injuries like hip fractures (WHO, 2019). As people age, they face more challenges with everyday activities. Occupational therapists help people gain independence and increase their quality of life (QoL). Since this population is not getting enough exercise due to perceived barriers such as pain, illness, feelings of depression, not wanting to exercise alone, not being motivated, and feeling self-conscious, a combination of physical activity and social participation will enhance the QoL of seniors (Northcott, 2011). By utilizing Cycli™ in weekly group exercise programs, it is the aim of the program to increase QoL by decreasing feelings of isolation and increasing motivation while decreasing fall risk factors through the increase of strength, balance, and range of motion in the lower extremities (Biedenweg et al., 2014; Hwang et al., 2019). However, there is limited research on the link between social participation and exercise in this population. Therefore, this manual may provide future researchers with a tool to gain more insight on the potential benefits of combining the two to improve QoL and to reduce falls.

Literature Review

Social Participation

Social engagement typically decreases as a person grows older, leading to loneliness, social isolation, and depression, all of which negatively impact physical health and general QoL (Hamar et al., 2013). Kanamori et al. (2016) performed a study comparing self-rated health in Japanese adults aged sixty-five and older who do not exercise, those who exercise alone, and those who exercise with others. The researchers found that those who exercise with others reported higher self-rated health than those who do not exercise or exercise alone. The researchers note that frequent exercise has important health benefits, but exercise with others has a greater impact on individuals' overall perceptions of their health, which is likely due to the development of social relationships, better adherence to the program, and higher self-esteem. Because exercising with others generates important aspects of healthy aging, it should be considered when developing programs for older adults. In response to the CDC's Healthy People 2010 guidelines, health plans began developing fitness-based wellness programs to support healthy aging for older adults, such as the SilverSneakers program (Hamar et al., 2013). In this program, older adults were provided with customized age appropriate fitness activities with an option to work out alone or in group programs. An analysis of survey responses from 2007 to 2010 found that those who participated in the SilverSneakers program had lower rates of depression and reported lower impairments when completing various activities of daily living (ADLs) such as bathing, dressing, and eating, than those who did not participate in the program (Hamar, Coberley, Pope, & Rula, 2013). Similarly, individuals who participated in The Walk 'n' Talk for Your Life

program felt increased motivation to exercise and decreased feelings of loneliness (Hwang et al., 2019). Hajek et al. (2017) found that the absence of social participation is associated with many adverse health outcomes, such as a decline in cognition or higher mortality rate. Furthermore, there was a positive association between social engagement and health-related QoL and a decrease in depressive symptoms such as lost interest in life, feelings of hopelessness, social avoidance, and trouble finding happiness in life (Hajek et al., 2017). The implementation of Cycli™ through our exercise intervention program is designed to increase the psychomotor, cognitive, and affective aspects of older adults by increasing social engagement through Cycli™'s smartphone application usage. The smartphone application allows program participants to interact with other participants even when they are not physically together. This feature promotes social engagement regardless of the individual's accessibility to physical social groups.

As previously stated, older adults are especially at risk for social isolation. Maher and Mendonca (2018) performed a study that assessed the ways performing an occupation in a group setting can impact functional health, QoL, self-perceived occupational performance, and satisfaction. The study consisted of various activities such as Tai Chi, poetry, dance, yoga, gardening and other activities, each of which incorporated social participation among participants by means of a group setting. The researchers utilized the SF-36, World Health Organization Quality of Life - Brief (WHOQOL–BREF), and Canadian Occupational Performance Measure (COPM) to examine overall health and QoL. The SF-36 is a test that measures an individual's QoL through a self-report of their mental health, physical health, and social functioning (Maher & Mendonca, 2018). The WHOQOL-BREF is a test that measures an

individual's QoL through assessing their physical health, their psychological health, and social relationships (Daly et al., 2015). The COPM is an individualized, client-centered outcome measure that reflects an individual's self-perception of performance in their everyday activities (Maher & Mendonca, 2018). Assessment results indicated that the program had the greatest impact on social relationships and mental health which are stated to be precursors to QoL. Moreover, the participants demonstrated a significant improvement in occupational functioning and self-satisfaction with their social relationships and physical well-being which directly caused the participants' QoL to significantly increase (Maher & Mendonca, 2018). To support the QoL in older adults, social participation has been interwoven into Pedaling for Health by including meaningful discussion topics for each session. In a systematic review, Papageorgiou, Marquis, Dare, and Batten (2016) examined research on using occupational engagement to prevent or reduce social isolation in older adults who live on their own. The studies included group programs which varied in types of occupational activities, yet they had a common result that fostered social participation and healthy aging. These studies suggest that occupational engagement in a group setting increases social participation, which then leads to increased QoL in older adults. Furthermore, another study where the researchers interviewed the participants and drop-outs of two established fitness programs for older adults found that the social aspects of the exercise programs and the accountability associated with participation were the biggest motivators (Biedenweg et al., 2014). This finding indicates that social participation not only improves QoL but can also be used as a means to motivate older adults to engage in meaningful occupations and exercise. Weekly discussion themes have been integrated into Pedaling for Health to facilitate

meaningful connection among participants and encourage social participation. Examples of themes included in the exercise manual are growing up, family, and travel.

Fall Risks

Falls in older adults have serious consequences such as injuries, chronic pain, physical and cognitive impairments, and loss of independence (Daly et al., 2015). Injuries related to falls are the leading cause of hospitalizations for individuals over 65 and are therefore considered a public health issue due to the associated economic burden (Daly et al., 2015; Davis et al., 2010; Zhao et al., 2019). In addition, individuals who suffer from a fall tend to develop a fear of falling thus leading to functional decline, lowered independence, and social withdrawal (Deshpande, Metter, Lauretani, Bandinelli, & Ferrucci, 2009). Following the WHO's (2019) recommendations for *Healthy Ageing* may minimize the potentially deleterious effects of aging. According to the WHO (2019), *Healthy Ageing* refers to enhancing the individual's functional ability, such as mobility preservation, to promote well-being. Age-related loss in muscle power is a useful predictor of disability and falls in older adults, hence the need for routine exercise (Daly et al., 2015). There is some evidence that supports the use of vigorous exercise programs to facilitate continued mobility in older adults (Daly et al., 2015; Harvey et al., 2018).

While vigorous strength training may increase muscle strength, studies show that it does not contribute to increased QoL and may even decrease it (Awick et al., 2015). In contrast, aerobic activity has been proven to increase QoL and mental health status in older adults. A systematic review performed by Zhao et al. (2019) looked at the impact of exercise on fall-related injuries as well as the safety and compliance of those exercises. They found that exercise programs with combined strength training, balance, and aerobic

activities, or those that only included balance training or only walking as exercise, resulted in decreases in fall-induced injuries. To minimize fall risk and increase QoL in older adults, Cycli™ was chosen because it combines lower extremity strength training and aerobic activity in order to increase balance and maintain muscle strength.

Physical Benefits

Pedaling for Health has been developed based on the literature that supports the role that social participation, fall risk reduction, and physical benefits are associated with exercise, specifically cycling. Additionally, some other benefits associated with physical exercise include improved sleep quality and enhanced executive functioning (Yang, Ho, Chen, & Chien, 2012; Leyland, Spencer, Beale, Jones, & van Reekum, 2019). Participation in an aerobic exercise program was also associated with decreased sleep latency, decreased use of sleep medication and improved subjective sleep quality (Yang, Ho, Chen, & Chien, 2012). Executive functioning improvements made during the eight-week cycling program included inhibition of irrelevant stimuli, updating of information as the brain perceives it, and processing speed (Leyland, Spencer, Beale, Jones, & van Reekum, 2019). While there are other important benefits of participating in a cycling program, the physical benefits of improved strength in lower extremities and its impact on fall risk reduction are the focus of this part of the literature review for Pedaling for Health.

There are many physical benefits of cycling, such as increased strength, which greatly benefits older adults (Ozaki, Loenneke, Thiebaud, & Abe, 2015). A study that examined older adults' muscle contraction differences in the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius during passive or active exercise found that

there was increased muscle activity during active exercises (Kang, Lee, Hong, Yu, & Kwon, 2018). The results of this study suggest that lower limb cycling helps maintain muscle strength and prevents muscle stiffness. Because cycling requires movement at the hip, knee, and ankle joints, it is a good method to improve extension and functional ability in the lower extremities (So, Ng, & Ng, 2005). Balance and proprioception have also been found to be positively affected by cycling (Rissel, Passmore, Mason, & Merom, 2013). Improvement in these areas will impact an older adult's functional ability to safely perform ADLs. Cycling is suitable for older adults because it is a non-weight bearing activity that puts less stress on the body (Rissel et al., 2013). The Cycling Against Hip Pain (CHAIN) program concluded that the use of a cycling exercise program for older adults can be beneficial in several areas. This study found that after a six-week cycling program participants scored better on physical evaluations and perceived pain levels, felt greater motivation to exercise, and found ADLs easier to complete (Wainwright, Immins, & Middleton, 2016). Therefore, cycling can help prevent fall risk by facilitating physical gains and ability to safely complete ADLs.

Statement of Purpose

In response to the growing population of older adults, an evidence-based exercise program has been developed to promote healthy aging. Participation in Pedaling for Health will improve the QoL of adults 65 years and older by enhancing social participation through meaningful interactions as well as maintaining their levels of physical activity. The exercise manual was created to help occupational therapists, physical trainers, and other health professionals have the necessary tools to successfully implement the exercise program at any facility. This program will help these

professionals increase client motivation for physical exercise through social participation while also improving client engagement in physical activity in their daily lives.

Maintenance of physical well-being will be accomplished through participation in a moderately vigorous cycling program. To facilitate meaningful conversations and enhance social well-being of the participants, question prompts for each exercise session have been included into the program design. While there is an abundance of evidence that assesses the impact of exercise or social participation on QoL individually, no studies have combined the components of both exercise and social participation into a single program. Pedaling for Health is an evidence-based program that bridges this gap in the literature by integrating social participation into physical activity in a novel and meaningful way.

Theoretical Framework

The Model of Human Occupation

The Model of Human Occupation (MOHO) addresses why humans engage in meaningful daily activities, also referred to as occupations. This model views humans as complex systems that interact with their environment through their thoughts, feelings, and actions (Kielhofner & Burke, 1980). There are hundreds of occupations that a person can choose to engage in throughout their lifetime. Through the occupations a person chooses to participate in, there could be a change in their lifestyle brought about through their thoughts, feelings, and actions. Those changes would then alter their values, interests, and motivation. MOHO supports the need for this program as it defines function as the ability to choose, organize, and perform occupations that are meaningful. To support older adults, it is imperative to provide a meaningful outlet for physical

exercise. Pedaling for Health differs from the programs currently available as it purposefully incorporates an opportunity to socially interact with other group members in a deeper context.

This program promotes QoL for older adults in both physical and mental domains. The development of Pedaling for Health has been guided by principles of MOHO that suggest that changes in thoughts, feelings, and physicality develop from a participation in an exercise program that positively impacts the QoL of older adults. The number of seniors who are living alone is increasing at a steady rate which puts them at higher risk for loneliness and social isolation (Hwang et al., 2019). Moreover, the lonely and socially isolated are at higher risk for a multitude of psychosocial and physical disorders including dementia, depression, physical decline, falls, hospitalization, and premature mortality (Cacioppo et al., 2015; Nicholson, 2012). A study found that the social aspects of the exercise programs and the accountability associated with participation were the biggest motivators (Biedenweg et al., 2014). By motivating them to participate in our exercise program, we hope to positively impact their overall QoL and how they intrinsically feel. Pedaling for Health aims to improve the social wellbeing of its participants as a means to enhance intrinsic motivation to adhere to exercise. While highlighting the numerous benefits of a regular exercise program, it is also important to consider the factors that positively influence exercise compliance. Some factors that have been integrated into the design of this program include making it a supervised program that aims to lower the risk for depressive symptoms (Rivera-Torres, Fahey, & Rivera, 2019). Inclusion of meaningful discussion topics in this supervised group exercise program aims to improve motivation and therefore long-term compliance to an exercise

regimen. Discussion topics include questions about their childhood, family, schooling, past careers, and others.

Performance capacity and volition are fundamental components of MOHO that guide the development of this exercise program. Performance capacity is a person's underlying mental and physical abilities that are used within occupational performance and applies to Pedaling for Health's goal of improving functional mobility within older adults (Kielhofner & Burke, 1980). This Cycli™ program aims to maintain functional mobility and preserve performance capacity in daily routines, such as ADLs. By doing so, this contributes to overall QoL as it promotes maximum independence in older adults. Another rationale for using MOHO as a foundation is the motivational aspect of the model as previously stated. We have included motivation through meaningful socialization in this nine week exercise program. According to MOHO, volition is an important aspect of participating in occupations because it provides internal motivation for activities. In one study, occupational competence and self-efficacy showed significant increase after participating in an exercise program where social participation and accountability served as the biggest motivators (Biedenweg et al., 2014). When an occupation is valuable and meaningful to the client, performance capacity is more likely to improve, facilitating a sense of self-efficacy and personal achievement in older adults.

Methodology

In response to the state mandate following the COVID-19 outbreak, Pedaling for Health transitioned from a randomized controlled trial study to a program development project. Pedaling for Health met with Flint Rehab to obtain five Cycli™ units to utilize for the study. After conducting a preliminary literature review, the exercise program for

older adults was designed based on the success of previously developed programs. Initially, the program was designed to work with adults 65 years and older to determine the impact of purposefully incorporating thematic discussions into exercise groups to facilitate meaningful connections.

A secondary literature review was completed to modify the exercise program to better fit the needs of the aging population. The articles that were used to guide the development of Pedaling for Health were summarized and included in the program binder to reference as needed. While the literature regarding the development of the exercise program was previously discussed, evidence for the suggested assessment battery is written about in detail here.

Sections of the Manual

The manual created for Pedaling for Health is a nine-week program for older adults. The manual was divided in such a way that it would be simple to follow with visual aids, explanations, and step-by-step directions. The manual includes instructions with images that explains how to set up the Cycli™ with ease. The next section is the Cycli™ user guide. It begins by showing how the Cycli™ should look after being set up properly, and goes on to include directions and images of how to navigate the Cycli™ touch screen, connect Cycli™ to Bluetooth, and how to create groups with Cycli™ machines.

After properly setting up Cycli™ and understanding how to utilize all its features, the manual includes a table of instructions and recommended devices for taking participant's vitals. Vitals should be taken before, during, and after each session to ensure the safety and health of each participant. Vitals to be taken include oxygen (O_2) saturation

levels, blood pressure (BP), and heart rate (HR) using a manual or automatic blood pressure cuff and pulse oximeter. Clearance from a medical doctor for each participant is suggested before admittance to the program. In addition, it is required that the Mini-Mental State Examination (MMSE) be administered to all potential participants. Participants must score a minimum of 25 to ensure cognitive ability to provide informed consent as well as engage in the daily discussions appropriately (Folstein, Folstein, & McHugh, 1975).

Next, the manual includes suggestions for how group members should be oriented to the Cycli™ group exercise program before the first day of the program. The orientation includes a fifteen minute instructional session to teach the group members how to safely and properly use the Cycli™. Group members will also be made aware of the safety protocols and how their vitals will be monitored. An explanation about the social component of the program is also provided to conclude the orientation. The group is a safe environment in which everyone is welcome to share their thoughts and ideas. It is expected that information gained from others stays confidential. The manual includes step-by-step instructions for each exercise session, including the five minute warm-up, twenty minute group activity, and five minute cool-down. The warm-up includes thirty seconds of marching in place, two and a half minutes of light stretching, and two minutes of low intensity cycling on Cycli™. The stretching during the warm-up is outlined in a chart that includes visual aids for each type of stretch that will be done, an explanation of how to properly do the stretch, and how long to hold the stretch for.

Once the warm-up is completed, there are instructions that detail the exercise program utilizing the Cycli™ and the social component of the activity. The cycling

program will consist of three different levels of difficulty that the participants will move through as the program progresses. The program is outline as the following:

- Week 1 - Week 3: Beginner (Cycli™ level 3)
- Week 4 - Week 6: Intermediate (Cycli™ level 4)
- Week 7 - Week 9: Advanced (Cycli™ level 5)

Following this, instructions for facilitating proper social engagement is outlined. The Cycli™ machines are recommended to be placed in a circular formation so that the participants are facing inward towards one another. The role of the instructor is to facilitate social participation between group members and ensure safety. In this section of the manual, there are one hundred questions categorized in a table that can be used as discussion topics to facilitate social participation.

The last section in the exercise program component of the manual is the cool-down at the end of each group session. The participants will cool-down with one minute of low intensity cycling on Cycli™ and four minutes of lower body stretches that will be led by the instructor(s) of the class. The cool-down section includes a detailed table that includes visual aids to see how the stretch is done, an explanation of how to do the stretch properly, and how long the stretch should be held.

The next section includes proper posture and position of the Cycli™. It is instructed that all Cycli™ machines are placed on a hard, flat, and stable surface at all times and stable, non-moving chairs with backrests should be used during the exercise. Chair height and position of the Cycli™ may vary across participants to accommodate for different participants' heights and preferences. The proper distance to position each Cycli™ between participants is also explained.

The suggested battery assessments to be used include the Timed Up and Go, the 6 Minute Walk Test, and the WHOQOL-BREF, which are detailed below.

Pre- and post-assessment guide. The suggested assessments included in Pedaling for Health aim to measure the impact of the nine-week program on social and physical QoL.

MMSE. This is a widely used assessment among older adults that assesses an individual's cognitive function and impairments. It assesses orientation, attention, calculation, recall, language, and motor skills (Dementia Care Central, n.d.). Because the MMSE is an assessment that provides insight into an individual's cognitive functioning, it has been utilized within Pedaling for Health to ensure that all who are interested in the program have a complete understanding of the exercise program's risk benefits prior to participating. A score of 25 to 30 suggests normal cognition and thus a capacity to make an informed decision to participate and in meaningful discussions throughout the program's duration (Folstein et al., 1975). Additionally, the brevity of the MMSE makes the assessment advantageous to use within a fast-paced, clinical setting as it should take no longer than 10 minutes to administer (Arevalo-Rodriguez et al., 2015).

Studies have found the MMSE to have excellent internal consistency with older adults, Cronbach's $\alpha = 0.9$, and excellent interrater reliability, intraclass correlation coefficients (ICC) = 0.75 (Marioni, Chatfield, Brayne, Matthews, & Medical Research Council Cognitive Function and Ageing Study, 2011; Feeney et al., 2016). The MMSE also has excellent convergent validity when compared to the General Practitioner Assessment of Cognition (GPCOG) and the Montreal Cognitive Assessment (MoCA; Brodaty et al., 2002; Trzepacz et al., 2015). Convergent validity between the MoCA and

the MMSE for patients with mild cognitive impairment resulted in a correlation coefficient of r= 0.60 (Trzepacz et al., 2015). Similarly, convergent validity between the GPCOG and the MMSE for community dwelling older adults resulted in a correlation coefficient of r= 0.683 (Brodaty et al., 2002). Due to excellent reliability and validity of the MMSE when used with the older adult population, as well as its popularity and quick time to administer, the MMSE is a highly recommended pre-assessment for Pedaling for Health. The MMSE will quickly and accurately measure the cognitive ability of participants prior to acceptance into the exercise program in order to ensure a participant understands the exercise program and can socially engage with peers.

Timed Up and Go (TUG). Initially known as the "Get-up and Go Test," this assessment was created to quantify balance and determine the risk of falls in elderly people (Mathias, Nayak, & Isaacs, 1986). Rather than using a rating system of 1 to 5, Podsiadlo and Richardson (1991) modified the TUG to measure the time in seconds it takes for a participant to stand, walk, and sit. To administer the TUG, the therapist will tell the participant "go" and then record the time it takes to stand from a seated position, safely walk to a previously marked point 10 feet (3 meters) away, and then return to their seated position. During this assessment it is imperative that the participant uses any ambulatory devices that support their safety and maintain a comfortable walking speed for the duration of the test.

In a study of 2,305 adults who were 69 years and older, the test retest reliability of the TUG was rated adequate (Rockwood, Awalt, Carver, & MacKnight, 2000). Meanwhile, in a study of 96 community-dwelling adults ages 61 to 89 years old, the test retest reliability of the assessment was rated excellent (Steffen, Hacker, & Mollinger,

2002). Researchers for each study used intraclass correlation coefficients to determine the test retest reliability and determined ICC= 0.56 when used with older adults, and ICC= 0.97 when used with community-dwelling older adults (Rockwood et al., 2000; Steffen et al., 2002). Adequate to excellent correlations between the TUG, the Tinetti Balance (r= -0.55) and the 2 Minute Walk Test (r= -0.68) established the convergent validity of the TUG (Brooks, Davis, & Naglie, 2006; Lin et al., 2004). The correlation coefficient (r) is used to measure the relationship strength between two variables. The negative r value for the TUG score suggests an inverse correlation, which is expected because lower TUG scores are equivalent to better outcomes. Brooks et al. (2006) demonstrated divergent validity of the TUG by correlating it against the Functional Reach Test (r= -0.36). Together, these components verify the construct validity of the TUG to screen for balance issues in older adults.

A minimum of two repetitions and a maximum of four yielded the most accurate results when administering the TUG (Collado-Mateo et al., 2019). A time of 12 seconds or more suggests that the participant is at risk for falls (CDC, 2017). It is important to note that while studies have established the test retest reliability and construct validity of the TUG, the scores of this assessment should be taken in context of other variables and cannot be used alone in identifying the participant's fall risk (Barry et al., 2014).

Data suggests that the TUG is a well-known and often-used test that shows clear results for a person's muscle function and balance in their lower body (Daly et al., 2015). Using the TUG, Daly et al. (2015) found their participants significantly decreased how many falls they had, and increased their muscle strength, muscle function, and functional balance. Parry et al. (2014) used the TUG as a screening and assessment tool for older

adults who were at high risk of falling. The TUG was used in Parry et al.'s (2014) research in order to identify older adults' current musculoskeletal function and balance at their baseline to then compare it to mid-assessment and post-assessment TUG in order to gauge the improvement through the means of a standardized test. It was found that from the TUG, the older adults' musculoskeletal function and balance significantly improved and that this assessment was an accurate representation of the older adults' increase in fall prevention and decrease in falls.

6-Minute Walk Test. The Six Minute Walk Test (6MWT) is a standardized assessment that evolved from the more physically demanding 12-minute walk test. In the official statement of American Thoracic Society (ATS) in 2002, the ATS board of directors described the 6MWT as equal in performance to its predecessor while being easier to administer, better tolerated by patients, and more reflective of ADLs than other walking assessments. The 6MWT is used to assess someone's functional mobility and can be an indicator for other physical limitations. The distance a patient can walk back and forth down a flat, hard one-hundred foot hallway in six minutes is measured during the assessment. A distance of five-hundred to six-hundred meters is considered normal functional mobility (ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002). This test will be incorporated into our program as an indicator for the likelihood of falls.

A study done with older adults showed that the 6MWT had excellent test-retest and inter-rater reliability (Chan & Pin, 2019). The test-retest intraclass correlation coefficients (ICC) was .91-.98, the inter-rater reliability was ICC = .86-.96. The correlation between the test and the functional measures it assesses were found to be p

= .34-.55, which is interpreted as moderate correlation. The 6MWT was also found to be able to accurately determine if someone could walk indoors only or if they had the ability to walk indoors and outdoors, p≤ .036. This study concluded that the 6MWT is a reliable and valid measure when assessing walking ability in older adults (Chan & Pin, 2019).

The 6MWT is relevant to the current study because it is a self-paced test that assesses an individual's submaximal level functional capacity (ATS Board of Directors, 2002). Because individuals are prompted to walk at their own intensity level with rest as needed, this test is highly representative of the individual's functional exercise ability and tolerance during daily activities. This test is also beneficial as it does not require any equipment or training to administer. Moreover, an active lifestyle has been proven to be a predictor of greater distance achieved in the 6MWT (Steffens et al., 2013). This is relevant because an active lifestyle is correlated with higher QoL (Mulry et al., 2019). In other words, 6MWT is correlated with improved QoL measures (ATS Board of Directors, 2002). Therefore, this assessment will be a useful outcome measure of fall risk and QoL.

WHOQOL-BREF. The WHOQOL-BREF is a standardized assessment method that is commonly used for health-related QoL measurements, which includes measuring a person's physical health, psychological health, social relationships, and environmental impacts (Daly et al., 2015). The WHOQOL-BREF has been shown to have good discriminant validity and test-retest reliability (WHO, n.d.). This shows that this assessment is a good choice to measure QoL in any population. For the test-retest reliability, one study found the "physical" aspect of the assessment was p= 0.92, the "psychological" aspect was p= 0.94, the "social relationships" aspect was p= 0.89, and the "environment" aspect was p= 0.80 (Carpiniello, Pinna, Carta, & Orrù, 2006).

Discriminant validity was shown by the significantly higher scores the control group received as compared to the experimental group. In this study, the control group was made up of people who did not have any mental health issues and the experimental group consisted of people who struggled with mental health. The scores show that this test is able to accurately discriminate between healthy participants and participants who have mental health concerns.

The WHOQOL-100, the longer version of the WHOQOL-BREF, was developed globally to be able to create a standardized test that could measure a person's QoL through statements drafted by patients with a wide variety of diseases, as well as health care professionals from a variety of cultures. The WHOQOL-BREF is a 26-item shortened version of the WHOQOL-100 that is available in over 20 different languages. The WHOQOL-BREF focuses on the individual's perception of their own well-being; this design allows for inclusion of the participant's perspective on their life and guides implementation of client-centered interventions (WHO, n.d.). The WHOQOL-BREF is an appropriate outcome measure for Pedaling for Health because it adequately and accurately measures multiple facets of QoL in accordance with the multiple facets of Pedaling for Health.

Literature review. A summarized literature review is provided for the implementers of the program to reference as needed and to provide participants with justification for the program. The literature review is formatted into three tables according to the subject matter of the article. The subject matter is divided into social participation, fall risks, and physical benefits as is done in the literature review of the present thesis.

Materials

Pedaling for Health is designed to be used with a Cycli™ unit, which can be obtained directly through Flint Rehab or online. Other materials needed to ensure safety include a manual or automatic blood pressure cuff, pulse oximeter, and a sturdy chair with a backrest. Optional materials to be used as needed include a non-slip grip to place under the Cycli™, water for participants, and cushions for chairs.

Ethical and Legal Considerations

The use of Cycli™ for this exercise program has been approved of by Flint Rehab. There is no intent to market or sell Cycli™ and there is no obligation to purchase a unit after participation in Pedaling for Health. During implementation of this exercise program, legal and ethical concerns regarding the risk of injury must be made. It is suggested that the group leader administer the MMSE to all potential participants to ensure that each individual is cognitively able to provide informed consent. Currently, evidence in the literature that normalizes for ages 65 and older is insufficient to determine a specific score cutoff that indicates dementia (Kvitting, Fällman, Wressle, & Marcusson, 2018). Therefore the original scoring of 25 or higher, which suggests no cognitive impairment, is suggested to be used by the group leader implementing the program when choosing participants (Pezzotti, Scalmana, Mastromattei, Di Lallo, & Progetto Alzheimer Working Group, 2008). During orientation, the participants must be informed of the risk of injury and be provided a waiver to sign. This waiver can only be signed once participants have understood the terms of participation as well as conferred with the necessary medical professionals to be cleared for participation. In addition, it is necessary to educate participants about physiological warning signs of overexertion and cease

participation if they are experiencing any symptoms. Placards displaying average vital signs such as O_2 saturation levels, BP, and HR can be displayed as a reminder (Harvard Health Education, 2015).

Discussion

As previously suggested, Pedaling for Health can be utilized by occupational therapists (OTs) to increase the quality of life of their patients. Specifically, Pedaling for Health can be used as an intervention for older adults in senior centers, skilled nursing facilities, hospitals, mental health clinics, dementia care clinics, assisted living facilities, residential care facilities, and more. The research collected and the program proposal suggest that functional and community mobility in older adults is not solely a physical issue, but also a social issue. We argue that this program encourages OTs to incorporate more social aspects into therapy to assist older adults in creating meaningful connections vital to their QoL. By using this program, OTs can help older adults improve their physical health and gain a broader and more meaningful social network. With this, older adults will feel encouraged to venture out into the community more often and more effectively engage in occupations. Pedaling for Health stays in accordance with the occupational therapy research agenda under the intervention and basic research sections (The American Occupational Therapy Foundation [AOTF] & The American Occupational Therapy Association, Inc. [AOTA], 2011). The program can be considered a preventative and restorative intervention that OTs can choose to implement with their clients (AOTF & AOTA, 2011). Extensive research has been provided to explain the necessary body structures and functions that are required to pedal and how these can

directly impact occupational performance, which qualifies this research to fall under the basic research category (AOTF & AOTA, 2011).

The field of OT continues to work towards the AOTA's Centennial Vision of being an evidence-based practice (AOTA, 2015). Steps to achieving this goal are guided by AOTF and AOTA's (2011) research agenda. As it was previously stated, Pedaling for Health accomplishes the objectives of basic and intervention research. However, it also has the potential to function in health services research in the future. Unprecedented medical advancements in conjunction with a growing population of older adults urges OTs to expand the number of available evidenced-based interventions to help promote healthy aging. While a review of the literature was done in this current study to develop a novel social exercise program for older adults, future implications for Pedaling for Health includes conducting health services research and examining the program's effectiveness. Evaluation of this program's outcomes would provide clinics such as skilled nursing facilities or hospitals with an evidence-based intervention to help enhance their rehabilitation programming. In addition, the ease of Pedaling for Health allows for its implementation within the community such as in adult daycares, thus contributing to preventative health services. Pedaling for Health is an engaging and meaningful alternative to traditional physical exercise for older adults.

Limitations

The proposed results of the exercise program cannot be confirmed as it has not yet been implemented. Efficacy of the proposed program cannot be assessed until it is tested. Future researchers can use this program to measure the effects of social participation and cycling on the QoL of older adults. Furthermore, there is an expected limitation in terms

of generalizability of this program as it may only be applicable to participants who are considered cognitively able to both provide informed consent as well as discuss their experiences in weekly sessions. The future direction of Pedaling for Health is to be implemented within a clinical setting to obtain quantifiable measurements about the program's effectiveness. However, there are natural time constraints faced by practicing therapists and clinicians that limit the feasibility of implementing a pre- and post-test intervention study as suggested by the program. The final limitation of this study relates to the accessibility of obtaining a Cycli™. Pedaling for Health may need to be modified utilizing already available exercise bikes in the setting that it is being implemented, however this modification has not been explicitly made with the program's design.

Conclusion

Adults over the age of 65 are at a higher risk for falls, muscle deterioration, and issues with balance (Harvey et al., 2018). Many older adults also report that they feel a sense of loneliness or disconnect from people as they age (Hamar et al., 2013). Exercise programs have been found to be a great tool to facilitate healthy aging and decrease the previously mentioned issues that many older adults face. The use of a cycling exercise program benefits older adults because it puts less stress on the joints and positively impacts a person's functional ability (Rissel et al., 2013; So et al., 2005; Wainwright et al., 2016). This literature review suggests that both exercise programs and social participation positively impact QoL in older adults. However, no studies have specifically integrated social activity with exercise to determine the effect on QoL and physical functionality. While group exercise programs have been proven beneficial in older adults, they do not guarantee social participation (Maher & Mendonca, 2018; Papageorgiou et

al., 2016). Pedaling for Health uniquely combines social participation with physical activity to holistically address the issues that older adults are currently facing. To support adults ages 65 and older, Pedaling for Health is a novel opportunity for clinicians to simultaneously implement exercise and meaningful socialization in treatment or community-based programs. The literature has stressed the positive impacts of both sustained physical activity as well as meaningful connections to others and Pedaling for Health is a vehicle to achieve those benefits in a fun and simple way.

Pedaling for Health is a program proposal intended to be utilized in OT practice or future research studies. The program has not been tested for clinical efficacy; therefore, it is recommended that future researchers consider utilizing the program to test its effectiveness with the intended population. The AOTA Centennial Vision emphasizes that OT practice is an evidence-based profession, hence why Pedaling for Health was developed from an extensive literature review of evidence-based interventions (AOTA, 2015). Moreover, subsequent studies aiming to prove the effectiveness, or lack thereof, of our program can contribute to the evidence-based literature OTs base their interventions on. Pedaling for Health also aligns with the AOTA Centennial Vision in that the program is designed to meet the occupation needs of older adults based on gaps gleaned from the research. To better align with the AOTA's Centennial Vision, it is recommended that future studies assess the efficacy of Pedaling for Health in order to establish its status as an evidence-based intervention. While this program can be used in OT practice today, a review of its efficacy will provide OTs with sufficient evidence to support their decision making with greater certainty and confidence.

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Appendix A

Pedaling for Health: A Social Exercise Program Manual

The Pedaling for Health: A Social Exercise Program Manual can be found at the following URL address:

https://drive.google.com/file/d/1qv0UvVeulyME7i7NupUilkuiA_Z1hG4y/view?usp=sharing

Appendix B

Institutional Review Board Approval

The Stanbridge University Institutional Review Board has completed a review of your application entitled “Exercise Program Manual for use with Cycli." Your application (MSOT09-016) is complete, approved, and categorized as exempt. Your modification request dated 04/14/2020 is also approved.

IRB Application Number	MSOT009-016
Date	04/15/2020
Level of Review	**Exempt**
Application Approved	X
Conditional Approval	
Disapproved	
Comments	Initial application was full board. Modification submitted 04/14/2020. Categorized as exempt.
Signature of IRB Chair