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Effectiveness Of An Aquatic Exercise Program For Reducing Weight, Body Fat And Chronic Low Back And Joint Pain

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EFFECTIVENESS OF AN AQUATIC EXERCISE PROGRAM FOR REDUCING WEIGHT, BODY FAT, AND CHRONIC LOW BACK AND JOINT PAIN

By

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ABSTRACT

EFFECTIVENESS OF AN AQUATIC EXERCISE PROGRAM FOR REDUCING WEIGHT, BODY FAT AND CHRONIC LOW BACK AND JOINT PAIN

By

Terilyn Marie Darley

According to the World Health Organization (WHO), obesity has risen at an alarming rate and has reached epidemic proportions throughout the world (WHO, 2017). In the U. S., approximately 93.3 million U.S. adults are obese with an overall prevalence of 39.8 %. Chronic pain is another public health issue in the U.S, affecting almost 100 million people and is associated with significant annual healthcare costs and lost productivity (National Center for Complementary and Integrative Health [NCCIH], 2017). Exercise is considered one of the most effective prevention strategies for reducing obesity and has been documented to decrease chronic pain. The purpose of this Doctor of Nursing Practice (DNP) project was to determine if the WATERinMOTION aquatics exercise program was effective in promoting weight loss, decreasing percent body fat, and reducing chronic low back or joint pain. These aquatic programs were offered at two rural Young Men's Christian Association (YMCA) sites. A pre/post-test, quasi-experimental design with a convenience sample (N = 11) was utilized. Participants completed a four or five-week aquatics exercise class which met twice a week. Pre/post-anthropometric measures (weight, percent body fat, and body mass index) and pre/post self-reported pain measurements were obtained using the numerical pain scale and survey questions about pain medication use. Upon analysis, statistically significant differences were observed in body weight (p = .005) and body mass index (p = .003) between the pre and post measurements. However, no significant differences were found in percent body

fat (p = .113) or pain (p = .112). Despite, the classes being offered only twice a week for four or five weeks and use of a small sample size, participants in the WATERinMOTION aquatics exercise program did demonstrate some positive weight loss benefits.

DEDICATION

This Doctor of Nursing Practice project is dedicated to those who have supported me through this journey. Thank you to my parents who pushed me to be the best version of myself. I am thankful for your kind hearts that influenced me to want to make a career out of helping others. Thank you to my sisters. You have always been there when I needed you and have been examples of resilience. To my husband, you have loved me, encouraged me, pushed me, and supported me, while providing for our family and earning your own FNP degree; you are a great example of dedication and perseverance in difficult times. Last but certainly not least, to my sweet girls, the joy and happiness you have brought to my life throughout this journey has been what has kept me afloat. You are my motivation and my heart, and I wish upon you, the same success and joy I have had in education and life. You deserve everything and I will always be there to encourage, support, and love you on your journey to greatness.

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
DNP	Doctor of Nursing Practice
HPM	Health Promotion Model
IRB	Institutional Review Board
LBP	Low Back Pain
NRS	Numeric Rating Scale
OA	Osteoarthritis
ODI	Oswestry Disability Index
RA	Rheumatoid Arthritis
SCT	Social Cognitive Theory
VAS	Visual Analog Scale
VRS	Verbal Rating Scale
WIM	WATERinMOTION
WOMAC	Western Ontario and McMaster Universities Osteoarthritis Index

Chapter One

Introduction to the Problem

Introduction

Obesity is a worldwide epidemic with alarming increases in prevalence across all ages and ethnic groups (WHO, 2017). In the United States, in 2017-2018, 42.4% of adults were obese (Hales, Carroll, Fryar, & Ogden 2020). The prevalence rates for obesity vary by age, gender, and ethnic groups. In 2017-2018, the U.S. prevalence rates for obesity were higher among middle aged adults (40-59) than younger aged adults (20-39) in both men and women. Men have a higher prevalence that women among the non-Hispanic white, Hispanic, and non-Hispanic Asian adults, but not among the non-Hispanic black adults (Hales et al., 2020). Further, the obesity rate is estimated to increase to 50% in developed countries by 2025 (Tamin & Loekito, 2018).

Obesity imposes financial burdens on the individual, family, and nation. The total annual medical costs for noninstitutionalized obese adults aged 18 and older in the United States was estimated to be $342.2 billion in 2013 (Biener, Cawley, & Meyerhoefer, 2017). The average medical costs of a person with obesity are approximately $1,429 more than for those persons with normal weight (Hales et al., 2020). Total health care spending for adults with obesity- related illness has increased from 20.6 percent in 2005, to 27.5 percent in 2010, and rose to 28.2 percent in 2013. Obesity is associated with serious health risks including heart disease, atherosclerosis, stroke, high cholesterol, certain cancers, and sleep disorders (National Heart, Blood and Lung Institute [NHBLI], n.d.).

In addition to being associated with serious health risks, obesity is also a comorbity in chronic pain conditions (Okifuji & Hare, 2015). Chronic pain is another significant U.S. public health issue affecting about 100 million people with an annual cost of approximately $560 to $635 billion for healthcare costs and lost work productivity (NCCIH, 2017). Chronic pain can be caused by pathogenic, genetic, or biologic conditions. Examples of disease associated with chronic pain include osteoarthritis (OA), rheumatoid arthritis (RA), and connective tissue disorders. Chronic pain can be idiopathic, for example fibromyalgia and chronic widespread pain. Many persons also suffer from chronic low back pain (LBP) or chronic pelvic pain (Ambrose & Golightly, 2015).

Regular physical activity is particularly important when a person is trying to lose weight or maintain a healthy weight. Physical activity increases the number of calories the body uses for energy (CDC, 2015). The increased use of calories during exercise in combination with healthy eating results in weight loss. Although, research has demonstrated most weight loss is due to decreased caloric intake of a healthy diet, the only way to maintain this weight loss is with regular physical activity (CDC, 2015). Physical activity is also important in those who suffer from chronic pain. Evidence has shown that physical activity can reduce severity of the pain, improve physical function, and has a variable effect on psychological function and quality of life (Geneen et al., 2017).

In addition to promoting weight loss and reducing chronic pain, physical activity has been documented to reduce high blood pressure and lower the risk for type 2 diabetes, myocardial infarction, stroke, and cancer (CDC, 2015). Additional muscle-skeletal benefits include reduction in osteoporosis and fall risk, and decreased arthritis pain along with the associated disability. Regarding mental health, regular exercise is well documented to decrease depression and anxiety (CDC, 2015). Thus, regular physical activity is a significant intervention that health care providers should consider as primary and secondary prevention strategies for several chronic diseases. Exercise can also help to mitigate symptoms and slow or stall disease progression (Ambrose & Golightly, 2015).

Statement of Problem

Overweight/Obesity. Being overweight or obese is caused by the increased size and amount of fat cells in the body (NHLBI, 2019). When a person's weight is higher than what is considered healthy for their measured height, this condition is defined as being overweight or obese (NHLBI, 2019). Body Mass Index (BMI) is a useful screening tool for determining healthy body weight and identifying persons who are underweight, overweight, and obese. BMI is a formula that takes "a person's weight in kilograms divided by the square of height in meters" (CDC, 2017). Overweight is defined as a body mass index (BMI) greater than 25.0, with obesity defined as a BMI of 30 or higher (CDC, 2017). While BMI's measurements are useful for screening, they are not diagnostic of the body fat or health of an individual. Some people may have a BMI that falls into the obese category but have no excess body fat. Thus, BMI's along with measurements of body fat have been strongly correlated with various adverse health outcomes (CDC, 2017).

Musculoskeletal Pain. Arthritis is the leading cause of disability in the U.S. affecting about 22% of adults and almost half of adults 65 and older (Ambrose &

Golightly, 2015). Osteoarthritis (OA) is the most prevalent form of arthritis and is becoming increasingly more common due to the expanding population of older adults. OA is the leading cause of long-term disability and activity restriction in the older adult population due to the related joint pain and mobility limitations (Stover et al., 2015).

In addition to arthritic pain, Rubin (2007), estimates that 50-80% of people in the U.S. will be affected by at least one episode of LBP in their lifetime. Research shows that at least 35% of patients who have had surgery for back pain remain in chronic pain or even disabled (Johnson, Keyan, & Rosario, 2016). Chronic pain from OA or back conditions may lead to several additional problems including fatigue, sleep troubles, difficulty with mobility, depression and anxiety, and a reduced quality of life (NCCIH, 2017).

Physical activity. Treatments for persons who are overweight or obese include recommendations for lifestyle changes such as healthy eating and increased physical activity. More extensive treatment plans include weight loss medications and possibly surgery (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2018). In contrast, physical inactivity is a modifiable risk factor for several diseases including obesity (Warburton, Nicol, & Bredin, 2006). Physical inactivity may also exacerbate chronic pain conditions and increase the risk of chronic diseases (Ambrose & Golightly, 2015).

Physical activity has been well-documented as a useful therapeutic modality for treating chronic pain conditions (Ambrose & Golightly, 2015). Although moderate to vigorous intensity exercise has been shown to be effective for weight management, some populations may need a lower impact exercise regimen. For example, persons who are obese, older, or in chronic pain, can benefit from a low resistance exercise program, such as aquatic exercise, which can minimize excessive joint loading and related joint pain (Ambrose & Golightly, 2015).

Statement of Purpose

The purpose of this Doctor of Nursing Practice (DNP) project was to determine if the WATERinMOTION aquatics exercise program at two rural Midwestern YMCAs was effective in promoting participants' weight loss, decreasing percent body fat, and reducing chronic low back or joint pain. Aquatic exercise may be a good option for promoting health by improving physical activity levels, decreasing chronic pain, and promoting weight loss.

Theoretical Framework

For this DNP project, the Pender (2011) health promotion model (HPM) was used to plan, promote, and evaluate the positive benefits of the WATERinMOTION aquatic exercise program on reducing weight, body fat, and chronic pain. One of the model's key assumptions is that persons will make a commitment to engage in behaviors in which they anticipate deriving some valued personal benefits (Pender, 2011). The second related HPM premise is a person's perceived competence or self-efficacy to execute these behaviors will increase their likelihood of commitment to action and performance of that behavior. The HPM takes into consideration how one's thoughts, behaviors, and the environment interact to allow or prohibit individuals from engaging in actions to reach achievable goals and valued outcomes (Pender, 2011). The intervention of the WATERinMOTION aquatic exercise program provided to individuals in the community should be useful to promote healthy behaviors. According to the Pender model, participants should be able to see the benefits of implementing a plan of action (aquatic exercise) to achieve desired goals (reduction of weight, body fat, and chronic pain) to reach the valued outcome of healthier lives.

Chapter Two

Literature Review

Introduction

The purpose of this literature review was to find and evaluate articles that looked at the importance and benefits of physical activity, specifically aquatic exercise, in improving the overall health of the adult population. This review examined obesity and musculoskeletal pain and the benefits of aquatic exercise specifically related to weight loss and pain reduction associated with musculoskeletal problems of low back and joint pain.

CINAHL, PubMed, Cochrane Database, and Google Scholar were utilized for this review of the literature. The timeframe included for the searches was limited to the last 10 years but some historical studies from greater than 10 years were also useful and supported more current evidence. Several topics were searched including physical activity, aquatic therapy, aquatic exercise, obesity, low back pain, joint pain using the following key words: aquatics, aquatic therapy, aquatic exercise, obesity, weight reduction, musculoskeletal pain, and pain reduction.

Obesity

Obesity is defined as an excess fat accumulation that increases risk to health. Body Mass Index (BMI) is often used an indicator of body fatness. BMI is calculated by taking a person's weight in kilograms and dividing it by the square of their height in meters (CDC, 2017). The CDC has established the following BMI parameters related to body fatness: BMI less than 18.5 is underweight, BMI from 18.5 to < 25 is normal weight, BMI ≥ 25 but less than 30 is overweight, and BMI of 30 or higher is obese.

Obesity is then subdivided into three classes; Class 1 is a BMI of 30 to < 35, Class 2 is a BMI of 35 to < 40, and Class 3 is a BMI of 40 or higher, which is also classified as extreme or severe obesity.

In 2018, obesity affected about 93.3 million U.S. adults with differences noted between ethnic, groups (Hales et al., 2020). In 2017-2018 the highest age-adjusted prevalence of obesity was found in non-Hispanic blacks (49.6%) and Hispanics (44.8%), followed by non-Hispanic whites (42.2%) and non-Hispanic Asians (17.4%) (Hales et al., 2020). Obesity rates among various age groups include: 20-39 years 40%, 40-59 years 44.8% and age 60 and older 42.8% (Hales et al., 2020). In 2008, the estimated medical cost of obesity was $147 billion (CDC, 2020a). It has been estimated that by 2030 obesity related medical costs could rise by $48 to $66 billion a year in the United States if obesity trends are not addressed (Harvard University School of Public Health, n.d.).

There are several factors that influence obesity. At first, it may seem simple; if a person consumes more calories than he/she burns through physical activity then that person will gain weight. However, this simple explanation is not the only reason why people gain weight. The risk factors can be complex and include the following: genetics, socioeconomic, metabolic, lifestyle choices, certain endocrine disorders, diseases, and medications side effects (Stanford Health Care, 2019). Obesity is a serious health concern as it is associated with poor mental health outcomes, reduced quality of life, and is one of the leading causes of death in the U.S. (CDC, 2020a).

Healthy lifestyle behaviors are essential for promoting and maintaining a recommended weight. A nutritious diet, proper portions, and regular physical activity are the primary healthy behaviors that need to be implemented. A person should strive for a balance between calories consumed and the calories their body uses to prevent excess weight gain (CDC, 2020b). Piercy et al. (2018) lists the Physical Activity Guidelines for Americans, which recommend for adults at least 150 to 300 minutes a week of moderate intensity activity or 75 to 150 minutes a week of vigorous activity, or an equal combination of both moderate and vigorous, as well as two or more days of strength training per week. These recommendations emphasize that more movement and less sitting provide benefits to nearly every adult.

Musculoskeletal Pain

Musculoskeletal conditions or disorders involve a part of the musculoskeletal system that is injured or affected over a period of time (Verhagen, Cardoso, & Bierma-Zeinstra, 2012). These conditions are among the most common chief complaints when patients see a general medical provider. Symptoms can include pain, dysfunction, and discomfort of bones, joints or muscles. These disorders can be acute, chronic, focal or diffuse in nature and may result from sports, work, hobbies, or systemic diseases such as rheumatoid arthritis or degenerative disease such as osteoarthritis, fractures, or contusions (Verhagen et al., 2012). Of these disorders, osteoarthritis and low back pain are the most common. Radiographic evidence of OA is observed in the majority of older adults age 65 and older (Arden & Nevitt, 2006) and the majority of adults will be affected by at least one episode of low back pain (Rubin, 2007). Interventions for the pain associated with musculoskeletal disorders can be pharmacological and non-pharmacological. Aquatic exercises, which are a non-pharmacological intervention, are often prescribed for these conditions (Verhagen, et al., 2012).

Arthritis

Osteoarthritis (OA) is the most prevalent form of arthritis worldwide. It is becoming increasingly common in the expanding population of older adults and is considered the leading cause of long-term disability and activity restriction in the older adult population (Stover et al., 2015). OA is associated with swelling, disability, decreased range of motion, bony deformities, reduced quality of life and risk of death, but pain is the most common symptom. Those who suffer with this debilitating disease become less active because of joint pain. This can lead to weight gain, muscle weakness, swelling, and depression (Stover et al., 2015).

Low Back Pain

Rubin (2007), estimates that 50-80% of people in the U.S. will be affected by at least one episode of low back pain (LBP) in their lifetime. LBP is defined as back pain that is located between the lower ribs and above the gluteal folds, and can be associated with or without leg pain (Shi et al., 2018). LBP can be a result of injury to different areas of the spine such as muscles, ligaments, facet joints, discs, nerves, or bones (Johnson, et al., 2016). The majority of LBP is non-specific, and the prevalence of LBP rises with advancing age. This increase is due to decreased bone strength, muscle elasticity and tone, as well as inactivity, injury and arthritic pain (Johnson et al., 2016).

Treatments for LBP include ice and heat, rest, surgery, medications, physical therapy, chiropractic adjustments, ultrasound, and acupuncture which can result in high healthcare costs (Johnson et al., 2016). It is unclear which of these treatments are most effective. Research shows that at least 35% of patients who have had surgery for back pain remain in pain and/or become disabled (Johnson et al., 2016).

Physical Activity & Exercise:

Physical activity is defined as any movement by the skeletal muscles that use energy expenditure (WHO, 2019). Exercise is a subcategory of physical activity that is planned, repetitive, and purposeful where the improvement of one or more components of physical fitness is the goal (WHO, 2019). Physical fitness is a physiological state of well-being that allows for a person to meet the demands of daily living. Physical fitness related to health status includes components such as cardiovascular fitness, musculoskeletal fitness, body composition, and metabolism (Warburton et al., 2006).

Warburton et al. (2006), completed a literature review that looked at the role that physical activity plays in the development of chronic disease and premature death. The authors reported irrefutable evidence that regular physical activity is essential in the primary and secondary prevention of several chronic diseases such as cardiovascular disease, diabetes, cancer, high blood pressure, obesity, depression, and osteoporosis, as well as premature death (Warburton et al., 2006). Also included were several studies that looked at the relative risk of death from any cause and specific diseases associated with physical inactivity. Males and females who had increased physical activity and fitness showed a reduction in relative risk of death by 20 - 35% (Warburton et al., 2006). Evidence clearly shows that an increase in physical activity will reduce-premature death risks and a decrease in physical fitness will increase the risk (Warburton et al., 2006).

Exercise is considered the most effective prevention strategy for obesity. It also contributes to weight loss and maintenance over the long term (DiPietro & Stachenfeld, 2000). Benefits of exercise include increasing one’s metabolic rate or the number of calories the body burns in 24 hours, improved circulation, improved heart and lung function, reduction in stress and depression, appetite suppression, improved sleep, and prevention of many chronic diseases (Wayne State University Physician Group [WSUPG], 2011).

Aquatic Exercise

One of the physical activities used to combat obesity is aquatic exercise. Aquatic exercise is defined as a low impact activity that takes place in the water (Mayo Clinic, 2016). This type of exercise reduces pressure on bones, joints, and muscles and strengthens muscles by offering a natural resistance (Mayo Clinic, 2016). There are several health benefits associated with aquatic therapy including improved heart health, reduction in stress, weight loss, and improved muscular endurance, and strength (Mayo Clinic, 2016).

Water based activities such as aquatic exercise have gained popularity over the years as an alternative physical activity that can improve health and well-being (Raffaelli, Lanza, Zanolla, & Zamparo, 2010). These exercises are useful in improving the physical conditioning of young and healthy individuals as part of recreational training and are also suitable for many other special populations. For example, persons with low levels of physical fitness such as the elderly, persons with orthopedic or neurological deficits, athletes with injuries, and persons with obesity can benefit from this type of exercise (Raffaelli et al., 2010). Specifically, for obese individuals or older persons with degenerative changes, aquatic exercise is a good option because these activities are perceived as less strenuous but will reduce body weight and improve health (Tamin & Loekito, 2018). Aquatic exercise has been shown to be helpful for persons with back, knee, or joint issues often associated with OA (WSUPG, 2011).

There are several factors that make aquatic exercise a feasible option for improving health. For example, the buoyancy experienced in water reduces the effect of weight bearing and compressive forces on the skeletal joints (Raffaelli et al., 2010). The buoyancy also helps to support weak muscles as well as reduce joints stress which allows for greater mobility (See, 2015). Aquatic exercise involves whole body movements which lead to increased heart rates and energy outflow due to the water providing more resistant than air (Tamin & Loekito, 2018). The higher specific heat and thermoregulatory characteristics of water allow for training intensity and duration to progress at an increased rate compared to land exercise (Tamin & Loekito, 2018). When a person performs an aquatic activity at the same consistent and continuous speed as many land-based activities, he/she will use more energy due to the increased resistance of the water which also acts to greatly reduce the speed of the movements (Verhagen et al., 2012). The water resistance also helps build strength and endurance even with gentle movements and the increased warmth of the water has been shown to reduce pain and stiffness (Cugusi et al., 2019). Further, See (2015) notes that each person can adjust their level of training to avoid unwanted fatigue, soreness, and poor posture.

Aquatic Exercise Standards and Guidelines. "The Aquatic Exercise Association (AEA), is the world's largest certifying organization for aquatic fitness programming" (Aquatic Exercise Association, 2020, p. 1). They have set forth specific guidelines, based on current research, that help to minimize risk of injury and provide the best benefits and enjoyment of physical activity in the aquatic setting (AEA, 2020). The aquatic exercise class format should include a warmup, conditioning, and a cool down phase. Any public or private pool offering aquatic fitness programs should be maintained by the proper licensed personnel and the instructors should notify management of any concerns with the water quality (AEA, 2020). Water temperatures should range from 83-86 degrees Fahrenheit which are the most comfortable for most water fitness classes. These temperatures allow the body to react normally to the start of exercise as well as the increased body temperature that may occur during the program. Any water temperatures above or below the recommended range will require instructors to make modifications in the program to adjust accordingly to the environmental conditions. AEA recommends that obese individuals have a water temperature of 80-86 degrees Fahrenheit, older adults 83-86 degrees Fahrenheit, and those with arthritis 83-90 degrees Fahrenheit (2020). There are several other things that must be taken into consideration when having an aquatics fitness program including water depth, pool entry and exit, air quality, intensity, music tempo, equipment considerations, proper footwear and clothing, class size, and professional education (AEA, 2020).

Aquatic Exercise and Weight Loss. Over the years, recommendations have been made for all people to participate in physical activity regularly (Neiva, Faíl, Izquierdo, Marques, & Marinho, 2018). Some people have limitations that may restrict their ability to participate in exercise programs. For example, persons who are obese or have poor physical fitness levels and persons with locomotion difficulties caused by aging, orthopedic or neurological disabilities, or persons diagnosed with pulmonary disease (Neiva et al., 2018). Raffaelli et al. (2016) found that water-based exercise when compared to land exercise led to substantial increases in physical exercise.

In a non-randomized controlled trial, Neiva et al. (2018), examined the effects of a 12-week water aerobics class on health indicators and physical fitness in adults. The sample consisted of 15 participants, age 58 and older in the exercise group and eight participants, age 59 and older in the control group. The exercise group performed 45 minutes of water aerobics twice per week for 12 weeks. For the same period, the control group was not allowed to perform any physical exercise (Neiva et al., 2018). Health indicators that were measured included physical fitness (cardiorespiratory fitness, explosive strength, and upper/lower limb endurance strength) and health status (anthropometrics, lipid profile, and blood pressure). Post training results showed that the exercise group had significant decreases in body fat mass and systolic blood pressures and increased explosive strength of upper limbs. However, there were no significant difference between groups for lipid profiles and cardiorespiratory fitness (Neiva et al., 2018). The researchers concluded that exercise program may need to be of longer duration than the 12 weeks used in this study and the intensity of the classes may have caused some of the differences which were further limited by the small sample size (Neiva et al., 2018).

In a study conducted by Ferrigan et al. (2017), a pretest, posttest, quasi-experimental design was used to determine the efficacy of an aquatic exercise program that was aimed at reducing weight. There were 12 participants from an active adult living community with a BMI of 25 or greater. The program lasted for 6 weeks with two 60-minute exercise sessions per week. This aquatic exercise program consisted of a five-minute warm up, 50 minutes of focus on cardiovascular endurance, major muscle group strengthening, flexibility, balance, and coordination, and ended with a five-minute cool down. Some exercise equipment was used such as underwater weights for resistance and 20” diameter beach balls for coordination (Ferrigan et. al., 2017). Data collected included weight in pounds, measured with a Detecto Weight Beam physician scale, height, waist, and hip circumference using a measuring tape, and percent body fat composition utilizing a hand-held bioelectrical impedance analyzer. BMI's were determined from this data using the CDC calculator. These data measurements were collected prior to the start of the 6-week program and at the end of the 6 weeks (Ferrigan et al., 2017). This study resulted in statistically significant results in weight in pounds lost, reduction of BMI, body fat composition reduction, and hip circumference. Waist circumference did decrease, although the results were not statistically significant. Specifically, the group experienced the following mean decreases: weight 216.6 pounds to 213.2 pounds, BMI 34.9 to 34.3, percent body fat 38.7 to 38.0%, waist circumference 44.4 to 44.2 inches, and hip circumference 46.7 to 46.1 inches (Ferrigan et al., 2017). These results suggest that aerobic exercise can help reduce body fat composition and weight in the middle-aged adult. Limitations included the small sample size, use of a convenience sample, and the inability to measure one participant's body fat accurately (Ferrigan et. al, 2017).

Aquatic Exercise and Musculoskeletal Pain Reduction. Aquatic exercises are a popular treatment modality and frequently used for people with musculoskeletal disorders, in particular arthritis (Verhagen et al., 2012). In addition to the buoyancy and reduced impact on joints and bones as mentioned prior, as well as the standard benefits of increased muscles strength and improved aerobic and cardiovascular capacity, the use of water exercise may also reduce risk of new injury or prevent further injury to muscles or joints (Verhagen et al., 2012). During water exercise, the alleviation of gravity by flotation helps to reduce joint stress during stretching and can allow for greater range of motion, which makes water exercise safer for individuals who are able to keep their heads out of the water (Verhagen et al., 2012).

Aquatic Exercise and Low Back Pain. Exercise in general has been shown to improve functioning and decrease pain in adults with chronic LBP (Johnson et al., 2016). Exercise protocols for treating LBP include land or water-based programs that consist of aerobic, muscle strengthening, and flexibility or stretching exercises (Johnson et al., 2016). Johnson et al., (2017), examined the benefits of aquatic based therapy for persons with LBP who were not in aquatic therapy (Johnson et al., 2016). The aquatic therapy group (N = 23) was a convenience sample of patients who were admitted for physical therapy with the diagnosis of chronic LBP with no specific etiology. Aquatic physical therapy was recommended by a referring medical practitioner or the evaluating physical therapist. The control group (N = 24) was recruited from the community, primarily a senior retirement community, and received no therapy at all. (Johnson et al., 2016). Participants in the control group were required to have current LBP present for more than three months and had to be able to walk more than six meters with or without assistive devices (Johnson et al., 2016). Participants also could not be engaged in any other type of aquatic exercise or receiving interventions for their LBP. The presence of LBP was assessed using the Oswestry Disability Index (ODI) and pain was assessed using a 1-10 numeric scale (no pain to highest imaginable pain). The treatment group received aquatic therapy for 30-60 minutes, two to three times per week for about one month. The aquatic group reported a significant decrease in pain level (5.7 to 3.0) between initial and follow up testing after one month while the control group had decreased pain during the 30-day study. The pain levels were even found to be increased from 3.0 to 4.5 in the control group. The aquatic group also had a significant reduction in self-reported disability with the ODI, but the control group had no change. Overall, aquatic therapy effectively reduced pain levels and pain related disability improving functional activities, which led to an overall improved quality of life (Johnson et al., 2016).

Shi et al., (2018), conducted a systematic literature review to identify randomized control trials (RCT) for a meta-analysis to evaluate the effectiveness of aquatic exercise for adults in the treatment of low back pain. Studies that were included used one of following outcome measures: Visual Analog Scale (VAS), Short-Form 12 Health Survey (SF-12 or the Short Form 36 Health Survey). Additional inclusion criteria were adequate data to evaluate the efficacy of aquatic exercise and at least two measurements before and after the exercise (Shi et al., 2018). Eight articles met the inclusion criteria. Combined subjects from these eight studies, resulted in 331 participants who were randomly assigned in these trials, 38.1% were males and 61.9% were females with an average age of 44.3 years old. The length of the aquatic programs ranged from 4-15 weeks, with frequency ranging from two to five times per week, and session durations ranging from 30-80 minutes. All the trials assessed pain level by using VAS. Patients treated with aquatic therapy had a statistically significant reduction in pain intensity compared to the control group. The meta-analysis also revealed a positive correlation between aquatic therapy and improvement of physical condition. There was no significant difference in the mental component between the experimental and control groups.

Aquatic Exercise and Osteoarthritis. Stover et al., (2015), conducted a study to evaluate the effectiveness of aquatic exercise for the reduction of OA-related pain in older adults. Using a pre and posttest quasi-experimental design, participants were evaluated before and after completion of an eight-week aquatic exercise program. A convenience sample was recruited by activity director via email (Stover et al., 2015). Inclusion criteria included: age at least 55, a medical diagnosis of OA in one or more joints, and attendance at eight of the 16 sessions. At the completion of the program, twelve participants had attended a minimum of eight classes; their ages ranged from 55-72, nine were females and three were males, and all reported pain in the hips/and or knees (Stover et al., 2015). Researchers utilized three tools for measurements: 1) the two-handed pain free functional reach measurement to evaluate changes in pain with mobility, 2) the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for patient reported outcomes related to pain, stiffness, and physical function, and 3) the visual analog scale (VAS) for participants' self-reported pain levels (Stover et al., 2015). For the twelve participants who completed the aquatics program, there were statistically significant differences for the pre and post VAS scores and pain free functional assessment. There was improvement with the pre and post WOMAC scores, but it was not statistically significant. Overall, all participants stated that they felt an improvement in their mobility due to the aquatic exercise program (Stover et al., 2015).

A meta-analysis was conducted by Barker et al. (2014), to evaluate the effectiveness of aquatic exercise in managing pain, physical function, and quality of life related to musculoskeletal conditions. The researchers reviewed RCT or quasi-RCT studies with participants diagnosed with at least one musculoskeletal condition (Barker et al., 2014). The researchers found 26 studies met the inclusion criteria which included 24 RCT's and two quasi-RCT's related to OA, RA, fibromyalgia, low back pain, and osteoporosis populations (Barker et al., 2014). The meta-analysis results showed a moderate reduction in pain with aquatic exercise (*SMD* = -0.37, 95% CI [-0.56 to -0.18] when compared to no exercise, but no significant difference when compared to land-based exercise (Barker et al., 2014). They also indicated a moderate improvement in physical function (*SMD* = 0.32, 95% CI [0.13to 0.51] when compared to no exercise and no significant difference when compared to land-based exercise (Barker et al., 2014). Finally, a moderate improvement in quality of life was found in the OA group (*SMD* = 0.39, 95% CI [0.06-0.73] when compared to no exercise and no significant difference when compared to land-based exercise. There was no significant effect in the osteoporosis and RA populations (Barker et al., 2014).

WATERinMOTION Exercise Program

The WATERinMOTION (WIM) program is an aquatic exercise program that reaches over 16,000 aquatic exercisers daily. WIM is an organization that has over 400 certified fitness professionals in over 200 aquatic facilities across the U.S. (WATERinMOTION Original, n.d.). The program provides a low impact, high energy workout for persons of all ages, skills, and fitness levels. The music is specifically arranged to allow persons of all ages to participate and the choreography is formatted to match the music. Instructors are updated every three months with any programmatic changes. The typical class includes a warm-up, linear and lateral movements, team building, group dynamic exercises, suspension of upper and lower body, core strengthening, and flexibility.

The WIM program is a high energy, calorie burning workout that provides lower impact on joints, particularly the knees and back (WATERinMOTION Original, n.d.). Because it's a water-based exercise program, it provides a lower impact environment but promotes a high intensity workout (WATERinMOTION Original, n.d.). The program also helps to relieve pressure from the spine and joints and creates less soreness than land-based exercise. According to the WIM website, participants can lose weight, improve mobility, improve heart health, reduce chronic illness risk, and enhance energy levels. Physician approval is recommended for persons who have had an injury or those just starting a workout regimen for the first time.

Theoretical Framework

This DNP project explored the use of an aquatic exercise program to improve health related to weight loss and pain improvement. Nola Pender's health promotion model (HPM) was utilized for this DNP project because promoting healthy behavior is the desired behavioral outcome and the end goal of this model (Nursing Theory, n.d.). Pender's health promotion model is one of the most commonly used models in planning for and changing unhealthy behaviors. The HPM has been widely cited in the nursing literature and is the framework for over 100 research studies (Srof & Velsor-Friedrich, 2006). This framework has been shown to be useful in a variety of health promotion behaviors, including physical activity research (Smith & Michel, 2006).

Pender's HPM makes four assumptions which include: (1) Individuals seek to actively regulate their own behavior; (2) Individuals, in all their biopsychosocial complexity, interact with the environment, progressively transforming the environment as well as being transformed over time; (3) Health professionals, such as nurses, constitute a part of the interpersonal environment, which exerts influence on people through their life span; and (4) Self-initiated reconfiguration of the person-environment interactive pattern is essential to changing behavior (Pender, 2011).

Pender’s HPM was initially developed in the early 1980’s and uses individual characteristics and experiences, behavior specific cognitions, and affects to predict and describe health promoting behavior (Smith & Michel, 2006). The model was derived from the social cognitive theory (SCT). SCT attempts to explain the nature of behavioral changes in larger social structures. Human agency, or the ability to control life events, is explained in a reciprocal relationship between behavior, interpersonal, and external factors (Srof & Velsor-Friedrich, 2006). The SCT and HPM assume that people have the power to control outcomes. Perceived efficacy is a major component of SCT and is defined as "the belief in one’s capabilities to organize and execute the courses of action required to produce given attainments” (as cited in Srof & Velsor-Friedrich, 2006). Self-efficacy is then a major construct in health promoting theories.

HPM classifies health behavior elements in three propositional groupings; individual characteristics and experiences, behavior specific cognitions and affects, and behavioral outcomes (Srof & Velsor-Friedrich, 2006). Individual characteristics include inherent factors such as gender, age, and genetics which can have a direct or indirect effect on participation in health promoting behaviors (Smith & Michel, 2006; Srof & Velsor-Friedrich, 2006). These individual characteristic factors are mostly unmodifiable and can be divided into three categories: *biological* (age, gender, BMI, aerobic capacity, strength agility, or balance), *sociocultural* (race, ethnicity, acculturation, education, socioeconomic status), and *psychological* (self-esteem, self-motivation, personal competence, perceived health status, definition of health). The behavior specific cognitions include perceived benefits or barriers to behavior, perceived self-efficacy, and affect cues to behavior (Srof & Velsor-Friedrich, 2006). These cognitions address the behavioral motivators and barriers to action such as no access to exercise programs or a history of sedentary behavior (Smith & Michel, 2006). Most of the more recent HPM research includes these factors as the focus of the targeted interventions. The behavioral outcomes are the changes that people make that are influenced by a plan of action such as participating in aquatic exercise programs, etc.

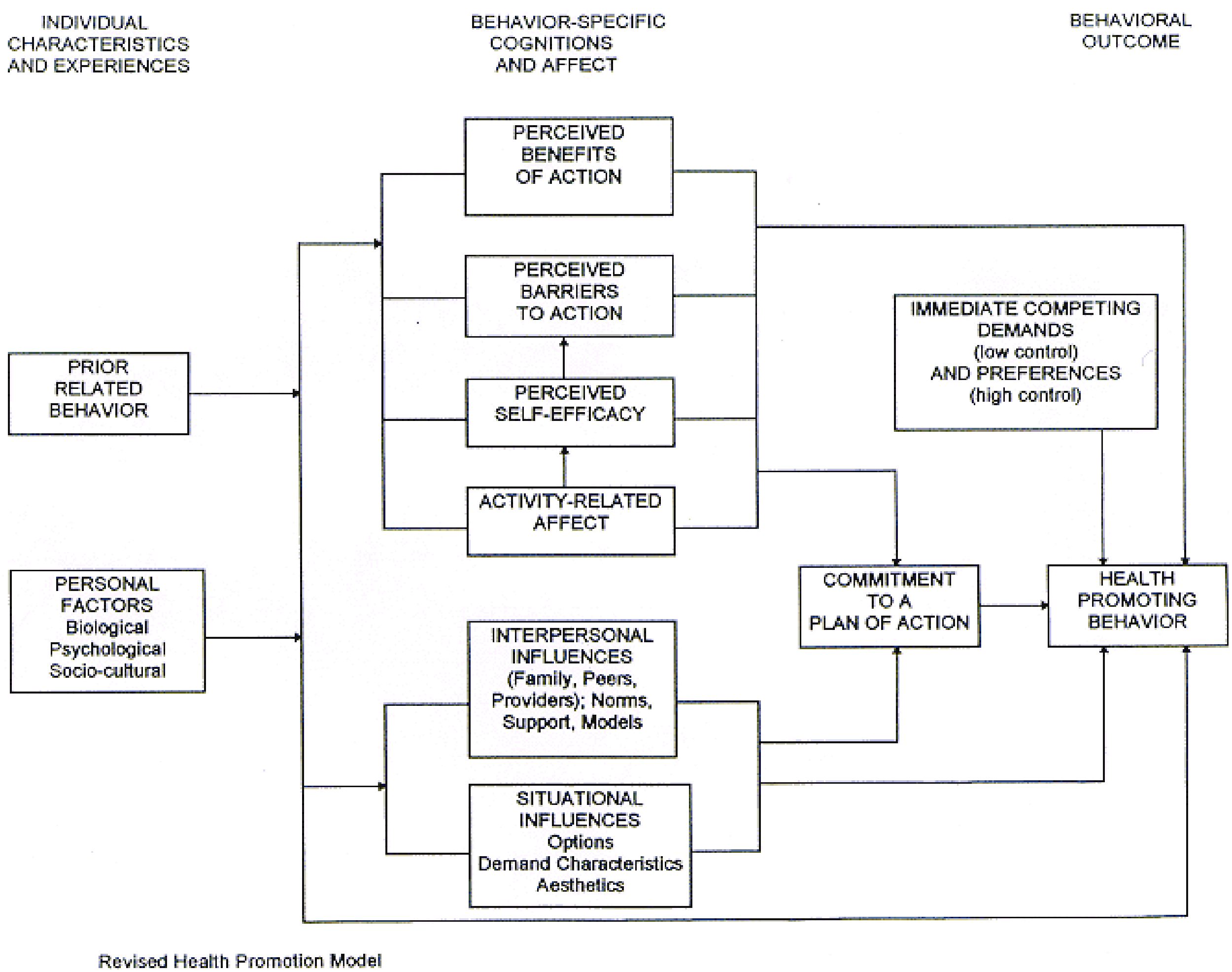

Figure 1. Revised health promotion model. From "Health Promotion Model Diagram," by N. J. Pender, 1996 (https://deepblue.lib.umich.edu/handle/2027.42/85351). Reprinted with permission.

In relation to this DNP project, Pender's health promotion model provided the framework for exploring the effectiveness of an aquatic exercise program in decreasing body weight, BMIs and percent body fat along with reducing back and musculoskeletal /joint pain in adult participants. Upon review of the fourteen theoretical statements found in Pender's HPM, three pertain directly to this DNP project including: (1) Persons commit to engaging in behaviors from which they anticipate deriving personally valued benefits; (2) Perceived competence or self-efficacy to execute a given behavior increases the likelihood of commitment to action and actual performance behavior; and (3) Greater perceived self-efficacy results in fewer perceived barriers to a specific health behavior (Pender, 2011). Participants in this DNP project committed to engage in the WATERinMOTION program in anticipation of some sort of personal benefit that could include weight loss or pain improvement. Participants may have experienced improved self-efficacy if they were better informed on the benefits this exercise program. As they gained confidence through exercising, participants might have become more committed to continuing this behavior. After program completion, participants might be motivated to continue to engage in a plan of action to maintain healthier lifestyles if personally valued benefits were achieved. In addition, as participants continue to exercise and experience benefits, their self-efficacy will increase and perceived barriers to exercise should diminish. These new health promotion behaviors should result in improved overall health, enhanced functional ability, and a better quality of life (Pender, 2011).

Summary

This DNP project examined whether the WATERinMOTION aquatics exercise program at two rural Midwestern YMCAs was effective in promoting participants' weight loss, decreasing percent body fat, and reducing chronic back or joint pain.

A review of the literature provided adequate evidence to support the use of an aquatic exercise program to promote weight and body fat loss as well as improvement of LBP and other musculoskeletal/joint pain. Exercise as a strategy to manage obesity has been shown to be beneficial for weight loss. Research supports the use of aquatic exercise programs to reduce weight and pain in persons with obesity. Aquatic exercise uses body movements to increase heart rates and energy expenditure promoting weight loss, and the water provides support causing less musculoskeletal stress and joint pain. This type of exercise has been shown to be an ideal method to improve functional health status, reduce obesity, and benefit those with pain related to musculoskeletal disorders. Although research supports similar aquatic exercise programs, no literature was found that specifically evaluated the WATERinMOTION aquatic program's effect on decreasing participants' body weight, percent body fat, and pain in back or joints. Further, participants in other programs had at least six weeks of an aquatic program, so this study will examine if two sessions per week for four to five weeks is sufficient for significant health benefits.

Chapter Three

Methods

Purpose

The purpose of this Doctor of Nursing Practice (DNP) project was to determine if the WATERinMOTION aquatics exercise program at two rural Midwestern YMCAs was effective in promoting participants' weight loss, decreasing percent body fat, and reducing chronic low back or joint pain.

Sample and Setting

WATERinMOTION is a standardized aquatic exercise program offered nationally at YMCA's and taught by WIM certified fitness professionals (WATERinMOTION Original, n.d.). The program's duration varied from four-week sessions or five-week sessions. Each session included two classes per week, either Monday-Wednesday or Tuesday-Thursday, with a maximum of six participants allowed in each session. The typical WIM class consisted of a five-minute warm-up and 45 minutes of low impact, high energy cardiovascular workout that included linear/lateral movements, upper body suspension, lower body work, core strengthening, and flexibility.

Participants for this project were drawn from a convenience sample of persons who enrolled for the WATERinMOTION program at two local YMCAs located in the rural Midwest. Potential participants were informed about the WIM program through the YMCA website. On the first day, of the program, the author explained the DNP project to potential participants, and they were able to voluntarily participate based on the following inclusion criteria: a) 18 years of age or older, b) have a BMI of ≥ 25 and c) be enrolled in the WATERinMOTION program. The presence or absence of chronic pain was not part of the inclusion criteria. Exclusion criteria included any participants who were pregnant. New participants were added to the study at the beginning of each new four or five-week period if they met the criteria. Any participant who wanted to enroll in another session for an additional four or five weeks, could continue in the study if the inclusion/exclusion criteria continued to be met. There were no participants that wanted to continue in the study after the initial four to five weeks.

The aquatic program was repeated throughout the summer and into early fall. One YMCA offered two sessions for three five-week periods and two sessions for a four-week period. Another YMCA was utilized for one session for one five-week period. There was a total of nine sessions with a potential for six participants per session for a possible total of 54 participants. With a possible population of 54, a confidence level of 95%, a confidence interval of five, a sample size of at least 47 would have been desirable (Creative Research Systems, 2012).

Project Approval

This topic for this DNP project was approved by the Northern Michigan University School of Nursing's Graduate Committee (Appendix A) and Institutional Review Board (IRB) approval was also obtained by the university prior to data collection (Appendix B). Permission from the YMCA (Appendix C) and by the WATERinMOTION program were obtained prior to data collection (Appendix D).

Design and Procedures

This DNP project utilized a pre-test, post-test, quasi-experimental design with a convenience sample. The project was explained by the author to the potential participants on the first-class day prior to starting exercise. Participants were informed that their participation was completely voluntary, and they could refuse to participate or discontinue being in the study at any time without penalty. Written consent was obtained from those who agreed to participate (Appendix E).

Demographic data related to age, gender, ethnicity, chronic pain, perceived health status, current pain level, location of pain, methods to treat pain such as prescription/non-prescription medication use, and other therapies were obtained from the participants by having them complete the Pre-Exercise Demographic & Pain Survey form (Appendix F). The forms were filled out by the pool or in the changing room while other participants were taken individually to a private area to obtain their weight, height, and body fat composition measurements. The pre-exercise demographic and pain surveys were attached to clip boards and pens were provided. Participants were told by the author that their anthropometric measures of weight, height, and body fat composition would be obtained prior to the start of the first class by the author and that their BMI's would be calculated from this data. All participants were asked to fill out a pre-program numeric pain scale (NRS) to indicate if they had low back pain or chronic joint pain in order to rate their current pain and their pain within the last 24 hours. The same data was collected by the researcher on the last day of the exercise session after the program was completed as well using a post-program survey (Appendix G).

Risks to participants were minimal but included the possibility of being uncomfortable or embarrassed during the data collection. The researcher tried to minimize any embarrassment or discomfort by obtaining pre/post anthropometric measures in a private area. Potential benefits included increased awareness of their anthropometric measures, increased understanding of their BMI calculations, better understanding of current health status, and possible improvements in their fitness levels.

Measures

Anthropometric. Participants' weight in pounds and height in inches were measured utilizing a physician scale (for both pre/post measures) rented from the local hospital. These measures were taken in a private area with participants dressed in bathing suits and without footwear. The CDC guidelines were used to determine the cutoff range for BMI's related to classifications for being overweight and obese (2017) . Participants' BMI were determined using the CDC's Adult BMI calculator (CDC, 2019). In this project, body fat composition is determined by percent body fat. Percent body fat was measured utilizing the Omron HBF-306C Handheld Body Fat Loss Monitor. This device works by measuring the percent body fat from the amount of bioelectric impedance in the body (Ferrigan et al., 2017). According to Gibson et al. (as cited in Ferrigan et al., 2017), although there have been no studies on the validity of this tool, it was found to be accurate, in previous research, when estimating percent body fat for adults ages 18-55 (Gibson et al. as cited in Ferrigan et al., 2017).

Pain. A pre and post numeric rating scale (NRS) was utilized to assess participants' self-reported pain levels for chronic LBP and/or joint pain before and after participation in the aquatic program (Pain BC Society, n.d.). The NRS uses an 11-point numeric rating scale to assess current pain or pain within the last 24 hours. The common format for this scale is a horizontal line with a 0 on one end that represents "no pain" and a 10 on the other end that represents "the worst pain." The participant was asked to select a whole number between 0-10 that best describes their pain level (Hawker, Mian, Kendzerska, & French, 2011). These pain scale ratings were obtained by distributing a pre and post pain survey to all participants as part of the demographic/health forms.

The NRS was selected for this DNP project because it tends to be preferred over the visual analog scale (VAS) by the older population as it is more easily understood (Alghadir, Anwer, Iqbal, & Iqbal, 2018). This scale has also been shown to be sensitive for chronic pain assessment and has a higher reliability especially in the elderly and less educated patient populations. Alghadir (et al., 2018) reported a higher responsiveness using the NRS to assess chronic pain compared to the verbal rating scale (VRS) and VAS. In patients with rheumatoid arthritis, Ferraz (et al., 1990) noted there was a high test-retest reliability observed between literate and illiterate patients using the NRS. In this study of 91 patients (25 illiterate and 66 literate), the Pearson product moment correlation between the first and second assessment was 0.963 for the NRS compared to a 0.937 for the VAS and 0.901 for the VRS (Ferraz et al., 1990). Regarding construct validity, the NRS is highly correlated to the VAS for patients with rheumatic or other chronic pain conditions, ranging from 0.86 to 0.95 (Hawker et al., 2011). In addition, the NRS is also available in the public domain (Pain BC Society, n.d.).

Data Analysis

A statistician was consulted for assistance with the data analysis portion of this project. The data was entered into an Excel file and then transferred into R programming using no patient identifiers to ensure confidentiality. Pre and post-anthropometric measures and pre and post pain measurements were analyzed using exploratory data analysis with graphics and permutation-based t-tests or hypothesis tests.

Research questions for this DNP project included:

1. After completion of the WATERinMOTION aquatics program, do participants experience a reduction in body weight, BMI’s and percent body fat?

2. After completion of the WATERinMOTION aquatics program, do participants, who suffer with chronic low back or joint pain self-report a decrease in pain using the numeric pain scale?
3. After completion of the WATERinMOTION aquatics program, do participants, who suffer with chronic low back or joint pain self-report a decreased use of prescription or nonprescription pain medication?

Potential risks included breach of confidentiality, however only the researcher saw the names of the participants and matched them with a participant identification number immediately after data collection on the first day. The de-identified aggregate results were shared with the YMCA and possibly published but no identifiable participant information was shared. Data were kept in a secure, locked box and carried by the researcher from her residence to the site of data collection in her personal vehicle. The secure box was always kept locked during transport and during collection except when putting data into the box. All data will continue to be stored in a secure box and will be destroyed after seven years. Excel and R Programming data files are being kept in a password protected computer and will also be destroyed after seven years.

Chapter Four

Results

Introduction

The purpose of this Doctor of Nursing Practice (DNP) project was to determine if the WATERinMOTION aquatics exercise program at two rural Midwestern YMCAs was effective in promoting participants' weight loss, decreasing percent body fat, and reducing chronic low back or joint pain. This chapter will start with a review of the research questions and descriptions of data analysis and findings. Finally, the author will discuss how the results compare to other related research, identify strengths and limitations of the project, and offer recommendations for future research.

This DNP project attempted to answer three research questions after the completion of the WATERinMOTION aquatics program: Did participants experience a reduction in body weight, percent body fat, and BMIs? Did participants who suffer from chronic low back pain or joint pain self-report a decrease in pain using the numeric pain scale? Did participants who suffer from chronic low back pain or joint pain self-report a decrease in prescription or nonprescription pain medication use?

Sample Demographics

The author recruited participants from two local rural midwestern YMCAs who were enrolled in the WATERinMOTION aquatics exercise program. However, enrollment rates were low and none of the classes were at the full capacity of six. Many of the participants who completed one of the four or five-week sessions also enrolled in another session. However, for this project, participants' measurements were obtained after the completion of the first session. If the participants enrolled in a second session, their second session measurements were not used.

After a four-month period (four sessions of five-week courses and one session of a 4-week course), the final sample size for this project was N =11 participants. There was a total of 12 participants who met the project criteria, but one stopped attending classes after week three. The final sample had 10 female participants and one male participant whose ages ranged from 31-79 years with mean age of 64.8. All participants were White in ethnicity. Educational level included four participants who had earned a high school diploma, two had earned an associate degree, one had earned a bachelor's degree, and four had earned master's degrees.

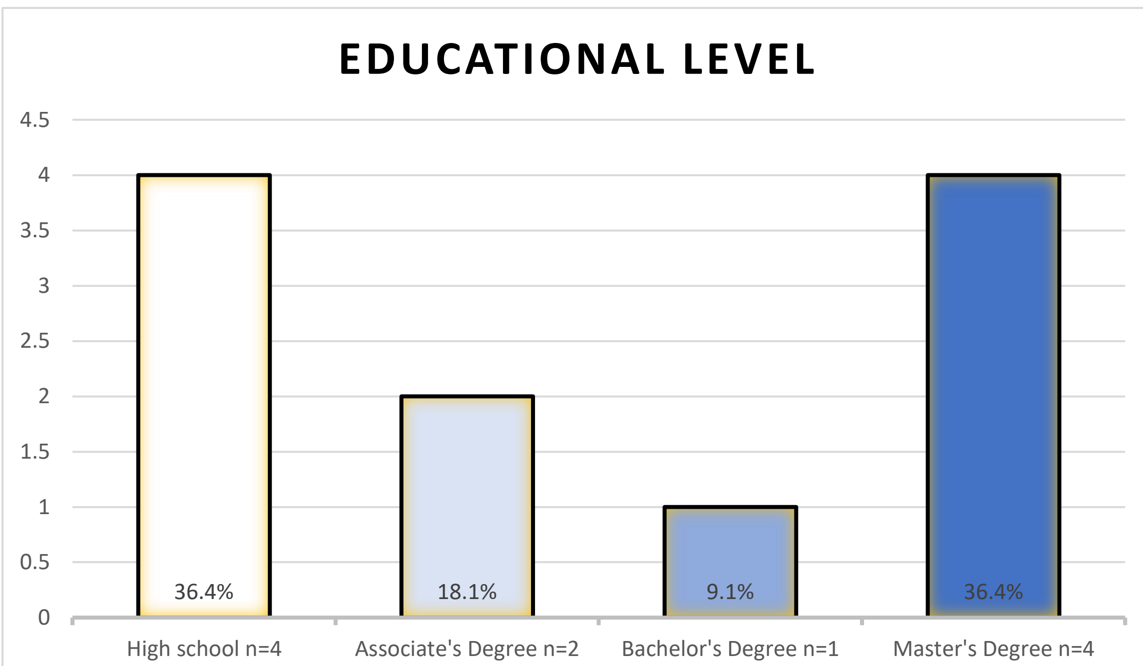

Figure 2. Participants' educational levels

Data Analysis:

To answer the research questions, a full exploratory data analysis and a set of hypothesis tests were completed. Plots and statistical analysis were created with R programming language, version 3.5.1. The exploratory data analysis was conducted with graphics created with the ggplot2 package in R and some base R and tidyverse functions were used to summarize the data. For the permutation-based t-tests, the R package RVaideMemoire was used. Permutation based t-tests were used to compare the mean of the differences of the variables between the pre and post-program periods. With the measurements being paired on a participant, analysis of the differences was completed and not the pre-measurements as one group and the post-measurements as another, as that would assume the two groups are independent which is not true because they were tied to a participant. The use of the permutation t-test makes the analysis equivalent to performing a one sample t-test on the differences of a variable of interest.

The four variables of interest that were evaluated in this project were weight, BMI, percent body fat, and chronic pain. Table 1 displays the pre and post-anthropometric group means, although it is important to note that the group means were not used in hypothesis testing but rather the mean of differences. The distinction is important because the participants' body weights, BMI's, percent body fat, and pain were not independent and by using the mean of differences with the permeated t-test this dependence was accounted for. Table 2 provides a summary of hypothesis test results related to the four variables of interest.

Table 1

Pre/Post Aquatic Program Means: Anthropometric Measures And Self-Reported Pain

Measure	Group Mean Pre-Program	Group Mean Post-Program
Weight (pounds)	185	179.9
BMI	31.9	30.9
Body fat (%)	43.0	42.5
Pain (0-10 numeric scale)	3.5	2.3

The first research question asked, *after completion of the WATERinMOTION aquatics program, did participants experience a reduction in body weight, BMI, and percent body fat?* To evaluate this question, permutation-based t-tests were used. For the participants' body weight, the observed mean of the weight change difference was -5.04 (SD = 5.29). The results suggested that participation in the program was associated with a significant decrease in body weight (t = -3.16, p = .005). For the second part of this question, whether the program was associated with a decrease in body mass index, the observed mean of differences was -0.98 (SD =1.01). The analysis suggests that participants experienced a significant decrease in their body mass index (t = 3.21, p = .003). For the final part of this question on whether participants had a decrease in percent body fat, the observed mean of difference was -0.47 (SD = 1.14). This result does not support that significant differences in percent body fat occurred after participation in the WATERinMOTION program (t = -1.38, p = .113). Table 2 displays the results discussed above.

The second research question asked, *after completion of the WATERinMOTION aquatics program, do participants who suffer with chronic low back or joint pain self-report a decrease in pain?* Participants with chronic pain listed the following locations for their pain; low back, knee, hip, wrist, and fingers. For those participants who reported low back pain or joint pain (n = 8) a permutation-based t-test was performed, the observed mean of the differences was -1.29, with t = -1.49 with the resulting p = .137. Thus, the findings did not support significant reductions in back or joint pain upon completion of the WIM aquatic course.

Table 2

Pre/Post Aquatic Program: Difference of Means

Measure	Mean of differences	*SD*	*t*	*p*
Weight (pounds)	-5.04	5.29	-3.16	.005*
BMI	-0.98	1.01	-3.21	.003*
Body fat (%)	-0.47	1.14	-1.38	.113
Pain (0-10 numeric scale)	-1.29	1.97	-1.49	.137

*$p < .05$

To provide additional information to analyze pain, participants were asked several survey questions pre/post completion of the aquatics program. Prior to the aquatics program and after completion, participants were asked the following question *"Do you currently take any prescription medications to help alleviate pain?"* At the start of the program five participants reported taking no medications, four used over the counter (OTC) pain medications, such as Tylenol (acetaminophen) or Motrin (ibuprofen), two reported using prescription medications for pain, and one person indicated use of both prescription and OTC pain medication. According to the post-program survey, there were no changes from the original responses. Survey responses are displayed in Table 3.

Upon completion of the program, the participants were asked several additional post-survey questions. "*If you had chronic pain or joint pain for at least three months before this program, do you feel that your pain has improved in the last five weeks since starting the WATERinMOTION program?* Seven participants reported an improvement in pain, and one indicated no improvement. Three of the 11 participants chose not to answer this question.

In a second post-survey question, participants were asked, "*If you were taking any pain medications for your chronic pain, are you taking less now than you were before starting the WATERinMOTION aquatics program?*" Only two participants reported taking less medications at the end of the program, with four reporting the same medication usage. These same two participants reported taking OTC medications pre and post program and indicated that their pain did improve. One participant had no improvement in pain, but also indicated no decrease of pain medication usage

Table 3

Pre/Post Aquatic Program: Pain Medication Usage

Type of Pain Medication	Participants using meds pre-program	Participants using meds post-program	Participants reporting post-pain improvement	Participants reporting less medication use post-program
No medications	5	5	2	NA
OTC	4	4	3	2
Prescription	1	1	1	0
Prescription & OTC	1	1	1	0

The third post-survey question, which was similar to pre-survey questions, asked participants, "*What is your current perceived health status after completing this program?* The number of participants who reported having higher perceived health at the end of the project tripled and one person reported their perceived health status as excellent.

Table 4

Pre/Post Aquatic Program: Perceived Health Status

Response	Pre-program	Post-program
Good	8	1
Very Good	3	9
Excellent	0	1

Open-Ended Survey Comments

In addition, the post-survey contained an open-ended question which gave participants the opportunity to express any other comments about the program. All participants (*N* = 11) had positive things to say about the WATERinMOTION program. Some of the comments included: “liked it”, “loved it”, and “great program.” Several had participated in past water aquatics but wrote comments indicating that the WATERinMOTION program was “more fast paced” and “enjoyable” than other aquatic exercise programs. In personal conversations with the author, all participants were very pleased with the WATERinMOTION program.

Discussion

This DNP project examined the effect the WATERinMOTION aquatics program on reducing body weight, BMI, percent body fat, and chronic low back and joint pain. The results suggest some support that the WATERinMOTION aquatic exercise program was associated with a decrease in body weight and BMI. Though most participants showed a decrease in percent body fat and reported an improvement in pain, there was not significant evidence that the program was associated with a decrease in these areas.

Overall, participants reported a higher perceived health status at the completion of the program than at the beginning, and all commented how enjoyable the program was.

Several other studies on aquatics programs have documented decreasing anthropometric measurements and pain reduction. Neiva et al. (2018), found that a 12-week water aerobics program, twice a week for 50 minutes per session contributed to improved upper limb strength as well as a reduction in body fat and systolic blood pressure. Ferrigan et al. (2017) conducted a six-week water aerobics program and concluded that aerobic exercises in the aquatic environment reduced weight and percent body fat in middle-aged adults.

In relation to back pain, Johnson et al. (2016) found that aquatic based exercise was effective in treating individuals with low back pain by improving their functional mobility, strength, and self-reported disability. Shi et al. (2018) concluded via a meta-analysis that aquatic exercise can significantly reduce pain and increase physical function in patients with low back pain. Stover et al. (2015) also noted that an aquatics program decreased joint pain from arthritis and improved functional mobility for the participants.

This DNP project did show an association between the WATERinMOTION program and a reduction in body weight and BMI. There was no significant evidence in this project to suggest that the WATERinMOTION program was beneficial in reducing percent body fat or chronic back or pain. Although other aquatics studies have shown a reduction in body weight (Ferrigan, 2017) and body fat (Ferrigan, 2017, Neiva et al. 2018), this was the only project that had significant findings for a shorter duration of exercise program that is four to five weeks compared to the standard six or 12. Although Nevia et al. (2018) found a significant decrease in body fat composition, this DNP project did not document significant decreases in percent body fat. The lack of significant decreases in percent body fat in this project may be due to the shorter duration of the WATERinMOTION program.

Pender's HPM provided the theoretical framework for this DNP project. One of the model's key assumptions is that persons will commit to engage in behaviors in which they anticipate deriving personal valued benefits. The participants were able to push themselves to attend two aquatic exercise classes each week, which in turn produced valued benefits (weight loss, reduction in BMIs, and an increase in general wellbeing). The attainment of these valued, personal benefits might encourage the participants to continue exercising.

The second related HPM premise is perceived competence or self-efficacy to execute behaviors will increase likelihood of commitment to action and performance of that behavior. The participants willingness to attend classes two times each week and complete the four or five-week program, demonstrated a commitment to an action (aquatic exercise) to improving their health. Their self-efficacy that these actions could result in the desired outcomes helped them reach their goal of completing the program as well as minimized their perceived barriers. The participants' attainment of positive outcomes may increase their perceived competence and the likelihood of commitment to similar actions that could benefit their health.

Strengths and Limitations

Though the project results look promising, caution must be advised due to several limitations. First, this project used a small convenience sample which consisted of mostly white females, with only one male and no persons of different races or ethnicities.

Further the project was conducted in two rural Midwestern communities and not all people in the population of interest had an equal chance to participate in the project. Thus, generalizations are limited due to the restricted scope and these results may not be seen in a larger population beyond the sample.

Second, because of the quasi-experimental design and convenience sampling, confounding variables might have been present. A project with random assignments to a control group might have allowed for elimination of confounding variables. For example, many of the participants performed other exercise such as walking. The project did not allow for a comparative analysis of a land-based exercise or other aquatic exercise programs. Data was not collected on whether the participants were using other methods such as dietary caloric restrictions to lose weight. Thus, the reductions in weight and BMI may not be solely attributed to participation in the WATERinMOTION program.

Third, the Omron HBF-306C Handheld Body Fat Loss Monitor device used to measure percent body fat may not be reliable or user error may have occurred limiting the accuracy of the data collected. This device works by measuring the percent body composition from the amount of bioelectric impedance in the body (Ferrigan et al., 2017). Although, there are no published studies on the validity of this device, it was found to be accurate in previous research for estimating percent body fat for adults ages18-55 (Gibson et al. as cited in Ferrigan et al., 2017). The lack of established reliability and validity for this device is a limitation.

Fourth, the class sessions in this project were notably shorter (four to five-weeks) than most of the programs found in the research which were at least six weeks in duration. Previous studies have documented reductions in weight, BMI, percent body fat, and chronic pain in programs that were at least six-weeks in duration (Ferrigan et al., 2017). No research was found that specified or supported four or five-weeks as being long enough duration to see a significant difference.

There were strengths of this DNP project. The significant associations found with weight and BMI reduction support the use of the WATERinMOTION program and suggests that programs of shorter duration (i.e. four or five weeks) may produce some of the desired outcomes. Most participants made positive comments about the program. Participants noted improvement in their daily movements and were able to participate in activities that they had difficulty with prior to the exercise program.

Recommendations for Future Research

Although, this DNP project showed some significant association between participation in the WATERinMOTION aquatics program and weight and BMI reduction, this relationship does not imply a causal effect and the findings cannot be generalized beyond the sample. Recommendations for future studies include using random assignment and sampling so that everyone in the population would have an equal probability of being selected. Obtaining a larger, more racially diverse sample and longer duration of exercise (greater than five weeks) is desirable. The use of a more reliable and valid device to measure percent body fat is also recommended for future studies to ensure accurate measurements. The collection of additional health data such as blood pressure, resting heart rates, and serum lipids prior to and after completion of an aquatics program might also be beneficial to examine.

Conclusion

This Doctor of Nursing Practice project examined the effectiveness of the WATERinMOTION aquatic exercise program on the reduction of weight, BMI, percent body fat, and chronic low back and joint pain in the adult population. The literature review provided evidence that aquatic programs were beneficial in weight and BMI reduction. Research also supported the use of aquatic exercise to reduce chronic pain related to the low back and joints.

In this project, a significant association between the WATERinMOTION aquatics program and weight and BMI reduction was found. However, there was no significant association between the program and percent body fat and chronic pain reduction. Careful consideration of the limitations and recommendations for future research may provide future practitioners the ability to design a more robust project that can evaluate similar outcomes on a larger more diverse population as well as examine additional benefits of the WATERinMOTION program. Future research on this aquatic program may provide greater evidence to support its use in reducing weight and improving chronic pain, as well as other additional health benefits. Results found in this DNP project and further documentation of these benefits will allow health care providers, such as nurse practitioners, to recommend aquatic programs such as WATERinMOTION to their patients to assist in achieving their fitness goals and an improvement in their overall health.

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Appendix A

School Of Nursing Graduate Committee Approval

NORTHERN MICHIGAN UNIVERSITY

Terilyn Darley <tdarley@nmu.edu>

Re: Terrilyn's proposal

2 messages

Melissa Romero <mromero@nmu.edu> Thu, Mar 28, 2019 at 1:58 PM
To: Lisa Flood <lflood@nmu.edu>, Terilyn Darley <tdarley@nmu.edu>

Hi Terilyn,

The Graduate committee met this afternoon and reviewed your DNP project approval request. Congratulations! It was approved and I just want to add that you did a beautiful job writing up the proposal. Everyone on the committee was impressed! Good luck as you collect your data 😀

Melissa Romero PhD, RN, FNP-BC
Associate Professor of Nursing | Graduate Program Coordinator
School of Nursing
Northern Michigan University
906-227-2488 | Fax: 906-227-1658 | 2131 New Science Facility
1401 Presque Isle Ave, Marquette, MI 49855
mromero@nmu.edu

Appendix B

Institutional Review Board Approval

Memorandum

TO: Terilyn Darley
Nursing Department

CC: Lisa Flood
Nursing Department

DATE: June 7, 2019

FROM: Lisa Schade Eckert
Dean of Graduate Education and Research

SUBJECT: **IRB Proposal** HS19-1049
IRB Approval Dates: 6/7/19 – 6/6/20
Proposed Project Dates: 6/10/19 – 10/1/19
"WaterinMotion: Effectiveness of an Aquatic Exercise Program in Weight Loss and Pain Reduction"

Your proposal "WaterinMotion: Effectiveness of an Aquatic Exercise Program in Weight Loss and Pain Reduction" has been approved by the NMU Institutional Review Board. Include your proposal number (HS19-1049) on all research materials and on any correspondence regarding this project.

A. If a subject suffers an injury during research, or if there is an incident of non-compliance with IRB policies and procedures, you must take immediate action to assist the subject and notify the IRB chair (dereande@nmu.edu) and NMU's IRB administrator (leckert@nmu.edu) within 48 hours. Additionally, you must complete an Unanticipated Problem or Adverse Event Form for Research Involving Human Subjects

B. Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding. Informed consent must continue throughout the project via a dialogue between the researcher and research participant.

C. If you find that modifications of methods or procedures are necessary, you must submit a Project Modification Form for Research Involving Human Subjects before collecting data.

D. If you complete your project within 12 months from the date of your approval notification, you must submit a Project Completion Form for Research Involving Human Subjects. If you do not complete your project within 12 months from the date of your approval notification, you must submit a Project Renewal Form for Research Involving Human Subjects. You may apply for a one-year project renewal up to four times. Failure to submit a Project Completion Form or Project Renewal Form within 12 months from the date of your approval notification will result in a suspension of Human Subjects Research privileges for all investigators listed on the application until the form is submitted and approved.

All forms can be found at the NMU Grants and Research website: http://www.nmu.edu/grantsandresearch/node/102

Janelle N. Taylor
Coordinator of Graduate Student and Research Affairs
Graduate Education and Research
Northern Michigan University
906-227-1407
1401 Presque Isle Ave, Marquette, MI 49855
http://www.nmu.edu/graduatestudies/

Appendix C

YMCA Project Approval

Gmail **Terilyn D <terilyn.darley@gmail.com>**

Permission to move forward with WATERinMOTION research project

John Leech <jleech@nlymca.com> Fri, Apr 12, 2019 at 9:19 AM
To: Terilyn D <terilyn.darley@gmail.com>
Cc: Jonathan Ringel <jringel@nlymca.com>

I, John Leech, Aquatic Director of the Northern Lights YMCA Dickinson Center hereby give Terilyn Darley permission to do a scholarly project in conjunction with the NLYMCA Water in Motion aquatic fitness class beginning the month of June 2019.

I have attached our center director as well. I don't know if you need his or my permission but we're both cool with it =)

Thanks

JL

Appendix D

WATERinMOTION Project Approval

water in motion

SCW Fitness Education
151 South Pfingsten Road Unit P, Deerfield, IL 60015
Phone: (847) 562-4020

May 28, 2019

Dear Mrs. Darley,

Please accept this letter as permission to use the WATERinMOTION aquatic exercise program offered through your local YMCA for your scholarly project. We understand that you will be collecting pre and post anthropometric data and pre and post pain assessments to determine the benefits of the aquatic exercise program.

Best Regards,

Mike Divello, MS
Director of Operations

www.scwfit.com | www.WATERinMOTION.com
Cell 773.817.9644 | Office 847.562.4020
Find us on Facebook and Twitter @scwfitness
Instagram #scwmania

Appendix E

Consent Form

CONSENT FORM

WATERinMOTION: Effectiveness for Weight Loss and Pain Reduction

Purpose of the Project

You are invited to participate in a study to evaluate if the WATERinMOTION aquatics program results in weight loss and chronic lower back or joint pain reduction. The data collected will be used to determine possible benefits of an aquatics exercise program related to weight loss and pain reduction. It is important that you read and understand the following information prior to consenting to participate in this study.

Potential Benefits

Participants may gain increased knowledge of the benefits of the WATERinMOTION program related to their health and chronic pain which may lead them to continue participation in a regular exercise routine and potentially improve their overall health and quality of life.

Potential Discomforts or Risks

This research poses minimal risks to the participants. Body measurement collections may cause some slight discomfort for the participant. All measurements will be obtained individually in a private area. Participants may choose to know or not to know their collected measurements. Potential risk includes a breach of confidentiality, however only the investigator will see the names of participants and actual measurements.

Procedures

If you choose to participate in this study, you will be asked to complete a short demographic/pain information form and the investigator will obtain the following measurements prior to the first class and after the last class of the five-week program:

- Weight
- Height
- Body Mass Index (BMI):
- Body fat composition
- A pre and post numerical pain score

The BMI will be calculated using your height and weight measurements. Your body fat composition will be obtained using a handheld body fat monitor called Omron HBF-306C. This device sends a very low electrical current through your body to determine the amount of fat tissue. This current is safe and should not be detectable (i.e. felt).

Confidentiality and Security of Data

All project data will be kept confidential by not using any personal identifying information. Confidentiality will be maintained by assigning each participant a code number. All demographic sheets, consent forms, measurements, and surveys will be kept secure stored in a locked box at the investigator's home and later destroyed. Electronic data will be stored on the investigator's password protected computer and later destroyed. This data will also be used to create a scholarly project for the investigator's doctorate degree in nursing. The results of this study may be shared with university faculty and YMCA staff, presented at conferences or published in professional journals. No individual data or results will be shared.

Participation and Withdrawal

Participation in this study is completely voluntary. You may withdraw your consent and discontinue participation at any time without penalty. You may skip any questions on the surveys or demographic form that you choose.

Questions about the Research

If you have any questions about this project, you may contact the primary investigator Terilyn Darley, the project advisor Dr. Lisa Flood, the IRB Chair Derek Anderson, or the IRB Administrator Lisa Eckert per the contact information below.

Investigator Terilyn Darley, RN, BSN Doctoral of Nursing Practice Student Northern Michigan University 1401 Presque Isle Ave Marquette, MI 49855 tdarley@nmu.edu Phone: (701)- 215-1751	**Project Advisor** Dr. Lisa Flood, DNP, RN, CNE Professor School of Nursing Northern Michigan University 1401 Presque Isle Ave Marquette, MI 49855 lflood@nmu.edu Phone: (906)- 250 -3704
IRB Chair Dr. Derek Anderson Northern Michigan University 1401 Presque Isle Ave Marquette, MI 49855 dereande@nmu.edu Phone: (906)-227-1873	**IRB Administrator** Lisa Eckert Northern Michigan University 1401 Presque Isle Ave Marquette, MI 49855 leckert@nmu.edu Phone: (906)-227-2300

Participant Consent

I have read the information provided above, or it has been read to me. I have had the opportunity to ask questions and any questions that I have asked, have been answered to my satisfaction. I understand that my participation is voluntary, and I can withdraw my consent at any time and discontinue my participation at any time without penalty. I confirm that I am at least 18 years of age. I consent voluntarily to participate in this research.

Date

Printed Name of Participant

Date

Signature of Participant

Date

Signature of Person Obtaining Consent

Appendix F

Demographic & Pain Survey

Pre-Exercise Demographic & Pain Survey

WATERinMOTION: Effectiveness for Weight Loss and Pain Reduction

Please answer the following questions to assist in the research project.

Age (in years): _______

Gender: Please mark one below.

___ Male ___ Female ___ Other (please specify): ___ Prefer not to say

Race/Ethnicity: Please place an X to indicate one or more groups below:

____ White
____ Black/African American
____ American Indian/Alaska Native
____ Asian
____ Hawaiian/Pacific Islander
____ Other
____ Prefer not to say

Level of Education: Please check your highest level of education completed (only check one).

____ GED
____ High school diploma
____ Associate degree
____ Bachelor's degree
____ Master's degree

What is your current perceived health status before completing this program?

(Circle one): excellent very good good fair poor

Are you currently in any other formal exercise programs?

Yes No

If you answered yes to other formal exercise programs, please list them below:

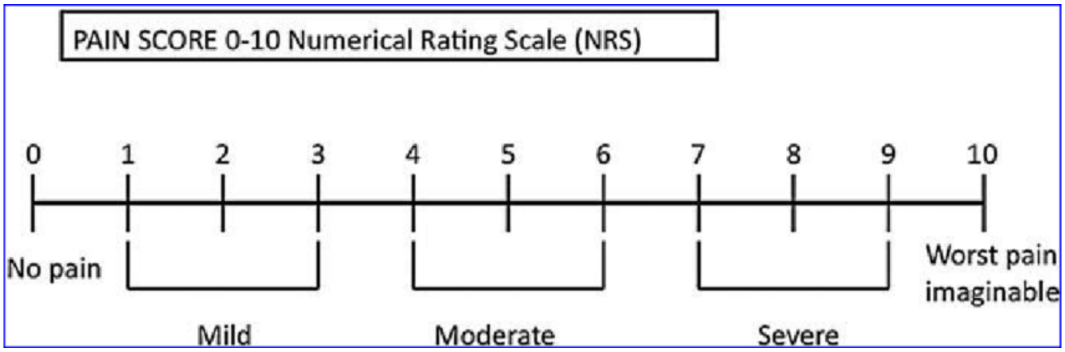
____

Do you currently suffer from chronic pain in the lower back or joints for at least the last three months?

(Circle one): Yes No

If above answer is yes, where is your pain located? ________________________

Please rate your current pain (0-10) using the numerical rating scale below for any chronic back or joint pain. (Circle your pain number).



Do you currently take any prescription medications to help alleviate pain?

Yes No Sometimes

Please list the names, doses, and amounts of any medications you currently take for back or joint pain (prescription or non-prescription):

Name of medication: _______________ Dose: ________ Amount per day: ________

Name of medication: _______________ Dose: ________ Amount per day: ________

Do you use any other measures to help alleviate the pain? (If yes, please specify in your own words what you do to help manage your pain.)

Appendix G

Post Exercise Survey

Post-Exercise Pain Survey

WATERinMOTION: Effectiveness for Weight Loss and Pain Reduction

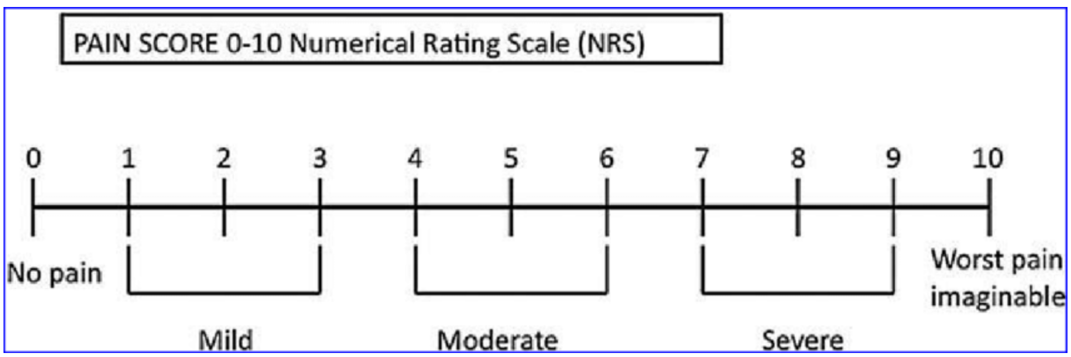
What is your current perceived health status after completing this program?

(Circle one): excellent very good good fair poor

If you had chronic pain or joint pain for at least three months before this program, do you feel that your pain has improved in the last five weeks since starting the WATERinMOTION program?

(Circle one): Yes No NA (Not applicable as I do not have chronic pain).

Please rate your current pain (0-10) using the numerical rating scale below for any chronic back or joint pain. (Circle your pain number).



Do you currently take any prescription medications to help alleviate pain?

Yes No Sometimes

If you were taking any pain medications for your chronic pain, are you taking less now than you were before starting the WATERinMOTION aquatics program? (Circle one)

Yes Same dose Not taking medication

Please list the names, doses, and amounts of any medications you currently take for back or joint pain (prescription or non-prescription):

Name of medication: ________________ Dose: _________ Amount per day: _________

Name of medication: ________________ Dose: _________ Amount per day: _________

If you used any other measures to help alleviate the pain, has the use of these methods changed as a result of this aquatic program? Please explain.

Do you have any other comments about the WATERinMOTION program?

Appendix H

Permission: Health Promotion Model Diagram

NORTHERN MICHIGAN UNIVERSITY

Terilyn Darley <tdarley@nmu.edu>

Permission to use Pender's

Nola Pender <npender@umich.edu> Wed, Apr 10, 2019 at 10:25 AM
To: Terilyn Darley <tdarley@nmu.edu>

Dear Terilyn:

You have permission to use and reprint the Health Promotion Model in your work.

I wish you success,

Nola Pender
[Quoted text hidden]

HEALTH PROMOTION MODEL WEBSITES.docx
15K