THE EFFECT OF A 9-WEEK STRUCTURED-EXERCISE PROGRAM ON HEALTH-RELATED FITNESS, SELF-EFFICACY, AND QUALITY OF LIFE OF ADULTS WITH PHYSICAL DISABILITIES

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The Lord bless you and keep you; the Lord make his face shine on you and be gracious to you; the Lord turn his face toward you and give you peace. Num 4:24-26

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ABSTRACT

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THE EFFECT OF A 9-WEEK STRUCTURED-EXERCISE PROGRAM ON HEALTH-REALTED FITNESS, SELF-EFFICACY, AND QUAITY OF LIFE OF ADUTLS WITH PHYSICAL DISABILITIES

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Structured-exercise (STE) has been recommended to improve physical and psychological health of individuals with physical disabilities (People, 2020). The purpose of the present mixed-methods research was to quantitatively examine the effect of a 9-week STE program on the health-related fitness, self-efficacy, and quality of life (QOL) of adults with acquired physical disabilities; to explore qualitatively the perceived benefits of a structure-exercise program, and identify a factors that might be related to their physical and psychological health.

A total of fifteen adults with physical disabilities (e.g., amputee, spinal cord injury, stroke, multiple sclerosis, and traumatic brain injury-related disability; AWPD) were purposely recruited for this study. The 9 weeks individualized STE program (90-min session, three times per week) focused on improving physical and psychological health by engaging participants in physical and mental training. The components of health-related fitness (i.e., muscular strength and body composition), self-efficacy, and QOL were measured at baseline and at the conclusion of the 9-week program. The focus group interview was conducted only at the post-program. Quantitative data were

analyzed by paired t-test (α = .05). Qualitative data were analyzed by thematic coding and content analysis (Creswell, 2014).

The results of the study indicated that participation in the STE program significantly improved health-related fitness (i.e., grip strength and body composition), self-efficacy, and domains of QOL at posttest compared to pretest. Significant improvement ($p < .05$) with average moderate effect size (Cohen's d = 0.5 - 0.8) was found across the variables. The qualitative data were collected and analyzed to follow up on the results of a change in self-efficacy and different variables within QOL. A total of six subthemes emerged, which were merged into two main themes: (a) perceived benefit of a 9-week STE program and (b) key factors of an exercise program for AWPD. Notwithstanding the limitations of this study, the study concluded that participating in a 9-week STE program may improve health-related fitness and positively influence on self-efficacy and domains of QOL of AWPD.

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CHAPTER I

INTRODUCTION

A physical disability, including chronic illness, is often characterized by varying degrees of neuromuscular dysfunction that impairs a range of motor activities (Washburn et al., 2002). According to the Centers for Disease Control and Prevention (Okoro et al., 2018), 61 million U.S citizens are living with at least one chronic illness and one-fourth have limitations in daily activities. Among them, the most common physical disability impairments are amputee, stroke, spinal cord injury (SCI), and traumatic brain injury (TBI), which are acquired through a traumatic event (Ma et al., 2014). Estimates of the number of Americans living with a physical disability are 2 million for amputees (Ziegler-Graham et al., 2008), 7 million for people with a stroke (Mozaffarian et al., 2016), 3 million for people living with SCI (White & Black, 2016), and 5.3 million for TBI (Ma et al., 2014). The frequency of adults with physical disabilities (AWPD) is growing each year as a result of the advancements in medical technology and improvements in survival rates from accidents and disease (Kraus et al., 2018).

Having a permanent physical disability often leads to a lifestyle that is dependent on others and more sedentary, which ultimately diminishes overall quality of life (QOL; Buffart et al., 2009; Jacobs & Nash, 2004; Ma & Ginis, 2018). QOL refers to a broad category of phenomena that encompasses life satisfaction, which generally is categorized as physical and psychosocial well-being perceived by an individual (Felec & Perry, 1995;

World Health Organization (WHO), 2013). Examples of dimensions of QOL include satisfaction with life, health and physical functioning, psychological, social, and environmental health (WHO, 2013). Overall, AWPD tend to report poorer QOL than those without disabilities due to the impact of physical disability (Dijkers, 2005). Ma and Ginis (2018) reported that AWPD often live a sedentary lifestyle and have a greater risk for developing secondary health conditions and poorer health-related fitness (Buffart et al., 2009; Jacobs & Nash, 2004; Rimmer & Marques, 2012). In addition to the physical aspect, depression, anxiety, post-traumatic stress disorder, low level of self-efficacy, and lack of motivation were commonly identified as psychological issues for AWPD (Jones et al., 2015; van Diemen et al., 2017); these psychological aspects contribute to diminishing overall QOL. In fact, 33% of AWPD in the US report being satisfied with their QOL, compared to 67% of individuals without disabilities reporting a high level of life satisfaction (Hays et al., 2002). Moreover, a recent study using meta-analysis indicated a large difference in the QOL between AWPD and non-disabled (Post & van Leeuwen, 2012). As such, improving physical and psychological health to enhance and minimize the disparities in QOL between these populations is becoming an urgent health-related issue.

Physical activity (PA) is important for achieving, maintaining, and improving physical health-related fitness, psychological health, and QOL. PA is recommended for people of all ages within the general population as well as AWPD (Ginis et al., 2010; People, 2020). More specifically, structured-exercise (STE), which is performed with the personal intention of improving or maintaining one or more components of health-related

fitness (e.g., muscular strength, body composition, and flexibility) is vital on improving physical and psychological health (Pratt, 1999). STE may encompass different domains of exercise such as aerobic exercise, strength training, aquatic exercise, or sport. Each modality can be completed individually, with an instructor, or within a group setting (Rimmer et al., 2010). Evidence suggest that AWPD whom engage in STE have greater measures of health-related fitness and higher QOL scores compared to sedentary and inactive AWPD (Jalayondeja et al., 2016; Pelletier et al., 2017; Termaoto, 2010). Moreover, compared to age matched active non-disabled population, AWPD did not differ in QOL scores (Cote-Leclerc et al., 2017). This suggests that participating in STE can improve QOL despite the physical disability and has the potential to minimize the QOL disparities between AWPD and the nondisabled population.

The benefit of STE has been well-documented; it is a key factor in the reduction of secondary health conditions and the improvement in physical, psychological and overall QOL for AWPD (Caddick & Smith, 2014; Hicks et al., 2011; Rimmer et al., 2010). Despite the positive benefits of STE, participation rates were significantly lower than the sub-optimal levels reported in the non-disabled population (Ma & Ginis, 2018). Research has been conducted to identify barriers and facilitators/benefits of exercise in the hope of informing exercise promotion for AWPD (Buffart et al., 2009; Caddick & Smith, 2014; Driver et al., 2012; Jaarsma et al., 2014; Lorenz et al., 2018; Richardson et al., 2017; Rimmer et al., 2004; Stephens et al., 2012). The factors of barriers and facilitators to engaging STE were identified, namely environment, social, and personal factors (e.g., physical and psychological). Environment barriers include inaccessibility to

built environment (e.g., transportation and parking space), unsuitable equipment, and unqualified staff who cannot modify or adapt exercise programs for AWPD. Social barriers include poor attitude from others, lack of exercise opportunity, and lack of information received, whilst in hospital and following discharge through outpatient clinics. Personal barriers include physical factors such as pain, lack of energy, and functional disability; psychological factors were identified as anxiety, depression, low self-esteem, low self-efficacy, and lack of motivation (Buffart et al., 2009; Driver et al., 2012; Jaarsma et al., 2014; Richardson et al., 2017; Rimmer et al, 2004; Stephens et al., 2012). Socialization (e.g., sharing similar experience and reintegration to society with people in a similar situation) is among the identified benefits to exercise participation and was a main factor of partaking in exercise. From a physical health perspective, development of functional capacity and increased strength was associated with the benefits of STE. Most importantly, the sense of 'doing things again' and gaining independence by engaging in STE shaped improvement in self-efficacy, self-worth, and QOL through personal growth in the aftermath of a physical and psychological trauma (Caddick & Smith, 2014; Driver et al., 2012; Jaarsma et al., 2014; Lorenz et al., 2018; Rimmer et al, 2004; Stephens et al., 2012). From a theoretical perspective, the interrelationship between the perceived benefits and continued involvement in STE implicates increased self-efficacy to perform various daily activities and manage health (Williams & French, 2011).

Self-efficacy refers to a level of self-confidence about the ability to manage specific situation or conditions (Bandrua, 1986). Self-efficacy has been demonstrated to

be an important predictor of different health behavior and repeatedly shown to predict PA behavior, adaptation, and maintenance of PA (Williams & French, 2011). Therefore, self-efficacy enables people to acquire knowledge and develop skills; as self-efficacy improves, individuals expect positive consequences, overcome barriers, and show motivation and commitment to a goal (Bandura, 1977). In relation to AWPD, self-efficacy has been shown to be positively related to psychological adjustment, PA participation and maintenance, perceived health status, and QOL (Geyh et al., 2012; Ginis et al., 2010; Motl et al., 2009; van Diemen et al., 2017).

Bandura (1977) proposed that self-efficacy is formed and affected by mastery of skills (e.g., previously learned skills or newly learned skills), vicarious experiences (e.g., observing other accomplishing a goal), social persuasion (e.g., feedback, knowledge, and information), and physiological state (e.g., positive, negative, tranquility, and fatigue). Ashford et al. (2010) reported that vicarious experience and feedback were strong moderators of self-efficacy. For example, peer-led wheelchair training (e.g., vicarious experience), and the provision of an exercise action plan with coping strategies (e.g., social persuasion) for AWPD were found to enhance self-efficacy (Arbour-Nicitopoulos et al., 2009; Best et al., 2016). Previous research has reported that STE participation is closely related to self-efficacy and QOL in both healthy populations and AWPD (Joseph et al., 2014; Motl et al., 2009; Van Leeuwen et al., 2012). The observed pattern supports that self-efficacy is one of the key constructs that directly influence activity participation and mental health while acting as a strong moderator affecting overall QOL for AWPD (Van Leeuwen et al., 2012). In turn, AWPD who were more physically active reported

higher levels of self-efficacy and measures of QOL (Motl et al., 2009). Consequently, incorporating the theory of self-efficacy into the design of a STE intervention may lead to improvement in QOL for AWPD.

Unfortunately, due to the sampling limitations within the research environment of AWPD, the effect of STE on AWPD research carried out to date is limited. Specifically, most of the studies were conducted as observational studies where researchers compared levels of self-efficacy and QOL between active and inactive AWPD (Geyh et al., 2012; Ginis et al., 2010; Middleton et al., 2007; Motl et al., 2013; Robinson-Smith et al., 2000). In addition, the majority of experimental research results on health-related fitness, self-efficacy, and QOL were inconclusive (Curtis et al., 2015; Jones et al., 2016; Nightingale et al., 2018). Moreover, most of the studies were conducted in controlled environments such as in hospital and clinic settings during post-trauma care. More importantly, inadequate information on engaging in community sport and PA opportunities after discharge from clinics or hospitals were identified as fundamental barriers of the environmental factors (Driver et al., 2012; Rimmer et al, 2004; Stephens et al., 2012). Therefore, the experimental research in AWPD should place more attention to the community-based setting or real-life environment where the majority of AWPD would engage in different types of PA after they are discharged from post-trauma care.

Significance of the Study

Unlike most of the existing STE studies, a mixed-methods approach was conducted in the current study to investigate the effects of STE on health-related fitness, self-efficacy, and QOL for AWPD. Use of a mixed-method approach strengthened the

internal validity of the study and expansion of the quantitative and qualitative findings increased the confidence of the conclusion. From an Adapted Physical Activity (APA) research perspective, Haegele et al.'s (2015) review found that most of the research heavily focused on quantitative design (70%) compared to qualitative (19%) and mixed method (4%). The current study could enrich the existing understanding of the effects of STE on various aspects of physical and psychological health. From a public health viewpoint, the findings from current study may increase an AWPD's use of STE to improve physical and psychological health, encourage AWPD to engage in STE, and hence become more physically active to achieve a better QOL. Lastly, findings of the current study may provide insight into health promotion and be useful in guiding community-based STE programs. The exploration of benefit, barriers, motivation, and perception of the STE programs on AWPD may provide valuable information to the service providers. From the findings of this study, service providers may develop new strategies to promote their program to AWPD, which may enhance QOL for AWPD.

Purpose

STE has been recommended to improve physical and psychological health for AWPD (People, 2020). The purpose of the present mixed-method research was to: (1) quantitatively examine the effect of a 9-week STE program focused on health-related fitness, self-efficacy, and QOL for AWPD; (2) qualitatively explore the perceived benefits of a STE program; and (3) identify factors that affect physical and psychological health, and domains of QOL in relation to their participation in the STE program.

Research questions

1. What is the effect of a 9-week STE program on health-related fitness (i.e., grip strength and body composition), self-efficacy, and QOL of the AWPD?

2. What are the perceived benefits of participating in a STE program focused on health-related fitness, self-efficacy, and QOL?

3. What are the key factors of STE program for AWPD?

Hypotheses

The following null hypotheses for this study were statistically tested. Each of the null hypotheses was evaluated using a significance level of $p < .05$.

Null 1: There is no significant difference in the mean pre- and post-program grip strength for adults with physical disabilities.

Null 2: There is no significant difference in the mean pre- and post-program body composition for adults with physical disabilities.

Null 3: There is no significant difference in the mean pre- and post-program self-efficacy for adults with physical disabilities.

Null 4: There is no significant difference in the mean pre- and post-program QOL for adults with physical disabilities.

Definitions

1. Structured-exercise - PA that is performed with a plan, repetitive bodily movement, and intention to improve or maintain one or more components of physical fitness (Pratt, 1999). Structured-exercise in the current study encompasses different domains of exercise such as aerobic, strength, flexibility, balance, and/or sport type of

exercises, which are tailored to the individual's specific needs and completed individually, with a trainer, or within group setting (Rimmer et al., 2010).

2. Mindfulness training – Training that integrates a mind-body based approach that helps people to manage their thoughts and feelings and mental health. Training included mental preparation and relaxation through meditation and breathing work.
3. Adults with a physical disability – Persons with varying degrees of neuromuscular dysfunction, yet who do not have a cognitive or intellectual disability (Washburn et al., 2002). Adults with physical disabilities may have compromised upper and/or lower limb function and loss of sensation depending on the nature and severity of their disability (i.e., amputee, spinal cord injury, stroke, multiple sclerosis, and traumatic brain injury-related disability).
4. Grip strength - The force (kg) that is generated by squeezing a handheld dynamometer device.
5. Body composition - Distribution of body fat mass (lb), lean body mass (lb), and bone mineral content (lb).
6. Self-efficacy – An individual's perceived competency and beliefs on their personal ability to develop strategies and complete tasks necessary to be successful in various endeavors (Bandura, 1977).
7. Quality of life- Individual’s perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards, and concerns (WHO, 2013).

8. Focus Group - Qualitative method where a group of people are selected and asked about their opinion, perceptions, or experience about a particular topic.

Limitations and Delimitations

1. Physical disability may not represent all types of physical disabilities (e.g., congenital and acquired).
2. A small sample size was conveniently selected, which may limit the generalizability of the result.
3. No control group was included within the study.
4. Participants may not respond truthfully to the questionnaire related to self-efficacy and QOL.
5. Participants may not give maximal effort for grip strength test.
6. Nine weeks of the exercise may not be adequate to change outcome variables.
7. Participants were not refrained from participating in other types of PA.
8. Only adults with physical disabilities who could hold handheld dynamometer were selected for this study.
9. Only adults with physical disabilities who had the cognitive ability to accurately comprehend questionnaires were selected for this study.
10. Only adult individuals with physical disabilities were selected for the study.

CHAPTER II

LITERATURE REVIEW

The purpose of the present mixed-method research was to: (1) quantitatively examine the effect of a 9-week STE program focused on health-related fitness, self-efficacy, and QOL for adults with physical disabilities; (2) qualitatively explore the perceived benefits of an STE program; and (3) to identify a factors that affect physical and psychological health, as well as domains of QOL in relation their participation in the STE program. This chapter contains an overview of the relevant articles on the impact of an exercise program on health-related components, self-efficacy, QOL, and the correlation between these variables. The relevant literature review is presented in the following sections: (a) physical disability and barriers/facilitators to exercise; (b) structured-exercise; (c) health-related fitness; (d) impact of exercise on health-related fitness components; (e) self-efficacy; (f) impact of exercise on self-efficacy; (g) QOL; (h) impact of exercise on QOL; (i) association between health-related components, self-efficacy, and QOL; and (j) application of mixed-method design research for AWPD.

A systematic review of the literature was conducted on exercise interventions on health-related fitness, self-efficacy, QOL, and the statistical relationship between physical strength, self-efficacy, and QOL. Published articles that had randomized, non-randomized, quasi-experimental, qualitative, or mix-method study designs and assessed the impact of PA participation (e.g., exercise, sport, and training) on health-related

fitness, self-efficacy, and QOL for AWPD were selected for this review. Moreover, articles that had correlation, structural equation modeling, simple and multiple regression studies that assessed relationships among the variables of health-related fitness, self-efficacy, and QOL were reviewed. Finally, articles that used mixed-method design with AWPD were reviewed. The articles that were indexed in the electronic databases SPORT Discus, Science Direct, Ovid MEDLINE, and Google Scholar within the last 10 years (2009 to 2019) were searched using a comprehensive search strategy. Relevant articles were evaluated using the Adapted Physical Activity Taxonomy (Carano, 2014) to rate the quality of each study and to enhance the validity of the current research.

Physical Disability and Barriers/Facilitator to Exercise

According to the American Community Survey (ACS), an annual survey conducted by the U.S. Census Bureau, the overall percentage of people with disabilities in the US in 2016 was 12.8% (Kraus et al., 2018). Disability is a complex term used to describe impairments, activity limitations, and participation restrictions, all of which interfere with an individual's ability to perform an activity at a level perceived as normal (WHO, 2013). Similarly, the Americans with Disability Act of 1990 defines disability as a physical or mental impairment that limits one or more major life activities of an individual (U.S. Department of Justice, 2008). The definition of disability has continued to evolve over time and is now more broadly conceptualized as a multidimensional concept, which includes disabilities that are physical, sensory, cognitive, or intellectual in nature, mental illnesses, and/or other types of chronic disease (United Nations, 2012). Thus, disability is not entirely dependent on physical health condition; rather it depends

on the interaction between individuals with a health condition and their personal and social environment (WHO, 2013).

A physical disability is often characterized by varying degrees of neuromuscular dysfunction that impairs a range of motor activities, such as completing daily tasks or engaging in physical activities (Washburn et al., 2002). Individuals with physical disabilities may have compromised upper and/or lower limb function, depending on the nature and severity of their disability. The CDC includes chronic illness as a physical disability and reports that 61 million US citizens have at least one chronic illness, with one-fourth of those individuals experiencing limitations in daily activities (Okoro et al., 2018). According to Ma et al. (2014), the most common physical disability conditions are back pain, limb loss, multiple sclerosis, osteoarthritis, SCI, stroke, and TBI.

For the purpose of this study, the physical disabilities of interest are limb loss (amputee), SCI, stroke, and TBI. For the US population, it is estimated that there are 2 million amputees (Ziegler-Graham et al., 2008), 7 million stroke survivors (Mozaffarian et al., 2016), 3 million people living with SCI (White & Black, 2016), and 5.3 million with a TBI-related disability (Ma et al., 2014).

Although their pathology, level of impairment, physiological symptom, and motor characteristics may differ, living with permanent physical disability (e.g., losing a considerable part of the body/functioning) often leads to a life dependent on others and makes it difficult to maintain an active lifestyle. Because of the impact of physical disabilities, individuals often live a sedentary lifestyle and have PA participation rates lower than the sub-optimal levels reported in the general population (Ma & Ginis, 2018).

In turn, there exists a greater risk for individuals with physical disabilities to develop secondary health conditions such as diabetes mellitus, cardiovascular disease, obesity, metabolic syndrome, pain, osteoporosis, hypertension, increased spasticity, reduced muscular strength and endurance, and reduced aerobic fitness (Buffart et al., 2009; Jacobs & Nash, 2004; Rimmer & Marques, 2012). In addition to the physical aspect, depression, anxiety, posttraumatic stress disorder, low level of self-efficacy, lack of motivation and low QOL were commonly identified as psychological issues for individuals with physical disabilities (Buffart et al., 2009; Craig et al., 2012; Jones et al., 2015; van Diemen et al., 2017).

Researchers identified the following facilitators and barriers to PA for AWPD as personal, social, and environmental factors as the key challenge to engage in physical activities (Buffart et al., 2009; Caddick & Smith, 2014; Richardson et al., 2017; Rimmer et al., 2004; Stephens et al., 2012). In addition, inaccessibility built environments, unsuitable equipment, lack of professional assistance, information, and opportunity were found as environmental barriers to PA. Especially, lack of available information and opportunity to engage in community-based exercise or PA after discharge from clinics or hospital was identified as key barriers of the environmental factors (Rimmer et al., 2004; Stephens et al., 2012). Physical function, emotional and psychological barriers were identified as personal barriers. Lastly, lack of social interaction, negative attitude and perception held by others were identified as social barriers. In contrast to barriers, social factors were identified as key facilitators and benefit of engaging in PA. More specifically, socialization such as sharing a similar experience with people who have a

true understanding of their situation and learning from others was identified as the greatest asset of partaking in PA (Stephens et al., 2012). Further, involvement in a PA facilitated reintegration to society and positively impacted QOL. The sense of ‘doing things again' shaped personal growth and development in the aftermath of physical and psychological trauma (Caddick & Smith, 2014).

Structured Exercise

According to Caspersen et al. (1985), PA is defined as an increase in energy expenditure that exceeds the basal level due to any bodily movement produced by the contraction of skeletal muscle. The term PA does not require or imply any specific aspect or quality of movement and rather it is categorized in a variety of types (Physical Activity Guidelines Advisory Committee Scientific Report, 2018). The types of physical activities include leisure-time physical activities such as sport, conditioning exercise, household task, work-related activities, other forms of daily activities, or even sleep (Caspersen, et al., 1985).

STE is defined as a subset of PA that is planned with repetitive bodily movement conducted with the intentions to improve or maintain one or more components of physical fitness (Pratt, 1999). STE is considered to be PA, yet not all physical activities can be considered STE. For instance, walking up the stairs, walking the dog, or walking from building to building can be categorized into PA as a result of the contraction of skeletal muscle and increasing energy expenditure. In contrast, setting an underlying purpose (e.g., to improve body composition), goal (e.g., lose 10 lb) and plans or frequency (e.g., 60-min for 3 times a week) for walking can be considered as STE

because it is intended to improve health-related fitness. Thus, STE may encompass different domains of exercise such as aerobic exercise, strength training, aquatic exercise, combined exercise, or sport that can be completed individually, with a trainer or instructor, or within-group setting (Rimmer et al., 2010).

The impact of STE has been well-documented and identified as a key component in the reduction of risk for coronary heart disease, diabetes, colon cancer, major chronic disease, and other psychological conditions such as anxiety and depression (Penedo & Dahn, 2005; Warburton et al., 2006). According to Rimmer et al. (2010), an intervention that focused on aerobic and strength exercise improved functional health, musculoskeletal health, cardiorespiratory fitness, metabolic health, and mental health of persons with physical and cognitive disabilities. Similarly, an exercise intervention, performed 2-3 times per week at moderate-to-vigorous intensity increased physical capacity and muscular strength in those with chronic SCI (Hicks et al., 2011) and may be beneficial in the regulation of stress, and reverse of deficit in neurocognitive performance in populations affected by TBI (Archer, 2012). Other researchers that examined sport as STE reported that, in addition to improvements in physical function, psychological well-being, social reintegration, self-efficacy, and QOL were improved for amputations and ill, injured, or wounded veterans (Bragaru et al., 2011; Craddick & Smith, 2013). Moreover, according to a meta-analysis study (Ginis et al., 2010) on physical exercise and subject well-being among people with SCI indicated that there was a medium-large effect size association between physical exercise and subject well-being (r = .38; 95% CI .30 to .46) and life satisfaction (r = .45; 95% CI .31 to .59).

Health-Related Fitness

PA is recommended for health, fitness, and function in people of all ages within the general population, to include people with disabilities (People, 2020). According to People 2020, the objective of participating in regular PA is to lower the risk of secondary health conditions (e.g., coronary heart disease, stroke, hypertension, diabetes, falls, and depression) and to improve health-related fitness. Health-related fitness refers to components of fitness that are affected by habitual PA. PA related to health status influences (a) the ability to perform and sustain daily activities, and (b) demonstrates the traits or capacities that are associated with development of health-related fitness. Caspersen et al. (1985) defined the five components of health-related fitness as (a) cardiorespiratory endurance, (b) muscular endurance, (c) muscular strength, (d) body composition, and (e) flexibility. Health-related fitness is accepted by the American College of Sports Medicine (ACSM) to “have a strong relationship with overall health and are associated with a lower prevalence of chronic disease and health conditions and their risk factors" (Pescatello et al., 2014, p 60). Given the heterogeneous attributes of the population of research participants (e.g., having different motor characteristics such as single-leg amputee, double leg amputee, para-, hemi-, and quadriplegia), the current study only measured muscular strength through grip strength and body composition via fat mass (FM; the amount of fat mass), lean body mass (LBM; the amount of fat-free tissues and essential lipids), along with bone mineral content (BMC; relative mineral content in the bone).

Muscular strength refers to “the muscle’s ability to exert force” (Pescatello et al., 2014, p 94). Common assessment protocols used to assess muscular strength include handheld dynamometers (e.g., handgrip and back muscle strength), and one-repetition maximum (1-RM or 10 to 15 RM). Handheld dynamometers assessments require a single handheld dynamometer and have been regarded as a safe and effective measurement for individuals of all ages and health status (Spruit et al., 2013). This assessment requires little equipment and training, while other assessments (e.g., maximum repetition assessment) require additional equipment, technician competency, and safety precautions. Several classes of dynamometers are available to the clinician and researcher for measuring the strength of a person with physical disabilities. Sisto and Dyson-Hudson (2007), who reviewed dynamometry testing protocol for AWPD, suggested several advantages of using hand-held dynamometers such as lower cost, greater ease of use, and better acceptability, portability, and practicability in a clinical setting.

Amaral et al. (2012) examined the possible difference between and reliability of handheld grip strength dynamometer (Takei) and an EMG system manual transducer with a modified handle. A total of 18 healthy college students were randomly assigned to each different method and measured with a 24-hr interval between methods. The result indicated there was a significant intraclass correlation of ICC = 0.871 (dominant), ICC = 0.847 (non-dominant) between two methods of measurement. This result suggested the two methods can be used interchangeably, and the handheld grip strength dynamometer can be used as a reliable and valid assessment tool in a field setting.

Body mass index (BMI), body weight relative to height, is widely used to estimate body fatness and risks associated with overweight and obesity (Gallagher et al., 2000; Nuttall, 2015). Overweight is defined with a BMI between 25.00 and 29.99 kg/m², while obesity as 30.00 kg/m² or higher. BMI does not distinguish between FM and fat free mass; therefore, other measures of body composition are used to evaluate various characteristics or components of the human body. These measures include FM, LBM, and BMC.

There are several clinical and field tests used to evaluate body composition. Common methods include densitometry (i.e., hydrostatic weighing), BMI, skinfold measurement, bioelectrical impedance analysis (BIA), and dual-energy X-ray absorptiometry (DXA; Pescatello et al., 2014). Densitometry techniques, such as hydrostatic weighing, are regarded as the reference standard for assessing body composition. However, this protocol requires detailed methodological requirements (e.g., an indoor pool), significant technical expertise, and is limited for some populations (e.g., children, elderly). As previously mentioned, BMI is regarded as the most basic estimation of body composition, yet the measurements are limited and fail to distinguish between adipose tissue, muscle mass, or bone mass. Lastly, skinfold measurement may require minimal requirements, but successful assessment relies on the accuracy of the technicians (Dehghan & Merchant, 2008).

BIA is a common body composition assessment used in health and fitness testing because of the relatively high accurate representation of the body composition (Pescatello et al., 2014). However, BIA still has a lack of accuracy in predicting body composition

(i.e., percent BF) compared to the DXA method. The standard error estimate of DXA measuring percent BF was reported to be ±1.8%, while BIA was reported as ±3.5% to 5% (Pescatello et al., 2014). Due to its reliability and accuracy, DXA has become a popular mode for assessing body composition and is recommended by the ACSM. DXA utilizes a low level of radiation x-rays to measure FM, LBM, and BMC (Aragon et al., 2017).

Impact of structured exercise on health-related fitness of AWPD

It is well documented that regular PA helps to achieve and maintain optimal health-related fitness for the general population (Physical Activity Guidelines Advisory Committee Scientific Report, 2018). Similarly, AWPD who engage in regular PA, sport, or exercise training tend to have better measures of health-related fitness compared to sedentary or inactive AWPD (Pelletier et al., 2017; Termaoto, 2010).

Pelletier et al. (2017) compared the body composition (i.e., vesical adipose tissue [VAT]) between people with chronic SCI who participate in any moderate-to-vigorous PA and those who participate in no- to low-levels of PA. Participants included 136 adults with chronic (mean = 15.6 years post-injury) tetraplegia (n = 66) or paraplegia (n = 70). The level of PA was measured with Physical Activity Recall Assessment for SCI and scores were summarized into categories of no participation or any moderate-to-vigorous PA. Another variable, VAT area, was assessed via DXA. The result of the study revealed that participation in any moderate-to-vigorous PA was significantly (p = .02) associated with VAT after controlling for time post-injury and age-at injury. Pelletier et al. (2017) inferred that participating in regular PA may relate to lower VAT area and improvement in body composition.

In a similar study, Teramoto (2010) examined the association between regular PA and body composition parameters in wheelchair users practicing in the adapted sports program and those being physically inactive. Using a DXA, percent BF, LBM, and bone mineral density (BMD) were compared among active paraplegia (n = 15), active quadriplegia (n = 9), inactive paraplegia (n = 7), and inactive quadriplegia (n = 5) groups. The result of the study showed that both physically active paraplegic and quadriplegic group had significantly higher arm bone mineral density than did their physically inactive counterparts. Furthermore, BMD tended to be higher in the paraplegic group than in the quadriplegic group. The paraplegic group had significantly lower percent BF and a higher LBM in the arms than did the quadriplegic group. This may indicate that a higher functional capacity and level of injury (less severe) may be related to better body composition by having higher active daily living.

Several studies (Feter et al., 2018; Gorla et al., 2016; Kim et al., 2015; Skucas, 2018; Vahlberg et al. 2017) investigated the effect of PA, STE, or sports participation on different components of health-related fitness in AWPD. Although the sample population (i.e., amputee, SCI, stroke) and mode of exercise differed from one study to another, there were similarities in assessing health-related fitness. The most common technique used for assessing strength was a handheld dynamometer; and body composition was DXA. From a sports aspect, studies that involved wheelchair basketball (Feter et al., 2018) and wheelchair rugby (Gorla et al., 2016) evaluated the health-related fitness level of wheelchair sport athlete. Feter et al. (2018) examined grip strength of 10 amateur wheelchair basketball players with SCI and amputations (mean age = 31.4 years; injury

time = 76.5 months) who participated in wheelchair basketball for 6 months. The result of the study was compared to the average value found in the other literature involving wheelchair sport (i.e., wheelchair dance and wheelchair handball). The result of the study indicated that there was no significant difference in handgrip strength between wheelchair sport athletes, which may support the notion of significant stronger grip strength in wheelchair players compared to sedentary AWPD. Gorla et al. (2016) examine the effects of wheelchair rugby training on body composition of subjects with tetraplegia (n = 13, mean age = 26.6 years). The training program was composed of aerobic and anaerobic activities over 3 hr per session, 4 times a week, for 8 months. The body composition was assessed by DXA and the result of the study showed a significant reduction in whole-body FM (15,191 vs. 13,212 g, p = .01) and increased BMC (183 vs. 195 g, p = .01) and LBM (2291 vs. 3332 g, p = .01).

Other modes of STE including strength, aerobic, combined exercise and whole-body vibration exercise investigated the changes of health-related fitness in a time series (i.e., pre vs. post). Skucas (2018) examined 8 weeks of strength and endurance training on the physical fitness of people with SCI. A total of 24 participants were evenly allocated to exercise and control groups. The exercise group received four training sessions per week, 2 hr per session for 8 consecutive weeks. The program was focused on training strength through circuit training with 65% of max heart rate and endurance training such as wheelchair laps around a gym were performed at 60% of max heart rate. All the physical fitness variables (i.e., handgrip, arm strength, and aerobic endurance), especially handgrip strength improved by 16% (50.4 to 58.6 kg; p = .05) and

demonstrated significant improvements when pre- and post-intervention results were compared.

Kim et al. (2015) investigated the effects of a 6-week indoor hand-bike exercise program on physical fitness and body composition of 15 people with SCI (mean age = 33.1 years). The intervention group (n = 8) exercised with the indoor hand-bike 60 min a day, 3 days per week, for 6 weeks. The intensity of the exercise was gradually increased on a weekly basis using the Borg rating of perceived exertion. The measure of upper-body strength and body composition was assessed using handheld dynamometer and BIA respectively. The result of the study showed a significant difference in upper-body strength ($p < .01$) favoring exercise group. Although the study demonstrated a 7.4% increase in average LBM and a 9% decrease in average percent BF, there was no significant difference in LBM and percent BF between the two groups.

According to Vahlberg et al. (2017), a 3 month resistance and balance exercise program improved body composition of adults who were 1 – 3 years post stroke. A total of 43 persons who had experienced stroke (mean age = 73.5 years) were allocated into exercise (n = 20) and control (n = 23) groups. The exercise group received 75 min of combined exercise training twice weekly over 3 months. Body composition was assessed with BIA and the result revealed significantly reduced fat mass and total body weight (p = .04) in the exercise group. However, no between-group difference in LBM was observed. Regardless of LBM, research showed improvement of muscle function by indicating an improvement of the 6-min walk test in the exercise group. Vahlberg et al.

(2017) discussed that no changes in LBM might be contributed by the age of population, intensity, and duration of the exercise.

Some studies examined the effect of STE on BMD of AWPD (Astorino et al, 2013; Davis et al., 2010; Edwards et al., 2018; Pang & Lau, 2010). Astorino et al. (2013) investigated the effect of activity-based therapy on lower extremity bone health in 13 individuals (mean age = 29.7 years) with SCI. All participants performed 2 hr a day of activity-based therapy targeting regions below the level of injury a minimum of 2 days per week, for 6 months. The activities were composed of functional movement, passive or active gait exercise, and resistance training. During the single session at baseline, at 3 and 6 months, participants underwent DXA scans to determine BMD. The results demonstrated a significant increase in spine BMD (+4.8%; $p < .05$) and decreases in total hip BMD (-6.1%; $p < .01$) from 0 to 6 months of training. Astorino et al. (2013) discussed that the intervention may not have reversed the bone loss in a population with SCI yet suggested participating in regular exercise can reduce the bone loss seen in sedentary SCI by about as high as 50%.

Pang and Lau (2010) used DXA and looked at BMD of 21 individuals with post-stroke (mean age = 64.5 years; injury = 8.3 years) who participated in a 6-month treadmill exercise program. The intervention was provided to the exercise group ($n = 10$) for 1 hour session, twice per week, for a period of 6 months, while the control group ($n = 11$) participated in their usual daily activities. The researchers were able to find the significant increase in the thickness at the 66% tibia site in the intervention group ($p = .04$), but not in the control group ($p = .25$), and the between-group difference in change

scores was statistically significant ($p = .02$). However, the total area BMD showed no significant changes in either group.

Edwards et al. (2018) and Davis et al. (2010) used whole-body vibration exercise as a mode to improve BMD of individuals with SCI. Edwards et al. (2018) randomized 61 individuals with SCI into three groups; medication (20µg/d teriparatide; $n = 20$), placebo medication with vibration 10 min/d ($n = 20$), and medication with vibration 10 min/d ($n = 21$). The result indicates that both groups treated with medication demonstrated a significant increase in areal BMD at the spine (4.8% - 5.5%). Edwards et al. (2018) summarized that anabolic medication may exhibit skeletal activity and BMD may not be augmented by vibration stimulation. On the other hand, Davis et al. (2010) found significant improvements in BMD on a single person (27-year-old female, 4 years post-injury) with SCI. The study was conducted as 10 weeks of progressive exercise per phase (i.e., standing, partial standing and vibration, and combined standing and vibration) with 7 weeks of rest between phases. The result indicated significant positive changes in BMD at the trunk and spine in combined standing and vibration phases.

Based on the results of the studies reviewed, a person living with physical disabilities but staying physically active tend to have better health-related fitness. This indicates that participating in STE may help to achieve and maintain optimal health-related fitness. However, studies concerning the effects of various forms of STE on BMD of AWPD have been limited; and the results of the studies have been mixed. Therefore, there is a greater need to investigate the effect of STE on health-related fitness on AWPD.

Social Cognitive Theory

Social learning theory, also known as observational learning theory, which posits that human behavior, is learned through observation of a social role model (Bandura, 1977). The memory of observation is used to inform an individual's response when a similar situation arises. In addition, the memory of the original observation is stronger if the model was an important person (e.g., higher authority-parent, sibling, coach, or leader). Bandura proposed that behavior acquisition may require more than observation and that changed behavior is more strongly mediated by a cognitive process. In his book *Social Foundations of Thought and Action* (1986), Bandura renamed the theory as social learning theory in order to emphasize the increasingly important role of observation and cognitive factor in learning, understanding, and predicting behavior. The major constructs of social cognitive theory involve personal cognitive factor, socio-environmental factor, and behavior factor. Bandura (2004) posited that human behavior is explained by the dynamic interaction between three major factors. This reciprocal determinism is evidenced in the PA domain by research that suggests personal factors, particularly self-efficacy, can act as a major determinant and a consequence of PA participation (McAuley & Blissmer, 2000). Table 1 shows the main construct and description of social cognitive theory.

Table 1

Construct and Description of Social Cognitive Theory

Personal Factor	Description
Self-efficacy	Confidence in an ability to perform a behavior
Collective efficacy	Confidence in the ability of a group to perform a behavior
Outcome expectation	The expectation of the consequence of taking action
Knowledge	Understating of the risk and benefit
Environmental	Description
Observation	Learning new information by observing others
Normative Belief	Cultural beliefs about the behavior
Social Support	Encouragement for social network
Opportunities and barrier	Environmental facilitator and barrier to behavior
Behavioral	Description
Skills	Personal skill and ability to perform the task
Intention	Readiness to perform the task
Reinforcement/Punishment	Stimulus from an outer source

Self- Efficacy

The primary variable of interest in social cognitive theory is self-efficacy, which concerns someone's belief in personal capabilities to successfully execute the necessary course of action to satisfy situational demands (Bandura, 1977). In other words, self-efficacy is an individual's competency and belief in their personal ability to develop strategies and complete tasks necessary to be successful in various endeavors. According

to Bandura (1986), self-efficacy has been demonstrated to be the most important determinant of the choice of activities in which people engage, the amount of effort expended on such activities, and the degree of persistence demonstrated in the face of failure or aversive stimuli. People with a high level of self-efficacy are more likely to be confident in their ability to succeed. Conversely, persons with a low level of self-efficacy tend to be pessimistic and are more likely not to take any action. It has been proposed that self-efficacy is determined and affected by four main sources of information (see Table 2).

Table 2

Main Sources of Self-Efficacy

Information	Description
Mastery experience	A positive or negative experience can influence the ability of an individual to perform a given task. If one has performed well at a task previously that person is more likely to feel competent and perform well at a similar associated task.
Vicarious experience	A person can watch another perform and then compare their competence with the other individual's competence.
Verbal persuasion	Self-efficacy is influenced by encouragement and discouragement pertaining to an individual’s performance or ability to perform.

Physiological Feedback	People experience sensations from their body and how they perceive this emotional arousal influences their belief of efficacy.

A recent systematic review with meta-analysis synthesized evidence of the intervention techniques most effective for changing self-efficacy in PA interventions for healthy adults (Ashford et al., 2010). These authors identified a total of 27 studies from 1996 to 2007 that included PA, sport, or exercise intervention using self-efficacy and factors related to self-efficacy as a dependent variable were reviewed. The result from the study revealed a significant, yet small, relationship between the intervention and changes in self-efficacy (mean $d = 0.16$, $p < .001$). Further results from moderator analyses demonstrated that tailoring ($d = 0.26$), vicarious experience ($d = 0.32$), feedback ($d = 0.44$), and goal setting ($d = 0.22$) were associated with higher levels of self-efficacy. Clark (1996) stated that if people have positive feelings in each of these moderator factors, the benefits will be amplified, and self-efficacy will tend to be higher. The negative feelings in any factor may reduce one's self-efficacy. Therefore, it is important for exercise professionals to understand these moderators and develop an exercise program that encourages participants to successfully experience the positive feelings of each factor and ultimately enhancing self-efficacy.

Impact of structured exercise on self-efficacy of AWPD

Several studies have been examined to improve self-efficacy for AWPD by providing exercise and education on PA based on SCT framework (Arbour-Nicitopoulos et al., 2009; Best et al., 2016; Carin-Levy et al., 2009). Best et al. (2016) evaluated the

effect of a peer-led wheelchair training program on self-efficacy. Community-living manual wheelchair users (n = 28, mean age = 49 years) were randomly assigned into two groups (treatment and control); the treatment group received 90 min of 1:1 peer-led wheelchair training session twice a week for 6 weeks. The program was tailored to participant-identified goals and the peer trainer guided the selection of specific objectives that may be required to achieve each goal, such as specific skills, skill sequencing, and overcoming barriers. In addition, the session focused on providing knowledge, problem-solving, advocacy, and controlling emotions through discussion and role-playing using situational scenarios. As a result, the experimental group had higher self-efficacy than the control group that reached statistical significance (F = 12.7, 95% CI, 7.3-26.8, d = 1.4). This study provided great evidence that vicarious experience from peer trainer who has similar characteristics may have a positive influence on improving self-efficacy.

Similar to the study above, Arbour-Nicitopoulos et al. (2009) conducted a study on coping self-efficacy in exercise while living with SCI. A total of 44 individuals with SCI were evenly divided into action plan group and action coping group. Both groups received action plans for participating 3 days a week in at least 30 min of moderate to heavy PA for 5 weeks. For each of the 3 days, participants were asked to specify the duration and intensity of PA. In addition to an action plan, the coping group received an additional coping plan document, which included coping strategies to overcome barriers that were self-identified from the participant. At the end of the 5th and 10th week, all participants were asked to complete physical activity recalls, and self-efficacy was measured. The result indicated a significant difference in PA duration (F = 5.53, p < .03,

d = .71) and self-efficacy (F = 5.51, *p* < .03, *d* = .18) favoring the action coping group. The results support that participation in planned PA such as STE where unexpected obstacles are minimized or coping strategies are provided by the supporter (e.g., trainer, coach) can improve self-efficacy and adherence to exercise.

The qualitative research conducted by Carin-Levy et al. (2009) also supports the importance of implementing a STE program for improving self-efficacy. A total of 14 community-dwelling stroke survivors age range from 45-85 were purposely selected and assigned into either exercise class (*n* = 6) or relaxation class (*n* = 8) for 12 weeks. In-depth, semi-structured interviews were carried out. The themes including enjoyment, QOL, empowerment, and effect of class participation emerged. Both groups demonstrated improvement in self-efficacy. The exercise group reported improvements to their physical function as a direct result which enabled them to take more control over their lives and to become more self-reliant and confident while the relaxation group perceived improvement in self-efficacy through the greater internal locus of control that enhanced their confidence to control stress and anxiety. The findings from this study support that participating in a structured community-based exercise (i.e., high or low intensity) program as a post-rehabilitation phase can have positive effects on self-efficacy for AWPD who have been discharged from hospital.

Quality of Life

QOL is a broad term involving the sense of well-being, happiness, and satisfaction of life and yet, operational definitions of QOL are diverse, with variability fueled not only by use of societal or individualistic perspectives (Felce & Perry, 1995).

The root of the QOL concept originated from the WHO, which defines health as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. QOL is defined as an individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns (WHO, 2013, pg 3) as social and emotional well-being (Felce & Perry, 1995).

Recently, the 2018 Physical Activity Guidelines Advisory Committee Scientific Report, stated overall QOL is a reflection of the way that individuals perceive and react to their health status and other, nonmedical aspects of their lives. Despite the variability in definitions, the majority of methodologies in health science and the social sciences have followed this definition and adapted at least three dimensions of QOL (i.e., physical function, mental status, and social function) to engage in normative social interaction (Spitzer, 1987).

AWPD tend to report poorer QOL than those without disabilities (Dijkers 1997; 2005). According to National Organization on Disability (Hays et al., 2002), 33% of individuals with disabilities in the US report being satisfied with their life, meanwhile 67% of non-disabled population report a high level of life satisfaction. A meta-analysis revealed the large difference in QOL between AWPD and the general population (effect size = -.77; Post & van Leeuwen, 2012). Various factors positively correlate with QOL, including health status, social integration, employment, community access and social support (Dijkers, 2005). Among the factors, QOL primarily is affected by functional impairments (e.g., inability to walk, pain, and fatigue) and psychological well-being.

One potential factor to increase QOL is to participate in STE. Research has established a clear benefit of engaging in STE on improving QOL, and consequently increase life satisfaction (Asano et al., 2008; Ginis et al., 2010; Tomasone et al., 2013). Thus, participating in STE can assist in minimizing the QOL disparities between AWPD and the general population. Many of the negative aspects that coincide with having a physical disability can decrease as physical exercise increases along with the level of QOL within AWPD.

Impact of structured exercise on quality of life of AWPD

Improvements of QOL for AWPD have been reported through a variety of STE intervention settings that are not limited to physical exercise training but also including sport (e.g., wheelchair basketball, wheelchair rugby, adapted sport), aquatics, progressive muscle relaxation, and exercise education (Cote-Leclerc et al., 2017; Holmgren et al., 2010; Kargarfard et al., 2012; Monteiro et al., 2014; Skucas, 2018; Zelenka et al., 2017).

There is supporting evidence that engaging in STE may improve QOL on both AWPD and the non-disabled population. Cote-Leclerc et al. (2017) conducted a study to compare the difference between the effect of playing sport on the QOL of individuals with a mobility disability and age-matched non-disabled population. A total of 34 individuals with disabilities (mean age = 37.9 years) who use a manual wheelchair for mobility and regularly participate in sports (at least once a week for at least 4 months) were recruited. The same number of age-matched non-disabled participants were recruited for comparison. The total score on the QOL indicated high scores that were similar and did not differ between the two groups ($p < .70$). In addition to QOL measure,

an in-depth interview was conducted with 10 wheelchair users. Qualitative data indicated that personal factor (e.g., health and psychological) and participation (e.g., relationship and enjoyable experience) were found to be a strong facilitator on improving QOL on the disability group. This study suggests that engaging in sports makes a positive impact and contribution to improving QOL despite physical disabilities.

According to Zelenka et al. (2017), participating in wheelchair rugby may be a benefit on improving the QOL of individuals with SCI. This study compared QOL of 20 male wheelchair rugby players (mean age = 32.5 years) and 16 male non-athletes with SCI (mean age = 39.44 years). The WHOQOL-BREF was administered and showed a significant difference in the physical health domain ($p < .03$) between the two groups favoring the wheelchair rugby group. There was no significant difference in the other three remaining domains, yet it showed a visible higher tendency was perceived in QOL among athletes. Zelenka et al. (2017) discussed that a larger sample size may be needed for further investigation. Despite the small number, this study shows great evidence that sports participation is beneficial to the physical health domains of QOL improving functional independence, activities of daily living, mobility and work capacity.

The study conducted by Monteiro et al. (2014) indicated QOL differences between STE participation and non-participation groups with physical disabilities. In this study, 138 individuals with lower-limb amputations (mean age = 36 years) were recruited and evenly distributed into a soccer group and non-athlete group. The International Classification of Functionality, Disability, and Health checklist was used to measure 4 different domains of QOL: body function, daily activities, performance, and social

participation. The result revealed that the soccer player group showed significantly better scores ($p < .001$) on all domains, which indicated a better QOL. Although there are limitations on how the intervention was implemented, comparing QOL between larger numbers of samples provides strong evidence that participation in sports activity improves QOL of AWPD.

Skucas (2018) reported the effects of 8 weeks of strength and endurance training on the improvement of mental health and physical state of individuals with SCI. A total of 24 participants were evenly allocated to exercise and control groups. The exercise group received four training sessions per week, 2 hr per session for 8 consecutive weeks. The program was focused on training strength through circuit training with 65% of max heart rate and endurance training such as wheelchair cycling were performed at 60% of max heart rate. The questionnaire SF-36 was used to measure physical and mental health as part of the QOL. In addition to QOL, isometric strength and aerobic endurance were measured. The primary outcome revealed that most values of mental health (i.e., energy, emotional state, and vitality) were significantly improved ($p < .05$) in the exercise group while physical health only showed improvement between pre- and post-test. The overall measures on physical performance showed significant improvement ($p < .05$) compared to the control group. This study suggests that improvement of mental health and physical state is closely dependent on the type of training. Moderate intensity training may have a potential advantage in enhancing positive affect such as energy, vitality, and happiness in AWPD.

Similarly, low-intensity STE that incorporates muscles relaxation and mindfulness training may also be beneficial to improving QOL for AWPD (Ghafari et al., 2009; Grossman et al., 2010). Ghafari et al. (2009) conducted 60 sessions, daily for 8 weeks, of progressive muscle relaxation exercise on 33 patients with Multiple Sclerosis (mean age = 31.1 years) while another 33 served as the non-exercise control group (mean age = 31.9 years). The intervention was provided through an instructional CD to familiarize with muscle group and perform progressive muscle relaxation technique using explanation. The results of the study revealed that, compared with the control group, the experimental group who exercised the progressive muscle relaxation over 8 weeks, experienced a higher QOL in physical and mental dimensions ($p < .05$), 1 and 2 months after the intervention.

Similar results of enhanced QOL was reported through mindfulness-based intervention (Grossman et al., 2010) on patients with Multiple Sclerosis (MS; $n = 150$, exercise group $n = 76$, control group $n = 74$). The intervention consisted of a structured 8 week program upon the concept of mental training that proposed nonjudgmental awareness of moment-to-moment experience, acceptance of intractable health-related changes, realistic sense of control, and appreciation of available life experiences. The program session held for 2.5 hr weekly and each session incorporated specific exercises and topics within the context of mindfulness training (e.g. yoga, observation of sensory, affective, and cognitive domains, and topic discussions on the stressful situation and social interactions). The result indicated that a significant difference ($p < .05$) in non-physical domains of QOL, fatigue, anxiety, and depressive symptoms between two

groups favoring intervention group. Furthermore, the significant difference in results remained after the 6 month follow-up. These studies suggest the significance and potential success of low intensity and relaxation focused STE aimed toward enhancing psychological domains of QOL by ameliorating psychological distress. Therefore, the future STE program should address relaxation and mindfulness aspects of training, as well as physical exercise to improve overall QOL for AWPD.

Relationship between physical strength, self-efficacy, and quality of life

Previous sections addressed the physical and psychological characteristics of AWPD and the potential benefits of STE on improving physical and mental health. It seems logical to understand that STE has a positive causal and effective link to physical and psychological characteristics. Nevertheless, the relationships between these variables are uncertain. Given the complexity in relationships between those variables, it is important to understand the interaction among the variables.

Another outcome from the current study was to examine the effect of exercise on the grip strength of the AWPD. Belka and DeBeliso (2019) provided evidence on the close relationship between self-efficacy and grip strength in older adults. A total of 35 elderly adults were measured with grip strength and self-efficacy using fall efficacy scales. The result demonstrated a moderate to near strong significant negative relationship between efficacy score and grip strength ranging from r = -.36 to -.44 (p < .05). It suggests that stronger adults have a lower fear of falling than their weaker counterparts. In relation to AWPD, falling and fear of falling are pervasive among amputees. Miller et al. (2001) revealed that from 435 (mean age = 62 years) community-

living individuals with amputee, 52% experiences fall and 49% had a fear of falling. Improved muscular strength through STE may enhance self-efficacy, which in turn will help maintain engagement in more physical activities and perpetuate continued exercise.

Using structural equation modeling, Van Leeuwen et al. (2012) were able to find the relationship between functional status, participation in activities, self-efficacy and different domains of QOL in persons with SCI. Multiple instruments (questionnaire) related to three variables were measured on 143 persons with SCI who were 5 years post discharge from the hospital. The result revealed that functional status and personal emotions were related to activity participation and explained 49% of the variance in participation. Moreover, self-efficacy and SCI appraisal were related to mental health and explained 35% of the variance in mental health. Lastly, activity participation, SCI appraisal, and mental health were related to overall QOL and together explained 50% of the total variance in QOL. Van Leeuwen et al. (2012) discussed that self-efficacy is one of the key constructs that have a direct influence on activity participation and mental health while acting as strong moderators that affects overall QOL on persons with SCI.

A study that examined the association between PA and QOL among persons with MS strengthens the importance of PA (Motl et al., 2009). A PA duration (measured by 7-day accelerometer record), self-efficacy, mood, and QOL were measured from 292 individuals with MS. Those who were more physically active reported a lower level of depression (r = -.31), impact of disability (r = -.50) and higher self-efficacy (r = .41) and QOL (r = .34). The observed pattern of relationship supports the possibility that PA has a

close association with improving QOL individuals with MS via depression and self-efficacy.

Mixed method studies in AWPD

Employing a mixed-method approach in field of health science, including studies within rehabilitation and adapted physical activity (APA) for AWPD, has been suggested to help researchers examine the complexity of health, health care, and the environments in which studies take place (Kroll et al., 2005; O'Cathain, 2010). Mixed methods approach involves 'mixing' qualitative and quantitative method in one study to best address research questions (Ivankova et al., 2006). APA can be considered as a cross-disciplinary field of health science that focuses on the study of PA for the education, wellness, sports participation, and leisure of individuals with unique needs (Winnick & Poretta, 2016). However, researchers in APA are faced with several challenges in conducting viable research due to the requirement of application of evidence or theory-driven research (Reid, 2000), heterogeneous in participant (Bouffard, 1993), small sample size, and research foci that is influenced by changing social demands (Lavay & Lasko–McCarthey, 1992). Therefore, scholars in APA have addressed the importance of using both quantitative and qualitative methodologies to expand the body of knowledge (Haegele et al., 2015). Unfortunately, only a limited number of studies have been conducted using mixed-method design in APA studies. According to Haegele et al. (2015), the research trends in journals of *Adapted Physical Activity Quarterly* (APAQ) from 2004 to 2013 indicated that the majority of studies were quantitative design (70%), followed by qualitative study (19%), single-subject or case study (5%), and only seven

(4%) out of 181 articles used mixed-method. Heagele et al. (2015) concluded the trend of research has remained unchanged from previous trends and suggested scholars seek different types of research to provide greater understanding of the efficacy and mechanisms of PA and provide evidence for the scientific research.

Curtis et al. (2015) examined the effect of an 8-week yoga program on psychological well-being (i.e., self-efficacy, physical and cognitive affect) of five individuals with SCI and followed up with a semi-structured interview to explore the experience of the program. The yoga program was held for 60 min per class per week and consisted of mindfulness training through breath awareness and upper body movement yoga. Significant changes were not found on any of the quantitative outcomes. However, qualitative analysis revealed main themes of self-efficacy, and emotional (e.g., calmness and relaxation), mental (e.g., self-efficacy), and physical domains benefits (e.g. strength) were reported. The identified themes suggest that well-being improved from pre- to post-intervention. This study was conducted with patients from within the hospital setting and showed limitation in high attrition rate due to discharge from hospital during the program. It was deemed that modified yoga could be a feasible STE that AWPD might potentially follow-up with once discharged into the community. However, it needs further study to be conducted in a community setting for generalizability of the result.

A group of researchers (Ginis et al., 2017) utilized a mixed-methods approach to examine psychosocial factors that could account for a lower level of PA among ambulatory individuals relative to manual wheelchair users with SCI (n = 343; mean age = 47.7 years). The quantitative data revealed ambulatory individuals held significantly (p

< .04) poorer attitudes toward PA than manual wheelchair user. The semi-structured interview with the ambulatory individuals (n = 5; mean age = 52.8 years) provided themes emerging around other's underestimation of their disability (e.g., misconceived as less serious injury than fulltime wheelchair user), low wheelchair and/or mobility self-efficacy, and the experience of chronic pain (e.g., pain and fatigue), which supports the negative attitude on participating in PA that was found as quantitative result. This study highlights the importance of components of the STE program in order to promote a positive attitude of physical activities within AWPD. The structured-exercise program that has a component of social support, improving self-efficacy, and adapted form of exercise environment would enhance PA attitude of AWPD.

Mixed-method research was also used to examine the relationship between PA level and QOL among AWPD (Jalayondeja et al., 2016). A total of 146 participants (mean age = 25.2 years) completed the PA level and QOL questionnaires. Although PA could not explain QOL, those who reported themselves as having good QOL showed high activity level (n = 30; 28.4 MET hr/day) ranging from poor to fair QOL group (n = 114; 21.7 MET hr/day). The qualitative result indicated that the group with poor to fair QOL (n = 10) reported greater anxiety, low self-efficacy, and more irritation with society, while persons with good QOL (n = 10) expressed better body image and being satisfied with their disability. The possible relationship between good QOL and PA level suggest the performing form of PA such as structure-exercise in AWPD is needed and further research should be encouraged.

Cote-Leclerc et al. (2017) used mixed-method design to determine the QOL difference between 34 (mean age = 37.9 years) AWPD who regularly participate in adapted sport and the age-matched group without mobility limitation (general population). In addition, 10 wheelchair users also participated in individual semi-structured interviews to explore their perceptions regarding how sports-related experience affected their QOL. The quantitative results revealed no significant QOL difference between AWPD and the general population (21.9 vs. 22.3 respectively). Based on the interview, sports participation with disabilities lead to better QOL and life satisfaction, mainly through improved physical (i.e., work capacity and ADL) and psychological health (i.e., self-efficacy), community and social participation, and support from the environment. Moreover, lack of physical resources (i.e., trained trainers), pain, and problems related to accessibility to the facility were found as the main stressor, which had impacted negatively on their QOL. Based on the study, the QOL similarity between the two groups may be attributable to the positive impact of adapted sports on personal factor and social participation. Also, it suggested that future research may need to incorporate physical resources such as knowledgeable adapted exercise trainers who can provide effective exercise while reducing pain and fatigue to promote QOL for AWPD.

CHAPTER III

METHOD

Mixed Method Research Design

The purpose of the present mixed-method research was to (1) quantitatively examine the effect of a 9-week STE program focused on health-related fitness, self-efficacy, and QOL for adults with physical disabilities; (2) qualitatively explore the perceived benefits of a STE program; and (3) identify the factors that affect physical and psychological health, as well as domains of QOL in relation to their participation in the STE program.

A mixed-method design is one in which the researcher incorporates both quantitative and qualitative methods of data collection and analysis in a single study (Ivankova et al., 2006). As such, a mixed-method design enables a researcher to examine the research questions through basic statistical analyses as well as qualitatively explain the research phenomena. There are many advantages to using a mixed-method research design. Using quantitative and qualitative approaches helps the researcher collect more in-depth information and knowledge of the problem as well as provide rich datasets. Mixed-method research designs also provide complementary information that addresses the shortcoming of using only one research method, which in turn increases the reliability and validity through triangulation and helps the generalization of the study's findings (Creswell, 2014).

The current study employed concurrent triangulation design, which is the most common framework whereby both methods are used simultaneously to confirm, cross-validate, or corroborate findings (Creswell, 2014). It is often used to overcome a weakness in one method with the strengths of another by expanding quantitative data through a collection of open-ended qualitative response (Ivankova et al., 2006). Concurrent triangulation strategy was appropriate to address the research questions of the current study so that the data from both methods can be integrated.

Participants and Sampling

The participants were recruited from a local adaptive-training facility that provides STE to AWPD. The recruitment flyer containing program and research information was shared with potential participants in person at the facility and disseminated through social network service (i.e., Facebook and Instagram) with assistance from the adaptive-training facility lead staff. A total of 15 AWPD were purposely selected by this same lead staff. A face-to-face orientation was conducted one week prior to beginning the STE program. During the orientation, the primary investigator (PI) verbally explained details of the study including the: (a) purpose, (b) procedure for the intervention and data collection (i.e., quantitative and qualitative measurement), (c) types and frequency of assessments being used for the data collection, and (d) inclusion and exclusion criteria. The inclusion criteria for the study were recorded as the participant: (1) having an acquired physical disability (e.g., spinal cord injury, amputation, stroke, multiple sclerosis, and traumatic injury resulting in mobility impairments); (2) being over 18 years of age; (3) being able to communicate with a

trainer and the PI; (4) having the motor ability to hold a grip dynamometer; and (5) voluntarily signing participation consent forms. The exclusion criteria were recorded as the participant: (1) having difficulty in comprehending written or verbal procedures of motor assessments; (2) participating in other types of exercise more than two times a week outside of the current program; and (3) having insufficient hand strength to hold a dynamometer. The consent form was distributed to AWPD interested in participating in the study. All procedures and consent forms were approved by the University's Institutional Review Board.

Intervention

The STE intervention was provided through the adaptive training facility located in North Texas. The training facility has a history of providing exercise programs to individuals who have sustained physical injuries, were born with an impairment and/or have a degenerative disease. The mission and vision of the adaptive training programs is to empower a person with physical disabilities to transform their lives by expanding a community of support, provide access to specialized adaptive training methods and equipment, and redefine identity for AWPD through an STE program.

The intervention of the current study was implemented through a program called ReDefine. ReDefine provides 9 weeks of intensive, individualized training in a group setting with other individuals who are experiencing similar life challenges such as physical impairment and/or psychosocial difficulties. Each participant was paired with an implementation team of two certified trainers, who delivered their customized program three times per week (Tuesday, Thursday, and Friday). The primary focus of each 2-hr

session was on pain reduction, improvement in body composition, and increase in functional strength, cardiovascular endurance, flexibility, and mobility. These components were addressed simultaneously all while building a community of social support for participants.

The program schedule of training was designed and implemented by the facility training staff. The participants were distributed into two groups (Group 1, $n = 8$; Group 2, $n = 7$) in order to match the 1:1 or 1:2 ratio between participants and trainers. Each group was assigned to participate in an exercise program at a specific time (Group 1: 10 am - 12 pm, and Group 2: 12 pm - 2 pm). Table 3 represents the outline of the exercise procedure.

Table 3

Outline of the Exercise Procedure

Program	Contents	Duration
Preparation	Exercise preview Mental preparation Energizing using proper breathing techniques	15 min
Main exercise	Warm up Aerobic exercise Resistance exercise Auxiliary exercise (e.g., balance, stability, mobility) Cool down	60 min

	Exercise review	
Relaxation	Group discussion	15 min
	Relaxation breathing work	

During the 90-min session, the first and last 15 min (total 30 min) were utilized as program preview, review, and discussion session. Included in this portion of the session were mental preparation and relaxation through meditation, breathing work, and mindfulness (e.g., awareness of moment-to-moment experience, acceptance of health-related changes due to physical disability, realistic sense of control, and appreciation of available life experience). The preview session included visualization of exercise and goals, and energizing breathing to prepare minds and bodies for exercise. The post-session included discussion time such as sharing experiences and providing feedback from one another incorporating relaxed restorative breathing and mindfulness to get participants ready to take on life and work tasks.

The main exercise program lasted 60 min and was composed of 5 min of warm-up, 50 min of combined exercise which focused on aerobic, resistance, and auxiliary (e.g., balance, stability, mobility, and range of motion) training, and 5 min of cool down exercises. The individualized exercise program was developed from each trainer based on each participant's unique attributes, special needs, and goals. The individualized program was reviewed each week by head trainers (n = 5), certified physical therapist (n = 2), and the PI to validate the progression of the exercise and ensure the program safety. Assistance to each participant, such as using adaptive equipment, access to the machines,

and modification of exercise (depending on motor ability) were provided by staff as needed. Assistance was kept to a minimum level to promote autonomy during the exercise program.

Instrumentation and Measures

Hand Grip Strength

Hand grip strength was measured with a digital hand dynamometer device (Takei 5401). For the test, participants were seated in a chair or wheelchair and asked to hold the device in the preferred hand and move the dynamometer away from their body with arm fully extended at 45º angle. This was kept below the shoulder height during use of the dynamometer measurement. Each participant performed two sets of handgrip strength measurement. First, they were asked to squeeze the handle for 3 s while maintaining the arm position. The measurement was repeated on the opposite side following the same protocol. Grip strength was recorded in kilograms. This measurement of handgrip strength on both sides was considered the completion of the first set. The participants had a 30-s rest time between the two sets. The average force of both hands was recorded.

Body Composition

The participants' body composition was assessed using a GE Lunar Prodigy Dual Energy X-ray Absorptiometry (DXA) machine (GE Healthcare, Madison, WI, USA). The participants were asked to remove shoes and anything metal. With minimal clothing, the participants were instructed to lie supine with hands at their side and feet pronated on the DXA table for 8-10 min. Assistance was provided to help the participant transfer from a wheelchair to the scanner bed. The DXA machine measured FM, LBM and Body

Mass Composition BMC pounds. All body composition measures were taken using the DXA and performed at a local health clinic by a trained clinician. Results were recorded, returned to the facility and made available to the researcher.

Self-Efficacy

Self-efficacy was measured with The University of Washington Self-Efficacy Scale (UW-SES). UW-SES is a self-efficacy instrument with 17 questions, using a 5-point Likert-scale (1 = *not at all* to 5 = *completely*) to measure self-perceived confidence in managing challenges related to MS and SCI that could be used across several disability categories (Amtmann et al., 2012). The UW-SES has excellent psychometric properties including well-functioning response categories, no floor effects, and low ceiling effects. Amtmann et al. (2012) reported that higher self-efficacy scores were significantly associated with better mental health and physical health, less fatigue, less stress, less pain interference, less pain, fewer sleep problems, and lower depressive symptoms. The correlation between the Chronic Diseases Self-Efficacy Scale is recorded as high (.83), providing support for convergent validity for different types of physical disabilities (Amtmann et al., 2012).

Quality of Life

The QOL was measured with the World Health Organization Quality of Life Brief version (WHOQOL-BREF). The WHOQOL-BREF is a widely used, reliable, valid, and self-administered measure of QOL in terms of physical health, psychological health, social relationships, and environment. WHOQOL-BREF is an abbreviated version of the WHOQOL-100 item assessment. Instead of 100 questions, this assessment contains 26

questions. The instrument measures four domains (i.e., physical health, psychological health, social relationship, and environmental health) as well as two items on overall QOL and health. Responses were rated by a 5-point Likert scale from 1 (*very poor/very dissatisfied/not at all*) to 5 (*very good/very satisfied/completely*). The higher scores indicate better QOL. The WHOQOL-BREF assesses QOL in a manner that saves times and minimizes the burden on the participant. It has been used with AWPD (Lundberg et al., 2011).

Quantitative method: Data collection and analysis

The quantitative method was conducted with quasi-experimental time series research design due to the limitations in population sampling and unavailability of a control group. Within-subject time-series design was implemented to examine the effect of the exercise program on the entire group. In a time-series, pre and post assessments were obtained from the participants which occurred one week prior to the 9 week intervention (pre) and one week after (post) completion of the intervention. The series of measurement pre and post could provide rich information about the changes in participants because measures at two points in time are likely to provide a more reliable picture of achievement (Gribbons & Herman, 1997).

The IBM Statistical Package for the Social Science (SPSS) version 25 was used to analyze the data. The demographic information (i.e., age, gender, height, weight, and disabilities) were represented through mean and standard deviation by using descriptive analysis.

Histograms was used to screen the normality in all dependent variables (i.e., grip strength, body composition, self-efficacy, and QOL

To examine the hypothesis, a comparison of the mean score of dependent variables within a different time period (pre and post) was analyzed by paried *t*-tests (i.e., grip strength, self-efficacy, and QOL) and MANOVA (i.e., body composition). The significant level was set at $p = .05$. Further, effect size of each variables was calculated to determine a practical significant difference across time in each dependent variable using Cohen's *d* (Cohen, 2013).

Qualitative method: Data collection and analysis

In this study, ethnographic research design was used to understand the perceived benefits of participating in 9-week STE program and identify factors that promote exercise participation for AWPD. Myers (1999) defines ethnography as the study of social interaction, behaviors, and perceptions that occur within groups, teams, organization, and communities. The central aim of ethnography is to provide rich, holistic insight into people's view and actions, as well as the nature of the location they inhabit, through the collection of detailed observation and interviews.

Thus, ethnographic researcher immerses themselves in the life of people they study and seek to place the phenomena studied in their social and cultural context. The ethnographic research in current study was well suited to provide information of AWPD who shared experience within social and organizational context that were collected through different sources (i.e., program observation and interview). In doing ethnography, researcher actively presented in the program in order to gain an insider's

perspective. The researcher deemed that conducting focus group interviews was appropriate to find the participants' perception and emotional reaction from an event (i.e., structured adapted exercise) they have experienced.

For the purpose of the study, a focus group interview was the preferred method of qualitative data collection as it is an efficient data collection technique to identify key concerns and to enable shared experiences to prompt deeper thinking and debate on the topic (Kitzinger, 1995). The focus group permitted the gathering of a large amount of information from potentially a large group of people in relatively short periods of time. The group environment also encouraged the participants to share their views during the discussion as compared to an individual interview. In turn, focus group interviews allow group interaction in response to research questions while contributing to the content of knowledge.

The number of participants in a focus group can vary from four to eight, as suggested by Onwuegbuzie and Collins (2007). The current study invited 12 participants to partake in a focus group one day after the completion of the intervention. The focus group interview was conducted as a semi-structured interview format held in the seminar room at the facility. Two moderators (i.e., PI and program coordinator) were present for the interview. Both moderators were able to develop a positive rapport with participants across 9 weeks of the program. This rapport provided a friendly interview environment, which allowed participants to share their views in-depth. The duration of the focus group interview was about one hour in order to help the participants stay focused on the discussion while also ensuring the researcher archived data saturation. Each participant

was assigned a unique code for identification during the focus group interview for assurance of confidentiality. The interview was conducted in English and recorded with two digital recorders. The focus group interview guiding questions were developed based on the research topics prior to the interview for the ease of facilitation. To ensure the content validity of the interview questions, interview questions were edited and revised by applying suggestions from two qualitative method study experts (i.e., experts in the area of Health Promotion and APA). Based on the functions during the flow of discussion, the guiding questions were divided into four categories, namely the opening, leading, main, and ending.

Table 4

Interview Guide Questions

Categories	Sample Interview Questions for Participants
Opening	• Could you share when or how you sustained your injury? • How was this structured-exercise experience different from previous exercise experience?
Leading	• What was your favorite part of the program? • What kind of changes have you noticed in yourself since the beginning of the program?
Main	• How do you feel about your self-confidence level since the beginning of the program? And what are the reasons for these changes? • How do you feel about your physical and mental health since the beginning of the program? And what are the reasons for these changes? • How do you think your participation in the program has impacted your social relationship? • How do you perceive your overall well-being?

Ending	• In general, what factors do you feel were most helpful in addressing the needs of people with different physical challenges and making it easier for them to participate in exercise? • What is your future plan for exercise?

Thematic content analysis was guided by six steps suggested by Creswell (2014) in a phenomenological approach:

1. All data were organized through transcribed verbatim using Microsoft Words 2013.
2. The transcribed data were read over several times in order to grasp the general sense of the information.
3. Transcribed data were organized into open coding which involved creating code with any words or lines that has typical meaning related to the research question (e.g., self-efficacy, quality of life, benefits of structured adapted exercise).
4. Themes were identified by combining a codes that represent a similar meanings.
5. The fact, stories, and compelling extract examples from themes were described as text and visual chart.
6. Finally**,** each theme was interpreted in a meaningful way.

A triangulation strategy was used to compare the qualitative data from the interviews with the quantitative data. Triangulation was also used as a strategy to increase the trustworthiness between qualitative and quantitative data. Moreover, analyzed data were shared with qualitative study experts for peer debrief. The researcher provided a detailed description of the research procedure and findings of the study in order to

increase the transferability. The transferability of this study may assist the reader in being able to generalize findings into the similar setting, population, and situation.

Ethical Consideration

Ethical approval of the current study was obtained from Institutional Review Board of Texas Woman's University. The researcher provided information regarding the study, including purpose, nature, and procedure of the study at program orientation. The participants were also informed of their right to withdraw from the study at any time without affecting the program they receive at the orientation. Participants were informed of any possible foreseeable risks such as pain, fatigue, and stress during the measurement (i.e., handgrip strength, self-efficacy questionnaire, and QOL questionnaires). They were also informed that the interview would be audio-recorded and used for research purposes. The participants were asked to sign the consent forms only if they fully understood the content of the study and were willing to participate

The PI safeguarded the confidentiality and privacy of participants by using a coding system for recording the data This system avoided the use of names, and used information sheets that included participants' name, telephone numbers, and email addresses. These sheets were locked in a cabinet, which only the PI was able to access. Participants were advised that all information would be kept confidential and names would not be disclosed in any research reports. All data collection records were destroyed at the completion of the study.

CHAPTER IV

RESULTS

This chapter presents the results of a 9-week STE program on the components of health-related fitness, self-efficacy, and QOL for AWPD. The chapter consists of six sections. The first section describes the characteristics of the study sample, and the following four sections report the changes from baseline to post-intervention for (a) grip strength, (b) body composition (i.e., FM, LBM, and BMC), (c) self-efficacy, and (d) QOL (i.e., PHY, PSY, SOC, and ENV). The last section reports the findings of the focus group interviews qualitatively analyzed.

Demographics

The study recruited 15 adults with physical disabilities at baseline, of which 14 completed the 9-week STE program. One participant dropped out of the program before post assessments were completed. All participants completed the assessments; however, only 11 participants were able to complete the body composition. The participants' demographic information is provided in Table 5. On average, the participants were 34.07 years old (*SD* = 7.54) and half of them were female (*n* = 7).

Table 5

Demographic characteristics of the 9-week structured-exercise program.

Variables	*N* (%)	*M*	*SD*	Range
Type of disability				
TBI	2 (14.3%)			
Amputation	4 (28.6%)			

SCI	4 (28.6%)			
Stroke	2 (14.3%)			
Other	2 (14.3%)			
Age (years)		34.07	7.54	28-50
Height (in)		67.96	3.72	61.5-72
Weight (lb)		164.61	35.86	114.9-257.8

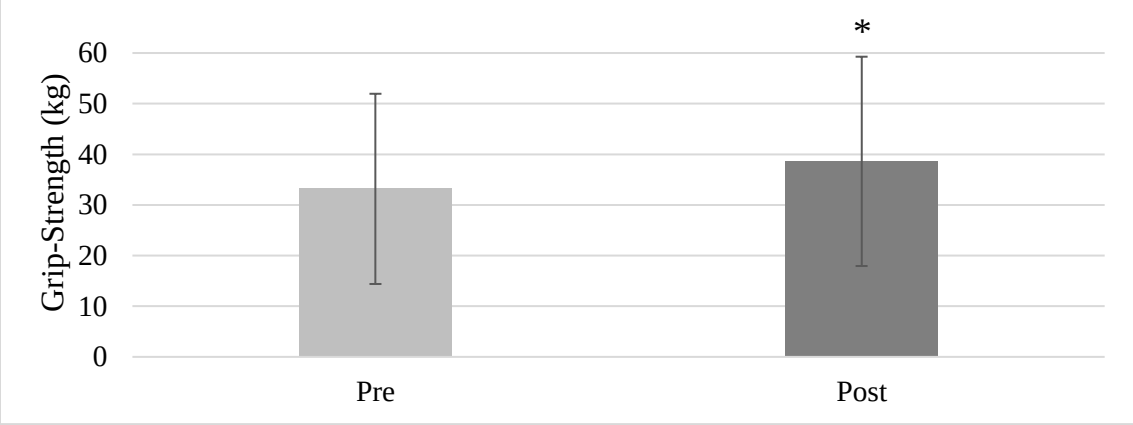
Note. *M* = mean; *SD* = standard deviation; TBI = traumatic brain injury; SCI = spinal cord injury; Other = Parkinson's disease and cerebral palsy

Grip Strength

A paired-sample *t*-test was conducted to compare grip strength before and after the 9-week STE program. The assumption of normally distributed difference scores was confirmed by the Shapiro-Wilk test ($p = .15$). Participants' grip strength was significantly improved at posttest ($M = 38.61$, $SD = 20.66$) compared to pretest ($M = 33.17$, $SD = 18.77$), $t(13) = -5.96$, $p < .001$, $d = 0.27$. However, the size of this improvement was small according to Cohen's (2013) guideline. Figure 1 shows the means and 95% confidence intervals of the mean difference between pre- and post- grip strength.

Figure 1

Comparison of mean scores for pre and post on the grip strength.



Note. *$p < .05$.

Body Composition

Out of 14 participants, only 11 participants were able to complete the body composition DXA scan. Three participants were unable to attend post- DXA assessment due to a personal schedule. A repeated-measures MANOVA was conducted to examine changes in body compositions before and after the 9-week STE program. The result of the multivariate test for time effect was significant (Wilk' $\lambda = 0.34$, F (3, 8) = 5.12, $p < .029$. partial $\eta 2 = .66$), indicating that the body composition variables as a set were significantly changed after the program. Given the significant multivariate test result, univariate tests were performed to examine changes in individual variables of body composition and the results are summarized in Table 6.

Table 6

Mean changes in body composition

Variable	Pretest *M* (*SD*)	Posttest *M* (*SD*)	*F* (1, 10)	*p*	Partial η^2
FM (lb)	54.61 (20.22)	51.53 (19.30)	7.85	.019	.44
LBM (lb)	102.18 (23.22)	107.40 (25.83)	5.50	.041	.35
BMC (lb)	5.72 (1.04)	5.76 (1.07)	.47	.506	.05

Note. *M* = mean; *SD* = standard deviation; FM = fat mass; LBM = lean body mass; BMC = bone mineral content

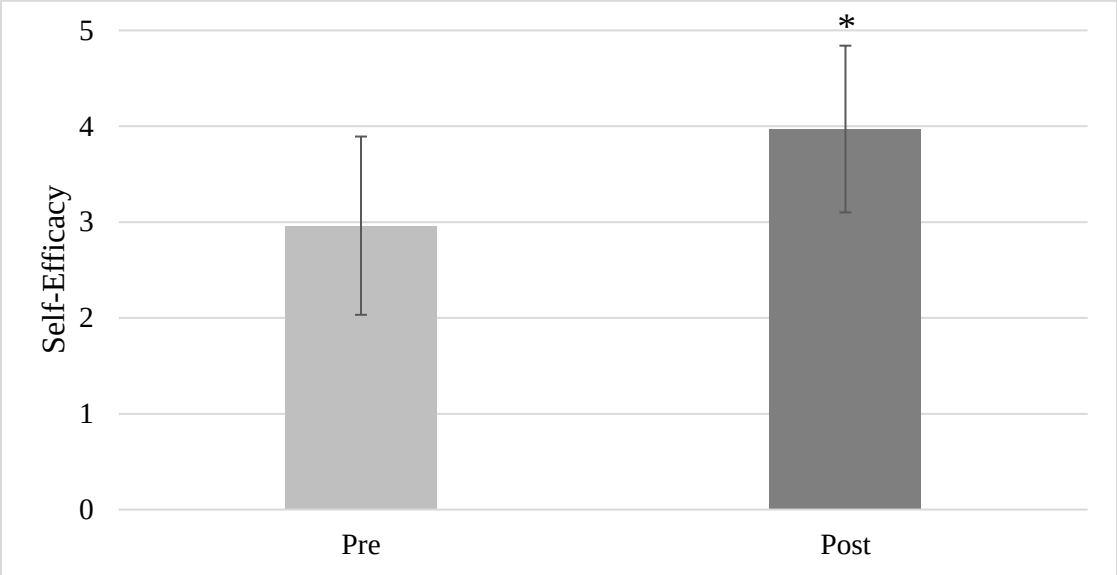
FM significantly reduced ($p = .0192$), while LBM was significantly increased at posttest compared to pretest ($p = .041$). These changes were large in size (Cohen, 2013). Although BMC improved post program (partial $\eta^2 = .05$), this change was not statistically significant at .05 alpha level.

Self-Efficacy

A paired-sample *t*-test was conducted to compare self-efficacy pre and post to the 9-week STE program. The assumption of normally distributed difference scores was confirmed by the Shapiro-Wilk test result ($p = .06$). Participants' self-efficacy was significantly improved at posttest ($M = 3.97$, $SD = .87$) compared to pretest ($M = 2.96$, $SD = .93$), $t\ (13) = –3.48$, $p = .004$, $d = 1.12$. The size of this improvement was large according to Cohen's (2013) guideline. Figure 2 shows the means and 95% confidence intervals of the mean difference between pre- and post self-efficacy.

Figure 2

Comparison of mean scores for pre and post on self-efficacy



Note. Scale range from 1 (not at all confident) to 5 (completely confident); *$p < .05$.

Quality of Life

A paired-sample *t*-test was conducted to compare subscales of QOL (i.e., PHY, PSY, SOC, and ENV) before and after the 9-week STE program. The assumption of normally distributed difference scores was confirmed by the Shapiro-Wilk test result (PHY $p = .41$; PSY $p = .57$; SOC $p = .59$; and ENV $p = .91$). Significant improvement ($p < .01$) in PHY, PSY, and SOC were observed. These changes were medium in size (Cohen, 1993). Although ENV improved after the program ($d = .41$*; medium)*, this change was not statistically significant at .05 alpha level ($p = .13$). The results of QOL are summarized in Figure 3 and Table 7.

Table 7

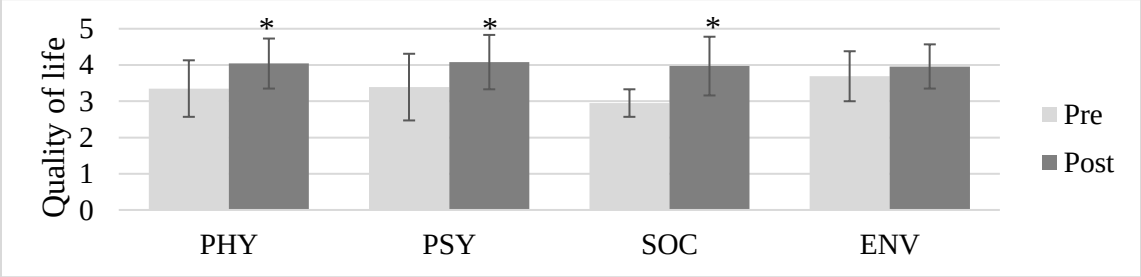
Mean changes in QOL

Variable	Pretest *M* (*SD*)	Posttest *M* (*SD*)	*t* (1, 13)	*p*	*d*
PHY	3.35(.78)	4.04(.69)	– 4.02	.001	.93
PSY	3.39(.92)	4.08(.75)	– 2.90	.012	.82
SOC	2.95(.38)	3.97(.81)	– 5.49	.0001	1.61
ENV	3.69(.69)	3.96(.61)	– 1.61	.13	.41

Note. *M* = mean; *SD* = standard deviation PHY = physical health; PSY = psychological health; SOC = social health; ENV = environmental health; *d* = Cohen's *d*; Significant at the $p < .05$ level.

Figure 3

Comparison of mean scores for pre and post on QOL.



Note. Scale range from 1 (not satisfied) to 5 (completely satisfied). *$p < .05$.

Findings from focus group

Demographics

Out of 14 participants, only 10 participants joined the focus group and completed the discussion. Four participants were unable to attend the full length of the discussion due to personal schedule (n = 3) and lack of interest (n = 1). The participants' demographic information is provided in Table 8. On average, the participants were 32.4 years old (SD =7.4) and 40% of them were female (n = 4). The majority of the participants were people with amputation (40%).

Table 8

Demographic characteristics of focus group

Variables	*N* (%)	*M*	*SD*	Range
Type of disability				
TBI	2 (20%)			
Amputation	4 (40%)			
SCI	2 (20%)			
Stroke	1 (10%)			
Other	1 (10%)			
Age (years)		32.4	7.4	25 - 50

Note. *M* = mean; *SD* = standard deviation; TBI = traumatic brain injury; SCI = spinal cord injury; Other = cerebral palsy

The current study used an embedded design of mixed-method, in which the qualitative data set provided a supportive, secondary role primarily on the quantitative data. The qualitative data were collected and analyzed to follow up on the results of a change in self-efficacy and different variables within QOL. Thematic content analysis was applied in this study. The result of the study attempted to answer the central questions of the study which were:

1. What are the perceived benefits of participating in a structured-exercise program?

2. What are the key factors of a structured-exercise program for adults with physical disabilities?

A total of six subthemes emerged, which were improvement in self-efficacy, having control in life, a sense of belonging, the exercise program, the importance of a trainer, and the environment where the program was conducted (See table 9). These subthemes were merged into two main themes (a) perceived benefit of a 9-week structured-exercise program and (b) key factors of an exercise program for AWPD. These themes are supported by subthemes that further elucidate the benefits of exercise programs and factors influencing the changes; those subthemes were discussed further within this chapter.

Table 9

Summary of Thematic Analysis

Theme	Subthemes	Categories
Perceived benefits	Self-efficacy	New skills
		Goal accomplishment
		Encouragement
	Control in life	Self-awareness
		Stress management
		Re-define
	Sense of belonging	Positivity
		Sharing
		Support
Key factors	Exercise program	Adapted exercise program
		Mindfulness training
		Resource and investment
	Trainer	Mentality
		Energy
		Safe spot
	Environment	Non-judgmental
		Motivation
		Comfortable

The perceived benefit of a structured-exercise program

At the beginning of the focus group, all participants were asked to discuss their perceptions of the benefits of the 9-week STE program. Participants' responses regarding the benefits of the STE program were coded and analyzed as meaningful units and categorized into three subthemes: including 1) self-confidence, 2) control in life, and 3) sense of belonging.

Self-Efficacy

All participants expressed the beneficial effects of a STE program on enhancing self-efficacy. They identified (a) new skills, (b) goal accomplishment, and (c) encouragement as the sources that helped to improve self-efficacy. First, they were able to realize their functional capability, both physical and mental, by learning new skills, which allowed them to feel confident in doing more things. One participant [male, stroke] commented:

> I would say my confidence comes from the fact that I can listen to my body. They taught me a skill because I kept injuring myself and hurting myself, like trying to do new things or trying to do a thing that I used to be able to do. It's not about the rep. It's not about the workout. It's about you are performing better, and better-being human.

Second, the participants demonstrated that achieving goals was another main source of improvement in self-efficacy. Participants responded that accomplishing a goal in the exercise program enhanced their confidence in achieving goals in other areas of life. One participant [male, single-leg amputee] commented:

> I met all the goals that I put down. My accomplishment was beating all of my goals. The biggest thing I regret is not having more goals. I did a lot of things that I did not think I can do. It means to me a lot. I can keep going so far above the goals that I thought I couldn't accomplish. Then you know it translates into my life. I didn't give up. I kept going. This accomplishment helps the other areas of my life. If I can do this, I can do others. I accomplished it all and I feel confident.

Lastly, positive verbal feedback and encouragement received from peers, staff, and trainers impacted enhancing self-confidence. The information and encouragement they received from the people around them helped mitigating anxiety, negative emotions, and provided motivation to move forward. A male participant with SCI commented:

> There is the society around you saying, 'won't and can't'. I don't think I couldn't break that wall down. The trainer shows that it's self-defeating right off the bat. And they let you know 'you are powerful, and you really do play a part in your won act'. They played the biggest role in my confidence.

Control in life

A majority of participants (n = 8) expressed that a 9-week STE program helped them regain control of their life by: (a) increasing self-awareness of their disability, (b) learning how to manage the stress, and (c) re-defining self-perception (i.e., former vs. current perceptions). The participants were able to observe changes in physical and mental aspects in their life, which brought an awareness of their disability and capability to control themselves. One of the participants (male, TBI) expressed the receiving positive 'validation' from another regarding changes in physical aspect play huge role in improving self-awareness. Another participant (male, single-leg amputee) shared:

> [I learned] Positive things to snap out of negative things. There are sometimes not in the gym, but outside of the gym. The negative thoughts creep in. Now I am aware they are just negative thoughts; they are not real. They are my negative side talking to me. I am now aware of how to bounce back to positive. That is a really

big thing. Not being swept away with emotions and thoughts. I am able to step back and control myself.

Some participants expressed difficulties in controlling their psychological issues such as post-traumatic stress disorder (PTSD), anxiety, and depression. They emphasized that they were able to control the psychosocial issues by 'breathing and meditation techniques' that were taught in the program. One participant [male, TBI] expressed that he was able to "break PTSD" and control his "anger" by implementing those techniques. A female participant with TBI commented:

> Time to time, whenever I'm working, my PTSD kicks in whenever I see things. I actually can calm myself down more than I used to before. Because I had to deal with my issues. Now he taught me how to do breathe and listening to my body, I am better.

Participants also shared the transformation of their life stories. The 9-week STE program, also known as the Re-define program, provided an opportunity to grow personally, enhance self-esteem, and change their view about life. A female participant with SCI described her experience of STE as "life transformation" after her serious injury. A male participant with SCI who relied on a mediation for his trauma commented:

> My life is completely changed. If you were to see me five months ago, you wouldn't know who I was. I had to be part of this, it brought me a true meaning of life. It's been a long time that makes me feel good and feel worth it. I am here now. I am on my own path. I was messed up, abusing my medication, and I reach out to other person, and she offered me help, supporting each other. My life is

> trying to embrace myself and started to happen here. My life is putting itself together because I am investing in myself, not try to force things. I am just being in a moment, present in a moment, realizing I can't control what's surrounding me, and that's all that matter.

Sense of belonging

All participants expressed a 9-week STE program helped to feel a sense of belonging. The participants described that the program promoted them to bond with each other by (a) exchange positive energy, (b) share deep stories, and (c) support each other. Some participants responded that having people who are motivated and have positive energy helped them interact with others. A female participant with TBI responded:

> Before I came into this program, I haven't had a chance to interact with other people to do something because of my condition. This program helped me to meet other people who are so motivated. The people I met (before), just learning about their problems which doesn't help you. (Everyone agrees). So it's nice to have people around you who see positive stuff, not just hear about people complains about 'medication and health condition', all that crap that you want to forget about.

Some participants responded that they were reluctant to share their stories and disabilities with other people in a public or private setting. The mindfulness training and group discussion that were part of the STE program provide chance to open their thoughts, feeling, and personal stories. Participants expressed that group discussion promoted building a close relationship with one another by sharing their personal stories,

receiving and providing feedbacks, and understanding others. A male participant with single-leg amputee expressed the uniqueness of the group:

> How the group holds and stick to each other. It's not just a workout program, it's not just a group that meets up at church something to talk about it. We each have different ways of targeting areas of our life, to make you better or more prepared with your life. So, we are always engaged, each turns our attention to help others, cheer them on.

Some participants also shared the hardships they experienced during the STE program and how the group comradeship helped to complete the program. Many of the participants shared that the biggest hardship they faced were being away from home for 9 weeks, physical and psychological capacity. A few participants expressed that they thought about quitting the program multiple times because of their personal issues. A female participant with single-leg amputee who relocated herself from home commented:

> I thought about quitting the program so many times. But it was you guys. I remember when you came over and talked to me how much you care about me. It was really you guys the reason I am still here.

Factors contributed to changes

Participants were asked to discuss factors that contributed to a change in their life (i.e., self-efficacy, health status, and social relationship) after experiencing a 9-week STE program. Most participants shared the unique characteristics of the STE program that were different than conventional community-based exercise program. The narratives of

interview were analyzed into three subthemes: 1) unique exercise program, 2) quality of trainers, and 3) motivating environment.

Exercise program

The participants identified three unique features of the program as (a) adapted/individualized exercise program, (b) mindfulness training, and (c) resources and investment. An exercise program that was adapted and tailored to meet unique individual characteristics were identified as unique features of the STE program. The individualized program provided an opportunity to learn new skills and regain functional capabilities that were lost from the injury. A male participant with single-leg amputee responded:

> How they breakdown the workout, you do this for specific muscle group and that for another muscle group. You do this specific workout for a specific outcome. Personalized and goal-oriented exercise program. It changes the way you work out, trying to lift a weight vs. trying to realize your muscle group and strengthen the muscle group to walk better.

All the participants identified the 15 min of mindfulness training before and after the exercise program was the most critical and unique feature of the STE program. The mindfulness training including breathing techniques, meditation, and group discussion helped change psychological health. A female participant with SCI shared her experience with mindfulness training as “total mental transformation,” which enabled her to realize the capability and mange stress. Some participants emphasized the importance of group sharing during the mindfulness training. One participant with single-leg amputee highlighted the experience of group sharing:

> I never feel able to talk about being completely vulnerable to a person or group of people. The stories that we share at the meeting, that was my dirty little secret I was gonna die with. It affected my whole life view of myself. Hearing other people, they have more shit than you do. People have worse shit than me, I felt more comfortable to share and some of the layers released.

Several participants shared the investment and accommodational service of the program toward participants. The program provided nutrition services (i.e., education and meal plan) transportation, temporary accommodation, and connection opportunities after completion of the program. The investment from the program was revealed as the unique feature that differed from conventional community-based exercise program. A male participant with TBI shared that the investment toward participants enabled them to solely focus on the exercise program. A female participant with single-leg amputee commented:

> They also have a variety of resources. They ended up connecting me with a different program so I can help with my mental state when I go back home. And the fact that I made a new family and friends who will be there for me after I leave

Trainer

All participants strongly emphasized the role of the trainers and discussed the credibility of training people with physical disabilities. The three major subthemes identified in relation to the trainer were (a) mentality (b) knowledge of the trainer, and (c)

being a safe spot for the trainee. All participants expressed deep appreciation to their main trainer during the interview. A male participant with SCI commented:

> Feels like the staff, they don't work here, this is their life. As opposed to their job. This is a complete lifestyle change. From the mental aspect, where they know you or not, we are picking up a lot of energy from staff and from each other.

All participants felt strongly that the trainer's knowledge of disability and motivation towards trainees was critical in the training environment. A male participant with stroke shared that trainers were extremely accountable where they push the participant to their limit, yet safe and empowering manner:

> For me, with the trainer, it became a safe spot. Like every time I came in, I trusted trainer, he got to know me the different level, so I can become vulnerable. He was my safe spot. Even if when I am having a bad day, he would make me stop and focus on my mental. It means nothing to him if my mental is not right. That was a huge thing because most of the trainers do not invest in their client like that.

A majority of participants expressed the importance of building a trustworthy relationship with the trainer. The positive relationship enabled participants to feel comfortable and safe around their trainer, which motivated them to focus on exercise program. However, one participant expressed the unsatisfied relationship with the main trainer and the overall program:

> If you get a really good trainer that listens to you, they learn from you and you learn from them, they invested in you, it is a really great program. In my mind, not everybody is gonna be perfect, if I did get a better trainer, I would have gone

> further. I'm not saying anything bad about my trainer, I'm just saying I would have done better if I was paired up with somebody else. I literally wanted to quit multiple times

Environment

The last unique feature of the STE was identified as the environment of the exercise facility. The three major subthemes of environmental factors that facilitate participants were: (a) non-judgmental, (b) motivation, and (c) welcoming. All participants strongly agreed with the non-judgmental environment as the biggest difference between the conventional community-based facility and the current program. They shared the negative experiences (i.e., equipment and negative stigma from others) at the conventional community-based exercise facility:

> I think one of the greatest things for me was, non-judgmental. Any other gym that I go into I hears 'oh, you are so inspiring, you are so… you know" (Everyone agrees). It's so annoying. Here it's non-judgmental, and it's also not a pity party…Like I said, I don't want to go back to a normal gym (conventional community-based exercise facility). I can't stop between reps because somebody comes and says thank you for my service.

Along with the non-judgmental environment, participants shared that absence of pity in the facility helped them to focus on the exercise program. Some participants shared their previous exercise experience where they constantly made a personal (e.g., physical and mental discomfort) excuse and comparison with non-disable population in order to skip exercise program:

> I think the absence of pity. Nobody here feels sorry for anybody, and that makes you less sorry for yourself. I can't come in here like 'oh my back hurts, wrist hurt, I can't work out today'. There are people living with chronic pain who comes here. I have chronic pain, but people live worse pain than me and come ready to workout. You are not allowed to feel sorry for yourself here.

Some participants' perceptions provide clear distinction between current STE program and conventional community-based exercise facility. Participants noted that having no mirrors in the gym as the unique features of the environment. This facilitates the deeper discussion about the correct movement with the trainer, providing an opportunity to observe, and receive motivation from other's accomplishing a goal:

> You are not in the normal gym where you are surrounded by mirrors. You are not looking at yourself working out. But that was a big thing (not having a mirror in the gym), we are not staying here obsessed with our body. Rather, I'm present and watching all of y'all crushing your workout

Finally, participants described a welcoming atmosphere as the facilitator of the exercise program. Chanting the name when a person enters a facility, cheering during the exercise, and showing genuine interest in the person contributed to creating companionable environment for participants:

> They invest and put interest in you. When you are a patient, you are numbered. When I walked through the doors here, you feel the love of the support. And then you are more adapted to the environment, so you show more interest in doing

what they want you to do. And bring out more capabilities of what you think you had. It’s a family.

CHAPTER V

DISCUSSION

The purpose of the present mixed-method study was to examine the effect of a 9-week STE program focused on health-related fitness, self-efficacy, and QOL for AWPD. A secondary aim was to explore the perceived benefits of a STE program and to identify factors that affect physical and psychological health, as well as domains of QOL. The result of the study confirmed the hypothesis, indicating that participation in the STE program had a positive influence on health-related fitness (i.e., grip strength and body composition), self-efficacy, and domains of QOL. Significant improvement ($p < .05$) with average moderate effect size (Cohen's $d = 0.5 - 0.8$) was found across the variables.

The discussion chapter consists of five sections. The first three sections discuss the result of the effect of 9-week STE program on (a) health-related fitness, (b) self-efficacy, and (c) QOL with previous research and relevant literature. The fourth section focuses on the limitations of the study. The implication of the findings and the recommendation for future research are presented in section five.

Health-Related Fitness

The components of health-related fitness are defined as (a) cardiorespiratory endurance, (b) muscular endurance, (c) muscular strength, (d), body composition, and (e) flexibility (Caspersen et al., 1985). Given the heterogeneous attributes of the population of research participants (e.g., having different motor characteristics such as single-leg amputee, double leg amputee, para-,hemi-, and quadriplegia), the current study only

measured muscular strength through grip strength and three variables of body composition (i.e., FM, LBM, and BMC) through DXA scan.

Participation in this 9-week STE program resulted in a significant improvement in the grip strength by 15% (p = .01). This observation was similar to the findings of the previous study conducted by Skukas (2018), in which adults with SCI demonstrated a 16% improvement in the grip strength after 8-weeks of strength and endurance circuit training with 65% of max heart rate. However, the participants in the current study received three training sessions per week, 90 min per session for 9 consecutive weeks with no set intensity. Although not measured, exercise intensity was assumed to be moderate to high by performing a set of exercises in a sequence of rapid aerobic exercise to increase heart rate, followed by moderate to heavy resistance training, and auxiliary exercises such as balance or motor coordination training.

Hicks et al. (2011), Skukas (2018), and van der Scheer et al. (2017) identified differences in muscle testing and method (e.g., dynamic, isometric, and manual). However, the intensity and frequency of exercise protocol from previously mentioned studies may provide stronger evidence in improving muscular strength. According to systematic reviews on exercise training and muscular strength for AWPD, improvements in muscle strength ranging from 12 – 30% are documented, when resistance training is performed 2 – 3 times per week, at 50 – 80% max heart rate (Hicks et al., 2011; van der Scheer et al., 2017). A study that examined the grip strength in persons with a stroke from two different exercise groups (i.e., upper body exercise vs. lower body exercise) showed improvement in grip strength and motor function in both groups (Pang et al.,

2006). The participants in current study considered STE as an effective way to improve muscular strength; some reported “work capacity,” “lifting more weight,” and “40 inch box jump” to describe their improvement in strength. These results indicate that grip strength may be improved by different types of exercise and suggest a strong correlation (r = .763 - .980; p < .01) between grip strength and total muscle strength (Wind et al., 2010). Handheld dynamometers assessments may be the most feasible assessment tool that can be used for AWPD in a community-based exercise setting. The assessment requires a single handheld dynamometer while other assessments such as maximum repetition assessment require additional equipment, technician competency, and safety precautions. A handheld dynamometer also provides easy accessibility to AWPD who may have different motor characteristics that could restrict other types of strength assessments (i.e., free-weight max test and Cybex machine [Donachy et al., 2004; Skucas, 2018]).

In accordance with improvement in muscular strength, the current study revealed significant improvement in body composition (p = .01). More specifically, there was a significant increase in LBM (p = .04) and reductions in FM (p = .02), to include a small increase effect on BMC. Different forms of STE such as the sport of wheelchair rugby, indoor hand bike exercise, and balance training that were composed of aerobic and resistance training resulted in a significant reduction in FM and increased LBM and BMC in AWPD (Gorla et al., 2016; Kim et al., 2015; Vahlberg et al., 2017).

The effect of STE on BMD and BMC were inconclusive (Astornio et al., 2013; Pang & Lau, 2010). Astorino et al. (2013) reported improvement in spine BMD

(+4.8%; $p < .05$) but decreases in total hip BMD (-6.1%; $p < .01$) from 0 to 6 months of activity-based therapy on persons with SCI. Pang and Lau (2010) examined BMD of 21 individuals with post-stroke (mean age = 64.5 years; injury = 8.3 years) who participated in a 6-month treadmill exercise program. The between-group difference in tibia cortical thickness change scores was statistically significant ($p = .02$). However, the total area BMD of the tibia showed no significant changes in either group. According to a review study that examined the body composition of AWPD, STE may be very promising for increasing muscle mass and possibly decreasing fat mass. However, further quality research is needed before conclusions can be drawn regarding its effectiveness (Hicks et al., 2011).

Self-Efficacy

The findings of the primary analysis of quantitative data within the current study revealed a significant increase in self-efficacy ($p = .01$) with a large effect size ($d = 1.12$). Also, the qualitative results strongly support improvement in self-efficacy as a benefit of participating in a STE program. The finding of improvement in self-efficacy from the current study is consistent with the findings of previous literature (Arbour-Nicitopoulos et al., 2009; Best et al., 2016; Carin-Levy et al., 2009). According to social cognitive theory (Bandura, 1977), self-efficacy is improved by mastering an activity, observing others perform a task (i.e., vicarious experience), social persuasion, and personal emotional arousal. Ashford et al. (2010) stated that an exercise program that is tailored to an individual ($d = 0.26$), provides vicarious experience ($d = 0.32$), feedback ($d = 0.44$), and goal setting ($d = 0.22$) that were associated with higher levels of self-efficacy.

A possible explanation of improvement in self-efficacy in the current study may come from the fact that the program was uniquely designed for each participant to accomplish self-set goals and provided opportunities for vicarious experience. Similar to peer-led wheelchair training (Best et al., 2016), the current program was tailored to participant-identified goals and gradually introduced to promote goal achievement. Schunk et al. (1995) found that self-set goals enhance motivation and self-regulation, and thus self-efficacy. Such an approach can produce a greater goal commitment from the participant. Also, the open environment where all participants were able to observe others with similar disabilities accomplishing a task may have positively influenced self-efficacy. Participants indicated that learning new skills, observing others accomplishing a goal, and beating self-set goals lead to an improvement in self-efficacy. More importantly, improvement in self-efficacy was transferred to different areas of life. This result was consistent with the improvement in active daily living scores in wheelchair quad-rugby players who had a higher score of self-efficacy when compared to non-physical activity group (Adnan et al., 2001).

According to Arbour-Nicitopoulos et al. (2009), participation in planned PA such as STE with an exercise action plan and coping plan can improve exercise adherence and self-efficacy in AWPD. The exercise action and coping plans allows people to anticipate and develop a plan to manage potential barriers that may interfere with exercise and increase the likelihood of participation in exercise under a threatening situation. Unlike the previous study (Arbour-Nicitopoulos et al., 2009), where action and coping plans were discussed and provided through email, the current study provided exercise action

and coping plans utilizing 15 min face-to-face meetings during the mindfulness training. Arbour-Nicitopoulos et al. (2009) indicated improvement in the facility barrier-efficacy, while participants in the current study indicated improvement in psychological the barrier-efficacy.

A majority of study participants demonstrated improvement in psychological self-efficacy wherein they were better capable of fighting back any emotional discomfort (e.g., PTSD, anxiety, anger) throughout their daily life. The participants also noted that verbal persuasion and positive feedback received from the trainer influenced initiation and adherence to exercise programs. They were able to overcome 'self-defeating behaviors' when participants felt anxiety, fear, and negativity perceived from society, or a lack of motivation. These findings are aligned with studies that utilized mindfulness training on AWPD and improvement in psychological discomfort (Grossman et al., 2010; Kearney et al., 2012). These findings suggest that action plans that are supplemented with coping strategies are effective for improving self-efficacy and sustainability in the exercise program.

AWPD may confront many challenges to participating in STE program, such as physical impairment, psychological discomfort, and environment barrier (Jaarsma et al., 2014; Richardson et al., 2017; Rimmer et al, 2004; Stephens et al., 2012), the development of barrier-coping plans may be a useful strategy to overcome obstacles and to carry out action plans. Thus, coping plans should be considered as an important component of a STE program for AWPD.

Quality of Life

The findings of the primary analysis of quantitative data revealed significant increases in three domains of QOL (PHY p = .01; PSY p = .01; SOC p = .01) with large effect sizes (d =.93; d =.82; d =1.62). Although ENV improved after the program (d = .41*; medium),* this change was not statistically significant at .05 alpha level (p = .13). The qualitative results strongly support improvement in all domains of QOL as a benefit of participating in a STE program.

First, the improvement in physical health domains of QOL may be related to the improvement of physical capacity in active daily living, physical activity, mobility, and strength. Engaging in different forms of STE (i.e., wheelchair sport, aquatics, yoga, and strength/endurance training) has shown to improve functional independence and work capacity, and decrease fatigue in AWPD (Ghafari et al., 2009; Grossman et al., 2010; Monteiro et al., 2014; Zelenka et al., 2017). The current study revealed the improvement in grip strength, which may indicate improvement in overall strength (Wind et al., 2010) may positively affect the physical domain of QOL. This result may also be supported by the qualitative results that participants were able to realize their capacity to grow stronger, complete more work, and eventually accomplish self-set goals. In turn, they felt confident in physical health, which translates into an improvement in active daily living. Hicks et al. (2011) stated that muscle strength is highly relevant with physical health domains of QOL in AWPD, as improvement in strength will have a significant impact on the ability to perform activities of daily living.

A number of studies supported positive benefits of STE on improvement in PSY

domains of QOL (Cote-Leclerc et al., 2017; Grossman et al., 2010; Holmgren et al., 2010; Kargarfard et al., 2012; Kearney et al., 2012; Skucas, 2018; Zelenka et al., 2017). The positive findings from the current study align with Skucas's (2018) results that demonstrated an increase in psychological well-being (i.e., vitality, energy, peacefulness, and happiness) among AWPD after an 8-week moderate intensity strength and endurance training program. In addition to exercise training, the current study implemented 30 min of mindfulness training, which strongly helped awareness of psychological discomfort (i.e., PTSD, anxiety, anger, and negative feelings) and managing emotional discomfort. Studies that examined psychological domains of QOL (Grossman et al., 2010; Kearney et al., 2012) suggested that mindfulness training may positively impact the mood by relaxation of nervous system, preventing PTSD, depression, and negative feelings, sense of depletion and tiredness that often-accompanied severe disabilities.

The exercise setting was individualized yet promoted group interaction that provided an opportunity for participants to socialize with others; especially for those shared with a common interest and characteristics (e.g., exercise and disability). Dean et al. (2008) proposed that participation in exercise among AWPD has the strongest correlation between SOC domains of QOL, which were aligned with the largest effect size (d = 1.61) in the current study. In contrast to current findings, Giacobbi et al. (2008) ranked social benefit as third highest-order themes followed by psychological and health benefits of STE programs in AWPD. Despite the rank, social encouragement, interaction, and being able to connect and form relationships were found as a motivational force for the initiation and adherence to exercise.

One of the subthemes of the current study, ‘sense of belonging,’ may represent a similar result. While causal links cannot be established, the majority of the participants’ feedback suggests that social benefits were derived from exchanging positive energy, sharing deeply personal stories, and supporting each other when they needed help. Based on findings from the current study, it is suggested that individuals place high importance on social standings and friendships with other participants and trainers. It seems that, during the 9 weeks of the exercise program, accomplishing and maintaining social integration is highly valued. This can be acknowledged that members of the training facility emphasized the importance of reintegration into social life as part of their ongoing program. In addition, participating in a STE program with people who have similar impairments may afford new opportunities for social integration.

There was no significant improvement in ENV domain of QOL, which aligns with a result from the systemic review study conducted by Tomasone et al. (2013) and a meta-analysis study conducted with a healthy population (Gillison et al., 2009). Both studies reported significant improvement in PHY, PSY, and SOC domains of QOL. Although the reason for this link has not been investigated, people with physical disabilities may rely heavily on their PHY, PSY, and SOC domains of QOL. Studies that examined the barriers to exercise (Rimmer et al., 2004; Stephens et al., 2012) identified that emotional and psychological barriers were major contributors for not exercising in addition to unwelcoming environments such as inaccessible built environments, unsuitable equipment, lack of professional assistance and negative perceptions and attitudes from nondisabled individuals. The qualitative result revealed that

nonjudgmental, surrounded with similar people, and welcoming were the key environmental factors for AWPD to participate in an exercise program. The findings of the study may suggest that the removal of environmental barriers such as negative social attitudes in the exercise setting and the addition of a disabled-friendly atmosphere could be one of the most effective facilitators.

Overall, and maybe most importantly, the qualitative finding from the current research uncovered a change in participants' optimistic view of life by accepting life with a physical disability and gaining a sense of control in current and future life. A positive view of the future requires a positive appraisal of the current person-environment interaction (Karademas, 2007), which were supported by the 9-week STE program. The optimism in life may be supported by Beck's (2005) study that optimism may be shaped by accumulation of personal capability (e.g., self-efficacy), being loved with social support (e.g., sense of belonging), and having positive daily emotion (e.g., stress management), which in turns predicts satisfaction with life.

Implications for Practice

The adjustment process after an injury that leads to permanent physical disability is a life-long challenge concerning not only physical but also psychological change in AWPD. Rimmer (2012) proposed a model describing the short-term gains in health and function achieved during rehabilitation, which then plateau following discharge. During this transitional period, individuals reach a point at which their health trajectory can either increase or decrease depending on the initiation of an effective exercise program. Given that community-based exercise and self-efficacy may play such a large role in the

exercise behaviors of AWPD, the current program may support Rimmer's model by appropriately serving to improve the physical and psychological health of AWPD faced during post-discharge from rehabilitation. The result of this current investigation offers community-based exercise specialists several practice recommendations.

The first implication could be related to the STE program combined with mindfulness training. Conventional community-based exercise training facilities, and/or even rehabilitation clinics may not offer mindfulness training as a part of the exercise program. Based on the results of the current study, quantitative measures and qualitative findings provided evidence for improving psychological health of AWPD. Mindfulness sessions may include goal visualization, positive self-talk, meditation, group discussion, stress management, and breathing exercise. This training would help prepare participants' mindset before the exercise and enable them to focus on the actual exercise routine. AWPD may feel anxious about the exercise or feel uncomfortable with the physical sensations of their bodies during or after exercise. The exercise specialist may teach them to use relaxation techniques such as deep breathing and positive self-talk to reduce anxiety. The post-workout mindfulness training could bring optimism to fight back unexpected stressors that AWPD might face outside of the program.

A second implication could be related to staff training and a trainer-trainee relationship. The exercise professional staff member should discuss AWPD's background information (e.g., injury, psychological trauma, physiological symptoms, accommodation, support, and social relationship status) before the beginning of the program. This discussion would help the trainer to develop an appropriate exercise

program based on current condition (i.e., physical and psychological) and ensures safety practices. The trainer has the ability to connect with and motivate trainees, which can be a large factor in exercise success, especially with AWPD who may presume low self-confidence. Building a trustworthy relationship between trainer and trainee allows a trainee to be vulnerable around the trainer and may serve as a safe spot for the trainee. This type of relationship may help the trainee to defeat vulnerability by working with a trainer side by side to achieve the same goal.

The last application could be promoting a positive exercise environment. Verbal and social persuasion (e.g., rooting, encouragement) from respected individuals (e.g., trainer, staff, other members) are key to creating a positive exercise environment. Acknowledging personal success in public may be applied. For example, the program can be stopped momentarily for an announcement across the entire environment (i.e., facility workout room) that acknowledges a trainee's personal short-term and/or long-term accomplishments. In doing so, it may provide extra motivation for other trainees.

Although the current study provides valuable information regarding acute effects of STE on physical and psychosocial health of AWPD, further study is needed to examine the long-term effects of STE in maintaining overall well-being among AWPD. A follow-up study of AWPD who completed a 9-month randomized control trial of exercise training demonstrated significant decrease in exercise adherence, QOL, and increase in pain, and stress at the 3-month follow up period (Ditor et al., 2003). Ditor et al. (2003) discussed that the controlled research setting may have influenced participants to adjust to the real-world practice. Further, absence of a goal during the follow-up period

compared to 9-month intervention may have diminished motivation to exercise (Ditor et al., 2003). In contrast, 10-week community-based exercise that was combined with health education found a maintenance of exercise, QOL, and mood in AWPD 6 months after completion of the intervention (Wise et al., 2012). A telephone follow-up was conducted every 2 weeks for an additional 6 months to promote exercise maintenance. More specifically, a general information oriented toward motivating change (e.g., self-efficacy), as well as information specific to change related to exercise (e.g., benefits on physical, psychological, and social health) were provided during the follow-up. The mechanism of maintenance of PA may be explained by perceived self-efficacy that is thought of as the foundation of motivation and action that leads to health behavior change of PA (Bandura, 2004). Self-efficacy has been proposed to predict PA and change in PA over time (Motl et al., 2009; Ng et al., 2013). A short-term wellness-program resulted in significant positive changes in self-efficacy, which were maintained up to 6 months may speculated from current study.

The validity of current STE program has important implication to meeting the needs of AWPD who may not otherwise have opportunity or access to such programs (i.e., community-based exercise program with mindfulness training). As such, implication as described could be important to help meet the short-term gains of physical and psychological health described in the Rimmer's model (2012). These short-term gains may then induce adherence in exercise and maintenance of QOL among AWPD.

Limitations

Several limitations of the current study should be considered for internal validity, generalizability, and evaluation of the results. First, participants were purposefully selected from a local community-based facility that provided a 9-week STE program. Also, the population of physical disability was heterogeneous (i.e., amputee, SCI, TBI, stroke, other conditions that debilitate physical movement) in terms of the causes, type, and time of injury. However, the heterogeneity of the population may provide meaningful evidence to community-based exercise specialists to develop an exercise program for different populations of AWPD.

Second, as part of the community-based exercise program that accepts only a small sample size (n = 15) the absence of a control group was inevitable. This lack of a control group may affect internal validity of the study. The current study used an embedded design of mixed-method that attempted to support the quantitative results by providing qualitative data to increase the internal validity of the study.

Third, participants were not refrained from participating in other types of physical activities that were provided as part of the current program (e.g., equine therapy, rock wall climbing, aquatic exercise, golf). Rather, they were encouraged to be active (e.g., engaging in physical activities and social activities) outside of the program in order to transfer the skills they have learned from the program to different areas of life. Participating in leisure and recreational exercise may have influenced changes in the dependent variables.

Fourth, outside supporters (i.e., people who had experience with the current program, family, and friends) may have influenced changes of dependent variables. The current program encouraged outside supporters to visit the site to engage in social activities, share information, build relationship, and help participants to adjust to the new environment.

Conclusion

The author feels this was a novel and pioneering approach to illustrate the effectiveness of a community-based STE program that had both components of physical and mindfulness training for AWPD. Notwithstanding the limitations, this study shows that participating in a 9-week STE program may improve health-related fitness measures such as muscular strength and body composition. AWPD can have favorable changes in FM, LBM, and BMC to some extent. Moreover, it may also positively influence self-efficacy and domains of QOL. The findings of the study revealed that the AWPD perceived the benefit of exercise as improvement in self-efficacy, having better controls in life, and the creation of a sense of belonging. Based on findings of the study, it can be suggested that the STE program for AWPD may require (a) exercise programs that are individualized and combined with mindfulness training, (b) knowledgeable trainers who understand physical and mental aspects of AWPD, and (c) exercise environment that is welcoming and non-judgmental towards AWPD. Future research should be conducted to support and generalize the meaningful findings of the present study using a larger sample size, a true experimental design, and an effective long-term program with follow-up.

Future Research

The following recommendations are suggested for future research based on the results of the present investigation:

1. Future studies should consider recruiting a larger sample size and have a control group for true-experimental research. This rigor will increase the validity of research and may provide a stronger causal relationship between independent and dependent variables.
2. Future studies should consider collecting data on multiple time periods. The current study was 9 weeks long and collected data pre- and post-intervention. Collection of quantitative data on multiple periods within 9-weeks (e.g., pre-, mid-, post-intervention, and follow- up) and qualitative data (e.g., weekly log and personal journal) will enable the researcher to compare the changes of dependent variables and may strengthen the rigors of findings.
3. Future studies should include a detailed information of participants (i.e., congenital vs. acquired, year post to injury, exercise experience previous and post to injury). These individual differences may play an important role in development of the self-concept, which in turn, affects QOL. The detailed information of participant may impose researcher to explain difference in experience of STE program among people with congenital or acquired physical disabilities.
4. Future studies should include a balanced sample of disability to examine different perspectives from different disabilities. Despite having physical disabilities, the

symptoms and unique physical attributes of the participants might differ from one disability to another.

5. Future studies should incorporate 1:1 in-depth interview, personal daily log, followed by a focus group. This may enable the researcher to capture rich data and allow the researcher to compare the data between different qualitative sources, which may strengthen the credibility and transferability of the qualitative result.
6. Future studies should incorporate a collection of different variables related to health-related fitness and psychological health. Further investigations determining the effect of a STE program on flexibility, cardiorespiratory and muscular endurance, motivation, adherence, and resilience in AWPD may be a potential area of interest.

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APPENDIX A

Adapted Physical Activity Taxonomy

Table 1

Wheelchair basketball: Fitness and quality of life (Feter et al., 2018)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Quasi-Experimental	Physical Disability N=10	To assess the physical activity level, perception of QOL, muscle strength, flexibility, and agility in WB players	WB for 6 months, twice a week, and 90 min per session.	The WB player showed agility level and psychological domain of QOL significantly higher than the average value found in the literature for other wheelchair athletes and sedentary AWPD. Although there was no significant difference in health-related fitness, WB player showed higher level of health-related fitness component compare to other wheelchair athletes and sedentary AWPD.

Note. AWPD = adults with physical disabilities; QOL = quality of life; WB = wheelchair basketball

Table 2

Quality of Life of Wheelchair Rugby Players (Zelenka, Kudlacek & Wittmannova, 2018)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Comparative Study	SCI N = 36 Experiment N = 20 Control N = 16	To show the effect of sport participation in wheelchair rugby on QOL of person with SCI.	N/A	The Wheelchair rugby players were higher in all four domains of QOL, the only significant difference was found in domain on focusing on perceived physical health.

Note. N/A = not applicable; SCI = spinal cord injury; QOL = quality of life

Table 3

Effect of strength and endurance training program on mental and physical health of spinal cord-injured persons (Skukas, 2017)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Experimental	SCI N = 12 Experiment N = 6 Control N=6	To examine the effect of eight week of strength and endurance training for the improvement of mental and physical health of spinal cord-injured person	Strength and wheelchair driving endurance training for 8 weeks, 4 sessions per week, and 120 min per session.	The experiment group showed significant improvement of mental and health state after an 8 weeks intervention. Strength and endurance exercise stimulated positive emotion and increased energy, vitality, fullness of life, feelings of quietness, peacefulness, and happiness. Experiment group showed less negative feeling, nervousness, bad mood, sadness, and gloominess. The value of mental and physical state of the control group did not change after the 8 weeks.

Note. SCI = spinal cord injury

Table 4

What is the benefit of a high-intensive exercise program on health-related quality of life and depression after stroke? A randomized controlled trial (Homgren, Gosman-Hedstrom, Lindstrom & Wester, 2010)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 1 Recommendation A	Experimental	Stroke N = 34 Experiment N = 15 Control N = 19	To evaluate the impact of a high-intensive exercise program containing high-intensive functional exercise implemented to real-life situations together with group discussions on fall and security aspects in stroke subjects with risk of falls.	Experiment group received an exercise program for 5-week, 3 session per week. A one session a week for 1 hour with educational group discussion about fall risk and security aspects. Control group received an exercise program for 5 weeks, one session per week, followed by one session of educational group discussion.	There was a significant difference in mental health domains of QOL between two groups after an intervention and at the 3-month follow-up. There was no significant difference in physical health domains of QOL and depression scores between two groups after an intervention and 3-month follow-up.

Note. QOL = quality of life

Table 5

Comparison of mobility and quality of life level in sedentary amputees and amputee soccer players (Guchan Topcu, Bayramlar, Ergun & Ercan, 2017)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Comparative Study	Amputees N = 25 Soccer Player N = 12 Sedentary N = 13	To compare the mobility and quality of life in male sedentary amputees an amputee soccer player.	N/A	The groups had no significant difference in mobility level. The soccer group had significantly better values than the sedentary group in two domains of quality of life (i.e., general psychosocial adjustments and athletic activity restriction).

Note. N/A = not applicable

Table 6

Soccer practice and functional and social performance of men with lower limb amputations (Monteiro, Pfeifer, Santos & Sousa, 2014)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Comparative Study	Amputees N = 138 Soccer Player N = 69 Non-athlete N = 69	To compare the functional and social performance of individuals with lower limb amputations between those who played soccer and those who did not engage in any sports activities.	N/A	The soccer player group showed significantly better performance than the non-athletes group in most items of body function, body structure, occupational performance components and daily activities, and also in some important items of social and environmental factors.

Note. N/A = not applicable

Table 7

Effect of Aquatic Exercise Training on Fatigue and Health-Related Quality of Life in Patients with Multiple Sclerosis (Kargarfard et al., 2012)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 1 Recommendation A	Experimental	MS N = 21 Experiment N = 10 Control N = 11	To examine the effectiveness of aquatic exercise training on fatigue and health related quality of life in women with multiple sclerosis.	The intervention consisted of 8 weeks supervised aquatic exercise in a swimming pool (3 times a week, each session lasting 60 min).	The patients in the aquatic exercise group showed significant improvement in fatigue and sub scores of HR QOL after 4 and 8 weeks compared with the control group.

Note. HRQOL = health-related quality of life; MS = multiple sclerosis

Table 8

How does playing adapted sports affect quality of life people with mobility limitations? Results from a mixed-method sequential explanatory study (Cote-Leclerc et al., 2017)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Mixed-Method Comparative study	Wheelchair user N = 34	To compare the subjective QOL of AWPD playing a wheelchair adapted sport to that of a population reporting no mobility limitations. And to explore the influence of playing an adapted sport on the QOL of AWPD.	N/A	AWPD who participated in adapted sports had a similar level of QOL comparable to the group without mobility limitation, except for poorer family-related QOL. Based on interviews, participants reported the positive effect of adapted sports on the QOL on AWPD operates through improvement in health, social participation, and positive social perception.

Note. AWPD = adults with physical disabilities; N/A = not applicable; QOL = quality of life

Table 9

Evaluation of a Modified Yoga Program for Persons with Spinal Cord Injury (Curtis et al., 2015)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Mixed-Method	SCI N = 12	To evaluate an 8-week modified yoga program for individuals with SCI, in terms of both participant experiences and with respect to program satisfaction.	The program consisted of one 45 – 60-minute class per week focusing on muscle alignment, posture, and movement awareness.	Although significant changes in health and well-being were not found on the surveys from baseline to exit, participants reported enjoying the yoga intervention, and the qualitative data indicated a number of therapeutic benefits (i.e., improvement in strength and decreased pain). The identified themes suggest that well-being improved from pre- to postintervention across several domains of functioning, including relaxation, achievement, and freedom from regular experience.

Note. SCI = spinal cord injury

Table 10

Home-Based Exercise Health-Related Quality of Life in Persons with Spinal Cording Injury: A randomized Controlled trail (Nightingale et al., 2018)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Experimental	SCI N = 21 Experiment N = 13 Control N = 8	To assess the influence of a home-based exercise intervention on indices of HRQOL in persons with spinal cord injury.	Participants assigned to the experiment group completed 4, 45-minute moderate-intensity (60 – 65% peak HR) arm-crank exercise sessions per week for 6 weeks. Participants assigned to the control group were asked to maintain their habitual physical activity.	Changes in the physical component of QOL, fatigue, and self-efficacy were significantly different between the two groups, with moderate to large effect size. Various HRQOL outcomes demonstrated to have positive influences in favor of experiment group following the 6-week exercise program. Change in self-efficacy was significantly associate with changes in physical and mental status, fatigue, and global fatigue.

Note. HRQOL = health-related quality of life; QOL = quality of life; SCI = spinal cord injury

Table 11

Pilot study of a Peer-Led Wheelchair Training Program to Improve Self-Efficacy Using a Manual Wheelchair: A Randomized Controlled Trial (Best et al., 2016)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Experimental	Manual Wheelchair User N = 28 Experiment N = 16 Control N = 12	To evaluate the effect of a peer-led wheelchair training program on self-efficacy of MWC use and to explore influences of the intervention on MWC skills, life-space mobility, and satisfaction with participation.	The experimental group received six 1.5 hours session of a peer-led self-efficacy-enhanced wheelchair training program. The control group received no intervention.	The program had a large statistically significant effect on MWC use self-efficacy in community-living adult MWC users that in a control group. It also had a significant effect on MWC skill capacity and performance. There was no significant difference in life-space mobility or satisfaction with participation scores between the groups.

Note. MWC = manual wheelchair

Table 12

myMove Program: Feasibility and Acceptability Study of a Remotely Delivered Self-Management Program for Increasing Physical Activity Among Adults with Acquired Brain Injury Living in the Community (Jones et al., 2016)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Quasi-Experimental	ABI N = 24	To evaluate the acceptability and feasibility of a remotely delivered self-management program aimed at increase physical activity among adults who dwell in the community and have ABI.	The myMoves Program comprises 6 modules delivered over 8 weeks via email. Participants were provided with regular weekly contact with physical therapist via email and telephone.	Acceptability was very high, with more than 95% of participants being very satisfied with the program. Secondary outcome revealed no significant changes in physical activity level and self-efficacy pre- to postintervention. The psychological distress reduced significantly immediately after the program.

Note. ABI = acquired brain injury

Table 13

The Psychosocial Effects of Exercise and Relaxation Classes for Persons Surviving a Stroke (Carin-Levy et al., 2009)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 2 Recommendation A	Qualitative	Stroke N = 14 Exercise N = 6 Relaxation N = 8	To explore unexpected findings emergent from a randomized controlled trial of exercise versus relaxation post-stroke.	N/A	The classes motivated participants to take part in other purposeful activities, to continue to practice what they had learned, and/or to attend another class in the community. Class participation also led to an improvement of QOL, specifically, improved self-efficacy, physical ability, psychosocial functioning, and sense of empowerment.

Note. N/A = not applicable; QOL = quality of life

Table 14

Planning, Leisure-Time Physical Activity, and Coping Self-Efficacy in Persons With Spinal Cord Injury: A randomized Controlled Trial (Arbour-Nicitopoulos, Ginis & Latimer, 2009)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 3 Recommendation A	Experimental	SCI N = 44 APO N = 22 ACP N = 22	To examine the effect of ACP on LPTA and coping self-efficacy in exercise initiates living with SCI	Participants in APO condition formed action plan for LTPA at week 1 and 5 and self-monitored their LTPA. Those in the ACP condition formed coping plans for managing self-identified activity barriers, in addition to forming action plans and self-monitoring.	In the ACP condition reported significantly greater LTPA, scheduling, and general barriers self-efficacy at weeks 5 and 10, in comparison with those in the APO condition. Scheduling self-efficacy mediated the effect of intervention on LTPA, accounting for 38% of the total effect of the intervention on week 5 LTPA.

Note. ACP = action-coping planning; APO = action planning only; LTPA = leisure-time physical activity; SCI = spinal cord injury

Table 15

Relationship Between Activities, Participation, Personal Factor, Mental Health, and Life satisfaction in Persons with Spinal Cord Injury (van Leeuwen et al., 2012)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 2 Recommendation A	Correlational	SCI N = 143	To clarify relationship between activities, participation, mental health, and life satisfaction in persons with SCI and specify how personal factor interact with each other.	N/A	Structural equation modeling showed that functional status and self-efficacy were related to participation and explained 49% of the variance in participation. Self-efficacy, helplessness, and acceptance were related to mental health and explained 35% of the variance in mental health. Participation, appraisals, and mental health were related to QOL and together explained 50% of the total variance in life satisfaction.

Note. N/A = not applicable; QOL = quality of life; SCI = spinal cord injury

Table 16

An exploratory study examining the relationship between the personal, environmental and activity participation variables and quality of life among young adults with disabilities (Yeung & Towers, 2013)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 2 Recommendation A	Correlational	Young adults with disabilities N = 119	To explore the relationship between ICF components, participation factors and QOL among young adults with disabilities.	N/A	The statistical modelling has shown that financial behavior and self-efficacy were significant predictors of overall satisfaction in participation. Satisfaction with participation was a significant predictor of QOL accounting for 31% the variation in QOL scores.

Note. ICF = international classification of functioning, disability and health; N/A = not applicable; QOL = quality of life

Table 17

Physical Activity, Self-efficacy, and Quality of Life in Multiple Sclerosis (Motl & Snook, 2008)

Strength Level & Recommendation Level	Research Method	Population	Purpose	Intervention	Summary of Result
Level 1 Recommendation A	Correlational	MS N = 133	To explore the relationship between physical activity, QOL, and self-efficacy among MS.	N/A	The path analysis indicated that those with MS who were more physically active had greater self-efficacy for function and control, and self-efficacy for function and control were associated with greater physical and psychological components of QOL.

Note. MS = multiple sclerosis; QOL = quality of life

APPENDIX B

Institutional Review Board Approval Letter - Texas Woman's University

IRB #: IRB-FY2019-429
Title: The Effect of a 9-Week Structured-Exercise Program on Health-Related Fitness, Self-Efficacy, and Quality of Life for Adults with Physical Disabilities
Creation Date: 8-29-2019
End Date: 9-17-2020
Status: Approved
Principal Investigator: Juntack Oh
Review Board: TWU IRB - Denton
Sponsor:

Study History

Submission Type Initial	**Review Type** Expedited	**Decision** Approved

Key Study Contacts

Member Ronald Davis	**Role** Co-Principal Investigator	**Contact** rdavis4@twu.edu
Member Juntack Oh	**Role** Principal Investigator	**Contact** joh4@twu.edu
Member Juntack Oh	**Role** Primary Contact	**Contact** joh4@twu.edu

APPENDIX C

A Recruitment Flier for Study

Research Study

The effect of a 9 week structured exercise program on
muscular strength, self-effcicay, and quality of life for adult with physical disailities

This research will only assess and collect your muscular strength, self-efficacy, and quality of life data as part of the Adaptive Training Foundation (ATF) program. The study will not intervene with your ATF's exercise program.

You may be eligible to participate if you:

1. **Are an adult age between 18 to 55**
2. **Are able to hold hand held dynamometer**
3. **Have physical impairment (e.g., spinal cord injury, stroke, traumatic brain injury, amputee, multiple sclerosis)**
4. **Do not engage in other form of physical exercise more than three times a week**

If you are eligible, you will be required to complete:

- Muscular Strength — Hand Grip
- Body Composition — DXA

- Self-efficacy survey: 17 questions
- Quality of life survey: 26 questions
- 90 min of group interview with your class at the end of the program
- 5 open-ended questions 6 weeks after completion of the program via E-mail

Your involvement in this study is completely voluntary and you may withdraw from the study at any time. You will receive free report on result of the 9 week of exerciser training.

There is a potential risk of loss of confidentiality in all email, downloading, electronic meetings, and internet transactions.

Juntack Oh, M.S., Texas Woman's University

APPENDIX D

Consent Form for Participants

TEXAS WOMAN'S UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH

Title: The effect of a 9-week structured exercise program on health-related fitness, self-efficacy, and quality of life for adults with physical disabilities

Investigator: Juntack Oh, MS.....940- @twu.edu
Advisor: Ronald Davis, Ph.D.....940- l@twu.edu

Explanation and Purpose of the Research

You are being asked to participate in a research study conducted by Mr. Oh, a doctoral student at Texas Woman's University (TWU), as part of his dissertation. The purpose of this research is to determine the effects of a 9-week structured exercise program on health-related fitness, self-efficacy, and quality of life (QOL) for adults with physical disabilities. You have been asked to participate in this study because you are an adult (over 18 years) and have physical disabilities.

This study will be conducted as part of a 9-week exercise program from Adaptive Training Foundation (ATF). The researcher will only partake in the collection of data from the result of your exercise program. As a participant, you will be asked to complete a) handgrip strength test, b) dual-energy X-ray absorptiometry (DXA) and c) self-efficacy and QOL survey. This data collection will occur before and after the 9 weeks of the ATF program. Also, you will be invited to participate in a focus group interview with other participants at the end of the 9-week program. Lastly, you will receive an e-mail that has 5 questions regarding your experience at ATF 6 weeks after completion of the program. The total time commitment for this study will be about two hours and 30 minutes. The risks of this study include fatigue during the assessment, emotional discomfort during the survey and interview. The additional risk may include loss of confidentiality and anonymity.

Your participation in this study is completely voluntary. If you are interested in learning more about this study, please review this consent form carefully and take your time deciding whether or not you want to participate. Please feel free to ask the researcher any questions you have about the study at any time. You have the right to ask questions and will have an opportunity to ask any questions during the program orientation meeting at ATF, anytime during the program, and after the study has ended. You are allowed to ask questions through direct conversation, e-mail, and/ or the phone.

Description of Procedure

As a part of the ATF program, the researcher will only partake in the collection of data will not intervene during your exercise program. You will have two assessment sessions (i.e., pre and post) which will last approximately 25 min for each session. The group interview (post) will last approximately 90 min. Following the group interview, 5 additional questions regarding your overall experience at ATF will be required, taking approximately 20 min.

1) Handgrip strength: You will be asked to sit on a chair or stand while holding the handgrip device. To properly hold the device, you will be asked to place the device with arm fully extended at a 45-degree angle. From that position, you will be asked to squeeze the handle while maintaining the arm position for 3 seconds each two trials per hand.

2) Body composition: You will be asked to remove shoes and anything metal and instructed to lie supine with hands at your side and pronated on the DXA table for 8-10 min. All body composition measures will be taken using the DXA and performed at a local health clinic by a trained clinician. Results will be recorded, returned to ATF and made available to the researcher.

Approved by the
Texas Woman's University
Institutional Review Board
Approved: September 18, 2019

3) Self-Efficacy survey: You will be asked to respond to 17 questions that are related to your self-efficacy. You must circle the answer using the scale 0 (not at all) to 4 (completely) for each question. Assistance will be provided to help clarify any concerns about the information requested.

4) Quality of Life survey: You will be responding to 26 questions that are related to your quality of life. You will circle the answer using the scale 0 (dissatisfied) to 4 (satisfied). Assistance will be provided to help clarify any concerns about the information requested.

5) Group interview: You will be asked to spend 90 min in a face-to-face group interview with the researcher and other participants. You will be provided pseudonym so that your response is not identified. The researcher will ask you questions about your 9-week experience (e.g., benefits, barriers, motivation) from the ATF program. The interview will be audio-recorded and kept in a secure location (i.e., TWU Adapted Physical Activity Lab, PH 119) where only the researcher will have access. Additional security measures will include written memos recorded by PI and properly stored to be used if needed to clarify your responses.

6) Open-ended questions (6 weeks follow up): You will receive an email that contains five questions regarding your 9-week experience from the ATF program. You will be asked to use your pseudonym and completely answer the five open-ended questions on the Google Doc. Only the researcher and you will have access to questions and responses.

Potential Risks

There is a possible risk of coercion. Your participation is voluntary, and you may withdraw from the study at any time at your discretion and remain in the ATF program, but not in the research study.

Possible risk of fatigue may occur during the handgrip strength assessment. To minimize the risk, the researcher will provide instructions on procedures of the task before asking you to perform. The researcher will ask you to perform the task at your own pace. Enough break time will be provided to minimize the potential fatigue between the two trials for each hand.

Emotional discomfort or frustration may occur while answering the survey and during the focus group interview. To minimize the risk, you will be placed in a quiet, private, and safe environment (i.e., ATF seminar room). The researcher will provide enough time to complete both survey and interview questions, and allow to take a break if needed.

Another possible risk in this study is a loss of confidentiality. Confidentiality will be protected to the extent that is allowed by law. Your name and assessment data will be coded using a 3-digit number and stored in a locked cabinet where only the researcher and the mentor will have access. The researcher will not reveal or share your personal data with other participants. All the recorded data will be stored in a locked file cabinet. Only the PI will have the access to the identifiable data. Consent form will be kept for three years from date of signed consent form. All the identifiable data written in a document will be destroyed by shredding machine, and electronic files will be deleted within a year after the study is finished. The results of the study will be reported in scientific magazines or journals but your name or any other identifying information will not be included.

The researchers will remove all of your personal or identifiable information (e.g. your name, date of birth, contact information) from the audio recordings and/or any study information. After all identifiable information is removed, your audio recordings and/or any personal information collected for this study may be used for future research or be given to another researcher for future research without additional informed consent.

Approved by the
Texas Woman's University
Institutional Review Board
Approved: September 18, 2019

If you would like to participate in the current study but not allow your de-identified data to be used for future research, please initial here_____.

Loss of anonymity will be a possible risk in this study. To reduce the loss of anonymity, you will be addressed using a pseudonym (e.g., Bugs Bunny, Mickey Mantle, Tiger Woods), and not your name for the focus group interview. Although pseudonyms will be used, you will be informed that due to the nature of the study, anonymity cannot be guaranteed since you will already know each other since you are a clients of the ATF.

The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

Participation and Benefits

Your involvement in this study is completely voluntary and you may withdraw from the study at any time. If you would like to know the results of this study we will mail them to you.*

Questions Regarding the Study

You will be given a copy of this signed and dated consent form to keep. If you have any questions about the research study you should ask the researchers; their contact information is at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the Texas Woman's University Office of Research and Sponsored Programs at 940-898-3378 or via e-mail at IRB@twu.edu.

_____ _____
Signature of Participant Date

*If you would like to know the results of this study tell us where you want them to be sent:

Email:_____or Address:_____

Approved by the
Texas Woman's University
Institutional Review Board
Approved: September 18, 2019

APPENDIX E

Research Permission Letter

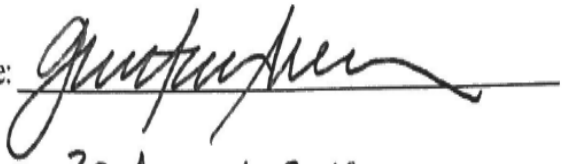
Adaptive Training Foundation Authorization Letter for Mr. Oh

Dear Juntack Oh,

I have reviewed your request regarding your study and am pleased to support your dissertation research entitled "The effect of a 9-week structured-exercise program on health-related fitness, self-efficacy, and quality of life for adult individuals with physical disabilities". Your request to use "Adaptive Training Foundation (ATF)" as a research site is granted. The research will include assessing and collecting data from a subjects who will be participating 9-weeks ATF program. This authorization covers the time period of 9/23/19 to 1/31/20. We look forward to working with you.

Sincerely,

Printed Name & Position: Gina Tacconi-Moore, Director of ReCalibrate

Signature: 

Date: 30 August 2019

APPENDIX F

Handgrip Strength Data Recording Sheet

Jun Oh – Handgrip Strength Data Recording Sheet

Handgrip Strength							
Participant Code	Pre			Post			Note
	Right	Left	Avg	Right	Left	Avg	

APPENDIX G

Sample Result of the DXA scan

PRIVATE HEALTH FITNESS

ADAPTIVE TRAINING FOUNDATION

Private Health Fitness
6119 Berkshire Lane
Dallas, TX 75225

Patient:		**Referring Physician:**	
Birth Date:	**Age:**	**Patient ID:**	(not specified)
Height:	**Weight:**	**Measured:**	11/20/2019 1:22:00 PM (17 [SP 4])
Sex:	**Ethnicity:**	**Analyzed:**	11/20/2019 1:22:02 PM (17 [SP 4])

Total Body Tissue Quantitation

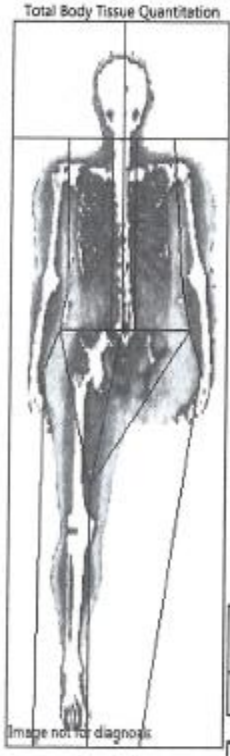


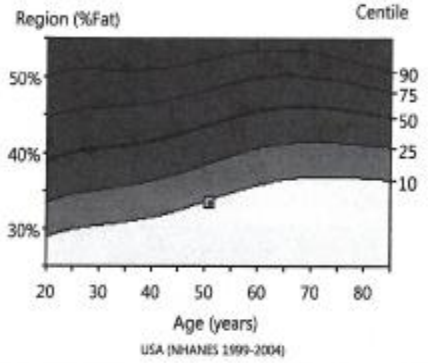
Image not for diagnosis

Color Coding

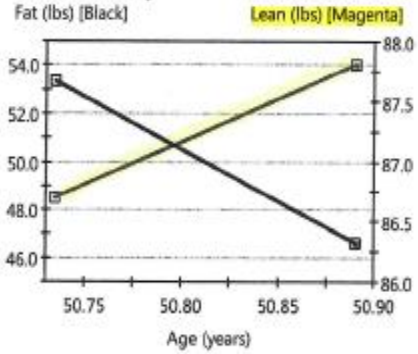
Composition (Enhanced Analysis)

Region	Region (%Fat)	Centile	Total Mass (lbs)	Fat (lbs)	Lean (lbs)	BMC (lbs)
Arms	29.8	-	19.3	5.7	12.7	0.8
Legs	43.3	-	28.1	12.1	15.0	0.9
Trunk	33.0	-	81.4	26.8	52.8	1.7
Android	37.0	-	11.8	4.4	7.3	0.1
Gynoid	39.2	-	19.0	7.4	11.2	0.3
Total	33.5	9	139.3	46.6	87.8	4.9

Total Body: Total



Composition Trend: Total



USA (NHANES 1999-2004) Trend: Total (Enhanced Analysis)

Measured Date	Age (years)	Region (%Fat)	Centile	Total Mass (lbs)	Tissue (lbs)	Fat (lbs)	Lean (lbs)	BMC (lbs)	Fat Free (lbs)
11/20/2019	50.8	33.5	9	139.3	134.4	46.6	87.8	4.9	92.7
09/24/2019	50.7	36.9	19	144.8	140.0	53.3	86.7	4.7	91.4

USA (NHANES 1999-2004) Trend: Fat Distribution (Enhanced Analysis)

Measured Date	Age (years)	Android (%Fat)	Gynoid (%Fat)	A/G Ratio	Total (%Fat)
11/20/2019	50.8	37.5	39.8	0.94	34.7
09/24/2019	50.7	40.0	43.3	0.92	38.1

RESTING METABOLIC RATE (RMR)

Resting Metabolic Rate (RMR) is synonymous with Resting Energy Expenditure (REE) and is an estimate of how many calories you would burn if you were to do nothing but rest. It represents the minimum amount of energy needed to maintain body temperature, heartbeat, and respiratory rate.

RMR:	1,241 cal/day

RMR (Resting Metabolic Rate) based on Mifflin-St Jeor equation.
RMR = 19.7 x FFM(fat free mass) + 413
Mifflin MD, St Jeor ST, Hill LA, Scott BJ, Daugherty SA, Koh YO. A new predictive equation for resting energy expenditure in healthy individuals. Am J Clin Nutr. 1990 Feb;51(2):241-7. PMID: 2305711

APPENDIX H

University of Washington Self-Efficacy Scale (UW-SES)

UW Self-Efficacy Scale for People with Disabilities and Chronic Conditions

How confident are you that:	Not at all	A little	Quite a bit	A lot	Completely
1. You can keep the fatigue caused by your health condition or disability from interfering with the things you want to do?	☐	☐	☐	☐	☐
2. You can keep the physical discomfort related to your health condition or disability from interfering with the things you want to do?	☐	☐	☐	☐	☐
3. You can keep the pain related to your health condition or disability from interfering with the things you want to do?	☐	☐	☐	☐	☐
4. You can keep the emotional distress caused by your health condition or disability from interfering with the things you want to do?	☐	☐	☐	☐	☐
5. You can keep any other symptoms or health problems you have from interfering with the things you want to do?	☐	☐	☐	☐	☐
6. You can do things other than just taking medication to reduce how much your health condition or disability affects your everyday life?	☐	☐	☐	☐	☐
7. You can keep your health condition or disability from interfering with managing your affairs?	☐	☐	☐	☐	☐
8. You can keep your health condition or disability from interfering with family relationships?	☐	☐	☐	☐	☐
9. You can keep your health condition or disability from interfering with close friendships?	☐	☐	☐	☐	☐
10. You can keep your health condition or disability from interfering with your ability to deal with unexpected events?	☐	☐	☐	☐	☐
11. You can keep your health condition or disability from interfering with your ability to interact socially?	☐	☐	☐	☐	☐
12. You can keep your health condition or disability from being the center of your life?	☐	☐	☐	☐	☐
13. You can keep your health condition or disability from interfering with having a fulfilling life?	☐	☐	☐	☐	☐
14. You can, using all the resources available to you, minimize the occurrence of complications related to your health condition or disability (such as bladder accidents or falls)?	☐	☐	☐	☐	☐
15. You can bounce back from frustration, discouragement or disappointment that your health condition or disability may cause you?	☐	☐	☐	☐	☐
16. You can, using all the resources available to you, successfully manage your medication needs?	☐	☐	☐	☐	☐
17. You can figure out effective solutions to issues that come up related to your health condition or disability?	☐	☐	☐	☐	☐

APPENDIX I

The World Health Organization Quality of Life (WHOQOL) –BREF

WHOQOL-BREF

The following questions ask how you feel about your quality of life, health, or other areas of your life. I will read out each question to you, along with the response options. **Please choose the answer that appears most appropriate.** If you are unsure about which response to give to a question, the first response you think of is often the best one.

Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life **in the last four weeks.**

		Very poor	Poor	Neither poor nor good	Good	Very good
1.	How would you rate your quality of life?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
2.	How satisfied are you with your health?	1	2	3	4	5

The following questions ask about **how much** you have experienced certain things in the last four weeks.

		Not at all	A little	A moderate amount	Very much	An extreme amount
3.	To what extent do you feel that physical pain prevents you from doing what you need to do?	5	4	3	2	1
4.	How much do you need any medical treatment to function in your daily life?	5	4	3	2	1
5.	How much do you enjoy life?	1	2	3	4	5
6.	To what extent do you feel your life to be meaningful?	1	2	3	4	5

		Not at all	A little	A moderate amount	Very much	Extremely
7.	How well are you able to concentrate?	1	2	3	4	5
8.	How safe do you feel in your daily life?	1	2	3	4	5
9.	How healthy is your physical environment?	1	2	3	4	5

The following questions ask about how completely you experience or were able to do certain things in the last four weeks.

		Not at all	A little	Moderately	Mostly	Completely
10.	Do you have enough energy for everyday life?	1	2	3	4	5
11.	Are you able to accept your bodily appearance?	1	2	3	4	5
12.	Have you enough money to meet your needs?	1	2	3	4	5
13.	How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
14.	To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

		Very poor	Poor	Neither poor nor good	Good	Very good
15.	How well are you able to get around?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
16.	How satisfied are you with your sleep?	1	2	3	4	5
17.	How satisfied are you with your ability to perform your daily living activities?	1	2	3	4	5
18.	How satisfied are you with your capacity for work?	1	2	3	4	5
19.	How satisfied are you with yourself?	1	2	3	4	5

20.	How satisfied are you with your personal relationships?	1	2	3	4	5
21.	How satisfied are you with your sex life?	1	2	3	4	5
22.	How satisfied are you with the support you get from your friends?	1	2	3	4	5
23.	How satisfied are you with the conditions of your living place?	1	2	3	4	5
24.	How satisfied are you with your access to health services?	1	2	3	4	5
25.	How satisfied are you with your transport?	1	2	3	4	5

The following question refers to how often you have felt or experienced certain things in the last four weeks.

		Never	Seldom	Quite often	Very often	Always
26.	How often do you have negative feelings such as blue mood, despair, anxiety, depression?	5	4	3	2	1

Do you have any comments about the assessment?

_____

_____