A pilot study on high intensity functional training in an adaptive population

by

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Abstract

Introduction: There are currently more than 56 million adults in the U.S. living with a disability that may affect activities of daily living and quality of life (QoL). Disabilities and chronic conditions may place impairments that limit participation in physical activity due to needing adaptations in order to be physically active. Physical activity is helpful in the prevention of secondary health conditions for those with an adaptive need. This pilot study investigated the effectiveness of adaptive high intensity function training (HIFT) for improving self-reported activity limitations and participation restrictions, QoL, sport/exercise beliefs, physical activity self-efficacy and enjoyment, and measured basic human movements (BHM). **Methods**: A two site pilot study was conducted using a single condition pre-test posttest design to provide an 8-week adaptive HIFT intervention to those with an adaptive need (e.g., cane, wheelchair). Eight participants (62.5% male, 37.5% White, 37.5% Black, 25% Hispanic/Latino, 100% with some college education or more) completed 2-3, 60-minute exercise sessions per week of high intensity, low volume workouts with trainers certified in adaptive HIFT. Participants completed online surveys including the World Health Organization QoL-BREF, the outpatient physical therapy improvement in movement assessment log (OPTIMAL), sport and exercise ability, and physical activity self-efficacy and enjoyment. BHM including the squat, lunge, rotation, push-up, brace, and hinge were directly measured via photographs. **Results**: While all 8 participants completed the exercise intervention, only 2 participants completed pre-test and post-test surveys, and 7 completed the BHM assessments at pre- and posttest. Participants reported baseline physical activity limitations involving walking and moving, coordination, balance, and agility. All other measures were within normal ranges or relatively high at baseline. Squatting was the lowest rated BHM at baseline. Descriptive analysis for the two participants showed small-to-

large percent changes in self-reported measures, with the largest improvements in Subject 1's sport/exercise ability ratings. Despite a lack of statistical significant differences, changes in BHM scores had medium effect sizes for the squat (d = 0.637), brace (d = 0.624) and lunge (d = 0.501). **Conclusion**: Adaptive HIFT may be beneficial to those with adaptive needs due to the ability to scale and modify movements to allow for inclusion of those with a disability or chronic conditions that require activity adaptations. Future research should study the effects of an adaptive HIFT program in a fully-powered randomized controlled trial with a larger group of adaptive athletes.

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Chapter 1 - **Introduction**

There are currently more than 56 million adults in the U.S. living with a disability that may affect activities of daily living (ADL) and quality of life (QoL) (Okoro, Hollis, Cyrus, & Griffin-Blake, 2018). The top three functional disabilities consist of mobility, cognition, and independent living difficulties that affect the ability to traverse the environment and maintain independence (Okoro et al., 2018). Individuals with decreased mobility tend to have lower QoL that may impact their health. Individuals with a disability are at a greater risk of acquiring a secondary health condition, such as various heart diseases, type 2 diabetes, and some cancers, as compared to able bodied individuals (Strine, Hootman, Chapman, Okoro, & Balluz, 2005; Washburn, Zhu, McAuley, Frogley, & Figoni, 2002). Physical activity is a common method to decrease the likelihood of developing a secondary health condition and assist with the rehabilitation of acquired disabilities (Rimmer & Lai, 2017).

Physical Activity

The U.S. Department of Health and Human Services (HHS) recommends that adults with chronic conditions and/or disabilities perform at least 150 minutes to 300 minutes a week of moderate-intensity, or 75 to 150 minutes a week of vigorous-intensity aerobic physical activity (U.S. Department of Health and Human Services., 2018). The 2018 physical activity guidelines also recommend that individuals perform muscle-strengthening activities on two or more days of the week. Individuals with a chronic condition and/or disability may not always be able to meet the physical activity guidelines and are recommended to perform as much physical activity as their abilities allow. The vagueness of the 2018 physical activity guidelines may create barriers that hinder the ability to be physically active such as lack of knowledge and access to professional physical activity trainers with the education necessary to train those with a disability

(Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004; Tweedy et al., 2017). Physical activity is commonly used during rehabilitation to assist an individual to transition from a rehabilitation patient to a physical activity participant (Rimmer & Lai, 2017).

Rehabilitation

The goal of rehabilitation is to promote physical function so that an individual may be independent, socially active, able to interact with the environment, and improve psychological health (World Health Organization, 2011). Rehabilitation commonly takes place with a physical or occupational therapist where a program is developed and completed until the therapist feels confident that the patient has met a specific standard to participate in activities outside of the clinic. Rehabilitation can sometimes take place in a fitness center that is designed to be inclusive for those with adaptive needs and/or with a fitness professional with the proper professional knowledge (Buffart, Westendorp, Van Den Berg-Emons, Stam, & Roebroeck, 2009). It is important for rehabilitation programs to be inclusive by removing barriers associated with physical activity and to provide an environment that individuals may enjoy in order to begin and sustain physical activity participation such as through adaptive sports programs (Lastuka & Cottingham, 2016).

Adaptive Sport

Adaptive sports, such as Paralympic sports found in the Olympics, have altered rules, gear, and competition levels for the purpose of inclusivity. They allow for participation in a fair manner while enabling individuals choose whether their participation be competitive or leisure (Blauwet & Willick, 2012b). Some individuals may want to only participate in a sport for the purposes of enjoyment and to maintain health, but may still face barriers such as needing access

to specialized equipment, other sport participants to train with, and personal factors (Hwang et al., 2016). Adaptive sports are used in an out-patient setting as a form of continuing rehabilitation either for leisure activity, pleasure, or competition with resources to limit barriers such as those described previously (Wilson & Clayton, 2010; Yazicioglu, Yavuz, Goktepe, & Tan, 2012). An individual may benefit from adaptive sports through increased self-esteem and self-efficacy, gaining new movement patterns, and improving QoL (Blauwet & Willick, 2012a). Participation in an adaptive sport allows physical activity in an enjoyable sport with participation barriers minimized (Lape et al., 2018). Adaptive sports may use a classification system to make a fair environment during competitions or scored games similar to Paralympic sports by using systems similar to those developed by the International Classification of Functioning, Disability and Health (Tweedy, Beckman, & Connick, 2014).

International Classification of Functioning, Disability and Health (ICF)

The International Classification of Functioning, Disability and Health (ICF) is a common classification system utilized in the Paralympics and adaptive sports for those with a disability and/or physical impairment (Rimmer, 2006). In order to address health concerns, such as physical inactivity, for individuals with chronic health conditions and disabilities various programs and movement have been developed and applied to address health. The World Health Organization (WHO) developed the ICF with the following goals: to prove an understanding of health changes and functioning, establish a common language to describe various health-related states, to promote communication across specialties, allow for the comparison of data across counties, and provide a code scheme for health information systems (Ustun, 2007). The ICF is used in many areas such as physical therapy clinics (sRimmer, 2006).

In order for the ICF to provide an understanding of health, changes and functioning are classified into various health and health-related domains and the following definitions are used:

Body Functions are physiological functions.

Body Structures are anatomical parts.

Impairments are problems in body function of structure.

Activity is the execution of a task or action.

Participation is a person's involvement in a life situation.

Activity Limitations are difficulties executing activities.

Participation Restrictions are problems experienced in life situations

Environmental Factors are the physical, social, environmental attitudes within which people live and conduct their lives.

Components of the ICF are grouped into two parts. Part 1 consists of **functioning and disability** which includes body functions, body structures, activity, and participation. Part 2 consists of **contextual factors** which include environment and personal factors (World Health Organization, 2001). The ICF model can be used identify functional problems, which can be used to identify activity limitations and participation restrictions. It is important to identify activity limitation and participation restrictions as they may play a vital role during the planning phase of rehabilitation or help shape intervention goals. The ICF can also provide a description for the severity of problems each person may face. The ICF components interact to express how individuals' current health condition may impact their capacity and performance.

Capacity, referred to as activity limitation later in this paper, is used to describe one's activity and participation levels without assistance in standardized environments such as at the doctor's office (World Health Organization, 2001). Capacity falls within the realm of the ICF's Activities

and Participation domain. It is important to focus upon each individual's capacity, what they can do, and not upon their limitations or restrictions. This allows for the mindset of proving all individuals full access to programs and resources.

Performance, referred to as participation restrictions later in the paper, describes what each individual can do in their usual environment, such as social events or at home. Participation falls within the realm of participation of ICF's Activities and Participation domain. Capacity and performance differences are compared to each other to identify changes that can be made to the situation to improve performance such as assistive devices.

An example using ICF may be an individual that presents with a spinal cord injury. The injury affects body function and structures through weakened lower limbs. Activities, or capacity, are impacted as the individual has difficulty walking. Participation or performance limitations would present as the individual not engaging in social activities or work. Environmental factors may present as inaccessibility to public transportation and building accessibility barriers. Contextual factors would describe the person's age, ethnicity, marriage status, education, and similar demographic characteristics. A physical therapist would use all of this information to create a baseline, set goals, perform rehabilitation, and test the individual's capacity at the end of services. An issue is presented when an individual has finished physical therapy but is in need of continued services to maintain a healthy state physically and mentally (Rimmer & Lai, 2017). A physical activity specialist can help fill the gap of continued out-patient rehabilitation.

The American College of Sports Medicine (ACSM) and the National Center on Health, Physical Activity, and Disability (NCHPAD) both believe physical activity professionals can use the ICF to create and organize individualized physical activity programs for those with chronic

conditions and disabilities (Wing, 2013)s. The physical activity professional uses information from the ICF model to develop and conduct physical training with the use of the Outpatient Physical Therapy improvement in Movement Assessment Log (OPTIMAL) to activity limitations and participation restrictions found in activities of daily living (Khan, Amatya, & Ng, 2010).

Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL)

A common way to identify capacity and participation levels is with the American Physical Therapy Association's (APTA) Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL) data collection instrument (Guccionne et al., 2005). The OPTIMAL can be used by many professionals such as clinical researchers, physical therapist, and physical activity professionals. Capacity is measured by assessing difficulty for specific tasks, while performance is measured by assessing self-confidence for the same tasks. The OPTIMAL works well with the ICF as difficulty closely relates to capacity (APTA, 2012b). It allows for a physical therapy clinician to set a baseline value at the beginning of physical therapy/rehabilitation treatments, identify key limiters, determine primary goals of the patient, and assess changes as treatment progresses or concludes, with an overall goal of improving the patient's QoL.

Quality of Life (QoL)

An individual's QoL is related to his or her perceptions of satisfaction within valued domains of life. Satisfaction within domains can be summed together and provide an overall satisfaction within one's life (Testa & Nackley, 1994). Satisfaction with life is a target outcome within public health and related organizations. It is a goal of the WHO to increase the QoL for all, but specific tactics are needed and used to target certain populations (World Health

Organization, 2012). The use of a QoL measure has a broad reach where a medical practitioner may find useful information when measuring changes in an individual's QoL during a treatment plan. A QoL measure also allows a researcher to view the impacts associated with a change in an individual's life in various domains. In regard to individuals with an adaptive need, QoL has been shown to be lower for amputees compared to the general population due to barriers such as the use of an assistive device/prosthesis and pain (Sinha, Van Den Heuvel, & Arokiasamy, 2011). Zidarov and associates (2009) found that an individual's QoL and satisfaction were strongly related to lower-limb pain and psychological factors such as body image. Physical activity has improved an individual's functional capacity and perceived health and life satisfaction (Bragaru et al., 2013; Devinuwara, Dworak-Kula, & O'connor, 2018). The inclusiveness of adaptive sports to allow an individual with a disability to be physically active via preferred types of physical activity may increase QoL (Yazicioglu et al., 2012). Adaptive physical activity programs are expanding and need to be studied to assist with the development of future programs and to ensure safe and enjoyable activities for the adaptive population. A factor that may be beneficial is to review an adaptive population's view on physical activity preference towards moderate and vigorous intensity physical activity programs regarding their self-efficacy and enjoyment towards the program.

Physical Activity Preferences

Physical activity intensity level preference includes task self-efficacy and enjoyment (Kendzierski & DeCarlo, 1991). Individuals with adaptive needs have specific preferences, regardless of adaptive need, suggesting that those with an adaptive need should have access to be as physically active as possible and receive health benefits from activity. (Murrock, Bekhet, & Zauszniewski, 2016; Sahlin & Lexell, 2015). Understanding enjoyment for adaptive populations

may be useful for program development and review to ensure that individuals enjoy the activities they are participating in and hopefully continue staying active throughout the life course (Sallis, 1988). Some individuals prefer physical activities that are at a moderate level, while others prefer those that are at a vigorous, or even high, intensity level (Ekkekakis, Hall, & Petruzzello, 2016). Physical activity participants have preferences for intensity level enjoyment that may best suite those with adaptive needs if they prefer vigorous intensity physical activity (Heinrich, Patel, O'Neal, & Heinrich, 2014). Self-efficacy in specific tasks can be used as a measure to identify the perceived successful completion or enjoyment of task completion (Bandura, 1977). Physical activity preference may be able to assist with the development of a physical activity program, or a deciding factor when choosing a new physical activity program, and needs to be further studied in the adaptive population.

Basic Human Movements (BHM)

Basic human movements (BHM) allow a person to interact with their environment through the squat, hinge, push, pull, rotation, brace, and lunge (K. Giles, 2006; Tompsett, Burkett, & Mckean, 2014, 2015). The BHM also distinct from fundamental sport movements, such as skipping, jumping, and throwing, which are usually involved in the participation of sport activities. The reason for separating BHM from fundamental sport movements is that not all individuals need to focus upon jumping, planting, and throwing sports if they have different activity goals. Basic human movements may be a method to measure functional movement capacity and movement competency for physical literacy. Children and adolescents comprise most of the current studied population for basic human movements and fundamental sports movements. Adults populations and those with an adaptive need are lacking in current studies and may provide novel information for identifying movement inefficiencies and deficits and to

review if physical activities are beneficial by observing movement skill increases through education and experience (Davis & Burton, 1991).

Physical Literacy

An individual who is physically literate is competent, confident, and motivated to be physically active throughout their life-course (Whitehead, 2008). Physical literacy is similar to the same standards society places on the importance of being able to read, write, and perform basic arithmetic. Individuals must gain competence in the physical domain to overcome barriers related to their chronic condition/disability (Chen, 2015). Competence is defined as the ability to develop movement skills and patterns that can be used at various intensities and durations (Mandigo, Francis, & Lodewyk, 2007; Whitehead, 2008). Just as people develop an increased verbal vocabulary to express meaning, physical competence requires the development of a movement vocabulary by the body. A movement vocabulary, conceptualized as movement skills, is expanded upon by learning new physical movements that can be performed in various physical activities and refined upon to improve proficiency for each movement (Tompsett et al., 2015; Whitehead & Duncan, 2010). In terms of physical literacy, an individual develops their movement vocabulary by learning new physical activities, or exercise movements, and then gaining confidence and competence for each new physical activity(Burton & Rodgerson, 2001; Hardy, King, Farrell, Macniven, & Howlett, 2010). Over time it is expected that the individual would be able to combine and structure various physical activities and/or exercise movements to develop an exercise routine.

Physical literacy is a novel concept skill being improved upon in countries such as Canada and Australia with similarities to the theory of ecological task analysis but with an emphasis placed upon the development of an individual to have the necessary skills for physical

activity programs of choice by the age of 12, where ecological task analysis tends to focus upon constraints either acquired or born with (Chen, 2015; Davis & Burton, 1991; Longmuir et al., 2015). It is proposed that the combination of a focus of basic human movements, along with constraints found in the theory of ecological task analysis, may be beneficial for the adaptive population in programs modeled around high intensity functional fitness (HIFT) due to the scalability and modifications capable with within the HIFT design.

High Intensity Functional Training (HIFT)

High intensity functional training (HIFT) is a training style that uses a variety of functional movements performed at relatively high intensity, designed to improve general physical fitness, and modifiable to meet specific individual needs (Feito, Heinrich, Butcher, & Poston, 2018). HIFT program examples are provided by Heinrich and associates (Heinrich et al., 2015; Heinrich, Crawford, Johns, Frye, & Gilmore, 2019) and Crawford and associates (Crawford, Drake, Carper, DeBlauw, & Heinrich, 2018). Common movements found in HIFT consist of various modalities such as gymnastics, weightlifting, and monostructural movements. The gymnastics modality includes bodyweight movements such as squats, push-ups, and pull-ups. The weightlifting modality includes weighted movements found in powerlifting and Olympic weightlifting such as back squats, front squats, presses, clean & jerk, and snatch. The monostrucutral modality consists of repetitive motions that elicit a cardiovascular training response such as bicycling, walking, running, rowing, and swimming (CrossFit, 2002). Emphasis is placed on these common movement modalities with the goal to condition someone for general physical preparedness rather than specific fitness goals, so that an individual may be healthy and can overcome physical barriers such as the need to move a heavy plant from one location to another, or picking up a grandchild. While high intensity might sound risks for adaptive

populations, the risk of injury in HIFT participation is equal to or lower than other common forms of exercise such as weightlifting, powerlifting, and running (Klimek, Ashbeck, Brook, & Durall, 2017). It is recommended that those new to HIFT seek a trainer knowledgeable in scaling and modifying workouts appropriately and safely (Meyer, Morrison, & Zuniga, 2017).

A HIFT pilot study among cancer survivors was feasible and resulted in improved functional movements, such as balancing and carrying a weighted object (Heinrich et al., 2015). The study used a HIFT intervention delivered by a trained fitness professional who varied exercise modalities and scaled movements as necessary for each participant. Some participants had varying after affects from cancer treatment that may have altered flexibility and strength increasing the difficulty of movements, leaving coaches to scale and modify movements to stimulate the desired workout effect. An example of such a scale would be to use lighter loads, such as substituting light dumbbells in place of an overhead barbell press. Benefits from participating in a HIFT program can include improved functional movement competency, aerobic capacity, and anerobic peak (Bellar, Hatchett, Judge, Breaux, & Marcus, 2015). These benefits may be helpful in the reduction or prevention of secondary health conditions similar to other forms of physical activity with less workout time required due to the increased intensity level (Katie M. Heinrich, Patel, O'Neal, & Heinrich, 2014; Skelly et al., 2014). Adults, older adults, and youth have comprised most of the HIFT studies to date with lacking research focused upon those with adaptive needs. As people may age with an adaptive need, or age into an adaptive need, there is a need to explore the benefits of a HIFT physical activity program focused upon the adaptive population. An adaptive HIFT program would build upon HIFT's potential to scale and modify due to limitations, or constraints, and individual may have. The flexibility of HIFT may even be a factor that would draw individuals towards such type of

physical activity program if it meets their physical activity intensity level preference for self-efficacy and enjoyment parameters.

Adaptive HIFT

As mentioned previously, it is common for adaptive sports to use modified equipment and/or rules that allow for the inclusion of those with chronic conditions/disability. Adaptive HIFT has not been recognized as a Paralympic sport but has been seen in common HIFT venues sponsored by organizations such as the Challenged Athlete Foundations (CAF) and the CrossFit Games. Adaptive HIFT programs either adapt (substitute) or scale (easier/harder versions of) functional movements to facilitate participation despite impairments that would otherwise exclude those individuals (Blanchard & Glasgow, 2014). For example, an individual with paraplegia would adapt the Concept 2 Ski Ergometer in place of a cycling or running movement. An individual with a below-the-knee prosthesis, would scale the depth of their squatting motion to account for balance loss (CrossFit, 2018).

Adaptive HIFT allows for inclusive fitness as a means of continued rehabilitation with a goal to increase QoL by decreasing barriers associated with physical movement impairments, therefore improving ability for ADLs. No previous research has examined the effects of adaptive HIFT on participants. This pilot study investigated the effectiveness of adaptive HIFT for improving self-reported activity limitations and participation restrictions, QoL, sport/exercise beliefs, physical activity self-efficacy and enjoyment, and measured BHM.

Chapter 2 - **Methods**

Design

This two-site pilot study used a single-condition pre-test posttest design. The Kansas State University Institutional Review Board approved all study protocols (#8875) and participants provided written informed consent prior to study commencement. Informed consent can be found in Appendix A.

Participants

Adaptive athletes (N = 8) were recruited from San Francisco CrossFit and CrossFit 1904 (San Diego, CA). Inclusion criteria required individuals to have an adaptive need, be between 18-65 years of age, and not pregnant. Participants were not excluded for existing or prior HIFT experience, either adaptive or non-adaptive. Some participants stated they had little to no experience with HIFT while some reported up to two years of adaptive HIFT experience.

Timeline

Study recruitment and consent began September 2017, baseline measures and the 8-week intervention began in October, and ended in December, followed by posttest measures. Data were analyzed at the completion of the intervention.

Intervention

The program included 8-weeks of 2–3, 60-minute adaptive HIFT sessions per week. Sessions consisted of high intensity (relative to each participant's ability and fitness level with scaled movements and exercise as need), low volume workouts. Trainers at each location were able to communicate with participants in-person and identify any activity limitations and participation restrictions that may affect each participant's ability to engage in the exercise

program. The same activity limitations and participation restrictions were taken into account to explain high intensity relative to each participant's ability and fitness levels either through exercise modifications/substitutions or by scaling exercise volume. The program was considered low volume based on three components including weight (i.e., load) used during exercise, the distance the weight traveled (i.e., range of motion), and duration of exercise task performance (i.e., how long each person chose to perform a task, length of rest, and then activity resumption). Appendix C documents the workouts that were completed by participants and used by the trainers. Participants attended one individually tailored session a week and then 1-2 group-based sessions where they would apply modifications or substitutions they learned for each movement, as necessary. Each session consisted of a check-in, 5-15 minute warm-up, 15 minutes of instruction and technique work, 10-20 minute workout (usually with participants completing as many rounds as possible of set exercises and repetitions within the time allotted), and 10 minutes of cool-down and stretching.

Workout Descriptions

Workouts met the definition of HIFT by including a sequenced variety of modalities categorized by monostructural (e.g., running, rowing, swimming), gymnastic (e.g., pull-ups, push-ups, air squats), and weightlifting (e.g., weighted squats, bench press, clean &jerk) movements (CrossFit, 2002; Glassman, 2004). Workouts could include one or all three HIFT modalities, usually cycling through each as follows: workout 1 = monostructural, workout 2 = monostructural + gymnastics, workout 3 = monostructural + gymnastics + weightlifting (and then alternating so that gymnastics and weightlifting would be the modality used during workout 1).

Workout duration and structure followed for time, rounds for time, as many rounds as possible, and chipper formats during each session as explained below. Workouts may have had a for time

expectation focused upon the development of skills found in HIFT, and then a second rounds for time (RFT) expectation for the emphasized focus of the session. For each of the workout types described below, participants were required to maintain proper form and technique. They were also able to rest during the workout as long or as little as they deemed necessary and then resumed the workout to completion.

- For time (FT): The goal is to complete a set distance, number of repetitions, moving an amount of weight, or a combination in as little time as possible.
- Rounds for Time (RFT): A set number of repetitions for specific exercises are completed in a linear fashion per round, which are repeated until the desired rounds are completed in as little time as possible.
- As Many Rounds/Reps as Possible (AMRAP): A time duration is set where participants are expected to complete a set of specific exercise in a linear fashion for as many rounds or repetitions in the allotted time.
- Chipper: This is a list of exercises where the repetitions for each are completed in a linear fashion in as little time as possible.

Exercise Equipment Used

Types of equipment used in the intervention included Rogue Fitness barbells, Rogue Fitness pull-up rigs, plyometric boxes, dumbbells, benches, cable machines, a running track / planned running route, medicine ball, Concept 2 ski ergometer, Concept 2 row ergometer, pool / ocean, kettlebell, Aerodyne cycle ergometer, and elastic bands. The equipment was used to complete workout movements either individually or in multiple combinations with not all items used during each workout sessions. Some pieces of exercise equipment were utilized in methods not

intended for their initial purpose (e.g., having a participant in a wheelchair use Aerodyne bike handlebars in place of pedals to bicycle during the workout).

Intervention Facilitator Characteristics

The adaptive HIFT program was facilitated by two CrossFit level 1 trainers, one trainer at each location. Both trainers had at least 5 years of coaching experience. Both trainers were adaptive athletes themselves and co-developed an adaptive training coaching program that is taught within the US and online. The trainers conducted the intervention at their respective gym locations that were indoor strength and conditioning facilities with wheelchair accessibility and adaptive exercise equipment (e.g., Concept 2 ski ergometer with hand extensions with anchored wheelchair users) available for participants.

Trainer 1 had a Doctorate in Physical Therapy and carried various training credentials to include the National Strength and Conditioning Association's Certified Strength and Conditioning Specialist, MobilityWOD instructor, CrossFit Level 1, CrossFit Weightlifting, and CrossFit Movement & Mobility. Trainer 1 also was the Co-Creator of the Functional Movement for Adaptive Athlete Course and Founder and President of Movement RX.

Trainer 2 had the CrossFit Level 1 credential and was also a Co-Creator of the Functional Movement for Adaptive Athlete Course. Trainer 2 was the founder of Adaptive Athletic and the Goodleg Project which provided insight into the adaptive community in the form of personal relations and a better understanding adaptive HIFT training.

Measures

Quality of Life

Quality of Life (QoL) was determined by having participants self-report their general health, overall health satisfaction, physical health, psychological health, social health, and environmental

health using the 26-item World Health Organization's QoL – BREF (WHOQoL-BREF) measurement tool (World Health Organization, 1996). The 26-item instrument measured overall health and QoL. Item 1 asks for an individual's perceived QoL on a 5-point rating scale (1 = very poor, 5 = very good). Item 2 asks for an individual's perceived health satisfaction on a 5-point rating scale (1 = very dissatisfied, 5 = very good). Twenty-four items were grouped into 4-domain level sub-scales within QoL including physical health, psychological health, social relationships, and the environment, and each item was rated on a 5-point rating scale (1 = lowest absolute value, 5 = highest absolute value; item 26 reverse scaled 1 = never, 5 = always) (World Health Organization, 1996). The physical health domain consisted of pain, energy, sleep, mobility, activities, medication, and work. The psychological health domain consisted of positive feelings, thinking, esteem, body image, negative feelings, spirituality. The social relationships domain consisted of relationships, support, and sex. The environment domain consisted of safety, home, finance, services, information, leisure, environment, and transportation. Each domain was scored as 4 = lowest, with 20 = highest using SPSS syntax (Hawthorne, Herrman, & Murphy, 2006; World Health Organization, 1996). The WHOQOL-BREF qol domains have been correlated with WHOQOL-100 with Pearson correlations values of r = 0.95 for physical health, r = 0.92 for psychological health, r = 0.89 for social relationships, and r = 0.94 for environment (World Health Organization, 2012). Cronbach's alpha for all domains have been shown to be >0.7 for physical health, psychological health, and environment domains, while the social domain's Cronbach alpha was shown to be 0.68 (Skevington, Lotfy, O'Connell, & WHOQOL Group, 2004).

Activity Limitations & Participation Restrictions

Activity limitations & participation restrictions were determined via self-report by having participants complete the OPTIMAL (APTA, 2012a).

The OPTIMAL measured an individual's difficulty and confidence in performing 22 ADL movements. Difficulty of completing a specific task in a controlled environment such as a doctor's office was rated on a scale from 1 = "able to do without any difficulty," to 5 = "unable to do," with 6 = "not applicable/missing." Confidence to complete a specific task in unsupervised environments such as at home or work was rated on a scale from 1 = "fully confident in my ability to perform," to 5 = "not confident in my ability to perform." An individual may have chosen "6 = not applicable" due to their inability to perform the task. Total scores for difficulty and confidence were calculated through summation of responses, except for score of 6, where lower scores were ideal (Guccione, Mielenz, Devellis, et al., 2005). Individuals were able to choose up to three movements they would like to be able to perform without any difficulty.

For analysis, the OPTIMAL was reported in three subdomains composed of: changing and maintaining body position; walking and moving; and carrying, moving, and handing objects. The OPTIMAL, when broken into 3 subscales of area of impairment, has shown a Cronbach alpha of .75 for the difficulty scale at baseline and .70 for the confidence scale at baseline (Guccionne et al., 2005). The same study showed baseline OPTIMAL correlations to physical function for difficulty scale scores (r = -.80) and confidence scale scores (r = -.72) (Guccionne et al., 2005).

Sport and Exercise Ability

Using items adapted from Perez (Bandura, 2006; Perez, n.d.), participants were asked to self-rate their "ability to do" 8 items related to sport and exercise ability (e.g., Do physical exercises that require resistance) on a scale from 1 "I cannot do this activity at all" to 10 "I am certain I can do this activity successfully." No reliability or validity data were available for the items.

Preferred Physical Activity Intensity Level Factors: Self-Efficacy and Enjoyment

Self-efficacy for moderate and vigorous exercise was measured using 3-items each scored 1 = "I'm sure I cannot" to 5 = "I'm sure I can." Self-efficacy items required individuals to provide their perceived ability to complete vigorous and moderate exercise while stressed, maintain exercise with life events, and set aside time to exercise. The second section for moderate and vigorous exercise factors involved 3-items each for enjoyment in each exercise intensity domain. Exercise enjoyment for both domains was scored 1 = "I strongly disagree" to 5 = "strongly agree." The measures were adapted from the Neighborhood Quality of Life study (J. F. Sallis et al., 2009). No reliability or validity data were available.

Basic Human Movement (BHM) Assessments

At both baseline and posttest participants' BHMs were measured using a 5-point scale for the squat, lunge, rotation, push-up, brace, and hinge (Giles, Penfold, & Giorgi, 2005; Tompsett et al., 2015). The BHMs were scored by researchers with the use of photos taken by intervention facilitators. Each movement had specific requirements to gain points, where 0 = absolute worst score and 5 = absolute best score. An example for the squat would be, "both heels maintaining contact with the ground during the entirety of the squat movement" = 1 point (Giles, 2015). No reliability or validity data were available for the measures.

Statistical Analysis

All data were entered into SPSS 25 (Armonk, NY). Baseline measures were recorded and group means and standard deviations were calculated for participants. Participation restrictions were determined by using the confidence measure found in the OPTIMAL along with self-confidence and sport/exercise ability measures. OPTIMAL movements that individuals would like to perform without difficulty were tallied and assigned rank weight by the overall percentage

of movements. The planned design was to compare pre-test and posttest results for each measurement, but only BHM assessments met this criteria. Two participants did complete pre-test and post-test self-report measures allowing for comparisons of results from each test and then compared using a percent change formula in Microsoft Excel for Mac version 16.25. To determine changes in BHMs, paired samples t-tests were performed. Effect sizes and percent change were calculated using Cohen's D formula with Microsoft Excel Office 365. Survey used can be found in Appendix B.

Chapter 3 - **Results**

Demographic Characteristics

Demographic characteristics for all participants (N = 8) are presented in Table 1. The average age for participants was 39.1 years (SD = 11.1 years). The majority of participants were male, 62.5% (N = 5). All participants had some form of college education. Seven of eight participants used an assistive device such as a cane, manual wheelchair, powered wheelchair, and other.

Table 1. Participant Demographic Characteristics (N=8)

Characteristic	Category	% (n)
Sex	Male	62.5 (5)
	Female	37.5 (3)
Race	White	37.5 (3)
	Black	37.5 (3)
	Other	25.0 (2)
Ethnicity	Hispanic or Latino	25.0 (2)
	Not Hispanic or Latino	50.0 (4)
	Missing	25.0 (2)
Insurance	Worker's Compensation	12.5 (1)
	Self-pay	12.5 (1)
	HMO/PPO/Private Insurance	25.0 (2)
	Medicaid	12.5 (1)
	Other	25.0 (2)
	Missing	12.5 (1)
Medicare	Yes	50.0 (4)
	Missing	50.0 (4)
Education	Attended college, did not graduate	37.5 (3)
	College graduate	50.0 (4)
	Completed graduate school/advanced degree	12.5 (1)
Annual Household Income	$15,000 - $24,999	12.5 (1)
	$25,000 - $34,999	12.5 (1)
	$35,000 - $49,999	25.0 (2)
	$50,000 - $74,999	12.5 (1)
	$75,000 - $99,999	12.5 (1)

	$100,000 - $149,999	12.5 (1)
	$150,000 or more	12.5 (1)
Do you use an assistive device?	Cane	12.5 (1)
	Manual Wheelchair	37.5 (3)
	Motorized wheelchair	12.5 (1)
	Other	25.0 (2)
	Missing	12.5 (1)
With whom do you live?	Alone	12.5 (1)
	Spouse/significant other	37.5 (3)
	Other relative	12.5 (1)
	Other	37.5 (3)
Where do you live?	Private home	50.0 (4)
	Private apartment	37.5 (3)
	Rented room	12.5 (1)

Baseline Self-Report Measures

Participant's Activity Limitations & Participation Restrictions

Ratings for overall difficulty and confidence for the 22-items from the OPTIMAL are shown by domain categories in Table 2. The greatest difficulty ratings were for walking long distance (M = 3.3, SD = 1.5) and squatting (M = 3.3, SD = 1.5). The worst confidence rating was for walking long distance (M = 3, SD = 2). As reflected by lower numbers for some activities, some participants had a chronic condition/disability that made the activity not applicable. The highest average domain score (i.e., the worst score) was found for the walking and moving domain.

Table 2. Activity of Daily Living Limitations and Restrictions

	Difficulty		Confidence	
Activity	N	M(SD)	N	M(SD)
Domain: Changing & Maintaining Body Position				
Squatting	7	3.3 (1.5)	5	2.4 (1.3)
Balance	8	2.8 (1.0)	8	2.8 (1.3)
Kneeling	7	2.7 (1.7)	5	2.4 (1.3)
Bending/Stooping	8	2.5 (1.4)	7	2.7 (1.3)

Standing	7	2.4 (1.8)	5	1.2 (0.4)
Lying Flat	8	2.1 (1.4)	7	1.3 (0.5)
Moving Lying to Sitting	8	2.0 (1.1)	8	2.4 (1.1)
Rolling Over	8	1.6 (0.7)	8	2.1 (1.1)
Sitting	8	1.5 (0.8)	8	1.9 (1.4)
Domain Average		2.3 (0.6)		2.1 (0.6)
Domain: Walking and Moving				
Walking Long Distance	7	3.3 (1.5)	5	3 (2)
Walking Short Distance	6	2.8 (1.8)	5	1.6 (0.9)
Hopping	6	2.7 (1.6)	5	2.2 (1.6)
Walking Outdoors	7	2.6 (1.8)	5	2.2 (1.3)
Jumping	6	2.5 (1.5)	5	2.6 (1.8)
Climbing Stairs	6	2.2 (1.6)	5	1.4 (0.5)
Running	6	1.9 (0.8)	5	3.0 (2.0)
Domain Average		2.8 (0.4)		2.3 (0.6)
Domain: Carrying, Moving, and Handling Objects				
Carrying	7	2.3 (1.0)	8	2.6 (1.6)
Lifting	8	2.1 (1.1)	8	2.1 (1.0)
Pulling	8	1.9 (0.8)	8	2.2 (1.0)
Reaching	8	1.8 (1.0)	8	2.1 (1.1)
Pushing	8	1.5 (0.5)	8	2 (1.1)
Grasping	8	1.1 (0.4)	8	1.6 (0.7)
Domain Average		1.8 (0.4)		2.1 (0.3)

*Difficulty score of 1 = “able to do without any difficulty” to 5 = “unable to do”. Confidence score of 1 = “fully confident in my ability to perform” to 5 = “not confident in my ability to perform”.

Table 3. provides the top three activities that each participants would like to be to do without any difficulty. The primary activities that participants would like to do without any difficulty included balance (n = 4), followed by lifting, walking long distances, and carrying (all n = 3).

Table 3. OPTIMAL Activities to do without Difficulty (N = 8)

Activity	N	%
Balance	4	16
Lifting	3	12

Walking Long Distances	3	12
Carrying	3	12
Squatting	2	8
Grasping	2	8
Reaching	1	4
Pushing	1	4
Reaching	1	4
Pulling	1	4
Jumping	1	4
Rolling Over	1	4
Lying Flat	1	4
Total	24	100

Participant Quality of Life (QoL)

Average WHOQoL—BREF responses can be found in Table 4. General QoL for participants was relatively high (M= 4.3, SD = 0.5). Overall health satisfaction was slightly lower (M = 3.9, SD = 1.3). The highest QoL domain score was for the environment (M = 16.6, SD = 1.6). The lowest QoL domain score was for physical health (M = 14.4, SD = 1.7).

Table 4. Participant Averages for the World Health Organization Quality of Life-BREF (N=8)

Domain	M (SD)
General Quality of Life	4.3 (0.5)
Health Satisfaction	3.9 (1.3)
Physical Health Domain	14.3 (1.7)
Psychological Health Domain	15.5 (2.8)
Social Domain	14.5 (1.9)
Environment Domain	16.6 (1.6)

*General Quality of Life and Health Satisfaction scores: 1 = absolute worst, 5 = absolute best. Domain scores: 4 = absolute worst score to 20 = absolute best score.

Participant Sport and Exercise Ability

Sport / exercise ability results can be found in Table 5. Participants scored the highest in their perception to do physical exercises or compete in a sport that requires strength (M = 8.4, SD = 2.9), followed by practicing a sport that requires effort (M = 8.1, SD = 3.0). The lowest scores recorded were for doing physical exercises or competing in a sport that required coordination (M = 6.7, SD = 3.6), balance (M = 6.4, SD = 3.4), or agility (M = 6.3, SD = 3.7)

Table 5. Participant Self-Rated Sport/Exercise Ability (N=8)

Item	Mean (SD)
Do physical exercises or compete in a sport that requires strength	8.4 (2.9)
Practice a sport that required effort	8.1 (3.0)
Compete in a sport that requires accuracy	7.3 (3.2)
Do physical exercises that require resistance	7.3 (3.3)
Avoid obstacles in a race	7.1 (3.3)
Do physical exercises or compete in a sport that requires coordination	6.7 (3.6)
Do physical exercises or compete in a sport that requires balance	6.4 (3.4)
Do physical exercises or compete in a sport that requires agility	6.3 (3.7)

* 1 = cannot do at all, 10 = certain I can do this successfully

Preferred Physical Activity Intensity Level Factors: Self-Efficacy and Enjoyment

Responses to items for self-efficacy aspects of moderate and vigorous physical activity can be found in Table 6. Self-efficacy was similar across all moderate-intensity items, but lowest

for “Stick to my vigorous exercise program even when family or social life takes a lot of time” (M = 4.1, SD = 0.8).

Table 6. Self-Efficacy Physical Activity at Moderate and Vigorous Intensity Levels (N=8)

Measures	Moderate-Intensity Mean (SD)	Vigorous-Intensity Mean (SD)
Set aside time for regular ____ exercise	4.6 (0.7)	4.6 (0.5)
Exercise ____ even though I am feeling sad or highly stressed	4.6 (0.5)	4.5 (0.6)
Stick to my ____ exercise program even when family or social life takes a lot of time	4.6 (0.5)	4.1 (0.8)

* 1 = strongly disagree, 5 = strongly agree; Note that the questions asked about moderate- or vigorous-intensity where indicated by the blanks.

Participant baseline exercise enjoyment for moderate- and vigorous-intensity activities was relatively high and is shown in Table 7. Participants reported high enjoyment for how they felt after doing moderate- (M = 4.9, SD = 0.4) or vigorous-intensity (M = 4.9, SD = 0.4) activities, as well as how they felt during moderate-intensity activities (M = 4.9, SD = 0.4).

Table 7. Physical Activity Enjoyment at Moderate and Vigorous Intensity Levels (N=8)

Measures	Moderate-Intensity Mean (SD)	Vigorous-Intensity Mean (SD)
I enjoy the feeling I get after doing _____ activities	4.9 (0.4)	4.9 (0.4)
I enjoy doing _____ physical activity	4.6 (0.7)	4.8 (0.7)
I enjoy the feeling I get while doing _____ activities	4.9 (0.4)	4.8 (0.7)

* 1= I'm sure I cannot, 5 =I'm sure I can; Note that the questions asked about moderate- or vigorous-intensity where indicated by the blanks.

Baseline Basic Human Movement Measures

As shown in Table 8. baseline BHM values were lowest for the squat (M = 3.6, SD = 0.8). Participant scores were highest for the lunge (M = 4.5, SD = 0.8) and push-up (M = 4.5, SD = 1.1). Two participants were unable to perform the squat and lunge movements.

Table 8. Basic Human Movement

Movement	N	Baseline M (SD)
Squat	5	3.6 (0.8)
Lunge	5	4.5 (0.8)
Rotation	7	4.4 (0.7)
Push-Up	7	4.5 (1.1)
Brace	7	4.3 (1.0)
Hinge	7	4.3 (0.9)

* 1 = "Absolute worst", 5 = "Absolute best".

Differences from Pre-test to Posttest Measures

Only two participants completed pre-test and posttest self-reported survey measures, limiting the type of comparisons possible to individual-level percent change between the two timepoints. Subject 1 had a below the knee amputation and use a prosthetic. Subject 2 had a spinal cord injury and used a manual wheelchair.

Differences in Difficulty for Activities of Daily Living

Changes in OPTIMAL difficulty can be found in Table 9. Subject 1 reported improved difficulty for squatting, balance, and walking long distance with their scores improving from, “Able to do with little difficulty” to, “Able to do without any difficulty,” for an overall decrease in OPTIMAL difficulty (Δ = -12%). Subject 2 reported increased difficulty for moving lying to sitting (Δ = 50%), sitting (Δ = 50%), bending/stooping (Δ = 50%), pushing (Δ = 100%), pulling (Δ = 100%), and reaching (Δ = 100%), for an overall increase in OPTIMAL difficulty (Δ = 30%). Subject 2 was unable to respond to multiple items due to the nature of their adaptive need.

Table 9. Differences in Optimal Difficulty

	Subject 1			Subject 2		
Measures	Pre	Post	% Δ	Pre	Post	% Δ
Domain: Changing & Maintaining Body Position						
Squatting	2.0	1.0	-50.0	NA	NA	NA
Balance	2.0	1.0	-50.0	3.0	3.0	0.0
Kneeling	1.0	1.0	0.0	NA	NA	NA
Bending/Stooping	1.0	1.0	0.0	2.0	3.0	50.0
Standing	1.0	1.0	0.0	NA	NA	NA
Lying Flat	1.0	1.0	0.0	1.0	1.0	0.0
Moving Lying to Sitting	1.0	1.0	0.0	2.0	3.0	50.0
Rolling Over	1.0	1.0	0.0	2.0	2.0	0.0
Sitting	1.0	1.0	0.0	2.0	3.0	50.0
Domain Average	1.2	1.0	-11.1	2.0	2.5	25.0
Domain: Changing & Maintaining Body Position						
Walking Long Distance	2.0	1.0	-50.0	NA	NA	NA
Walking Short Distance	1.0	1.0	0.0	NA	NA	NA
Hopping	1.0	1.0	0.0	NA	NA	NA
Walking Outdoors	1.0	1.0	0.0	NA	NA	NA
Jumping	1.0	1.0	0.0	NA	NA	NA
Climbing Stairs	1.0	1.0	0.0	NA	NA	NA
Running	1.0	1.0	0.0	NA	NA	NA
Domain Average	1.1	1.0	-7.1	NA	NA	NA
Domain: Carrying, Moving, and Handling Objects						
Carrying	1.0	1.0	0.0	2.0	2.0	0.0
Lifting	1.0	1.0	0.0	2.0	2.0	0.0
Pulling	1.0	1.0	0.0	1.0	2.0	100.0
Reaching	1.0	1.0	0.0	1.0	2.0	100.0
Pushing	1.0	1.0	0.0	1.0	2.0	100.0
Grasping	1.0	1.0	0.0	1.0	1.0	0.0
Domain Average	1.0	1.0	0.0	1.3	1.8	50.0

*Difficulty score of 1 = “able to do without any difficulty” to 5 = “unable to do”.

Differences in Confidence for Activities of Daily Living

OPTMAL confidence results for case studies can be found in Table 10. Subject 1 reported no change on OPTIMAL confidence measures maintaining a score of, “Fully confident in my ability to perform” for all 22-items. Subject 2 reported an increase in confidence for sitting (Δ = -25%), balance (Δ = -25%, pushing (Δ = -33%), pulling (Δ = -33%, and reaching (Δ = -33%), for an overall increase in confidence for their compiled score (Δ = -15%). Subject 2 was unable to respond to multiple items due to the nature of their adaptive need.

Table 10. Differences in OPTIMAL Confidence

	Subject 1			Subject 2		
Measures	Pre	Post	% Δ	Pre	Post	% Δ
Domain: Changing & Maintaining Body Position						
Squatting	1.0	1.0	0.0	NA	NA	NA
Balance	1.0	1.0	0.0	4.0	3.0	-25.0
Kneeling	1.0	1.0	0.0	NA	NA	NA
Bending/Stooping	1.0	1.0	0.0	4.0	4.0	0.0
Standing	1.0	1.0	0.0	NA	NA	NA
Lying Flat	1.0	1.0	0.0	1.0	1.0	0.0
Moving Lying to Sitting	1.0	1.0	0.0	3.0	3.0	0.0
Rolling Over	1.0	1.0	0.0	3.0	3.0	0.0
Sitting	1.0	1.0	0.0	4.0	3.0	-25.0
Domain Average	1.0	1.0	0.0	3.2	2.8	-8.3
Domain: Changing & Maintaining Body Position						
Walking Long Distance	1.0	1.0	0.0	NA	NA	NA
Walking Short Distance	1.0	1.0	0.0	NA	NA	NA
Hopping	1.0	1.0	0.0	NA	NA	NA
Walking Outdoors	1.0	1.0	0.0	NA	NA	NA
Jumping	1.0	1.0	0.0	NA	NA	NA
Climbing Stairs	1.0	1.0	0.0	NA	NA	NA
Running	1.0	1.0	0.0	NA	NA	NA
Domain Average	1.0	1.0	0.0	NA	NA	NA
Domain: Carrying, Moving, and Handling Objects						
Carrying	1.0	1.0	0.0	2.0	2.0	0.0
Lifting	1.0	1.0	0.0	2.0	2.0	0.0
Pulling	1.0	1.0	0.0	3.0	2.0	-33.0
Reaching	1.0	1.0	0.0	3.0	2.0	-33.0
Pushing	1.0	1.0	0.0	3.0	2.0	-33.0

Grasping	1.0	1.0	0.0	1.0	1.0	0.0
Domain Average	1.0	1.0	0.0	2.3	1.8	-16.5

*Confidence score of 1 = "fully confident in my ability to perform" to 5 = "not confident in my ability to perform".

Differences in Quality of Life and Related Domains

WHOQoL-BREF results for subjects 1 and 2 are found in Table 11. Subject 1 reported no change in general QoL and health satisfaction. Subject 1 did report a decrease in social relationship domain (Δ = -9%), and environment domain (Δ = -6%) scores. Subject 2 maintained general QoL and reported an increase in health satisfaction (Δ = 300%). Subject 2 also reported an increase in domain scores for physical health (Δ = 53%), psychological (Δ = 50%), social relationships (Δ = 22%), and environment (Δ = 17%).

Table 11. Differences in WHO Quality of Life Domains

	Subject 1			Subject 2		
Measures	Pre	Post	% Δ	Pre	Post	% Δ
General QoL	4.0	4.0	0.0	4.0	4.0	0.0
Health Satisfaction	4.0	4.0	0.0	1.0	4.0	300.0
Physical Health	15.4	15.4	0.0	10.8	16.5	53.0
Psychological	14.0	14.0	0.0	10.6	16.0	50.0
Social Relationships	14.7	13.3	-9.0	12.0	14.6	22.0
Environment	16.5	15.5	-6.0	15.0	17.5	17.0

*General Quality of Life and Health Satisfaction scores: 1 = absolute worst, 5 = absolute best. Domain scores: 4 = absolute worst score to 20 = absolute best score. % Δ = percent change.

Differences in Sport/Exercise Ability

As shown in Table 12, subject 1 reported an improvement in all measures with the largest gains in avoiding obstacles in a race (Δ = 900%), practicing a sport that requires effort (Δ = 400%), competing in a sport that requires accuracy (Δ = 400%), doing physical exercises that require resistance (Δ = 400%), doing physical exercises or competing in a sport that requires balance (Δ = 400%), strength (Δ = 400%), agility (Δ = 350%), and coordination (Δ = 233%). Subject 2 had only one change in their responses decreasing from, "Certain I can do this successfully" to, "Moderately certain I can do this" for avoiding obstacles in a race (Δ = -30%), with all other responses maintaining, "Certain I can do this successfully."

Table 12. Differences in Sport/Exercise Ability

	Subject 1			Subject 2		
Measures	Pre	Post	% Δ	Pre	Post	% Δ
Practice a sport that required effort	2	10	400	10	10	0
Compete in a sport that requires accuracy	2	10	400	10	10	0
Do physical exercises that require resistance	2	10	400	10	10	0
Do physical exercises or compete in a sport that requires agility	2	9	350	10	10	0
Avoid obstacles in a race	1	10	900	10	7	-30
Do physical exercises or compete in a sport that requires coordination	3	10	233	10	10	0
Do physical exercises or compete in a sport that requires balance	2	10	400	10	10	0
Do physical exercises or compete in a sport that requires strength	2	10	400	10	10	0

* 1 = absolute worst, 10 = absolute best. % Δ = percent change.

Differences in Preferred Physical Activity Intensity Level Factors: Self-Efficacy and Enjoyment

Changes in self-efficacy for moderate and vigorous physical activity can be found in Table 13 with changes in enjoyment found in Table 14. Subject 1 reported a decrease in self-efficacy to, “Exercise vigorously even though I am feeling sad or highly stressed” (Δ = -25%) and an increase in self-efficacy to, “Stick to my vigorous exercise program even when family or social life takes a lot of time” (Δ = 25%). Subject 2 reported a 25% increase in all three self-efficacy questions. Differences in enjoyment reported no change with both subjects reporting the highest enjoyment value at both test points.

Table 13. Self-Efficacy Physical Activity at Moderate and Vigorous Intensity Levels (N=8)

Measures	Vigorous-Intensity						Moderate-Intensity					
	Subject 1			Subject 2			Subject 1			Subject 2		
	Pre	Post	% Δ	Pre	Post	% Δ	Pre	Post	% Δ	Pre	Post	% Δ
Set aside time for regular ____ exercise	5	5	0	4	4	0	5	5	0	4	5	25
Exercise ____ even though I am feeling sad or highly stressed	4	3	-25	4	4	0	4	5	25	4	5	25
Stick to my ____ exercise program even when family or social life takes a lot of time	4	5	25	4	4	0	4	5	25	4	5	25

* 1 = strongly disagree, 5 = strongly agree; Note that the questions asked about moderate- or vigorous-intensity where indicated by the blanks.

Table 14. Physical Activity Enjoyment at Moderate and Vigorous Intensity Levels (N=8)

Measures	Vigorous-Intensity						Moderate-Intensity					
	Subject 1			Subject 2			Subject 1			Subject 2		
	Pre	Post	% Δ	Pre	Post	% Δ	Pre	Post	% Δ	Pre	Post	% Δ
I enjoy the feeling I get after doing _____ activities	5	5	0	5	5	0	5	5	0	5	5	0
I enjoy doing _____ physical activity	5	5	0	5	5	0	5	5	0	5	5	0
I enjoy the feeling I get while doing _____ activities	5	5	0	5	5	0	5	5	0	5	5	0

* 1= I'm sure I cannot, 5 =I'm sure I can; Note that the questions asked about moderate- or vigorous-intensity where indicated by the blanks.

Differences in Basic Human Movements

Measured BHM scores at pre-test and posttest are found in Table 15. Three participants were unable to perform the squat and lunge at each time point due to adaptive needs. One participant was unable to perform post-testing due to a scheduling conflict. No significant differences were found between time points for BHM, although a medium effect size was found for the squat (d = 0.637), brace (d = 0.624), and lunge (d = 0.501). A small effect size was found for the differences in rotation (d = 0.390), hinge (d = 0.303), and push-up (d = 0.276).

Table 15. Basic Human Movement Scores at Pre-test and Posttest.

Movement	N	Pre-test M (SD)	Posttest M (SD)	t	p	d
Squat	5	3.6 (0.8)	4.2 (0.8)	-2.2	0.1	0.6
Lunge	5	4.5 (0.8)	4.8 (0.4)	-1.6	0.2	0.5
Rotation	7	4.4 (0.7)	4.6 (0.5)	-1.5	0.2	0.4
Push-Up	7	4.5 (1.1)	4.8 (0.7)	-1.5	0.2	0.3
Brace	7	4.3 (1.0)	4.8 (0.5)	-1.9	0.1	0.6
Hinge	7	4.3 (0.9)	4.5 (0.8)	-1.5	0.2	0.3

* 1 = "Absolute worst", 5 = "Absolute best".

Chapter 4 - **Discussion**

This pilot study investigated the effectiveness of adaptive HIFT for improving self-reported activity limitations and participation restrictions, QoL, sport/exercise beliefs, physical activity self-efficacy and enjoyment, and measured BHM. Overall study findings indicated no statistically significant differences in any measures, although there were showed small to medium effect sizes for improvements in BHM after 8-weeks of adaptive HIFT participation. The potential improvements in BHM follows along with using adaptive HIFT as a form of outpatient rehabilitations to assist with the transition of being an adaptive patient to adaptive physical activity participant (Rimmer & Lai, 2017). One of two participants with complete data reported 17-300% improvement in QoL areas, while the other participant reported 233-900% increases in sport/exercise abilities.

The high baseline average domain score for walking and moving activity limitations has also been found in previous studies where the score was linked to area of impairment such as the upper limb, lower limb, and mid-section (Guccionne et al., 2005). While not powerful enough to be meaningful, it was surprising to find that walking (long distance, short distance, or outdoors) was rated overall as more difficult than running as an activity limitation. Thus, at baseline walking had moderate difficulty with moderate confidence and running had little difficulty with moderate confidence. The separation of activity limitations may represent that individuals would perceive walking as more difficult than running when discussing the topic in a structured environment, compared to how confident they may be in when the task is considered in a non-structured environment such as sport (Khan et al., 2010). The baseline results for the domain of carrying, moving, and handling objects reported as the least difficult and most confident domain of all three. Participants rated carrying and lifting as the most difficult activity with pulling,

reaching, pushing, and grasping as able to do without any difficulty even when taking into account that the majority of participants required an assistive device for mobility. The rating for carrying, moving, and handling objects may be in part to past HIFT participation, but would be interesting to see if the ratings stay similar with a larger sample size with more variety in assistive device use and adaptive needs.

Participants were able to choose up to three movements they would like to be able to perform without any difficulty. One measure from each domain was reported as the top three activities participants would like to perform without difficulty which were: balance, lifting, walking long distance. Balance can be found within both domains of changing & maintaining body position and walking and moving. With balance involved in two domains it can be seen as walking and moving domain as the most sought after domain of activities of daily living. Balance and walking are common barriers associated with adaptive needs, but it was interesting to see lifting as a sought after activity. Lifting is commonly found in HIFT and would be practiced with most sessions. Of the three movements liked to perform without difficulty subject 1 saw a reduction of difficulty for balance and walking long distance and no change in lifting. Subject 2 saw no change for balance or lifting difficulty, but did see an increase in confidence for balance. The difference in reported changes are still unknown, but perhaps due to affected body regions that may impact scores (Guccione, Mielenz, DeVellis, Goldstein, & Janet K Freburger, Ricardo Pietrobon, Sarah C Miller, Leigh F Callahan, Kenneth Harwood, 2005; Guccionne et al., 2005)

Few studies have used the WHOQoL-BREF measurement tool with an adaptive population. QoL responses were similar to a past study that compared QoL scores of those with adaptive needs that participated in sports and those that did not have sport participation

(Yazicioglu et al., 2012). This study's QoL responses showed the environment domain had the highest score. The environment domain consists of tasks involved with interacting with the environment. If individuals were able to pull and push with little-to-no difficulty they may be able to pull or push open doors that would be an environmental barrier to other individuals (Rimmer et al., 2004). General QoL and health satisfaction were within the range for similar age groups in a preliminary population using the WHOQoL-BREF (Hawthorne et al., 2006). Although it would have been helpful to measure changes in QoL measures for the overall group this was only possible for two participants where the only change was an increase in health satisfaction score. The change in health satisfaction for participant 2 may have been related to the recent timing of acquiring an adaptive need and gained experience from the intervention. More research is needed comparing the timing of an acquired adaptive need and changes post adaptive HIFT intervention participation.

Participant baseline responses to the sport/exercise ability measures indicated that participants were at least moderately confident that they could participate in activities commonly found in HIFT. These responses suggest that activities found in HIFT may not be a barrier to participation when provided movement modification options, such as those provided by the intervention facilitators. Subject 1 increased in all sport/exercise ability measures while subject 2 saw a decrease in avoiding obstacles in a race. Subject 2's use of a manual wheelchair may be a factor related to the score, but further research is needed.. In future studies it would helpful examine sport/exercise ability scores by type of disability and measure how long an individual has had an adaptive need.

Self-efficacy for physical activity baseline scores indicated that participants had high self-efficacy for both moderate and vigorous intensity levels suggesting that individuals may perceive

participation in such activities as less difficulty or easier to continue (Bandura, 1977). Participants did not report self-efficacy barriers regarding physical activity intensity level preference, that may indicate they feel confident enough to perform activities at various intensity levels (Kendzierski & DeCarlo, 1991) Enjoyment for participation in moderate and vigorous intensity physical activity was relatively high. Enjoyment levels found may suggest that those with an adaptive need may enjoy an adaptive HIFT program. Enjoyment in an adaptive HIFT program may assist suggest those that find such a program pleasing may continue to stay physically active throughout the life course (Sallis, 1988). While baseline data, and data differences, did not show an enjoyment preference towards moderate intensity physical activities adaptive HIFT may not be the program of choice or their preference (Ekkekakis, Hall, & Petruzzello, 2016).

Although significant differences in BHM were not found, participants scores were similar to a pilot study using the same measure for youth to include boys and girls in grades four, six, and eight in Australia (Tompsett et al., 2015). The measure may not be specific enough and may benefit from changing the scoring range from 1-5 to 1-10 to account for small variations in movement to account for adaptive needs such as the use of a wheelchair, prosthetic, or crutch. One of the intervention facilitators has developed another measurement tool with similar movements to include the squat, push, pull, and brace. Future research would benefit in using the new measurement and comparing results.

Practical Applications

Individuals with an adaptive need may benefit from participation in an adaptive HIFT program, although additional research with a fully powered randomized controlled trial is needed to establish efficacy. Practitioners desiring to work with adaptive populations should be educated

to develop an understanding of adaptive needs for scaling and modifications. Adaptive HIFT programs should provide an on-ramp program to gradually and safely educate participants.

Study Limitations

A key limitation of this pilot study was the small sample size as well as the fact that only two participants completed pre- and post-test self-report measures. Reasons for low survey completion likely included lack of a monetary incentive, lack of time, and forgetfulness as reported to intervention facilitators in-person and research staff via email. Forgetfulness may be remedied in the future with a way to support the intervention facilitators financially to remind participants on a regular basis. Intervention facilitators stated lack of time was a barrier and they provided the intervention free of cost to participants when performing one-on-one individual sessions.

The variety of chronic conditions and disabilities experienced by participants may have affected results and created confounders. The OPTIMAL may not have been the best measurement tool for activity limitations and participation restrictions, as the participants involved in the study who regularly used a wheelchair could not complete any questions within the mobility domain. The BHM measure did not appear to be sensitive enough to measure changes over time and may need to be adjusted.

Study Strengths

Study strengths consist of intervention facilitators, program adherence, and facilities available for the intervention. Intervention facilitators were educated and experienced in working with adaptive HIFT participants. The facilities used for exercise training were accessible for entry and exit and provided the necessary equipment for the adaptive HIFT program. All participants completed the full 8-weeks of training for 100% adherence with no reported injuries.

Future Research Suggestions

Future research should study the effects of an adaptive HIFT program in a fully-powered randomized controlled trial with a larger group of adaptive athletes.

Chapter 5 - **References**

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Appendix A - Informed Consent

Consent Form

Start of Block: Default Question Block

Q1
CONSENT FOR PARTICIPATION:
Effects of Sport and High-Intensity Functional Training on Adaptive Athletes' Quality of Life

Approval Date: 08/07/2017
Expiration Date: 08/07/2018

Project Information:
As an adult adaptive athlete, you are invited to participate in a pilot research study to assess the effects of participation in adapted sports for a high-intensity functional training (HIFT) exercise program on: participation restrictions, physical functioning, activities of daily living, self-confidence and exercise enjoyment, health-related quality of life, and sport/exercise ability. This study is being conducted under the guidance of Dr. Katie Heinrich at Kansas State University in the Functional Intensity Training (FIT) Laboratory (bit.ly/fitlab). The purpose of this study is to gather data to help further research on the experiences of adaptive athletes and improvement of functionality in daily activities for better quality of life. The information gathered during this pilot study will be used to help plan a larger HIFT intervention study to help adaptive athletes for funding by the Patient-Centered Outcomes Research Institute. This study was approved by the Institutional Review Board at Kansas State University (#8875).

What is involved?
This is an eight-week study with baseline and posttest assessments.

Those participating in HIFT classes will complete adapted group exercise training that will include higher intensity, lower volume workouts using HIFT training two-three days per week. The intensity and exercises will all be relative to your current ability and fitness level and will be scaled as needed. All exercise sessions will be led by a certified trainer who is also certified in CPR/AED and First Aid. In general, each exercise session will consist of 5 minutes for check in, 5-10 minutes of warm-up and stretching, 5-15 minutes of instruction and technique work, 5-25 minutes for the workout of the day, and 5-10 minutes of cooldown and stretching. Workouts will contain a combination of monostructural activities (e.g., walking, jogging, rowing, jumping), body weight exercises (e.g., squats, pushups, situps), and weight lifting exercises (e.g., presses, back squats, kettlebell swings). You will be continuously monitored during workout sessions by the certified trainer to ensure safety.

Those only participating in adapted sports will continue participating in regular activities.

You will be asked to complete a daily log of your exercise/sport activities using a provided paper or online template. You will also be asked to complete the following assessments at the beginning and end of the eight-week study period: an interview where you will describe your experience participating in adapted HIFT or and/or sport as well as self-care, productivity, and leisure activities. We will assess your basic human movements including your ability to squat, lunge, push, pull, hinge, brace, and rotate (as applicable). You will be asked to complete an online questionnaire to assess difficulty and self-confidence in performing 22 movements for functional daily activities, self-confidence and exercise enjoyment, health-related quality of life, and sport/exercise ability.

Photography/Video Information:

Please note that you may be photographed or videotaped during the assessment and exercise training sessions. These images and/or videos may be used to share information about the study on the FIT Lab website or when presenting study information at conferences or for publication.

Voluntary Participation:

Your participation in this research study is completely voluntary. If you feel uncomfortable for any reason, you may refuse to participate or withdraw your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to complete any of the measures.

Risks & Benefits:

There are minimal risks associated with this study, including potential loss of confidentiality. Those in the HIFT classes may experience an injury if proper form or modifications of exercises are not performed correctly. You may experience muscle soreness or fatigue from the exercise sessions; we will teach you appropriate stretching exercises as well as encourage you to get proper rest, nutrition and hydration. The physical literacy test and the workouts will be conducted by trained and certified personnel with previous experience. Each trainer is certified in first aid (including AED) and CPR. You may improve your quality of life, functional abilities and self-confidence. The information you provide will be beneficial to inform a larger, similar study.

Confidentiality

Study information that might identify you will be kept confidential to the extent allowed by law. Efforts will be made to keep your personal information confidential. All information that is sent outside of Kansas State University will have your name and other identifying characteristics removed, so that your identity will not be known. Every effort will be made to maintain the confidentiality of your participation in this project. Only members of the research team will have access to the data.

Questions

If you have any more questions after signing this you may contact Dr. Heinrich at (785) 532-7771 (office), (808) 457-9525 (cell), or kmhphd@ksu.edu. If you have any question about your rights as a research participant, you may contact Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

Consent

I verify that my typed signature below indicates that I have read and understood this consent form. I have been given the opportunity to ask questions and have received answers. I have also been emailed a copy of this consent form for my personal records. I consent to take part in this program evaluation research study as described.

Participant Typed Signature:

_____

Q2

Image Acknowledgement:

Effects of Sport and High-Intensity Functional Training on Adaptive Athletes' Quality of Life

I _____authorize Kansas State University to photograph my image for use in research, educational, and promotional programs.

- ○ Yes, I authorize the use of my image (1)
- ○ No, I do not authorize the use of my image (2)

Q4 In addition, I authorize Kansas State University to record me participating in exercise activities for use in research, educational, and promotional program

- ○ Yes, I authorize the use of my recordings (1)
- ○ No, I do not authorize the use of my recordings (2)

End of Block: Default Question Block

Appendix B - Measures

Adaptive Athlete Questionnaire

Start of Block: Demographics

Q33 Please answer the following questions to the best of your ability. This survey will take you at least 30 minutes to complete. The system will let you save your progress and complete the survey later, if needed. Thank you for your help in completing the survey!

Q1 Date of Birth (MM/DD/YYYY)

_____

Q2 Sex

- ○ Male (1)
- ○ Female (2)

Q3 Race

- ○ Aleut/Eskimo (1)
- ○ American Indian (2)
- ○ Asian/Pacific Islander (3)
- ○ Black (4)
- ○ White (5)
- ○ Other (6) _____

Q4 Ethnicity

- ○ Hispanic or Latino (1)
- ○ Not Hispanic or Latino (2)

Q5 Insurance (Please check all that apply)

- ☐ Worker's compensation (1)
- ☐ Self-pay (2)
- ☐ HMO/PPO/private insurance (3)
- ☐ Medicare (4)
- ☐ Medicaid (5)
- ☐ Auto (6)
- ☐ Other (7) _____

Q6 Education

- Less than high school (1)
- Some high school (2)
- High school graduate (3)
- Attended or graduated from technical school (4)
- Attended college, did not graduate (5)
- College graduate (6)
- Completed graduate school/advanced degree (7)

Q7 Please check the combined annual income of everyone in your household

- Less than $10,000 (1)
- $10,000 - $14,999 (2)
- $15,000 - $24,999 (3)
- $25,000 - $34,999 (4)
- $35,000 - $49,999 (5)
- $50,000 - $74,999 (6)
- $75,000 - $99,999 (7)
- $100,000 - $149,999 (8)
- $150,000 or more (9)

Q10 Employment/Work (Check all that apply)

- ○ Working full-time outside of home (1)
- ○ Working part-time outside of home (2)
- ○ Working full-time from home (3)
- ○ Working part-time from home (4)
- ○ Working with modification in job because of current illness/injury (5)
- ○ Not working because of current illness/injury (6)
- ○ Homemaker (7)
- ○ Student (8)
- ○ Retired (9)
- ○ Unemployed (10)
- ○ Other (11) _____

Q8 What is your occupation?

_____

Q9 Do you use a: (Check all that apply)

- ○ Cane? (1)
- ○ Walker, rolling walker, or rollator? (2)
- ○ Manual wheelchair? (3)
- ○ Motorized wheelchair? (4)
- ○ Other (5) _____

Q11 With whom do you live?

- ○ Alone (1)
- ○ Spouse/significant other (2)
- ○ Child/children (3)
- ○ Other relative(s) (4)
- ○ Group setting (5)
- ○ Personal care attendant (6)
- ○ Other (7) _____

Q12 Where do you live?

- ○ Private home (1)
- ○ Private apartment (2)
- ○ Rented room (3)
- ○ Board and care/assisted living/group home (4)
- ○ Homeless (with or without shelter) (5)
- ○ Long-term care facility (nursing home) (6)
- ○ Hospice (7)
- ○ Other (8) _____

End of Block: Demographics

Start of Block: Difficulty-Baseline

Q13 Please choose the level of difficulty you have for each activity today.

	Able to do without any difficulty (1)	Able to do with little difficulty (2)	Able to do with moderate difficulty (3)	Able to do with much difficulty (4)	Unable to do (5)	Not applicable (6)
1. Lying flat (1)	○	○	○	○	○	○
2. Rolling over (2)	○	○	○	○	○	○
3. Moving-lying to sitting (3)	○	○	○	○	○	○
4. Sitting (4)	○	○	○	○	○	○
5. Squatting (5)	○	○	○	○	○	○
6. Bending/stooping (6)	○	○	○	○	○	○
7. Balancing (7)	○	○	○	○	○	○
8. Kneeling (8)	○	○	○	○	○	○
9. Standing (9)	○	○	○	○	○	○
10. Walking-short distance (10)	○	○	○	○	○	○
11. Walking-long distance (11)	○	○	○	○	○	○
12. Walking-outdoors (12)	○	○	○	○	○	○
13. Climbing stairs (13)	○	○	○	○	○	○
14. Hopping (14)	○	○	○	○	○	○

15. Jumping (15)	○	○	○	○	○	○
16. Running (16)	○	○	○	○	○	○
17. Pushing (17)	○	○	○	○	○	○
18. Pulling (18)	○	○	○	○	○	○
19. Reaching (19)	○	○	○	○	○	○
20. Grasping (20)	○	○	○	○	○	○
21. Lifting (21)	○	○	○	○	○	○
22. Carrying (22)	○	○	○	○	○	○

Q14 From the previous list, choose the 3 activites you would most like to be able to do without any difficulty (for example, if you would most like to be able to *climb stairs, kneel,* and *hop* without any difficulty, you would choose: *1.* 13 *2.* 8 *3.* 14)

○ 1. (1) _____

○ 2. (2) _____

○ 3. (3) _____

Q15 From the previous list of three activities, choose the primary activity you would most like to be able to do without any difficulty (for example, if you would like to be able to *climb stairs* without any difficulty, you would choose: Primary goal. 13)

○ Primary Goal: (1) _____

Q16 Please choose the level of confidence you have for doing each activity today.

	Fully confident in my ability to perform (1)	Very confident (2)	Moderate confidence (3)	Some confidence (4)	Not confident in my ability to perform (5)	Not applicable (6)
1. Lying flat (1)	○	○	○	○	○	○
2. Rolling over (2)	○	○	○	○	○	○
3. Moving-lying to sitting (3)	○	○	○	○	○	○
4. Sitting (4)	○	○	○	○	○	○
5. Squatting (5)	○	○	○	○	○	○
6. Bending/stooping (6)	○	○	○	○	○	○
7. Balancing (7)	○	○	○	○	○	○
8. Kneeling (8)	○	○	○	○	○	○
9. Standing (9)	○	○	○	○	○	○
10. Walking-short distance (10)	○	○	○	○	○	○
11. Walking-long distance (11)	○	○	○	○	○	○
12. Walking-outdoors (12)	○	○	○	○	○	○
13. Climbing stairs (13)	○	○	○	○	○	○

14. Hopping (14)	○	○	○	○	○	○
15. Jumping (15)	○	○	○	○	○	○
16. Running (16)	○	○	○	○	○	○
17. Pushing (17)	○	○	○	○	○	○
18. Pulling (18)	○	○	○	○	○	○
19. Reaching (19)	○	○	○	○	○	○
20. Grasping (20)	○	○	○	○	○	○
21. Lifting (21)	○	○	○	○	○	○
22. Carrying (22)	○	○	○	○	○	○

End of Block: Difficulty-Baseline

Start of Block: Self Confidence for Vigorous Exercise

Q22
"Vigorous" exercise includes activities like jogging, running, fast cycling, aerobics classes, swimming laps, singles tennis, and racquetball. These types of activities usually increase your heart rate, make you sweat, and you get out of breath. (Do not count weight lifting.)

Q17 This section is about doing vigorous exercise in different situation. For each item, **please mark how sure you are that you could exercise vigorously in that situation**.

Q18 Select one answer for each item.

	I'm Sure I Cannot (1)	I Believe I Cannot (2)	Maybe I Can (3)	I Believe I Can (4)	I'm Sure I Can (5)
Exercise vigorously even though I am feeling sad or highly stressed (1)	○	○	○	○	○
Stick to my vigorous exercise program even when family or social life takes a lot of time (2)	○	○	○	○	○
Set aside time for regular vigorous exercise (3)	○	○	○	○	○

Q19 I enjoy doing vigorous physical activity

- ○ strongly disagree (1)
- ○ somewhat disagree (2)
- ○ neutral (3)
- ○ somewhat agree (4)
- ○ strongly agree (5)

Q20 I enjoy the feeling I get while doing vigorous activities.

- strongly disagree (1)
- somewhat disagree (2)
- neutral (3)
- somewhat agree (4)
- strongly agree (5)

Q21 I enjoy the feeling I get after doing vigorous activities.

- strongly disagree (1)
- somewhat disagree (2)
- neutral (3)
- somewhat agree (4)
- strongly agree (5)

End of Block: Self Confidence for Vigorous Exercise

Start of Block: Self Confidence for Moderate Exercise

Q23
"Moderate" physical activity includes activities like brisk walking, gardening, slow cycling, or dancing. A moderate physical activity is any activity that takes moderate physical effort and makes you breathe somewhat harder than normal.

Q24
This section is about doing moderate physical activity in different situations. For each item, **please mark how sure you are that you could do moderate physical activity in that situation**.

Q25 Please choose one answer for each item.

	I'm Sure I Cannot (1)	I Believe I Cannot (2)	Maybe I Can (3)	I Believe I Can (4)	I'm Sure I Can (5)
Do moderate physical activity even though I am feeling sad or highly stressed (1)	○	○	○	○	○
Stick to my program of moderate physical activity even when family or social life takes a lot of time. (2)	○	○	○	○	○
I will set aside time for regular moderate physical activity (3)	○	○	○	○	○

Q26 I enjoy doing moderate physical activities.

- ○ strongly disagree (1)
- ○ somewhat disagree (2)
- ○ neutral (3)
- ○ somewhat agree (4)
- ○ strongly agree (5)

Q27 I enjoy the feeling I get while doing moderate physical activities.

- strongly disagree (1)
- somewhat disagree (2)
- neutral (3)
- somewhat agree (4)
- strongly agree (5)

Q28 I enjoy the feeling I get after doing moderate physical activities.

- strongly disagree (1)
- somewhat disagree (2)
- neutral (3)
- somewhat agree (4)
- strongly agree (5)

End of Block: Self Confidence for Moderate Exercise

Start of Block: Block 5

Q34
This assessment asks how you feel about your quality of life, health, or other areas of your life. **Please answer all the questions.** If you are unsure about which response to give to a question, **please choose the one** that appears most appropriate. This can often be your first response.

Please read each of the following questions, assess your feelings, and circle the number on the scale for each question that gives the best answer for you.

Q35
How would you rate your quality of life?

- ○ Very poor (1)
- ○ Poor (2)
- ○ Neither poor nor good (3)
- ○ Good (4)
- ○ Very good (5)

Q36 How satisfied are you with your health?

- ○ Very dissatisfied (1)
- ○ Dissatisfied (2)
- ○ Neither satisfied nor dissatisfied (3)
- ○ Satisfied (4)
- ○ Very satisfied (5)

Q37 The following questions ask about **how much** you have experienced certain things in the last two weeks.

	Not at all (1)	A little (2)	A moderate amount (3)	Very much (4)	An extreme amount (5)
To what extent do you feel that physical pain prevents you from doing what you need to do? (1)	○	○	○	○	○
How much do you need any medical treatment to function in your daily life? (2)	○	○	○	○	○
How much do you enjoy life? (3)	○	○	○	○	○
To what extent do you feel your life to be meaningful? (4)	○	○	○	○	○
How well are you able to concentrate? (5)	○	○	○	○	○
How safe do you feel in your daily life? (6)	○	○	○	○	○
How healthy is your physical environment? (7)	○	○	○	○	○

Q38 The following questions ask about **how completely** you experience or were able to do certain things in the last two weeks.

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

Q39 How well are you able to get around?

- Very poor (1)
- Poor (2)
- Neither poor nor good (3)
- Good (4)
- Very Good (5)

Q40 The following questions ask you to say how **good or satisfied** you have felt about various aspects of your life over the last two weeks.

	Very dissatisfied (1)	Dissatisfied (2)	Neither satisfied nor dissatisfied (3)	Satisfied (4)	Very satisfied (5)
How satisfied are you with your sleep? (1)	○	○	○	○	○
How satisfied are you with your ability to perform your daily living activities? (2)	○	○	○	○	○
How satisfied are you with your capacity for work? (3)	○	○	○	○	○
How satisfied are you with yourself? (4)	○	○	○	○	○
How satisfied are you with your personal relationships? (5)	○	○	○	○	○
How satisfied are you with your sex life? (6)	○	○	○	○	○
How satisfied are you with the support you get from your friends? (7)	○	○	○	○	○
How satisfied are you with the conditions of your living place? (8)	○	○	○	○	○

How satisfied are you with your access for health services? (9)	○	○	○	○	○
How satisfied are you with your transport? (10)	○	○	○	○	○

Q41 **How often** do you have negative feelings such as blue mood, despair, anxiety, depression?

- ○ Never (1)
- ○ Seldom (2)
- ○ Quite often (3)
- ○ Very often (4)
- ○ Always (5)

End of Block: Block 5

Start of Block: Sport / Exercise Ability

Q29
Using the scale below, rate how confident you are that you can perform each of the activities identified. Note that the scale ranges from 0 (I cannot do this activity at all) to 10 (I am certain that I can do this activity successfully). You may use any number between 1 and 10.

Q30 Practice a sport that requires effort

Cannot do this at all			Moderately certain I can do this			Certain I can do this successfully

	0 10
Practice a sport that requires effort. ()	
Compete in a sport that requires accuracy. ()	
Do physical exercises that require resistance. ()	
Do physical exercise or compete in a sport that requires agility. ()	
Avoid obstacles in a race. ()	
Do physical exercises or compete in a sport that requires coordination. ()	
Do physical exercises or compete in a sport that requires balance. ()	
Do physical exercises or compete in a sport that requires strength. ()	

End of Block: Sport / Exercise Ability

Appendix C - Recorded Workouts

Intervention Facilitator 2 WODS

9-Oct

A) Cardio Warm-Up

10 Sets of 30 Seconds on

B) 10 Round EMOM

Mixed Ball Toss with Partner

Sit-Ups

24-Nov

B) 10,9,8,7...,3,2,1

DB Hang Power Clean> DB Power Clean > Barbell DL Hang Power Clean

Assisted Burpee > Burpee > Burpee over Bar (Seated: Dips (.5))

Nov-31

10 Rounds

3 Heavy Strict Movements. Deadlift or Strict Press.

8-Dec

10 Rounds

1 min - Cardio of choice

5-10 DB Clean to Strict Press

15-Dec

1 min - Cardio of Choice

20 Ball Tosses

Participant 2 WODS

Date (MM/DD/YY)	Activity (exercise, workout or sport)	Duration of Activity	Weight Used (if applicable)	Output (repetitions, score, statistics, distance traveled, etc)
10/9/2017	weight lifting	1 hour		back squats 135x8 , box pistols 4x8, DB bench 4x(8-10) -55lbs, 3x max set pull ups
10/11/2017	weight lifting	1 hour		front squats 135x5, overhead squat 4x6-45lbs, glute raises

			4x8, pull downs 4x10-12, dips 3x max reps
10/13/2017	weight lifting	1 hour	hang cleans 115x5, db split squats 4x8-30lbs, push jerk 4x3 - 115lbs, db row 4x8-65lbs cable curl 3x12-15, flutter kicks 3x30
10/16/2017	weight lifting	1 hour	clean from floor 6x3, squat jerk 6x2, split squat 4x15, rows 4x15, preacher curl 4x10, adductor machine 3x20
10/18/2017	weight lifting	1 hour	front squats 5x5 increase weight, box jumps 3x15, hip extension 4x10, bench press 4x8, pulldowns 4x12, dips 3x max reps
10/20/2017	weight lifting	1 hour	back squats 5x5 increasing weight, single leag deadlift 4x8, hamstring curl 3x10, incline db bench 4x15, pull ups 3x max reps, abductor machine 3x20
10/24/2017	weight lifting	1 hour	front squats 5x5 increasing weight, box jumps, hip extension 4x10, bench 4x8, pulldowns 4x12, dips 3x max repsabductor machine 3x20
10/25/2017	weight lifting	1 hour	deadlift 205x2/2/2, broad jumps 4x8, step ups 4x8, leg press single leg 3x12-15, handstand hold against wall 4x30 sec, hanging leg raises 3x25
10/31/2017	weight lifting	1 hour	back squat 205x 2/2/2, good morning 4x8, hamstring curls 3x15, db bench 4x8-10 - 55lbs, pull ups 3x max reps with good form, tricep pressdown 3x12-15
11/1/2017	weight lifting	1 hour	
11/9/2017	weight training	1 hour	Out of town for fundraiser
11/10/2017	weight training	1 hour	out of town for fundraiser

Participant 6 WODS

10/13/2017	SWIM	35min	2250 yards
10/14/2017	Bike	6hr 7m	71.2miles
15-Oct	bike	7hrs	87.4m
16-Oct	Bike	4hr 41m	67.1m
17-Oct	Bike	3hr	35.9m
18-Oct	Bike	6hr	86.9m
19-Oct	Bike	6hr	82.8m
20-Oct	Bike	3hr 30m	55m
21-Oct	swim	35m	1600y
23-Oct	Crossfit	1hr	
24-Oct	Swimming	1.15 hrds	3800 yards
25-Oct	Crossfit	1hr	
27-Oct	Bike	50m	HARD
28-Oct	Walk	10miles	Easy Walk
30-Oct	Crossfit	1hr	
31-Oct	Swim	1hr 15m	3525 yards
1-Nov	crossfit	1hr	24m AMRAP10 kipping swings, 10hang powr cleans r85 s55,10 squats, 10 box jumps r24 a20 11rounds +23
1-Nov	Ride Bike indoor	1hr	18miles
3-Nov	Rike Bike Indoor	1.15hr	22miles
4-Nov	Crossfit		
5-Nov	Run	43m	4.5m
6-Nov	Crossfit		14m AMRAP; 10TTB, 6 RENEGADE ROWS,1o weighted step ups, 10lbsx2 . each took ~3.45m
7-Nov	Swim	1.15hr	3520 yrds
8-Nov	crossfit	1hr	team work out - 100 alt db snatch, 50 hand release push ups, 100 calorie row, 50 altern DB Snatch , 25 HR P-U, 50 calorie row
	Ride Bike	1hr	
8-Nov	Indoor	30min	27miles
9-Nov	Swim	1hr	3500yard
10-Nov	Run	40min	4miles
10-Nov	Core/Strenght	30min	
11-Nov	Walk	90m	4miles

11-Nov	Crossfit Casual	90m		
12-Nov	Swim	1rh30		5000 yards
13-Nov	Crossfit	1hr		20/15/10/5;burpee box jump over, KBS 35LBS, kipping toes to elbow. 17:35
14-Nov	swim	1hr 15m		3600 yards
14-Nov	run	30min		3miles
15-Nov	Crossfit	1hr		HARD
15-Nov	Indoor Cycling	90min		HARD-27miles
16-Nov	swim	90min		3350 yrds
17-Nov	swim	40m		2000yrds
18-Nov	cycling outdoors	3hs		25MILES
19-Nov	RUN	52min		5.5miles
20-Nov	Crossfit	1hr	18m	wallballls, Kipping PU, lunge, plate burpe, ski row
21-Nov	off			
22-Nov	off			
23-Nov	run	90m		9.5miles
24-Nov	crossfit	1hr		
25-Nov	Run	40m	4miles	Easy
26-Nov	run	42min	4.2	hard
27-Nov	crossfit	1hr		hard
28-Nov	swim	75min	3500yrds	hard
29-Nov	crossfit	1hr		hard
29-Nov	Cycle	90min	27miles	hard
30-Nov	swim	75min	3500yrds	hard
3-Dec	run	52MIN	5MILES	hard
12/4/2017	crossfit	1hr		hard
6-Dec	crossfit	1hr		hard
7-Dec	swim	1hr	2800yards	hard
8-Dec	swim	1hr	3k	hard
8-Dec	run	30m	3m	hard
9-Dec	bike	2hrs		casual

Participant 10 WODS

9-Nov	Crossfit Workout - AMRAP 8 backward lunges, 16 step ups, 8 kipping swings, 90 cal row GHD - 13 sit ups every minute for 5 min	5-Dec

11-Nov	Crossfit workout: 10 sit ups, 10 Pushups, 16 weighted squats (18lbs), 1-2 min plank hold	20 min
13-Nov	Crossfit Workout - 20, 15, 10, 5. burpee to jumps, kettlebell swings (18lbs), toes to bar	25 min
15-Nov	Crossfit Workout - EMOM Wall Balls (10lbs), kipping pull ups, push ups (green band), burpee to snatch (25lbs), max cal row. Second half - weighted sit ups (5 min)	18 min /5 min

26-Oct	crossfit workout - 12 min AMRAP 10 step back lunges, 10 burpee deadlifts, 10 step ups (15 inches). 5 minutes tabata midline work
19-Oct	crossfit workout - 20 min amrap. 5 pushups, 10 burpees, 15 air squats

Participant 12 WODS

Date (MM/DD/YY)	Activity (exercise, workout or sport)	Duration of Activity	Weight Used (if applicable)	Output (repetitions, score, statistics, distance traveled, etc)	Notes
10/9/2017	Crosssfit workout-warmup: 3 sets of L-hangsX30 sec, clean n jerk, feet to bar x10. workout 5X5 front squat. 20-15-9 burpees 200m run	1hr	clean n jerk 25ilbs. front squat w/35ilbs		
10/10/2017	rest day				good workout. 200m run in between each set of burpees. focus was on form with light weight

10/11/2017	single leg star balance drill. kettle bell front squat. banded bridge single leg squat max reps. single leg pistols 2 min amrap 3 rounds. aerodyne 2 min max	1hr	front squat 35, 45, 60.	bridge and front squat 3x8. singl leg max rep left(prosthetic)30 right 20. aerodyne 53 calories .8 miles	
10/12/2017	modo yoga	1hr	NA	modo yoga	star drill 1 min per side with 4 rounds. really helped stretch before workout
10/13/2017	stationary bike	25 min	NA	level 9	
10/14/2017	rest day				
10/15/2017	rest day				
10/16/2017	Front Squat 6 x 3 fight gone bad. (2 rounds) 1 min per. Wall ball. Sumo DL high pulls. Step ups. Push Press. Row. Rest		Front squat 135, 155, 175./ wall ball 20lbs/ sumo DL 35lbs KB, push press barbell 75lbs		
10/17/2017	Hot power fusion yoga	1 hr		corepower	

10/18/2017	single arm kettle bell banded squats 3 x 8 per side. interval training 1 min per round. 4 x 10 meter sprint and backpedal, hollow rocks, 10 x pushups + 10 shoulder taps	interval 15 min	kettlebell banded squats 15lbs, 20 lbs		
10/19/2017	rest day				
10/20/2017	surf session	45 min			
10/21/2017	rest day				
10/22/2017	3 mile hike				
10/23/2017	surf session	1 hr			
10/23/2017	CF workout single leg kettle bell deadlift 3x8 with 10 m overhead carries. 3 rounds of 1 min rows. 10 min AMRAP push press, L-hang ascends	1 hr	single leg DL 30 LBS. push press 35 LBS	AMRAP made it through 6 rounds	
10/24/2017	yoga	1hr			

10/25/2017	CF workout warmup: wallball chest pass, granny pass, wallball pass, twist pass. strength: 50 m zercher sand bag carries x 3. Superset-10 L/R Lateral ball toss.. Conditioning: 21-16-12-9 pull ups, Ring dips.	1hr	wall ball-16LBS. sand bag carries-80lbs. ball toss- 20lbs		
10/26/2017	rest day				
10/27/2017	50 pull ups 50 pushups				
10/30/2017	CF warmup 200m single arm farmer carry. Mobility- hip rotation and stretching. 2 rounds of extension holds and hollow holds. Strength- 3x5 back squat barbell. conditioning- 5 rounds for time 12 seated wallballs, 8 plank walks	1hr	farmer carry-50lbs kettlebell. back squats 135,155, 185. wallballs 20lbs	extension holds/hollow holds 4x20seconds. conditioning finished in 5m 50 seconds	
10/31/2017	rest day				

11/1/2017	CF workout. Warm up; row 2 rounds 50 sec normal 10 sec fast. Strength; superset single arm L/R neutral bench /single arm bent over rows L/R 10 sets 3 rounds. conditioning;10 min AMRAP 200 meter run with weighted ball, 15 sec hang on pull up bar, 12 hanging high knees on bar, 12 kettle bell swings.	1hr	single arm bench and rows- 40lbs, 45lbs, 50lbs. 200m run- 20lbs medicine ball. kettlebell swings 50lbs.		
11/2/2017	Hot power fusion yoga	1hr			
11/8/2017	warmup: 10 min stationary bike. strength: Single arm suitcase DB deadlift conditioning: AMRAP 10min: 10 cal. row, 15 push ups, 5 X DB Clean and press.	40 min	single arm DB deadlift 50,65,70. DB clean and press: 40	AMRAP 3 rounds plus 5 cal row	
11/9/2017	hot yoga	1hr			
11/14/2017	yoga	1hr			

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