A mixed methods investigation into the impact of wheelchair fencing on quality-of-life and perception of disability.

Occupational Therapy Doctoral Capstone

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Abstract

Background: Adaptive sports are an essential resource for individuals with disabilities. They expose the general population to individuals with disabilities and help break down barriers. Current research supports the use of adaptive sports to improve socialization, mental health, and physical health. However, very little research exists surrounding the adaptive sport of wheelchair fencing.

Purpose: The purpose of this capstone is to investigate the quality-of-life impacts wheelchair fencing has on both able-bodied and disabled athletes in the short-term and long-term. Quality of life will be measure through physical health (reported functional outcomes, pain levels, stamina, and sleep quality), social participation, mental health (reported happiness, self-confidence, anxiety, and future mindset), and cognition (problem solving and attention). In addition, this capstone worked on establishing programs in New York and New England and established program development outlines.

Methods: This study is a mixed method design combining a quantitative survey with a qualitative phenomenological research design method. Semi-structure interviews were conducted and analyzed through in vivo coding to identify themes.

Participants: Participants were individuals who were currently active in fencing or retired from fencing, who had experience with wheelchair fencing. Participants were recruited through snowball and convenience sampling via an email blast. Thirty-five individuals participated in the survey process and twenty-five individuals participated in the semi-structure interview portion of the study.

Results: *Quantitative data:* No correlation between age, gender, and fencing experience. Most participants noted they are greatly affected by pain, have a positive mind-set about the future, have a lot of self-confidence, have access to multiple leisure activities, have disabled friends, and are satisfied with their social needs, physical health, quality-of-life, mental health, endurance, and access to sports. A majority of able-body participants noted that wheelchair fencing improved their technical skill, changed how they viewed disability, and benefited from wheelchair fencing while injured. Data showed that fencing was different from other sports and is desired due to the individuality of the sport, community, and mental aspects of the sport. *Qualitative data* also supported the quantitative data. Three main themes with ten sub-themes were identified. 1. Why fencing: a. Mental Challenge, b. Provides both individual and team dynamics, and c. Longevity of participants. 2. Impact on able-bodied participants: a. Appreciation and awareness of adaptive sports, b. Skill improvement, and c. Improvement of mental health while injured. 3. Quality-of-life impacts on disabled participants: a. Improved physical health, b. Access to a supportive community, c. Improved cognitive processes, and d. Improved mental health.

Conclusions: In terms of impacts it was found that wheelchair fencing significantly improved the physical health, mental health, socialization, and cognitive processes of disabled participants. In addition, this research found that the main draw to fencing are the mental game, community, and longevity of the sport for all populations of individuals. Wheelchair fencing was also shown to have positive impacts on able-bodied peers who trained with wheelchair fencers. These positive impacts were improved technical skill and changes in the view of disability and adaptive sports.

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Special Notes:

IRB approval for this research project can be found in Appendix A

Chapter 1: Introduction

Background

The *Healthy People 2030* statement focused on well-being for all. Exercise, health management, social participation, and leisure pursuits all contribute to well-being (*Healthy People 2030*, 2021). Sports are a means of social participation, leisure pursuit, and health management; however, sports opportunities are not as readily available to the disabled community as their able-bodied peers. Disability is defined by the CDC as "any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities and interact with the world around them" (Centers for Disease Control and Prevention [CDC], 2021). This definition aligns with occupational therapy philosophy that disability is based in the context of the task, person, and environment. 9% of Connecticut's adult population have a mobility disability, 10% have a cognitive impairment, and 5% have a disability that impairs independent living (CDC, 2021). Similarly, New York has 13% of the adult population living with a mobility disability, 10% with a cognitive disability, and 7% have a disability that impairs independent living (CDC, 2021). In both New York and Connecticut, the rate of obesity, smoking, diabetes, and heart disease are higher in the disabled population in comparison to populations who do not have a disability (CDC, 2021).

The CDC found that less than half of the disabled population participates in aerobic activities, leading to higher rates of cancer, stroke, diabetes, obesity, and other health conditions (CDC, 2021). A 2007 study found that about 12% of the school age population lived with a disability and noted significant health disparities in this population (Rimmer et al., 2007). Access to physical activity can be done through accessible community areas, individual training plans, community programming, independent programs, or outpatient services. However, a 2005 study

found that many public recreational facilities were not in compliance with FDA and ADA regulations and were not set up to or trained to have their programs accessible, which limits participation (Rimmer, 2005). Adaptive sports programming is one of the options for the disabled population to receive exercise, along with social participation, and other occupations. Wheelchair or para-fencing is one such adaptive sport.

Developing more adaptive sports opportunities will help provide the community with more opportunities to pursue sports and fitness. Sports are a leisure pursuit and help promote social participation, which combined with fitness leads to increased quality of life in the participants. Occupational therapists bring a unique background and skill set to working with adaptive-sports due to their focus on helping clients adapt and thrive. The focus of this research paper is on wheelchair fencing. Currently throughout the Northeast there are very minimal clubs offering this option to their community. Wheelchair fencing is a very adaptive sport and can cater to a very wide range of disabilities.

Fencing can help improve fine motor control, body awareness, problem solving, concentration, and balance as these are key tenants to success in the sport. Fencing is different than other sports because it is as much of a mental game as it is a physical one. In the sport of fencing the athletes must be able to assess the situation and make appropriate changes in a short amount of time. The variables of a fencing bout are affected by what the athlete can perform, what their opponent is doing, and how the referee is determining touches. The sport challenges the athletes to solve problems and allows for the athletes to develop their own unique style.

Population Information

The populations that utilize wheelchair fencing the most are those with amputations or limb deficiencies, spinal cord injuries (both acquired and traumatic), brain injury (both traumatic

and acquired), and cerebral palsy. In the United States there are about 17,810 new spinal cord injuries every year (National Spinal Cord Statistical Center, 2020). There are an estimated 2 million people in the United States living with a loss of a limb as of 2017, with about 185,000 occurring every year (Amputee Coalition, 2017). Cerebral palsy is the most common motor disability in children and is seen in 1/345 children, resulting in mobility, cognitive, and other difficulties (Centers for Disease Control and Prevention [CDC], 2020). Yearly there are 1.5 million people who sustain a traumatic brain injury, with between 80,000 to 90,000 of those individuals experiencing long term disability (Centers for Disease Control and Prevention [CDC], 2016). There is a large community of individuals with disabilities and adaptive sports can be crucial to their quality-of-life.

Currently, the participation of individuals in physical activity falls under the responsibility of the individual themselves. Practitioners and sports programmers can build the programs but cannot force people to participate in the programs. Individuals must be motivated to participate in physical exercise or sports. Additionally, insurances often do not pay for adaptive sports programming as part of the rehabilitative process, putting more of the responsibility on the individual themselves to seek out these opportunities.

Social Significance

Medical expenses and secondary impacts of disability have a large impact on the financial status of a country. In 2015, the medical expenses of disability accounted for 36% of all healthcare expenses (CDC, 2021). Medicare paid $324.7 billion dollars, Medicaid paid $277.2 billion, and non-public sources paid $266.1 billion on disability related health costs (CDC, 2021). Disability related health conditions lead to a large strain on the USA economy and

impacts the country's debt. Improving physical activity opportunities can lead to reduced secondary health conditions, such as obesity, and eventually lead to a decrease in the economic impact it has on the country as the disabled population has access to more physical activity opportunities.

As disparities between access to opportunities and participation in occupations remain in the disabled community, society will be impacted. As health and access disparities remain, less people can contribute to society. Individuals who can go to work can contribute to the workforce, volunteer to help the community, and bring unique perspectives on projects. Individuals with disabilities can contribute to the sports community, when given the opportunity. More athletes competing at a higher level means more opportunities for the USA to have representation at the international level. Healthier individuals can contribute more to the workplace and society. Research has shown positive correlations between participation in adaptive sports and increased employment, return to work, and or job performance (Lastuka & Cottingham, 2015). In summary, society benefits from all individuals being able to contribute to it and adaptive sports is one of the tools that can be utilized to help individuals build the skills needed to return to work.

Access to physical activities improves the individual's participation in life and their occupations. Having sports opportunities can decrease their risk of secondary complications such as obesity and heart disease (CDC, 2021). Adaptive sports have been found to improve functional mobility and independence in individuals with spinal cord injuries (Hanson et al., 2001). As an individual has more opportunities to pursue leisure pursuits, explore their own motivations, and goals, there is an increased ability to self-actualize and live independently. A global review found that with as little as one hundred and fifty minutes of physical activity a week can have a positive impact on both mental and physical health (Ginis et al., 2021). Sports

offer an intriguing and motivating approach to participating in physical activity. Sports play into an individual's inner drive and help strengthen an individual both physically and mentally. Often individuals with disabilities are occupationally deprived when it comes to independence, leisure pursuits, and health management; however, adaptive sports programming can help fill this gap.

Significance to OT

Currently, there is a wide variety of research on the impacts of adaptive sports on the disabled population, with there being some studies on specific conditions and programs. However, there are only a handful of studies conducted by occupational therapists about adaptive sports in conjunction with occupational therapy services. Leisure is an important area of occupational intervention and can lead to an improved quality of life in individuals. Studying and implementing adaptive sports programs through an occupational therapy lens is important for future practice because it is currently an underutilized resource, despite the considerable data showing its positive impacts it has on individuals with disabilities in quality of life, functional mobility, and independence. A breakdown of current studies and their findings can be found in Chapter 2: Literature Review.

Stakeholders

Information on stakeholders and the developmental process of this project can be found in Appendix B.

Chapter 2: Literature Review

Introduction

The purpose of this literature review is to establish what current research-based evidence there is regarding adaptive sports impacts on quality of life, fencing, and on the benefits of sports on occupational performance. This literature review will be used to build the background and identify the gap in the literature surrounding adaptive sports to help facilitate an adaptive sports-based capstone experience. The capstone is composed of two parts focused on wheelchair fencing, also called para-fencing. The first part of the capstone is on the establishment of a program and developing group protocols on how to develop para-fencing programs out of current fencing programs. The second part of the capstone is using a qualitative design to study the short-term and long-term impacts of para-fencing on the quality of life in the athletes who participate in para-fencing. Quality of life throughout the capstone will be defined by social participation, cognition, mental health, and physical health.

Sports Impacts on Occupational Performance

The impacts of sports on occupational performance, mental health, and physical health have been an area of interest in the world of sports and therapeutic medicine due to the prevalence of sports in individuals' communities and lives. Recent studies have investigated the impact sports have on quality of life, mental health management, social participation, and behavioral impacts. Younger populations, individuals under twenty-one, who participate in sports have a higher reported quality of life when compared to non-active peers (Snedden et al., 2018; Vella et al., 2014). Additionally, PTSD and depression symptoms that lead to mental health declines were decreased through sports interventions (Chekroud et al., 2018; Rogers et al., 2014). Sports have also been linked to increased social participation and positive behaviors, such as

decreased antisocial behaviors and play skills (Cahill et al., 2020; Costalonga et al., 2020; Lopez & Kume, 2018). Sports in general have the potential to be a great resource for improving quality of life in individuals, but there are still many gaps in the current research surrounding this topic, such as, long-term impact studies and studies including large population sizes.

Snedden et al. investigated the correlation between mental health, physical health, and activity level/sports (2018). The research found that undergraduate students displayed a positive correlation between mental health components on the Veterans RAND 12 health survey. The study displayed a link between sports and fitness with improved mental health. While the research showed some correlation between physical components and the Veterans RAND 12 health survey, the statistical significance was not strong enough to support these observations (Snedden et al., 2018). Responder's bias could have skewed these results, as individuals involved in sport were noted to be more likely to respond to the survey. Vella et al. had similar bias concerns. The study followed the same group of children over a five-year period to see the impacts sports had on their quality of life the longer they stayed in the sport. Those who stayed in sports had a higher reported quality of life (Vella et.al, 2014). However, a limitation of this study is that the quality of life is reported by the parents and parents may score their children higher out of personal bias. This should be considered during future research and determining appropriate evaluation tools that can remove the bias potential is recommended.

Rogers et al. conducted a feasibility study investigating the impacts sports based occupational therapy care had on client outcomes in clients with post-traumatic stress disorder (PTSD). Five four-hour sessions were conducted using surfing and focused group processing. The study showed that there was a significant reduction in symptom severity of PTSD, higher group retention, and more opportunities for success due to the programs focusing on

goal-oriented tasks (Rogers et al., 2014). This study is a good starting point for justifying sports-based interventions for improving mental health, but also group retention. Individuals with PTSD are less likely to stay in mental health groups but incorporating sports into the therapy retained more individuals throughout the intervention process (Rogers et al., 2014). Using this, more interventions should be sports and goal oriented to promote higher retention and better outcomes for clients. This study was small in sample size and more studies to confirm these findings are suggested. Chekroud et al. utilized CDC data and balanced the study groups, to attempt to eliminate external biases, to investigate trends between mental health burden and exercise levels (2018). After applying multiple sensitivity analyses to reduce bias impacts on the study they found that there were 1:49 fewer poor mental health days in those who exercised than those who did not (Chekroud et al., 2018). Study outliers highlighted that the demographic variable has a large impact on mental health, which can impact outcomes. It is difficult to eliminate demographic impacts on mental health outcomes; therefore, future research groups should be broken down by specific demographics to identify trends. This would acknowledge demographic impacts and give a fuller image of what the true correlation is.

Cahill et al., performed a literature review to complete a meta-analysis on occupation-based interventions outcomes (2020). The review contained 32% level one studies and 36% level two studies. Social participation, mental health, and positive behaviors were the target outcomes and only three areas impacted all three categories: sports, life skills, and yoga. Sports impacts on mental health had mixed outcomes; however, for antisocial behaviors there was a significant decrease in the behaviors following sports interventions (Cahill et al., 2020). Likewise, social participation improved in sports interventions (Cahill et al., 2020). Costalonga et al., also performed a literary review and found similar findings as Cahill et al.'s review. They

found that there were positive correlations between participation in leisure and positive outcomes when sports interventions were used (Costalonga et al., 2020). These studies outline multiple studies and indicate where gaps in the literature for sports and occupational performance interactions are. Research lacks in this area and often contains small study sizes. It is recommended that more studies are conducted, including studies that go further into detail on social participation and positive behavioral outcomes.

Lopez and Kume's study had a small sample size but looked specifically into sports impacts on children with autism spectrum disorder (2018). The study found an inclusive sports and occupation-based sports program led to significantly increased improvements in socialization, play, leisure skills, and adaptive behaviors. Improvements in other areas of life were also noted, but due to the sample size did not hold any statistical significance (Lopez & Kume, 2018). It is recommended that this model be utilized in large programs and continued to be investigated. The application of an inclusion model can allow more individuals to participate in sports regardless of cognitive and physical capabilities. Adaptive sports are inclusive and require further research surrounding their impacts on quality of life.

Adaptive Sports Impacts

Adaptive sports provide opportunities for individuals with disabilities to pursue sports, like their able-bodied peers, using adaptive equipment and accommodations. Adaptive sports research, like sports research, on quality of life requires more research. Available current research investigated the impacts adaptive sports had on quality of life, through looking at social participation, self-perception, physical health, cognition, and other occupational areas. Adaptive sports have been linked to improved physical health in participants (Declerck et al., 2019; Nagata et al., 2018; Feitosa et al., 2017). Improved social participation was seen in adaptive sports

interventions (Brown et al., 2020; Dimitropoulou et al., 2019; Nagata et al., 2018; Lastuka & Cottingham, 2015). Cognition, improved employment outcomes, and improved sense of self were also associated with adaptive sports interventions or participation (Brown et al., 2020; Declerck et al., 2019; Lastuka & Cottingham, 2015). Adaptive sports research shows the benefits of this opportunity on participants' lives; however, the studies are often small and need further research to support the research findings.

Declerck et al. performed a systematic review and analysis of individuals' engagement with adaptive sports and the impacts it had on their lives. Studies focusing on acquired neurologic conditions, spinal cord injury, stroke, and multiple sclerosis were analyzed. The analysis concluded that adaptive sports programming had higher compliance then other interventions in these populations and across the board there was improved muscle function, movement, functional mobility, and improved independence (Declerck et al., 2019) Decreased carotid thickness and slowed heart disease was noted in spinal cord patients who did sports post injury and rugby players with tetraplegia displayed improved pulmonary functions (Declerck et al., 2019). Similarly, a stroke group found that adaptive cycling improved cardiopulmonary health, with improved resting heart rates and improvements sin physical resilience (Nagata et al., 2018). Feitosa et al. found that adaptive soccer and swimming programs designed for children with cerebral palsy improved the participants mobility, upper extremity functions, global functions, and improved pain levels (2017). Overall, these studies support the idea that adaptive sports have positive health impacts on the participants and can lead to improved quality of life and independence through improving pain, functional mobility, and decreasing the risk of secondary conditions.

Qualitative interviews of participants and their families in a local adaptive sports program showed that there was an improved perceived change in self-efficacy, social impact, and social participation after participating in the adaptive sports program (Brown et al., 2020). Dimitropoulou et al. is another small study that did not produce significant statistical data for physical outcomes in cerebral palsy participants, in the GAME ON program, but found that there were high impacts on social participation and engagement (2019). Social participation was also improved in wheelchair rugby and basketball. Lastuka and Cottingham surveyed players at the national tournaments in 2014 and found that there were reported improvements in social participation and social benefits once the individuals joined an adaptive sports program (2015). Nagata et al. found that adaptive cycling improved social occupations in participants, 55% reported improvement in their socialization and their social occupations (Nagata et al., 2018). Overall, there is some evidence that adaptive sports improve social participation in participants, but the current research is not strong. This topic needs more investigation to confirm the current findings surrounding socialization and adaptive sports.

Sense of self was found to be improved through empowerment of self, holistic enhancements, and disability perception changes in the adaptive sport program studied by Brown et al. (2020). Sense of self was also improved in the national wheelchair rugby and basketball players, through reported improvements in employment and confidence (Lastuka & Cottingham, 2015). Golf and yoga programs were found to improve cognitive performance in stroke patients, specifically visual spatial skills, selective attention, and global cognition (Declerck et al., 2019). Sense of self and cognitive impacts is often a secondary finding in research studies, and it is recommended that future research focus just on cognitive and self-perception changes in adaptive sport participants.

Current Fencing Research

Fencing is a niche sport that has not been focused on in research extensively; however, current research on the sport has focused on muscle usage, common injuries, and desired skills for high-level performance. Therefore, the purpose of this research is to build guidelines surrounding conditioning protocols. Understanding this information helps build conditioning programs to prevent future injury in the program's athletes, as well as help guide training protocols for individuals with a wide range of impairments. Preventing injury through conditioning and understanding the kinesthetic functions of the body during fencing will help produce better outcomes in the program's participants by allowing them to be more successful in the program, without wearing down the body.

A level four cohort study was conducted to study the muscles used in para-fencing during the lunge. The lunge is an offensive move that helps the individual attack their opponent. Para-fencing is broken down into three categories based on the disabilities impacts on the trunk and functional mobility. Category A athletes have trunk control, category B athletes have trunk impairments or have impairments that impact their fencing arm, such as quadriplegic athletes, and category C athletes have severe impairments to mobility and limbs, such as cervical injuries (IWAS Wheelchair Fencing, 2022). The study observed the Hong Kong international team with EMG and found that there was a difference in muscle usage between the A and B athletes (Borysiuk et al., 2020). In the category A fencers, the latissimus dorsi fired first, followed by the middle deltoid, external abdominal oblique, extensor carpi radialis longus, and the triceps (Borysiuk et al., 2020). In the category B fencers, the extensor carpi radialis longus fired first, followed by the latissimus dorsi and obliques where contraction was possible, and the other muscles of the arm (Borysiuk et al., 2020). Anticipatory muscle movement was seen in both

populations. The same research group investigated common injuries among the Hong Kong Fencers. The level four cohort study found that para-fencers often had upper extremity injuries due to poor trunk control and twisting when fencing. (Chung et al., 2012). Injuries were seen more in the competition season and in those with compounding conditions (Chung et al., 2012). Injuries in the cervical and thoracic spine, referred shoulder pain, and soft tissue injuries are also common due to the repetitive movements of the sport and impacts from the sport (De Luigi, 2018). It is recommended that conditioning is incorporated into the training process to prevent upper extremity injuries to help promote longevity in athletes in the sport.

A level 6 Delphi study investigated the desired skills or attributes para-fencing coaches look for when developing athletes. Thirty attributes broken down to eight themes were established. These themes are speed, strength, flexibility, stability/motor control, agility, fitness, and anthropometry (Villiere et al., 2021). Speed was determined to be the number one indicator of success, as it had the greatest difference between elite athletes and non-experienced athletes. The ability to change direction quickly and move the arm quickly can be a determining factor in success (Villiere et al., 2021). Joint angles increased as the fencers' lunges got longer, showing the positive impacts of flexibility on fencers' success (Villiere et al., 2021). Using this information will help guide training programs, focus training around strengthening joints, building endurance, building speed, and helping to increase flexibility in athletes. Future research should be done to analyze the skills the current top fencers have in the sport to see what makes them successful, due to everyone being an individual. This study sets the groundwork for building training programs, but everyone is an individual and training programs will be adapted and changed for the individuals throughout the program.

Cognition and emotional control in elite level fencers who received a functional movement training program were evaluated in a level 3 study (Xu et al., 2017). The athletes showed increased reaction time and shoulder mobility following the intervention. Balance was also improved by the intervention; however, it was also noted that as balance improved so did the cognitive effort, meaning that fencing movements required less active thought as balance was improved. Anxiety and stability had a positive correlation. Athletes who had poor stability had higher anxiety levels and decreased function movement performance (Xu et al., 2017). This study is a starting point for how functional stability and conditioning impacts the mental health and cognition of fencers. This study lends support to the importance of conditioning in supporting athletes, as the study shows that increased conditioning led to decreased cognitive loads and decreased anxiety.

Overall, fencing is shown to be demanding of the trunk and upper extremities of the body. Athletes who perform conditioning show greater outcomes and potentially less injuries. Muscle and general skills needed to be successful are seen in these studies; however, there are many gaps in fencing literature (De Luigi, 2018). There is a lack of large group studies and information looking at different fencing styles. Fencing has multiple varieties of teaching and technique styles depending on country of origin. Fencing styles impact on muscle usage, injuries, and necessary conditioning is needed. Furthermore, research found on fencing is primarily on injuries and muscle function. Therefore, it is recommended that future research focuses on the connection between body and mind in fencing, such as the connection between mental processes, socialization, and performance.

Discussion

Summary

Sports are an important leisure pursuit that can have mental health and physical benefits that lead to improved participation in one's occupations and improved quality of life. Current research on sports demonstrates that involvement in sports can lead to improved social participation, improved mental health, and improved reported quality of life. It is known that sports have a positive impact, but to what extent is not fully understood. Likewise, there is little research surrounding adaptive sports and their impacts on quality of life. Some studies have pointed towards adaptive sports improving social participation, which aligns with the research found on sports in general. However, current research may be influenced by response biases and gaps in the literature are still prevalent due to small sample sizes and lack of research into specific topics.

Responder's bias could have skewed the results in the Snedden et al. study. Individuals who have a perceived level of happiness when exercising may be more likely to pursue sports. Exploring correlation does not equal causation and doing more comprehensive investigations is suggested to confirm this study's findings. The GAME ON program study utilized a small sample size. This study, like most adaptive sports studies, started to show the links between social participation and adaptive sports; however, the validity of the study is weak due to the small sample sizes. Both responder's bias and small sample sizes are current barriers to effective and applicable adaptive sports evidence-based practice.

Future research needs to continue to explore specific adaptive sports and continue to contribute to current research on adaptive sports. Fencing is a growing sport in the United States with some research on common injuries and current training programs focused on injury prevention and skill growth. Desired skills and training programs are outlined in two studies, but there is no evidence-based studies surrounding quality-of-life impacts of fencing.

Statement of Need for Research or Project

This author's future research through the capstone process will address the gaps highlighted above through investigating the quality-of-life impacts para-fencing has, establishing practice guidelines for program implementation, and continue to add to the ongoing research surrounding adaptive sports impacts on participants' lives.

Chapter 3: Research methodology

Research Design

This study applied a mixed method design combining a quantitative survey with qualitative phenomenological research design method. This study utilized surveys and interviews to establish themes and find connections between wheelchair fencing and quality of life. In addition, the study investigated the impacts wheelchair fencing has on able-bodied athletes. Questions and the study focus were influenced by occupational therapy theories and values.

Participants

Participants in this study were actively involved in the fencing community either as an active athlete (both wheelchair and able-bodied), a former athlete, or a coach. Participants were recruited through snowball and convenience sampling via multiple email blasts (see Appendix E). The emails were sent out in four different ways. Emails were initially sent to all athletes registered in the system for both Rogue Fencing and The Phoenix Center. A second email was sent to the CEO of USA Fencing, the head national coach for wheelchair fencing, and the head of program development for wheelchair fencing in the United States. After receiving the email, the head of program development sent an additional email blast to all registered wheelchair fencers in the United States. In addition to an email, it was added to the monthly newsletter that was sent out to the entire USA Fencing membership base. The email was then shared by those in the wheelchair fencing circuit to their clubs. Finally, a message was sent to a WhatsApp group for all USA wheelchair fencers. The surveys were open for seven and a half weeks to ensure maximum response rate.

Participants who had self-identified experience with wheelchair fencing were recruited to participate in a follow-up audio-recorded semi-structured interview. The purpose of the interviews was to dive deeper into the participants' perception of experience and impact of the sport. Consent for the interview and use of the survey information was implied when participants provided their contact information and filled out the consent aspect of the quantitative survey (see Appendix C).

Participants who met the following criteria were included in the interview. Participants who currently or have participated in wheelchair (para)[*1] fencing in the past, have a permanent disability (as defined by IWAS outlines or by USA fencings standards for participating in para-fencing North American Cups and camps), and were able to maintain attention during the interview process. Able-bodied athletes were required to have participated in wheelchair fencing prior to participating in the study. Individuals who did not sign the informed consent forms were excluded from this study. Individuals under the age of 6 did not participate in the study.

**1: The sport is known as wheelchair fencing internationally and para-fencing nationally. Both names are used interchangeably.*

Instrument Design and Data Collection

The instrument for the quantitative portion of this study was an investigator developed survey with ideas taken from the World Health Organization's quality of life survey, the biomechanical model, the model of human occupations, motor learning theories, and the person-environment occupation-performance model. For this study, quality of life was defined as physical health (pain, stamina, sleep quality, and reported functional outcomes), social participation, mental health (reported happiness, self-confidence, anxiety, and future mindset), and cognition (problem solving and attention). The survey was created using Google Forms. Survey questions consisted of short answers, Likert-type, and multiple-choice questions (see

Appendix D). At the end of the survey, participants were asked if they were willing to consent to participate in a follow-up semi-structured interview, and if so, to provide their contact information. The instrument of the qualitative research was a semi-structured interview that was developed by the investigator and administered either via ZOOM or in person. Recordings of interviews were transcribed via ZOOM and the OTTER transcription app. The transcriptions were saved and stored on a password protected computer of the investigator or in lock boxes. The purpose of the interview was to evaluate and determine more details about the impact wheelchair fencing had on the participants.

Data Analysis

Data from Google Forms were downloaded as excel spreadsheets to allow for determination of correlations between and identification using descriptive statistics. Demographic information included participant age, gender, years of fencing experience, and perceived level of satisfaction for physical, mental, and social health. Quality of life was measured utilizing Likert-scale questions and open-ended survey questions.

For the qualitative portion in-vivo coding was utilized. Predominant themes emerged. For trustworthiness, triangulation was completed via field notes. Twenty-five participants were interviewed to achieve saturation of data. Survey statistics were utilized to describe demographic and background information of participants.

Chapter 4: Research findings

Quantitative Results

Demographics

Thirty-five individuals participated in the survey process, with three people filling out two surveys. The demographics of the total participants and the three surveys can be seen in **Table 1**. There was no common trend in age, gender, or years of fencing experience among the participants. There was an even spread of participants from a variety of ages and experiences. There was no correlation between age and years of fencing experience.

Table 1

Demographic distribution

Survey Name	Gender Demographics	Age distribution	Years of fencing experience	# of participants
Wheelchair fencing quality-of-life impacts on individuals with disabilities	Male: 12 Female: 6 Non-binary: 0	<13: 0 14-19: 2 20-29: 1 30-39: 4 40-49: 4 50-59: 4 60+: 3	<1: 1 1-2: 3 3-5: 2 6-9: 5 10-15: 4 16+: 3	18
Experience of learning along-side para-fencers	Male: 9 Female: 5 Non-binary: 1	<13: 1 14-19: 3 20-29: 3 30-39: 1 40-49: 0 50-59: 2 60+: 5	<1: 0 1-2: 2 3-5: 1 6-9: 2 10-15: 3 16+: 7	15
Benefits of wheelchair fencing when injured	Male: 2 Female: 3 Non-binary: 0	<13: 0 14-19: 2 20-29: 1 30-39: 0 40-49: 0 50-59: 1 60+: 1	<1: 0 1-2: 0 3-5: 1 6-9: 0 10-15: 1 16+: 3	5
Total Demographics	Male: 22 Female: 12 Non-binary: 1	<13: 1 14-19: 5 20-29: 5	<1: 1 1-2: 5 3-5: 4	35

(Individuals who filled out two surveys were taken in consideration to give final totals, as to avoid repetitious data.)		30-39: 5 40-49: 5 50-59: 6 60+: 8	6-9: 7 10-15: 7 16+: 11	

Survey Data

The data from the *wheelchair fencing quality-of-life impacts on individuals with disabilities* survey can be found in **Table 2** and **Table 3**. Common correlations in data were noted in responses that received over 50% agreement (agree and strongly agree, very much and an extreme amount, and satisfied and very satisfied). A majority of participants noted they are greatly affected by pain, have a positive mind-set about the future, have a lot of self-confidence, have access to multiple leisure activities, and have disabled friends. A majority also reported feeling satisfied with their social needs, physical health, quality-of-life, mental health, endurance, and access to sports. 94.4% of participants reported fencing has impacted their life overall. Physical health, socialization, and mental health were all notably impacted by fencing, with 27.8% also reporting fencing impacted their attention span. There were no correlations between years of fencing and responses. Of important note, while a majority of participants reported high pain there was no correlation between pain and quality of life, self-confidence, or positive outlook of the future.

The data from the *experience of learning along-side para-fencers* survey can be found in **Table 4** and **Table 5**. A majority of the participants (over 50%) noted that wheelchair fencing improved their technical skill, changed how they viewed disability, and made them better fencers. Prior to trying wheelchair fencing 60% of participants thought it looked fun and 40% thought that they would not benefit from the sport as someone who doesn't have a disability. Following trying the sport participants noted how their views of wheelchair fencing change, see

Table 8. A majority of the participants noted they found the sport challenging, no longer see it as easier than able body, or noted they found some benefit in the sport.

The data from the *benefits of wheelchair fencing when injured* survey can be found in **Table 6** and **Table 7**. All participants noted they felt restless and had a negative impact on their mental health due to being injured. 60% also noted they experienced increased anxiety. While injured the participants all noted that it positively impacted their socialization, fencing technique, and physical health. In addition, 80% of participants noted it improved their mental health and restlessness.

All three surveys investigated how fencing differs from other sports, why participants do not participate in other sports, what their favorite part about fencing was, and how the sport has impacted them. This data can be seen in **Table 9** and **Table 10**. The most common theme for not participating in other sports was that other sports put too much strain on the participants' body, or they experienced an injury that prevented them from continuing in their previous sport. Fencing was noted to be more individualized than other sports, while still having a community aspect to it, making it different than other sports. The individuality of the sport and the mental games required in the sport were both noted as the major difference between other sports. 42% of participants also noted that their favorite part of fencing was the mental game of the sport. A majority of the participants in the open-ended questions noted access to community, the adaptability of the sport to their disability, the self-confidence building, and discovering of a passion were the biggest impacts the sport had on them.

Table 2

Likert-scale responses: Wheelchair fencing quality-of-life impacts on individuals with disabilities. (n=18)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Agree and Strongly Agree
My day-to-day life is greatly affected by pain.	16.7%	16.7%	5.6%	38.9%	22.2%	61.1%
My pain limits me from doing the things I want to do.	22.2%	27.8%	5.6%	33.3%	11.1%	44.4%
I tire very easily.	11.1%	11.1%	38.9%	27.8%	11.1%	38.9%
I can get a good night's sleep consistently.	22.2%	38.9%	0.0%	33.3%	5.6%	38.9%
I have no trouble concentrating throughout the day.	16.7%	5.6%	44.4%	22.2%	11.1%	33.3%
I have a positive mindset about my future.	0%	0%	11.1%	55.6%	33.3%	88.9%
I have a lot of self-confidence.	5.6%	0.0%	22.2%	50.0%	22.2%	72.2%
I am greatly impacted by anxiety and depression.	16.7%	38.9%	11.1%	22.2%	11.1%	33.3%
I have friends that are also disabled.	5.6%	0.0%	0.0%	38.9%	55.6%	94.5%
I have access to multiple leisure activities.	5.6%	11.1%	5.6%	38.9%	38.9%	77.8%
	Not at all	A little	A moderate amount	Very much	An extreme amount	
To what extent do you feel all your social needs are met?	0.0%	11.1%	33.3%	50.0%	5.6%	
To what extent do you feel all your physical needs are met?	0.0%	11.1%	33.3%	27.8%	27.8%	
To what extent do you find anxiety	22.2%	44.4%	27.8%	0.0%	5.6%	

limiting your daily activity?					
	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
How satisfied are you with your quality of life?	0.0%	0.0%	16.7%	61.1%	22.2%
In general, how satisfied are you with your physical health?	0.0%	22.2%	27.8%	33.3%	16.7%
In general, how satisfied are you with your mental health?	0.0%	11.1%	22.2%	55.6%	11.1%
In general, how satisfied are you with your socialization?	0.0%	5.6%	22.2%	50.0%	22.2%
In general, how satisfied are you with you access to sports?	5.6%	11.1%	16.7%	38.9%	27.8%
In general, how satisfied are you with your endurance?	0.0%	27.8%	16.7%	38.9%	16.7%

Table 3

Open ended questions: Wheelchair fencing quality-of-life impacts on individuals with disabilities.(n=18)

Do you feel fencing has made your life better overall?	What areas have been positively impacted?	Currently involved in other sports?	How did they learn about the sport?
Yes: 94.4% Maybe: 5.6%	Socialization: 77.7% Physical health: 94.4% Mental health: 83.3% Attention span: 27.8%	Yes: 55.6% No: 44.4%	Rehabilitation Program: 11.1% Social Media: 27.8% Friends/family: 33.3% Local event: 27.8%

Table 4

Likert-Scale responses: Experience of learning along-side para-fencers. (n=15)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Agree and Strongly Agree
I feel that training with wheelchair fencers improve my technical skill.	0.0%	0.0%	26.7%	33.3%	40.0%	73.3%
I feel that training with wheelchair fencers changed how I view disability.	0.0%	6.7%	13.3%	46.7%	33.3%	80.0%
I feel that training with wheelchair fencers made me a better fencer.	0.0%	0.0%	20.0%	40.0%	40.0%	80.0%

Table 5

Open ended questions: Experience of learning alongside para-fencers. (n=15)

Initial thoughts on wheelchair fencing.	Areas of experience with wheelchair fencing.	Have they ever trained with a wheelchair fencer?	How did they learn about the sport?	Currently involved in another sport?
Thought it looked fun: - 60.0% Harder than able body: - 13.3% Easier than able body: - 20.0% Thought it would not be beneficial to someone without a disability:	Bouting: - 86.7% Competition: - 33.3% Lessons: - 26.7% Conditioning: - 13.3% Group Class:	Yes: 100%	Social Media: 6.7% Friends/family: 60.0% Local event: 33.3%	Yes: 20.0% No: 80.0%

- 40.0%	- 6.7%			

Table 6

Likert-scale responses: Benefits of wheelchair fencing when injured.(n=5)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Agree and Strongly Agree
While injured, I was more anxious.	0.0%	20.0%	20.0%	0.0%	60.0%	60.0%
While injured, I felt restless.	0.0%	0.0%	0.0%	40.0%	60.0%	100%
While injured, I felt my mental health was negatively impacted.	0.0%	0.0%	0.0%	40.0%	60.0%	100%

Table 7

Open-ended questions: Benefits of wheelchair fencing when injured. (n=5)

How they learned about the sport?	Are they currently involved in another sport?	Have you ever had an injury that limited your fencing?	Did you have access to chair lessons while injured?	What area did chair lessons have a positive impact?
Friend/family: 60.0% Social Media: 20.0% Local event: 20.0%	Yes: 0.0% No: 100%	Yes: 100%	Yes: 80.0% No: 20.0%	Socialization: 100% Mental health: 80.0% Physical health: 100% Restlessness: 80.0% Improved fencing technique: 100%

Table 8

Responses to how the participants view of wheelchair fencing changed.

Code	Response	Prior View
2c	"It's harder than I thought it would be (not that I thought it would be easy). My arms, and wrist and fingers became much more tired than usual. Felt like I always had to be on the defense because I couldn't back up out of range (which I don't often do—but lacking the option made me more aware of getting tired and feeling unable to escape to rest)"	Thought it looked fun.
3a	"The creativity needed to compete with the relative lack of movement on the strip is higher than expected."	Harder than able body.
3b	"It is valuable training in ways I didn't anticipate."	Though it looked fun.
3c	"I find it to be very fun and challenging."	Though it looked fun.
4a	"I originally thought of it as being a more stripped-down version of fencing, like its fencing with less of distance element. Now I think of it more as fencing but with different aspects being more important, like it's the same sport more or less but with a different meta. It's really nifty not gonna lie."	Though it looked fun.
1c	"Wow! Wheelchair fencing is much harder than able body! The distance is closer, and actions need to be smaller."	Easier than able body
4b	I thought it would just train my tip/hand control. Rather, it's a core workout, makes me think of critical distance way more carefully (like, once I'm there, what I should do), and indeed puts tip control and hand position under a microscope.	Thought it would not benefit you as someone without a disability.
2b	It's something I plan on doing as I get older.	Thought it would not benefit you as someone without a disability. Though it looked fun.
4c	It's much faster than I expected.	Thought it looked fun

5a	much more physical than I realized before doing it; stresses different dimensions of your overall fencing game given change in mobility.	Thought it would not benefit you as someone without a disability. Easier than able body.
6b	Just as hard.	Thought it would not benefit you as someone without a disability. Thought it looked fun.
8b	I appreciate it more because of how different than able-bodied fencing is. It takes just as much skill, if not more, to read your opponent and have precise blade work.	Harder than able body
8c	I haven't done a ton of wheelchair fencing, but I used to think it would not help someone without disabilities. When I fenced wheelchair a few times, I realized that it required a lot of precision and endurance that I didn't have. There aren't any chances to retreat away for more space and "cool down"/collect my thoughts before beginning a new action. It is also a great core workout. I wish I could do some more wheelchair fencing training!	Thought it would not benefit you as someone without a disability. Thought it looked fun.
11c	Many of the same skills are required, and more upper body strength and flexibility than able bodied. I of course prefer being able to move in regular fencing.	Easier than able body. Thought it would not benefit you as someone without a disability.
12b	When I began fencing, I did not know that wheelchair fencing existed, and when I found out about it, I thought it was cool that there were options for non-able-bodied people to fence. Because of training and interacting with wheelchair fencers, I have also come to appreciate the differences and challenges of wheelchair fencing, and I have become more interested in watching bouts and learning wheelchair specific rules.	Thought it looked fun.

Table 9

Open ended responses, all three surveys.(n=35)

Reason for no longer participating in other sports.	Favorite part about fencing.	How the sport differs from others.
Lack of time: 8.6% Lack of interest: 8.6% Injured/ too much on the body: 28.6% Fencing is first sport: 2.9%	Mental Game: 42.9% Fun: 14.3% Using swords: 17.1% Competition: 20.0% Community: 25.7% Physical game: 17.1%	Individuality: 31.4% Mental game and processes: 34.3% Technical Skill: 20.0% Usage of the sword: 2.9% Community involved: 20.0%

N/A (still in sports or didn't answer question): 60.0%	Fast pace: 8.6% Working towards goals: 11.4% Adaptable/individualized: 5.7%	Expensive: 2.9% Thrilling competition: 5.7% Requires active participation: 2.9% "Other sports are pointless": 2.9% Haven't done other sports: 2.9%

Table 10

Impact of fencing open ended question responses across all three surveys.

Code	Quote
1a	I appreciate the opportunity to compete in a sport that is tailored to my disability in a way that I only need moderate help to access it.
1b	I have been connected to several communities through fencing - the international para-fencing community (just getting started there), my local club, and then fellow USA para-fencers. I feel like I have many more social connections with different types of people in various age groups. Although I'm only starting to socialize with folks outside of fencing practice/events, I do feel more socially connected. I enjoy working towards a goal, and fencing has given me something separate from my professional work to focus on, which is a relief. I love that during a fencing lesson, or bout, I can only be thinking about what I'm doing, and really be in the moment, and not think about a million things at once. I also know that when folks are expecting me to show up, I'm more likely to show up than when it's just something I want to do or think I should do (working on making sure that I show up just for myself more often). I love that it's a form of exercise that many folks do throughout their lifespan, not just for a short period of time until they get injured and can no longer play/participate. I feel that's one of the things lacking in other adapted sports I've tried; I was always worried about getting injured - with fencing I feel like the background work I need to do to be better at fencing is also work that helps keep me healthy and mobile.
5b	To keep my body and mind from falling apart requires training every day. Fencing is something that has a lot of skill without a lot of damage and is much easier to maintain 5-6 days a week of training for compared to triathlon or velodrome
5c	It's difficult to sum up 18 years of para and standing fencing combined, but I wouldn't be the person I am without it.
6b	Fencing gave me the opportunity to compete and meet people around the world. I enjoyed meeting athletes that were different like me and had found ways to compete with their disabilities.
6c	It has helped with mental sharpness and increased my physical strength and abilities. It allowed me to travel the world. I never would have been able to see the world without fencing. I have met a variety of people I now consider my friends. I had always dreamed of being an Olympian as a child and even played "Olympics"

	in the backyard. As an adult to have the opportunity to be a Paralympian and participate in the opening ceremonies and the games was a dream come true!
7c	Made international friends, got to travel the world as me, not a military dependent or active-duty military.
7a	I acquired a permanent mobility impairment following an accident. Was unsure how I would be able to adapt and feel “successful”. Fencing allowed me to succeed and provided an outlet for “giving back”.
7b	It saves my life I was way overweight and going though PTSD fencing made me feel part of something again.
9a	The exercise is a boon, as are the social interactions of the other Team USA members.
9b	It's given me the ability to compete with others.
9c	Was planning to sit on porch and drink whiskey after bball. Fencing consumed my time and I retired early to make more time, fencing costs will affect future retirement years. Fencing keeps me fit; fighting keeps me young!
10a	Fencing is a motivator in my life - get better, stronger, achieve certain goals, etc.
10b	Especially as something to help move past trauma or cope with mental health problems, having something fun, preferably physical and is unrelated to your professional life, that is intellectually engaging, and can be worked on and progressively improved upon, can help bring a sense of normalcy, motivation, and structure that is incredibly helpful. Personally, doing HEMA and fencing (I can't separate them in this instance since I started one as a way to benefit the other and engage with them similarly) has helped me find a sense of purpose, become more accepting of my disability, and given me a place where I can consistently find a very uncomplicated and healthy feeling of joy.
10c	During early Covid, I didn't do much physical activity. Finding fencing gave me something to do that was active and social. It led to my coaches recommending para-fencing, which has led to a whole new group of friends, competition, and challenges, which I welcome because I know I'm improving.
11a	Fencing gave me an outlet for competition and sports after my injury that I could do. I feel like through fencing, I got a sense of accomplishment and self-worth that complemented other aspects of my life. The friends i made me aware of opportunities and more confident in myself as someone with a disability.
11b	It has helped improve my mental health because for me it is calming.
12a	It affected my attention span. I am able to concentrate for longer periods of time with more forethought into what I'll be doing next, while still paying enough attention to detail. It comes in handy with learning to drive and high school life. Fencing has always been a part of my life, and I think that the greatest way has been opportunity and what I've learned. I was a relatively OK fencer before I joined para-fencing, and since I've been improving on my skills with blade work, my focus, among other things. But this injury that introduced me to the sport gave me opportunity to meet cool new people and help to grow this community.
2c	It’s the only sport I love. It’s the only physical activity I enjoy.
3a	Additional framework for strategic thinking/gaming and better health.
3b	It challenges me to grow in lots of different ways.

3c	It has given me a home as well as a purpose in life.
4a	It has given me something fulfilling and enjoyable to work at. It has helped improve my work ethic and has motivated me to work harder in order to afford myself the time and money needed to pursue my goals in fencing.
1c	It has changed my life, it gave it an outlet and meaning for myself.
4b	It's guided how I want to build my career and it's been my biggest coping mechanism and social network for over a decade.
2b	It's joyous. Its focus, and its distance from work. First fenced in 1974. Made friends and learned team sport and camaraderie. Lessons have remained with me for decades.
4c	It let me work out stress and anxiety when I was in college. Now it lets me connect with people of many ages.
5a	A great way to make new friends and keep in touch with old friends; outlet for competitive nature; shared experience with my (now grown) kids; achieving good fencing results requires attention to overall fitness.
6a	Busier.
8b	I've met many people and made many friends, it keeps me active, I've travelled to places I wouldn't have otherwise.
8c	Fencing helped me come out of my shell! I was a really shy 10-year-old, and fencing helped me learn how to make friends and talk to people. It has made me feel more confident in myself. I learned how to work hard and practice a skill, rather than assuming I should be perfect at it on the first try. It has taught me a lot about hard work!
11c	Initially a nice way to keep in shape, but later on I found that the competitive aspects made it a very compelling activity, as well as the ability to have a life sport opportunity.
12b	Fencing has helped me gain confidence in myself, as well as led me to discover a physical activity that I am passionate about.
2c	Fencing has given me many opportunities and has included me in a large community of people who enjoy the same things as me. This sport has also taught me patience and discipline.
8a	I had trouble making friends as a young kid, and having a consistent place to go where I had friends, older role models, and mental and physical development helped improve my confidence and sense of self. Doing something consistently for 16 years taught me how to value a process more than a result and how to think positively in the face of setbacks. It also helped me gain strong time management skills and work ethic that I believe helped me in school and now help me in the work force.

Qualitative Results

Of the thirty-five survey participants twenty-five participated in the semi-structure interview process. After transcription, and through in vivo coding, the following themes emerged:

1. Why fencing?
    a. Mental Challenge
    b. Provides both individual and team dynamics.
    c. Longevity of participants
2. Impact on able-bodied participants
    a. Appreciation and awareness of adaptive sports
    b. Skill improvement
    c. Improvement of mental health while injured
3. Quality-of-life impacts on disabled participants
    a. Improved physical health
    b. Access to a supportive community
    c. Improved cognitive processes
    d. Improved mental health

Why fencing?

Fencing was noted to be a sport that was mentally challenging, unique, a great community, and a way to stay active despite physical capabilities. Participant 1a stated, “The puzzle aspect is fun because that is like the thinking part of the game. So, you know, you get to kind of ask questions, get responses, and then change your question based on their response to, then achieve success. I think, that is the main part of fencing that I enjoy, but, like overall fencing in its core is a bit of a sport that you're probably not going to overall like long term; unless you do find it at least somewhat enjoyable to hit someone else with a stick.” Fencing allows participants to concentrate on the moment stated participant 2b. 2b noted, “For me, the thing that's the best about it is that the concentration shuts out everything else, period. So, you had a bad day, you've had a stressful day, you’re worried about loans, debt, commitments, appointments, anything it goes. So even though it's terribly exciting and in the end, exhausting, it's also relaxing.” Concentration and ability to mentally adapt is a large part of fencing, providing a unique mental challenge in the sport.

Mental challenge.

“I feel fencing has a little bit more mental. There's a big focus on technique and form. But I feel like with fencing there's also more tactics. You have to constantly adapt and pay attention. You have to think about what your opponent's thinking, what they know, and what you know.”, stated participant 8c. The strategy and mental aspect of fencing allows athletes to be successful regardless of their athletic abilities. Participant 3c stated, “I’m not a super fit guy. But I can still find success just by having strategical skill.” Similarly participant 4a stated, “I just like the fact that there is a big technical element in addition to the physicality, because I’m a scrawny dude.” The mental aspect and strategy required in the sport allows for a wide range of body types and ages to be successful.

Participants noted that the mental engagement of the sport was satisfying as it gave immediate feedback during the problem-solving process, as well as challenged them to fight through difficult challenges. Participant 10b noted, “It's really, really satisfying to be able to fix a mistake that you're making in real time. I'm not sure if I'm going to be able to get out much more than just it's really satisfying. But it feels like a very rare thing where you have like some interaction that reiterates on itself.” The multiple variables of the sport allow for a lack of monotony in the sport. “There are just a ton of variables. There’s more often than not a plethora of right answers for the problem. I have to exercise a kind of creativity. The need to exercise creativity is what makes it uniquely satisfying to me.”, stated participant 4b. Participant 7a further supported this sentiment by saying, “The sport really gives you an opportunity to use your brain and not perform repetitive, you know, back and forth and back and forth movements. So that really hooked me.”

Besides the problem-solving fencing also challenges athletes to work through frustration and difficult times, as previously noted by participants 2b above. Participant 12b stated,

> "Well, it's definitely a challenge when you're going through times that are not great fencing wise, like you're not getting the results you want or nothing's working out the way you want it. You definitely feel like stopping or quitting or giving up a lot. So, it's mentally challenging to continue to work through that. But also, on a more fun side. It's like strategies and things like that. It has a lot more mental games than I expected it to be. So yeah, a lot of people compared it to chess, and I agree. A lot of moves and countermoves."

Fencing pushes athletes to problem solve and think creatively. The mental aspect of fencing was noted as a contributing factor to the uniqueness of the sport and as a favorite aspect of the sport for participants in the above quantitative data.

Provides both individual and team dynamics.

The individuality of the sport allows individuals to make a game unique to themselves. It also allows the athletes to see success as a one-on-one situation. Participant 2c had previously done other sports and stated, "It feels less like you as an individual can get invested in developing your style, your strategy, and your preferences in those sporting contexts as opposed to fencing where I feel like that's what it's about." Similarly, participant 4a had previously tried other sports but did not like the team dynamic of success being reliant on others. They stated, "When I'm actually competing it's on me, but there is still an option, or an opportunity to have other people you can route for as well as yourself. You kind of grow together." The sentiment of growing together was a common statement throughout the research process. Many noted the fencing community to be a big reason for their involvement in the sport in the long-term.

"I still see people that I've worked with quite a few years ago, 30 years ago, or 38 years ago. We're like transported back to when we were fencing in the basement in the armory at RPI. I

think it's a welcoming community. I think you know; any group of people are going to have some people that you don't get along with, but there are a lot of people that you really do get along with I find in fencing.", noted participant 5a. The fencing community was noted to be a community of a variety of interesting people who bond together because of the sport. Participant 11 c stated, "When you're fencing, you do try to beat the snot out of somebody. But at the end of it, you shake hands and you're gonna go and have a beer or something. So, it's, good can lead to you make good friends, real friends." The community has smaller networks such as the community of women fencers. "The community of women athletes is amazing. The women I interact with a lot range from, I would say, mid-twenties to mid-seventies. It's pretty diverse and thar is just so great to have", stated participant 3b. Multiple participants noted that the fencing community helped build lifelong connections and promoted social skills. "I've been able to grow connections with like a really strong connection with people throughout my life that I've been able to go back to for support. It's given me a job. It's given me like, goals for my life.", stated participant 3c.

Young athletes spoke on the importance of the fencing community in building a safe space and helping them make friends. Participant 12b stated,

> "When I started in ninth grade, I was very quiet and I didn't talk a lot, unless my friends were there. especially like to my coach, I didn't like talking to other people. I guess I got more comfortable with interacting with teammates or with people I practice with and with expressing my own questions or concerns."

Participant 8a spoke on their experiences with having an accepting environment stating,

> "My fencing club that I grew up in was always kind of a consistent place that I could go to and had a group of friends at. They were always very open and accepting of me,

> regardless of if they were people who I probably wouldn't have been friends with if I met them in a different setting. They were always just people who were supportive, and there to see me at my best moments and worst moments, you know. So, kind of just the consistency through just kind of having that community to go back to has been very helpful mentally and physically."

Some participants compared their experiences in the fencing community to their non-fencing peers. Participant 12a reflected on this stating, "Fencing is a very different aspect of my life compared to my friend who does high school sports. My best friend is in high school varsity basketball, and she goes in every day, and she doesn't like a lot of the people, and I don't have that. I love all the people who I fence with, I have a great time." The importance of the community for fencing was also seen in the above quantitative data.

Longevity of participants.

A common theme amongst the wheelchair fencer and veteran age fencers (forty or older) was that the nature of the sport has allowed them to stay in sports longer. Participant 3a spoke on the importance of the mental aspect of the sport and how it allows them to stay in the sport. They stated, "You know, as you get older, being physically active is just, you know, that much harder to do and more important to do. It's the mental aspect of the game." Participant 9c also noted the same sentiment stating, "But at age of sixty, my aerobic capacity wasn't really up to running ninety-three feet for forty minutes, five times in one weekend anymore. So, I saw fencing as a "stationary" sport that's still requires a high level of athleticism and a certain amount of aggressiveness. This is really one of the ideal sports for some recently injured or at the other end of the spectrum, folks like myself." The adaptability of the sport allows athletes to participate despite declining physical capabilities or disabilities. Participant 10a discussed this topic stating,

"I chose fencing based on my own physical limitations, now having hemi-paresis. I only really have full mobility with one side of my body, so learning about para-fencing and being able to do that with one arm and one hand appealed to me." Participant 11c further exemplified this ideal stating, "You don't have to have extreme abilities. There are skills that can offset your declining physical capabilities such that you can still be competitive and because they now have veteran age specific categories of fencing, you're with a similar cadre of people." The longevity and ability to participate in the sport for prolonged periods of time was a reason many people chose fencing as their sport.

Impact on able-bodied participants

Individuals who trained or competed against wheelchair fencers were interviewed about their experiences and how it impacted them. Through working with wheelchair fencers these participants reported increased appreciation for paralympic sports and noted being more aware of what other adaptive sport opportunities existed. They also noted their fencing technical and strategic games improved. Participants that had been injured during their fencing careers reported improved mental health when they had access to wheelchair fencing while injured, due to it being an outlet for social and physical participation.

Appreciation and awareness of adaptive sports.

Many participants noted that they were ignorant about adaptive sports or even unaware of wheelchair fencing. When asked about their original views of the sport prior to trying it and compared them to their views after trying the sport there were notable changes and how they viewed wheelchair fencing and disability. Participant 2b stated,

> “Well, the main reason why I didn't give much thought to Paralympic fencing was ignorance. You can't know what you don't know. I'm a physician in internal medicine, you generally don't get people until they are long broken for lack of a better word. It used to be the about the only thing I could offer somebody who had a skeletal problem was to say to them, look, if you can't do anything else you can float and if you float you can swim but now there's much more. I hope in my practice that when I get those people, I know to say to them, look, you still got opportunities to exercise yourself. You've still got opportunities to do cardiovascular training. You don't have to just sit there and watch TV. You can go out and here's where you can go.”

Participant 4c also spoke on how their view of disability changed stating, “It added another dimension to my view of disabled people. As opposed to okay, they can do this they can do that. Because this whole thing rolling around and wheelchairs basketballs which you see periodically, but there's this. There's this sport, which I know it's hard, but they can do it.” Others spoke on how their experience with wheelchair fencing opened their eyes to what other para-sport opportunities there are. Participant 12b stated,

> “I think it's definitely increased my like view of what is possible in para-sports, because like, I don't follow sports that much in general and those that I do follow its just non-para. So, it kind of showed me what could be possible and how it can be just as challenging and fun to do. So yeah, I think it's made me consider possibilities for other sports as well as how it's done and that’s sort of cool.”

Participant 4b discussed how their view of para-sports was limited to the most popular ones, such as swimming and running. They stated, “I mean, the first thing is that I didn’t know much. I feel like, at least from a non-fencing perspective, like when people think about disabled sports, they

just imagine swimmers with no legs or like runners with prosthetics. I guess I would say the biggest thing was an absence of knowledge. I just didn't know anything, really." After the experience they felt their knowledge of disabled sports had grown. Participant 3c reflected on how the experience helped them understand the complexities of para-sports. They noted,

> "The idea of disabled sports still seemed very new and kind of in progress when I first learned about it. But after doing it, it became pretty apparent that it's actually extremely complex and equally as challenging and competitive as able-bodied sports. I learned that it's a different sport, for sure. But it still shares the same levels of like, complexity."

Similarly, to participant 3c, other participants also reflected on how their view of wheelchair fencing changed and they appreciated it as its own separate sport. Participant 4a stated, "I originally viewed it as kind of a stripped down that it was just taking distance, footwork, and a lot of that movement aspect of fencing and took it out of the equation Then once I actually did wheelchair fencing, I realized it was not just absent, but just kind of different. The difference is part of what makes it fun. You know, more intense more in the moment." Participant 5a also spoke on the change of movement dynamics stating, "I think it just elevates my perception of it. Certainly, for me I didn't understand how the body motion replaces footwork. I didn't appreciate how working in a more constrained space would force you to be more precise with your tip control. It gave me a stronger appreciation of what the top-level wheelchair fencers do, how they work, and what they've accomplished." Prior to trying wheelchair fencing 40% of participants, see **Table 5,** did not think it would benefit them or be a resource they could use. Participant 8c elaborated on this saying,

> "I didn't really know a lot about disabled people. So, I thought, like, Oh, that's their lane. I'll stay in my lane and like not encroach on that. This is gonna sound kind of

uninformed. But like, I thought, oh, it's how we help disable people be able to fence instead of it being its own thing. But it's its own sport. I feel like viewing it as like less this is how we like help disabled people, and more like, no, this is how disabled people compete. I guess it's less like you can play too, but more like a serious competitive sport." Individuals who had interactions with disabled people in their lives, such as siblings, did not have changes in their views of disability; however, they did report increased appreciation for the sport. "I definitely thought it was gonna be easier than normal fencing, but it was actually pretty hard. You still have to move, but it's with leans.", stated participant 6a. Participant 11c spoke on their appreciation for the sport stating, "It gave me a better appreciation for the fact that being disabled you can still continue to be an active athlete. I've seen it in other sports, where you know, disabled people are able to be competitive, but having an upfront in person experience with it makes me a little bit more appreciative." Throughout their experiences with the sport the participants also reported improvements in their fencing skills outside of wheelchair fencing.

Skill improvement.

Able-bodied participants reported that wheelchair fencing helped with tip control and blade actions, which is also shown in the above quantitative data. In addition to improving technical skill, creativity and strategy were also improved. Participant 11c stated, "You really have to rely on the technical skills, it forces you to think more about the technical skills. Which isn't a bad thing to apply to normal fencing." In a similar fashion 12 b stated, "Isolating actions in wheelchair with repetitions could really build precision and muscle memory. So, then it would be easier to build it into the legs and footwork." Wheelchair fencing in this context was a good way to build skills in an isolated context. Other participants noted that wheelchair fencing helped them improve specific technical skills such as blade takes and tip control. Blade takes are fencing

actions that involve driving through your opponent's blade to maintain control while blasting to hit them. Tip control is how a fencer controls keeping their epee, foil, or sabre on target. Participant 5a stated, "I'd say part of it is just recognizing that I need to focus on my tip control more. That's a weak area for me and I tend to make wide hand actions, not small precise tip actions. Wheelchair fencing forces me to be more precise." Participant 3b also noted that point control was needed stating, "You know, if I get wild with my point, I'm gonna end up hitting the skirt and that's leaves me vulnerable." The skirt in wheelchair fencing covers the legs in epee and prevents touches from being scored if hit. When athletes go large in these situations it leaves them exposed to getting hit. Hand speed was noted to improve as a faster hand was required in wheelchair fencing by both participant 4a and 4b. Participant 4b stated, "It really demands a much better hand. I think that the ability to escape with distance in able-bodied gives us some safe room. Whereas, when you are para-fencing I can say, more specifically, for epee, if your guard is off, your hand is a little lower, a little high, you're gonna get picked off way faster, just because of the critical distance. Every centimeter count in a way… So, it's made my technique way better." One participant, participant 2c, had only tried wheelchair fencing a few times, but noted they saw benefit it, stating, "I could see an opportunity for me to get much better at blade takes and binds because I would want to be better at controlling my opponent's blade than I currently am… I think that would be a valuable skill for me."

Participants spoke on the impact wheelchair fencing had on decision making and timing. Participant 8c stated, "I thought it would help a lot with infighting and quick decision making. I don't think we get a lot of practice with that." Similarly, participant 4c noted, "It made me try to deal with situations where I couldn't get away and where I had to be able to do a better attack in prep, with much less time to play with." Attacking in preparation is when a fencer hits their

opponent while they are setting up an action and are not ready to defend themselves. Attacking in preparation required confidence. Participant 3c spoke on this saying, “You are kind of forced to have a lot of accuracy and be very confident in your arm strength.” Creativity is part of the mental aspect of the sport noted participant 3a. They stated, “It's another tool to develop creativity. You've taken tools out of the box, for lack of a better word, for the able-bodied fencer. It gets them thinking about a new situation.” Fencers who experienced injury and wanted to continue fencing also saw benefits from access to wheelchair fencing.

Improvement of mental health while injured.

While injured many of the participants reported increased anxiety and restlessness, see quantitative results. Participant 2b spoke on this saying,

> “I've always felt that I'm emotionally labile. I think it's something everybody should understand about themselves, what their personality is, and their emotional state. I know I'm labile, I know if I'm not careful, I can get depressed To be injured and all of a sudden to have crutches and to have to ask people to open doors for me, to not go up the stairs, too not attend to every activity of daily living, to have to use the rails to get into the bathroom shower, and to have to brace myself to get in the car was frankly depressing. I'm used to bouncing around quite literally. The very nice thing about para-fencing was that it just took all that disability away. In that chair I was free, which sounds kind of contradictory, but it is when you take away a person's disability and give them something to do that, they can be good at with what they have. It's tremendously liberating.”

The chair allowed participants to continue to participate in the sport despite not being able to utilize their legs in practice. Participant 12a stated, “I had a lot of anxiety stemming from the not knowing. This is new, this is scary. I don't know what’s going to keep me going. I don't even

know if I'm going to be able to keep fencing, a sport I've done my entire life. It was just comforting to know that there was new ways, new people, and wheelchair fencing was just a great tool for me to keep up the mental part of it." One participant in the study had access to chair lessons, but it was not part of the club culture. After their injury participant 8a stated, "I think the not getting exercise was big definitely. Also, the anxiety and then I just wasn't sleeping well. When I'm not getting enough sleep or as good as sleep as I was very much used to, it definitely increased daytime, like agitation, anxiety, and restlessness, all of those sorts of things that go along with getting bad sleep." Participant 8a would have people fence in the chair with them, but not as much fencing as they were used to. The social dynamic changed. On this topic they stated, "I think if it would have been more normalized, and if people had done it more they probably would have realized that it's good for them as well."

Quality-of-life impacts on disabled participants

Wheelchair fencers reported improved physical, mental, cognitive, and social health. Overall physical health, relationship to pain, stamina, and sleep quality improved in many of the participants, as exemplified in the above quantitative data. Self-confidence, self-assuredness, and being goal focused were all noted to improve through the sport. Mental health improvements were also noted to be partially due to the community participants built through the sport. The sport provided the participants with a community of disabled peers to interact and grow with. Cognitive processes such as attention and problem solving were noted to improve by some participants.

Improved physical health.

Throughout the study participants noted improvements in physical health and overall fitness. "Overall having a greater level of physical fitness is better, and I think that if I didn't

have a physical sport my ability to do focused workouts would be significantly lower. So, having sport in my life, I think, positively impacts my overall physical fitness and health", stated participant 1a. Other participants also spoke on how having a sport they could participate in also improved their baseline fitness. Participant 5c stated, "I think it's definitely a positive, because in terms of pure physical health I've noticed and impact. This is something I think I have had a little bit of insight since I've been injured. It's like I am wildly out of shape, and I hate it because if I'm not doing fencing I'm just sitting here at my desk for hours on end." Desk jobs impacting activity was also noted by participant 11a. They said, "The sport has gotten me more active and not. It's got me less, well, sedative and sitting in a chair all the time." Many participants noted that the sport gave them physical engagement they lacked in their lives and helped strengthen their bodies. Participant 9c reported difficulty with strengthening due to their spinal cord injury. They noted that the sport, "strengthened my core in particular and also I lost weight in order to fence better." While building strength in the sport, some participants also noted they became more attuned to their body and pain.

Participant 1b stated,

> "I'm always on a journey to better understand the difference between discomfort and pain. That's my life's journey like, oh, maybe this is a little uncomfortable, but it's okay to push through. When it is an oh, no! There is the like red alarm of oh, my God, I have to stop! Which has never happened in fencing. But I think it just. I feel more in tune with my body, because we work on it in fencing a lot. A lot of the time I'm telling them like I can't feel it. Then they'll say 'Oh, you're winding up before you beat in foil.' We keep talking about it. So, I'm finding different ways of listening to myself".

They went on to discuss how in other sports, such as rowing and biking, the repetitive motions lead to pain, while in fencing they do not often find themselves pushed into those painful zones. Participant 5b shared this sentiment. Participant 5b was formerly involved in triathlon and spoke about how their relationship with pain evolved after switching to fencing. They stated,

> "It's changed some, because in triathlon, at least being in pain, like self-inflicted pain, is part of the sport, you know, if you're able to ride your bike 10% harder, it hurts a lot more. But if you just endure the pain, you go faster. But in fencing it's like if it hurts you probably shouldn't be doing it. Also, there's a lot less wear and tear after fencing workouts, you know. My arm is tired. It's a little sore, but it's not like my whole-body hurts, and I can't get out of bed. You know you're not supposed to be in pain all the time, you know a lot better."

Participant 5b spoke about the pain limiting them from being social and even causing heart palpitations, all of which improved after doing wheelchair fencing. He also noted his sleep improved. Stating, "I sleep a lot better now. With triathlon, you're over training all the time, and one of the things with over training is your sleep quality goes down. The amount you sleep goes down. Then in fencing it's hard to overtrain, like you know your arm will fry long before you're hitting the over training of the rest of your body."

Sleep was noted to improve by multiple participants due to being physically tired. Participant 1b stated, "I have been sleeping pretty well otherwise (stated night practices make it hard to wind down sometime), and that is not that typical for me. I'm one of those people who tend to take like an hour to go to sleep. It's been, I think, because I'm exercising a lot more now. I just sleep better as long as I don't do it at night." Along a similar thought process participant 12a stated, "My sleep quality has gotten a lot better because of just the different way I'm using my

body.” Participant 9c spoke about how being physically active helps with their sleep but they also noted that they found improved sleep following breathing exercises found in fencing. They stated, “I sleep way better. I'll tell you why. I've read some books about fencing. I read one called Strength Training for Fencers, by Harry James who talks about breathing and talks about breathing exercises. When I can't sleep at night I go into
slow inhale through the nose and breath deep.” Physical engagement improved sleep but it also improved stamina in the participants.

Participant 7c experienced a stroke and had difficulty with regaining muscle function in their dominant hand. “I didn't really fully regain use of my hand until I started fencing. For physical stamina and physical ability, fencing absolutely made a huge difference,” they stated. Participant 12a also noted they saw improvements in their arm stamina and strength stating, “My stamina has increased and so has the amount of muscles in my arms. The way I interact with those muscles has changed, and it's become more sustainable in the long term.” Being more physically active naturally improved some participants’ stamina. Participant 7a stated, “You know, being active even a little bit, every time you're building up endurance.”
Some of the participants train outside of practice to be able to perform better in the sport, resulting in better stamina. Participant 10a stated, “I think my stamina has improved as I try to get better and more physically in shape to do well within the sport. So, I'll do things outside of training for fencing, such as aerobic activities, weightlifting, etc., kind of all tied to wheelchair fencing to get better and physically stronger.”

Improved mental health.

“The sport is me against myself at the same time it, I think, increases your drive, your desire to win, and your desire to improve yourself”, stated participant 7c. Many participants

noted that the desire to improve and being goal oriented helped them regulate depression and anxiety, as they had something to keep them going. Participant 1a stated,

> "Sport is useful because it is very goal oriented. I have a calendar full of dates of things that I am going to do and things that I am planning for. So even if, like individual days, get a little bit muddled down in the weeds I know what's coming next. I know what I am working towards. I know what I am planning towards."

Being muddled down by life and careers was a sentiment also shared by participant 1b. They stated,

> "There aren't always things that I don't love about my career, that aren't perfect or things that are hard to change. There's limited growth in my current job, you know. You can be the lead and get a tiny stipend. But that was, that's pretty much the only way to go up from where I am currently in my job. So, it's like studying. I like to have something to work towards in my life in general. I guess I should say having goals and sport is nice because it's like smaller things I can work on, and it's not as painful as like personal growth goals that are like, I want to lose five pounds, or I wanna make sure I eat vegetables at every single meal. Those feel harder to stick to and maybe less purposeful… But having the goals of like, oh, I'm gonna go fence ten people tonight, and I'm going to get at least one touch on everybody. Things like that help make it fun. They're like little celebrations. I like lots of little celebrations."

Being goal oriented helps with anxiety; however, some participants also noted that the sport teaches adaptability and helps manage anxiety in other ways as well.

Participant 5b spoke on the need to be adaptable saying, “With fencing, if you do the same thing you lose. So, you learn to change it up and I feel like the ability to change my pattern has helped a lot to kind of break, you know, from the daily routine. I feel for the first time in years, that I don’t have that issue (of getting stuck in a routine), fencing has taught me to be more. It improves my adaptability.” They then went on to discuss the anxiety release that comes from fencing in general, stating, “I mean stabbing people makes you feel better. Just, you have a bad day. You go stab your coach; you feel a lot better. With the Triathlon you didn't really get that release like that.” Overall happiness was another indicator noted by participants. Participant 10b stated,

> “I’m like mentally just more chill with everything. I think I'm generally a happier person, having been involved in all of this. I need something outside of whatever I'm doing as a job or profession to put my energy into that can be fulfilling and engaging. So, I think fencing has kind of filled that for me. In a way I think it just as a whole helps me keep a better life balance and keeps me more mentally healthy. I can be a generally anxious person, but any time that I am around swords I am a much less anxious person.”

Being involved in this sport, regardless of success level, was noted to improve self-confidence in participants.

Participant 12a spoke on the role of the consistency of the sport helping with their mental health stating,

> “It gives me motivation, it gives me joy, and it gives me a space to just focus on my skills and get better. I really, really love it. Also, it is consistent I know what I’m gonna do when I go in. I know all my equipment stays the same. I know all these things will be the same week to week. Wheelchair fencing has greatly affected my self-confidence. I know

> I have these skills and it's made my future very positive. It has given me something I want to think about when I'm thinking about colleges."

Participant 11a was successful on the international circuit and spoke on how the sport helps improve their confidence overall, stating,

> "There's always been a part of me trying to prove that I'm worthy for lack of better words. I think being able to compete at that high level added some level of confidence to me in life. Being able to go out and be like, Yeah, I can do these things. I say that in the context of I feel like there's still a little bit of an imposter syndrome in me as well. It's like, why am I really doing this, should I really be here? I think it took a number of years to get that point, and a number of years of self-reflection, looking back and going. 'Oh, wait! I actually did do some things that are pretty amazing.' It did give me some self-confidence. A boost you know, particularly when in the context of social life. I think the thing I struggled with the most after my injury was feeling like I was attractive. feeling like I had something to offer other people. I think being in fencing and quite frankly, being around a lot of other disabled athletes and watching them do things and achieve things, gave me more self confidence in what I could do."

The community of disabled athletes also helped participant 10a. They stated, "Being involved, having friends, and watching other friends who are athletes with disabilities, I think gives me a certain level of self-assuredness or confidence to continue to do new things or to push myself." They go on to further comment about the role of the community on mental health stating, "It gave me a certain amount of confidence in my own abilities, and you know, breaking through some of the self-imposed limitations that are put upon myself. To try something new and be relatively competitive at it increased my self-confidence, and it increased it outside of sport. I

think it translated into my professional career." Access to a community of peers was noted to have a large impact on social participation as well during this study.

Access to a supportive community.

Being involved in a community of disabled peers helped individuals learn to navigate their own disabilities. Participant 1a reflected on their experiences after their accident. They had a family member who was also disabled and was able to interact with disabled peers in the rehabilitation setting; however, the community in wheelchair fencing made a different impact. They stated, "Meeting all the guys who were in fencing, who had been injured for years, was very helpful to me. Getting to see like a wide variety of injuries, and a wide variety of how people deal with them was helpful." Participant 11a had a similar experience. They felt limited in what they could do until they met other wheelchair fencers. They stated,

> "A lot of the advice and things we would talk about surrounded having disabilities and how you live in the world, and what you couldn't do. I would watch them do things and be like you're not supposed to do that, and they would go on and do it. Like, why not? Why can't I do this? I think that gave me a lot more confidence in what I could do and where I could go and have a life beyond. Instead of a life that most people envisioned for me. I remember my mom telling me stories about the people at church telling my brother that he needed to quit college and come take care of me. That was the expectation that I was just going to live at home for the rest of my life… Of course, I went back to school and got my PhD."

Participant 5b had a long experience of being the only disabled person they knew. They reflected on their experiences of always trying to keep up with their able-bodied friends. They stated,

> "Everyone I generally competed against (in prior sports) was able-bodied, unless I'm specifically doing a para-sport. So, like I just kinda of tried to always be at their level… My friends would want to go find this waterfall and climb up a mountain. I would just do it. I know it'd be harder for me, but I never considered how do I make this easier. You know it's gonna be harder. Whereas, when I hang out with people in chairs, we're not gonna do stuff but we might do it differently. We might do something that's more disabled, friendly. So, I would say, because disabled friendly activities are definitely a lot easier, and especially after like it's been a long day and you've been training. You have less energy and focus. So, you can still do that stuff."

Participants experienced life lessons from being in the community, but they also made lifelong friendships. Participant 7c is now retired from the sport but maintains these friendships stating, "We still communicate to tis day. We tell each other happy birthday and ask how the kids or grandchildren are. I just made great friends. I mostly found these friends through the sport. I live out in the country and I'm the guy in the wheelchair here." One participant did not have many disabled friends outside of a close relationship with a disabled family member. Participant 10 stated, "My friendships from being involved in wheelchair fencing have increased. It wasn't until I became involved myself that personal friendships took hold." A young participant reflected on how a community with individuals their age was impactful. Participant 10b stated,

> "I've become more social and have been able to maintain pretty positive relationships that I don't think I really have done before (with people with disabilities). I've been going to a spinal cord injury clinic since I was injured, but almost everyone there was a physical therapist or significantly older than me. Fencing has been a positive in that, like, there's at least a lot more people in my general age group."

Participants noted changes in how they viewed their community through the sport as well. Participant 7a stated, “When I started para-fencing, that was when I started learning so much more about the disabled community and feeling accepted.” Similarly, participant 5c stated, “Everyone has their different challenges, but we all have challenges and can relate in that way. I think it’s something that I hadn’t really had in my life.”

Two participants, who are new to fencing, discussed the change to their social lives following joining the sport later in life. Participant 1b reflected on how many of their friends’ houses are not accessible, limiting social participation. However, their experiences at the fencing club have improved their social interactions. They stated, “My club is just so amazingly welcoming and kind. I just feel like I have a better community. I think that that improves my self-confidence because I feel like people like me.” Another participant moved from being a coach to an athlete. When they first started the sport they felt like a novelty to the club, but now have begun to develop a community with the other athletes. Participant 9c stated, “I give them some feedback on how they can get better… I talk with the parents because I’m at the age where I’m like a grandfather to the other athletes. Fencing is very family-oriented based socialization within the club.” They go on to note that family-oriented socialization provides them with many interactions they didn’t always have.

Improved cognitive processes.

Attention, concentration, and problem solving were all noted to improve in some of the participants. Some participants found the attention required in fencing translated to their day-to-day lives. Participant 5c stated, “There will be moments in my life that are not fencing but feel like fencing flow. A state where things slow down. Like, I think when things drop, and you go to catch them like that kind of reflex.” A younger participant noted fencing helped them

prepare for getting their drivers permit, stating, “When I was learning to drive. I took the focus I've learned from fencing, and I can put it into that part of my life. I can meditate to think of this is what I'm doing, and this is how I can fix that. That and coming up with different solutions creatively.” Short term concentration and decreased distractibility were also noted. “My short-term rational awareness, like concentrating intensely for a couple of minutes at a time have gone way up”, stated participant 5b. Participant 1b also spoke on concentration stating, “I think during fencing you have to think about fencing. You cannot think about other things… I think I’m just less distractable in general.” Some participants reported having better cognitive processes but couldn’t pinpoint exactly what improved. Participant 7a said their brain was more active when they were more active. But couldn’t elaborate on what more active meant. Likewise participant 9c stated their “mind is better” because of fencings demand to “circumventing the cognitive process to got from observation of a stimulus and then you’re automatically in control of it (not reacting).” Overall, a few participants reported improved cognitive processes due to the sport.

Summary

The above themes highlight the benefits of wheelchair fencing and the fencing community, for all of those who are involved. There were notable impacts on social participation, physical health, mental health, and view of disability. As well as some noted impacts on cognition.

Chapter 5: Discussion and analysis of findings

Demographic analysis

Demographic information showed no trend between gender, age, and years of fencing experience. This is most likely due to the nature of fencing and the current diversity initiatives. Women were first allowed to compete in fencing in 1924, but only allowed to fence with a foil. Women were allowed to fence epee in 1996 and sabre in 2004. In comparison, men have been allowed to fence foil since 1896, epee since 1900, and sabre since 1896 (Olympic Studies Centre, 2017). Due to this, women have had less time to build numbers in the sport. However, USA Fencing and international fencing governing bodies started initiatives to promote women in the sport, leading to increased numbers. Based on this information it is expected for there to be slightly less women in the research compared to men, which is what was seen. Similarly, there have also been initiatives to build veteran and para-fencing. Veteran programming allows for adults to start fencing and compete at an older age or stay competitive, due to the age category being catered to the older population. Similarly, athletes can begin at a very young age and fence in youth and cadet categories. The sport allows individuals of any age to start fencing and stay competitive. Due to this there is a wide range of fencing experience, regardless of age. During the research process there were participants who started fencing at seven years old and now have twenty years of experience at twenty-seven and participants who started fencing in their sixties and have been at it for only two years. Due to this there was no trend in age and years of experience.

Why fencing

The mental game, the community, and the individuality of the sport was noted to be the main drives to participating in fencing in both the qualitative and quantitative data. 42.9% of participants said the mental aspect of fencing was their favorite part of the sport. Fencing is, by nature, a strategy game. Athletes can be physically fit, but if they do not understand how to apply tactics and technical skill, they will not be successful. Likewise, the mental aspect of the sport was found to be one of the main differences between other sports. Due to this, it can be assumed that the mental games are the largest reason the sport differs from others, while also being a big draw to athletes. Fencing was also found to differ from other sports due to the individuality of the sport. The individuality of the sport was noted to be the second main difference between fencing and other sports. Likewise, it was also one of the largest draws to the sport for athletes. Due to the wide variety of tactics and technical skills that can be applied to fencing individual athletes can create their own style of fencing and are not restricted to a mold of what fencing should be. The ability for the sport to be individualized allows for a level of adaptability in the sport allows individuals from a wide variety of disabilities and age ranges to participate in the sport. The variety in the sport allows for fewer repetitious movements and allows for an increased variation of movements. This was reported to be a reason some wheelchair fencers switched to fencing due to prior sports being too much wear and tear on the body. In addition, wheelchair fencing athletes can adapt their equipment to their needs, allowing for decreased injury rates, as all equipment is customed to them. The sport being mentally engaging also comes down to the individuality of the sport. Allowing athletes to develop their own sense of style creates more variables in the sport and produces a more mentally challenging game as no solution fits every variable.

Fencing is inherently an individual sport but also has a very large community. In addition, athletes can compete as individuals while also cheering on teammates, producing a sense of community. Community was noted by 25.7% of participants as a reason they remain in fencing or joined in the first place. In addition, 20% of participants noted that the community is one of the reasons fencing stands apart from other sports. Qualitative data showed that community was a large aspect of both able-bodied athletes' experiences and the para-athletes' experiences. When discussing the impact of community, individuals noted that they made lifelong friends and found a supportive community in which they learned life lessons. This is exemplified in the qualitative data discussing the impacts of having more disabled friends and wheelchair athletes. For example, some participants noted that being around individuals with similar disabilities in the sport showed them that they can accomplish more than they previously thought. Being part of a large community allows people from different backgrounds to come together and have discussions, while also bonding over the love of their sport. The large demographics of individuals found in fencing leads to an integrative community and more opportunities for individuals of various backgrounds to bond and compete in the sport. This is also noted in the above demographic analysis discussing veteran programming and women's programming. Overall, the sport of fencing is unique in the way it challenges people mentally, allows individuality, and contains a large supportive community.

Impacts on able-bodied participants

Able-bodied peers noted that training with wheelchair fencers improved their technical skills and changed their view of disability or their view on wheelchair fencing. 73.3% noted it improved their technical skill and 80% noted it changed their view of disability. Prior to trying wheelchair fencing, 40% of participants did not think they would benefit from a sport designed

for individuals with disabilities and 20% thought it would be easier than able-body fencing. After trying the sport many noted during qualitative interviews or in the open-ended quantitative questions that they no longer view the sport as easier or as not beneficial to themselves as athletes. This data can also be seen in **Table 8**. During the qualitative interview process individuals noted that one of the main reasons they did not know a lot about the sport or viewed disabilities in a different light was because of ignorance. However, after trying the sport and being around more individuals with disabilities their viewpoint changed. Exposure to different people in different situations is important for combating ignorance. By having these athletes work with individuals with disabilities, they would be able to experience a little bit of their world and work on breaking down some biases they had in their life. Everyone has biases, no matter how small and whether they're aware of them, and the best way to combat them is through exposure. Based on the findings it can be concluded that having wheelchair fencing in your club can help combat ignorance surrounding adaptive sports, and also improve individuals' view of disability.

Individuals noted that they did not think the sport would be beneficial to them, but after trying the sport 73.3% noted it improved their technical skill. The nature of wheelchair fencing puts a harsher demand on technical skill and speed. In able-body fencing, athletes can use their legs to expand distance and escape into "safe spaces" outside of the critical distance where one can get hit. However, in wheelchair fencing the athletes are locked into a distance much closer and constantly in that critical distance. This puts pressure on the athletes to be able to perform at a higher speed and be technically strong from the hand to defend themselves. Experienced wheelchair fencers can utilize athleticism to move out of these critical distances and rely on speed to compensate for decreased technical skills. However, able-bodied athletes training in the

chair often do not have the experience necessary to compensate with body movements; therefore, forcing them to be more reliant on technical skill. This will improve their technical skill in the long run. This is noted in the qualitative interview process where most individuals noted needing a faster hand and how it forced them to be more technically sound to be successful. Due to this, it can be extrapolated that having wheelchair fencing in fencing clubs would also be beneficial to the able-bodied athletes, as well as the disabled community.

When investigating the impacts wheelchair fencing had on individuals experiencing injury, 100% of participants noted that wheelchair fencing improved their socialization, physical health, and improved their fencing technique while injured. In the quantitative data, participants who were injured noted that they had increased restlessness, negative mental health, and increased anxiety due to being injured. Wheelchair fencing helped reduce the impact of anxiety and restlessness by allowing participants an outlet while injured. 80% reported wheelchair fencing improved their mental health and restlessness. Being able to participate in wheelchair fencing allowed them to remain in the community of fencing and stay on top of their technical skills through taking lessons in the chair, despite having injuries. Training in the chair allowed them to be physically active while not aggravating injuries. The most common injuries in fencing tend to be hamstring pulls and other leg-based injuries due to the nature of the movements of able-bodied fencing. One participant was healing from a meniscal tear of their knee and was able to continue to take lessons and fence with their friends due to having access to wheelchair fencing. Due to this information, it can be extrapolated that having wheelchair fencing in your program also helps able-bodied athletes during periods of injury. Overall, wheelchair fencing benefited able-bodied athletes in multiple ways including combating ignorance, improving technical skills, and allowing athletes to continue to train and remain in the community despite

injury. Making wheelchair fencing a useful tool not only for disabled athletes, but also their peers.

Quality-of-life impacts on disabled participants

Physical health, socialization, mental health, and cognitive impacts were all seen in participants in both the qualitative and quantitative data. When looking at physical health participants reported improvements with pain, sleep, stamina, and overall physical fitness. Pain was not something that was consistently improved in individuals due to the nature of some people's disabilities. 94.4% of participants noted there was a change in their physical health through wheelchair fencing. 61.1% of participants noted that they had high pain levels. However, while diving into this topic deeper in the qualitative section of this research, it was found that while people still had high pain levels, their relationship with pain had changed through wheelchair fencing. Individuals with spinal cord injuries noted that they always have high pain levels due to the nature of their disability. Participant 1A noted that they have severe nerve pain due to their spinal cord injury and that this impacts their sleep quality, as well. Individuals in the study noted that the sport helped teach them how to regulate their activity levels to reduce their pain levels. Being able to modulate what they were doing in the sport helped them manage their pain levels. As previously stated, individuals with spinal cord injuries did not notice changes with their sleep quality as their spinal cord injury makes sleeping harder. However, individuals without spinal cord injuries all noted improvements in their sleep quality if they had poor sleep prior to starting the sport. The largest factor for improved sleep quality was that they were now physically tired or had developed skills, such as deep breathing exercises, through the sport. Similarly, due to the increased physical activity individuals noted increased stamina. Stamina was noted in arm muscles and in general endurance. This was largely contributed to just being

more physically active in general and some individuals noted that if it was not for wheelchair fencing, they probably would not be getting any physical activity due to lack of motivation, access to exercise, or due to the nature of their work. Wheelchair fencing also allowed individuals to be more physically active while putting less wear and tear on their bodies compared to cycling and other repetitive nature sports. Multiple participants noted that they chose fencing over other sports because of the decreased repetitive nature on their shoulders, which was very important since they rely on their arms to utilize their chairs. Participants were able to improve stamina without repetitive use injuries.

A notable trend in the quantitative data was that while individuals reported high levels of pain there was no correlation between this impacting quality of life, self-confidence, or positive outlook of the future. 88.9% of participants reported a positive future mindset and 72.2% reported having high self-confidence. In addition, 83.3% of participants noted that their mental health improved through the sport, even though pain levels did not necessarily decrease. One of the key themes noted in the qualitative section surrounding mental health was that the sport allowed individuals to be very goal oriented. Having goals can help individuals shift their mindset towards the future and work towards something despite the day-to-day struggles they may experience. In addition, it was noted that the sport allowed for anxiety release from stressful situations and days, allowing individuals to reduce their own anxiety. Therefore, even though pain levels did not decrease, the sport gave individuals an outlet for their anxiety and helped them be goal-oriented to maintain a positive outlook. Self-confidence was also increased in the sport due to the community and achievement of goals through the sport. One participant noted setting goals helped them feel like they were celebrating little victories in the day-to-day and allowed them to have a more positive outlook and increase self-confidence. The nature of

fencing allows individuals to be more goal oriented due to the individuality of the sport. When competing, the results are based on individual performance and puts the responsibility on the individual themselves. This allows individuals to take responsibility for their actions and for their outcomes, pushing individuals to work towards goals and celebrate the little victories. It can be extrapolated that the goal-oriented nature of the sport helps improve the mental health of the participants involved. Mental health was also improved due to the close-knit supportive community outlined in this research.

77.7% of participants noted that socialization was improved due to wheelchair fencing. During quantitative research it was found that 55.6% of individuals noted that their social needs were met and 94.5% reported having disabled friends. In addition, 72.2% noted that they were satisfied with their socialization. Reasons individuals were not happy with their socialization levels were due to inaccessibility of homes of their friends, lack of leisure pursuits in their community if they lived in rural areas and impacts from the current pandemic. A strong trend that was found during the qualitative research was that having a community of similar peers also with disabilities improved mental health and had positive impacts on individual socialization. This is exemplified in the quantitative data and the qualitative data. In the qualitative data it is seen that multiple participants reported that they learned to push past their boundaries due to having disabled peers. It is also noted that some of these individuals that have now retired from the sport continue to maintain lifelong friendships that they made during fencing. The need for socialization and peer support has always been a forefront of occupational therapy and for quality of life of individuals. Having adaptive sports programming that allows individuals with similar interests to interact in a competitive environment can improve socialization and mental health. The unique community found in fencing, highlighted in the demographics and the reasons

why people fence, hold true here as well. Individuals are drawn to fencing based on the strong community that is here in the sport.

Attention and cognitive processes were noted to improve in 27.8% of participants. The sport requires a high level of concentration and fast reflexes to be successful. Fencing requires individuals to maintain attention on their opponent and on themselves while things are happening at a rapid speed. In wheelchair fencing this holds even more true than able-bodied fencing due to the close distance at which the athletes are competing in. Individuals who noted cognitive process improvements related it back to the problem-solving nature of this sport and the need for concentration. The participants noted that they found themselves being able to concentrate more intensely for short periods of time outside of fencing and taking a unique approach to problem solving in work environments and home environments. Future research into the cognitive impacts are recommended to further understand the impact wheelchair fencing has on individuals who are neurodivergent, such as individuals with ADHD and autism, and individuals who are neurotypical. Neuroscience and cognitive processes are very complex and can be impacted by different conditions or learning styles which makes this a variable hard to tack down. Overall disabled participants who participated in wheelchair fencing found improvements in physical health, mental health, socialization, and cognitive processes due to the nature of the sport, the community they are involved in, and through the opportunities gained through being in an adaptive sport.

Implications to occupational therapy practice

During the literary review process, it was noted that there was a gap in research surrounding wheelchair fencing and little research on the impacts of adaptive sports on quality of life of individuals in general. There was no research done by occupational therapist investigating

the impacts of wheelchair fencing at all. All research done on wheelchair fencing was on muscle usage and what is looked for to make an ideal athlete. Understanding the impacts specific adaptive sports have on individuals with disabilities and the community around them is important in order to help advocate for adaptive sports and contribute to improving the quality-of-life for individuals living with disability. This is important to the occupational therapy field due to the large role occupational therapists play in advocacy for their clients and making sure their clients meet all their occupational needs. These occupational needs include leisure pursuit, physical health, mental health, and socialization. These are all areas that were noted to be improved during the study by wheelchair fencing. It is the hope that this research will be utilized in the future to help advocate for the role of occupational therapy in adaptive sports and to also be used to advocate for adaptive sports overall. This research will serve as one of the first research projects looking into the quality-of-life impacts of wheelchair fencing on US athletes.

Conclusion

In terms of impact, it was found that wheelchair fencing significantly improved the physical health, mental health, socialization, and cognitive processes of disabled participants. In addition, this research found that the main draw to fencing are the mental game, community, and longevity of the sport for all populations of individuals. Wheelchair fencing was also shown to have positive impacts on able-bodied peers who trained with wheelchair fencers. These positive impacts were improved technical skill and changes in the view of disability and adaptive sports. Limitations of this study are noted to be the small sample size compared to the population of fencers in the United States. In addition, the study is limited by the lack of medical knowledge of the participants. This is a limitation because it makes it more difficult to identify trends between the impact the sport has on specific disabilities. It is recommended that future studies follow

athletes from the start of the sport for at least five years to see the impact the sport has on the athlete and to obtain a full medical history on each participant in the study, in order to see the impact wheelchair fencing has on specific disabilities. It is also recommended that future studies have a larger number of participants and include international para-fencers from other countries as well. More quantitative research looking at cardiopulmonary and functional mobility utilizing standard assessments would also be beneficial. A more quantitative approach to research would benefit our understanding of the impacts of this sport by providing a more in-depth analysis of what those impacts are through a standardized lens.

Information from this research, as well as information learned from the program development process that coincided with this research, have been utilized to produce clinical practice guidelines for program development of wheelchair fencers. These documents can be found in appendix F and appendix G. These clinical practice guidelines outline the importance of goal-oriented design and other highlighted factors that produce a successful program. Information from this research process was also used to develop materials and workshops to provide education on wheelchair fencing and the need for adaptive sports to the community at large. Overall adaptive sports serve a very important role in the disabled community and spreading the knowledge of the impacts of adaptive sports is crucial to program development and growing the adaptive sports community.

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Appendices

Appendix A: IRB Approval

QUINNIPIAC UNIVERSITY

Human Experimentation Committee/Institutional Review Board

Appendix B:

Political Context for Adaptive Sports Programming in New York and Connecticut

Project Proposal

Adaptive sports provide individuals in the disabled community an opportunity to pursue leisure opportunities, social participation, and other occupations. Compared to able-bodied peers, there are significantly less sports opportunities for those who live with a disability. The goal of this project is to establish a niche adaptive sport programs in the Connecticut and New York area to provide more adaptive sports opportunities to the disabled community. In addition, educational materials will be produced, workshops will be provided to other professionals, and a study on the effects of wheelchair fencing on the individual's quality of life and perceived happiness will be conducted. Wheelchair or para-fencing is an adaptive sport that is highly adaptable and different compared to the typical ball sports usually offered in sports programming. This project will provide private lessons, group lessons, integrated programming, camps, and educational programs at two fencing club locations located in Connecticut and New York. This qualitative ground theory study will use interviews and assessments to investigate the short term and long-term impacts of para-fencing on quality of life. Quality of life for the purpose of this study is defined as the perceived happiness, functional mobility, health management, social participation, and leisure pursuits.

Stakeholders Perspectives

This project holds the interest of multiple stakeholders: USA fencing, Quinnipiac University, The Phoenix Center, Rogue Fencing, the participants, and any future partnerships with rehabilitation programs. USA fencing, The Phoenix Center, and Rogue Fencing hold an interest in the program and research due to its focus around fencing and program building, specifically in the realm of para-fencing. Quinnipiac University and future rehabilitation partnerships hold interest due to the research aspect of the project investigating the impacts of this specific adaptive sport on therapeutic outcomes in participants. Understanding these

outcomes can provide evidence-based support for future implementation of this adaptive sport in therapeutic practice for individuals with disabilities.

USA fencing is currently in the process of promoting and growing their para-fencing program. USA fencing is trying to get more clubs to run accessible programming, grow the national and international team, and build awareness for paralympic fencing. USA fencing provides all fencing clubs in the United States with insurance, specific trainings (such as SafeSport), and is the overarching body that regulates fencing in the United States. USA fencing provides grants, training, and free camp opportunities to those involved in the para-fencing programming and community. USA fencing is specifically interested in this program due to it being the first one implemented in Connecticut and bringing increased opportunities to the New England area, since there are few opportunities for para-fencing currently in this area. As the overarching body, USA fencing can dictate what training and certifications the programs coaches and locations need to operate. Support from USA fencing is already gained due to their initiative and current professional connection, due to this author's status on the international team for para-fencing.

The Phoenix Center and Rogue Fencing are sister clubs, owned and operated by the same team. Owner of The Phoenix Center and co-owner of Rogue fencing, Eric Soyka works with Rogue co-owner Sandra Marchant, to teach and spread the sport of fencing to their local communities. Both individuals are interested and excited to build a para-fencing program and interacted with the local disabled community. Implementing this program at their clubs would build the club's membership and increase opportunities for grants. The clubs want to build the program to help the community also. The clubs can dictate when classes and lessons can be run,

class size capacity, cost of programming, and overall schedule to prevent overlap with current classes. Support from both locations has been established with a memorandum of intent signed.

Quinnipiac University and their occupational therapy doctorate classes helped form this project, apply for the necessary IRB and paperwork, and help build the programs connections through connecting their students with a faculty mentor. Quinnipiac has a vested interest in the success of their students and the research they create. The more students they have that contribute to occupational therapy knowledge through evidence-based practice and research the more the prestige of the school rises. Quinnipiac's occupational therapy doctorate program helps build the guidelines and ensures that the students complete all research legally and ethically. The university dictates what students can do and helps guide the direction of their research.

Participants involved in the program will also benefit. The program provides them opportunities to be involved in leisure pursuits, get physical activity, and to form a social group. In addition, individuals' responses to surveys and interviews can help promote the sport in the future. This can help increase the number of individuals with access to the sport and provide more opportunities for participants to expand their social circle and build a community. Future partnerships with rehabilitative programs have an interest in this program because it provides another community service they can utilize for their clients. It also helps to create future evidence-based practices focused on adaptive sports that can be utilized by these programs in the future. These programs can provide guidelines and required training before the partnership can be formed. It would be a collaborative partnership. To build these connections the author would reach out to these programs and set up meetings to pitch the program.

There are few competing interests among the stakeholders. The only potential conflict could be between the desire of USA fencing to have large competitive teams nationally and

internationally and the philosophy of the partnered fencing clubs. Rogue and Phoenix just want to bring the sport to the community, whether it be hobby or competitive. There is the potential for conflict if USA fencing pushed for the program to become competitive, instead of a program that is designed to provide opportunities for the community. This conflict is unlikely but should be considered. The acquirement of an IRB and understanding of HIPPA regulations will be required for the implementation of this program to ensure it runs smoothly and the evidence-based practice guidelines are followed. The installation of locked filing cabinets, private meeting spaces, and consent from participants will be needed.

Appendix C: Informed consent

Informed Consent Form:

Para-fencing Programming: The establishment and investigation of para-fencing's impact on Quality of Life

You are invited to participate in a study on the impacts para-fencing has on quality of life. Please read this form or listen while it is being read.

To participate in the study, you must: (for QOL Survey)

- Be permanently disabled as outlined by IWAS guidelines or USA participation precedents.
- In stable health
- Over the age of six

To participate in the study, you must: (for along-side para-fencers survey or wheelchair fencing while injured survey)

- Mentally able to consent.
- Have done chair lessons while injured or trained with wheelchair fencers currently or previously.
- Over the age of six.

This study is being conducted by faculty and student (s) of Quinnipiac university in conjunction with Eric Soyka of The Phoenix Center.

Background Information:

The purpose of this study is to investigate the impacts para-fencing has on quality of life. Quality of life will be measured through physical health (functional mobility, cardiopulmonary health, pain levels, range of motion and muscle function), social participation, mental health (reported happiness and depression), and cognition (attention).

Procedures:

If you agree to be in this study, you will be asked to:

- Partake in a series of interviews.
- Fill out an intro and exit survey.
- Consent to use of information being utilized to write up findings and be published in paper and presentation format. (Information will be coded)

Choice to do the Study:

Your participation in this study is your choice. Your decision to participate will not affect your relations with the program or administrators of the study or your ability to still be part of the fencing program. If you participate, you are able to change your mind at any time without penalty.

Risks and Benefits:

Due to the nature of the study, there is an emotional risk. Individuals may experience stress or anxiety due to reflecting on their disability. To mitigate this, researchers are trained in mental health first aid, coping skills, and will following a pre-set mental health emergency protocol in order to reduce the stress and anxiety of participants.

Reward:

No reward will be provided for doing this study and participation is free during the trial period.

Privacy:

Records from this study will be kept private and only accessible to the researchers. Names will be coded, and files will be destroyed at the completion of the study process.

Contact and Questions:

The researcher doing this study is Victoria Isaacson, an occupational therapy doctoral student, under the supervision of Eric Soyka and Professor Elizabeth Wescott. Victoria Isaacson may be contacted at Victoria.isaacson@quinnipiac.edu. You may also contact Eric Soyka and Elizabeth Wescott at ESoyka@aol.com or elizabeth.wescott@quinnipiac.edu for questions or concerns.

Statement of Consent:

I have read the above information. I have asked and received answers. I consent to participate in the study. A copy of this form has been given to me.

Printed Name of Participant

Guardian (if required) ----------

Participant Signature

Guardian signature ----------

Date:

Appendix D: Survey and Interview Questions

<u>In all surveys</u>

1. Statement of Consent: I have read the above information. I have asked and received answers. I consent to participate in the study. A copy of this form has been given to me. Please type your name below and add the date next to your name. If a minor, have a guardian sign and date.
2. Name: _____
3. Gender Identity
    a. Female

   b. Male
   c. Non-binary
   d. Other
   e. Prefer not to answer
4. Age:
   a. <13 years old
   b. 14-19
   c. 20-29
   d. 30-39
   e. 40-49
   f. 50-59
   g. 60+
   h. Prefer not to answer
5. How did you learn about fencing?
   a. A friend
   b. Social media
   c. An event
   d. Other: _____
6. How long have you been fencing for?
      a. < a year
      b. 1-2 years
      c. 3-5 years
      d. 6-9 years
      e. 10-15 year
      f. 16+ years
7. Are you involved in other sports currently?
   a. Yes
   b. No
8. If you are no longer doing these sports, please explain why.
9. What is your favorite part about fencing?
10. How has this sport compared or differed from other sports?
11. Please tell me a little bit about how fencing impacted your life.
12. Would you be willing to do an interview to discuss your life before fencing and the impacts it had on your life?
      a. Yes
      b. No
      c. Maybe
13. If yes, please provide your email.

Survey 1: *Wheelchair Fencing Quality-of-Life Impacts on Individuals with Disabilities*

14. My day-to-day life is greatly affected by pain.
   a. Strongly agree
   b. Agree somewhat
   c. Neither agree or disagree
   d. Disagree somewhat
   e. Strongly disagree

15. My pain limits me from doing the things I want to do.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
16. I tire very easily.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
17. I can get a good night's sleep consistently.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
18. I have no trouble concentrating throughout the day.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
19. I have a positive mindset about my future.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
20. I have a lot of self-confidence.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
21. I am greatly impacted by anxiety and depression.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree
    d. Disagree somewhat
    e. Strongly disagree
22. I have friends that are also disabled.
    a. Strongly agree
    b. Agree somewhat
    c. Neither agree or disagree

   d. Disagree somewhat
   e. Strongly disagree
23. I have access to multiple leisure activities.
   a. Strongly agree
   b. Agree somewhat
   c. Neither agree or disagree
   d. Disagree somewhat
   e. Strongly disagree
24. To what extent do you feel all your social needs are met?
   a. Not at all
   b. A little
   c. A moderate amount
   d. Very much
   e. An extreme amount
25. To what extent do you feel all your physical needs are met?
   a. Not at all
   b. A little
   c. A moderate amount
   d. Very much
   e. An extreme amount
26. To what extent do you find anxiety limiting your daily activity?
   a. Not at all
   b. A little
   c. A moderate amount
   d. Very much
   e. An extreme amount
27. How satisfied are you with your quality of life?
   a. Very dissatisfied
   b. Dissatisfied
   c. Neutral
   d. Satisfied
   e. Very satisfied
28. In general, how satisfied are you with your physical health?
   a. Very dissatisfied
   b. Dissatisfied
   c. Neutral
   d. Satisfied
   e. Very satisfied
29. In general, how satisfied are you with your mental health?
   a. Very dissatisfied
   b. Dissatisfied
   c. Neutral
   d. Satisfied
   e. Very satisfied
30. In general, how satisfied are you with your socialization?
   a. Very dissatisfied

   b. Dissatisfied
   c. Neutral
   d. Satisfied
   e. Very satisfied
31. In general, how satisfied are you with your access to sports?
   a. Very dissatisfied
   b. Dissatisfied
   c. Neutral
   d. Satisfied
   e. Very satisfied
32. In general, how satisfied are you with your endurance?
   a. Very dissatisfied
   b. Dissatisfied
   c. Neutral
   d. Satisfied
   e. Very satisfied
33. Do you feel fencing has made your life better overall?
      a. Yes
      b. No
      c. Maybe
34. In what areas of your life do you feel fencing had a positive impact? Please select all that apply.
      a. Socialization
      b. Physical health
      c. Mental health
      d. Attention span
      e. Other:--------

Survey 2: *Benefits of Wheelchair Fencing When Injured*

35. Have you ever had an injury that limited your ability to fence?
      a. Yes
      b. No
      c. Maybe
36. While injured, I was more anxious.
      a. Strongly agree
      b. Agree
      c. Neutral
      d. Disagree
      e. Strongly disagree
37. While injured, I felt restless.
      a. Strongly agree
      b. Agree
      c. Neutral
      d. Disagree
      e. Strongly disagree
38. While injured, I felt my mental health was negatively impacted.

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

39. Did you have access to chair lessons while injured?
    a. Yes
    b. No
    c. Other
40. If no, do you think having access to chair lessons would have been beneficial?
    a. Yes
    b. No
    c. Maybe
41. If yes, check off all areas you felt chair lessons had a positive impact.
    a. Mental health
    b. Socialization
    c. Physical health
    d. Restlessness
    e. Improved fencing technique
    f. Other

Survey 3: *Experience of Learning Along-side Para-fencers*

42. Have you ever trained with wheelchair fencers?
    a. Yes
    b. No
43. Check all areas in which you trained with wheelchair fencers.
    a. Bouting
    b. Lessons
    c. Conditioning and workouts
    d. Group classes
    e. Competition
    f. Other
44. What were your initial thoughts about wheelchair fencing, prior to trying it?
    a. Easier than able-body
    b. Harder than able-body
    c. Though it would not benefit you as someone without a disability
    d. Thought it looked fun
    e. Other
45. Briefly explain how you view wheelchair fencing now and how your view of it has changed.
46. I feel that training with wheelchair fencers improved my technical skill.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

47. I feel that training with wheelchair fencers changed how I view disability.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
48. I feel training with wheelchair fencers made me a better fencer.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

Interview Questions

Interview questions were designed to be open/semi-structured in nature to allow for catering to individuals based on their survey responses and allow for a deeper exploration into the individuals lived experiences.

1. Tell me more about what appealed to you about fencing.
2. Tell me more about your relationship with pain and how it has changed through the sport (or lack of change).
3. Tell me more about the physical health impact the sport had on you.
    a. Stamina
    b. Sleep quality
    c. Concentration
4. Tell me more about the mental health impacts the sport had on you.
    a. Self-confidence
    b. Anxiety
    c. Future mindset
5. Tell me about how fencing impacted you socially.
    a. Did you have disabled friends prior to the sport?
    b. What has the impact of having disabled friends been like?
6. Tell me how fencing has impacted you overall.
7. Tell me more about your first experience with wheelchair fencing.
8. How did/can wheelchair fencing improve your fencing as an able-bodied athlete?

Appendix E: Recruitment Emails

Phoenix/Rogue Email:

Hello everyone! Coach Tori is conducting research surrounding fencing and wheelchair fencing. Tori would really appreciate the help in collecting data. If you have time, they would really appreciate you taking some time to fill out the two surveys below. Thank you in advance.

Survey One:
If you have taken lessons or fenced in a wheelchair while injured, please fill out this survey.
Benefits of wheelchair fencing while injured

Survey Two:
If you have fenced with, trained with, or competed with wheelchair fencers, please fill this survey.
Benefits of training alongside

Email to USA Fencing officials:

Hello, I hope your week is going well. I am reaching out about my doctoral thesis to see if I can get some help distributing my surveys, as my research revolves around the benefits of para-fencing. I have outlined what my project is and the survey information as well as links below. Would appreciate any help getting these surveys to the US population, as I feel my research can be used to help promote the sport. Thank you!

research synopsis:

The purpose of this study is to investigate the impacts para-fencing has on quality of life. Quality of life will be measured through physical health (functional mobility, cardiopulmonary health,

pain levels, range of motion and muscle function), social participation, mental health (reported happiness and depression), and cognition (attention).

The capstone research had been approved by a regulatory board and I have attached their approval letter.

Survey One:

https://forms.gle/qaRFDKmMwv3teork9

This survey is for individuals with a disability that currently or have been involved in wheelchair fencing. The purpose of this survey is to help establish themes and gather information on the benefits wheelchair fencing has on the quality of life of individuals with a disability.

Survey Two:

https://forms.gle/L582JytnfHP8wFJm9
This survey is for individuals who train along-side para-fencers. The focus of this survey is to determine the common experiences and impacts training with para-fencers has on abled-bodied athletes.

Survey Three:

https://forms.gle/LUTM3B2A8EqsaRkb6
This survey is for individuals who took wheelchair fencing lessons while recovering from an injury. The purpose of this research is to determine common experiences and impacts wheelchair fencing had on these individuals.

Appendix F: Clinical practice guidelines

Clinical Practice Guideline Process

Clinical practice guidelines (CPGs) help set standards for program implementation, to help guide evidence-based future practices. These CPGs can help practitioners through providing easy to read information and steps on how to apply it to practice (AAFP, 2019). CPGs contribute to knowledge translation due to their heavy research and literature-based backgrounds. CPGs are formed through hours of research and literary review producing evidence-based recommendations. In the author's following statements, level of evidence will be indicated by the word usage of *may* and *should*. *May* indicates the statement is backed by moderate to weak evidence, while *should* statements reflect moderate to strong evidence. Evidence level in relationship to study type is indicated in *figure 1* and *figure 2.*

Figure 1 (Physiopedia, 2022)

A: Strong evidence	A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study.
B: Moderate evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C: Weak evidence	A single level II study or a preponderance of level III and IV studies including statements of consensus by content experts support the recommendation.
D: Conflicting Evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E: Theoretical/ foundational evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/bench research support this conclusion
F: Expert Opinion	Best practice based on the clinical experience of the guideline's development team

Figure 2 (Physiopedia, 2022)

1A	Systematic reviews of randomized controlled trials
1B	Individual randomized controlled trials with narrow confidence intervals
2A	Systematic reviews of cohort studies
2B	Individual cohort and low quality randomized controlled studies
3A	Systematic reviews of case control studies
3B	Case-controlled studies
4	Case Series and poor-quality cohort and case control studies
5	Expert opinion

Identifying Evidence

Evidence was found through a thorough literature review utilizing AOTA databases, PUBmed, Elsevier, and other scholarly journal databases. Textbooks on adaptive sports and research articles found through google scholar were also utilized in the literature review. Key words searched are adaptive sports, fencing, sports, sports and quality of life, sports and mental health impacts, factors of health post-disability, adaptive sports impacts, and quality of life in disabled individuals. Research found was analyzed for themes and read thoroughly to look for biases, peer-reviewed status, and its application to the authors research topic. Following coding an evidence table and literature review paper were drafted. Through research it was found that there are no current CPGs for adaptive sports implementation, surrounding fencing or program implementation in an already established sports community.

Following the establishment of PICO questions, see *figure 3*, and statements, a list of preliminary topics was formed. Preliminary topics surround the impacts sports and adaptive sports have on quality-of-life indicators, current research around fencing, impacts for athlete best outcomes, and impacts of routines on athlete outcomes. Research was focused on these topics and the PICO questions. Based on the research that was found the CPGs were based on what practitioners and programmers should know and what interventions will produce the best outcomes for their participants.

Figure 3

P: Population/ Problem	**I:** Intervention	**C: C**omparison	**O:** Outcome
Population: Individuals in New York and New England with disabilities such as spinal cord injury, cerebral palsy, amputation, and any disability that causes a motor impairment. *Problem:* Does adaptive sport specifically, para-fencing, improve quality of life in participants with a disability?	Adaptive sports programming, specifically para-fencing.	Peers who do not participate in adaptive sports and/or pre and post assessments for individual participants.	Quality of Life: - Mental health - Physical health - Social participation - Leisure pursuits - Cognitive impacts

Background

The CDC defines disability as, “any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities and interact with the world around them” (2021). Current CDC studies have found individuals with disabilities have higher incidences of obesity, smoking, diabetes, and heart disease compared to the abled-bodied population. In addition, less than half of individuals with a disability participate in enough aerobic exercises, further increasing the risk of secondary complications (CDC, 2021). Medical expenses for disabilities and secondary conditions accounted for thirty-six percent of healthcare expenses in 2015 (CDC, 2021). Secondary conditions from decreased aerobic exercise

can lead to decreased health management of individuals with disabilities and increase the financial strain on the individual themselves and on society. Adaptive sports provide a resource to the disabled community to pursue leisure activities and to participate in meaningful exercise. Prior studies have shown that adaptive sports have positive impacts on individuals' social participation, functional mobility, and other occupations (Costalonga et al., 2020; Declerck et al., 2019; & Feitosa et al., 2017). Wheelchair or para-fencing is building interest in the United States and can become a resource for the disabled community. The following clinical practice guidelines are focused around understanding the impacts adaptive sports have on client outcomes, the role of goal writing, the role of routines, importance of conditioning, and skills desired for para-fencing. The CPGs will help orient new adaptive sports programmers or fencing coaches to the current research and help guide them in their program development.

Clinical Evidence

CPG 1

Fencing coaches and adaptive sports programmers may utilize adaptive sports to improve, 1) social participation, 2) physical health (functional mobility, cardiopulmonary health, pain levels, and muscle function), 3) mental health (PTSD, depression, and reported happiness improvements), and 4) cognition (global cognition, attention, and social behavioral skills) in their participants.

When implementing a program, it is important to understand current research that supports the intervention to build on it and add to the research. Promoting programs through educating rehabilitation programs and participants on potential outcomes will also help build programs. Adaptive sports have been linked to improved physical health in participants (Declerck et al., 2019; Nagata et al., 2018; Feitosa et al., 2017). Improved social participation

was seen in adaptive sports interventions (Brown et al., 2020; Dimitropoulou et al., 2019; Nagata et al., 2018; Lastuka & Cottingham, 2015). Cognition, improved employment outcomes, and improved sense of self were also associated with adaptive sports interventions or participation (Brown et al., 2020; Declerck et al., 2019; Lastuka & Cottingham, 2015). Adaptive sports research shows the benefits of this opportunity on participants lives; however, the studies are often small, leading to this CPG statement being a *may*. For a more comprehensive evaluation of the current evidence review the literature review and evidence tables formulated by this author.

CPG 2

Fencing coaches and adaptive sports programmers may utilize goal writing, working with the athletes to establish program and individual goals, in individual training programs to improve athletic performance.

Occupational therapy is based on understanding our clients' goals and motivations to promote the best occupational outcomes and ensure participation. Including the participants goals in the adaptive sports program can increase retention of participants in the program. A meta-analysis conducted by Healy et al. acknowledge that goal writing is a positive tool in athlete development, but that the process has been too simplified (2018). The article continued to discuss the needs of goal reassessments, its role in self-regulations, and the process in which goals should be developed. Consistent reassessment of goals that were unattainable and changing course to reach intended outcomes can lead to improved goal reengagement and a resurgence of motivation in the sport (Healy et al., 2018). The social environment surrounding the coach and the athlete plays a role in the attainment and achievement of goals. Empowering environments were found to have higher goal reengagement in athletes. Coaches who promoted positive spaces

and support were found to have more athletes engage autonomously with their goals (Healy et al., 2018). In comparison negative environments were found that athletes were more affected by external and internal pressures and less likely to reengage with their goals (Healy et al., 2018). Simões et al. investigate process-oriented goal setting and its impacts on swimmer performance (2012). The study originally found that in the absence of mental training and proper feedback that goal writing led to a decline in the swimmers' performances; however, in the following season when feedback and training was modified there was a change in swimmer performances. While results did not change the thought process and persistence of the athletes changed (Simões et al., 2012). Athletes were more committed to the process, more persistent, and were able to analyze and interpret their results more productively (Simões et al., 2012). Based on this finding, when goal writing is done correctly it can have positive effects in athlete mentality and eventually results. McCarthy et al. investigate the impact goal setting had on three athletes (2010). The study found that there was a significant increase in the athletes' positive affect (McCarthy et al., 2010). This indicated that goal setting can also increase overall happiness in athletes alongside higher motivation.

CPG 3

Fencing coaches and adaptive sports programmers should use sport specific conditioning in their training programs to decrease the risk of injury in their athletes, including stretching, muscle training, and neuromuscular training.

Preventing injury and taking care of an athlete at all levels can increase retention and positive outcomes in a program. Borysiuk et al. found that in category A fencers, the latissimus dorsi fired first, followed by the middle deltoid, external abdominal oblique, extensor carpi radialis

longus, and the triceps (2020). In the category B fencers, the extensor carpi radialis longus fired first, followed by the latissimus dorsi and obliques where contraction was possible, and the other muscles of the arm (Borysiuk et al., 2020). Injuries in wheelchair fencing are most seen in the upper extremities and back, with an increase in injuries noted during the competitive season (Chung et al., 2012). Over exertion and poor mechanics while fencing can lead to these injuries. Implementing condition to the muscles and movements used has the potential to decrease injuries or recovery time. Hubscher et al. found that conditioning programs reduced the number of injuries in sports that involved pivoting (2010). Talpey et al. stated that conditioning decreases the risk of injuries in athletes in multiple ways (2017). Conditioning improves the athlete's ability to participate in their sports with decreased stain on the body, but also provides an extra pair of eyes on the athlete to catch warning signs of injury. Properly trained condition coaches can keep up to date on current research, report injuries, and help instruct athletes through the injury recovery process, which will also prevent future injuries of the same origin (Talpey et al., 2017). Overall, conditioning can improve outcomes for athletes by reducing injury impacts and risks.

CPG 4

Fencing coaches and adaptive sports programmers may seek to improve reaction time, speed, flexibility, and strength in their participants to improve sports performance and decrease sports anxiety.

Understanding the skills that will make an athlete successful and incorporating them into a training program will help promote better sports outcomes in the future and help athletes reach their goals. Speed, flexibility, and strength in actions are the most sought-after skills for

para-fencers internationally (Villiere et al., 2021). Speed was shown to have the highest impact on success between athletes, with most of the higher-level athletes sporting faster speeds while fencing then non-experienced peers (Villiere et al., 2021) Xu et al. found that fencers who participated in movement training programs, focused on speed, flexibility, and strength also reported lower levels of sports-based anxiety (2017). Currently, all observable top para-fencers in the United States and abroad can be noted to rise through the points list as their speed, flexibility, strength, and anxiety improves.

CPG 5

Fencing coaches and adaptive sports programmers may incorporate individualized routines into their programs, such as warm up routines, daily routines, and program structure, to decrease sports related anxiety.

In OT, routines are a strong skill to promote occupational participation. Routines have long been a part of sports and have had reported impacts. Rupprecht et al. conducted a meta-analysis to investigate the reported benefits of routines on athletic performance (2021). Pre-performance routines were composed of a single or several elements that included physical, imagery, self-talk, external focus, and relaxation (Rupprecht et al., 2021). The comprehensive analysis concluded that routines prior to performance have a significant impact on the athlete's ability to perform in a variety of settings; however, the authors encourage individualized programs has the potential to have better effects and that there are many variables of success that need to be considered when evaluating results (Rupprecht et al., 2021). Sports that require explosive efforts were found to have improved performance when a warm-up routine was utilized in conjunction with avoiding long rest breaks (Silva et al., 2018). Overall, there are many

studies looking into routines and sports performance, providing this suggestion with moderate support.

Implementation

Potential barriers to implementation are: 1) lack of exposure of the sport to the public, 2) competition between businesses, 3) decreased exposure and training of staff, 4) conflicting desires between clubs and the community, such as money allocation, 5) finding and maintaining athletes, and 6) managing programming with COVID 19. Implementation will use the following strategies to ensure success of the program and CPGs implementation in practice.

Strategies	***Strategy implications***
Build a coalition	*Program cannot grow alone and need to learn from one another. Reaching out to other adaptive programs to help grow one another will help the CPGs and fencing program grow.*
Change structure and equipment	*Evaluate the current environment and modify it to be accessible. Use current equipment to build equipment for individuals based on their disability. Need space to be accessible to be successful and get the effects of the CPG statement.*
Conduct education meetings	*Use the CPG data on QOL to produce more competent staff and abled-bodied teammates. Also helps educate the future families on the benefits of the program.*
Quality monitoring	*Check in with staff and other program connections to ensure the program is conducted and information is shared correctly. To have a good reputation we cannot lie to the community. Address areas of concern immediately.*
Educational Materials	*Compose the educational materials in an easy distributable packet to be handed out at events and lead to the outcome measures being easier to understand and be spread.*
Involve Participants	*Include participants in the evaluation of program development. The program is for them, and feedback is key. Dynamic training means all individuals are unique and will have unique views and needs.*

Reflections

Implementing a program and spreading the program ideals using CPGs is a difficult journey and task. CPGs will be continually reassessed throughout the program implementation and feedback process. The use of CPGs will help make a base for program launch and coaching training. Para-fencing development in the United States has been slow but is recently picking up interest and speed with the collective efforts of coaches across the country. The use of these CPGs and programming in New England hopes to help further develop this adaptive sport.

Appendix G: Application of clinical practice guidelines

Practical application of clinical practice guidelines

Para-fencing Programming

Isaacson, Victoria A.
DOCTORAL CAPSTONE: QUINIPIAC UNIVERSIYY OTD PROGRAM

Table of Contents

Clinical Practice Guidelines

1. Fencing coaches and adaptive sports programmers may utilize adaptive sports to improve, 1) social participation, 2) physical health (functional mobility, cardiopulmonary health, pain levels, and muscle function), 3) mental health (PTSD, depression, and reported happiness improvements), and 4) cognition (global cognition, attention, and social behavioral skills) in their participants.

2. Fencing coaches and adaptive sports programmers may utilize goal writing, working with the athletes to establish program and individual goals, in individual training programs to improve athletic performance.

3. Fencing coaches and adaptive sports programmers should use sport specific conditioning in their training programs to decrease the risk of injury in their athletes, including stretching, muscle training, and neuromuscular training.

4. Fencing coaches and adaptive sports programmers may seek to improve reaction time, speed, flexibility, and strength in their participants to improve sports performance and decrease sports anxiety.

5. Fencing coaches and adaptive sports programmers may incorporate individualized routines into their programs, such as warm up routines, daily routines, and program structure, to decrease sports related anxiety.

These clinical practice guidelines were created utilizing evidence-based research and are supported by current research. The background, evidence, and rationale behind these clinical practice guidelines can be found in the associated document: Clinical Practice Guidelines: Para-fencing Programming.

CPG #1:

Fencing coaches and adaptive sports programmers may utilize adaptive sports to improve, 1) social participation, 2) physical health (functional mobility, cardiopulmonary health, pain levels, and muscle function), 3) mental health (PTSD, depression, and reported happiness improvements), and 4) cognition (global cognition, attention, and social behavioral skills) in their participants.

Importance:

Understanding the impact of wheelchair fencing as an intervention can help promote the sport, advocate for the need of sport in rehabilitation, and help potential new athletes understand the worth of the sport.

Goal:

All coaches and programmers will be able to advocate for the need for wheelchair fencing. They will do so through understanding all the impacts sport has and being able to relay that information to the community.

Case Study: The support for this CPG and multiple case studies can be found in the author's final capstone paper on the topic.

Application: An example of the application of this CPG is…

A new participant came to the program following a car accident resulting in a spinal cord injury. The individual had difficulty maintaining their weight and was often out of breath. Since the accident they reported feeling depressed and not having a lot of friends, since their social circle was largely other motorcyclists.

The individual was hesitant at first but was recommended to come by a friend. At the first session the impacts the sport could have and an introduction to the other participants was given. The individual wanted to give it a try since the program had proven results. A conditioning plan, lesson plan, and group class schedule was provided to the individual. They started coming once a week and slowly increased to coming to the program three days a week.

After a couple of months, the individual reported feeling happier and goes out often with the other individuals in the program. They also reported they have lost some weight and have increased their stamina.

CPG #2:

Fencing coaches and adaptive sports programmers may utilize goal writing, working with the athletes to establish program and individual goals, in individual training programs to improve athletic performance.

Importance:

Evidence has shown that goal writing, goal re-assessment, and athlete involvement in goal writing leads to positive outcomes in athletic performance and engagement. Individuals who are in a positive environment and engage with the goal writing process can handle internal and external pressures better compared to their peers who are not as involved. Goal writing is a mental process that can help athletes learn to modify their training and mentally engage in feedback while training. Due to this goal writing and athlete involvement in goal writing is a critical part to making a successful athlete both in and out of the sport.

Goal:

Through the application of this CPG, programmers and coaches will be able to understand the importance of goal writing in developing successful athletes. In addition, resources and case studies will be provided to help guide coaches and programmers through the goal writing process.

Case Study:

Participant N was an athlete who enjoyed the sport but had difficulty determining goals and what they wanted in the sport. N started to become frustrated when competition and training became difficult. N reported that they had difficulty with regulating their emotions, motivating themselves to continue training, and that they felt that they did not know what they wanted to do. The more frustrated N became the worse their tournament results became, leading to a frustration loop. N worked with our program and started working on building a routine (see CPG 5) and discussed with coaches about how to write goals. With the help of the coaches N was able to come up with three basic goals. An example of one of the goals was to increase stamina when

fencing, so that they would not be fatigued after thirty-minutes of fencing. The routine, conditioning plan, and lesson schedules were made to meet N's goals.

After two months N reported a more positive mindset towards the sport, a clearer understanding of what they want from the sport, and improvements in frustration management. They reported that they're able to focus on the process and not the results, leading to less burn out. Working with N to teach them how to write goals and work towards them and involving them in the initial process led to more positive outcomes mentally for N. N is now capable of thinking about long-term goals and is able to plan ahead for progress, instead of getting stuck in the moment. The application of this CPG in N's programming helped them become comfortable in the process towards success and develop a healthier mindset in sport. It has also helped them focus and work towards specific goals that has led to improved tournament results.

Application:

Writing goals require insight into an individual's weaknesses, strengths, barriers to participation, and desired outcomes. In occupational therapy goals are determined by the information found in the occupational profile. The same concept can be applied for goal writing when working with individuals in a wheelchair fencing program. The table below outlines how to determine the above pieces.

Area to address	**What is it?**	**How to apply it?**	**Example(s)**
Weaknesses	Weaknesses in this context refer to areas the athlete feels unsuccessful or limited in. This can be body functions, body structures, or environmental.	Understanding where an athlete has difficulties in can help structure the goals. If it is something that can be addressed goals can be made for it. If it's a permanent barrier the goals can be modified to accommodate the athlete's needs.	Athletes have decreased muscle strength in the torso due to a spinal cord injury and rely heavily on their arms. Goals can be made to address arm strength to prevent further injury and compensate for limitations due to spinal cord injury.
Strengths	These are areas in which the athlete feels successful in.	These can be used to help build success in goals by supporting an athlete's weaknesses with their strengths.	Athlete is having trouble seeing distance due to poor depth perception. They noted proprioception as a strength of theirs. Incorporate blade actions

			into the training plan to help access distance to compensate for depth perception.
Barriers to participation	Barriers are environmental, body function, or task demands that limit the individual's ability to participate in a task.	Understanding what is limiting an individual and how to compensate or overcome the barriers to improve participation is important for the success of a goal.	Athlete cannot make it to the gym to do conditioning due to the gym not being wheelchair accessible. Not having access to a gym can limit the athlete's ability to reach conditioning-based goals.
Desired outcomes	These are what the athlete wants to achieve at the end of the process. If the athletes' goals do not align with the staff's goals, they will never commit to the goals or accomplish them.	Take the athletes' desire into consideration and incorporate them into the goals.	The athlete wants to be able to fence for 45 minutes without needing to stop in order to prepare for tournaments. Incorporate cardio and endurance goals into the plan to meet the athletes desired outcomes.

Once the above pieces are determined one must work with the athlete to produce goals. When determining and implementing goals four things should be kept in mind.

1. Long-term goals should be achievable in a six-month period. These goals should address where or should the individual be in this period of time.
2. Goals need to be achievable in the set time frame, otherwise you are setting up the athlete for failure. Think about what is reasonable and doable.
3. Short term goals should be set to help scaffold. Scaffolding with goals means to set short term goals that slowly progress the athlete towards the long-term goal.
4. There should be multiple short-term goals that set the athlete up for success.

<u>Resources:</u>

For more information on goal writing and addressing athlete goals see the resources below.

- https://www.ucop.edu/local-human-resources/_files/performance-appraisal/How%20to%20write%20SMART%20Goals%20v2.pdf

- https://www.indeed.com/career-advice/career-development/how-to-write-smart-goals
- https://www.youtube.com/watch?v=1-SvuFIQjK8

CPG #3:

Fencing coaches and adaptive sports programmers should use sport specific conditioning in their training programs to decrease the risk of injury in their athletes, including stretching, muscle training, and neuromuscular training.

Importance:

Injuries can put athletes out of action for prolonged periods of time. In individuals with disabilities injuries can directly impact the ability to be mobile in their environment also. Injury prevention is important to help reduce the strain of sport on the athlete's body. Training muscles and motor pathways can improve coordination and athletic performance, making a more successful athlete.

Goal:

Through the application of this CPG, programmers and coaches will be able to understand the importance of conditioning in developing successful athletes and preventing injuries. In addition, resources and case studies will be provided to help guide coaches and programmers through the conditioning process for disabled athletes.

Case Study:

An athlete in our program had difficulty with holding their arm up and their body up when lunging due to poor coordination and abdominal strength. This created anxiety in lessons, as well as increased soreness. The athlete was non-compliant with conditioning plans, due to lack of interest. Lack of interest was determined to be because the plan was originally designed for athletes in their 20s, while this athlete was still in grade school. To make conditioning more novel the plan was changed to include all game-based exercises. After changing the plan compliance increased. After a few sessions of incorporating play into the conditioning plan the athlete reported decreased soreness and was performing their lunges better in lessons. The exercises were specific to the sport and the athlete, allowing for functional performance changes as well as strengthening. The staff's experience working with pediatric clients allowed for the success of this plan.

Application:

Athletics depend heavily on our ability to physically and mentally perform in a stressful environment. With any sport there is a risk of injury if the body is not prepared to perform the task. Fencing is an explosive sport that can put a lot of strain on joints and muscles. Building a well-rounded conditioning plan requires an interprofessional team working together to coordinate a specific plan for specific athletes. As implemented in our program development, our team was comprised of fencing coaches, an occupational therapist, a personal trainer, and the athletes themselves.

Role Name	**Role Description**	**Importance**	**Example**
Coach	This team member has a vast understanding of the sport and what skills are needed to make an athlete successful on the sports side.	The coach is key to help determine what areas will lead to success in the sport and help set the rest of the team on the correct path for designing a conditioning plan.	The coach notices an athlete's shoulder drops during a lunge and that they are slow on the retreat. They point this out to the team. The dropped shoulder and slow pace is getting the athlete hit during competition.
Occupational therapist	This team member has extensive training in working with individuals with disabilities, developmental delays, and rehabilitation.	Occupational therapists are trained in how to make adaptive equipment, work with a variety of conditions, and how to help clients reach all of their goals and participate in all of their occupations. This team member is trained to be adaptable and sees how to prevent further injury.	The program has an individual with multiple health conditions that is limiting their ability to participate in a generalized conditioning plan. The occupational therapist can make recommendations based on their training to make the athlete successful and reduce barriers to the athlete.
Personal trainer	This team member has extensive training in how to strengthen and condition	This team member has extensive knowledge on how to work towards conditioning goals. Working with the	See the goals of the coach and athlete. Discuss how to make modifications to exercises with the occupational therapists. Then

	individuals for desired tasks.	other team members they can make a comprehensive conditioning plan.	designs a plan and teaches it to the athlete.
Athlete	The athlete is the focus point of the team.	The athlete has to be an active participant in the process or else compliance may decrease. The goals and likes of the athlete are important to making a successful plan.	The athlete may hate working with weights but loves using bands or participating in group activities. Once expressed to the team a more calisthenics approach can be used when making the plan.

Every team member brings something to the table. A coach alone can only do so much for one athlete when working in a large program. Having an interprofessional team allows for multiple eyes, brains, and hands to be on one project and to monitor progress. In our experience having a team allowed for more work to be done and for faster more effective problem solving to occur.

CPG #4:

Fencing coaches and adaptive sports programmers may seek to improve reaction time, speed, flexibility, and strength in their participants to improve sports performance and decrease sports anxiety.

Importance:

Fencing is a sport reliant on speed, reaction time, and ability to play the mental game of the sport. Athletes in fencing can lose bouts due to overthinking, lack of confidence, or anxiety. Setting athletes up for success through applying motor learning theories to build movement patterns, improve reflexes, and improve reaction time can help set athletes up for success and reduce anxiety. Wheelchair fencing requires flexibility mentally and physically. Improving these areas can also improve sports performance.

Goal:

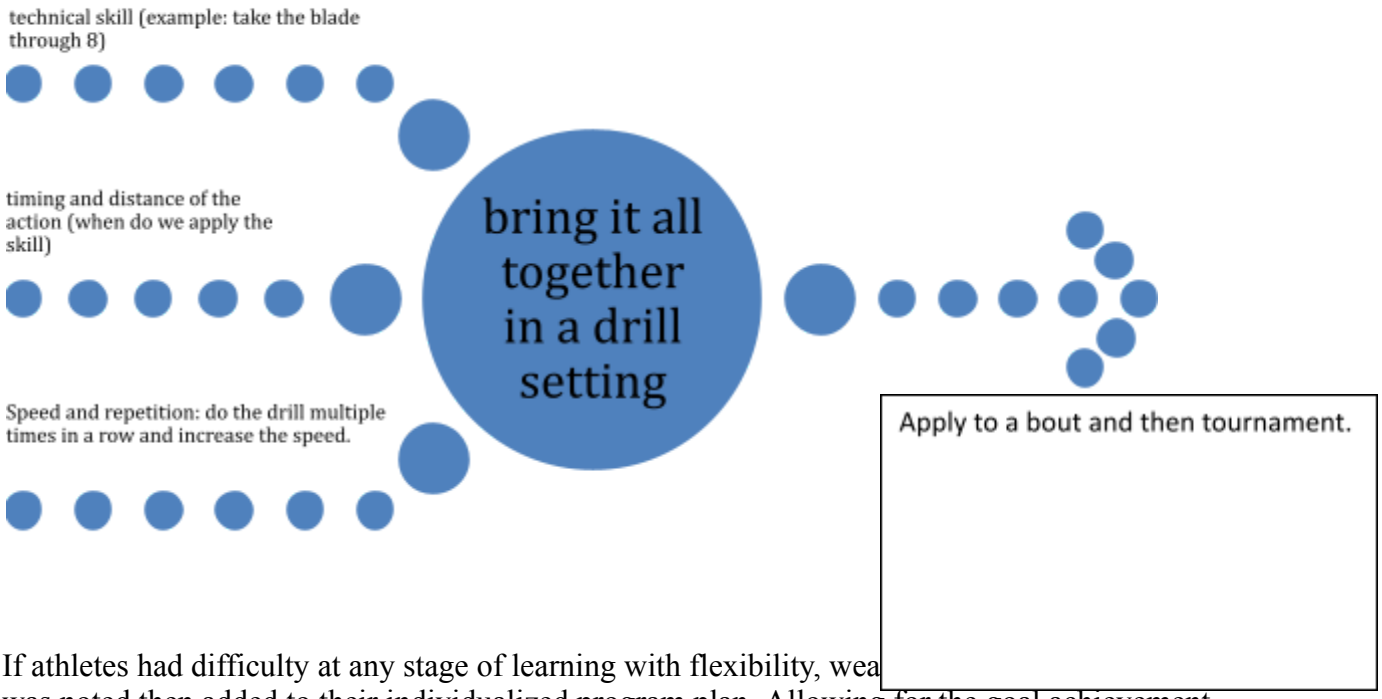
Through the application of this CPG, programmers and coaches will be able to understand the importance of conditioning in improving athletic performance and reducing sport anxiety. In addition, resources and case studies will be provided to help guide coaches and programmers through the conditioning process.

Case Study:

An athlete in our program with over thirty years of fencing experience was struggling to have good tournament results. The athlete noted that he was having issues staying balanced, reacting in time, and second guessing his actions. After an evaluation by the team, we determined he had decreased ankle stability, shoulder weakness, and a slower reaction time to stimuli compared to what he used to have. We started the athlete on a conditioning program as well as working on reaction time specific drills. After three months of working on conditioning and improving reaction time the athlete started to display improved confidence when fencing, as well as improved balance. The improved balance allowed the athlete to perform actions faster and more accurately.

Application:

CPG #4 integrates well into goal writing and conditioning protocols. One cannot implement the 4th CPG without an understanding of how to utilize goal writing. Working with the interprofessional team we were able to determine that for fencing and wheelchair fencing flexibility, reaction time, and speed were necessary on top of strength and technique to produce strong athletes. Athletes that had reduced reaction time, flexibility, or speed often would struggle more with technical application and have increased performance anxiety. To reduce this impact, we incorporated these three aspects into goal writing, program plans, and into individualized conditioning plans. A focus on motor patterns and repetition was implemented to help improve reaction time for specific actions. A good program plan builds on itself and works to keep the athlete improving. An example of how we incorporated these aspects into our program plan is through tiered learning. Technical skill, timing, and speed would be practiced in isolation. Then it would be practically applied, incorporating all the skills into a successful action. The speed and strength of the action could be modified based on conditioning and practice the athlete puts in. All working towards achieving STG along the way. Short term goal #1 would be to perform the drill slowly and stationary. Then slowly add more aspects until the LTG of applying the skill in a tournament environment is achieved.



If athletes had difficulty at any stage of learning with flexibility, wea
was noted then added to their individualized program plan. Allowing for the goal achievement process to continue while also cauterizing the process to the student.

CPG #5:

Fencing coaches and adaptive sports programmers may incorporate individualized routines into their programs, such as warm up routines, daily routines, and program structure, to decrease sports related anxiety.

Importance:

Current research supports the use of routines to improve athlete's ability to perform across multiple settings. Setting routines can promote success at tournaments, decrease the amount of time wasted in class settings, and prepare the mind for tasks as hand.

Goal:

Through the application of this CPG, programmers and coaches will be able to understand the importance of routines in reducing sports anxiety. In addition, resources and case studies will be provided to help guide coaches and programmers through the routine building process.

Case Study:

One of our athletes reported having difficulty with feeling ready when at tournaments. She stated that she becomes anxious in the new setting, starts overthinking, and then doesn't know how to warm up. Working with the athlete the team developed a warmup routine and suggested that she makes a playlist she listens to every time she is warming up. After two months of utilizing the warmup routine she implemented the same warm-up at a tournament. Following the tournament, she reported she felt more aware and mentally ready than at previous tournaments. She noted that she felt less anxious as she had a set plan when entering the event.

Application:

To build effective routines the staff must understand how the athlete learns and their preferred warmup style. For example, one athlete may benefit best from just listening to music and visualizing while another athlete may need a physically demanding warmup to be prepared to perform. An athlete needs to be connected to their body and mind to perform, as seen in the chart below. Athletes can prepare mentally, physically, and emotionally through their routines.

Ultimately determining the best program can only be done with the collaboration of a team and the athlete. Below are recommended starting points for routine building based on category of body and mind connection.

Area of intervention	**Importance and definition**	**Example routines**
Mental Preparation	The brain's ability to attend to and perform tasks. Fencing is a very mental game and being mentally ready is a big component of success in the sport.	- Visualization - Music routines While listening to the same playlist utilized while training the athlete visualizes what tasks they will have to perform.
Physical Preparation	The body's ability to perform the needed task. Fencers need to be physically ready to perform actions or else their performance could be impacted.	- Warmup routine Athlete does sprints, jumping jacks, and footwork before every session. - Warmup bouts while at a tournament (can also warm up mental aspect)
Emotional Preparation	The individual's ability to remain calm, intake	- Positive self-talk - Journaling

	information, and respond appropriately. Frustration and doubt can be detrimental to an athlete. Having routines to cope with the emotions of sports can help set athletes up for success.	- Deep breathing exercises - Calming music

Complete case study:

The athlete:

The athlete is a male in his early twenties. He sustained a high-level spinal cord injury when he was a child resulting in decreased abdominal, latissimus dorsi, and torso strength. Prior to building a plan for him he noted that he had difficulty with performing at the level of his opponents. He had difficulty with retreating in his new back brace and with being able to perform heavy blade actions and flicks without severe fatigue and shoulder pain. He approached our team because he wanted to build strength, endurance, accuracy, and start being able to keep up with the competition. Early on when discussing with the athlete we noted that he did not have any solid goals for the sport, which was impacting his motivation. Mental and emotional tools were included in the plan to help the athlete succeed.

Conditioning based goals:

- In two weeks, he will be consistent with performing the workout and can do so independently.
- He will be able to transfer independently from the floor to chair and chair to chair while utilizing his back brace, 50% of the time within six months.
    - This goal incorporated flexibility.
- He will be able to land 75% of his flicks by June.
    - This goal incorporated reaction time.

Mental goals:

- He will identify what his STG and LTG in the sport are by the end of the week.
    - He did go on to identify his goals and noted a spark in motivation following this.

Long-Term Goals:

- He will be able to increase ROM backwards to a functional level in the sport.

- He will be able to accelerate forwards, utilizing the back arm for power, to a functional level in the sport.
    - This goal is only achievable with work in reaction time, strengthening, mental preparation, and routine building.

The interventions:

A strengthening plan was made for the athlete that included shoulder strengthening, speed training, reaction time training, and repetition of skills to build a motor plan. In addition, discussions surrounding routines were conducted. Working with the athlete we made him a schedule of when to do what exercises and drills. Due to the schedule, he was consistent with the program and saw improvements within a few weeks.

End results:

15 weeks following the program plan for this athlete the following improvements were seen:

- Shoulder stability and strength
- Reflexes
- ROM in the chair slightly improved
- Speed in retreats and lunges increase.
- Accuracy of flicks and blade actions had improved.
- Mental ability to process progress improved, leading to reduction of frustration.
- Athlete had goals for the sport and started making noticeable mental progress in training and in competition.

Overall, due to the conditioning plan and implementation of routines the athlete saw an improvement in his physical strength, mental processes, and in sports performance.