Journal of Novel Physiotherapies
ISSN: 2165-7025

Laferrier et al., J Nov Physiother 2017, 7:5
DOI: 10.4172/2165-7025.1000365

Research Article OMICS International

Investigation of the Impact of Sports, Exercise and Recreation (ser) Participation on Psychosocial Outcomes in a Population of Veterans with Disabilities Using the Sports Outcome Research Tool and Comprehensive Uniform Survey (Sportacus). A Longitudinal Study

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Received date: September 13, 2017; **Accepted date:** September 25, 2017; **Published date**: September 27, 2017

Abstract

Objective: The aim of this study was to investigate the effects of participation in sports, exercise and recreation (SER) on self-esteem, depression, posttraumatic growth and quality of life (QOL) in veterans with disabilities longitudinally at four time points.

Design: A convenience sample of 163 individuals (91 sports-participants and 72 non-participants) matched on disability type with a variety of disabilities took part in this longitudinal study. Variables of interest were: SER participation vs. non-participation, years of SER participation since onset of disability (less than one year, one to five years, five to ten years, and more than ten years), the type of activity they engaged in (individual activities or a combination of team and individual activities) and time (pre-event, immediately post-event, one month post-event, and three months post-event). Main outcome measures were self-esteem, depression, posttraumatic growth and QOL.

Results: SER participants had significantly higher self-esteem, posttraumatic growth and QOL, and significantly lower depression scores than non-participants. There were also significant differences found between the independent variables of: time, number of years participating in SER since onset of disability and type of activity engaged in and various outcome measures studied.

Conclusions: The results of this study support that participation in SER has positive effects on self-esteem, depression, posttraumatic growth, and QOL.

Keywords: Psychosocial well-being; Adaptive sports; Recreation; SER participation; Rehabilitation, Disability; Self-esteem; Depression; Posttraumatic growth; Quality of Life; Service members; Veterans

Abbreviations: NVWSC: National Veterans Winter Sports Clinic; WG: Warrior Games; NVWG: National Veterans Wheelchair Games; QOL: Quality of Life; PTSD: Post-Traumatic Stress Disorder; TBI: Traumatic Brain Injury; VA: Department of Veterans Affairs

Introduction

The number of individuals living with some type of disability is increasing at an accelerating rate. The World Health Organization (WHO) estimates that approximately 1 billion people or 15% of the world's population have a disability [1]. According to the Bureau of the Census, nearly one in five individuals in the United States has a disability, making this population the third largest minority in the country [2]. Unfortunately, this number is on the rise due to issues such as an aging population, natural disasters and the wars in Iraq and Afghanistan.

Veterans

Since September 2001, over 2 million service members have served tours of duty in Afghanistan and Iraq [3]. Survival rates for these conflicts have increased dramatically due to improvements in battlefield care and protective equipment. Wounds that would have proven fatal in the past are now resulting in a number of physically and psychologically disabling conditions.

Combat related injuries are recognized as an unfortunate by-product of war and are accounted for in the overall healthcare budget. However, the number of service members returning with disabilities from the current conflicts has been significantly underestimated. The addition of a population of aging veterans from past conflicts with acquired disabilities increases the total number of veterans in the United States living with some type of disability to approximately 5.5

million [4,5]. The costs of veterans' medical care and disability benefits over the next 40 years are expected to range between $355 to $534 billion [6]. The constant influx of new and acquired disabilities has placed considerable stress on an already taxed healthcare system. Treatment plans may thus not be as comprehensive as would be considered optimal and patient outcomes can suffer. Medical providers are continually looking for the most effective ways to use their limited resources to provide the best possible care and maximize patient outcomes.

Physiological deficits related to disability are typically readily apparent and treated, while negative effects related to psychosocial health may go unnoticed. Among veterans who utilized.

VA care, 48% were diagnosed with a mental health problem [7]. Psychosocial issues can be significant problems in the disabled population and have been associated with unemployment, difficulty with community re-integration, poor physical health and overall decreased function [7-10].

The psychosocial effects of participation in sport, exercise and rehabilitation (SER) have been extensively studied in individuals without disabilities. Reported benefits include, but are not limited to; decreased depression, increased self-esteem, and improvements in overall quality of life [11-18]. A recent study by Rhodes et al. (2009) notes that regular physical exercise is presently considered to be beneficial in the primary and secondary prevention of approximately 25 disabling conditions [19]. As SER has a wide range of benefits for those without disabilities, it is postulated that participation in SER by individuals with disabilities may yield similar positive effects. While there have been numerous narrative accounts of positive life changing experiences that provide qualitative evidence related to involvement in SER there is a paucity of quantitative research studies measuring the clinical efficacy of participation in SER to support these claims. The following tenants of psychosocial health were selected for investigation in this study: self-esteem, depression, posttraumatic growth and QOL.

Self-esteem

Self-esteem is a global measure of an individual's perception of their self-worth and is thought to be maintained through experiences of success and positive judgments from others [20]. A high self-esteem contributes to a positive attitude toward oneself and life in general while low self-esteem stops people from changing their situation, even if they are not very satisfied with it [21]. In the military many training programs, most notably recruit training (or boot camp), are used to influence self-esteem.

Gains in self-esteem and acceptance of disability have both been found to be psychological indicators of successful rehabilitation for individuals with traumatic disabilities [22,23]. SER has been suggested as an effective mode through which self-esteem can be enhanced based on its ability to provide the individual with a meaningful mastery experiences as well as positive interactions with others and an improved perception of physical self [24-28].

Depression

Depression has been ranked as the leading cause of disability in the United States. Over $66 billion is spent each year on lost work productivity and medical treatment and veterans alone account for slightly more than 14% of that total [29,30]. The percentage of veterans reporting depressive symptoms is two to five times higher than found in the general public [31]. Depression is known to be a risk factor for suicide. Risk for suicide in U.S. veterans with depression differs in significant ways from those of the general population. In general, the risk for suicide increases with age, but among the veteran population, younger veterans are at the most risk. [32]. Unfortunately, veteran suicides continue to rise, national statistics show that veterans constitute about 20% of the 30,000 to 32,000 U.S. deaths each year from suicide [33]. This is an alarming number considering that veterans make up less than 10% of the population. Depression has also been linked to impaired cognitive function, decreased physical work capacity and psychotic symptoms similar to schizophrenia [34-39].

In the able-bodied population, SER has been shown to alleviate depressive symptoms in clinical and sub-syndromal depression when used as a monotherapy [40] and in combination with other treatments for depression [41,42]. When compared with other traditional treatments for depression, exercise was just as beneficial and not significantly different from psychotherapy, pharmacologic therapy, and other behavioral interventions [18].

Post-traumatic growth

Tedeschi and Calhoun coined the term posttraumatic growth to describe positive life changes following exposure to or treatment associated with illness, trauma, and/or disability [43]. Posttraumatic growth is not simply a return to baseline from a period of suffering; instead it is an experience of improvement that, for some individuals, is deeply profound [44-52].

Posttraumatic growth has been positively associated with social support, active coping, and participation in leisure activities [53-57]. The results of a thematic analysis revealed that leisure influenced at least four aspects of life experiences related to growth: 1) providing opportunities to find personal strengths and abilities, 2) building companionship and meaningful relationships, 3) making sense of traumatic experience and finding meaning in everyday life, and 4) generating positive emotions.

Quality of life (QOL)

A substantial body of literature supports a link between physical activity and improved quality of life among various populations including the elderly, individuals with chronic illnesses and individuals with a variety of disabilities [58-64]. The longest running longitudinal study that has examined exercise and mental well-being concludes that exercise improves one's ability to enjoy life [61-62]. A review of 14 studies showed a consistently positive association between physical activity level and health-related quality of life [59]. There is, however, less conclusive evidence for positive effects of physical activity on disability and global QOL [59].

By improving psychosocial health and well-being, SER may greatly decrease the cost of lifetime care required and improve the long-term prognosis for individuals with disabilities. Healthy People 2020 reported that only 28% of persons with disabilities get the recommended amount of exercise for good health compared to 47% of individuals without disabilities [65]. The history of past wars shows that the cost of caring for combat veterans rises for several decades and peaks approximately 30-40 years after a conflict [66]. Reasons for this peak, which are also present in the civilian population, include progressive functional decline and acquisition of new conditions exacerbated by decreased physical activity.

Developing an evidence base to support the benefits of SER will serve multiple purposes. First, it would help to educate medical providers and assist them in developing the most effective treatment plans and rehabilitation programs, allowing them to make the best use of available time and resources. Second, it would provide a knowledge base to train programs, trainers, and coaches outside of rehabilitation centers. Third, it would serve to educate third party payers and possibly lead to reimbursement for equipment and services. Fourth, it could lower lifetime health care costs while decreasing functional decline and secondary conditions brought about by inactivity. Finally, and most importantly, it would provide an avenue for veterans with disabilities to return to a fuller, healthier life.

Methods

Structure/content

Two versions of the Sports Participation Outcomes Research Tool and Comprehensive Uniform Survey (SPORTACUS) were given at multiple time points. The first version was administered to the SER participant group. This version of the survey was composed of 5 sections with questions related to demographics; (I) medical information, (II) assistive technology use, (III), community, (IV) SER participation, and (V) standard measures of self-esteem, depression, posttraumatic growth and QOL. The second version was administered to the group that did not participate in SER. The non-participant version was similar to the participation version and consisted of the same sections. The main difference was that the non-participant version asked questions related to reasons and barriers for non-participation in SER and if they would participate if these conditions were changed.

Standardized questionnaires

The final section of the questionnaire used measures previously evaluated and found to be valid and reliable to assess the four outcome variables of choice.

Self-esteem was measured by the Rosenberg Self-Esteem Scale (RSES). The RSES consists of ten statements that ask level of agreement (4-point Likert scale). The scale ranges from 0-30. A total score is calculated, with a higher score indicating better self-esteem. Scores between 15 and 25 are within normal range; scores below 15 suggest low self-esteem [23].

Depression was assessed using the Center for Epidemiologic Studies Depression Scale. The CES-D is a 10-item continuous score scale ranging from 0 to 30. Higher total scores indicate greater levels of depressive symptoms. Traditionally, CES-D scores of 16 or higher indicate significant depressive symptoms [51].

Post-traumatic Growth was assessed with the Posttraumatic Growth Inventory (PTGI). The PTGI measures the degree of change experienced in the aftermath of a traumatic event. PTGI is comprised of five factors: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life, consists of 21 items. The degree of posttraumatic growth for each item is rated on a 6-point scale (range, 0-105) [52].

Quality of life (QOL) was assessed by using portions of the WHOQOL-BREF. The WHOQOL-BREF is a 26 item self-report questionnaire developed by the World Health Organization. Twenty-four items constitute four sub–domains: physical health, psychological health, social relationships, and environment, whereas the other two items measure overall QOL and general health. The domain scores denote an individual's perception of quality of life in each particular domain. Domain scores are scaled in a positive direction (i.e. higher scores denote higher quality of life) [62].

Participants and data collection

This study consisted of two groups: individuals with disabilities that participate in SER and individuals with disabilities that do not participate in SER. The sports group participants were recruited in 2010 and 2011 from registered athletes at the National Veterans Winter Sports Clinic (NVWSC), the United States Olympic Committee Warrior Games (WG), and the National Veterans Wheelchair Games (NVWG). All participants were active duty service members or veterans of all branches of the United States Armed Forces who currently have some type of disability. Potential participants approached the designated research area at the events, indicated an interest in participating, were provided an opportunity to read an informational sheet with the essential elements of informed consent and provided verbal consent if they desired to participate.

SER participants completed surveys at four time points. The initial survey was completed before competition began at the event. The second survey was completed directly upon completion of the event. The final two surveys were completed at one month and three months post event via telephone or online. While severe TBI was an exclusion criterion, no differentiation was made between mild and moderate TBI. No exclusion criteria were based on race, ethnicity, gender, or HIV status. The non-participant group was also service members or veterans and was recruited during the same time frame from the Assistive Technology Registry maintained by the Human Engineering Research Laboratories (VA IRB #01185) and the VA Pittsburgh Healthcare System. The non-participant group completed a total of three surveys: the initial survey, one month after the initial survey and a final survey three months after completion of the initial. The surveys were filled out in person when possible, by phone or online. This study was approved through the VA Pittsburgh Healthcare System Institutional Review Board (#02954).

Statistical analysis

Descriptive analysis examined demographics and medical history. Analysis of the outcome measures for SER participants versus non-participants was done as a 3 × 2 mixed design analysis of variance (ANOVA) performed on each outcome measure as a function of time and SER participation. The within-subject independent variable was comparing time with three levels (post event scores for the SER participant group and initial scores for the non-participant group, one month follow-up, and three month follow-up). The between-subjects independent variable was SER participation with two levels (SER participant and non-participant). Assessments of the assumptions of a mixed design ANOVA were performed for each outcome (self-esteem, post-traumatic growth, depression, physical health domain QOL and social health domain QOL). The assumption of normality and compound symmetry were violated for all outcomes and there were outliers identified for two of the three outcome measures. Correcting for the violations of assumptions could have greatly complicated the interpretation of the results. Instead Bootstrap values were computed. Bootstrapping does not require the same assumptions and similar results were found between the bootstrap p-values and ANOVA p-

values. This similarity suggests that the ANOVA results are robust even with the violations of the test assumptions [67].

The analysis of the SER participants was performed as a separate mixed design ANOVA for each outcome measure (4 × 4 × 2 for self-esteem, posttraumatic growth, and depression and 3 × 4 × 2 for QOL domains due to only three time periods). The within-subject independent variable was time with four levels (pre event, post event, one month follow-up, and three month follow-up). The between-subjects independent variables were the number of years participating in SER since onset of disability with four levels (less than one year, one to five years, five to 10 years, and more than 10 years) and SER activity type with two levels (individual activities and a combination of team and individual activities). For these analyses, the same steps were taken to check for violations of the assumptions. When significance was found simple two-way interactions and post-hoc marginal comparisons with Bonferroni adjustment were performed in order to find the pattern of difference between variables. Bootstrapping was also performed to check the reliability of the results. Secondary correlation analyses were performed to investigate relationships between years lived with a disability and the psychosocial outcomes as well as activity intensity and the psychosocial outcomes. All analyses were done using IBM SPSS version 19.0.

Results

Demographics

A convenience sample of 163 study participants were recruited (91 SER participants and 72 non-participants) from 2010 to 2011. SER participants were over the age of 18 and registered athletes at the NVWSC, WG, and the NVWG. Non-sports participant group was recruited through the assistive technology registry and the VA Pittsburgh Healthcare system. The total group included 138 males and 25 females. Demographic information of the study samples from each group including; age, race, highest level of education achieved, marital status and employment status are presented in Table 1.

Demographic Information	Participant (N=91) freq. (%)	Control (N=72) freq. (%)
Gender		
Male	75 (82.4)	63 (87.5)
Female	16 (17.6)	9 (12.5)
Ethnicity		
African American	11 (12.1)	11 (15.3)
Asian	2 (2.2)	1 (1.4)
Caucasian	63 (69.2)	54 (75.0)
Hispanic/Latino	6 (6.6)	3 (4.2)
American Indian/Alaskan Native	1 (1.1)	2 (2.8)
Pacific Islander	0 (0)	1 (1.4)
Two or more races	8 (8.8)	0 (0)
Education Level 8th grade or less	0 (0)	1 (1.4)
9th grade through 11th grade	1 (1.1)	1 (1.4)
High school/GED	31 (34.1)	27 (37.5)
Associates	27 (29.7)	14 (19.4)
Bachelors	19 (20.9)	17 (23.6)
Masters	8 (8.8)	5 (6.9)
Doctorate	3 (3.3)	1 (1.4)
Other	2 (2.2)	6 (8.3)
Marital Status		
Single	17 (18.7)	11 (15.3)
Single but living with partner	5 (5.5)	4 (5.6)
Married	45 (49.5)	37 (51.4)
Divorced	19 (20.9)	12 (16.7)
Separated	3 (3.3)	2 (2.8)
Widowed	1 (1.1)	6 (8.3)
Occupational Status		
Working part or fulltime	30 (33)	7 (9.7)
Homemaker	0 (0)	0 (0)
OJT	0 (0)	0 (0)
Not employed by choice	0 (0)	0 (0)
Not employed due to disability	15 (16.5)	34 (47.2)
Retired	39 (42.9)	24 (33.3)
Student	4 (4.4)	2 (2.8)
Unemployed, unable to find a job	2 (2.2)	1 (1.4)
Other	1 (1.1)	4 (5.6)

Table 1: Demographic information for sport participants vs. non-participants.

Medical history

Disabilities of the study participants are reported in Table 2. It is important to remember that each participant may have more than one disabling condition.

Injuries	Participant (N=91) freq. (%)	Control (N=72) freq. (%)
Spinal Cord Injury		
No	40 (44)	38 (52.8)
Yes	51 (56)	34 (47.2)
Lower Limb Amputation		
No	76 (83.5)	63 (87.5)
Yes	15 (16.5)	9 (12.5)

Upper Limb Amputation		
No	87 (95.6)	72 (100)
Yes	4 (4.4)	0 (0)
Traumatic Brain Injury		
No	74 (81.3)	57 (79.2)
Yes	17 (18.7)	15 (20.8)
Spina Bifida		
No	90 (98.9)	72 (100)
Yes	1 (1.1)	0 (0)
Muscular Dystrophy		
No	90 (98.9)	71 (98.6)
Yes	1 (1.1)	1 (1.4)
Multiple Sclerosis		
No	86 (94.5)	65 (90.3)
Yes	5 (5.5)	7 (9.7)
Cerebral Palsy		
No	91 (100)	72 (100)
Yes	0 (0)	0 (0)

Table 2: Injury specific demographic information for SER participants vs. non-participants.

SER Participant vs. Non-participant Analysis

Self-esteem

There was a significant difference in self-esteem scores between the levels of time averaged across SER participation, $F(2,322)=11.594$, $p<0.001$. SER participants had significantly higher self-esteem scores than non-participants, $F(1,161)=37.081$, $p<0.001$. Self-esteem scores were significantly higher immediately post event than at one month follow-up or three month follow-up averaged across SER participation, $F(1, 161)=12.515$, $p=0.002$ and $F(1, 161)=14.127$, $p=0.001$, respectively.

Depression

Depression scores between the levels of time were significantly different between the levels of SER participation, $F(2, 322)=15.186$, $p<0.001$. There was a significant difference in depression scores between the levels of time averaged across SER participation, $F(2,322)=11.501$, $p<0.001$. SER participants had significantly lower depression scores than non-participants averaged across time, $F(1, 161)=27.538$, $p<0.001$. SER participants had significantly lower depression scores than non-participants post event, $F(1,161)=52.025$, $p<0.001$. SER participants also had significantly lower depression scores than non-participants at one month and three month follow-ups, $F(1,161)=12.131$, $p=0.001$ and $F(1,161)=14.114$, $p<0.001$, respectively.

Posttraumatic growth

There was a significant difference in post-traumatic growth scores between the levels of time averaged across SER participation, $F(2,322=10.565$, $p<0.001$. SER participants had significantly higher post-traumatic growth scores than non-participants averaged across time, $F(1,161)=34.876$, $p<0.001$. The post-traumatic growth scores were also significantly higher post event than at one month follow-up or three month follow-up averaged across SER participation, $F(1,161)=10.539$, $p=0.004$, and $F(1,161)=14.160$, $p=0.001$, respectively.

Quality of life (Physical health domain)

SER participants had significantly higher physical health domain QOL scores than non-participants averaged across time, $F(1,161)=23.609$, $p<0.001$.

Quality of life (Social health domain)

SER participants had significantly higher social health domain QOL scores than non-participants averaged across time, $F(1,161)=35.420$, $p<0.001$.

Sports Participant Analysis

Self-esteem

Self-esteem scores between the levels of years participating in SER since onset of disability were significantly different between the SER activity types averaged across time (Figure 1), $F(3,81)=6.823$, $p<0.001$. There was a significant difference in self-esteem scores between the levels of time averaged across years participating in sports since onset of disability and SER activity type, $F(3,243)=9.536$, $p<0.001$. There was a significant difference in self-esteem scores between the levels of years participating in SER since onset of disability averaged across time and SER activity type, $F(3,81)=7.470$, $p<0.001$. Individuals participating in a combination of SER activities had significantly higher self-esteem scores than those only participating in individual events averaged across time and years participating in SER since onset of disability, $F(1,81)=4.763$, $p=0.032$. There was a significant difference in self-esteem scores between the levels of years participating in SER since onset of disability for those participating in individual SER events averaged across time, $F(3,81)=8.872$, $p<0.001$. There was also a significant difference in self-esteem scores between the levels of years participating in SER since onset of disability for those participating in a combination of SER events averaged across time, $F(3,81)=5.057$, $p=0.003$. For those participating in individual events, the self-esteem scores were significantly lower for those who participated in SER for less than one year as opposed to those who participated in SER one to five years, five to ten years, or more than ten years averaged across time, $F(1,81)=9.867$, $p=0.014$, $F(1,81)=10.214$, $p=0.012$, $F(1,81)$ 19.474, $p<0.001$, respectively. For those participating in a combination of SER events, the self-esteem scores were significantly lower for those who participated in SER one to five years as opposed to those who participated in SER less than one year, five to ten years, or more than ten years averaged across time, $F(1,81)=8.290$, $p=0.031$, $F(1,81)=9.549$, $p=0.016$, $F(1,81)=14.627$, $p=0.002$, respectively. Self-esteem scores were significantly higher post event than pre event, at one month, or three month follow up averaged across years participating in SER since onset of disability and SER activity type $F(1,81)=21.571$, $p<0.001$, $F(1,81)=8.717$, $p=0.025$, $F(1,81)=9.023$, $p=0.021$, respectively.

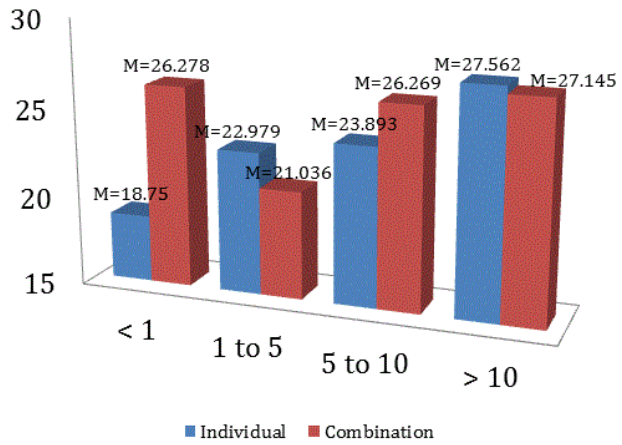

Figure 1: Mean self-esteem scores taking into account the number of years the individual has participated in SER since the onset of their disability and the SER activity type the individual participated in at the event.

Self-esteem scores were significantly higher for those who have participated in SER for more than 10 years than for those who participated in SER for one year or less or one to five years averaged across time and activity type, F(1,81)=15.297, p=0.001, F(1,81)=16.565, p=0.001, respectively (Figure 2).

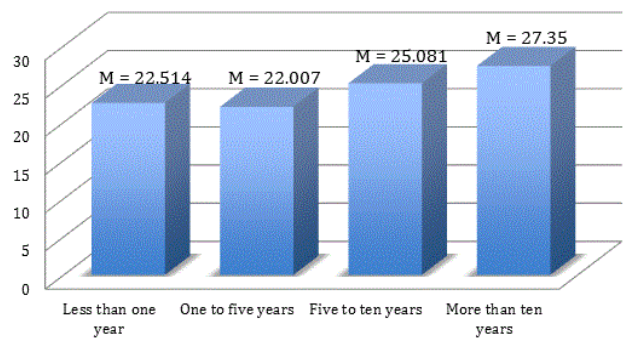

Figure 2: Mean self-esteem scores only taking into account the number of years the individual participated in SER since onset of their disability without regard to which SER activity type the individual participated in at the event.

Depression

The interaction of years participating in SER since onset of disability and SER activity type on depression scores was significantly different between the levels of time, F(9, 243)=2.295, p=0.017. There was a significant difference in depression scores between the levels of time averaged across years participating in SER since onset of disability and SER activity type, F(3,243)=7.943, p<0.001. There was a significant difference in depression scores between the levels of years participating in SER since onset of disability averaged across time and SER activity type, F(3,81)=5.070, p=0.003.

Depression scores between the levels of years participating in SER since onset of disability were significantly different between the SER activity types at one month follow-up, F(1,81)=3.244, p=0.026. There was a significant difference in depression scores between the levels of years participating in SER since onset of disability for those participating in individual SER events at one month follow-up, F(3,81)=4.157, p=0.009. For those participating in individual events, depression scores were significantly higher for those who only participated in SER less than one year as opposed to those who participated in sports five to 10 years at one month follow-up, F(1,81)=9.545, p=0.016.

Depression scores were significantly lower for those who have participated in SER for more than 10 years than for those who participated in SER for one year or less or one to five years averaged across time and SER activity type, F(1,81)=9.756, p=0.015, F(1, 81)=0.350, p=0.011, respectively (Figure 3). Depression scores were also significantly lower post event than at pre-event, one month, or three month follow-ups, averaged across years participating since onset of disability and activity type, F(1,81)=13.758, p=0.002, F(1, 81)=18.627, p<0.001, F(1, 81)=15.269, p<0.001, respectively.

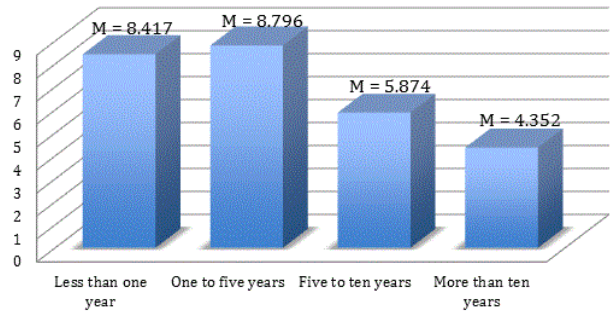

Figure 3: Mean depression scores only taking into account the number of years the individual participated in SER since the onset of their disability without regard to which SER activity type the individual participated in at the event.

Posttraumatic growth

There was a significant difference in posttraumatic growth scores between the levels of time averaged across years participating in SER since onset of disability and SER activity type, F(3,243)=9.496, p<0.001. There was a significant difference in post-traumatic growth scores between the levels of years participating in SER since onset of disability averaged across time and SER activity type, F(3,81)=5.782, p=0.001.

Posttraumatic growth scores were significantly higher pre event than at one month or three month follow up averaged across years participating in SER since onset of disability and SER activity type, F(1,81)=12.568, p=0.004, F(1,81)=13.512, p=0.003, respectively. Posttraumatic growth scores were significantly higher post event than at one month or three month follow up averaged across years participating in SER since onset of disability and SER activity type, F(1,81)=9.580, p=0.016, F(1,81)=9.779, p=0.015, respectively. Posttraumatic growth scores were also significantly higher for those who have spent five to 10 years or 10 years or more participating in SER since onset of disability than for those who only participated in

SER for a year or less since onset of disability averaged across time and SER activity type, F(1,81)=11.857, p=0.005, F(1,81)=12.209, p=0.005, respectively.

Quality of life (Physical health domain)

The pattern of difference in physical domain QOL scores between the levels of years participating in SER since onset of disability were significantly different between the SER activity types averaged across time, F(3, 81)=3.734, p=0.014 (Figure 4).

There was a significant difference in physical domain QOL scores between the levels of years participating in SER since onset of disability for those participating in individual SER events averaged across time, F(3, 81)=5.212, p=0.002. For those participating in individual events, the physical domain QOL scores were significantly lower for those who only participated in SER less than one year as opposed to those who participated in SER one to five years, five to 10 years, or more than 10 years averaged across time, F(1,81)=8.734, p = .025, F(1,81)=7.582, p=0.044, F(1, 81)=7.957, p=0.036, respectively.

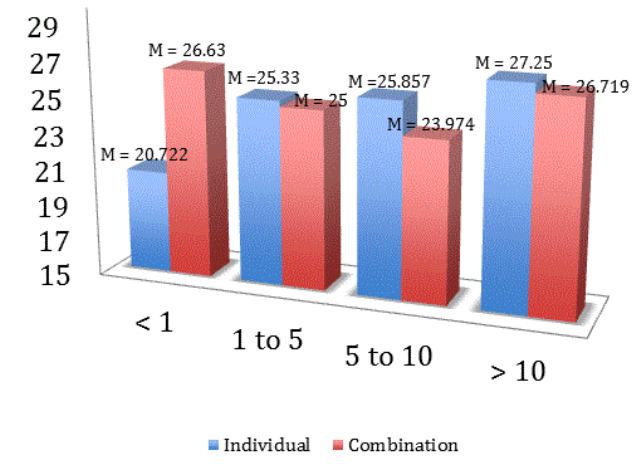

Figure 4: Mean physical health domain QOL scores taking into account the number of years the individual has participated in SER since the onset of their disability and the SER activity type the individual participated in at the event.

Quality of life (Social health domain)

There was a significant difference in social health domain QOL scores between the levels of years participating in SER since onset of disability averaged across time and SER activity type, F(3, 81)=3.684, p=0.015.

Social health domain QOL scores were significantly higher for those who have spent 10 years or more participated in SER since their onset of disability than for those who participated in SER for one to five years since their onset of disability averaged across time and sport activity type, F(1, 81)=7.628, p=0.043.

Correlations

To investigate the association of possible confounding factors and the outcomes of interest secondary correlation analyses were conducted. Due to differences in numerical scales of the variables of interest three different correlations were calculated. Pearson correlations were calculated for years the individual has lived with their disability and the study outcomes. Polyserial correlations were calculated for years participating in SER since injury, and Point-biserial correlations for the intensity of the SER activities (low intensity and high intensity) and the study outcomes (Table 3).

	Years since injury and the study outcomes		**Years participating in SER and the study outcomes**		**Intensity of the SER activities (low intensity and high intensity) and the study outcomes.**	
Psychosocial Outcomes	r	p	r	p	r	p
PTGI pre-event	0.053	0.742	0.354	<0.001	0.125	0.373
PTGI post-event	0.112	0.486	0.271	0.002	0.068	0.629
PTGI one month	-0.162	0.312	0.287	0.003	0.043	0.759
PTGI three months	-0.248	0.117	0.267	0.016	-0.036	0.796
RSES pre-event	0.159	0.321	0.435	<0.001	-0.062	0.66
RSES post-event	0.297	0.059	0.596	<0.001	0.04	0.777
RSES one month	0.237	0.136	0.575	<0.001	0.03	0.829
RSES three months	0.241	0.13	0.594	<0.001	-0.058	0.681
CESD pre-event	-0.168	0.294	-0.444	<0.001	-0.094	0.503
CESD post-event	-0.295	0.061	-0.477	<0.001	0.188	0.178
CESD one month	-0.238	0.134	-0.392	<0.001	0.291	0.034
CESD three months	-0.234	0.14	-0.401	<0.001	0.339	0.013
Physical health QOL pre-event	-0.031	0.845	0.545	0.041	-0.208	0.135
Physical health QOL one month	0.131	0.414	0.417	<0.001	0.001	0.993
Physical health QOL three months	0.143	0.372	0.414	<0.001	-0.104	0.457
Social health QOL pre-event	0.046	0.774	0.265	0.006	-0.113	0.42
Social health QOL one month	0.16	0.317	0.392	<.001	0.006	0.966
Social health QOL three months	0.202	0.204	0.495	<0.001	0.033	0.815

Environmental health QOL pre-event	0.031	0.848	0.142	0.043	0.018	0.896
Environmental health QOL one month	0.151	0.345	0.342	0.008	0.101	0.471
Environmental health QOL three months	0.146	0.363	0.375	0.003	0.062	0.66

Table 3: Pearson correlations between years since injury and Polyserial correlations between years participating in SER and Point-biserial correlations for the intensity of the SER activities (low intensity and high intensity) and the study outcomes.

Discussion

With disability statistics rising at a tremendous rate and funding for healthcare being reduced there has never been a more important time to investigate new approaches in order to maximize functional outcomes and improve well-being. While SER as a rehabilitation tool is not a new idea for individuals with disabilities there is a paucity of quantitative evidence to support its use as a primary means of treatment and therefore it is difficult to obtain or maintain funding and resources needed to facilitate well run adaptive SER programs.

Data for the current study compared the SER participant group to the non-participant group and also analyzed the SER group separately to investigate the effects of years of participation since onset of disability, activity type engaged in, and time among the athletes.

SER Participants vs. non-participants

Sports, exercise and recreation participants reported significantly higher self-esteem, posttraumatic growth, and QOL scores along with lower depression scores compared to individuals that did not participate SER.

Self-esteem

Maslow included self-esteem in his hierarchy of needs and believed that without it people would be unable to grow or achieve self-actualization [68]. Sport, exercise, and recreation have the ability to foster self-esteem in several ways. Firstly, it offers the opportunity to improve one's skills through participation in enjoyable activities. This can lead to a sense of mastery of those tasks. As the individual develops an improved sense of competence it allows them to see things once viewed as obstacles now as opportunities and take on more difficult challenges.

A study by Wann et al. [69] reported that team identification is also closely related to social well-being and temporary and enduring social connections provided by participation in SER, especially on a team, are predicted to have a significant impact on psychosocial health and self-esteem [69]. This may have an even more pronounced effect on the current study population due to the high number of service members and veterans involved.

The military is often regarded as its own culture defined by camaraderie and esprit de corps. This strong sense of "team" affiliation can be lost when an individual becomes disabled and/or leaves the military. SER provides a means to reconnect with one's peers and develop new connections, social support and acceptance.

Depression

The effect of SER on depression in able-bodied individuals has received considerable attention over the last several decades. While research supports a consistent relationship between SER and depression, the mechanisms underlying the antidepressant effects of SER are still poorly understood. Several theories have been proposed such as the distraction hypothesis [70], the endorphin and the monoamine hypothesis [71] among others. However, there is little quantitative evidence to either support or refute these theories especially in individuals with disabilities.

Participation in SER can provide a situation in which the individual can escape negative thoughts and feelings if only for a short time. Social contact may also be an important mechanism in reducing depression, especially when it comes to our study population. Military service members tend to spend a considerable amount of time together and lean on each other in good times and bad. Being removed from this 'family' type environment may cause the individual to withdraw emotionally from society. Another more obvious reason is that improvements in the mobility skills of individuals with physical impairments related to their disability would decrease depressive feelings by increasing accessibility to the world at large.

Posttraumatic growth

Trauma has been defined as a threat to psychological integrity, especially cognition [72]. Dr. Tedeschi described trauma as, "a shattering of the assumptive world or the way in which one perceives the world around him". It is perceivable that SER allows the individual to connect with things that they have control over and still makes sense. Following a traumatic disability or on-going chronic illness, life roles (such as employment, disciplinarian, etc.…) may be lost temporarily or even permanently.

SER can initially help to fill the void of lost life roles and evolve into a meaningful part of the person's life such as ongoing participation in adapted sports teams or mentoring others with disabilities. Service members and veterans may look to SER faster than civilians to fill those life roles due to it being an integral part of military life whether they initially want it to be or not. Even those who do not consider themselves 'athletes' before they join the military benefit from participation in one form or another and have a tendency to continue living a more active lifestyle when they separate from the service.

Quality of life

The past decade has seen an increase in the importance of QOL as a crucial measure for well-being in population studies and as an outcome measure in clinical trials [73]. Measuring QOL provides a means by which the respondent's perspective can be placed alongside traditional indicators such as economic growth or medical morbidity [74]. QOL is a complex multifactor concept that has proven difficult to quantify in the past. In the current study we examined two sub-domains, physical and social health, as well as overall QOL.

We found significantly higher scores in all facets of QOL in the SER participant group when compared to non-participants. The idea that participation in SER improves physical health in able-bodied individuals is well established in the literature and it is no surprise that participation by individuals with disabilities improves scores in self-perceived physical health. SER provides numerous avenues to facilitate and strengthen personal relationships and social interactions. Previous

studies found strong correlations between participation in SER and improvements in QOL and acceptance of the disability [75-77].

SER Participant Group

Self-esteem

When controlling for the effects of time and years spent participating in SER since their disability subjects in the SER group reported significant differences in self-esteem scores based on the type of activity they engaged in. Those who participated in a combination of team and individual activities reported significantly higher scores than those who only participated in individual events. A recent study by Laferrier et al. [77] suggested that the environment created by being surrounded by a group of your peers or your "team" provides the internal support system that helps to foster positive self-esteem [77]. The cohesive group mentality fostered in a team can help to promote many facets related to improving self-esteem. First, it provides a situation where individuals with more recent disabilities can interact and learn from others with similar injuries more distant from date of their disability. Secondly, tasks that may seem nearly impossible when viewed from an individual perspective become less daunting and more enjoyable when surrounded by a team of one's peers. Finally, it allows individuals with disabilities of different types and severity to meet and be competitive on common ground decreasing the overall stigma sometimes associated with having a disability.

A significant effect was found between the number of years someone has participated in SER and the activity type they participated in. Participants that had less than one year of participation in SER following their disability reported significantly lower self-esteem scores than the other three levels of years of participation (one to five years, five to 10 years, or more than 10 years). One possible reason for this finding is that self-esteem is improved through mastery of new skills and the feeling that a task can be completed with the desired outcome. It takes time to develop even an initial comfort level let alone mastery, especially if that individual is still learning how to deal with the impairments related to one's disability. Physical self-concept has been linked to self-esteem and depending on the type of disability the individual may still be dealing with body awareness and other issues [78]. Post-event scores were significantly higher than pre-event scores suggesting a significant positive effect of the SER event. While scores at the one and three month follow-ups regressed slightly below the post-event scores they still remained higher than the pre-event scores. These events were all of short duration, between seven to nine days long, and it would be interesting to see if long-term significance would be maintained with interventions of longer duration. Even though there were no other significant differences found between the levels of years of participation the trend showed an increase in self-esteem scores as years of participation increased for those participants engaged in individual activities.

Participants engaged in a combination of individual and team activities also reported significant differences in self-esteem scores. For this condition individual that had been participating in SER since their disability for a period of one to five years reported significantly lower self-esteem scores than any other condition. A study by Arango-Lasprilla found that major depressive disorder (MDD) commonly occurs between one to five years following disabilities such as spinal cord injury. The high prevalence of MDD may be attributed to dealing with the alteration of life-roles that may occur following disability. While initially the individuals time is spent concentrating on rehabilitation once they return home and settle back into life things may not run as smoothly as they thought. Some roles may have been taken over by others, work performed prior to their disability may no longer be a viable option and the individual with the disability may have a difficult time accepting the situation or themselves.

Depression

Our current study found significant effects of the number of years of participation in SER since the time of onset of disability as well as time. Significantly lower depression scores were associated with more years participating in SER since onset of disability. Studies have reported depressed patients are less fit and have a diminished physical work capacity, which in turn may contribute to other physical health problems. These issues can create a negative cascade that increases feelings of hopelessness and depression. Individuals with more years of participation in SER may have developed an active lifestyle and refined their exercise and recreational regime leading to not only short term but long term benefits of participation in SER including increased mobility and decreased risk of secondary conditions brought on by inactivity. As with self-esteem, post-event scores were significantly lower than pre-event supporting a positive effect of the event itself on depression scores and then regressed to non-significance at one and three months. Craft and Landers conducted a meta-analysis to investigate moderating factors of exercise on depression. Interestingly, exercise program characteristics such as duration, intensity, frequency, and mode of exercise did not moderate the effect. Only the length of the exercise program was a significant moderator, with programs nine weeks or longer being associated with larger reductions in depression and the effects being maintained for longer periods of time [79]. So it is conceivable that the events selected were not of sufficient duration to provide a lasting effect.

Post-traumatic growth

A significant difference was found in posttraumatic growth scores related to the main effects of years of participation since onset of disability and time respectively. Individuals that had participated in SER five to ten years, or ten years or more reported significantly higher posttraumatic growth scores than those who participated in SER for less than five years. These findings support the proposition that 'growth' does not occur overnight and change takes time. This maybe improved through the interactions and experiences offered through continued participation in SER. Interestingly, with regard to time, pre-event scores were significantly higher than one and three-month follow-up scores but not post event scores. In contrast to resilience, hardiness, optimism, and a sense of coherence, posttraumatic growth refers to a change in people that goes beyond an ability to resist and not be damaged by highly stressful circumstances; it involves a movement beyond pre-trauma levels of adaptation. It could be possible that people who are highest on these dimensions of coping ability will report relatively little growth.

Quality of life

Physical health domain scores were significantly higher for those individuals who had more than one year of experience participating in SER since the onset of their disability if they participated in solely individual activities. Typically those with less than one year of participation in SER are closer to the onset of their disability. It can be postulated that these individuals may not have come to terms with their disability yet. At this stage they are still learning how to deal with

the physical and psychological effects related to their altered functional status thus decreasing their satisfaction with the perception of their physical health. The fact that those who were participating in individual activities reported lower physical health scores with less than one year of experience with SER may be explained by the lack of support to be gained with being surrounded by a 'team' of one's peers. These individuals may initially be fighting through the impairments of their disability either trying to re-learn something they were passionate about before their disability or trying a new activity. These individuals may not be able to fully benefit from the knowledge and experience that is provided by individuals with similar disabilities further from the onset of their disability. This can lead to some of the participants "having to learn the hard way", and give them a false perception that they are worse off physically than they actually may be.

Social health domain scores remained fairly similar however there was a significant difference found. Individuals who had participated in SER for more than ten years reported significantly higher scores than those who had participated in SER for one to five years. There seemed to be a clear delineation with those individuals with less than five years of participation reporting lower scores on the perceived satisfaction with their social health than those with greater than five years of participation although the difference was not significant. The questions in this domain deal considerably with personal relationships so it would stand to reason that prolonged exposure to SER and the positive social characteristics it offers would help to foster new relationships and strengthen those already in place.

Correlations

In order to further investigate several of the possible confounding variables associated with the significant findings in the study outcomes secondary correlation analyses were performed. Variables chosen included the amount of time the individual has lived with their disability, years of participation in SER since onset of disability, and high intensity activities vs. low intensity activities. It has been theorized that it is not the increased years spent participating in SER that leads to the improvements in psychosocial well-being but simply the ability of the individual to come to terms with their impairments over time and accept their disability as they age. As this is certainly a plausible hypothesis, since you cannot have more than ten years of participation in adaptive SER if you have not had a disability for more than ten years we believed it warranted further analysis. Surprisingly, even though post-event self-esteem and depression were close, none of the correlations based on the amount of time and individual has lived with their disability were significant for any of the levels of the outcome measures. In contrast all of the correlations were significant for the variable of years of participation since onset of disability with moderate to high effect sizes suggesting that it truly was the participation in SER leading to the improvements in the psychosocial outcomes study and not simply the amount of time someone has been living with their disability. For years proponents of competitive sports have stated that high intensity sports and/ or activities such as wheelchair basketball or rugby lead to greater benefits than those of lower intensity such as bowling or billiards. Our analysis only found significance in two of the 25 outcome conditions suggesting that the psychosocial benefits investigated are more related to the participation in SER itself and not necessarily the type or intensity of the activity.

Conclusion

Adaptive SER is not a new idea for individuals with disabilities. Formal physical education and intramural sports programs have been in practice since the 1800's. However, its use as powerful, low cost rehabilitation tool is just beginning to be realized. While there is an abundance qualitative support and clinical observations preaching the indelible effects of participation in SER there is still a lack of quantitative support for these claims.

This study attempts to bridge the gap between what medical providers and sports participants believe and what can be supported. Overall, the results from this study support a strong positive effect of participation in SER on self-esteem, depression, posttraumatic growth and QOL.

Limitations

Several limitations to this study must be noted. First, although not drastic, there was a significant difference between the mean ages of the sports participant group and the non-participant. Second, level and severity of disability was not taken into account during the analysis due to the wide variety of physical and cognitive disabilities present in the study population leading to disagreement of level of severity between the two. Third, the control group was recruited primarily from the VA Pittsburgh Healthcare System and Assistive Technology Registry, which could lead to a possible sampling bias. Finally, this was a convenience sample with no randomization of participants and a small female cohort representation; however this more closely represents the military injury rates between males and females.

Even with the limitations listed this is an important move forward in order to provide insight and develop an evidence base related to the multidimensional benefits of participation in SER for individuals with disabilities. Future research needs to address potential longitudinal benefits both physiological and psychosocial.

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