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Effects of Adaptive Sports on Quality of Life in Individuals with Disability

Victoria Reljin
vr31@zips.uakron.edu

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Victoria Reljin

School of Sport Science and Wellness Education

Honors Research Project

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Approved:

Honors Project Sponsor (signed) Date 4/15/19

RONALD OTTERSTETTER
Honors Project Sponsor (printed)

Reader (signed) Date 04-15-19

JOHN RONCONE
Reader (printed)

Reader (signed) Date 4-15-19

Barbara Jackson
Reader (printed)

Accepted:

Department Head (signed) Date 4-19-19

Judith A. Juvancic-Heltzel
Department Head (printed)

Honors Faculty Advisor (signed) Date 4-15-19

Laura Richardson
Honors Faculty Advisor (printed)

Dean, Honors College Date

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Abstract

The purpose of this study was to identify any correlation between quality of life and adaptive sport participation in individuals with disability. **Methods:** A questionnaire including the World Health Organization's Quality of Life - BREF questionnaire and an adaptive sports impact questionnaire were electronically distributed to adults participating in an adaptive sport program. Athletes participating in the adaptive sport program's wheelchair rugby team completed skill assessments that were examined for changes in physical domain. **Results:** All participants (n=11) rated their quality of life good or very good. Participants performed best in the environmental and physical domains of the WHOQOL-BREF. Skill assessment data showed only some improvements in physical skill data. **Conclusion:** Adaptive sport participation was found to correlate with high quality of life; duration of participation did not affect scores. Adaptive sports were found to increase environmental, physical, and social domains of wellness.

Key Words: Adaptive sport, quality of life, wellness, physical activity, skill assessment, wheelchair rugby, disability.

Introduction

Physical activity is strongly recommended by the American College of Sports Medicine, American Heart Association, and health care professionals. Studies have also been done showing that physical activity contributes to QoL (Gill et al., 2013). However, when an individual cannot participate in regular physical activity because of mobility limitations caused by disease or injury other forms of physical activity are necessary.

Adaptive sports allow for modifications of the sport to allow individuals with a disability to be able to participate. Almost any sport can be modified to allow for inclusion of those with any level of disability: basketball, hockey, rugby, lacrosse, and so on. Adaptive sports offer many benefits to the individuals that participate in them, including improved levels of functioning and independence in activities of daily living, increased physical capability, improved physiological capacity, increased levels of employment, and improved social status and sense of belonging. All of these components influence an individual's quality of life.

This study aims to determine which aspects of wellness are most improved by adaptive sport in the population examined. The aspects of wellness targeted by the WHOQOL-BREF questionnaire are physical, psychological, social, and environmental. These will be examined, as well as physical skill assessment data, to determine the impact of adaptive sports. It is hypothesized that adaptive sports lead to high qualities of life of individuals with disability. If true, this should encourage more adaptive sport participation and creation of programs in more areas for the benefit of those that will be able to participate in them. It will additionally increase appreciation for and change attitudes towards individuals with disability.

Review of Literature

Benefits of Physical Activity

The American College of Sports Medicine started a global health initiative in 2007 called Exercise is Medicine (EIM). The goal of the EIM initiative is to "implement physical activity interventions that will slow, stop and reverse the progression of chronic diseases" by creating a collaboration between resources in the healthcare field and fitness resources by making physical activity assessments and promotion standardized healthcare procedure ("What is exercise…"). This would absolutely be able to help individuals with type II diabetes mellitus, obesity, cardiovascular disease, and many more such conditions plaguing the country. However, what if an individual has a cervical spinal cord injury (CSCI) or a congenital condition like cerebral palsy? Can exercise still be medicine for these populations even if they may always have to use a wheelchair?

Along with improving chronic diseases, engaging in physical activity has been understood to improve quality of life. Participants of a study examining what quality of life (QoL) is found that responders - both college students and community members - strongly agree that physical activity contributes to QoL (Gill et al., 2013). However, individuals reliant on a wheelchair may not have as much of an opportunity to engage in physical activity to positively contribute to QoL. A solution to these problems is adaptive sports.

Adaptive Sports

Adaptive sports are sports that allow participation of all populations with inclusion of assistive devices such as wheelchairs, crutches, specially created chairs, modified hand-held equipment, and so on. Adaptive sports allow individuals who may not be able to walk, run, hold a ball, or otherwise participate, to get involved in physical activity as well. Almost any sport can be adapted to be able to be performed by an individual with a disability. The athletes included in this study participate in adaptive sports through a program called the Adaptive Sport Program of Ohio. This program is based in Wooster, Ohio, but has locations throughout northeast, northwest, and central Ohio. Sports offered through this program include basketball, power soccer, sled hockey, softball, track and field events, strength and conditioning, rugby, and kayaking, at six locations in the state. The program also provides all necessary equipment, including sport chairs, for individuals to participate ("About ASPO"). Through avenues like this, individuals with disability are able to engage in physical activity to potentially improve QoL.

There are several populations that would most benefit from adaptive sports. As mentioned previously, anyone that relies on a wheelchair for the majority of their mobility may not be able to ordinarily engage in the recommended amount of 150 minutes per week of moderate physical activity. These disabilities could be the result of several different circumstances: congenital conditions such as cerebral palsy or muscular dystrophy, disabling viruses such as polio, or traumatic injuries resulting in amputations or spinal cord injuries ("Introduction to wheelchair rugby", 2012). The National Spinal Cord Injury Statistical Center found that 59% of individuals went from being ambulatory prior to injury to using a wheelchair

for mobility after the first year post-injury, and this number only increased years post-injury: nearly 64% after five years, over 69% after ten years ("2018 annual report", 2018).Whether partially ambulatory or not at all, individuals with these conditions, and more, would be able to see benefit from participating in adaptive sports.

Wheelchair Rugby

This study has a partial focus on a wheelchair rugby team's physical skill assessment. The International Wheelchair Rugby Federation shared that wheelchair rugby was created in 1977 by athletes with quadriplegia, meaning their condition affects both arms and legs . It is a combination of wheelchair basketball, handball, and rugby and is the only full contact wheelchair sport ("Introduction to wheelchair rugby", 2012). Silveira et al. (2019) states there are approximately 600 wheelchair rugby athletes in the United States, but there is still a great lack of availability to the sport as, for example, the cities of New York and Boston - nearly four hours apart - share one team. Although this is not the only sport examined in the study or played by the participants, there will be a slight preference toward it in literature due to the emphasis of the physical skill assessment.

Benefits of Adaptive Sports

Evidence of benefits from various adaptive sports have been examined. These benefits include improved levels of functioning and independence in activities of daily living, increased physical capability, improved physiological capacity, increased levels of employment, and improved social status and sense of belonging. All of these components influence an individual's

quality of life. This is not a comprehensive list, but highlights some of the more significantly observed changes in individuals after participation in adaptive sport.

Function and Independence

Life following a traumatic injury or disease progression that causes changes in functioning comes with challenges for those individuals affected by such events. Once easy activities of daily living (ADLs) - eating, dressing, washing - may now be difficult or impossible to perform, which can take away from an individual's sense of independence (Silveira et al., 2019). For adults with disabilities, feelings of autonomy and independence are vital to rehabilitation outcomes and minimizing incidence and severity of secondary conditions. Independence in functioning following SCI is universally shown to markedly improve one year after initial rehabilitation, which is crucial as functional independence (i.e., individual capability to perform ADLs) has a large impact on several factors including quality of life, employment, and mental health status. Furmaniuk et al. (2010) found wheelchair rugby has been shown to improve functional motor skills in relation to activities of daily living; the study showed a 24% increase in skill functioning following a two-year training program in wheelchair rugby athletes, whereas the control group with no training only saw a 4% improvement in functioning. As an athlete interview said, "I get way more independence by playing rugby then I ever did from any doctor . . . that's an absolute truth" (Goodwin et al., 2009). Overall, athletes of many levels and lengths of participation have been found to comment on improved independence as one of the greatest positive effects of participating in adaptive sport.

Physical Strength

Hand-in-hand with daily functioning, physical strength has also improved following adaptive sport participation, making ADLs easier to perform overall. Côté-Leclerc et al. (2017) directly interviewed athletes for their reasons for participating in adaptive sports. The athletes commented that participating in adaptive sports makes them physically stronger, which makes ADLs, like wheelchair transfers, easier to perform. An athlete commented that development of "physical strength" also makes it easier "to overcome environmental barriers, such as moving in snow: "You think it's difficult to roll your chair, then you realize it's easier than you think"". The upper body muscular strength necessary for speed and agility on the court for the prolonged duration of gameplay can account for increased strength results spoken of by the athletes in the study (Côté-Leclerc et al., 2017).

Physiological Functioning

Playing adaptive sports not only improves muscular strength, but also other aspects of physiological functioning. Sarro et al. (2016) presented data obtained through spirometry tests showing increased thoracoabdominal mobility (superior thorax mobility increase of 61.3% with quiet breathing and 31.5% with maximal breathing) and subsequent vital capacity increase (24.8%) in participants following one year of wheelchair rugby training. A study on aerobic capacity in the form of VO2 peak values found that values significantly increased in wheelchair rugby players after one year of training: 27.36± 4.80ml·min-1·kg-1 in 2004 increased from 19.86± 4.89 ml·min-1·kg-1 in 2003 (Morgulec et al., 2006). Otsuka et al. (2008) analyzed autonomic responses - systolic blood pressure and cardiovascular response by EKG - of

wheelchair basketball athletes and untrained individuals during and following an orthostatic challenge. The basketball athletes showed much better regulation of autonomic responses than the untrained individuals. As can be seen, adaptive sport participation can increase physiological function in many areas.

Employment Levels

With better physical and physiological functioning and independence comes the capacity to be able to do more in the way of a profession. The National Spinal Cord Injury Statistical Center presented statistics that employment levels of those with SCI decrease from 66% prior to injury, to only 17.4% at one year post-injury ("2018 annual report", 2018). This contributes to the feelings of dependency mentioned previously. Zwierzchowska et al. (2017), studied physically inactive men with disability compared to wheelchair rugby players and found only 34% of physically inactive men had jobs working "only as teleworkers and never left their place of residence", while 88% of wheelchair rugby players did have jobs and had cars adapted to be able to get around independently. "Undoubtedly, the ability to start professional work determines the feeling of your own effectiveness and allows for the independent life of men after cervical spinal cord injury." This also allows for contributions from these individuals back to the economy.

Social Status and Belonging

Though getting out and participating in the workforce contributes to the sense of independence, individuals with disability, especially those that use a wheelchair, have very little contact with others in similar circumstances in day-to-day life (Goodwin et al., 2009). The social

aspect of adaptive sport is a huge benefit to those that participate for many reasons. Initially after progression of disease or traumatic injury, participation in adaptive sport makes it easier for the individual to accept their disability and develop a more positive outlook on life (Côté-Leclerc et al., 2017). Additionally, with continued participation, a sense of belonging and understanding of others is developed; an athlete interviewed describes this as "[My team] is like my family" (Côté-Leclerc et al., 2017). Goodwin et al. (2009) summarizes the benefits of the social aspect well: "The athletes found membership with a community of people with common interests, a shared understanding of their disability, camaraderie on and off the court, and a bond that made it okay to be a quad for themselves and their immediate families."

Overall Quality of Life

All aspects mentioned thus far detail the benefits in various dimensions or domains of wellness: physical, social, occupational. The domains that the WHOQOL-BREF (Appendix A) focuses on are physical, psychological, social, and environmental. The University of California, Riverside (2014) defines these aspects of wellness as follows. Physical wellness is a quality of life that allows the ability to perform the activities of daily life without excessive fatigue or stress. Psychological wellness can be compared to emotional wellness which allows individuals to understand and cope with feelings in a productive way. Social wellness is the ability to form and foster meaningful relationships and connections to others. Environmental wellness is the ability to make a positive impact on the environment around us. The additional three domains of wellness are occupational, spiritual, and intellectual; all seven together contribute to quality of life ("Seven dimensions of wellness", 2014). It is undeniable that all components are reliant on

functional abilities, which all cumulate to an "independent and fulfilling life" and good quality of life (Zwierzchowska et al., 2017). A life satisfaction study has found that, although low functioning athletes score similarly in life satisfaction to physically inactive individuals, the high functioning athletes showed a significantly higher life satisfaction value (Zwierzchowska et al., 2017). Zelenka et al. (2017) conducted a study involving 20 individuals with quadriplegia who engaged in wheelchair rugby and analyzed their QoL utilizing the WHOQOL-BREF (Appendix A) compared to 16 individuals with quadriplegia that did not engage in wheelchair rugby. The data showed the athletes scored higher in all domains, but the only statistically significant domain was the physical health domain.

Risks of Participation

Studies have shown that the benefits of adaptive sports for individuals outweigh the risks associated with participation. Since all of the wheelchair sports are so heavily dependent on upper body musculature, risks for shoulder injuries increase with increased intensity of play, which is not good when these upper body musculature are what keep individuals with disability functional (Côté-Leclerc et al., 2017). However, in personal accounts from interviewed athletes, they recounted that they resisted the advice of medical professionals telling them that they shouldn't play the sports in order to preserve long-term shoulder function, and instead kept participating due to the importance of identification, group membership, and physical wellness (Goodwin et al., 2009).

Implications

Evidence in literature of benefits of adaptive sports definitely show more positive than negative effects. With this knowledge, healthcare professionals may make recommendations for participation in adaptive sports for individuals following a traumatic injury or onset of disease affecting mobility. “Encouraging sport participation as part of rehabilitation services and continuation post-discharge could have a considerable impact on independence in ADLs among individuals with tetraplegia from SCI” (Silveira et al., 2019). In addition to SCI or diseases later on in life, more adaptive sports programs should be introduced to grade schools and colleges to allow inclusion and acceptance for individuals with disabilities and promote physical activity for youth and into the young adult years. This will help improve functional skills from a young age to encourage employment, higher education, and more independent living in individuals with a disability.

Research Questions

The specific research questions addressed in this study are as follows. How do various adaptive sports, including wheelchair rugby, affect quality of life in individuals with a disability? Which areas of the quality of life spectrum (denoted by the WHOQOL-BREF scale scoring sheet) are most impacted by adaptive sports? Which domains of wellness - physical, psychological, social, intellectual, emotional, spiritual, environmental - does adaptive sports most impact? Is there a correlation between duration of participation in the adaptive sports and increased quality of life?

Methodology

The population examined in this study was the Adaptive Sports Program of Ohio's (ASPO) adult athletes. Any adult athlete participating in ASPO programming was eligible to receive the link and complete the online questionnaire. There was also a focus on the physical aspects of wellness including ASPO's wheelchair rugby team, which is composed of six adult males, all with quadriplegia. To preserve the participants' anonymity no identifying information was gathered in the questionnaires or assessment data besides sport and duration of participation.

The study was reviewed and approved by the University's Institutional Review Board on March 19, 2019 under the category exemption 2: research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior. The study utilized The World Health Organization's Quality of Life - BREF (WHOQOL -BREF) assessment tool (Appendix A) to evaluate quality of life of the athletes (WHOQOL-BREF..., 1996). This assessment tool has been tested for reliability and validity more than once, but an international study of 11,380 individuals from 23 countries found that the assessment tool is a "sound, cross-culturally valid assessment of [quality of life]" (Skevington et al., 2004). This assessment tool contains 26 questions evaluating physical, psychological, social, and environmental domains and is able to be scored on a standard scale included with the assessment. Questions appeared for this study exactly as they do on the WHOQOL-BREF questionnaire, with the only difference being the addition of the component of participants reflecting on their life "including adaptive sport participation" in the instructions before the questions. Identifying information in the "about you" section of the original questionnaire - date of birth, marital status, etc. - is not included in

this study to preserve participant anonymity. Another questionnaire was created with specific questions regarding the participants sport(s), the reason they joined their organization and began playing adaptive sport(s), and how they personally feel that adaptive sport(s) have impacted their lives.

All questions were presented to the participants in the form of an online questionnaire created using the survey platform Qualtrics. The link to the questionnaire was sent out to the program director of the partner through email with an anonymous survey link, which was then forwarded to all adult ASPO participants. The program director sent the link to 31 athletes, out of which eleven (n=11) athletes gave informed consent and completed the questionnaire. This is a response rate of just over 35%. Informed consent (Appendix C) was indicated by submitting the questionnaire. Questions were copied directly from the WHOQOL-BREF assessment tool (Appendix A) into the Qualtrics platform. The WHOQOL-BREF questions were on separate pages of the questionnaire from the adaptive sports participation survey (Appendix B) that was created, but both were sent out in the form of one assessment.

For the physical component involving the wheelchair rugby team, skill assessments for the pre-season and postseason were compared to see how wheelchair rugby specifically has impacted the physical aspect of wellness in these athletes. These skill assessments included an endurance portion, a strength portion, and various speed/agility/quickness-type drills all performed in the chair used while playing the sport. The skills used were compiled by the program director, utilizing some from the International Wheelchair Rugby Foundation, but also incorporating a medicine ball throw and endurance laps. The skills of 20-meter sprint, cone

right/left (slalom), and down and backs (suicides) have been validated by a source observing wheelchair basketball to have good validity and reliability (De Groot et al., 2012). There were no validity assessments found for the endurance test or the medicine ball throw. The pre-season assessment was completed on September 9, 2018, while the postseason assessment was completed on February 17, 2019. Skill assessment data was not obtained directly by the researcher, but was given to the researcher by the program director at ASPO to be used to assess differences in the physical aspect of wellness.

Physical skill assessment skills performed by the wheelchair rugby team are as follows. The endurance test involved the athletes pushing themselves in the wheelchair used for the sport around the outside boundary lines of a standard sized basketball gym five times without stopping. The strength portion involved the athletes sitting in the rugby wheelchair backed up against a wall. A tape measure was placed at the level of the back of the chair, against the wall. An eight-pound medicine ball was thrown using both arms as far as possible, using the tape measure to measure the first point of contact to the ground. Two trials were completed after one practice throw. The speed portion involved a 20 meter (65 feet 7 inches) sprint in the rugby wheelchair. The athletes had to accelerate a fast as possible from one line marker to another line marker 20 meters apart. Three trials were completed. Agility portions included up and backs and cone drills. Up and backs included lines placed three feet apart. Athletes sitting in their rugby chairs pushed themselves forward to the first line, crossed two wheels over the line, stopped, and then pushed backwards to the starting line. This was repeated for all seven lines, with time stopping after the final reverse run to the starting line. Three trials were completed. Cone right and left drills involve cones placed four feet apart. Athletes must navigate using rugby chair

slalom-style around the cones from both the right and left (direction indicated cone right or cone left) without hitting the cones with the chair. Once the last cone is cleared, the athlete then sprints back instead of navigating around the cones back. When the drill is performed "with ball" the athlete must hold the ball on their lap while navigating and dribble every ten seconds, as in game play. Penalties of an additional second are added if a cone is hit or an additional five seconds if the ball is not dribbled in time. Three trials were completed. Times for all drills were kept track of with a stopwatch.

All data was kept secure on a password protected account. No identifying information was obtained through the questionnaires or kept with the skill assessment data. All data will be deleted following the submission of the study.

Results

The questionnaire was sent out electronically by the program director to 31 athletes. The electronic questionnaire link was viewed by forty percent (n=14) of people to which it was sent. Out of those, eleven participants accepted the informed consent (Appendix C) and completed the electronic questionnaire (n=11). This is a response rate of just over 35%. All participants (n=11) have participated in adapted sports for at least three years. Respondent participation levels ranged from three to four years (n=4) to more than 10 years (n=3); there were four participants in the mid-range of five to ten years (n=4). Participants have engaged in all of the following adaptive sports: rugby, track, power wheelchair soccer, tennis, baseball, sled hockey, basketball, lacrosse, softball, swimming, weight lifting, and shooting (rifle).

WHOQOL-BREF Questionnaire

The data from the first part of the questionnaire, utilizing the WHOQOL-BREF assessment tool (Appendix A), was scored and analyzed using the analysis scales included in the assessment document. Each answer was scored on a 1-5 point scale. Total domain scores and mean scores for each domain for each athlete were calculated. The mean of individual averages was found to give mean domain scores for all participants. These values were converted from raw scores to transformed scores using tables in the document. Values are recorded for each domain in Table 1. Raw scores cannot be used for data comparison due to question quantity differences. Transformed scores on 0-100 scale can be directly compared to each other, similar to percentages, and are recommended for interpretation.

Compared on the 0-100 scale, the environmental domain (4) had the highest score by about 5.27% with 86.0. The second highest scoring domain was the physical domain (1) with a score of 80.73 followed closely by the psychological domain (2) with a score of 79.10. The social domain (3) had the lowest score by 6.37% with a score of 72.73.

Domain Number	Question Numbers	Raw Score (Mean)	Transformed on 4-20 Scale (Mean)	Transformed on 0-100 Scale (Mean)
1 - Physical	3, 4, 10, 15, 16, 17, 18	30.36	16.91	80.73
2 - Psychological	5, 6, 7, 11, 19, 26	25.0	16.64	79.10
3 - Social	20, 21, 22	11.73	15.64	72.73
4 - Environmental	8, 9, 12, 13, 14, 23, 24, 25	35.09	17.73	86.0

Table 1. Mean values for each domain from scored WHOQOL-BREF questionnaires. Mean values should be compared on 0-100 scale for ease of interpretation.

Questions 1 and 2 from the WHOQOL-BREF questionnaire are individually scored. Figure 1 displays the results for question 1: how would you rate your quality of life? All respondents (n=11) rated good (n=5) or very good (n=6). Question 2, how satisfied are you with your health?, showed positive results as well. Respondents were overwhelmingly satisfied (n=9) or very satisfied with their health (n=1), with only one respondent reporting neither satisfied nor dissatisfied (n=1).

Figure 1. Graph representing the responses to question 1 on the WHOQOL-BREF questionnaire: How would you rate your quality of life? All respondents (n=11) rated good (n=5) or very good (n=6).

Adaptive Sport Impact Questionnaire

The adaptive sport impact questionnaire (Appendix B) asked the respondents to reflect whether they felt more physically active, stronger, happier,

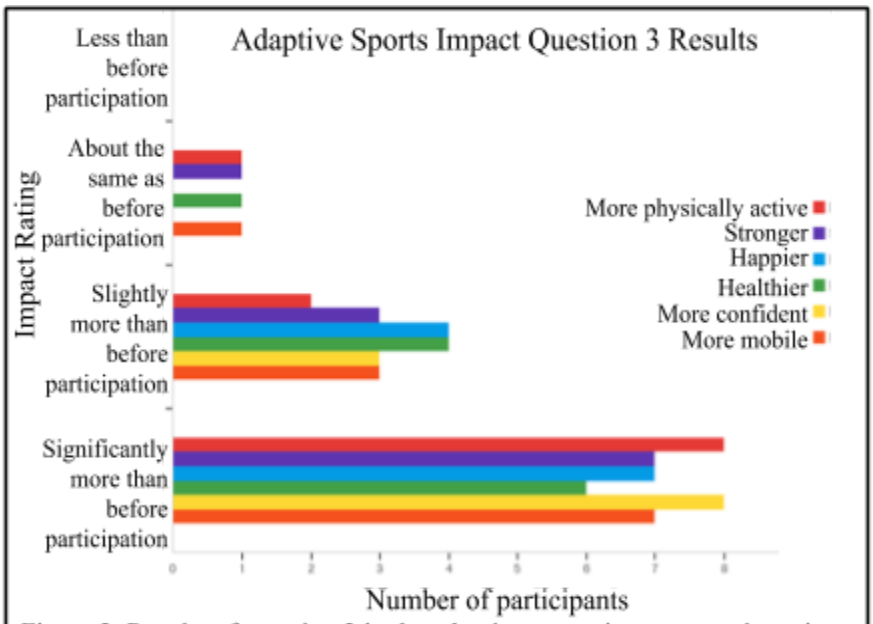

Figure 2. Results of question 3 in the adaptive sports impact questionnaire: "As a direct result of your participation in adaptive sport(s) do you feel...:" Endings to the question are found in the legend on right and scaled based on the y-axis labels. Adaptive sport participation impacted participants physical activity, strength, happiness, health, confidence, and mobility significantly more (range: 6-8) or slightly more (range: 2-4) than before.

healthier, more confident, and more mobile as a direct result of their adaptive sport participation. Figure 2 shows the results of the question. A range of 6-8 respondents (depending on category) reflected that experienced each of the positive changes significantly more than before their participation in adaptive sports. Only one response each that physical activity, strength, health, and mobility components were about the same as before participation in adaptive sports was recorded. No participants reflected that adaptive sports negatively affected any of the categories.

In question 7 of the adaptive sport impact questionnaire (Appendix B), "In a few words, or 1-2 sentences, explain your reason(s) for participating in adaptive sport(s)." Common categorized answers can be found in Figure 3. Nine respondents answered this question (n=9). Socialization with others was mentioned as a top reason for participation by 89% of respondents (n=8). One response emphasizes having "friends that can relate to my disability," while another enjoys "the fellowship with the other team players." One participant said that there are "amazing people that have helped me immensely." Exercise and physical activity was also mentioned by more than half of the participants (n=5). One participant specifically mentioned that adaptive sports include "having fun while

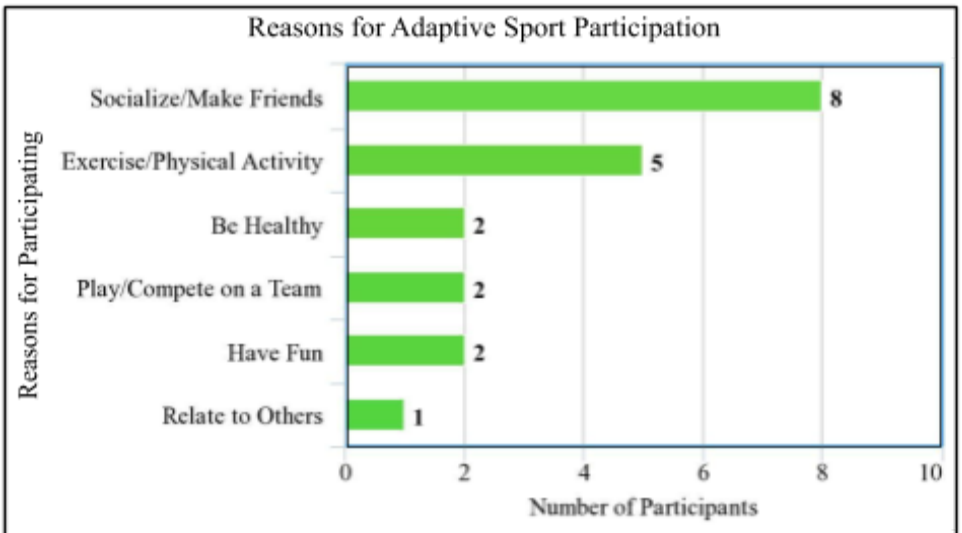

Figure 3. Reasons for Adaptive Sport Participation. Responses to question 7 of the adaptive sport impact questionnaire categorized based on keywords. Number of participants indicates each unique respondent out of total respondents (n=11).

exercising." Respondents also mentioned maintaining their health, having fun, playing/competing in a team aspect, and relating to others with disability as their reasons for participation in adaptive sports.

Wheelchair Rugby Skill Assessment Data

The physical fitness data from the skill assessments of ASPO's wheelchair rugby team are displayed in Tables 2 and 3. The values were compared pre-season on September 9, 2018 to postseason on February 17, 2019. Improvements are highlighted in the postseason values. Values that are statistically significant (greater than 5% change) are outlined in bold. Significant

Wheelchair Rugby Pre-Season Skill Assessment Scores - 9/9/2018							
Skill	Endurance	Strength - Med Ball Throw		20 Meter (65' 7") Sprint			
Units	time (in minutes)	distance (in feet/inches)		time (in seconds)			
Trial Number	1	1	2	1	2	3	Avg
Athlete 1	3:18.15	12'0"	11'9"	8.06	7.87	7.69	7.87
Athlete 2	2:27.31	12'0"	12'0"	7.6	7.66	7.72	7.66
Athlete 3	3:36.00	12'0"	12'2"	7.75	7.54	7.34	7.54
Athlete 4	3:26.66	10'0"	10'6"	8.16	8.13	8.21	8.17
Athlete 5	5:11.69	6'6"	6'9"	9.69	9.65	9.4	9.58
Athlete 6	7:39.78	7'6"	8'0"	11.1	10.85	11.5	11.15
Wheelchair Rugby Post-Season Skill Assessment Scores - 2/17/2019							
Trial Number	1	1	2	1	2	3	Avg
Athlete 1	3:14.00	12'5"	12'0"	8.14	8.6	8.41	8.38
Athlete 2	2:29.37	13'8"	14'0"	7.68	7.25	7.66	7.53
Athlete 3	3:25.16	12'0"	12'0"	8.15	7.21	8	7.79
Athlete 4	3:06.00	12'3"	12'8"	8.15	8.84	8.11	8.37
Athlete 5	3:55.00	6'8"	6'6"	9.88	9.89	10.26	10.01
Athlete 6	5:13.00	7'9"	7'3"	11.5	10.66	12.31	11.49

Table 2. Pre-season and postseason skill assessment scores for endurance, strength, and speed drills. Highlighted values in the postseason scores show improvements. Outlined values show statistical significance (greater than 5% improvement). Only the average values were evaluated for the 20m sprint. Most significant improvement was seen in the endurance values.

improvements can be seen in the endurance portion of the assessment. All except one athlete (n=5) improved their times for the endurance portion; four athletes (n=4) improved by statistically significant amounts. Athlete five improved by nearly 25% and athlete six improved

Wheelchair Rugby Pre-Season Skill Assessment Scores - 9/9/2018								
Skill	Up and Backs				Cone Left		Cone Right	
Units	time (in minutes:seconds)				time (in seconds)		time (in seconds)	
Trial Number	1	2	3	Avg	without ball	with ball	without ball	with ball
Athlete 1	47.94	48.06	49.03	48.34	17.97	19.81	17.25	20.25
Athlete 2	42.9	42.3	42.12	42.44	14.44	15.58	15.16	14.4
Athlete 3	47	49	48.59	48.2	16.19	16.16	16.22	17.38
Athlete 4	42.54	40.45	42.13	41.71	18.69	20.13	19.58	20
Athlete 5	55.81	55.38	53.34	54.84	23	23	21.5	27.75
Athlete 6	1:25.00	1:10.00	1:08.00	1:14.3	37.68	39.68	42.5	45.5
Wheelchair Rugby Post-Season Skill Assessment Scores - 2/17/2019								
Trial Number	1	2	3	Avg	without ball	with ball	without ball	with ball
Athlete 1	54.94	52.18	52.3	53.14	18.43	21.23	19.33	21.25
Athlete 2	40.91	42.58	42.7	42.06	14.9	15.33	14.43	14.61
Athlete 3	43.72	44.98	45.31	44.67	15.71	15.6	15.48	16.68
Athlete 4	41.74	42.16	41.56	41.82	16.58	18.25	17.64	18.93
Athlete 5	52.89	53.87	53.52	53.43	20.18	23.52	21.96	23.76
Athlete 6	1:17.67	1:10.35	1:14.33	1:14.12	34.22	42.38	34.56	46.38

Table 3. Pre-season and postseason skill assessment scores for agility drills. Highlighted values in the postseason scores show improvements. Outlined values show statistical significance (greater than 5% improvement). Only the average values were evaluated for the up and backs. Improvement was seen over all the skills assessed for at least three of the six athletes.

their original time by 32%. The skill that saw the least improvement was the 20-meter sprint. There were no athletes that showed significant improvement in this skill. Four athletes (n=4) improved times in the up-and-back skill assessment but only one athlete's time was statistically significant (n=1). The strength assessment and cone right/cone left drills saw improvements approximately half of the time, but only saw statistically significant improvements about a third of the time.

Discussion

Discussion of Results

The research question was presented: how do various adaptive sports, including wheelchair rugby, affect quality of life in individuals with a disability? It can be seen, based on the data collected, that the participants (n=11) had overall good qualities of life. Figure 1 in the results section shows responses to the question, "how would you rate your quality of life?" and all participants rated good or very good. This likely indicates that adaptive sports improve quality of life for those with disability. However, a comparison should be made between the examined population and those with no adaptive sport participation to more fully suggest the correlation between adaptive sport participation as the cause of greater quality of life.

Another question was presented: Is there a correlation between duration of participation in the adaptive sports and increased quality of life? From the information gained in this study, there does not seem to be a correlation between duration of participation and increased quality of life. Table 4 shows that quality of life values are consistently high across participation durations. However, a limitation of this study is

Quality of Life vs. Duration of Participation

		How long have you been participating in (an) adaptive sport program(s):					
		Less than 1 year	1-2 years	3-4 years	5-10 years	More than 10 years	Total
How would you rate your quality of life?	Very poor	0	0	0	0	0	0
	Poor	0	0	0	0	0	0
	Neither poor nor good	0	0	0	0	0	0
	Good	0	0	2	2	1	5
	Very good	0	0	2	2	2	6
	Total	0	0	4	4	3	11

Table 4. Quality of life compared while accounting for duration of participation. Similar scores of good (n=5) or very good (n=6) are shown across the board for all participants (n=11). No correlations are found.

participants all had at least three years of participation. Additional studies could explore individuals just beginning an adaptive sport program to individuals participating for a longer duration to identify any possible differences.

Two more questions were presented: 1) Which areas of the quality of life spectrum (denoted by the WHOQOL-BREF scale scoring sheet) are most impacted by adaptive sports? 2) Which domains of wellness - physical, psychological, social, intellectual, emotional, spiritual, environmental - does adaptive sports most impact? The areas of the quality of life spectrum as indicated by the WHOQOL-BREF questionnaire (Appendix A) - physical, psychological, social, and environmental - most impacted by adaptive sports as seen from the questionnaire results, were environmental (n=86.0) and physical (n=80.73), with psychological not far behind (n=79.1). These domains had the highest scores, as seen in Table 1. Based on the information included in the literature review, it is easy to see how these domains correlate with strength and mobility gains as a result of playing the sport. Increased capacity in the physical domain allows ease of navigation and satisfaction of the environmental domain. The dichotomy of the low social domain score (n=72.73) and the majority (n=8 of 9) responses to the question asking the reasons for participating indicating socializing can be explained with the questions included in the social domain. The questions 20-22 from the WHOQOL-BREF (Appendix A) include satisfaction with personal relationships, sex life, and support from friends. Dissatisfaction/no answer to the question of sex life in respondents brought the social domain down in score. The other two questions included in the social domain, if separated from the question about sex life, would have had the highest score overall across domains. This, along with responses to the reasons for participation seen in Figure 3, shows the importance of a good social support system

for individuals with disability and how adaptive sports offers that by improving the social domain of wellness.

Additionally, the physical skill assessment data from the wheelchair rugby team showed only some improvement in physical skill performance in the speed and agility drills, but did show much improvement in endurance. The endurance necessary for a small team (n=6) to compete for the duration of gameplay with only minimal breaks for recovery would account for this increase in endurance across the team. Other skills would have been expected to improve as well, but only some statistically significant improvements occurred, as seen in Tables 2 and 3. However, improvements in the physical domain of wellness skill did occur. In answer to the research question of which domains of wellness participation in adaptive sport most improves, this study has found that environmental, physical, and social were most improved. Intellectual, emotional, and spiritual domains were not examined by this study. Additional research may further explore these topics.

Implications

This study did show positive correlation with adaptive sports participation and quality of life scores. All athletes that completed the questionnaire responded positively to quality of life and other topic questions. This implies that adaptive sports could be beneficial to individuals with any level of disability. The availability of adaptive sports programs is not widespread and individuals that would benefit from it may not have access to a program, as discussed in the literature review. Due to the positive changes that can occur in the lives of such individuals, a proposal is to include more adaptive programming for all ages, beginning in elementary school

through higher education. These programs would increase physical activity opportunities for those who may not be able to engage in traditional physical activity. This would also increase interactions between individuals with disabilities and those without, and improve attitudes and reactions towards individuals with disability, as suggested by Archambault et al. (2018). Some programs, including the Eastern College Athletic Conference have already begun to add opportunities for adaptive sports, or include accommodations to already existing sports (College Conference…, 2015). It is proposed that more schools, universities, and communities would benefit from adding adaptive sport programs for not only individuals with disability, but for anyone who would be able to experience adaptive sport.

Limitations

A limitation to the study was a small sample size (n=11). The population of adult athletes participating through ASPO programming is not very large to begin with. Additionally, the electronic distribution method of the questionnaire may have additionally decreased the sample size due to low participation rates in electronic questionnaires. The questionnaire portion was also opened up to all adult athletes regardless of sport, which may influence results as athletes for different sports vary in ability levels or participation. This was done to try to offset the small sample size of just the one sport of wheelchair rugby. The wheelchair rugby team observed for the physical skill assessment portion only consists of six athletes. A smaller sample size decreases the statistical significance of any changes in the results. Ideally, this study could be performed again while taking into account athletes participating in adaptive sports across the nation or in a larger geographic area than only northeast Ohio to obtain a larger sample.

Additionally, the questionnaire involved self-reported data which could have been falsified or forgotten to yield results that are different from actuality.

Recommendations

Findings from the literature review show the topic of adaptive sports has not been thoroughly examined. When trying to find articles supporting participation in various sports, only a few core sports were found: wheelchair rugby, wheelchair basketball, and track and field being the most common. Exploration into other adaptive sports - lacrosse, sledge hockey, tennis, and so on - would be beneficial. Perhaps also comparing sports to determine if one is safer, more beneficial, or yields a greater improvement in performance.

There are studies comparing athletes to physically inactive individuals, but very few - if any at all - studies comparing athletes to themselves longitudinally to see if duration of participation outside of the study training window yields more improvements long-term. Longitudinal studies observing individuals before participation in adaptive sport and then throughout life looking at long-term participation affects on health and physical functioning in older years post-injury would be beneficial. Additionally, studies viewing athletes pre- and post-season to see any changes short-term would be more manageable, but still beneficial as a semi-longitudinal study.

This study examined mostly environmental, physical, and social domains of wellness. Additional studies could be conducted to determine if there is any impact on the additional four domains of wellness: psychological/emotional, intellectual, occupational, and spiritual.

Research could also be explore the impact of adaptive sports on individuals in schools, communities, or families involved to determine the reach of benefit adaptive sports have.

Personal Statement from Author

The first time I saw an adaptive sport being played was at the Adaptive Sports Program of Ohio's wheelchair rugby tournament in early 2017. The first time I played wheelchair rugby was in November of 2017. Since then, I have been fortunate to have been able to participate in activities at the Adaptive Sports Program of Ohio many times, individually and through the Adapted Physical Education class taught at Wayne College in summer of 2018. I can confidently say that these experiences were eye-opening and life-changing. An athlete interviewed by Côté-Leclerc et al. (2017), commented that "We're all at the same height [in a wheelchair], we're all equal." When I play wheelchair rugby and wheelchair lacrosse all of my personal capabilities that make me "able-bodied" are thrown out of the window and I'm humbled because I have much less skill, coordination, and strength than an individual that is considered "disabled". Like Archambault et al. (2018) proposed, I would also like to see more opportunities for adaptive sport participation for those that need and would benefit from it, but also for the general public to improve attitudes and interaction between the two populations. It is these experiences that fueled my desire to expand my knowledge on this topic and share it with those who may not have been as fortunate as I have been to be able to experience it. I am thankful to have had exposure to this subject for a couple of years now, but even with all of that I was still able to learn so much from completing this project.

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Appendix A

The World Health Organization's Quality of Life - BREF (WHOQOL-BREF) assessment tool:

*All question directions were modified to add "including adaptive sport participation."

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

		Very poor	Poor	Neither poor nor good	Good	Very good
1(G1)	How would you rate your quality of life?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
2 (G4)	How satisfied are you with your health?	1	2	3	4	5

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

		Not at all	A little	A moderate amount	Very much	An extreme amount
3 (F1.4)	To what extent do you feel that physical pain prevents you from doing what you need to do?	1	2	3	4	5
4(F11.3)	How much do you need any medical treatment to function in your daily life?	1	2	3	4	5
5(F4.1)	How much do you enjoy life?	1	2	3	4	5
6(F24.2)	To what extent do you feel your life to be meaningful?	1	2	3	4	5

		Not at all	A little	A moderate amount	Very much	Extremely
7(F5.3)	How well are you able to concentrate?	1	2	3	4	5
8 (F16.1)	How safe do you feel in your daily life?	1	2	3	4	5
9 (F22.1)	How healthy is your physical environment?	1	2	3	4	5

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

		Not at all	A little	Moderately	Mostly	Completely
10 (F2.1)	Do you have enough energy for everyday life?	1	2	3	4	5
11 (F7.1)	Are you able to accept your bodily appearance?	1	2	3	4	5
12 (F18.1)	Have you enough money to meet your needs?	1	2	3	4	5
13 (F20.1)	How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
14 (F21.1)	To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

*Question 15 was modified to add “assistive devices included”.

		Very poor	Poor	Neither poor nor good	Good	Very good
15 (F9.1)	How well are you able to get around?	1	2	3	4	5

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

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
16 (F3.3)	How satisfied are you with your sleep?	1	2	3	4	5
17 (F10.3)	How satisfied are you with your ability to perform your daily living activities?	1	2	3	4	5
18(F12.4)	How satisfied are you with your capacity for work?	1	2	3	4	5
19 (F6.3)	How satisfied are you with yourself?	1	2	3	4	5
20(F13.3)	How satisfied are you with your personal relationships?	1	2	3	4	5
21(F15.3)	How satisfied are you with your sex life?	1	2	3	4	5
22(F14.4)	How satisfied are you with the support you get from your friends?	1	2	3	4	5
23(F17.3)	How satisfied are you with the conditions of your living place?	1	2	3	4	5
24(F19.3)	How satisfied are you with your access to health services?	1	2	3	4	5
25(F23.3)	How satisfied are you with your transport?	1	2	3	4	5

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

		Never	Seldom	Quite often	Very often	Always
26 (F8.1)	How often do you have negative feelings such as blue mood, despair, anxiety, depression?	1	2	3	4	5

Appendix B

Adaptive Sport Impact Questionnaire, created by the researcher for this study.

Adaptive Sport Impact Questionnaire

How long have you been participating in (an) adaptive sport program(s): (circle one)

Less than 1 year 1-2 years 3-4 years 5-10 years More than 10 years

Which adaptive sport(s) have you participated in: (please list)

_____

_____

As a direct result of your participation in adaptive sport(s) do you feel…: (circle a number for each)

	Less than before	About the same	Slightly so	Significantly so
More physically active	-1	0	1	2
Stronger	-1	0	1	2
Happier	-1	0	1	2
Healthier	-1	0	1	2
More confident	-1	0	1	2
More mobile	-1	0	1	2

After completing the Quality of Life Questionnaire, reflect:

Would your ratings have been different **before participation** in adaptive sport(s)? (circle) Yes No

How would your ratings have been different in the past compared to now? (circle one)

Much better than now	A little better than now	About the same as now	A little worse than now	Much worse than now

In a few words or 1-2 sentences, explain your reason(s) for participating in adaptive sport(s):

_____

_____

Appendix C

The University of Akron

Institutional Review Board

Informed Consent Form

Title of Study: Effects of Adaptive Sports on Quality of Life in Individuals with Disability

Introduction: You are invited to participate in a research project being conducted by Victoria Reljin, a student in the College of Health Professions - School of Sport Science and Wellness Education at The University of Akron.

Purpose: The goal of this study is to identify any change in quality of life with participation in adaptive sports. This study will also be used to determine if duration of participation in adaptive sports causes changes in quality of life. Changes in physical wellness will also be observed through previously collect skill assessment data.

Procedures: For this study, all participants will be asked to answer two questionnaires: The World Health Organization's Quality of Life questionnaire and a questionnaire asking about adaptive sport participation. These should take no longer than 20-30 minutes.

Limitations to Participation: To participate in this study, the participant must be 18 years of age or older.

Risks: There are no known risks associated with participation in this study.

Benefits: You will receive no direct benefit from your participation in this study, but your participation may help us bring more awareness to adaptive sports.

Right to Refuse or Withdraw: Participation in this study is voluntary. Refusal to participate or to withdraw from the study at any time will involve no penalty.

Confidential Data Collection: All data collected will be kept confidential. Only minimal identifying information will be included in the data you provide (sport, duration of participation, etc.). Individual identification will not occur in the research procedures or in any formal publication. Only the researchers will have access to the data. The only data collected will be in the form of written questionnaires and observation of the sports. No data will be reproduced, duplicated, or further used beyond this study. Your signed consent form will be kept separate from your data, and nobody will be able to link your responses to you.

If you have any questions: Questions may be emailed to Victoria Reljin at victoria.reljin@gmail.com or call Dr. Ronald Otterstetter at 330-972-7738. This project has been reviewed and approved by The University of Akron Institutional Review Board. If you have any questions about your rights as a research participant, you may call the IRB at (330) 972-7666.

Acceptance: I have read the information provided and all my questions have been answered. I voluntarily agree to participate in this study. My completion and return of this questionnaire will serve as my consent. I may print a copy of this consent statement for future reference.