Adaptive Sports for Spinal Cord Injury

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CLINICAL SCENARIO:

Michael is an 18-year-old male who sustained a T5-T6 complete spinal cord injury during a high school football game. Michael is a high school student who enjoys all sports and had dreams of playing football in college. During his rehabilitation he experienced significant depression and anger, lacked motivation to participate with nurses and therapists, and was noncompliant. After his return home 6 weeks later, his depression deepened and his bowel and bladder care were the only ADL routines he chose to do. His mother arranged meetings with a wheelchair sports coach and athletes. Although Michael was initially resistant, after watching a game he was quickly interested and ready to participate. His mother expresses concerns with possible risks and questions the long-term effects of wheelchair or adaptive sports programs.

FOCUSED CLINICAL QUESTION:
"What are the effects of adaptive sports on spinal cord injury?"

SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:

- A meta analysis including 21 cross-sectional, experimental, and quasi-experimental studies examining the relationship between subjective well and physical activity in people with spinal cord injuries.
- A systematic review including randomized controlled trials and controlled clinical trials examining the effects of upper body exercise for improvement of physical capacity in individuals with spinal cord injury.
- A randomized controlled trial to determine if coping planning increases participation in leisure time physical activity in persons' with spinal cord injury.
- A prospective non-randomized controlled trial determining if functional wheelchair skills can be improved through a 2 year training program.
- A descriptive study which compared physical performance, cardiovascular parameters, metabolic demands, and stress demands during wheelchair ergometry and a competitive wheelchair basketball game among elite female

wheelchair basketball players versus sedentary spinal cord injury persons.
- A quasi-experimental pilot study to assess if wheelchair sports increase attitudes and motivation towards leisure in persons with spinal cord injury.
- A descriptive study using psychometric instruments examining the psychological benefits of sports activity in individuals with spinal cord injury.

CLINICAL BOTTOM LINE: Individuals with spinal cord can improve their attitudes, motivation, coping and functional skills, and overall physical health when participating in adaptive sports programs, teams, or training.

Limitations of this CAT:
- Some studies included diagnosis other than SCI.
- Many of the articles do not use similar outcome measurements.
- Some studies did not have significant findings.

SEARCH STRATEGY:
Terms used to guide Search Strategy:

- **P**atient/Client Group: spinal cord injury (SCI); T5/T6; lower level injury; male; female; adolescent; young adult

- **I**ntervention (or Assessment): adaptive sports program; sports programs; basketball; team sports

- **C**omparison: n/a

- **O**utcome(s): effects; psychological effects; social effects; physiological effects; physical effects; benefits; risks; quality of life; long-term; short-term

Databases and sites searched	Search Terms	Limits used
Cochrane	• Spinal cord injury • Adaptive sports • Spinal cord injury AND adaptive sports	-English Only -Holms Level 1 through 4
PubMed	• Spinal cord injury • Sports programs • Team sports • Spinal cord injury AND sports • Spinal cord injury AND team sports • Spinal cord injury AND adaptive sports • Sports program AND spinal cord injury • Paraplegics AND sports • Paraplegics AND team sports • Paraplegics AND adaptive sports • Wheelchair basketball • Basketball post spinal cord injury • Sports post spinal cord injury	-Human subjects only -Published from 1998-to 2010
SPORTDiscus		
CINAHL	• Spinal cord injury AND adaptive sports • Spinal cord injury AND pilot study	
	• Spinal cord injury • Adaptive sports	

INCLUSION and EXCLUSION CRITERIA

- Inclusion:
  English only
  Holm's level IV and above
  Diagnosis of spinal cord injury
  Published between 1998 and 2010
  Incorporation of physical activity

- Exclusion: We did not exclude any articles that met our inclusion criteria.

RESULTS OF SEARCH

Databases searches were limited to Holms levels 1-4 studies published after 1998 that met inclusion criteria. Twelve studies were identified in the databases above and 5 of the studies were eliminated by title and abstract.

Table 1: Summary of Study Designs of Articles retrieved

Study Design/ Methodology of Articles Retrieved	Holm's Level	Number Located	Author (Year)
Meta-analysis	I	1	Martin Ginis, Jetha, Mack, & Hetz (2010)
Systematic Review	I	1	Valent, Dallmeijer, Houdijk, Talsma & Van der Woude (2007)
Randomized Controlled Trial	II	1	Arbour-Nicitopoulus, Martin Ginis, & Latimer (2009)
Non-Randomized Controlled Trial	III	1	Furmaniuk, Cywinska-Wasilewska & Kaczmarek (2010)
Quasi-experimental pilot study	III	1	Wickham, Hanson, Shechtman & Ashton (2000)

Descriptive	IV	2	Muraki, Tsunawake, Hiramatsu, & Yamasaki (2000) Schmid, Huonker, Stober, Barturen, Schmidt-Trucksass, Durr, Volpel & Keul (1998)

BEST EVIDENCE
The following studies/papers were identified as the 'best' evidence and selected for critical appraisal.

- Arbour-Nicitopoulus, K.P., Martin Ginis, K.A., & Latimer, A.E. (2009) Planning, leisure-time physical activity, and coping self-efficacy in persons with spinal cord injury: A randomized control trial. *Archives of Physical Medicine Rehabilitation, 90*, 2003-2011.
- Furmaniuk, L., Cywinska-Wasilewska, G., & Kaczmarek, D. (2010). Influence of long-term wheelchair rugby training on the functional abilities of persons with tetraplegia over a two year period post-spinal cord injury. *Journal of Rehabilitation Medicine, 42,* 688-690.
- Martin Ginis, K.A., Jetha, A., Mack, D.E., & Hetz, S. (2010) Physical activity and subjective well-being among people with spinal cord injury: A meta-analysis. *Spinal Cord, 48,* 65-72.
- Muraki, S. Tsunawake, N., Hiramatsu, S., & Yamasaki, M. (2000). The effect of frequency and mode of sports activity on the psychological status in tetraplegics and paraplegics. *Spinal Cord, 38,* 309-314.
- Schmid, A., Huonker, M., Stober, P., Barturen, J.M., Schmidt-Trucksass, A., Durr, H., Volpel, H.J., & Keul, J. (1998). Physical performance and cardiovascular and metabolic adaptation of elite female wheelchair basketball players in wheelchair ergometry and in competiton. *American Journal of Physical Medicine & Rehabilitation, 77*(6), 527-533.
- Valent, L., Dallmeijer, A., Houdijk, H., Talsma, E., & Van der Woude, L. (2007). The effects of upper body exercise on the physical capacity of people with a spinal cord injury: A systematic review. *Clinical Rehabilitation, 21*, 315-330.
- Wickham, S.E., Hanson, C.S., Shechtman, O., & Ashton, C. (2000). A pilot study: attitudes toward leisure and leisure motivation in adults with spinal cord injury. *Occupational Therapy in Health Care, 12*(4), 33-50.

Reasons for selecting these studies were:
-Studies met inclusion criteria
-Studies looked at one of the following: physical activity, subjective well being, psychological measures, adaptive sports attitudes and motivation towards leisure activity.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of meta-analysis by Martin Ginins, K.A., Jetha, A., Mack, D.E., & Hetz, S., (2010)

Aim/Objective of the Study: To determine if there is a relationship between physical activity and subjective well being among people with spinal cord injuries. Secondary purposes were to investigate the relationship between physical activity and specific subjective well being measures and determine study design as a predictor of physical activity and subjective well being.

Study Design: Meta-analysis.

Search strategy/ Methods: Embase, CINHAL, Medline, PsychINFO, and SPORTDiscus were searched for English language articles published before February 2008 on spinal cord injuries that included measures of physical activity and subjective well being**.** Physical activity was operationally defined participation in a sport or any activity used to improve or maintain physical health. Subjective well-being was operationally defined by Deiner construct which included pleasant and unpleasant affect, life satisfaction and domain satisfaction. A total of 12 physical activity terms and 21 subjective well-being terms were utilized. All data such as sample characteristics, study design definitions, and effect size calculations were extracted by the first, second, or fourth author and coded. Nine different statistics were calculated for each study (ex: sample sizes, correlations, confidence intervals).

Selection criteria: Studies were included if they met four inclusion criteria which were: 1) More than 51% of participants had a spinal cord injury 2) Physical activity was calculated by self report, observation, indirectly, or participants were grouped into active/inactive groups 3) A minimum of one measure of subjective well being 4) Adequate data was provided to determine effect size.

Outcome Measures/Results: There were a total of 21 studies that met the inclusion criteria. A total of 16 studies included paraplegic and tetraplegic participants, 2 with only paraplegic participants, 3 with paraplegic, tetraplegic, and other physical disabilities participants. There were a total of 12 cross sectional studies, 6 pre/post single group studies, 2 non-randomized experimental studies, and one RCT. Results found that there was a statistically significant (small to medium) positive relationship between physical activity and overall subjective well being (robs¼0.25; 95% CI 0.19–0.31). In terms of specific subjective well being constructs, statistically significant results were found between physical activity and greater life satisfaction (robs¼0.23; 95% CI 0.16–0.30) and lower depression scores (robs¼0.22; 95% CI 0.16–0.28).. The last purpose of this study found that experimental and quasi-experimental had statistically significant stronger relationships between physical activity and subjective well being over non-experimental studies.

Main Findings: Despite the various levels of spinal cord injuries and diagnosis, participation in physical activity whether it be playing a sport, joining a exercise group, or being active in a leisure activity resulted in higher subjective well being, higher life satisfaction, and lower depressive symptoms.

Original Authors' Conclusions: It was hypothesized that there would be a positive relationship between subjective well being and physical activity. This research supports the need for people who have sustained a spinal cord injury to maintain physical activity to enjoy a better quality of life. It is recommended future research investigate underlying reasoning for this positive relationship, utilize experimental designs, and quantify physical activity (frequency, duration, intensity).

Critical Appraisal:
Validity
Holmes Level: 1
Score: 20; moderate

Interpretation of Results*:* The evaluators of this study were not blinded to the authors, institutions, or results of the studies. The results of all the studies were not combined appropriately, and not all studies were similar enough to combine results. There was also no test for heterogeneity and sensitivity analyses were not performed.

Summary/Conclusion: This study supports the need for physical activity in order to maintain well-being among the spinal cord injury population. Physical activity participation provides numerous benefits and should be utilized by those following a SCI. Further research is needed to define parameters of physical activity utilizing an experimental design approach.

Table 3: Description and appraisal of systematic review by Valent et al. (2007).

Aim/Objective of the Study/Systematic Review: To summarize and describe the effects of upper body training on the physical capacity of people with a spinal cord injury. Also, compare impact of training effects on physical capacity between persons with tetraplegia and paraplegia in different training modes

Study Design: Systematic review of randomized controlled trials and non-randomized clinical trials.

Search Strategy/Methods: The research team used the following resources to obtain relevant articles for review: PubMED, MEDLINE, CINAHL, Sports Discus, and Cochrane Library. The search terms used were 'spinal cord injury', 'paraplegia', 'tetraplegia', and 'quadriplegia', in combination with the word 'training'. The researchers only viewed resources in the English language from years 1970-May 2006. The review accepted randomized control trials, however, the evidence was lacking, so non-randomized clinical trials were also included. Statistics were affected by small sample size which limited statistical power and not all studies appeared consistent with compliance, adverse affects, and drop out rates.

Selection Criteria: Studies that would be used for review had to meet the following inclusion criteria: 1) the population of the study must be adequately described and the individuals must have less than 25% impairments other than the spinal cord injury. 2) The study must include upper body training. 3) Functional electrical stimulation will not be used as part of training. 4) Training protocol is specifically stated 5) One or both of

main components of physical capacity peak oxygen uptake (VO2 peak) or peak power output (POpeak) are included in the outcome measures.

Methods (Identify data collection/analyses): The methodological quality was assessed using two independent assessors who scored articles and discussed discrepancy in specific articles, reasoning to a conclusion to accept or reject. The scores had to represent at least 50% total of the Van Tudler et al. rubric. After two independent reviews looked at a total of 40 papers, only 25 were deemed significant and relevant consistent with inclusion criteria. Although the 25 articles met inclusion criteria, blinding of the assessors (not available in RCT), compliance (10 studies), and dropout rates were not mentioned (8 studies).

Participants: Of the 25 studies approved, the sample size ranged from 1-20 participants, ages from 24-47. Studies consisted of individuals with paraplegia, tetraplegia, and combination of both.

Outcome Measures/Results: 25 studies met the appropriate criteria. There were 11 studies with paraplegic individuals, 10 studies with tetraplegia, and 4 studies that combined both paraplegic and tetraplegic participants. There were only 2 RCTs that were deemed appropriate according to the Van Tulder et al. scoring. The rest of the studies were low methodological scoring RCTs and non-randomized control clinical trials. Individuals who participated less than one year after injury were included, which is important because their scores seem to have increased the most, which could be primarily attributed to the neurological recovery. Participants who had tetraplegia less than one year from injury and higher level of injury showed improvements in POpeak between 10%-30% which included a slightly higher increase in VO2peak and POpeak with 29.7% increased. Considering some of the low methodological scores, and non-randomized trial designs, the increased respiratory percentages are more difficult to use for evidence in showing change in physical capacity.

Main Findings: Regardless of small sample sizes, the studies do give the impression that training interventions do help physical capacity because the VO2 peak and PO peak increased. These findings should be interpreted with caution due to design flaws.

Original Authors' Conclusions: It was concluded there needs to be stronger research design such as RCTs to validate that physical capacity can increase when upper body training is applied. The authors also state the participants may become adjusted to testing and this could have been a possible reason scores showed increasing measurements. Future studies should focus on specific populations of spinal cord injury, and kinds of protocols developed or used in training.

Critical Appraisal:
Validity
Holmes Level: 1
Score: 11; moderate

Interpretation of Results*:* The evaluators of this study realized that vital pieces of information were missing. Things such as small sample sizes, omitting drop out rates and compliance could possibly skew results or outcomes, which lowers the statistical power of the study and its relevance in providing proper evidence.

Summary/Conclusion: There are not enough relevant studies to support that training in the upper body increases physical capacity in individuals with spinal cord injury. Although the researchers do feel that an exercise program does increase overall health in an individual with a spinal cord injury, more research must be completed which accurately depicts protocols specifically developed for individuals who have spinal cord injury before supportive evidence will be available.

Table 4: Description and appraisal of randomized controlled trail by Arbour-Nicitopoulos, K.P., Ginis, K.A., & Latimer, A.E. (2009).

Aim/Objective of the Study/Systematic Review: To determine the effects that action planning and coping planning have on participation in leisure time physical activity in persons with spinal cord injury.

Study Design: Randomized controlled trial, 10 weeks,

Setting: General community

Participants: 44 participants, all sedentary. Inclusion criteria: 19 years old and older, diagnosis of neurologic impairment secondary to SCI, had no cognitive impairments, leisure time participation of 2 times or less for the past 6 months, planning on participating in leisure activity 3 days a week for the next 10 weeks. There were 2 dropouts before intervention started. Random numbers table used to randomize participants.

Intervention Investigated
-Action planning with coping planning to increase participation in exercise
-Participants planned when to exercise, for how long, and to what level of intensity they would exercise
-The coping planning involved ways to overcome 3 self identified leisure time physical activity barriers by forming a detailed plan of how to deal with each barrier
-Intervention lasted 20 to 30 minutes where a researcher would record each barrier and coping strategy
Control: Action planning only condition (APO)
Experimental: Action and coping planning condition (ACP)

Outcome Measures
-Intentions: Two statements were used to measure this. The first was, “I will try to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next 4 weeks” and the second was, “I intend to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next 4 weeks”. These statements were rated on a 7 point scale with 1 being definitely false/extremely unlikely and 7 being definitely true/extremely likely.
-Coping self-efficacy: 3 types of self-efficacy items (see below) were used to measure participants’ level of confidence in being able to overcome barriers to leisure time physical activity. The items were rated on a 7 point scale with 1 being not at all confident to 7 being completely confident.

-General barriers self-efficacy: a 6 item questionnaire was used to measure participants' confidence in being able to overcome barriers to LTPA. The 6 barriers came from a study done previously on persons with SCI.
-Facility barriers self-efficacy: a 5 item questionnaire was used to measure participants' confidence in overcoming barriers at fitness centers. The 5 barriers came from a study done previously on persons with SCI.
-Scheduling self-efficacy: This was measured by having the participants rate their confidence in being able to fit 30 minutes of exercise into their schedules 3 times a week.
-Health related break from leisure time physical activity: Information was obtained if any participant had missed LTPA because of a health-related problem.
-Weekly leisure time physical activity: a trained research assistant administered A short version of PARA-SCI over the phone. This has the participants identify the number of days and minutes they participated in LTPA. Outcomes were measured at weeks 1, 5, and 10.

Main Findings: Participants in the action and coping-planning group had significantly higher leisure time physical activity. This suggests that action planning alone is not enough to keep persons with SCI participating in LTPA; coping planning is also needed.

Original Authors' Conclusions*:* Persons with SCI face many barriers to participating in LTPA. Coping plans are effective in helping persons' with SCI being able to sustain LTPA so they should be considered as a key component to interventions with LTPA.

Critical Appraisal:
Validity
Holms Level 2
AACPDM 6/7; Strong

Interpretation of Results: The evaluators of this study were not blinded to what group the participants were assigned to.

Summary/Conclusion: Coping plans can help individuals with SCI develop and follow through with a LTPA, therefore they should be considered an important component to helping an individual with a SCI participate in LTPA for life.

Table 5: Description and appraisal of the prospective non-randomized controlled trial by Furmaniuk, L., Cywinska-Wasilewska, G., & Kaczmarek, D. (2010).

Aim/Objective of the Study/Systematic Review: The aim of this study is to determine the effects of long-term wheelchair rugby training post-spinal cord injury.

Study Design: Prospective non-randomized controlled trial.
Setting: Sports camp for promoting active rehabilitation and rehab center.

Participants: Prospective non-randomized controlled trial with 40 participants, all men presenting a mean age of 29.4. Each of the participants had a diagnosis of incomplete tetraplegia and were 5 years post spinal cord injury and had to have a B or C on the ASIA impairment scale. The wheelchair rugby (WR) group was recruited from a wheelchair rugby league, and the control group from a foundation for active rehabilitation. At the beginning of the study there were 54 participants, however, a total of 14 participants dropped out due to transportation, illness, and work conflicts. No blinding was shown since assessors were from the actual centre where the training took place.

Intervention:
Control: 20 men, mean age 28.8, who attended 8-day sports camp

Experimental (WR): 20 men, mean age 30, who attended 8-day sports camps attended supervised exercise sessions once a week for two years.

During the sports camp the individuals participated in 3 training sessions that lasted 1.5 hours. The individuals worked on wheelchair skills, swimming, table tennis, and archery. The WR group then participated in the once a week training sessions for two years. This program provided three different phases.

Outcome Measures
Primary outcome of the study was to check the participants' functional changes using the Wheelchair Skills Test version 2.4 which measures (1) Wheelchair activities: wheelies, overcoming obstacles, turning/rolling, reaching for objects, transferring in and out of wheelchair and (2) the use of wheelchair skills such as: open/folding wheelchair, move the footrests/armrests, application of the breaks. Secondary outcome was to measure if the participants' upper body strength changed from the training. The assessors used manual muscle testing with the 7-grade scale of the ASIA motor score. Experienced physiotherapists and trainers administered all examinations and measurements. Scoring of the test consisted of giving a 0-failed, or 1-passed. Measurements were taken from the experimental and control groups 2 years after the intervention was put into effect.

Main Findings: The wheelchair rugby group showed a significant increase of 24% in wheelchair skills after attending training. However, the control group reported a 4% increase, which was not significant. A correlation between the ASIA score and the wheelchair skills test was significant.

Original Authors' Conclusions The participation in the WR group showed increase in the wheelchair skills after the two-year training program, while both groups showed increase in functional skills (Furmaniuk, pg. 690). The study did not produce any evidence supporting the training efforts in comparison to increased muscle strength, but the "poor sensitivity of manual muscle testing" may be to blame (Furmaniuk, pg. 690).

Critical Appraisal:
Validity
Level of Evidence:

Holm's Level: III
Score: 5; moderate

Study is a prospective non-randomized controlled trial, with no blinding or masking. Inclusion and exclusion criteria were clearly stated and were implemented in recruiting participants. The WR group adhered and there was controlled exposure of treatment between groups, and the control group adhered to instructions.

Interpretation of Results: Individuals who participated in the WR group made significant increase in skills. However, both groups showed improvement. In the control group, the individuals with a higher injury at (C6-C7) actually demonstrated better improvements, but only showed 4% increase in skills overall.

Summary/Conclusion: Individuals with tetraplegia may promote and exhibit better functional skills and actually preserve abilities by participating in the sport of wheelchair rugby.

Table 6: Descriptive study by Schmid, Huonker, Stober, Barturen, Schmidt-Trucksass, Durr, Volpel, and Keul. (1998).

Aim/Objective of the Study: The purpose of this study was to compare physical performance, cardiovascular parameters, metabolic demands, and stress demands before and during wheelchair ergometry and a competitive wheelchair basketball game among elite female wheelchair basketball players versus sedentary spinal cord injury persons.

Study Design: Descriptive study.

Setting: Competitive basketball games took place in the community and ergometry testing occurred in the lab. This study was carried out in Germany.

Participants: A total of 23 participants took part in this study -13 female wheelchair basketball players and 10 female sedentary spinal cord injury participants. The elite female wheelchair basketball players were recruited from the German National basketball League. Wheelchair players were further divided into groups of three; lesion between T-1 and T-10, lesion between T-11 and L-5, and those with a lower limb amputation. Injuries resulted from the following; 65.4% motor vehicle accidents, 13.2% sports related, 5.7% industrial, 8.2% from surgical treatments, and 7.5% from other accidents.

Intervention Investigated: Both groups of participants underwent a graded exercise test and participated in a competitive basketball game. During the graded exercise portion, participants utilized their own chairs in which the front wheels were fixed to the ergometry and resistance was applied to the back wheels via a computerized electronic brake. The competitive basketball game consisted of two 20-minute halves.

Outcome Measures*:* During the ergometry test, baseline total heart volume and relative heart volume measurements were taken with each participant at rest with echocardiography. Lactate concentration and heart rate from the electrocardiogram were obtained before the test begin and at each level of exercise. Oxygen

consumption was measured with spirometry. The anaerobic threshold was determined at 4 mmol lactate (AT4) from the lactate curve. As for the competitive basketball game the heart rate was monitored continuously every 5 seconds. The documented heart rates represent the average taken every 2 min. Researchers took lactate acid concentration measurements from all players at random points during halftime.

Main Findings: Results found that the overall cardiac proportions for wheelchair basketball players were larger (620.3 ml; 9.6 ml) when compared to the sedentary spinal cord-injured persons (477.4 ml; 8.2 ml). The graded wheelchair ergometry exercise portion found that wheelchair basketball players had a higher maximal work rate (59.9 v 45.5 W), higher maximal oxygen consumption (33.7 v 18.3 ml), and higher maximal lactate (9.1 v 5.47 mmol) without a difference in maximal heart rate and workload at AT4 than did spinal cord-injured persons. The average heart rate during the wheelchair basketball game was 151 bpm, and the lactate concentration was 1.92 mmol. As for the different categories of injuries in the female wheelchair basketball players, the athletes with a lower level injury and higher maximal oxygen consumption reached a higher game level during competition. During the competitive basketball game, high cardiovascular stress was seen across all participants revealing fast aerobic metabolism was reached. Therefore, it may be concluded that wheelchair basketball provides physical benefits to those with spinal cord injuries by resulting in increased physiological parameters.

Original Authors' Conclusions: Physical activity is an important part of the rehabilitation process for persons spinal cord injuries. Wheelchair dependent people may greatly benefit from the demands of playing highly competitive sports. When selecting the intensity of the physical activity for rehabilitation it is also important to consider the severity of the injury.

Table 7: Description and appraisal of a pilot study: Attitudes toward leisure and leisure motivation in adults with spinal cord injury by Wickham, Hanson, Shechtman, and Ashton. (2000).

Aim/Objective of the Study/Systematic Review: This study was designed to look at the effects wheelchair sports have on persons with spinal cord injuries' motivation and attitudes toward leisure activities.

Study Design: Pilot study, quasi-experimental design.

Setting: Wheelchair sports camp

Participants:
-24 total participants
-12 participants with a spinal cord injury in the experimental group, chosen by a convenience sample of persons who participated in the 1998 wheelchair sports camp
-12 participants with a spinal cord injury in the control group who did not participate in the camp
-Inclusion for control group: must be the same gender and have similar characteristics of a participant in the experimental group

-Both the control and experimental groups had 8 men and 4 women
-There were participants with paraplegia and quadriplegia
-Age was 18-48
-Participants from both groups stated that they exercised 3-4 times per week
-2 participants from the control group did not return post-testing paperwork, so persons of similar demographic characteristics replaced those participants

Intervention Investigated: Participants from the experimental group were given a packet with all 3-assessment forms at registration on the first day of camp. There were trained assistants to answer questions about the forms and collect them.
The leisure attitude measurement (LAM) and the leisure motivation scale (LMS) were mailed to the participants 5 days after the camp. This also included a camp evaluation form.
The control group also had pre-testing that was done by the trained assistant who gave instructions at the camp. Their post-testing was mailed to them to arrive 1 week after initial testing.

Outcome Measures:
-Craig Handicap Assessment and Reporting Technique (CHART): Measures a person's extent of handicap according to the World Health Organization's definition. This has been shown to be valid and reliable. This was used to show that the participants in the control and experimental groups were alike.

-Leisure Attitude Measurement (LAM): Examines the person's attitude toward leisure in 3 areas; cognitive, affective, and behavioural. It has 36 items that are divided so that 12 apply to each of the 3 areas.

-Leisure Motivation Scale (LMS): Measures the person's motivation for participating in leisure activities. There are 4 primary motivators tested:
-intellectual, which can be learning, exploring, discovering, creating, or imaging
- social, which are activities that build friendships and interpersonal relationships
-competency-mastery, activities that entail achievement, mastery, challenge and competition
-stimulus avoidance, activities that allow the person to escape from overstimulating situations

Main Findings: There was no significant increase found in the scores of the LAM and the LMS for the experimental group. The 3 factors that motivate had higher effect sizes. The control group showed no significance and very low effect sizes. Independent t-tests showed no significance between experimental and control groups pre and posttest scores.

Original Authors' Conclusions*:* The authors think that a 2 day adapted sports program is not enough time to make a big impact on a person's attitudes and motivation.

Critical Appraisal:
Validity
Holms Level 3

AACPDM 6/7; Strong

Interpretation of Results*:* The evaluators of this study were not blinded to what group the participants were assigned to.

Summary/Conclusion: More research should be conducted through wheelchair sports programs of extended time frames to determine if they do increase attitudes and motivation towards leisure persons with SCI.

Table 8: Description and appraisal of: descriptive study by Muraki, S., Tsunawake, N., Hiramatsu, S., & Yamasaki, M. (2000).

Aim/Objective of the Study: The aim of this study was to examine the psychological benefits of sports activity in both tetraplegics and paraplegics and to investigate the effects of mode and intensity of sports activity on the psychological benefits in individuals with spinal cord injury(SCI).

Study Design: Descriptive study

Setting: Western Japan

Participants: 500 individuals living with SCI who completed a rehabilitation program at a hospital and lived in the community were mailed questionnaires; 269 individuals responded. Those with SCI over 60 years old and females with ISCI were removed due to low rates of participation for sports activity, as to exclude the influence of the age and sex on psychological status. This left 169 male with SCI, ages 18 to 59.

Intervention: No intervention; descriptive study

Outcome Measures
A questionnaire was specifically designed for this study; tetraplegics and paraplegics were divided into 4 groups (high-active, middle-active, low-active, and inactive) according to their frequency of sports activity. High and middle-active groups were then classified according to the mode of sports activity they performed most frequently and individuals of these groups were asked to answer the frequency, duration, and intensity of the mode. Borg's ratings of perceived exertion (scale from 6 to 20) were used to answer the intensity. The participants' psychological status was then assessed using the following psychometric instruments:

- Zung self-rating depression scale (SDS)- used as a self-report measure of severity of depression; individual responds to 20 items (10 worded positively and 10 negatively) on a 4-point scale.
- State-Trait Anxiety Inventory (STAI)- used to assess state and trait anxiety; individual responds to 20 state anxiety items and 20 trait anxiety items on a 4 point scale.
- Profile of Mood States (POMS)- used to assess the mood stat, including tension, depression, anger, vigor, fatigue, and confusion; individual responds to 65 items on a 5 point scale.

Main Findings: No significant differences were found for the variables (depression, state and trait anxiety, tension, depression, anger, vigor, fatigue, and confusion) between tetraplegics and paraplegics. However, the higher frequency of sports activity in persons with SCI indicated lower scores of depression and trait anxiety and a higher score in valor. Significant effects were found in the intensity, frequency, and duration of activity in wheelchair basketball, wheelchair racing, wheelchair tennis, and minor modes among subjects in the high and middle-active groups. There was no significant difference observed in psychological variables among the different sports compared.

Original Authors' Conclusions: Sports activity can improve the psychological status, including reduced depression and trait anxiety and an increase in vigor in persons with SCI with tetraplegia or paraplegia. Participating in sports with a frequency of three times a week or more emphasizes psychological benefits.

IMPLICATIONS FOR PRACTICE, EDUCATION, AND FUTURE RESEARCH:

This CAT sought to determine the effects of implementing adaptive sports on people with spinal cord injury. Implications for practice may be the following: encourage participation in physical activity and/or sports programs to increase functional skills, physical attributes, and psychological well being. Therapists should be competent in how to access the programs available for clients. Implications for education may consist of therapists' understanding the effects of adaptive sport programs on spinal cord injury through communication with colleagues and latest published peer-reviewed research. They should also be proficient in communicating and educating the client of these effects. Future research should focus on applying stronger methodological studies and specific details of benefits within these training programs; further study regarding kinds of physical activity and how much is beneficial are needed. Also studies that identify program differences between SCI levels would be helpful.

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