



Narrative Review

Impact of Organized Sports on Activity, Participation, and Quality of Life in People With Neurologic Disabilities

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Abstract

Physical activity and exercise is the mainstay of chronic disease prevention and health maintenance for all people with and without a disability, and clear evidence exists of the benefits among various populations with neurologic disabilities. However, the potential benefits of organized sports for people with neurologic disabilities are not as well explored. In this narrative review, current evidence regarding the impact of organized sports on activity, participation, and quality of life in people with neurologic disabilities of all ages is summarized, and facilitators of and barriers to participation in sports for this population are discussed. The articles reviewed were divided into 2 sets: (1) children and adolescents and (2) adults. The subjects of almost all of the studies were persons with a spinal cord injury. Children and adolescents with a disability who engaged in sports reported self-concept scores close to those of able-bodied athletes, as well as higher levels of physical activity. Adults with a spinal cord injury who engaged in organized sports reported decreased depression and anxiety, increased life satisfaction, and increased opportunity for gainful employment compared with nonathletic persons with disabilities. General facilitators, regardless of age, were fitness, fun, health, competence, and social aspects, whereas overall barriers were lack of or inappropriate medical advice and facilities, decreased self-esteem, poor finances, dependency on others, and views held by others. The importance of this topic for further research is highlighted, and suggestions for future studies are proposed.

Introduction

Physical activity and exercise is the mainstay of chronic disease prevention and health maintenance for all people with and without a disability [1,2]. Evidence indicates benefits among various populations with neurologic disabilities, such as spinal cord injury (SCI), stroke, traumatic brain injury, cerebral palsy, multiple sclerosis, and Parkinson disease [3-7].

Participation in sports, whether competitive or noncompetitive, is one way for people with neurologic disabilities to engage in regular physical activity and exercise. Participation of persons with disabilities in sports is not a new concept [8]. More than 50 years ago, Sir Ludwig Guttmann contributed to the development of organized sports for people with disabilities, which led to the evolution of the Paralympic Games [9,10]. With lengths of stays in rehabilitation units decreasing, the need exists for a smooth transition after discharge from hospital-based rehabilitation to continued, regular community-based physical activity [11]. This need, in

turn, has led to a heightened interest in the importance of participation in sports for people with disabilities.

In past decades, several articles highlighted the importance of organized sports for people with disabilities. Sports for children and adolescents with disabilities have focused on the psychological, social, and moral developmental benefits associated with sports participation [12-14]. Psychological benefits include companionship, a sense of achievement, and heightened self-esteem. Two reviews [15,16] have argued that people with an SCI who participate in sports and recreational activities improve self-confidence, self-esteem, and quality of life, as well as performance of activities of daily living. Reviews of adults with various disabilities have described the physical, psychological, social, and economic benefits of participation in sports and recreational activities [17-22]. Taken together, the literature suggests that participation in sports and recreational activities is beneficial to people with disabilities. However, research evidence of the importance of

organized sports for people with neurologic disabilities is limited, and thus scientific development of this field is necessary.

To further advance our knowledge and facilitate future developments in the field of physical medicine and rehabilitation, current scientific evidence regarding the importance of participation in organized sports for people with neurologic disabilities needs to be summarized. In this narrative review, we summarize the impact of organized sports on activity, participation, and quality of life in people with neurologic disabilities of all ages and discuss facilitators of and barriers to sports participation. The need for further research in this area is highlighted, and suggestions for future studies are proposed.

Method

Article searches were conducted using MedLine, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsychINFO, and AMED. Combinations of the following terms were used: "nervous system diseases," "sports," "disability," "Paralympic," "activities of daily living," "quality of life," "employment," "facilitators," and "barriers," along with terms such as "spinal cord injury," "cerebral palsy," "stroke," and other neurologic diagnoses. We limited searches to articles published in 1980 and later. Articles were excluded if the main focus was other than that related to activity, participation, and quality of life from participating in organized sports. Studies that did not include persons with mainly physical neurologic disabilities were also excluded, together with those that focused on persons with vision or auditory impairments, although studies of persons with both physical and cognitive impairments were included. If the study group consisted of varied diagnoses but partly matched the search, they were included. In addition, articles were collected by searching through the reference lists of included studies.

Results

Organized Sports for Children and Adolescents With Neurologic Disabilities

Although children and adolescents with neurologic disabilities constitute a large population, few studies regarding their participation in organized sports were found. Because most of the participants are minors, the need for parental consent may partly explain the difficulty of obtaining data for persons in this age group. [Table 1](#) describes the published studies that met the requirements for inclusion in this narrative review. The disability groups included were cerebral palsy, SCI, and myelomeningocele.

Sherrill et al [23] examined the self-concepts (ie, perceived competence and perceived identity) of 158 athletes with a disability (cerebral palsy and SCI) between the ages of 9 and 18 years because no research on children and adolescents with a disability was available at the time of their study. The participants completed a self-concept inventory in which they rated themselves lower on having close friends, self-perceived appearance, and job competence. However, these ratings were close in range to the means of the test manual's normative ratings for able-bodied children and adolescents. Even though the participants with a disability in that study had marked physical impairments, the authors suggested that they might have had a different frame of reference compared with control subjects. For example, the group of athletes with a disability might instead have compared themselves with peers with a disability (rather than able-bodied peers) who are not active in sports.

Buffart et al [24] performed a study that included 51 persons, aged 16-25 years, with myelomeningocele. The investigators found an association between sports participation and social support, enjoyment of exercise, competence, self-perceived physical appearance, and global self-worth. However, sports participation was not associated with level of education or cognitive function.

Table 1
Impact of participation in organized sports among children and adolescents with neurologic disabilities

Author and Year	Type of Study	Main Results and Conclusions
Sherrill et al [23], 1990	158 participants, aged 9-18 y, cerebral palsy, spinal cord injury, vision impairments, short-statured and amputee; questionnaire: What Am I Like	Children and adolescents with a disability who participated in sports rated lower on close friends, appearance, and job competence, but these ratings were close in range to the means of the test manual's normative ratings from able-bodied children and adolescents
Buffart et al [24], 2008	51 participants, aged 16-25 y, with myelomeningocele; cross-sectional study; measures: Functional Independence Measure, Functional Assessment Measure, Social Support of Diet and Exercise Behaviors, Harter's Social Perception Profile for Adolescents scale, Groningen Enjoyment Questionnaire, and Physical Activity Scale for Individuals with Physical Disabilities	About two thirds of the population with a disability participated in sports; an association was found between sports participation and social support, enjoyment of exercise, competence, self-perceived physical appearance, and global self-worth; sports participation may be important to increase and maintain health in children and adolescents with myelomeningocele

Additionally, no association was found with objective physical activity levels, but self-reported physical activity levels were higher in persons who participated in sports. The reasons for not participating in sports were mainly lack of time and lack of interest, not lack of ability. The authors concluded that increasing sports participation might serve to improve and maintain health in children and adolescents with a disability. Sherrill et al [23] did not calculate the level of significance, and Buffart et al [24] found no significant correlations in their results. Use of statistical methodologies is an important consideration for future studies.

Organized Sports for Adults With Neurologic Disabilities

The studies that we examined focused on several outcomes of sports participation, including life

satisfaction and community integration, and almost exclusively included people with SCI (Table 2). Studies compared (1) athletes with an SCI and nonathletes, (2) athletes with an SCI and able-bodied athletes, (3) active and nonactive persons with an SCI, and (4) different levels of activity among persons with an SCI.

Sherrill et al [25] conducted a study with 68 U.S. athletes, mainly with an SCI, who competed in the 1986 Pan American Wheelchair Games, along with athletes with a disability from U.S. basketball teams. The Personal Orientation Inventory was used to assess this study group, as well as 3 different statistical reference groups of able-bodied athletes and the normal population. Female athletes with a disability scored lower on self-actualization than did male athletes with a disability, but the difference was not significant. However, both groups were close in range to the general population. In addition, the male athletes with a disability scored significantly higher than the able-bodied athletes on

Table 2
Impact of participation in organized sports among adults with a spinal cord injury and other neurologic disabilities

Author and Year	Type of Study	Main Results and Conclusions
Sherrill et al [25], 1990	68 participants, aged 16-54 y, wheelchair athletes at elite level, mainly SCI; measure: Personal Orientation Inventory	Both men and women were close in range to the general population; male athletes scored significantly higher than able-bodied athletes on self-actualization, whereas female athletes scored self-actualization to the same degree as able-bodied athletes
Hanson et al [26], 2001	48 participants with an SCI, aged 26-53 y, 30 athletes and 18 nonathletes; questionnaire: Craig Handicap Assessment and Reporting Technique	Athletes scored significantly higher than did nonathletes on 4 out of 5 subscales of the questionnaire; disability sports might be a way for people with an SCI to continue to participate in regular physical activity
Muraki et al [27], 2000	169 participants with an SCI, aged 18-59 y, groups based on level of activity (high, middle, low); questionnaires: Self-reporting Depression Scale, State-Trait Anxiety Inventory, and Profiles of Mood States	Sports participation appeared to decrease anxiety and depression, particularly in the group with the highest level of activity, although no significant differences were found
Tasiemski et al [28], 2000	45 participants with an SCI, aged 18-50 y; pilot postal survey; 26-item questionnaire included demographics, injury data, educational level, employment, and sports/recreational activity before and after injury	42% participated in sports before their injury and 20% participated after their injury; no significant correlations between sports/recreation and education status were found
Gioia et al [29], 2006	137 participants with an SCI, aged 18-65 y, 2 groups based on sports participation; cross-sectional study; questionnaires: State Anxiety Inventory Form X2, Eysenck Personality Questionnaire for Extraversion, Questionnaire for Depression	Athletes with a disability showed significantly lower depression and anxiety scores than did nonathletes and displayed relatively higher scores on extraversion; sports activity alone was the most powerful predictor influencing anxiety scores
Tasiemski et al [30], 2005	985 participants, all wheelchair users, aged 18-50 y; questionnaires: Sport Participation Questionnaire, Life Satisfaction Questionnaire, and Hospital Anxiety Depression Scale	About half of the participants were physically active or participated in organized sports; those who participated in sports had a higher level of life satisfaction, along with a decreased depression and anxiety level
McVeigh et al [31], 2009	90 participants with an SCI, >15 y, 2 groups based on sports participation; cross-sectional study; questionnaires: Community Integration Questionnaire and Reintegration to Normal Living Index	Athletes had higher scores on the Community Integration Questionnaire and Reintegration to Normal Living Index, indicating that those participating in sports were more integrated in the community; sports participation at higher competitive levels and participation in individual sports were associated with increased community integration both before and after SCI
Blauwet et al [32] 2013	149 participants with an SCI, aged 24-65 y, about half veterans; cross-sectional study; questionnaire: self-authored, including questions regarding demographic factors, employment history, durations of injury, and participation in organized sports	Participation in organized sports was significantly associated with employment, after adjusting for other factors, such as gender, duration of injury, wheelchair use, and participation in individually planned exercise programs

SCI = spinal cord injury.

self-actualization, whereas the female athletes with a disability scored on self-actualization to the same degree as did the able-bodied athletes.

Hanson et al [26] conducted a study with 48 persons who had an SCI. These investigators found that athletes had a relatively greater level of community integration than did nonathletes. The participants responded to the Craig Handicap Assessment and Reporting Technique, which showed significantly higher scores in the athlete group on 4 of the 5 subscales: physical independence, mobility, occupation, and social integration. The vast majority of the participants were either employed or students. The athletes expressed a wish for an earlier exposure to sports during their rehabilitation process. The authors concluded that sports activities are a refreshing change from rehabilitation. This finding implies that being introduced to sports more quickly might facilitate the speed of improvement in functional ability. The authors also concluded that disability sports might be a way for persons with an SCI to continue to participate in regular physical activity because of the playful and social nature of sports.

Another questionnaire-based study with a total of 169 participants divided the subjects into 3 different groups based on their level of activity [27]. Sports participation appeared to decrease anxiety and depression, particularly in the group with the highest level of activity (ie, active more than 3 times per week), although no significant differences were found. This study provides an interesting baseline for the relevant frequency of activity for persons with an SCI in order to maintain optimal psychological health.

A pilot postal survey with 45 participants who had an SCI failed to find any significant correlations between participation in sports or leisure activities and the level of education or employment [28]. People with an SCI kept being active in sports or other physical activities primarily to maintain good physical condition and improve upper body strength. Other important factors included enjoyment, competition, improved self-esteem, and better weight control. The authors emphasized the need for future studies with larger study groups.

Goia et al [29] conducted a study of 137 persons with an SCI and found that athletes with a disability showed significantly lower depression and anxiety scores than did nonathletes. The athletes also displayed relatively higher scores on extraversion. Sports activity alone was the most powerful predictor influencing anxiety scores. These results are similar to the findings of Muraki et al [27], although these 2 studies used different types of questionnaires. Goia et al [29] also found that persons with tetraplegia scored higher on the depression scale than did persons with paraplegia. The investigators concluded that sports have psychological benefits for persons with an SCI regardless of

injury level and that those benefits are not related to demographic factors.

Tasiemski et al [30] performed a very large questionnaire-based study, including almost 1000 participants, in which about half were physically active or participated in organized sports. The participants were all wheelchair users. Those who participated in sports had a higher level of life satisfaction, along with a decreased depression and anxiety level. The overall conclusion was that the participants were satisfied with life in general, especially in social domains, but with the lowest satisfaction in sexual life and vocational situation. The authors also found a decrease in sports participation after the SCI occurred, particularly in team sports. About one third of the participants reported a lack of accessible facilities, which might have affected their opportunities to participate in sports. Thirty percent stated that because they were dependent on others in activities of daily life, sports participation was prohibitive. The investigators also stated that past studies had failed to find a significant link between participation of persons with disabilities in sports and quality of life.

McVeigh et al [31] used questionnaires to study community integration in relation to sports participation in a population of 90 persons with an SCI who used their wheelchair more than 1 hour per day. Numerous potential factors were taken into account, and significant differences were found between persons who were and were not active in sports. Sports participants were 4.75 and 7.00 times as likely to have high scores on the Community Integration Questionnaire and the Reintegration into Normal Living Index, respectively, indicating that persons participating in sports were more fully integrated in the community. In addition, sports participation at higher competitive levels and participation in individual sports were associated with increased community integration both before and after SCI. The authors concluded that sports participation should be recognized as an adjunct to SCI rehabilitation programs, which may provide a smoother transition for patients with a SCI from clinical rehabilitation to continued regular exercise.

The most recent study by Blauwet et al [32] investigated the association between sports participation and employment through a self-authored questionnaire answered by 149 participants, including both veterans and nonveterans with an SCI. The authors found that participation in organized sports was significantly associated with a higher rate of employment, after adjusting for demographic factors. However, employment was also correlated with young age and a high level of education, whereas obesity decreased the likelihood of employment. Other factors measured that did not reach significance were gender, duration of injury, wheelchair use, and participation in individually planned exercise programs. The discrepancy between sports participation

and individually planned exercise, as defined by the authors, was noted, which could indicate that sports participation results in benefits that are greater than that of just physical exercise. Lastly, the authors expressed the need for future studies to determine the relationship between sports participation and employment. Does sports participation increase the opportunity for gainful employment for a person with an SCI, or could it be that employment increases the possibility of participating in a sport? The answers to these questions have yet to be determined.

Facilitators of and Barriers to Participation in Organized Sports

Table 3 summarizes articles that addressed facilitators of and barriers to participation in organized sports. In 2 studies, the participants had an SCI [33,34], whereas the third study had a mixed population of people mainly with an SCI but also with cerebral palsy and other neurologic and non-neurologic disabilities [35].

Wu and Williams [33] studied preinjury sports participation in 143 persons with an SCI. The authors found that the persons who had been active prior to their injury initiated regular sports participation much sooner after the injury and had longer sports careers. Those who were introduced to sports for the first time after their SCI had significantly more challenges with training. Both groups rated sports peers with disabilities

as the most important sources of information. The main overall reasons for participation in sports after the injury were fitness, fun, health, and competition. Many participants also noted that social aspects and rehabilitation influenced their sports participation. The study also identified the need for better information about sports participation for persons with an SCI. Informing patients about opportunities for sports participation is important, and if this information was provided prior to discharge, they would benefit by having the positive aspects of sports participation presented to them at an earlier time point.

Stephens et al [34] collected information from 7 persons with an SCI through semistructured interviews. Facilitators included socialization, acquisition of knowledge from others, development of greater awareness of health and well-being issues, weight maintenance, functional development, and independence. Some participants gained motivation by observing other persons with an SCI who had higher functional independence than themselves. Another important factor was to be able to demonstrate one's competence and provide purpose by redefining oneself. One participant noted during the interview: "You know people might turn round and say I hate the fact that I can't walk or I hate the fact that there is this, that, and the other, but you forget about it all when you are playing a sport" [34].

Some identified barriers were financial constraints, lack of or inappropriate medical advice, lack of sporting

Table 3
Facilitators of and barriers to participation in organized sports for people with neurologic disabilities

Author and Year	Type of Study	Main Results and Conclusions
Wu and Williams [33], 2001	143 participants, aged 18-55 y, with an SCI; questionnaire: Disability Sports Participation Questionnaire	Those who had been active prior to their injury initiated regular sports participation much sooner after the injury and had longer sports careers; both groups rated sports peers with a disability as the most important sources of information; the main overall facilitators for sports participation were fitness, fun, health, competition, and social aspects
Stephens et al [34], 2012	7 participants, aged 26-49 y, with an SCI; semistructured interviews	Facilitators included socialization, acquisition of knowledge from others, development of greater awareness of health and well-being issues, weight maintenance, functional development, and independence; barriers were financial constraints, lack of or inappropriate medical advice, sporting opportunities, dependence on others, secondary complications, reduced confidence, and feeling patronized
Jaarsma et al [35], 2013	76 participants, all Paralympic athletes, aged 20-40 y; questionnaire based on the International Classification of Functioning, Disability and Health model and theory of planned behavior	Barriers were mostly environmental, whereas facilitators were mainly personal factors; the most frequently mentioned personal facilitators to initiate sports participation were fun, health, and competition; barriers, such as dependency on others and lack of sports facilities, were over-represented among wheelchair athletes; attitudes (positive or negative outcome expectancies of behavior) and subjective norms (social pressure regarding the behavior) were considered the most important components contributing to the intention to participate in organized sports

opportunities, dependency on others, secondary complications, reduced confidence, and feeling patronized. The investigators concluded that the benefits clearly demonstrate that sports need to be encouraged in persons with an SCI.

The final study, which compared wheelchair athletes with ambulatory athletes, was based on survey replies from 76 Dutch Paralympic athletes [35]. Compared with Wu and Williams [33], Jaarsma et al [35] had similar findings in that the most frequently mentioned personal facilitators to initiate sports participation were fun, health, and competition. Additionally, Jaarsma et al [35] found social support to be the main environmental facilitator, and they also reported that barriers were mostly environmental, whereas facilitators were mainly personal factors. Barriers, such as dependency on others and lack of sports facilities, were over-represented among wheelchair athletes. Interestingly, one third of the participants reported no barriers. Attitudes (positive or negative outcome expectancies of behavior) and subjective norms (social pressure regarding the behavior) were considered the most important components contributing to the intention to participate in organized sports. This study included many different disability groups, so the results could be generalized to people with disabilities. Additionally, the results are similar to those of the other 2 studies of people with an SCI [33,34].

Discussion

Several scientific studies on children, adolescents, and adults regarding the impact of participation in organized sports have been published. Children and adolescents with cerebral palsy and myelomeningocele who participate in organized sports reported an increased self-concept, competence, self-perceived physical appearance, and global self-worth. Persons with an SCI who participate actively in sports display increased community integration, life satisfaction, employment, and extraversion, as well as decreased levels of anxiety and depression. Compared with able-bodied athletes, athletes with a disability scored higher or the same on self-actualization. The identified facilitators and barriers were similar, even though the studies included different types of disabilities. General facilitators were fitness, fun, health, competence, and social aspects, whereas overall barriers were lack of or inappropriate medical advice and facilities, decreased self-esteem, poor finances, dependency on others, and views held by others.

Most of the articles we reviewed included persons with an SCI, whereas only a few focused on cerebral palsy, myelomeningocele, or wheelchair athletes, the latter without specifying the type of disability. Interestingly, no articles were found specifically on traumatic brain injury, stroke, Parkinson disease, multiple

sclerosis, or muscular dystrophy, although people with these disabilities participate in organized sports, even at the Paralympic level. Thus in future research it is important to highlight disabilities other than SCI that represent large groups of the neurologic patient population. Several studies have investigated facilitators of and barriers to physical activity and exercise in persons with a disability [36-39], but similar studies regarding the participation in organized sports of people with disabilities are lacking.

Because of the large variation in methodology, future research would benefit from more standardized outcome measures to facilitate comparison of results between studies. Additionally, it would be interesting to use more qualitative methods to identify the participants' own perceptions of the impact of organized sports. The studies reviewed were performed in different countries (the United States, United Kingdom, Canada, the Netherlands, Italy, Australia, and Japan), which can result in variations that depend on cultural and societal differences and differences in the health care system.

Future studies would also benefit from a unified definition of "organized sports" in order to standardize study groups and facilitate comparison of results between studies. Some of the included studies had a broad definition of "organized sports" that included physical activity and leisure, whereas some did not describe their interpretation of this definition at all. Other studies used elite athletes, such as participants in the Paralympics. The studies also used different comparison and control groups. The most common groups were athletes with a disability compared with nonathletes with a disability, and some investigators compared athletes who had a disability with able-bodied athletes.

Based on the articles reviewed, it is apparent that organized sports can play an important role for people with neurologic disabilities, regardless of age. However, current research is underdeveloped, which results in limited evidence. Disability sports have developed novel opportunities for people with disabilities, but a gap in the ability to participate in sports still exists between persons with and without a disability. People with neurologic disabilities now have a longer life span than in the past. Further, some neurologic disabilities are congenital or have an early onset, whereas others are becoming more frequent at early ages. Therefore, it is essential to increase participation in sports, regardless of age, because such participation can empower people with neurologic disabilities to set and attain goals and reach a higher quality of life on their own terms. This also motivates further studies of sports participation as a way to increase health, function, quality of life, and community integration.

Sports activities can serve as an effective complement to traditional rehabilitation. Participation in organized sports is thought to be fun and inviting,

providing comradeship and social fellowship. It is therefore important to further strengthen the development of sports for people with neurologic disabilities, as well as other forms of disabilities. Based on the facilitators and barriers explored in the reviewed studies, it is relevant to organize sports differently in order to reduce the barriers experienced in this population and be more attentive to facilitators that will increase participation.

Summary

Based on current scientific evidence, people with neurologic disabilities who participate in organized sports display increased self-concept, self-esteem, life satisfaction, and opportunity for gainful employment, as well as decreased depression and anxiety. Thus participation in organized sports ultimately suggests that people with neurologic disabilities are more satisfied and integrated in society. These findings emphasize the need for physicians and other health care professionals to acknowledge the impact of participation in organized sports. Future research needs to determine the full impact of organized sports for individuals with disabilities. We recommend standardizing methods, isolating sports participation from physical activity and exercise, and including other groups of people with neurologic disabilities in addition to persons with an SCI.

References

- Laskowski E, Lexell J. Exercise and sports for health promotion, disease and disability. *PM R* 2012;4:795-796.
- Rimmer JH, Chen MD, McCubbin JA, Drum C, Peterson J. Exercise intervention research on persons with disabilities: What we know and where we need to go. *Am J Phys Med Rehabil* 2010;89:249-263.
- Anneken V, Hanssen-Doose A, Hirschfeld S, Scheuer T, Thietje R. Influence of physical exercise on quality of life in individuals with spinal cord injury. *Spinal Cord* 2010;48:393-399.
- Crizzle AM, Newhouse IJ. Is physical exercise beneficial for persons with Parkinson's disease? *Clin J Sport Med* 2006;16:422-425.
- Dalgas U, Stenager E. Exercise and disease progression in multiple sclerosis: Can exercise slow down the progression of multiple sclerosis? *Ther Adv Neurol Disord* 2012;5:81-95.
- Verschuren O, Ketelaar M, Gorter JW, Helden PJ, Uiterwaal CS, Takken T. Exercise training program in children and adolescents with cerebral palsy: A randomized controlled trial. *Arch Pediatr Adolesc Med* 2007;161:1075-1081.
- Wise EK, Hoffman JM, Powell JM, Bombardier CH, Bell KR. Benefits of exercise maintenance after traumatic brain injury. *Arch Phys Med Rehabil* 2012;93:1319-1323.
- DePauw KP, Gavron SJ. *Disability Sport*. 2nd ed. Champaign, IL: Human Kinetics Publishers; 2005.
- Vanlandewijck YC, Thompson WR, eds. *The Paralympic Athlete: Handbook of Sports Medicine and Science*. Hoboken, NJ: Wiley-Blackwell; 2011.
- Brittain I. *The Paralympic Games Explained*. New York, NY: Routledge; 2009.
- Rimmer JH. Getting beyond the plateau: Bridging the gap between rehabilitation and community-based exercise. *PM R* 2012;4:857-861.
- Carroll KL, Leiser J, Paisley TS. Cerebral palsy: Physical activity and sport. *Curr Sports Med Rep* 2006;5:319-322.
- Patel DR, Greydanus DE. Sport participation by physically and cognitively challenged young athletes. *Pediatr Clin North Am* 2010;57:795-817.
- Wind WM, Schwend RM, Larson J. Sports for the physically challenged child. *J Am Acad Orthop Surg* 2004;12:126-137.
- Martin Ginis KA, Jorgensen S, Stapleton J. Exercise and sport for persons with spinal cord injury. *PM R* 2012;4:894-900.
- Slater D, Meade MA. Participation in recreation and sports for persons with spinal cord injury: Review and recommendations. *NeuroRehabilitation* 2004;19:121-129.
- Hutzler Y, Bar-Eli M. Psychological benefit of sports for disabled people: A review. *Scand J Med Sci Sports* 1993;3:217-228.
- Jackson RW, Davis GM. The value of sports and recreation for the physically disabled. *Orthop Clin North Am* 1983;14:301-315.
- Klapwijk A. The multiple benefits of sports for the disabled. *Int Disabil Stud* 1987;9:87-89.
- Richter KJ, Gaebler-Spira D, Mushett CA. Sport and the person with spasticity of cerebral origin. *Dev Med Child Neurol* 1996;38:867-870.
- Shephard R. Benefits of sport and physical activity for the disabled: Implications for the individual and for society. *Scand J Rehab Med* 1991;23:51-59.
- Vanderstraeten GG, Oomen AG. Sports for disabled people: A general outlook. *Int J Rehabil Res* 2010;33:283-284.
- Sherrill C, Hinson M, Gench B, Kennedy SO, Low L. Self-concepts of disabled youth athletes. *Percept Mot Skills* 1990;70:1093-1098.
- Buffart LM, van der Ploeg HP, Bauman AE, et al. Sports participation in adolescents and young adults with myelomeningocele and its role in total physical activity behaviour and fitness. *J Rehabil Med* 2008;40:702-708.
- Sherrill C, Silliman L, Gench B, Hinson M. Self-actualisation of elite wheelchair athletes. *Paraplegia* 1990;28:252-260.
- Hanson CS, Nabavi D, Yuen HK. The effect of sports on level of community integration as reported by persons with spinal cord injury. *Am J Occup Ther* 2001;55:332-338.
- Muraki S, Tsunawake N, Hiramatsu S, Yamasaki M. The effect of frequency and mode of sports activity on the psychological status in tetraplegics and paraplegics. *Spinal Cord* 2000;38:309-314.
- Tasiemski T, Bergstrom E, Savic G, Gardner BP. Sports, recreation and employment following spinal cord injury—a pilot study. *Spinal Cord* 2000;38:173-184.
- Gioia MC, Cerasa A, Di Lucente L, Brunelli S, Castellano V, Traballesi M. Psychological impact of sports activity in spinal cord injury patients. *Scand J Med Sci Sports* 2006;16:412-416.
- Tasiemski T, Kennedy P, Gardner BP, Taylor N. The association of sports and physical recreation with life satisfaction in a community sample of people with spinal cord injuries. *NeuroRehabilitation* 2005;20:253-265.
- McVeigh SA, Hitzig SL, Craven BC. Influence of sport participation on community integration and quality of life: A comparison between sport participants and non-sport participants with spinal cord injury. *J Spinal Cord Med* 2009;32:115-124.
- Blauwet C, Sudhakar S, Doherty AL, Garshick E, Zafonte R, Morse LR. Participation in organized sports is positively associated with employment in adults with spinal cord injury. *Am J Phys Med Rehabil* 2013;92:393-401.
- Wu SK, Williams T. Factors influencing sport participation among athletes with spinal cord injury. *Med Sci Sports Exerc* 2001;33:177-182.
- Stephens C, Neil R, Smith P. The perceived benefits and barriers of sport in spinal cord injured individuals: A qualitative study. *Disabil Rehabil* 2012;34:2061-2070.
- Jaarsma EA, Geertzen JH, de Jong R, Dijkstra PU, Dekker R. Barriers and facilitators of sports in Dutch Paralympic athletes: An explorative study. *Scand J Med Sci Sports* 2013;24:830-836.

36. Buffart LM, Westendorp T, van den Berg-Emons RJ, Stam HJ, Roebroek ME. Perceived barriers to and facilitators of physical activity in young adults with childhood-onset physical disabilities. *J Rehabil Med* 2009;41:881-885.
37. Ellis T, Boudreau JK, DeAngelis TR, et al. Barriers to exercise in people with Parkinson disease. *Phys Ther* 2013;93:628-636.
38. Damush TM, Plue L, Bakas T, Schmid A, Williams LS. Barriers and facilitators to exercise among stroke survivors. *Rehabil Nurs* 2007;32:253-260, 262.
39. Kayes NM, McPherson KM, Taylor D, Schluter PJ, Kolt GS. Facilitators and barriers to engagement in physical activity for people with multiple sclerosis: A qualitative investigation. *Disabil Rehabil* 2011;33:625-642.

Disclosure

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Disclosure: nothing to disclose

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Disclosures outside this publication: other (money to institution); reimbursement as Chief Medical Officer for the Swedish Paralympic Committee

Submitted for publication February 25, 2014; accepted March 25, 2015.
