Exercise self-efficacy is weakly related to engagement in physical activity in persons with long-standing spinal cord injury

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Abstract

Aims: Many people with a long-standing spinal cord injury have an inactive lifestyle. Although exercise self-efficacy is considered a key determinant of engaging in exercise, the relationship between exercise self-efficacy and physical activity remains unclear. Therefore, this study examines the relationship between exercise self-efficacy and the amount of physical activity in persons with long-standing spinal cord injury.

Methods: This cross-sectional study included 268 individuals (aged 28-65 years) with spinal cord injury ≥ 10 years and using a wheelchair. Physical activity was measured with the Physical Activity Scale for Individuals with Physical Disabilities. Exercise self-efficacy was assessed with the Spinal cord injury Exercise Self-Efficacy Scale. Univariate and multivariable regression analyses were performed to test for the association between exercise self-efficacy and physical activity, controlling for supposed confounders.

Results: Univariate regression analysis revealed that exercise self-efficacy was significantly related to the level of daily physical activity ($\beta=0.05$; 95% CI 0.04-0.07; 15% explained variance; $p<0.001$). In multivariable regression analysis exercise self-efficacy remained, explaining a significant additional amount of the variance (2%; $p<0.001$) of physical activity.

Conclusion: Exercise-self efficacy is a weak but independent explanatory factor of the level of physical activity among persons with long-standing spinal cord injury. Longitudinal trials are needed to study the impact of interventions targeting an increase of exercise self-efficacy on the amount of physical activity performed.

Introduction

Improvements in medical care have increased the life expectancy of people with a spinal cord injury. [1] Therefore, because the number of people aging with a spinal cord injury is increasing, it is important to maintain a stable health status and functioning in this group. [2] This presents new challenges for those aging with spinal cord injury and their healthcare professionals. [2]

Physical activity is considered to be an important determinant of health, both in the general population and in people with a long-standing spinal cord injury. [3, 4] Physical activity has different components, including involvement in participation in daily exercise (including sports), leisure activities, and other physical activities (for example housekeeping, work, and travelling). Higher physical activity levels in people with spinal cord injury are associated with the prevention or reduction of secondary health conditions, physiological and psychological benefits, and higher quality of life.[5-8] However, even compared to other populations with chronic disabilities, physical activity levels in people with spinal cord injury are very low. [9] Therefore, optimizing the amount of physical activity is of great importance to improve the health and quality of life in people with spinal cord injury.

To optimize levels of physical activity, it is necessary to focus on the key factors that support a behavioural change towards a more active lifestyle. In most behavioural change models self-efficacy is such a key factor. [10] Self-efficacy has been defined as 'one's belief in one's own ability to complete tasks and to reach goals',[11] and can be considered as a general personality factor or as a task-specific factor. In the first case, self-efficacy can be regarded as a stable personal characteristic that is difficult to change.[12] When self-efficacy is seen as a task-specific factor, for example in terms of exercise self-efficacy,[10] it appears to be an easier target for interventions to support behavioural changes favouring higher amounts of physical activity. [3, 10]

Although not completely in line with the given definition of physical activity, with exercise as one of its components, exercise self-efficacy has also been defined as: "The confidence of individuals to plan and carry out physical activities and/or exercise based on their own volition".[13] Exercise self-efficacy is significantly correlated with the amount of physical activity in the general population,[3] and in people with spinal cord injury.[14, 15] However, the spinal cord injury studies did not specifically aim at people with long-standing spinal cord injury. We do not know whether the relationship between exercise self-efficacy and physical activity is the same for people with a long-standing spinal cord injury.

Furthermore, people with a long-standing spinal cord injury are more at risk of an inactive lifestyle and developing more SHCs.[16] To counteract this SHCs it is probably helpful if people with a long-standing spinal cord injury become more physically active.[15,17] There has been much attention focused on increasing physical activity in people with recent spinal cord injury compared with people who have a long-standing spinal cord injury.[2]

Furthermore, those studies focused on specific components of physical activity, such as exercise, sports activities and/or leisure physical activities; other daily physical activities for example transportation to a work or supermarket by a wheelchair or doing chores around the house, were disregarded. [14, 15] Because the contribution of these activities to the total amount of physical activity is substantial, it is relevant to examine the relation of exercise self-efficacy and physical activity in a broader perspective. Therefore, the present study examines the relation between exercise self-efficacy and the overall level of physical activity in persons with a long-standing spinal cord injury. We hypothesize that there is a significant relation between exercise self-efficacy and overall physical activity in people with a long-standing spinal cord injury, even when controlled for possible confounders.

Materials and Methods

Study design

For the purpose of the current study cross-sectional data from a large Dutch cohort study (ALLRISC)[2] was used. In the ALLRISC study, participants were recruited from eight rehabilitation centres in the Netherlands with a specialized SCI unit.[16] The aim was to include 30-35 persons per centre. Based on an expected response rate of 50%, 62 persons per centre were invited by means of a random sample drawn at each centre.

The study protocol was approved by the Medical Ethics committee of the University Medical Centre Utrecht, and by all participating centres.

Participants

Persons with SCI were eligible for inclusion if they met the following criteria: having sustained their SCI at least 10 years before the study and aged 18-35 years at that moment; current age 28-65 years long-standing; using a wheelchair for their daily mobility (at least for distances ≥ 500 m); and being able to propel a hand-rim wheelchair. This age range was chosen to include individuals with long-standing SCI while minimizing the effects of aging in general. Participants were excluded from the study if they had a progressive disease or severe co-morbidities, psychiatric problems that could affect the procedures, or if they had insufficient knowledge of the Dutch language to understand the purpose of the study and the evaluation methods.

Recruitment and consent

The physician of the rehabilitation centre's Spinal cord injury department pre-selected former inpatients using information from medical records. Individuals who met the inclusion criteria received the patient information letter. Two weeks later they were contacted by telephone by a research assistant to check.

Procedure

Participants were invited for a one-day visit to the rehabilitation center for an after-care check-up by the local spinal cord injury rehabilitation physician, and tests were performed by a trained research assistant. Before this visit participants were asked to complete a self-report questionnaire.

Included participants

For the purpose of this study participants were included if they completed the questionnaire, the aftercare check-up and got the Spinal Cord Independence Measure III administered at the rehabilitation centre.

Measurements

The main variables of interest were self-reported daily physical activities and exercise self-efficacy. Both were part of the self-report questionnaire.

Self-reported level of physical activities was assessed by the Physical Activity Scale for Individuals with Physical Disabilities (PASIPD). Internal consistency of the PASIPD is reported to be 0.83 to 0.95, and test-retest reliability 0.45 to 0.82.[19] The Dutch version of the PASIPD consists of 11 items covering all components of physical activity, such as sports, hobbies, and household and work-related activities. The questionnaire assesses the number of days per week and the hours per day a certain activity was performed during the past 7 days. The total score of the PASIPD is computed by multiplying the average hours per day for each item by a metabolic equivalent value (MET) associated with the intensity of the activity, MET*hour/week;[20] the total PASIPD score ranges from 0 to 182.3.

The Spinal Cord Independence Measure III exercise self-efficacy scale[13] measures self-reported self-efficacy and includes 10 items with a 4-point response scale ranging from (1): not at all true to (4): exactly true. An example of an item is: "I am confident that I can overcome barriers and challenges with regard to physical activity and exercise if I try hard enough". The total score ranges from 10 to 40. The internal consistency and test-retest reliability was 0.93 and 0.81, respectively.[21]

In the analyses, several confounders were taken into account. From the demographic variables, age and gender were selected. Level of functional independence was included as confounder by using the Spinal Cord Independence Measure III,[22, 23] a functional status measure developed for people with spinal cord injury. Spinal cord injury measure III includes the following areas of daily function: self-care [sub score (0-20), respiration and sphincter management (0-40) and mobility (0-40)]. The total score ranges from 0 to 100; the higher the score, the higher the level of functional independence. This variable was included in the analysis, since people who function more independently in their daily life have more possibilities to be physically active.[24]

Because lesion characteristics are related to the level of physical activity,[20] we evaluated time since injury, age of onset, and the type of spinal cord injury according to the ASIA impairment scale (AIS),[25] based on a neurological examination. Additionally, type of spinal cord injury was assessed as tetraplegia (a lesion at or above the Th1 segment) or paraplegia (a lesion below Th1).

Also, as secondary health conditions are associated with lower levels of physical activity [26] they were assessed during a consultation with the physician; in this meeting, the presence and severity of the problems were assessed.[18] For the analyses we summed the presence of the most common of spinal cord injury -specific secondary health conditions,[27, 28] including; cardiovascular diseases, pulmonary diseases, urinary disorders, perianal disorders, decubitus, problematic spasms, autonomous dysreflexia, hypotension, thrombosis, edema, neurogenic heterotopic ossification, fractures, respiratory problems and pain (musculoskeletal and neuropathic pain). The secondary health conditions score ranges from 0 to 19.

Data-analyses

Log-transformation of the physical activity score was necessary to obtain a normal distribution of the residuals. Descriptive statistics of the demographic variables, lesion characteristics and the main outcomes were performed. The association between exercise self-efficacy and physical activity was first examined by univariate (simple) regression analysis, followed by nested multivariable regression analysis to investigate possible confounding (age, gender, independent functioning, lesion characteristics, secondary health conditions). In the multivariable analyses, multi-collinearity was deemed present if any two independent variables were highly correlated with each other ($R > 0.8$). When multi-collinearity was present between two variables, the one that showed the weakest association with physical activity was excluded from the model. Two nested regression models, one excluding and one including exercise self-efficacy in the predictors set, were compared by means of the Fisher-test, to determine whether the addition of exercise self-efficacy significantly improved the goodness of fit of the model. Alpha was set at 0.05.

We have performed sub analyses where we divided the PASIPD outcomes in two subcategories performing sports activities (yes/no) and daily activities not sports related (METS) and we have performed the same analyses as our main association in this article.

Results

The ALLRISC long-standing follow-up study included 282 participants; of these, 268 completed both the self-reported questionnaire and the aftercare check-up at the rehabilitation centre and were selected for the current final analysis. Table 1 presents the characteristics of the study population.

The mean and median PASIPD score for physical activity were 19.4 METs-h/d (SD 20.6) and 12.7 METs-h/d [IQR 5.7-26.3], respectively. Figure 1 shows how the different components of physical activity contribute to the total physical activity score.

Table 1 Characteristics of the study population (n=268)

Variable	n	%	Mean (SD)
Male	197	73	
Age in years: mean (SD)			47.7 (8.8)
Highest level completed education			
- Prevocational practical education or less	28	10.5	
- Prevocational theoretical education and secondary education	72	26.8	
- Higher vocational education and university	137	51.4	
- Missing	31	11.3	
Paid work	105	39.2	
Retired	6	2.2	
Married or permanent partner	163	60.9	
Time since injury in years, mean (SD)			24.0 (9.1)
Age at onset of SCI in years: mean (SD)			23.9 (4.7)
Motor complete SCI	221	82.8	
Paraplegia	159	59.3	
Daily physical activity (MET, range 0-183)			19.4 (20.6) 12.7 [5.7 - 26.3] *
Exercise self-efficacy (range 10-40)			31.4 (7.8)
Functional independence (range 0-100)			56.4 (18.5)
Health problems (range 0-19)			5.3 (2.8)

*Median [IQR]

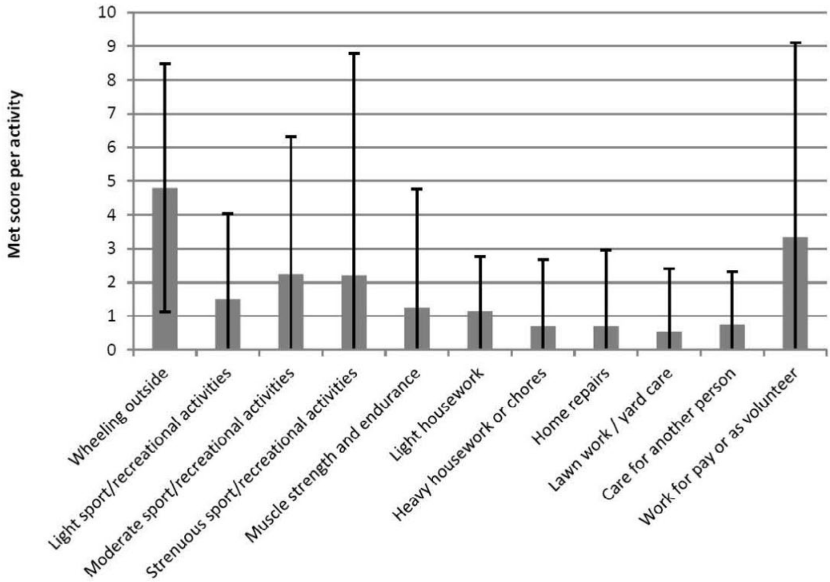

Figure 1 Median (IQR) PASIPD score per activity measured by the PASIPD.

Association between exercise self-efficacy and physical activity

Figure 2 shows the relation between exercise self-efficacy and log-transformed level of physical activity. Univariate regression analysis modelling the log-transformed physical activity upon exercise self-efficacy showed a significant positive association (LOG β= 0.05, 95% CI 0.04-0.07) explaining 15% of the total variation in log-transformed level of physical activity.

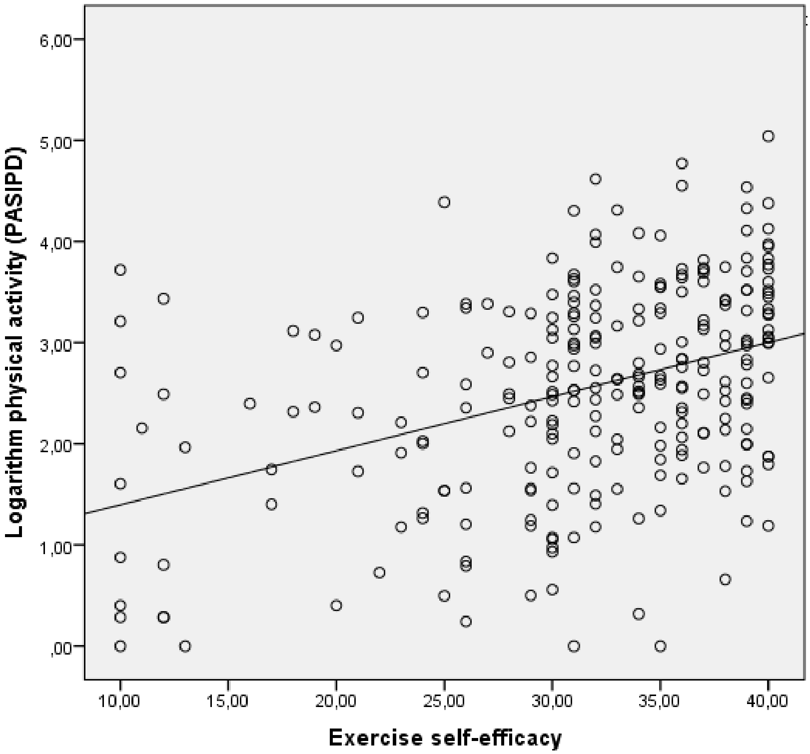

Figure 2 Relation between exercise self-efficacy and the logarithm physical activity

Table 2 Regression analyses overall physical activity

Univariate regression analyses						
	Unstandardized Coefficients		**Standardized Coefficients**		**95% CI**	
Model	LOG β	SE	Beta	Sig.	Lower bound	Upper bound
(Constant)	0.90	0.30		0.00	0.40	1.40
Exercise self-efficacy	0.05	0.01	0.40	0.00	0.04	0.07

Multivariate regression analyses						
	Unstandardized Coefficients		**Standardized Coefficients**		**95% Confidence interval**	
Model	LOG β	SE	Beta	Sig.	Lower bound	Upper bound
(Constant)	1.82	0.48		0.00	0.88	2.76
Exercise self-efficacy	0.02	0.01	0.17	0.01	0.01	0.04
Gender	-0.16	0.12	-0.07	0.20	-0.40	0.08
Functional independence	0.02	0.00	0.41	0.00	0.02	0.03
Health problems	0.00	0.02	0.01	0.83	-0.04	0.04
Time since injury	-0.02	0.01	-0.16	0.00	-0.03	-0.01
Lesion level	-0.14	0.13	-0.07	0.25	-0.39	0.10
Completeness SCI	-0.40	0.15	-0.15	0.01	-0.69	-0.11

Dependent variable: Logarithm of Physical Activity (PASIPD)

Sub analyses with the PASIPD outcomes in two subcategories performing sports activities (yes/no) and daily activities not sports related

We found a significant association between self-efficacy and performing sports activities (LOG β= 0.04, 95% CI 0.03-0.06), and we have found that there is still a significant association between self-efficacy and daily activities which are not sports related (LOG β= 0.01, 95% CI 0.02-0.05).

Discussion

In this group of individuals living with a spinal cord injury for (on average) 24 years, the present study shows an independent significant relationship between exercise self-efficacy and the overall amount of physical activity. Although we cannot draw causal conclusions, these data might indicate that enhancing exercise self-efficacy is a way to enhance physical activity, even in people living with of spinal cord injury for many years.

The present findings are in accordance with other studies reporting that exercise self-efficacy is significantly related to physical activity.[14, 15] Nevertheless, we examined this association in more detail. First, the regression coefficient of the relation between exercise self-efficacy and physical activity seems low (LOG β=0.02, β=1.02) compared to the scale and range of the Physical Activity Scale for Individuals with Physical Disabilities.

However, this regression coefficient should be considered in relation to the mean and median Physical Activity Scale for Individuals with Physical Disabilities score we found (19.4 and 12.7, respectively), and the range of the exercise self-efficacy scale (Range: 30; Min/max: 10/40). Therefore, a gain on the Physical Activity Scale for Individuals with Physical Disabilities score of 1.02 is expected when exercise self-efficacy improves by one step. In addition, a maximum gain of 30.60 on the Physical Activity Scale for Individuals with Physical Disabilities score can be achieved by focusing on exercise self-efficacy alone. Furthermore, we found that exercise self-efficacy alone explains 15% of the variance of physical activity. Although this percentage seems low, bearing in mind that the level of physical activity is influenced by many factors[3] a high percentage of explained variance cannot be expected. The total amount of explained variance of the total physical activity score was 34%; in comparison, Ginis et al.[29] reported a total explained variance of only 19-25% of the total variance of leisure time physical activity in a population of people of spinal cord injury. Another explanation could be that the authors included different determinants, with the type of self-efficacy probably being the most important. Ginis et al.[29] included barrier self-efficacy, instead of exercise self-efficacy as applied in our study. Because exercise self-efficacy is theoretically more directly related to physical activity than barrier self-efficacy, a higher explained variance seems logical. Furthermore, Ginis et al.[29] only examined leisure time physical activity, whereas we included all components of physical activity.

In the present study, the total explained variance of 34% suggests that other factors might also be important in explaining physical activity levels. Behavioural change models suggest that potentially modifiable factors such as motivation, social support and attitude, are also determinants of behavioural change.[30, 31] Although we did not measure these factors, we feel that behavioural change models can support the development of interventions targeted at behavioural change towards a more physically active lifestyle.[32]

In our study sample, activity levels (mean 19.4; SD 20.6) were similar to the means of 17.8 (SD 18.6) and 19.8 (SD 19.0) found in an earlier Dutch study in people with spinal cord injury at 1 and 5 years post discharge from initial inpatient rehabilitation.[15, 20] In the Canadian study of Ginis et al. [15] an average of 27.14 (SD 49.36) min of leisure time physical activity per day was found in a sample of persons with spinal cord injury with a mean time since injury of 13.5 years (SD 10.0). They also reported that 50% of their population spent no time on leisure time physical activity. To compare our data with those of Ginis et al., we converted our MET scores of the leisure time physical activity component of the Physical Activity Scale for Individuals with Physical Disabilities. We then found that our study population spends 26.8 (SD 4.5) min per day on these activities, which is similar to the results of Ginis et al.

In the present study, given the long time since injury it is remarkable that the activity levels are not lower than those reported by others with a shorter time since injury. With a longer time since injury, a decline of activity levels is expected. [9] This expectation is supported by the significant association we found between time since injury (P=0.00) and levels of physical activity, as well as by the strong correlation (R>0.80) found between time since injury and current age. Furthermore, other studies in people with an spinal cord injury in Sweden and Canada, showed that Age was significantly, negatively associated with total leisure time physical activity. [17, 33]

In contrast to other studies on the association between self-efficacy and physical activity, we chose an outcome measure of physical activity that includes all aspects of physical activity. Earlier studies on people with chronic diseases [34] and with early-onset spinal cord injury [35] have shown that exercise self-efficacy is related to exercise and sport engagement. The current study adds to previous evidence that exercise self-efficacy is also related to physical activity that is more broadly defined, i.e. that also includes other components of physical activity (Figure 1). For instance, our sub analyses showed that that there is still a significant association between self-efficacy and daily activities which are not sports related.

This approach broadens the target of interventions to enhance physical activity, since it proves easier to increase physical activities in daily life rather than getting individuals involved in exercise or sport programs. For example, a relatively easy way to increase physical activity is to use a self-propelled wheelchair or handbike to go to work or for shopping, rather than using a car.

Another reason to focus not only on exercise and sports is the increasing evidence for the importance of avoiding sedentary behaviour, since it is an independent risk factor for health problems. A person can meet the norms for an active lifestyle, for instance by achieved by sports and exercise, but can still be at risk for health problems due to prolonged periods of sitting with low levels of energy expenditure in daily life [36]. This emphasizes the need to include daily physical activities in both research and interventions.

Study limitations

The present cross-sectional study has some methodological limitations. First, we cannot draw valid conclusions on the causality of the associations studied. Longitudinal data would have provided important information on the course of physical activity and the influence of self-efficacy on that activity. Second, a self-reported questionnaire was used to measure physical activity even though self-reported measures are prone to bias, for example people often tend to overestimate their activity levels, and it is difficult for some individuals to recall physical activities.[37] Nevertheless, the Physical Activity Scale for Individuals with Physical Disabilities is the best self-reported questionnaire for which a validated Dutch version is available.[20] Instruments, like accelerometers, are an option to measure physical activity objectively. However, for both practical and financial reasons these types of instruments could not be used in the present study. Currently, more user-friendly and cost-effective instruments have been developed which make it easier to implement objective measures in rehabilitation research.[38]

Conclusions

This study indicates that exercise-self efficacy is an independent significant explanatory factor of the level of physical activity in people with a long-standing spinal cord injury. Longitudinal studies are required to explore the relationships and effects of exercise self-efficacy-oriented intervention programs on the amount of physical activity in persons with long-standing spinal cord injury.

References

1. Strauss, D.J., M.J. Devivo, D.R. Paculdo, and R.M. Shavelle, *Trends in life expectancy after spinal cord injury.* Arch Phys Med Rehabil, 2006. 87(8): p. 1079-85.
2. van der Woude, L.H., S. de Groot, K. Postema, J.B. Bussmann, T.W. Janssen, Allrisc, and M.W. Post, *Active LifestyLe Rehabilitation interventions in aging spinal cord injury (ALLRISC): a multicentre research program.* Disabil Rehabil, 2013. 35(13): p. 1097-103.
3. Trost, S.G., N. Owen, A.E. Bauman, J.F. Sallis, and W. Brown, *Correlates of adults' participation in physical activity: review and update.* Med Sci Sports Exerc, 2002. 34(12): p. 1996-2001.
4. Martin Ginis, K.A., S. Jorgensen, and J. Stapleton, *Exercise and sport for persons with spinal cord injury.* PM R, 2012. 4(11): p. 894-900.
5. Tasiemski, T., P. Kennedy, B.P. Gardner, and N. Taylor, *The association of sports and physical recreation with life satisfaction in a community sample of people with spinal cord injuries.* NeuroRehabilitation, 2005. 20(4): p. 253-65.
6. Buchholz, A.C., K.A. Martin Ginis, S.R. Bray, B.C. Craven, A.L. Hicks, K.C. Hayes, A.E. Latimer, M.A. McColl, P.J. Potter, and D.L. Wolfe, *Greater daily leisure time physical activity is associated with lower chronic disease risk in adults with spinal cord injury.* Appl Physiol Nutr Metab, 2009. 34(4): p. 640-7.
7. Hetz, S.P., A.E. Latimer, and K.A. Ginis, *Activities of daily living performed by individuals with SCI: relationships with physical fitness and leisure time physical activity.* Spinal Cord, 2009. 47(7): p. 550-4.
8. Tawashy, A.E., J.J. Eng, K.H. Lin, P.F. Tang, and C. Hung, *Physical activity is related to lower levels of pain, fatigue and depression in individuals with spinal-cord injury: a correlational study.* Spinal Cord, 2009. 47(4): p. 301-6.
9. van den Berg-Emons, R.J., J.B. Bussmann, J.A. Haisma, T.A. Sluis, L.H. van der Woude, M.P. Bergen, and H.J. Stam, *A prospective study on physical activity levels after spinal cord injury during inpatient rehabilitation and the year after discharge.* Arch Phys Med Rehabil, 2008. 89(11): p. 2094-101.
10. Ashford, S., J. Edmunds, and D.P. French, *What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis.* Br J Health Psychol, 2010. 15(Pt 2): p. 265-88.
11. Bandura, A., *Self-efficacy: toward a unifying theory of behavioral change.* Psychol Rev, 1977. 84(2): p. 191-215.
12. Erez, A. and T.A. Judge, *Relationship of core self-evaluations to goal setting, motivation, and performance.* J Appl Psychol, 2001. 86(6): p. 1270-9.
13. Kroll, T., M. Kehn, P.S. Ho, and S. Groah, *The SCI Exercise Self-Efficacy Scale (ESES): development and psychometric properties.* Int J Behav Nutr Phys Act, 2007. 4: p. 34.
14. Kroll, T., A. Kratz, M. Kehn, M.P. Jensen, S. Groah, I.H. Ljungberg, I.R. Molton, and C. Bombardier, *Perceived exercise self-efficacy as a predictor of exercise behavior in individuals aging with spinal cord injury.* Am J Phys Med Rehabil, 2012. 91(8): p. 640-51.
15. Ginis, K.A., A.E. Latimer, K.P. Arbour-Nicitopoulos, A.C. Buchholz, S.R. Bray, B.C. Craven, K.C. Hayes, A.L. Hicks, M.A. McColl, P.J. Potter, K. Smith, and D.L. Wolfe, *Leisure time physical activity in a population-based sample of people with spinal cord injury part I: demographic and injury-related correlates.* Arch Phys Med Rehabil, 2010. 91(5): p. 722-8.
16. Nooijen, C.F., H.J. Stam, M.P. Bergen, H.M. Bongers-Janssen, L. Valent, S. van Langeveld, J. Twisk, G. Act-Active Research, and R.J. van den Berg-Emons, *A behavioural intervention increases physical*

activity in people with subacute spinal cord injury: a randomised trial. J Physiother, 2016. 62(1): p. 35-41.

17. Jorgensen, S., K.A. Martin Ginis, and J. Lexell, *Leisure time physical activity among older adults with long-term spinal cord injury.* Spinal Cord, 2017. 55(9): p. 848-856.
18. Adriaansen, J.J., F.W. van Asbeck, E. Lindeman, L.H. van der Woude, S. de Groot, and M.W. Post, *Secondary health conditions in persons with a spinal cord injury for at least 10 years: design of a comprehensive long-term cross-sectional study.* Disabil Rehabil, 2013. 35(13): p. 1104-10.
19. Washburn, R.A., W. Zhu, E. McAuley, M. Frogley, and S.F. Figoni, *The physical activity scale for individuals with physical disabilities: development and evaluation.* Arch Phys Med Rehabil, 2002. 83(2): p. 193-200.
20. de Groot, S., L.H. van der Woude, A. Niezen, C.A. Smit, and M.W. Post, *Evaluation of the physical activity scale for individuals with physical disabilities in people with spinal cord injury.* Spinal Cord, 2010. 48(7): p. 542-7.
21. Nooijen, C.F., M.W. Post, D.C. Spijkerman, M.P. Bergen, H.J. Stam, and R.J. van den Berg-Emons, *Exercise self-efficacy in persons with spinal cord injury: psychometric properties of the Dutch translation of the Exercise Self-Efficacy Scale.* J Rehabil Med, 2013. 45(4): p. 347-50.
22. Catz, A., M. Itzkovich, E. Agranov, H. Ring, and A. Tamir, *The spinal cord independence measure (SCIM): sensitivity to functional changes in subgroups of spinal cord lesion patients.* Spinal Cord, 2001. 39(2): p. 97-100.
23. Itzkovich, M., I. Gelernter, F. Biering-Sorensen, C. Weeks, M.T. Laramee, B.C. Craven, M. Tonack, S.L. Hitzig, E. Glaser, G. Zeilig, S. Aito, G. Scivoletto, M. Mecci, R.J. Chadwick, W.S. El Masry, A. Osman, C.A. Glass, P. Silva, B.M. Soni, B.P. Gardner, G. Savic, E.M. Bergstrom, V. Bluvshtein, J. Ronen, and A. Catz, *The Spinal Cord Independence Measure (SCIM) version III: reliability and validity in a multi-center international study.* Disabil Rehabil, 2007. 29(24): p. 1926-33.
24. Kawanishi, C.Y. and M. Greguol, *Physical activity, quality of life, and functional autonomy of adults with spinal cord injuries.* Adapt Phys Activ Q, 2013. 30(4): p. 317-37.
25. Kirshblum, S.C., S.P. Burns, F. Biering-Sorensen, W. Donovan, D.E. Graves, A. Jha, M. Johansen, L. Jones, A. Krassioukov, M.J. Mulcahey, M. Schmidt-Read, and W. Waring, *International standards for neurological classification of spinal cord injury (revised 2011).* J Spinal Cord Med, 2011. 34(6): p. 535-46.
26. Fernhall, B., K. Heffernan, S.Y. Jae, and B. Hedrick, *Health implications of physical activity in individuals with spinal cord injury: a literature review.* J Health Hum Serv Adm, 2008. 30(4): p. 468-502.
27. Kalpakjian, C.Z., W.M. Scelza, M.B. Forchheimer, and L.L. Toussaint, *Preliminary reliability and validity of a Spinal Cord Injury Secondary Conditions Scale.* J Spinal Cord Med, 2007. 30(2): p. 131-9.
28. Rauch, A., C. Fekete, A. Cieza, S. Geyh, and T. Meyer, *Participation in physical activity in persons with spinal cord injury: a comprehensive perspective and insights into gender differences.* Disabil Health J, 2013. 6(3): p. 165-76.
29. Ginis, K.A., K.P. Arbour-Nicitopoulos, A.E. Latimer-Cheung, A.C. Buchholz, S.R. Bray, B.C. Craven, K.C. Hayes, M.A. McColl, P.J. Potter, K. Smith, D.L. Wolfe, R. Goy, and J. Horrocks, *Predictors of leisure time physical activity among people with spinal cord injury.* Ann Behav Med, 2012. 44(1): p. 104-18.
30. Kosma, M., B.J. Cardinal, and J.A. McCubbin, *Predictors of physical activity stage of change among adults with physical disabilities.* Am J Health Promot, 2004. 19(2): p. 114-7.