Spinal Cord (2011) 49, 560–565

www.nature.com/sc

ORIGINAL ARTICLE

Is manual wheelchair satisfaction related to active lifestyle and participation in people with a spinal cord injury?

S de Groot[1,2], MWM Post[3], HMH Bongers-Janssen[4], JH Bloemen-Vrencken[4] and LHV van der Woude[2,5]

[1]Duyvensz-Nagel Research Laboratory, Rehabilitation Center Amsterdam, Amsterdam, The Netherlands; [2]Centre for Human Movement Sciences, University Medical Centre Groningen, University of Groningen, Groningen, The Netherlands; [3]Centre of Excellence in Rehabilitation Medicine, Rehabilitation Center De Hoogstraat and Rudolf Magnus Institute for Neuroscience, University Medical Center, Utrecht, The Netherlands; [4]Spinal Cord Department, Adelante Rehabilitation Centre, Hoensbroek, The Netherlands and [5]Center for Rehabilitation, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands

Study design: Cross-sectional study.
Objectives: To describe the satisfaction of the manual wheelchair user with hand rim wheelchair-related aspects (for example, dimensions, weight and comfort) and wheelchair service-related aspects and to determine the relationship between wheelchair users' satisfaction, personal and lesion characteristics, and active lifestyle and participation in persons with a spinal cord injury (SCI).
Setting: Eight Dutch rehabilitation centers with a specialized SCI unit.
Methods: The Dutch version of the Quebec user evaluation of satisfaction with assistive technology (D-QUEST) was filled out by 109 participants 1 year after discharge from inpatient SCI rehabilitation. Relationships between the D-QUEST scores and personal and lesion characteristics, and active lifestyle and participation (physical activity scale for individuals with physical disabilities (PASIPD), Utrecht activity list (UAL), mobility range and social behavior subscales of the SIP68 (SIPSOC)) were determined.
Results: A high level of satisfaction was found with wheelchair-related aspects. The participants were less satisfied with the service-related aspects. Participants with an incomplete lesion were slightly more satisfied regarding both aspects than those with a complete lesion. A higher satisfaction regarding wheelchair dimensions and a higher overall satisfaction were related to a more active lifestyle. Persons who were more satisfied with the simplicity of use of the wheelchair had a better participation score.
Conclusion: Dutch persons with SCI are in general quite satisfied with their hand rim wheelchair. Some aspects of the wheelchair (dimensions and simplicity of use) are important to optimize as these are related to an active lifestyle and participation.
Spinal Cord (2011) **49,** 560–565; doi:10.1038/sc.2010.150; published online 2 November 2010

Keywords: spinal cord injuries; wheelchair; participation; active lifestyle

Introduction

A spinal cord injury (SCI) is a rare but serious condition that results in loss of motor, sensory and autonomic function below the lesion level.[1] The incidence of SCI in the Netherlands is estimated to be around 200–250 patients per year.[2] As a consequence of the motor dysfunction, the majority of people with SCI (80%) need a manual wheelchair for their mobility.[3] It is important that persons with SCI maintain an active lifestyle as it appears to be associated with several health benefits.[4] Furthermore, participation is deemed important as it is the main goal of rehabilitation.[5] Users of manual wheelchairs considered the wheelchair to have a positive influence on their possibility to work and to have an active leisure life.[6] An important aspect in assessing the quality of the wheelchair is the satisfaction of the wheelchair user. Only two studies[7,8] have focused on the wheelchair user satisfaction of people with an SCI. However, they did not look at differences in satisfaction between groups with different personal or lesion characteristics[7,8] or the effect of user satisfaction on active lifestyle and participation.[7] Therefore, the purpose of the present study is (1) to describe the satisfaction of the manual wheelchair user with wheelchair-related aspects and wheelchair service-related aspects and (2) to determine the relationship between manual wheelchair users' satisfaction, personal and lesion characteristics, and active lifestyle and participation in persons with SCI. The hypothesis is that those who are more satisfied with their wheelchair will have a more active lifestyle and show more participation in the society.

Correspondence: Dr S de Groot, DNO, Revalidatiecentrum Amsterdam, PO Box 58271, Amsterdam 1040 HG, The Netherlands.
E-mail: s.d.groot@rcamsterdam.nl
Received 29 June 2010; revised 31 August 2010; accepted 24 September 2010; published online 2 November 2010

Methods

Participants

The current cross-sectional study was part of the Dutch prospective cohort study 'Physical strain, work capacity and mechanisms of restoration of mobility in the rehabilitation of persons with SCI'.[2] Participants from eight rehabilitation centers that are specialized in SCI rehabilitation in the Netherlands were included. They were eligible to enter the project if they had an acute SCI, were between 18 and 65 years of age, were classified as A, B, C, or D on the American spinal injury association impairment scale, were (partly) wheelchair dependent, did not have a progressive disease (for example, tumor) or psychiatric problem that interferes with constructive study participation according to the physician and had sufficient understanding of the Dutch language to understand the purpose of the study and the testing methods.

All tests and protocols were approved by the Medical Ethics Committee of the rehabilitation center Hoensbroek. After they were given information about the testing procedure, all participants completed an informed consent form. Participants using a manual wheelchair at least 1 day per week were included in the data analysis.

Design

Data for the current study were collected 1 year after discharge from inpatient rehabilitation by trained research assistants with a paramedical background using standardized procedures.

Personal and lesion characteristics

Participant information regarding age, gender, level and completeness of the lesion was collected. Time since injury was determined as the time between the occurrence of SCI and the measurement date on which the questionnaires were filled out.

Dutch version of the Quebec user evaluation of satisfaction with assistive technology

D-QUEST consists of a written questionnaire[9] and proved to be a reliable and valid instrument.[9] The respondent is asked to rate his or her satisfaction with the manual wheelchair with respect to 13 different aspects using a five-point scale. The scale ranges from 1 (not satisfied at all) to 5 (very satisfied). Also the answer 'not applicable or I do not know' could be given (score = 6). In all, 8 of the 13 questions relate to the wheelchair (dimensions, weight, adjustments, safety, durability, simplicity of use, comfort and effectiveness) and four questions relate to the service provision process of the wheelchair (service delivery, repairs and servicing, professional services and follow-up services). The 13th question relates to the general satisfaction of the user regarding the wheelchair. An average score was calculated for the answers of the eight questions related to the wheelchair and for the answers of the four questions related to the service provided. The answer 'not applicable or I do not know' was not taken into account. Thereafter, a total score was calculated for both subscales by multiplying the average score by the number of questions belonging to that dimension. The total score related to the wheelchair ranged from 8 to 40 and for the service, between 4 and 20.

Active lifestyle and participation

Information on level of physical activity (leisure, household and occupational activity) was collected using the PASIPD.[10] The PASIPD consists of 13 questions. The first item was included only to familiarize respondents with the item format and was not scored. Two of these questions, question 10 on lawn work or yard care, and question 11 on outdoor gardening were merged into a single question, as this better represented the Dutch situation. Respondents were asked to recall the number of days in the past 7 days that they participated in these activities as never, seldom (1–2d wk^{-1}), sometimes (3–4d wk^{-1}), or often (5–7d wk^{-1}) and on average how many hours a day they participated (<1 h, 1 but <2 h, 2–4 h and >4 h). The score for the PASIPD was created by multiplying the average hours per day for each item by a metabolic equivalent (in h per day) associated with the intensity of the activity and summing over all items. The maximum score is 182.3 metabolic equivalent h per day after combining question 10 and 11. The Utrecht activity list (UAL)[11] was used to assess the time spent on eight vocational and leisure activities such as work, study, voluntary work, hobbies and sports activities, in hours per week. This questionnaire is a Dutch adaptation of the Craig handicap assessment and reporting technique.[12] The sum of the hours spent on these activities was calculated. The sickness impact profile contains 68 items (SIP68), all of which are statements regarding behavior. Respondents are asked to check the items that apply to their situation on the day they fill out the list and the items related to their health status. The sum of the subscales mobility range and social behavior of the SIP68 make up the social dimension of functional status (SIPSOC) and was used to assess perceived limitations in participation.[13]

Statistics

The D-QUEST questions and the average and total scores of the subscales related to the wheelchair and the service were described descriptively.

Differences between groups (complete/incomplete, tetraplegia/paraplegia, old/young, men/women, high/low PASIPD, high/low UAL and high/low SIPSOC) regarding the average and total scores on the subscales were analyzed with an independent *t*-test. The population was divided in groups regarding age, PASIPD, UAL and SIPSOC by using the median of these scores.

The effects of the wheelchair user satisfaction on the activity level and participation were analyzed by linear regression. The activity or participation score was the dependent variable; the total score of the subscale related to the wheelchair was the independent variable. The relationship between wheelchair user satisfaction and activity or participation was checked for the possible confounding effect of lesion level and completeness, age and gender. Furthermore, all eight D-QUEST questions of the subscale

related to the wheelchair were used as independent variables in a backward regression analysis. Level of significance was set at $P<0.05$.

Results

Descriptives

Table 1 presents the characteristics of the 109 participants with SCI who used a manual wheelchair at least 1 day per week. The participants were in general more satisfied with the wheelchair-related aspects (mean score 4.1) compared with the service-related aspects (mean score 3.4). Figure 1 shows the answers on each D-QUEST question. The majority (>80%) of the participants was quite to very satisfied regarding the wheelchair-related aspects simplicity of use, effectiveness, adjustments, safety and dimensions. More than half of the participants (62–73%) were quite to very satisfied with the durability, comfort and weight of their wheelchair. The service-related aspects were scored lower. Less than half of the group was quite to very satisfied regarding the service delivery, whereas around 60% was quite to very satisfied regarding the aspects repairs/servicing, professional services and follow-up services. The overall general satisfaction was good, 82% of the participants indicated that they were quite to very satisfied. The mean score on each question is presented in Figure 2 and results are compared with Bergström and Samuelsson.[7]

Differences between groups

No differences regarding the subscale scores of the D-QUEST were found between age groups, gender, lesion level and those with a high or low UAL score. Participants with an incomplete lesion were slightly more satisfied than participants with a complete lesion regarding the wheelchair-related aspects (mean score: 4.3 (0.6) versus 4.0 (0.6), $P=0.02$) and service-related aspects (mean score: 3.7 (1.1) versus 3.3 (1.0), $P=0.05$). Furthermore, active participants were more satisfied with the service-related aspects compared with less active participants (mean score: 3.6 (0.8) versus 3.2 (1.2), $P=0.03$). Persons with a lower SIPSOC score, that is, better participation, showed more satisfaction regarding service-related aspects compared with those with a higher SIPSOC score (mean score: 4.4 (0.5) versus 4.0 (0.6), $P<0.001$).

Table 1 Characteristics of the study population and mean score of the D-QUEST subscales and active lifestyle and participation parameters $N=109$

Personal and lesion characteristics	
Mean age in years (s.d.)	40.4 (14.2)
Male (%)	73%
Tetraplegia (%)	27%
Complete lesion (%)	72%
Mean time since injury in days (s.d.)	708 (162)
D-QUEST subscales	
Mean score wheelchair-related aspects (s.d.)	4.1 (0.6)
Mean score service-related aspects (s.d.)	3.4 (1.0)
Mean total score wheelchair-related aspects (s.d.)	32.9 (4.9)
Mean total score service-related aspects (s.d.)	13.5 (4.0)
Active lifestyle and participation	
Mean UAL in hours (s.d.)	46.4 (23.3)
Mean PASIPD score in METs (s.d.)	18.6 (18.2)
Mean SIPSOC score (s.d.)	6.4 (4.4)

Abbreviations: D-QUEST, Dutch version of the Quebec user evaluation of satisfaction with assistive technology; MET, metabolic equivalent; PASIPD, physical activity scale for individuals with a physical disability; SIPSOC, subscales mobility range and social behavior of the SIP68; UAL, Utrecht activity list.

Relationship user satisfaction and activity/participation

No relationship was found between the wheelchair-related aspects total satisfaction score and the activity and participation scores (Table 2).

When looking at the separate questions, the satisfaction regarding the dimensions of the wheelchair was related to the PASIPD score ($P=0.04$) as well as the general (overall) satisfaction score ($P=0.007$). Participants who were more satisfied with the wheelchair dimensions or overall had a more active lifestyle. None of the wheelchair-related questions were associated to the UAL score. The aspects, simplicity of use ($P=0.02$), durability ($P=0.05$) and comfort, ($P=0.03$) related to the SIPSOC score. Participants who were more satisfied with these items showed a better participation score.

Discussion

The relatively high level of satisfaction with manual wheelchair properties was comparable to a Swedish study among people with SCI (Figure 2).[7] Both studies showed that the participants with SCI are most satisfied with the wheelchair-related aspects, such as simplicity of use, effectiveness, safety and dimensions whereas comfort showed the lowest score but still scores a 3.6–3.8, that is, close to the score 'quite satisfied'. It is difficult to optimize all aspects, as for example, simplicity of use in terms of propulsion will not always match with sitting comfort[7] although these aspects were identified as most important to wheelchair users with SCI.[7] Ideally, the assessment for a wheelchair should be made by a team consisting of the user, the therapist and the technician who together decide what the most optimal wheelchair is, when taking all the aspects into account.[14]

In the Netherlands and in Sweden, almost everyone has access to wheelchairs regardless of income. In China, the satisfaction regarding the wheelchair-related and service-related aspects were lower, respectively 3.5 and 2.9.[8] Unfortunately, Chan and Chan[8] did not report the score per item so these cannot be compared with the Dutch and Swedish study. The satisfaction regarding the service-related aspects is, in the Dutch, Swedish and Chinese study, lower than the wheelchair-related aspects. However, in the Netherlands and Sweden the score is still above average (3.4 and 3.8 respectively). Previous Dutch studies[3,15] showed that the satisfaction with service delivery procedures was very low, although most respondents got what they wanted in the end. Most dissatisfaction was caused by the slowness of the

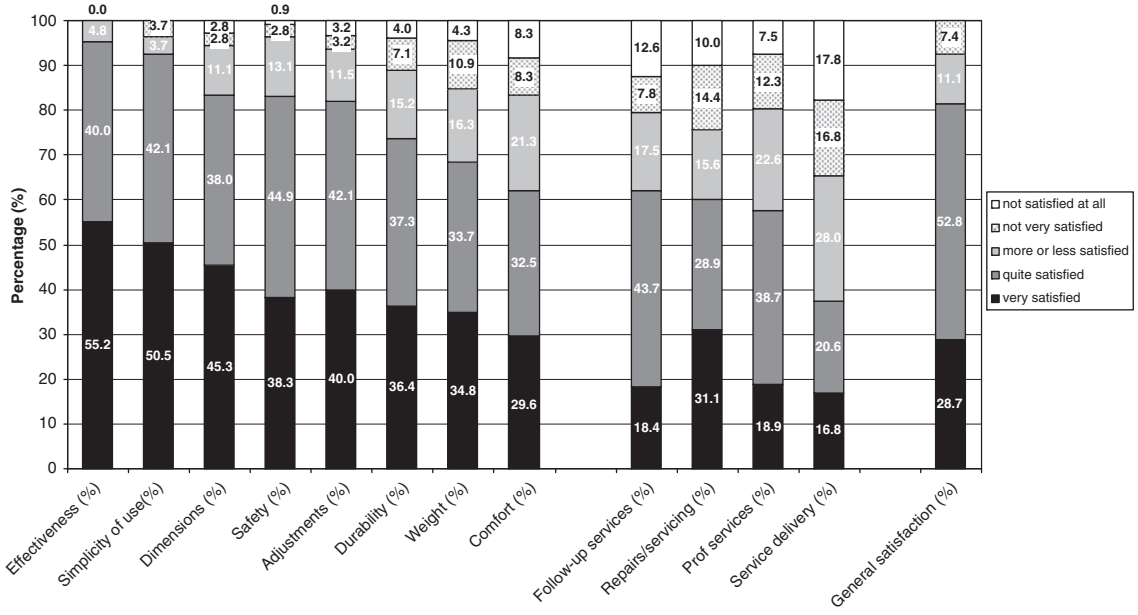

Figure 1 Percentages of answers given to the items of the D-QUEST.

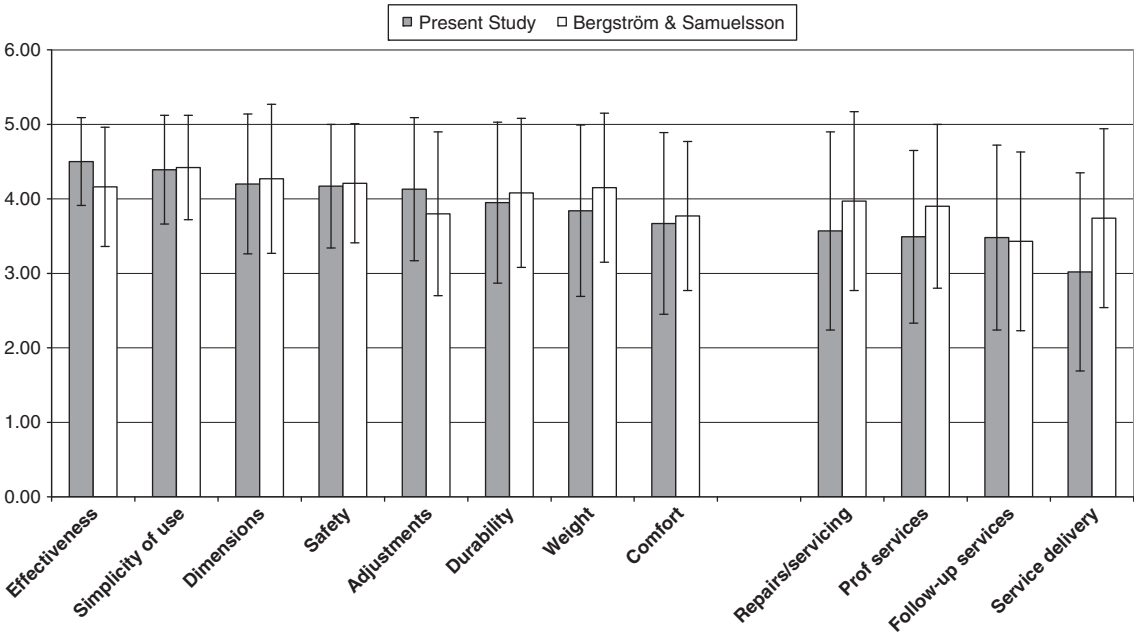

Figure 2 Average score and s.d. per item of the QUEST for the present study (gray bars) and the study of Bergström & Samuelsson[7] (white bars).

procedures owing to the number of organizations and officials involved in the whole procedure.[3,15]

Participants with a complete SCI were less satisfied with both the wheelchair-related aspects and service-related aspects compared with persons with an incomplete SCI. This latter result was also found by Post *et al*.[3] who studied service delivery procedures. Persons with a complete SCI might be more dependent on a wheelchair and, therefore, make higher demands compared with persons with an incomplete lesion.

The two subscales of the D-QUEST did not relate to the active lifestyle or participation score. However, a higher general satisfaction with the wheelchair and, more specific, with the wheelchair dimensions was related to a more active lifestyle, expressed by the PASIPD score. The importance of a good fit of the wheelchair to the user has been previously described in the wheelchair ergonomics literature. For example, seat height has an effect on the physical strain of wheelchair users with SCI.[16]

Table 2 Relationship between wheelchair user satisfaction and activity and participation

	PASIPD		*UAL*		*SIPSOC*	
	B *(s.e.)*	*P*	B *(s.e.)*	*P*	B *(s.e.)*	*P*
Constant	18.8 (14.2)		58.9 (19.6)		4.3 (3.4)	
Wheelchair-related satisfaction	0.6 (0.4)	0.12	0.2 (0.5)	0.66	−0.09 (0.09)	0.30
Confounders						
Lesion level	—		4.1 (5.3)	0.44	—	
Completeness of lesion	−2.0 (4.1)	0.62	−8.1 (5.4)	0.14	1.7 (0.9)	0.08
Age (years)	−0.4 (0.1)	0.001	−0.7 (0.2)	<0.001	0.1 (0.03)	0.002
Gender	—		8.2 (5.0)	0.11	—	—

Abbreviations: PASIPD, physical activity scale for individuals with a physical disability; SIPSOC, subscales mobility range and social behavior of the SIP68; UAL, Utrecht activity list.

As far as known, only two other studies[8,17] have looked at the relationship between wheelchair user satisfaction and an active lifestyle or participation. One of these studies[17] studied a group of wheelchair users with different disabilities and looked at user satisfaction regarding push-rim activated power-assisted wheelchair versus power wheelchairs, which cannot be compared completely with manual wheelchairs on issues as for example, weight and safety. The other study showed that in the Chinese SCI population, the user satisfaction with the wheelchair did not have a strong association with their perception of participation in the community.[8] The aspects that were related to participation in our study were the simplicity of use, durability and comfort. The simplicity of use and comfort are important to wheelchair users with SCI[7] and are also necessary for good participation.

The lack of strong relationships between wheelchair user satisfaction and active lifestyle or participation might be explained by the fact that an active lifestyle or participation are also determined by individual factors such as wheelchair skills[13] and physical capacity[18] as well as external factors, such as architectural and social factors.[8] Furthermore, secondary complications, such as pressure sores, and the subsequent bed rest might have an effect on activities and participation as well and were not taken into account in the present study.

Conclusion

Dutch persons with SCI are in general quite satisfied with their wheelchair. Persons with a complete SCI are slightly less satisfied compared with persons with an incomplete lesion. Therefore, the wheelchairs and opinions of the persons with a complete SCI might need more attention. Some aspects of the wheelchair (dimensions, comfort and simplicity of use) are important to optimize as these are related to an active lifestyle and participation. The wheelchair services offered showed lower user satisfaction scores. Especially, the service delivery can be improved in the Netherlands.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgements

We would like to thank the eight participating rehabilitation centers and especially the research assistants for collecting all the data. This study was supported by the Dutch Health Research and Development Council, Zon-Mw Rehabilitation program, Grant no. 1435.0003 and 1435.0025.

References

1 Marino R, Barros T, Biering-Sorensen F, Burns S, Donovan W, Graves D *et al*. ASIA Neurological Standards Committee 2002. *J Spinal Cord Med* 2003; **26**: S50–S56.
2 de Groot S, Dallmeijer AJ, Post MW, van Asbeck FW, Nene AV, Angenot EL *et al*. Demographics of the Dutch multicenter prospective cohort study 'Restoration of mobility in spinal cord injury rehabilitation'. *Spinal Cord* 2006; **44**: 668–675.
3 Post MW, van Asbeck FW, van Dijk AJ, Schrijvers AJ. Services for spinal cord injured: availability and satisfaction. *Spinal Cord* 1997; **35**: 109–115.
4 Fernhall B, Heffernan K, Jae SY, Hedrick B. Health implications of physical activity in individuals with spinal cord injury: a literature review. *J Health Hum Serv Adm* 2008; **30**: 468–502.
5 Gutenbrunner C, Ward A, Chamberlain M. White book on physical and rehabilitation medicine in Europe. *J Rehabil Med* 2007; **39**: 1–48.
6 Samuelsson K, Wressle E. User satisfaction with mobility assistive devices: an important element in the rehabilitation process. *Disabil Rehabil* 2008; **30**: 551–558.
7 Bergstrom AL, Samuelsson K. Evaluation of manual wheelchairs by individuals with spinal cord injuries. *Disabil Rehabil Assist Technol* 2006; **1**: 175–182.
8 Chan SC, Chan AP. User satisfaction, community participation and quality of life among Chinese wheelchair users with spinal cord injury: a preliminary study. *Occup Ther Int* 2007; **14**: 123–143.
9 Wessels RD, De Witte LP. Reliability and validity of the Dutch version of QUEST 2.0 with users of various types of assistive devices. *Disabil Rehabil* 2003; **25**: 267–272.
10 Washburn RA, Zhu W, McAuley E, Frogley M, Figoni SF. The physical activity scale for individuals with physical disabilities: development and evaluation. *Arch Phys Med Rehabil* 2002; **83**: 193–200.
11 van Asbeck FWA. Handboek dwarslaesierevalidatie. Bohn Stafleu Van Loghum: Houten, 2007.
12 Whiteneck GG, Charlifue SW, Gerhart KA, Overholser JD, Richardson GN. Quantifying handicap: a new measure of long-term rehabilitation outcomes. *Arch Phys Med Rehabil* 1992; **73**: 519–526.
13 Kilkens OJ, Post MW, Dallmeijer AJ, van Asbeck FW, Van Der Woude LH. Relationship between manual wheelchair skill performance and participation of persons with spinal cord

injuries 1 year after discharge from inpatient rehabilitation. *J Rehabil Res Dev* 2005; **42**: 65–73.
14 Batavia M, Batavia AI, Friedman R. Changing chairs: anticipating problems in prescribing wheelchairs. *Disabil Rehabil* 2001; **23**: 539–548.
15 Jedeloo S, De Witte LP, Linssen BA, Schrijvers AJ. Client satisfaction with service delivery of assistive technology for outdoor mobility. *Disabil Rehabil* 2002; **24**: 550–557.
16 van der Woude LH, Bouw A, van WJ, van AH, Veeger D, de Groot S. Seat height: effects on submaximal hand rim wheelchair performance during spinal cord injury rehabilitation. *J Rehabil Med* 2009; **41**: 143–149.
17 Giesbrecht EM, Ripat JD, Quanbury AO, Cooper JE. Participation in community-based activities of daily living: comparison of a pushrim-activated, power-assisted wheelchair and a power wheelchair. *Disabil Rehabil Assist Technol* 2009; **4**: 198–207.
18 Van Velzen JM, de Groot S, Post MW, Slootman JH, van Bennekom CA, Van Der Woude LH. Return to work after spinal cord injury: is it related to wheelchair capacity at discharge from clinical rehabilitation? *Am J Phys Med Rehabil* 2009; **88**: 47–56.