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Functional status and prosthesis use in amputees, measured with the Prosthetic Profile of the Amputee (PPA) and the short version of the Sickness Impact Profile (SIP68)

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Introduction

Amputation of (a part of) the lower extremity will cause loss or disturbance of locomotion. With prosthetic devices and rehabilitation many amputees are able to restore their locomotive function as well as their social function. Maintenance or restoration of function after discharge is even more important. In rehabilitating amputees, prosthetic devices can improve mobility. Little is known about whether these devices will still be used at home after discharge and if the improvement in functioning is stable. To verify whether the treatment strategy of amputees is sufficient or needs to be modified, it is important to check if the goals of rehabilitation are achieved.

Outcome in amputees used to be related to mortality and cure, especially mobility, for example, by the Amputee Activity Score, a measure for activity, not related to age, sex or handicap (Day, 1981). Recently, 'quality of life' and 'reintegration in normal life' have been emphasized in measuring outcomes of rehabilitation programmes. Research on 42 amputees (Nissen and Newman, 1992) indicated that more attention should be paid to community, mobility, recreation and additional illnesses after amputation to improve reintegration to normal living.

The purpose of this study is to evaluate (1) the status at discharge and (2) the maintenance of physical functioning (including mobility) and psycho-social functioning after a follow-up period of 2 months after discharge from a rehabilitation setting. Since mobility is related to prosthesis use, prosthesis use is also evaluated.

Material and methods

To determine the functional status and prosthesis use at discharge (t_0) and stability over a period of two months after discharge (t_1), a disease-specific instrument and a generic instrument were selected. Generic instruments are widely available (Streppel *et al*., 1996; Caulfield *et al*., 1999), but disease-specific instruments for amputees are few and rather scarcely documented. For this study, the Sickness Impact Profile (SIP) and the Prosthetic Profile of the Amputee (PPA) were used. Due to the lack of experience with the Dutch translation of the PPA, the advantages and the disadvantages of this instrument in Dutch amputees are also described.

Instruments

The PPA is a disease-specific follow-up instrument for amputees in a clinical setting (Grisé *et al*., 1993). The PPA measures prosthesis use and factors potentially related to prosthesis use by a person with a lower extremity amputation after discharge from rehabilitation. The PPA consists of 44 closed-end and semi-closed-end questions and assesses 11 subcategories of the predisposing, enabling and reinforcing factors. The questions are grouped under six themes: physical condition, prosthesis, prosthesis use, environment, leisure activities and general information. To evaluate locomotor skills with the prosthesis, an index of locomotor capabilities was used (Gauthier-Gagnon and Grisé, 1996). The PPA was developed in Canada using the Dillmann's Total Design Method in an English and

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French version. It appears to be reliable and valid for clinical and research use (Gauthier-Gagnon and Grisé, 1994a). For this study the PPA was translated into Dutch using the 'back translation' method (Del Greco *et al*., 1987). Some typical regional sports (golf, ice skating, hunting) are replaced by sports more suitable for the Dutch situation (ball sports, adjusted sports).

The SIP is a general health measure that operationalizes health in functional or behavioural terms. Because of the length of the original Sickness Impact Profile, a short version of the SIP was developed, the SIP68 (de Bruin *et al*., 1994). The SIP68 contains 68 items divided over six subscales: Somatic Autonomy, Motor Control, Psychic Autonomy & Communication, Social Behaviour, Emotional Stability and Mobility Range. The SIP68 appeared to be a valid and reliable alternative to the original SIP (de Bruin, 1996).

Protocol

Amputees, regardless of the cause of amputation or the level of amputation, participated in this study. The only exclusion criterion was poor command of the Dutch language. At discharge, inpatients and outpatients were requested by their physician to participate in this study. After obtaining informed consent they received the PPA and the SIP68. They were asked to fill out these questionnaires at home and to return them to the research institute. Approximately 2 months later the PPA and SIP68 were sent by post to be filled out again. Patients who submitted questionnaires with many missing values were contacted by phone to answer these questions. Seven rehabilitation centres or rehabilitation departments recruited patients.

Analysis

Only descriptive statistics are used for this study. Since the expectation was that the level of functioning and prosthesis use would be sustained or further improve, the percentage of amputees who remained stable or improved on the PPA was calculated. Only questions related to function and prosthesis use were analysed (questions 10–14, 16, 18–20, 31, 34, 36, 37, 39). Also, mean change in time of the SIP68, and the corresponding 95% confidence intervals (CI), were computed.

The measure of practicality of the PPA is the ease of filling out the form and its clinical usefulness. For this purpose, inconsistencies in answering and responsible physician's opinions were checked.

Results

The study population ($n = 50$) of 28 amputees treated on an inpatient basis and 22 treated on an outpatient basis gave informed consent. Mean age ($\pm$SD) was 61.2 ($\pm$16.2) and 68% of the population was male (Table 1). Reason for amputation was mainly vascular (74%, including diabetes mellitus, 44%). Level of amputation was mainly transtibial (48%), 16% with bilateral amputation. Mean ($\pm$SD) duration of treatment was 165 ($\pm$111) days. The non-response was not measured or evaluated.

Table 1. Population characteristics ($n = 50$)

		n	%
Mean age ($\pm$SD)	61.2 ($\pm$16.2)		
Sex	34 (68%) male		
Treatment	28 inpatient, 22 outpatient rehab.		
Mean duration of treatment in days ($\pm$SD)	165 ($\pm$111)		
Aetiology			
Vascular (including diabetes mellitus; DM)		37 (incl. 22 DM)	74 (incl. 44 DM)
Trauma		8	16
Tumour		3	6
Inflammation		2	4
Level of amputation			
Hip exarticulation		2	4
Transfemoral		10	20
Knee disarticulation		5	10
Transtibial		24	48
Part of the foot		1	2
Bilateral		8	16

Table 2. Mean (±SD) SIP68 score at discharge ($n = 41$)

SIP dimension	*(Score range)*	*Mean score*	*(± SD)*
Somatic Autonomy	(0–17)	1.4	(±2.2)
Motor Control	(0–12)	6.0	(±2.7)
Psychic Autonomy & Communication	(0–11)	1.3	(±2.6)
Social Behaviour	(0–12)	4.7	(±2.9)
Emotional Stability	(0–6)	0.8	(±1.5)
Mobility Range	(0–10)	3.2	(±2.7)
Total	(0–68)	17.4	(±10.1)

STATUS AT DISCHARGE

PPA

The first PPA was filled out by 86% ($n = 43$) of the respondents. Bilateral amputees with both legs amputated higher than the ankles ($n = 5$) did not have to fill out all questions. At least 92% (1 missing value) of the remaining (unilateral) amputees are prosthesis wearers. Of the prosthesis wearers ($n = 35$), 94% wear their prosthesis daily; 76% for more than 9 hours per day. Sixty-three per cent of the prosthesis wearers answered that they use their prosthesis for '75% or more' of indoor activities and for 71% of outdoor activities. The most important reason for not using their prosthesis indoors (69%) and outdoors (80%) is because it is too tiring. Basic activities (e.g. donning prosthesis, walking indoors/outdoors, mounting curbs) can be performed by at least 80% of the prosthesis wearers. Advanced activities can be performed by fewer prosthesis wearers: 79% can pick up an object from the floor, 63% can get up from the floor or can climb a few stairs with a handrail, 60% can walk while carrying an object and 16% can walk a few stairs without a handrail. Sixty-six per cent can walk one block (5–6 houses) or move non-stop while 45% need to concentrate on every step they take. Fifty-eight percent of users who walk indoors use one or more assistive devices and 74% do so outdoors. More than 83% can perform various activities of daily living (dressing, house keeping, etc.) independently, with some help or do not have to perform that activity. Amputation and prosthesis are accepted by the social environment of more than 84% per cent of all amputees (including bilateral amputees). Of all amputees, about one-third practice sports and three-quarters have recreational activities or hobbies.

SIP68

Response on filling out the first SIP68 was 82% ($n = 41$). Table 2 shows the scores of the SIP68 dimensions and total score. Low scores represent good function and vice versa.

As expected, Motor Control scores are relatively high. This seems to have consequences for Social Behaviour and Mobility Range also. Although physical functioning is the most prominent problem for amputees, psychological function is also affected, seen by the scores on Psychic Autonomy & Communication and Emotional Stability.

MAINTENANCE AFTER FOLLOW-UP

Stability in functioning and prosthesis use

Twenty-nine amputees filled out the PPA 2 months after discharge (response 58%), including four bilateral amputees, who did not fill out questions 3–23. Generally, the answers for the discharge measurement and the follow-up measurement, 2 months after discharge, are comparable. The percentage stability/improvement was calculated for various activities and is shown in Table 3.

Prosthesis use (question 12) and number of falls (question 19) is calculated at discharge and follow-up. Mean (±SD) hours of prosthesis use at dis-

Table 3. Percentage stability/improvement of various activities ($n = 25/29$ excl./incl. bilateral amputees)

PPA question	*Stability/improvement (%)*
(10) Donning prosthesis	95
(11) Performing indoor and outdoor activities	76–90
(12) Prosthesis use	87
(13) Standing and/or walking around	90
(14) Walking with prosthesis indoors	84
(16) Walking with prosthesis outdoors	78
(18) Walking distances non-stop	78
(20) Walking automatism	90
(31)* (I)ADL	96–100
(34)* Sport participation	83 (89)
(37)* Recreational activities and hobbies	93 (82)

*Including bilateral amputees. (I)ADL, instrumental activities of daily living (household work).

charge was 10.1 (±5.6); 2 months later this was 10.4 (±5.7). At discharge the number of falls since home-coming was 0.46 (±0.95); 2 months later this was 0.52 (±1.28).

Generally 85–90% of the amputees remained stable or improved in functioning and prosthesis use. Stability/improvement of outdoor and advanced activities appeared to be a little lower (76–78%).

Stability in functional status

The SIP68 was filled out twice by 27 subjects (response = 54%). No difference was found in discharge scores between response and non-response ($n = 14$) groups. Mean scores at discharge and follow-up, mean differences between both measurements and 95% CI are given in Table 4.

Negative differences represent improved functional status and vice versa. Increments as well as decrements are small and the 95% CIs include zero, suggesting that the differences cannot be considered as changes in functioning.

PRACTICAL USE OF THE PPA

The physicians concerned pointed out that the PPA covers all relevant aspects of amputee rehabilitation, for example, (I)ADL, other activities (work, hobby, sport), prosthetic use and mobility with prosthesis. However, they considered that the PPA is too extensive for daily routine.

The researchers are of the opinion that the PPA is quite extensive and that the questionnaire is difficult to understand, especially for older persons. An indication of this was the fact that many questionnaires were incompletely or improperly filled out and patients had to be phoned to answer the missing questions. Further, the PPA has no total or subscore; to get an impression of the functioning of the patient, all questions have to be reviewed.

Discussion

To our knowledge, the PPA has so far never been used in the Netherlands for research purposes. To get an impression of the level of functioning in Dutch amputees, the results of this study will be compared with another study.

In Canada, where the PPA was developed, 396 amputees filled out the PPA over a period of 5 years (Gauthier-Gagnon and Grisé, 1994b, 1995). Although population characteristics differ a little, the results show remarkable resemblance. Unfortunately, the exact time of measurement is not known. Gauthier-Gagnon's results show that 85% of the respondents are prosthesis wearers: 90% wear prostheses daily and 75% for more than 9 hours per day. It was further shown that 53% of the amputees were actively using their prosthesis for 'more than 75%' of their indoor activities and 64% outdoors. Over 80% of prosthesis users reported being capable of carrying out basic activities alone. The proportion of people capable of more advanced locomotor activities alone is considerably less (48–76%). Sixty per cent were able to walk one block or more non-stop, but 50% of the people who have undergone amputation need to concentrate on every step they take even years after discharge.

Functioning and prosthesis use has been studied in Dutch amputees 1 year after amputation with use of, among other instruments, the SIP68 (Winnubst *et al*., 1997). Again, population characteristics were different to our study; this population also consisted of amputees who did not receive rehabilitation or who were rehabilitated in hospitals or nursing homes. Mean age was not reported. Mean SIP68 score ($n = 61$) is slightly higher in the domains Somatic Autonomy, Social Behaviour and Mobility Range (SD unknown). Because of this, mean total SIP68 score is also higher, 19.3 versus 16.1 in our population (2 months after discharge).

Table 4. Mean (±SD) scores of SIP68 at discharge and at 2 months follow-up, mean difference in scores and 95% CI of the mean difference ($n = 27$)

SIP dimension	*Mean score at discharge (± SD)*	*Mean score at 2 months follow-up (± SD)*	*Mean difference*	*95% CI of the difference*
Somatic Autonomy	1.26 (±2.03)	1.70 (±2.38)	−0.44	−0.99–0.97
Motor Control	5.85 (±2.58)	6.41 (±2.47)	−0.56	−1.39–0.28
Psychic Autonomy & Communication	1.22 (±2.36)	1.00 (±2.24)	0.22	−0.34–0.79
Social Behaviour	4.63 (±2.73)	4.15 (±2.41)	0.48	−0.43–1.40
Emotional Stability	0.74 (±1.51)	0.70 (±1.41)	0.04	−0.46–0.53
Mobility Range	3.00 (±2.82)	2.48 (±2.34)	0.52	−0.34–1.38
Total	16.70 (±9.25)	16.44 (±9.44)	0.26	−1.97–2.49

In our population, variance is rather high (SD = 9.1), indicating that differences are not significant.

Next to status of the amputee at discharge, the present study was also designed to assess the stability of results after a 2-month follow-up. The PPA is not developed for repeated measures, although we used a selection of questions for this purpose. It appeared that 85–90% of the amputees remained stable or improved in functioning and prosthesis use. The percentage stability/improvement of outdoors and advanced activities is a little lower (76–78%). This might be attributed to the fact that amputees have less experience with these activities (e.g. walking outdoors in inclement weather or on uneven ground) at discharge than at follow-up. They may have overestimated their functioning at discharge and have learned that they were not able to perform certain activities. However, it is possible that 22–24% are less capable of performing outdoors and advanced activities. With PPA information (i.e. physical condition, prosthesis characters, environmental problems) it is possible to discover the reasons for deterioration. From the SIP68 results it can be concluded that the functional status was stable after 2 months follow-up.

The follow-up period was quite short and mainly chosen from a practical point of view. A longer period would be interesting. Disadvantage of an extended follow-up period is that other factors (e.g. co-morbidity) are likely to influence outcomes.

The PPA is a very informative questionnaire that gives a good impression of prosthesis use, functioning with the prosthesis and factors that may influence this. The PPA is rather a qualitative instrument. Because of its length it is not suitable for daily practice.

Since the PPA is an extensive and relatively complex questionnaire, for the elderly, use of the telephone version or filling out the PPA with assistance would be preferable. If these methods are not feasible, one should consider a selection of PPA questions. This may also improve response.

Publications on outcomes of rehabilitated amputees measured with the PPA and SIP68 are scarce. To compare state and stability of amputees after rehabilitation, reference values would be helpful. So far the PPA has not been validated for the Dutch situation, therefore as this was the first time the PPA was used in the Netherlands, the results should be handled with care. Despite the shortcomings of a non-validated questionnaire, we advocate translation of a well-designed questionnaire instead of creating a new one.

From the results it can be concluded that prosthesis use, leisure activities, indoor and outdoor activities and functional status of the amputees measured in this study were good at discharge and stable for a 2-month period after discharge from the rehabilitation centre.

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References

Bruin, A.F. de (1996). The measurement of sickness impact, the construction of the SIP68. Unpublished thesis, Maastricht.

Bruin, A.F. de, Diederiks, J.P.M., de Witte, L.P., Stevens, F.C.J. and Philipsen, H. (1994). SIP68: *Short Version of the Sickness Impact Profile, 'Een verkorte versie van de Sickness Impact Profile'* (manual). IRV/Rijksuniversiteit Limburg, Maastricht, Vakgroep Medische Sociologie

Caulfield, B., Garrett, M., Torenbeek, M. and van Harten, W. (Eds.) (1999). *Rehabilitation Outcome Measures in Europe; the State of the Art*. Enschede: Roessingh Research & Development.

Day, H.J.B. (1981). The assessment and description of amputee activity. *Prosthetics and Orthotics International*, **5,** 23–8.

Del Greco, L., Walop, W. and Eastridge, L. (1987). Clinical epidemiology, questionnaire development. 3: Translation. *CMAJ*, **136,** 817–18.

Gauthier-Gagnon, C. and Grisé, M.C. (1994a). Prosthetic profile of the amputee questionnaire: validity and reliability. *Archives of Physical Medicine and Rehabilitation*, **75,** 1309–14.

Gauthier-Gagnon, C. and Grisé, C. (1994b). The use of the prosthesis by the lower extremity amputee: a follow-up study of predisposing factors (abstract). In *Joint APTA/CPA Congress*, held in Toronto, Canada, 1994.

Gauthier-Gagnon, C. and Grisé, C. (1995). The use of the prosthesis by the lower extremity amputee: a follow-up study of enabling factors (abstract). In *World Confederation for Physical Therapy (WCPT)*, held in Washington, 1995.

Gauthier-Gagnon, C. and Grisé, M.C. (1996). *PPA; Handbook of Documents Developed within the Framework of a Prosthetic Follow-up Study*, revised November 1996. Montreal, Quebec

Grisé, M.C.L., Gauthier-Gagnon, C. and Martineau, G.G. (1993). Prosthetic profile of people with lower extremity amputation: conception and design of a follow-up questionnaire. *Archives of Physical Medicine and Rehabilitation*, **74,** 862–70.

Nissen, S.J. and Newman, W.P. (1992). Factors influencing reintegration to normal living after amputation. *Archives of Physical Medicine and Rehabilitation*, **73,** 548–51.

Streppel, K.R.M., Harten, W.H. van and Warmerdam, C.G.M. (1996). Short version of the Sickness Impact Profile for evaluating rehabilitation programs. *Journal of Rehabilitation Sciences*, **9**(3), 66–71.

Winnubst, G.M.M., Pernot, H.F.M., Cluitmans, J.J.M., Lindeman, E., de Witte, L.P. and van het Hooft, W. (1997). Functioning after a lower limb amputation at Limburg (2) (in Dutch). *Revalidata*, **80,** 14–17.