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Accuracy of physical and occupational therapists' early predictions of recovery after severe middle cerebral artery stroke

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Introduction: The ability of physical therapists (PTs) and occupational therapists (OTs) to predict level of outcome accurately was investigated prospectively in 91 severely disabled stroke patients with a first-ever middle cerebral artery (MCA) stroke.
Methods: Within the second and fifth week after stroke onset, 364 predictions were made by 59 PTs and 47 OTs about walking ability, dexterity, activities of daily living (ADL), need for additional care in ADL, time required to achieve independent walking ability and maximal level of ADL, and destination of discharge at six months after stroke. The functional recovery patterns of stroke patients were assessed by an independent observer. The accuracy of the therapists' predictions was compared with that of derived prediction models. In addition, the influence of characteristics of patients and therapists on the accuracy of the predictions was investigated.
Results: Compared to observed outcomes at six months after stroke, therapists' lowest accuracies of prediction were found for the moment at which maximal ADL score was achieved (r_s = 0.07; p = NS), and highest accuracy was for level of dexterity of the hemiplegic arm (r_s = 0.78; p <0.01). Therapists' predictions of functional outcome at six months tended to be too pessimistic. No significant differences were observed for dexterity and walking ability when the predictions by PTs and OTs were compared with those of regression models, whereas significant differences were found for the accuracies of OTs' and PTs' first prediction of destination of discharge and second predictions of outcome in ADL and need for additional care in ADL. No significant differences were found between the accuracy of PTs' and OTs' predictions, and their ability to predict functional outcome was not significantly influenced by the characteristics of patient and therapists.

Conclusions: At two and five weeks after stroke, OTs and PTs can accurately predict level of walking ability and dexterity at six months. The prediction of time required for achieving maximal level of recovery, destination of discharge, outcome of ADL as well as need for additional care in ADL leaves room for improvement.

INTRODUCTION

The ability of physical therapists (PTs) and occupational therapists (OTs) involved in stroke rehabilitation to predict functional recovery is crucial in making clinical decisions about therapeutic goals[1–4] and is therefore fundamental to the practice of PT[4] and OT.[4] The judgement of goal-setting has an impact on the type of treatment and its intensity as well as the length of stay in a hospital.[5,6] Effects of training appear to be limited to tasks specifically trained,[7,8] implying that treatment goals should be based on a detailed understanding of individual recovery patterns of stroke patients.[8]

The rehabilitation goals should be discussed with the patient and his or her family in terms of current levels of disability and potential for recovery.[9] An accurate and realistic prognosis of outcome after stroke is hampered, however, by (1) heterogeneity of individual recovery patterns, [8,10–11] (2) lack of knowledge of training effects,[8,12] and (3) lack of knowledge of sociodemographic factors and housing facilities which influences destination of discharge.[13,14] Clinical decision-making is often considered to be based on intuition,[1,4] and may be improved by, for example, therapists' (past) experience in stroke rehabilitation,[4] knowledge of the patients' history, and knowledge of findings from prognostic and intervention studies in the field of stroke rehabilitation.[2,3,8,11]

Korner-Bitensky and colleagues indicated that the accuracy of PTs' prediction of a patient's ability to perform activities of daily living (ADL) ranged from 53% (climbing stairs) to 67% (lying to sitting),[5] whereas the accuracy of OTs' prediction of a patient's ability to perform ADLs ranged from 52% (grooming) to 65% (feeding).[15] In addition, they demonstrated that therapists were more likely to be optimistic than pessimistic[5,15] and their characteristics as well as those of the patients did not influence PTs' and OTs' prediction of functional milestones.[5,15]

Kent and colleagues reported Spearman rank correlation coefficients (r_s) between predicted and achieved functional outcomes ranging from 0.53 (p <0.01) for gait indoors to 1.0 (p <0.01) for unsupported standing. They suggest that less complex motor tasks were more accurately predicted than more complex ones.[16] Lower correlation coefficients were found for the accuracy of PTs' prediction of the week after stroke in which the functional outcome was achieved ($0.57 < r < 0.72$; $p < 0.01$).

In the above mentioned studies, no uniform start and end points were defined and assessment of outcome was not recorded blindly. In addition, the ability to predict destination of discharge and need for additional care, which are important aspects in the formulation of treatment goals focused on ADL and in advising members of the stroke team and family in the preparation for discharge (e.g. ordering a wheelchair, adapting the home and training family members in transfer techniques), has not been investigated yet.[9,15]

Finally, in the literature reported, the interpretation of correlation coefficients and accuracies of PTs' and OTs' predictions of observed outcome remains difficult because of a lack of an adequate frame of reference reflecting the optimal judgement of final outcome. Thus far, the accuracy of PTs' and OTs' prediction of final outcome has not been compared with the accuracy of prediction models obtained by means of regression analysis.

In the present study the following research questions are addressed:

1. At two and five weeks after stroke to what extent are PTs and OTs capable of predicting achieved outcome in walking ability, dexterity of the hemiplegic arm, ADL, need for additional care in performing ADL and destination of discharge at six months after stroke onset?
2. Are the predicted outcomes of PTs and OTs comparable to those of prediction models?
3. To what extent are PTs and OTs at two and five weeks after stroke capable of predicting the time required to achieve independent walking ability and maximal level of ADL within six months after stroke onset?
4. Is the accuracy of PTs' and OTs' ability to predict functional outcome affected by the characteristics of patients or therapists?

SUBJECTS AND METHODS

Subjects

In 29 months, between September 1994 and February 1997, 91 stroke patients were recruited from seven hospitals as part of a randomized clinical trial. Stroke diagnosis was based on the definition of the World Health Organization (WHO).[17] To ensure weekly follow-up assessments, three rehabilitation centres and 15 nursing homes were selected in Amsterdam and Haarlem to participate in the present study. The study was coordinated by the Department of Physical Therapy of the University Hospital Vrije Universiteit, Amsterdam, and the research protocol was approved by the ethics committees of the participating hospitals.

Patients met the following admission criteria: (1) first-ever stroke involving an ischaemic infarct in the territory of the middle cerebral artery (MCA) as revealed by CAT or MRI scanning; (2) 30–80 years of age; (3) an impaired motor function of upper as well as lower extremity; (4) inability to walk during the first assessment; (5) no complicating medical history such as cardiac, pulmonary or other neurological disorders; (6) no severe deficits in communication (i.e. 50 percentile or higher corrected for age on the Dutch Foundation Aphasia test[18]), memory and understanding (24 points or higher on the Mini-Mental State Examination (MMSE)[19]); and (7) informed consent and sufficient motivation to participate. Written or verbal informed consent was obtained and patients were sufficiently motivated to participate in the research protocol. During the first 48 hours, all patients were assessed by a neurologist confirming the diagnosis ‘stroke’ as well as level of consciousness (Glasgow Coma Scale, GCS).[20] In addition, patients were classified according to the Oxfordshire Community Stroke Project (OCSP) into: (1) total anterior circulation infarcts (TACI); (2) partial anterior circulation infarcts (PACI); or (3) lacunar anterior circulation infarcts (LACI).[21] The OCSP classification is not only reliable between observers,[22] but also has a high predictive validity in terms of side and size of cerebral infarction when compared to computerized tomography scan, and is easy to apply.[23]

Design

In the present study staff PTs (*N* = 59) and OTs *(N* = 47) who were involved in the treatment of 91 stroke patients, were invited to predict in the second and the fifth week after stroke the likely outcome at six months after stroke in terms of a number of tests, which were also used in the assessment of walking ability, dexterity of the hemiplegic arm, ADL, need for additional care in ADL, destination of discharge six months after stroke onset, and time (i.e. number of months) required to achieve maximal level of ADL as well as independent walking ability at six months after stroke (Figure 1).

[FIGURE 1]

All outcome variables were assessed weekly by an independent observer (GK) in the first 10 weeks after stroke onset and every two weeks between the 10th and 20th week. Final outcome was evaluated at six months after stroke onset. PTs and OTs were instructed to use Functional Ambulation Categories (FAC),[24,25] Action Research Arm test (ARA),[26] and the Barthel Index (BI)[27,28] to optimize their prediction of final outcome. The above mentioned tests were also used in the development of prediction models (see Statistics). Finally, the number of years of experience of PTs and OTs as well as type and number of courses in stroke rehabilitation were registered. In addition, the number of days between stroke onset and time of assessment as well as the actual number of treatment days were recorded. Depending on moment of discharge, therapists did not necessarily administer both assessments.

Measurements

Walking ability was measured with the FAC.[24,25] The test includes six ordinal levels of support needed for gait, but does not evaluate whether or not an aid was used. A score of four points on the FAC represents the ability of the patient to walk safely and independently on flat surfaces.

Dexterity of the hemiplegic arm was measured with the ARA comprising 19 functional movement tasks[26] divided into four levels. These were the ability to carry out (1) only gross movements (score 0–9 points), (2) some grip, pinch and/or grasp movements (score 10–29), (3) most grip, pinch and grasp movements but slow and clumsy (score 30–56); and (4) normal arm and hand function (i.e. maximum score 57 points).

The BI was applied in order to evaluate the ability of the patient to perform 10 different activities of daily living,[27,28] and can be categorized into four levels of dependency: very and severely disabled (scores 0–9), moderately disabled (scores 10–14), mildly disabled (scores 15–19), and functionally independent (score 20).[29] To overcome unfamiliarity of OTs and PTs with one of the above mentioned assessments, all measurements were combined in a list of seven multiple choice questions.

Statistics

Spearman rank correlation coefficients (r_s) were used to evaluate the correspondence between, on the one hand, PTs' and OTs' predictions of functional outcomes, time required to achieve independent walking ability (i.e. FAC 4) and time required to achieve maximal BI level, and, on the other hand, observed outcome. The Wilcoxon signed-ranks test was used to evaluate the relative magnitude as well as the direction of difference between predicted and observed outcome (too optimistic or too pessimistic).

The correspondence between the predicted and observed dichotomous outcomes 'need for additional care in ADL' and 'destination of discharge', was determined by applying conditional logistic regression analysis. In addition, the percentage of true positives and negatives, false positives (i.e. too optimistic) and false negatives (i.e. too pessimistic) were calculated.[30] The relations were regarded as significant (p <0.05) when the 95% confidence interval (CI) of the odds ratio (OR) did not include the value 1.

The correlation coefficients between PTs' and OTs' predicted and observed outcomes were compared to those of derived prediction models (obtained by forward linear or logistic regression analysis in week two and five after stroke).[31,32] To enable the latter comparisons, a Fisher's Z transformation of the calculated correlation coefficients was applied and the 95% CI was calculated.[33]

In order to estimate the influence of the characteristics of patients and therapists on the accuracy of prediction of the BI, FAC and ARA by PTs and OTs, the standardized univariate correlation coefficients of predictions were transformed by Fisher's Z, the 95% CI was calculated, and subsequently adjusted for relevant covariates.[33] This influence was considered to be statistically significant when the correlation coefficient changed more than two standard deviations (beyond 95% CI) after adjustment for tested covariate. For all tests 0.05 (two tailed) was cho- sen as level of significance (SPSS for Windows software, release 7.5).

RESULTS

As shown in Table 1, 91 patients with a first-ever MCA stroke were included in the present study. On admission, all patients were unable to walk and had an initial BI score of 9 points or lower, indicating that the sustained strokes resulted in a (very) severe disability.[29] For two patients the outcome at six months after stroke could not be assessed as a result of recurrent stroke and oncological comorbidity.

[TABLE 1]

Ninety-three per cent of the questionnaires by PTs (i.e. 169 out of the 182) and 79% of the questionnaires by OTs (i.e. 143 out of the 182) were returned. Table 2 presents the main characteristics of PTs (N = 59) and OTs (n = 47) participating in the present study.

[TABLE 2]

No statistically significant differences in mean interval between stroke onset and time of first prediction, experience in stroke rehabilitation (years), number and type of courses in the field of neurological rehabilitation were found between OTs and PTs. PTs had significantly more treatment days between the moments of stroke onset and first assessment than OTs (5.7 ± 3.3 and 3.1 ± 2.3, respectively; see Table 2).

Prediction of final outcome

Table 3 presents the correlation coefficients and percentages of accuracy between predicted and achieved outcomes. The lowest correlation coefficient (r_s = 0.21; p <0.05) was found for OTs' first prediction of destination of discharge and the highest correlation coefficient (r_s = 0.78; p <0.01) for

PTs' and OTs' second prediction of final outcome of dexterity. All correlation coefficients between predicted and achieved levels of outcome were statistically significant.

[TABLE 3]

Contrary to OTs, PTs' percentage of accuracy of first made predictions of level of outcome in BI, FAC and ARA were significantly lower (i.e. too pessimistic) estimated than observed outcomes. The second predictions of PTs and OTs of level of outcome in ARA also revealed signif- icantly lower estimates (i.e. too pessimistic) than observed outcomes (Table 3).

Except for PTs' prediction of BI, higher correlation coefficients and percentages of accuracies were found for the second prediction compared to the first one. However, the increment in correlation coefficient was only significant for OTs' second prediction of dexterity ($|Z| = 2.08$; $p < 0.05$).

No statistically significant differences in accuracy of prediction were found between PTs and OTs.

Prediction of dependency in ADL and destination of discharge

Table 3 shows the correlation coefficients and percentage of accuracy for the prediction of need for additional care in ADL and destination of discharge assessed at two and five weeks after stroke. All correlation coefficients were statistically significant. In addition, higher percentages of accuracy were found for the prediction of need for additional care in ADL (ranging from 78.9% for OTs' first prediction to 83.8% for OTs' second prediction) compared to the prediction of destination of discharge (ranging from 65.3% for OTs' first prediction to 79.0% for PTs' second prediction).

For both outcome variables, a slight improvement in accuracy was found for the prediction at five weeks after stroke compared to the one at two weeks after stroke (Table 3). However, the improvement for destination of discharge and need for additional care in ADL was only significant for OT ($|Z| = 1.96$; $p = 0.05$). No significant differences in percentages of false-negative and false-positive prediction for both PT and OT were observed (Table 3). Finally, no significant differences between PTs' and OTs' accuracy of predicting destination of discharge and need for additional care in ADL ($0.09 < |Z| < 1.12$; $0.13 < p < 0.46$) were found.

Prediction of time required to final level of outcome

The univariate correlation coefficients between observed and predicted outcomes for time required to achieve independent walking ability ranged from 0.15 ($p = 0.12$) to 0.43 ($p < 0.01$) for OTs' and PTs' first prediction, respectively (Table 3). The correlation coefficients for the time required to achieve maximal BI level ranged from 0.07 ($p = 0.27$) for PTs' first prediction to 0.38 ($p < 0.01$) for OTs' second prediction (Table 3). In addition, OTs' second prediction of the time required to achieve maximal BI level was set significantly later in time than actually observed, whereas the other predictions of time required to achieve maximal BI and independent walking ability revealed no significant differences (Table 3). OTs' first prediction of the time required to achieve maximal BI level was significantly better than the first prediction by PTs ($|Z| = 2.00$; $p < 0.05$), whereas other comparisons revealed no significant differences.

Comparisons with prediction models

Table 4 shows the regression models for BI, FAC, ARA, dependency in ADL and destination of discharge. The linear regression models for BI were based on initial BI, sitting balance and social support, whereas for FAC only initial BI and sitting balance were included. The prediction models for ARA were based on the Fugl-Meyer hand score and Motricity Index of hemiplegic side.

[TABLE 4]

Comparing the accuracy of PTs' and OTs' first predictions of final outcome in terms of BI, FAC and ARA (Table 3) with the accuracy of the obtained regression models on the basis of the assessments in the second week (Table 4), revealed no significant differences. The differences ranged from minimally 2.9% (i.e. PTs' first prediction of BI) to maximally 21.8% (OTs' first prediction of ARA; i.e. $0.83 < |Z| < 1.51$, $0.07 < p < 0.20$).

Comparing the accuracy of PTs' and OTs' second prediction of final outcome with the accuracy of the obtained regression models on the basis of week 5 revealed no significant differences for FAC and

ARA (i.e. $0.73 < |Z| < 1.51$, $0.07 < p < 0.23$), whereas a significant difference for both PTs and OTs were found for BI (i.e. 24.4–26.7%, $2.10 < |Z| < 2.4–5$; $p < 0.05$).

The explained variance of both PTs' and OTs' second prediction of outcome in dexterity was 8.1% lower than the variance explained by the regression model obtained in the fifth week after stroke, whereas for FAC the second prediction of outcome by PTs was 8.3% and for OTs 17.7% lower (Table 4).

The prediction models for destination of discharge at both week two and five were based on BI and social support. The prediction model for need for additional care in ADL obtained at week two after stroke was based on BI, age and visuospatial inattention (Table 4). Except for BI, no other determinants were included in the logistic regression model obtained at week five after stroke.

The explained variance of the first predictions of destination of discharge by PTs ($|Z| = 2.07$; $p < 0.05$) and OTs ($3.17 < |Z|$; $p < 0.01$) were significantly lower than the variance explained by the prediction models. No significant differences were found for PTs' and OTs' second prediction of destination of discharge compared to the explained variance of the prediction models for destination of discharge.

The explained variance of PTs' and OTs' first prediction of need for additional care in ADL was not significantly different from the explained variance of the prediction model. However, the accuracy of the second prediction of need for additional care in ADL by PTs ($|Z| = 3.89$; $p < 0.01$) and OTs ($|Z| = 2.71$; $p < 0.01$) was significantly lower than the accuracy of the prediction model.

Influence of patient- and therapist-related characteristics

No significant influence of the characteristics of therapists and patients on the ability to predict final outcome of BI, FAC and ARA was found (Table 5).

[TABLE 5]

DISCUSSION

The aim of the present investigation of PTs and OTs was to predict final outcome in walking ability, dexterity, ADL, need for additional care in ADL, destination of discharge at six months after stroke, using prediction models as a frame of reference. In addition, the effects of patient- and therapist-related characteristics on the predictions were studied.

Prediction of final outcome and destination of discharge

The present study demonstrates that within two weeks after stroke PTs and OTs are capable of predicting final outcome defined at six months after stroke in terms of walking ability, dexterity of hemiplegic arm, ADL, and need for additional care in ADL. The present study also shows that OTs and PTs were less accurate in predicting destination of discharge within two weeks after stroke. The proportion of explained variance of PTs and OTs was 24.0–37.4% lower than the accuracy of prediction obtained by logistic regression analysis. This may be explained by nonmedical factors influencing discharge disposition such as presence of social support (e.g. quality and quantity of interpersonal relationships, marital status and proximity of caregivers), financial income, and patient's residential situation at stroke onset.[13,14] However, it may also indicate that discharge planning, which preferably should begin on the day of admission,[9] was not a part of PTs and OTs goal-setting within the first two weeks after stroke. It should be acknowledged, however, that prediction of outcome in terms of discharge destination is dependent upon knowledge of local culture and social circumstances preventing generalization of the present results to other districts.

Clinical messages

- OTs and PTs can accurately predict level of walking ability and dexterity at six months after stroke.
- Prediction of time required to achieve functional outcome, ADL, need for additional care in ADL and destination of discharge is less optimal.
- The predictions by PTs and OTs are not influenced by the characteristics of patients or therapists.

Except for PTs' prediction of final outcome in BI, slightly more accurate predictions of final outcomes were made at week five after stroke compared to predictions at week two after stroke. The increments in accuracy were, however, only significant for OTs' second predictions of dexterity. However, a comparison between OTs' prediction of dexterity with the prediction model for dexterity revealed an almost significantly lower accuracy for OTs' first prediction (i.e. 21.8%). The latter findings suggests that the improvement in predicting dexterity by OTs was mainly due to the low accuracy of prediction of OTs at onset.

The present study shows, however, an almost optimal prediction of final outcome in dexterity by PTs and OTs at five weeks after stroke; the explained variance of the prediction was only 8.1% lower compared to the explained variance of the prediction model. Data from our prognostic study show that the variance explained by the prediction model for dexterity reached the maximal value from about five weeks after stroke onwards.[31] Apparently, therapists seem to be aware of the fact that the prognosis for functional recovery of the hemiplegic arm is poor in patients with a severe MCA stroke. This is especially the case when functional improvement occurs later in time[34] and voluntary handfunction is not possible during the first weeks after stroke.[35] It was surprising to find that PTs' prediction of ADL at five weeks after stroke was less accurate than the prediction at two weeks after stroke, whereas the prediction model for ADL at five weeks after stroke showed an increment in accuracy of 12% compared to the prediction model at two weeks after stroke. In addition, significant lower accuracies of PTs' and OTs' second predictions for ADL and need for additional care in ADL were found compared to obtained prediction models. These observations may reflect the complexity of predicting ADL as well as need for additional care in ADL, because of the large diversity of functional skills involved. However, the latter findings may also indicate that continuity in monitoring global ADL after stroke is not an integral part of the daily practice of PTs and OTs.

The too pessimistic predictions in the present study compared to the too optimistic prediction found by Korner-Bitensky *et al*.[5,15] and Kent *et al*.[16] may be explained by, on the one hand, the slow but gradual improvement of ADL and walking ability over a relatively long time period, and, on the other hand, the unexpected number of patients (36.2%) who showed, despite a severe hemiparesis at onset, some (24.1%) or complete (12.1%) functional recovery in dexterity. For example, the Copenhagen Stroke Project showed that especially stroke patients with severe disability at onset may show remarkably good functional recovery that may last for at least five months.[36] Accuracy of PTs' and OTs' predictions of time

Required to achieve predicted functional level

The accuracy of OTs' and PTs' predictions of the time necessary for achieving their predicted score at six months after stroke was disappointing. This finding is in agreement with those reported by Korner-Bitensky *et al*.[5] and Kent *et al*.,[16] who also found that the accuracy of prediction was better for achieved level of outcome than for the time necessary to achieve the pro jected goal. This finding may be due to factors such as motivation, mood, perceptual–cognitive deficits, and other factors that may affect the speed of recovery. In addition, the lack of knowledge of therapists about the time course of functional recovery patterns may be an important confounder.[10–11,37] A remarkable finding is that OTs were better in predicting the time required for achieving maximal outcome in ADL than PTs, whereas PTs showed a tendency to make a better prediction of the time required to achieve independence in gait. Both findings may reflect the area of interest of both professions in stroke rehabilitation, that is, OTs are more focused on training ADL and PTs on training walking performance. It should be noted, however, that lack of staff experience did not significantly influence the accuracy of prediction.

The influence of patient and therapist characteristics

Confirming the findings of Korner-Bitensky *et al*.,[5,15] the present study revealed no significant influence of patient characteristics (i.e. age, gender, lesion side, type of stroke and treatment allocation) or therapist-related characteristics (i.e. staff experience, days of observation and number of courses) on the accuracy of predictions of PTs and OTs in the present study. Similar results were obtained when OTs (N = 37) and PTs (N = 49) who treated the patient during both first and second assessment period, were analysed separately. The failure to find that days of observation, staff experience and number of courses influence the accuracy of prediction suggests that the ability to set feasible treatment goals is not influenced by the experience of the therapist. The question is whether or not the lack of knowledge about achievement of treatment goals in the long term is an important omission in the learning process to optimize clinical judgement.[3,38] In addition, the exchange of information about adequateness of (long-term) goals should provide a standardized element in the education of staff members involved in an early stage of stroke management. The latter enables clinicians to evaluate the hypotheses, which is a key element for improving the process of clinical reasoning.[3,38]

It should be acknowledged, however, that the number of patients included in the present study is small and involved a highly selected group of patients who fulfil the selection criteria, excluding many other factors which may explain the variability in outcome. However, especially for this homogeneous group of stroke patients, predicting outcome of ADLs as well as destination of discharge is critical. In addition, the statistical analysis needed to validate the accuracy of predictions as well as to enable comparison with derived models is quite complex. Another limitation is that findings with respect to, for example, discharge destination, are dependent upon knowledge of local culture and social circumstances preventing further generalization of results in the present study. Even destination of discharge (e.g. home, nursing home or rehabilitation facility) may have limited applicability in other countries. Despite these limitations it can be concluded that compared to prediction models, OTs and PTs can accurately predict level of walking ability and dexterity at six months after stroke. The prediction of time required to achieve final outcome, destination of discharge, outcome of ADL as well as need for additional care in ADL leaves room for improvement.

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TABLES AND FIGURES

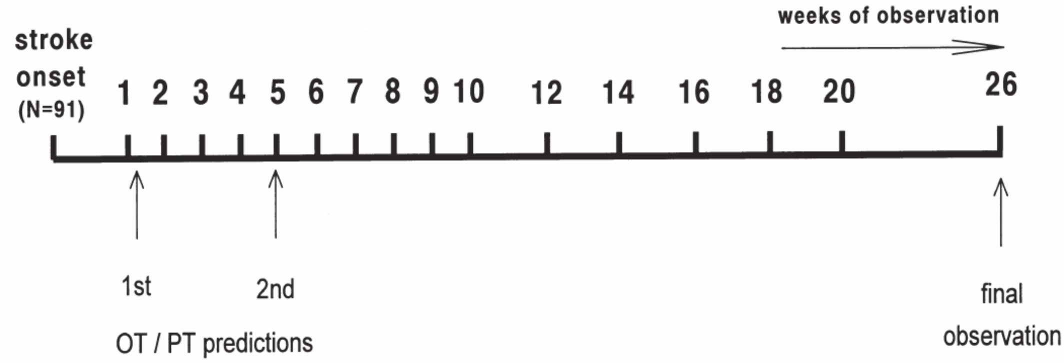

Figure 1 Time schedule for OTs' and PTs' predictions and moments of observation.

Table 1 Characteristics of stroke patients included in the study

Number	91
Sex (m/f)	52/39
Age, years (±SD)[a]	65.5 (10.3)
MMSE (±SD)[a]	26.3 (2.4)
Hemisphere of stroke (L/R)	36/55
Type of stroke (OCSP)	
TACI	54
PACI	30
LACI	7
Score within 2 weeks after stroke:	
% SB (0/1)	73.3
BI (0-20)[b]	6.0 (4.0)
FAC (0-5)[b]	0.0 (1.0
ARA (0-57)[b]	0.0 (1.0)
Final score at 6 months after stroke:	
BI (0-20)[b]	17.0 (8.5)
Months needed to achieve maximal BI level[a]	4.6 (1.7)
FAC (0–5)[b]	4.0 (2.0)
Months needed to achieve FAC 4[a,c]	2.1 (1.9)
ARA (1-57)[b]	1.0 (42.0)
% need additional care in ADL	65.2
% discharged home	58.4

[a]Mean scores (standard deviations in parentheses).
[b]Median scores (interquartile ranges in parentheses).
[c]Performed on 77 patients who were not able to walk independently (FAC 4 or more) at moment of second assessment.
MMSE, Mini-Mental State Examination; OCSP, classification following Oxfordshire Community Stroke Project;
TACI, total anterior circulation infarct; PACI, partial anterior circulation infarct; LACI, lacunar anterior circulation infarct;
SB, sitting balance; BI, Barthel Index; FAC, Functional Ambulation Categories; ARA: Action Research Arm test;
ADLs, activities of daily living.

Table 2 Characteristics of PTs' and OTs' predictions in the second and fifth week after stroke

Characteristic	PT (mean ±SD)	OT (mean ±SD)	Test statistic	*p*-value
Number of participating therapists	59	47		
Number questionnaires returned:				
First prediction	91	74		
Second prediction	78	69		
Mean interval (days) between stroke onset and first prediction (± SD)	9.4 (4.7)	10.9 (5.0)	0.14[a]	0.71
Mean interval (days) between stroke onset and second prediction (± SD)	32.8 (7.9)	34.1 (8.3)	0.27[a]	0.60
Days of treatment before first prediction (± SD)	5.7 (3.3)	3.1 (2.3)	4.09[a]	0.045*
Days of treatment before second prediction (± SD)	13.1 (9.3)	14.4 (13.9)	0.15[a]	0.70
Years of experience with stroke rehabilitation at first prediction (± SD)	7.3 (5.7)	6.3 (5.1)	0.12[a]	0.73
Years of experience with stroke rehabilitation at second prediction (± SD)	6.3 (5.1)	6.4 (5.0)	0.62[a]	0.43
Number of courses (%) at 1st assessment:				
0 courses	20.0	25.6		
1 course	64.4	62.8	0.81[b]	0.53
2 courses	15.5	10.3		
3 courses or more	1.1	1.3		
Number of courses (%) at 2nd assessment:				
0 courses	8.2	7.6		
1 course	75.3	74.2	0.74[b]	0.64
2 courses	16.5	18.2		
3 courses or more	0	0		
Type of courses (number) at 1st assessment:				
NDT	80	64		
PNF	10	4	0.74[b]	0.64
Brunnstrom	1	0		
Other approach	3	1		
Type of courses (number) at 2nd assessment:				
NDT	57	58		
PNF	6	14	1.08[b]	0.19
Brunnstrom	0	0		
Other approach	1	1		

*$p < 0.05$.
[a]Test statistic following Student's *t*-test.
[b]Test statistic following Kolmogorov–Smirnov two-sample test.
PT, physical therapist prediction; OT, occupational therapy prediction; 1st, comparison between first predictions of OTs and PTs; 2nd, comparison between second predictions of OTs and PTs; NDT, neuro-development treatment; PNF, proprioceptive neuromuscular facilitation.

Table 3 Correlation coefficients and percentages of accuracy of PTs' and OTs' first and second predictions of observed outcomes at six months after stroke

	Chance (%)	Association and accuracy of PTs' first prediction				Association and accuracy of PTs' second prediction				Association and accuracy of OTs' first prediction				Association and accuracy of OTs' second prediction			
		r_s (95% CI)	%ac	%opt	%pes	r_s (95% CI)	%ac	%opt	%pes	r_s (95% CI)	%ac	%opt	%pes	r_s (95% CI)	%ac	%opt	%pes
Projected level:																	
FAC level (0–5)	16.6	0.60** (0.51–0.72)	33.0	30.7	36.3	0.71** (0.57–0.80)	48.0	26.0	26.0	0.60** (0.42–0.73)	48.0	18.6	33.3	0.64** (0.57–0.80)	49.2	24.6	26.2
ARA level (1–4)	25.0	0.68** (0.55–0.78)	51.1	14.7	34.1**	0.78** (0.67–0.85)	63.6	9.1	27.3[b]	0.60** (0.43–0.73)	48	21.3	30.6	0.78** (0.67–0.86)	59.1	10.6	30.3**
BI level (1–4)	25.0	0.69** (0.54–0.79)	42.5	18.3	39.0*	0.60** (0.43–0.72)	57.3	24.0	19.0	0.61** (0.44–0.74)	54.2	19.5	26.4	0.62** (0.45–0.75)	56.7	20.9	22.4
Need additional care in ADL (0/1)[c]	50.0	0.63** (0.48–0.74)	81.8	5.7[a]	12.6[b]	0.64** (0.49–0.76)	80.5	10.3[a]	9.2[b]	0.59** (0.41–0.73)	78.9	8.5[a]	12.6[b]	0.73** (0.60–0.82)	83.8	10.3[a]	5.9[b]
Destination of discharge (0/1)[c,d]	50.0	0.50** (0.32–0.64)	72.4	11.5[a]	16.1[b]	0.61** (0.45–0.74)	79	10.5[a]	10.5[b]	0.34** (0.12–0.53)	65.3	15.3[a]	19.4[b]	0.60** (0.42–0.74)	78.8	13.6[a]	7.6[b]
Projected time:																	
Month(s) to achieve FAC 4[e]	14.3 16.6[f]	0.43** (0.22–0.61)	22.0	48.0	40.0	0.30* (0.05–0.50)	10.4	29.2	60.4	0.28* (0.03–0.50)	12.2	36.6	51.2	0.15 (−0.11–0.39)	7.3	31.7	61.0
Month(s) to achieve BI level[e]	14.3 16.6[f]	0.07 (−0.15–0.27)	20.3	45.2	34.5	0.29** (0.07–0.49)	21.6	33.8	44.6	0.38** (0.16–0.55)	27.5	30.4	42.1	0.33** (0.09–0.53)	24.7	27.7	47.6*

*p <0.05.
**p <0.01.
r_s, Spearman rank correlation coefficient; %ac, percentage of accurate predictions; %opt, percentage of optimistic predictions; %pes, percentage pessimistic predictions.
[a]% false positives ('too optimistic').
[b]% false negatives ('too pessimistic').
[c]Based on logistic (conditional) regression analysis (i.e. goodness-of-fit statistic based on the coefficient of Nagelkerke R^2).[32]
[d]Possibilities for predicting discharge disposition 6 months after stroke. 0 Represents 'discharged to home' at 6 months and 1 represents 'discharged to nursing-home or rehabilitation centre' at 6 months after stroke.
[e]Patients who at second prediction had reached already FAC level 4 (or more) (n = 14) or maximum ADL level (n = 9) were excluded for further analysis of time needed to achieve functional task.
[f]% chance at 5th week post stroke.
% within 1 score = percentage of accurate predictions deviating one point from level of outcome.
Chance (%) = % of accuracy by chance at moment of first prediction after stroke.
ARA (1–4) = Level of Action Research Arm score (level 1 = score 0–9 points; level 2 = score 10–29 points; level 3 = 30–56 points and level 4 = 57 points).
FAC (0–5) = Functional Ambulation Categories, scores range from 0 (unable to walk) to 5 (able to walk independently stairs and unequal surfaces).
BI (1–4), Barthel Index categorized into 4 levels of dependency (level 1 = score 0-45%; level 2 = score 50-70%; level 3 = score 75-95%; level 4 = score 100%).

Table 4 Multiple correlation coefficients of derived regression models based on determinants (variables) assessed at week 2 and 5 after stroke onset

Week of assessment after stroke	BI[a]		FAC[a]		ARA[a]		Dependency[b]			Destination of discharge[b]		
	Variable	R (± 95% CI)	Variable	R (± 95% CI)	Variable	R (± 95% CI)	Variable	R (± 95% CI)	%ac	Variable	R (± 95% CI)	%ac
Week 2	BI-2, SB, SS	0.71 (0.59–0.80)	BI-2, SB	0.68 (0.55–0.78)	FMH-2, MI-tot	0.76 (0.66–0.83)	BI-2. Age, neglect	0.75 (0.64–0.83)	83.2	BI-2, SS	0.70 (0.57–0.79)	82.0
Week 5	BI-5, SB, SS	0.79 (0.71–0.86)	BI-5, SB	0.77 (0.66–0.84)	FMH-5, MI-tot	0.83 (0.77–0.90)	BI-5	0.88 (0.82–0.95)	88.5	BI-5, SS	0.74 (0.63–0.82)	83.9

[a]Based on multiple linear regression analysis.
[b]Based on logistic (conditional) regression analysis (i.e. coefficient of Nagelkerke *R*).
R=Derived (standardized) multiple correlation coefficient after Fisher's *Z* transformation (95% CI between brackets).
%ac, percentage accurate (false negative + false positive) predictions; BI, Barthel Index; SB, sitting balance; SS, social support; FMH, Fugl-Meyer hand score; MI-tot, Motricity Index of hemiplegic side.

Table 5 The (adjusted) correlation coefficients for covariates possibly influencing accuracy of therapists' first and second predictions

	PTs' first prediction			PTs' second prediction			OTs' first prediction			OTs' second prediction		
Adjusted covariates	BI	FAC	ARA	BI	FAC	ARA	BI	FAC	ARA	BI	FAC	ARA
95% CI for r* (lower and upper bound)	0.56<r<0.78	0.51<r<0.76	0.56<r<0.78	0.40<r<0.72	0.63<r<0.84	0.67<r<0.85	0.45<r<0.74	0.40<r<0.72	0.43<r<0.73	0.40<r<0.72	0.33<r<0.69	0.67<r<0.86
Therapist-related covariates:												
Number of days before first observation	0.69	0.65	0.70	0.56	0.74	0.79	0.61	0.58	0.60	0.61	0.68	0.77
Actual number of days of observation	0.69	0.64	0.69	0.59	0.75	0.8	0.61	0.57	0.62	0.58	0.67	0.78
Staff experience (years)	0.68	0.64	0.71	0.59	0.75	0.82	0.62	0.57	0.62	0.57	0.57	0.78
Number of courses	0.68	0.65	0.70	0.58	0.76	0.79	0.61	0.57	0.61	0.56	0.63	0.79
Patient-related covariates:												
Age of patient (years)	0.64	0.61	0.69	0.53	0.73	0.79	0.54	0.55	0.62	0.51	0.65	0.77
Gender of patient	0.68	0.65	0.71	0.58	0.75	0.80	0.62	0.58	0.62	0.56	0.66	0.78
Lesion side	0.69	0.65	0.70	0.60	0.75	0.80	0.61	0.58	0.62	0.60	0.67	0.78
Type of stroke (OCSP)	0.59	0.58	0.65	0.47	0.69	0.75	0.48	0.50	0.57	0.44	0.56	0.72

*r**95% Confidence Interval for standardized and transformed (i.e. Fisher *Z*) regression coefficients of PTs and OTs without adjustment for covariates.
BI, Barthel Index; FAC, Functional Ambulation Categories; ARA, Action Research Arm test; OCSP, Oxfordshire Community Stroke Project.