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The Functional Independence Measure used in a Dutch rehabilitating stroke population; a pilot study to assess progress

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In contrast to the United States, the Functional Independence Measure (FIM) is seldom used in Dutch rehabilitation settings. The purpose of this study was to determine if the FIM could be used in a Dutch stroke population to assess progress during rehabilitation. Patients with a recent stroke who received inpatient treatment were included in this longitudinal pilot study, which used the standard error of measurement (SEM) to quantify progress. Mean (SD) age of the subjects (n=48) was 61.3 (10.5) and 25 (56%) were male. Mean (SD) length of stay (LOS) was 141.3 (75.0) days. For 42 subjects, admission and discharge scores of the FIM were registered. The mean admission (93.0, SD=23.3), as well as the discharge (112.4, SD=11.0) scores were rather high. The mean FIM difference (SD) between admission and discharge was 19.3 (16.9). However, only 55% exceeded a difference score of 13 points, indicating progress. Results of this pilot study confirm the ceiling effect of the FIM in this population. Based on the findings of our pilot study we conclude that the FIM is not suitable to assess progress in a Dutch rehabilitating stroke population.

Im Gegensatz zu den USA wird der funktionale Selbständigkeitsindex (FIM) in niederländischen Rehabilitationseinrichtungen selten herangezogen. In dieser Studie sollte festgestellt werden, ob der FIM in einem niederländischen Kollektiv von Schlaganfallpatienten zur Beurteilung des Fortschritts bei der Rehabilitation verwendet werden kann. In diese Längsschnitt-Pilotstudie, in der der Fortschritt anhand des Standardfehlers des Mittelwerts (SEM) quantifiziert wurde, wurden Patienten mit kürzlich stattgehabtem Schlaganfall, die stationär behandelt wurden, aufgenommen. Das mittlere (SD) Alter der Patienten (n=48) lag bei 61.3 (10.5), und 25 (56%) waren männlich. Die mittlere (SD) Dauer des stationären Aufenthalts (LOS) lag bei 141.3 (75.0) Tagen. Für 42 Patienten wurden die FIM-Scores bei Aufnahme und Entlassung dokumentiert. Das mittlere Score bei der Aufnahme (93.0, SD=23.3) und bei der Entlassung (112.4, SD=11.0) waren relativ hoch. Der mittlere FIM-Unterschied (SD) zwischen Aufnahme und Entlassung betrug 19,3 (16.9). Allerdings lag der Unterschied in den Scores nur bei 55% über 13 Punkten, was einen Fortschritt anzeigt. Die Ergebnisse dieser Pilotstudie bestätigen den Ceiling-Effekt des FIM in diesem Kollektiv. Auf der Basis der Befunde unserer Pilotstudie schließen wir, dass der FIM für die Beurteilung des Fortschrittes in einem niederländischen Kollektiv rehabilitierender Schlaganfallpatienten nicht geeignet ist.

A la différence des Etats-Unis, l'Indicateur d'Indépendance Fonctionnelle (FIM pour Functional Independence Measure) est rarement employé dans les institutions de réadaptation des Pays-Bas. Le but de la présente étude était de déterminer si cet indicateur pouvait être utilisé pour évaluer les progrès au sein d'une population de patients néerlandais hospitalisés, en cours de réadaptation à la suite d'un accident vasculaire cérébral (AVC). Cette étude pilote longitudinale a inclus des patients ayant récemment subi un AVC, dont les progrès ont été quantifiés à l'aide de l'erreur standard de mesure (SEM). L'âge moyen (ET) des patients (N=48) était de 61.3 (10.5) ans et 25 sujets (56%) étaient de sexe masculin. La durée moyenne du séjour (ET) a été de 141.3 (75.0) jours. Le FIM a été déterminé chez 42 sujets lors de l'admission et de la sortie de l'institution et les scores moyens ont été plutôt élevés, tant lors de l'admission (93.0, ET=23.3) qu'à la sortie de l'institution (112.4, ET=11.0). La différence moyenne (ET) des scores du FIM entre l'admission et la sortie a été de 19.3 (16.9). Toutefois, seuls 55% des sujets ont présenté une différence supérieure à 13 points, indicatrice d'une évolution favorable. Les résultats de cette étude pilote confirment l'effet plafond du FIM dans cette population. Sur la base des résultats de notre étude pilote, nous concluons que le FIM n'est pas adapté à l'évaluation de l'évolution de la réadaptation dans une population néerlandaise ayant subi un AVC.

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A diferencia de la situación en los Estados Unidos, en Holanda apenas se emplea la Medida de Independencia Funcional (*Functional Independence Measure*, FIM) en el ámbito de la rehabilitación. El objetivo de este estudio fue determinar el posible uso de la FIM en una población de pacientes holandeses con ictus para evaluar el progreso conseguido durante la rehabilitación. Se trató de un estudio piloto longitudinal en el que participaron pacientes con ictus reciente tratados en régimen hospitalario; para cuantificar el progreso se utilizó la medida del error estándar (MES). La edad media (DE) de los sujetos (N=48) era de 61.3 años (10.5), y 25 de ellos (56) eran varones. La duración media (DE) de la estancia hospitalaria (DEH) fue de 141.3 (75.0) días. Se obtuvieron las puntuaciones de la FIM en el ingreso y el alta de 42 sujetos. Los valores promedio tanto en el ingreso (93.0, DE=23.3) como en el alta (112.4, DE=11.0) fueron bastante elevados. La diferencia media (DE) fue de 19.3 (16.9). No obstante, sólo el 55 de los pacientes presentaron una diferencia de más de 13 puntos, indicativa de progreso. Estos hallazgos confirman el efecto de tope de la FIM en esta población. Llegamos a la conclusión de que la FIM no es adecuada para evaluar el progreso en un población de pacientes holandeses en rehabilitación tras un ictus.

Keywords: FIM; outcome; progress; rehabilitation; stroke

Introduction

The Functional Independence Measure (FIM) is a method of assessing basic quality of daily living activities (Ottenbacher *et al*., 1996). However, unlike the United States, the FIM is seldom used in Dutch rehabilitation settings. In stroke rehabilitation, Dutch physicians far prefer the (modified) Barthel Index (Torenbeek and van Harten, 1999). A disadvantage of the Barthel Index is that items pertaining to communication and cognition, important aspects in stroke rehabilitation, are missing. Moreover, its ceiling effect could hamper its possible use as an outcome indicator.

The FIM is used for various purposes such as: predicting hours of care needed (Disler *et al*., 1993), identifying rehabilitation needs (Ockowski and Barreca, 1993), predicting rehabilitation outcomes (Heineman *et al*., 1994) and predicting discharge destination (Mauthe *et al*., 1996).

In recent years, the FIM and other instruments have tended to be used for outcome measurement, thus providing information on the progress of the patient. In scientific terms they serve as an 'outcome indicator'; a measurable aspect of the health care provision that can be used as a possible indicator of the quality of care (van Harten, 1997). In Dutch rehabilitation only 5–10% of stroke patients are admitted for specialised medical in-patient rehabilitation; these are mostly younger patients (<75 years) with serious disabilities and with a reasonable expectation of discharge to the home situation. This is usually successful in about 95% of those entering the rehabilitation program (van Harten, 1999). Often, a mix of initially in-patient and out-patient rehabilitation or home-based physiotherapy is provided to help patients to achieve optimal functioning.

The FIM is an internationally often-used instrument but in European countries a varying rate of uptake is found (Torenbeek and van Harten, 1999). Among Dutch rehabilitation physicians there is – as yet – no support for structural implementation of the FIM.

Before choosing an instrument that can serve as an outcome indicator, a set of criteria has to be established that can differ per study or program. In addition to scientific properties, practical aspects such as the administrative burden and acceptance by the professionals who undertake the scoring must be considered. We therefore decided to perform a series of pilot studies with various outcome instruments in order to be able to make informed choices for systematic use in quality management (Streppel *et al*., 2001).

The purpose of this study was to determine whether the FIM can be used in a Dutch rehabilitating stroke population to assess progress between the level of disability at admission and discharge.

Materials and Methods

Design

Patients with a recent stroke who were prescribed an in-patient treatment at the rehabilitation centre were included. Patients or, in case of serious aphasia or cognitive problems, proxy respondents were asked to participate in this study in the first week after admission. Only patients/proxies with a good command of the Dutch language were included.

After receiving informed consent, an occupational therapist completed the FIM, if necessary with help from a member of the nursing staff, a speech therapist

or a physical therapist. This was repeated (by the same occupational therapist) the last week before discharge. The occupational therapists received an informal training in completing the FIM, consisting of a review of the manual and a comparison of results using some case studies. In this study, an unpublished Flemish translation of the FIM and FIM manual was used.

Instruments

The FIM is part of the Uniform Data System for Medical Rehabilitation (UDS_{MR}). The FIM is an 18-item, 7-level scale of independent performance in self-care, sphincter control, transfers, locomotion, communication, and social cognition. By adding the points for each item, the possible score ranges from 18 (lowest) to 126 (highest level of independence).

The reliability, validity and responsiveness of the FIM has been tested by several researchers. Ottenbacher *et al*. (1996) concluded, after a quantitative review of 11 studies, that the FIM demonstrated acceptable reliability across a wide variety of settings, raters and patients. Dodds *et al*. (1993) examined UDS data on 11 102 general rehabilitation in-patients to find evidence concerning the internal consistency, responsiveness over time, and construct validity of the FIM. They concluded that the FIM has high internal consistency and adequate discriminative capabilities for rehabilitation patients. It is a good indicator of burden of care, and demonstrates some responsiveness, but its capacity to measure change over time needs further examination and comparison with competing scales. Bohannon (1999) studied whether FIM scores for individual items are more responsive than Barthel scores for transfers and locomotion in a home care patient population. He concluded that the FIM was more responsive than the Barthel for measuring both independence at transfers and locomotion.

Statistics

The standard error of measurement (SEM) is a method that can be used to calculate longitudinal change in time. The SEM provides an interpretation of the magnitude of the within-subject variability, which is also known as error variance. Difference between two measurements should be at least $1.96*\sqrt{2}*SEM$ to be 95% confident of a real difference between the true scores (Beckerman, 1996).

The SEM can be computed using the formula: $SEM=SD\sqrt{1}-r$, where SD is the standard deviation and r is the reliability value. Ottenbacher *et al*. (1996) computed the SEM for the FIM using the standard deviation contained in the annual UDS_{MR} report for 1994 (n=150 000) and the test–retest reliability obtained in their own review study. Using their information, progress in this investigation is expressed as: $1.96*\sqrt{2}*(21\sqrt{1}-0.95) = 13.0$.

Results

Sixty stroke patients signed informed consent forms. After admission, two subjects died, five returned to the hospital and five had to be admitted to a nursing home. The mean (SD) age of the remaining 48 subjects was 61.3 (10.5) and 25 (56%) were male. Mean (SD) length of stay (LOS) was 141.3 (75.0) days.

Due to practical problems not all admission and discharge scores could be registered. Both admission and discharge scores of the FIM were registered for 42 subjects. These scores are shown in Table 1. The mean admission (93.0) as well as the discharge (112.4) scores are rather high. The standard deviation of the mean admission score is large (23.3), indicating large differences between patients. The standard deviation of the mean discharge score is much lower (11.0). This could indicate a ceiling effect.

In this stroke population, the most serious problems are experienced during transfers and mobility. Compared with the admission scores, the scores on the domains self-care, transfers and locomotion increased most.

The expectation was that all patients would make progress after an intensive in-patient rehabilitation treatment. Although the mean FIM difference is 19.3, only 55% exceeded a difference score of 13 points,

Table 1. Mean (SD) FIM scores at admission, discharge and difference scores (n=42)

FIM domains	*Score range*	*Admission (SD)*	*Discharge (SD)*	*Difference (SD)*
Self-care	6–42	30.1 (8.8)	38.1 (4.8)	7.9 (6.8)
Sphincter control	2–14	12.7 (2.6)	13.6 (1.4)	0.9 (2.2)
Transfers	3–21	14.5 (5.8)	19.5 (1.5)	5.0 (5.0)
Locomotion	2–14	9.0 (2.9)	11.6 (2.0)	2.6 (2.3)
Communication	2–14	10.8 (4.2)	11.8 (3.0)	1.0 (1.8)
Social cognition	3–21	15.8 (5.0)	17.8 (3.6)	1.9 (3.0)
Total score	18–126	93.0 (23.3)	112.4 (11.0)	19.3 (16.9)

indicating progress (see Statistics). On looking more thoroughly at the data, it appeared that 11 subjects (26%) had FIM admission scores higher than 113. For those subjects it was impossible to achieve a difference score of at least 13 points, because the maximum score is 126. When these 11 subjects were omitted from the data set, the percentage that progressed by at least 13 points was 74%. If the rehabilitation goals are set lower, such that the patients perform some or all activities relatively independently (score 6) instead of totally independently (score 7), the progress percentage enlarges further. These results confirm the ceiling effect in this population.

Discussion

The purpose of this study was to determine if the FIM can be used in a Dutch rehabilitating stroke population to assess progress concerning the level of disability between admission and discharge. Most probably because of a ceiling effect, only 55% of the subjects showed progress of 13 points or more in our study. Based on these results, the FIM is not suitable as an outcome instrument in the present stroke population. Only by changing admission policies or by omitting the initially 'good' patients (admission score >113) does the FIM become more applicable.

The ceiling effect seen here can be explained by comparing our admission and discharge scores with other FIM studies in rehabilitating stroke patients. Table 2 indicates the admission and discharge scores and LOS of two American studies (Fiedler *et al*., 1996), (Dodds *et al*., 1993), one Canadian study (Ockowski and Barreca, 1993), one study from Israel (Ring *et al*., 1997) and the present study.

In our population, admission scores are comparable or even higher than the discharge scores in the American and Canadian populations. The mean (SD) LOS is also different. The results of Ring *et al*. (1997) indicate that rehabilitation of stroke patients in Israel is more comparable to the Dutch situation. The stroke rehabilitation population and rehabilitation treatment in various countries thus seems to differ; perhaps American stroke patients are admitted and discharged faster after their stroke and treatment goals are set somewhat lower. Ockowski and Barreca (1993) stated that patients with admission FIM scores of 36 or less never return home, whereas patients with admission FIM scores of 97 or more inevitably go home. Exclusively, this last group of patients is admitted in Dutch rehabilitation centres.

There is no reason to suggest that the subjects of this pilot study are an unrepresentative sample of stroke patients. Het Roessingh is one of the four largest rehabilitation centres in the Netherlands. It would, however, seem more likely that the centre admits more severe stroke patients, with lower FIM admission scores. Comparing age and gender distribution and LOS with two other Dutch studies (Prevo *et al*., 1998), (Engbers and van Harten, 2001) shows that mean/median age (58.1, 61.3, respectively) and gender distribution (48 (56%) male) are similar. However, mean LOS is lower in this pilot study; 20 weeks compared with 28 and 31.5 weeks, respectively. This might indicate that the severity of stroke in the pilot population was less than in the national studies.

Another explanation for the differences in scores might be that no formal UDS training took place in this study and that the therapists scored consistently higher than normal. However, there are no indications that this was the case, because the therapists indicated that the low scores (2–4) were especially difficult to differentiate whereas the high scores (6,7) were not.

The 7-point scales of the FIM are recorded ordinally and are not unidimensional. This means that the FIM data allow only rank ordering. Some researchers (Cook *et al*., 1994) even think that the separate scales cannot be summed. Rasch analysis is suggested by several researchers (Heinemann *et al*., 1993; Linacre *et al*., 1994) to transform these ratings to an interval scale on which the intervals between units of the scale have equal values. In this study the FIM items were summed, and the standard error of measurement (SEM) was used to analyse the data.

The conclusion of this pilot study is that the FIM can, as yet, not be used in a Dutch rehabilitating

Table 2. Admission and discharge FIM-scores and LOS of several studies in rehabilitating stroke patients

Authors	*n*	*Mean (SD) admission score*	*mean (SD) discharge score*	*LOS (days)*
Fiedler *et al*. (1996)	47,124	62.5 (21)	86.6 (25).	25 (16)
Dodds *et al*. (1993)	5,717	68*	93*	–
Ockowski and Barreca (1993)	113	80 (median)	94 (median)	64*
Ring *et al*. (1997)	151	72.3*	97.9*	109.3*
Present study	42	93.0 (23.3)	112.4 (11.0)	141 (75)

*SD unknown

stroke population to assess progress concerning the level of disability between admission and discharge. These results are unexpected, because the FIM has proved its value in many (mainly American) studies. Unfortunately, no other measures besides the FIM are used in this study, so no recommendations can be made concerning alternatives for assessing progress. Research studies in other Dutch rehabilitation centres, after formal UDS training, and in other subgroups of patients might provide more insight into possible differences between Dutch and foreign rehabilitation programmes.

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