



British Society of Rehabilitation Medicine
C/o Royal College of Physicians
11 St Andrews Place
London NW1 4LE
Tel: 01992 638865
Fax: 01992 638674
admin@bsrm.co.uk
www.bsrm.co.uk

Measurement of outcome in Rehabilitation

The British Society of Rehabilitation Medicine

"Basket" of Measures

1.1 Introduction

Few dispute the need to measure outcome in rehabilitation, but it is easier said than done. A large number of instruments are available, but many of them are "home-grown" and poorly validated. To compare different populations, practices and programmes a common language will be required.

No one single instrument can be used as a common language in disability measurement, but since 2000, the BSRM has published a "basket" of recommended instruments which provide a working shortlist.

1.2 Selection criteria

Selection of the basket will inevitably depend on a number of criteria which may vary from service to service. They include:

- The level at which measurement is required (e.g. impairment, activity, participation)
- The type of clients and conditions treated (e.g. neurological, musculoskeletal, amputation)
- The rehabilitation setting (e.g. hospital, community, uni-disciplinary, multi-disciplinary)
- Time constraints and other external factors.
- The purpose for which the data are required (research, reporting to commissioners etc.)

Instruments selected should, as far as possible, be:

- Valid
- Reliable
- Sensitive to change
- Clinically useful
- Feasible to use in the given setting

One possible indicator of a scale's usefulness is how widely it is used. If teams do not find the information clinically useful, it is unlikely that they will continue to collect it. In 1997 the BSRM undertook a survey of its membership to establish the outcome measures in common usage, across different services and settings(1). The most commonly used scales were identified and formed the basis for the provisional BSRM basket of measures. The survey has recently been repeated (Skinner and Turner-Stokes, 2005 in press) to inform updating of the basket.

1.3 Principles of the Basket

- The proposed basket represents a selection of the scales that are:
 - Scientifically evaluated
 - In routine use in clinical practice in the UK (by at least 10 units) , or recommended for routine use through guidelines/standards published by the BSRM.
- The basket is periodically reviewed by the BSRM Research and Clinical Standards Committee. Additional measures may be added if they meet those criteria
- An information sheet is available from the BSRM indicating how copies of the basket instruments may be obtained.
- Training courses may be run from time to time in conjunction with the BSRM to familiarise users with some of the scales, help to maintain consistent scoring and to encourage collaborative working between users.
- Many of the measures are detailed and referenced in Derick Wade's book "Measurement in Neurological Rehabilitation" OUP. Oxford. 1992. However, the list and source references are given on the attached sheet.

1.4 Application of measures

In applying these measures, the user is reminded of the following:

1. The fact that change has occurred during rehabilitation does not mean that it is necessarily due to the rehabilitation – it could have occurred spontaneously.
2. It is important to choose an instrument which is relevant to the intervention and responsive to the scale of change that is likely to be produced.
3. Data should still be handled appropriately according to good scientific principles.
 - If data is not consistently collected, there is still no valid comparison.
 - Instruments should be used according to the manual.
 - If specific training is necessary, make sure the team is properly trained and updated. Familiarising the team with a small number of instruments makes for consistent use.
 - Ordinal data should not be summated or subjected to mathematical manipulation (eg divided by other figures) unless there is good evidence that this is a valid approach.
 - They may be handled by non-parametric statistical methods.
 - The user is referred to the original literature for information on how the scales should be used. For this reason, the relevant evaluative literature is given for each instrument listed.

Prof Lynne Turner-Stokes DM FRCP
Research and Clinical Standards Lead, BSRM
July 2005

2 BSRM Basket of recommended outcome measures

Category	Recommended and widely used	Alternative options used by some units
Neurological Impairment and Spinal Cord Injury classification	American Spinal Injury Association International Standards for Neurological Classification of Spinal Cord Injury (ASIA)(100)	Frankel Scale(101)
Motor function tests		
Generalised motor impairment	Motricity Index(2)	Motor Assessment Scale(3)
Mobility	10 m Walk(4)	Rivermead Mobility Index(6) Functional Ambulation Categories(7, 8) SIGAM Mobility grades (9)
Mobility in Amputees	Haroldwood and Stanmore Mobility grades(5)	
Upper limb function	Nine-hole Peg Test(10)	Frenchay Arm Test(11)
Global Disability / Activities of daily living (ADL)	Barthel Index (manual as per Wade and Collin 1988(12)) UK FIM±FAM(13)_(Includes a neurological impairment set)	Health Assessment Questionnaire (HAQ) – UK version(14))
Dependency and care hours	Northwick Park Dependency Score (NPDS)(15) Northwick Park Care Needs Assessment (NPCNA) (16, 17)	
Extended ADL	Frenchay Activities Index(18)	Nottingham EADL scale(19) BICRO-39(20)
Participation	Canadian Occupational Performance Scale (COPM)(21)	London Handicap Scale (stroke)(22) Craig Handicap Assessment and Reporting Tool (CHART)(23) Life Satisfaction Index(24)
General health		[General Health Questionnaire - version GHQ-12 or -28(25)]
Pain	Numbered rating or Visual Analogue Scale.	Oswestry Low Back Pain Disability Questionnaire (ODQ)(26) McGill Pain Score(27)
Depression* Screening Non-verbal Behavioural	Yale Question: 'Do you often feel sad or depressed?'(28) Graphic rating scale e.g. (DISCs)(29) Depression Intensity Scale Circles Signs of Depression Scale (SDSS)(30) Geriatric Depression Scale (Shortform-16)(31)	[Hospital Anxiety and Depression Scale (HADS)(32)] [Beck Depression Inventory (BDI-II)(33)]
Verbal		
Carer Burden	Caregiver Strain Index(34)	

* As recommended in the BSRM/RCP Concise guidance on Assessment and Management of depression in acquired brain injury

[Scales in blue are copy-right protected]

3 Comments on validation

3.1 Specific Motor function tests:

a) Generalised

3.1.1 Motricity Index(2)

" A simple short measure of motor loss primarily developed for use after stroke but probably useful in any patient with upper motor neurone weakness. Validity and reliability proven, and sensitive to change seen in recovery after stroke."

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(2, 7, 35-37)

3.1.2 Motor Assessment Scale(3)

"Eight hierarchical scales largely focused on disability (the assessment of tone is of impairment, but it is unreliable). Although well studied with good support for validity and reliability, it is a long test"

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(3, 38, 39)

b) Mobility

3.1.3 10 m Walk(40)

The 10-m timed walking test is remarkably simple, reliable, valid, sensitive, communicable, useful and relevant – almost the perfect measure! Validity has been established in many studies, albeit often unintentionally. Reliability has also been established in many studies, both for test-retest and between observers. It is important to give consistent directions to the patient because overt encouragement can increase speed "

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(4, 7, 40-42)

3.1.4 Rivermead Mobility Index(6)

"A further development of the Rivermead Motor Assessment – it is simple to use, clinically relevant and reliable within 1 point"

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(6)

3.1.5 Functional Ambulation Categories(8, 42)

"This categorisation is designed to give detail on the physical support given by patients who are walking, particularly in a physical therapy department. Validity and reliability are established: simple to use and sensitive to change during the transition from being immobile to walking."

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(7, 8, 42)

Amputee and prosthetic rehabilitation

3.1.6 Harold Wood and Stanmore Mobility Grades (Amputee rehab)(5)

These simple mobility grades have been developed for categorisation of mobility in prosthetic rehabilitation, but are currently being revised.(5)

c) Upper limb function

3.1.7 Nine-hole Peg Test

"It has been tested for validity and reliability. Its advantages include simplicity, portability and brevity. It is sensitive to changes at the upper level of performance, but not when impairment is severe."

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(10, 36, 43, 44)

3.1.8 Frenchay Arm Test(11)

"Validity and reliability have been demonstrated. Sensitivity is reasonable, but patients tend to either pass or fail all tests. It is simple and quick, but requires some equipment and is not portable"

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(11, 36, 44-46)

3.2 Global disability/ADL measures

3.2.1 Barthel Index(47)

Very widely used assessment of dependency in activities of daily living. Reliability and validity well-established, but sensitivity relatively poor. Useful as a spot test of function and as an indicator of gross functional change. No direct assessment of cognitive and communicative function which are often the limiting factors for independence following brain injury. A weakness of the Barthel Index is that there are many different versions and modifications and several published manuals. The one recommended by the BSRM is that published by Wade and Collin, 1988.

Lynne Turner-Stokes. July 2005
(12, 38, 48)

3.2.2 UK FIM±FAM(11)

The Functional Independence Measure (FIM) was developed in the 1980s by a consortium from The American Congress of Rehabilitation and the American Academy of Physical Medicine and Rehabilitation, with a view to creating a global measure of disability along similar lines to the Barthel, but which was more sensitive and also addressed cognitive and psychosocial areas of function(49). It is very widely used as a global measure of disability in the USA, and increasingly so across the western world. Its originators, Uniform Data Systems (UDS) provide a centralised system of data collation and also training and updating of users, to ensure that the instrument is scored consistently wherever it is used.

The Functional Assessment Measure was developed specifically for use in brain injury(50). It does not stand alone - hence the abbreviation "FIM+FAM" - but adds a further 12 items to the FIM which specifically address cognitive and psychosocial issues. The latter are inevitably more subjective and difficult to score(51, 52). The UK FIM+FAM was developed to improve reliability for these difficult items(13). The FIM+FAM offers an opportunity to score psychosocial function following brain injury, and still maintains the integrity of the FIM, providing the opportunity of comparison at that level, with units which score only the FIM.

It is recommended that the FIM+FAM is scored by a multi-disciplinary team, which improves inter-rater reliability. However, the requirement for multi-disciplinary scoring makes the FIM+FAM relatively cumbersome to use.

Lynne Turner-Stokes. July 2005
(13, 49-52)

3.2.3 Health Assessment Questionnaire (HAQ) – UK version(14)

This questionnaire was developed primarily for people with rheumatic diseases. Some of the items (e.g. tap-turning) are specific problems faced frequently by people with joint disease, but most apply equally well in neurological disability, especially at the more able end of the spectrum. The questionnaire is designed for self-completion, reflecting the lack of cognitive and communicative difficulties in rheumatological impairment. The original American version (Stanford Health Assessment Questionnaire) has been translated for UK use by Kirwan and Reeback(14)

Lynne Turner-Stokes. July 2005
(14)

3.3 Dependency / Care Needs Assessment

The Barthel Index and the FIM+FAM are shown to correlate with care hours, but cannot be used to measure them directly since they do not assess the number of people required to help nor the time taken to complete the task. The NPDS and NPCNA were designed specifically to provide an assessment on care hours and costs at the more dependent end of the spectrum.

3.3.1 Northwick Park Dependency Score(15)

The Northwick Park Dependency Score (NPDS) is an ordinal scale, designed to assess the dependency of a patient in terms of impact on nursing time. It takes 3-5 minutes to complete depending on the familiarity of the scorer with the patient and the instrument. Items were selected on basis that they impact on nursing time in a hospital-based rehabilitation setting are divided into two sections: a) basic self-care needs and b) special nursing needs. Cut-off points reflect the number of helpers needed and time taken, whether at the level of supervision or physical help. Because it differentiates between the number of people required to help and the time taken, it is sensitive to change in patients who fall below the floor of the FIM or Barthel Index. The NPDS is shown to be reliable and valid in its assessment of nursing dependency on the ward and is simple and practical to use in a busy setting.

Lynne Turner-Stokes. July 2005
(15, 53, 54)

3.3.2 Northwick Park Care Needs Assessment(16)

Using a short set of additional questions, the NPDS can be translated into a simple generic assessment of care needs in the community which provides a direct assessment of hours of care, the care package that would be required to meet those needs, and its approximate weekly cost. Preliminary evaluation shows the NPCNA to be both valid and sensitive to changes in care needs which can be induced by targeted rehabilitation(16, 17)

Lynne Turner-Stokes. July 2005
(16, 17)

3.4 Extended Activities of Daily Living

3.4.1 Frenchay Activities Index(18)

"This index was devised initially by a social worker in order to help her with her clinical service. It has since been revised but its reliability needs further testing. However, it is clinically relevant, easy to perform and has been used in clinical research"

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(18, 55)

3.4.2 Nottingham EADL scale(19)

"A simple extended ADL index in four sections, each of which was found to form a hierarchical scale in stroke patients. Little published evidence concerning validity, reliability, utility or sensitivity, but can be used as a postal questionnaire. No published guidelines. ...Nonetheless, an attractive EADL index."

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(19)

3.4.3 Bicro-39(20)

The Bicro scales were developed as a series of three self-completion scales for use in community rehabilitation of patients following brain injury. The instrument overcomes the problem of which domestic activities the individual undertook pre-morbidly (eg many young men did not do the washing up of the shopping before their brain injury!) and also the problem of proxy information by providing 3 questionnaires administered simultaneously: a) patient – current activity, b) patient – pre-morbid, c) carer 's view. The scales have been tested for repeatability (20) but have not as yet been widely taken up by other centres.

Lynne Turner-Stokes. July 2005
(20)

3.5 Participation

3.5.1 The Canadian Occupational Performance Measure(21)

Published originally in the 1930s, the Canadian Occupational Performance Measure (COPM) has become widely accepted as an outcome measure within the occupational therapy practice and research. It has been widely translated and use in a variety of settings and conditions ranging from pain(56) through to stroke(57). A systematic review of the literature examining the COPM in relation to its psychometric properties (19 papers), research outcomes (33 papers) or practice (33 papers), was published in 2004 by Carswell and colleagues(58). Overall, the conclusion is that the COPM is a valid, reliable, clinically useful and responsive outcome measure acceptable for occupational therapist practitioners and researchers. It is used with a wide variety of clients, enables client-centred practice, facilitates evidence-based practice and supports outcomes research(58).

Lynne Turner-Stokes. July 2005
(21, 56-61)

3.5.2 London Handicap Scale (stroke)(22)

This instrument was developed as a simple six-item assessment of handicap following stroke. Validity was initially demonstrated in a stroke population(22), but is has subsequently been demonstrated to be equally applicable in the context of arthritis(62), multiple sclerosis(63), and elderly care(64). The initial instrument used weighted scores, but recent evaluation indicates the un-weighted scores to be just as useful, and easier to calculate and interpret(65), so it is now recommended that these are used.

Lynne Turner-Stokes. July 2005
(22, 62-65)

3.5.3 Life Satisfaction Index(24)

"Primarily designed for use with elderly people, this scale has been used many times, with some evidence to support its validity and reliability. There are many different versions including some shortened ones, but the questions may not always be appropriate for all subjects."

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992
(24, 66-68)

3.5.4 Craig Handicap Assessment and Reporting Tool (CHART)(23)

The Craig Handicap Assessment and reporting Technique was developed originally for assessment of handicap in patients following spinal cord injury. The original paper reports test-retest patient- and proxy inter-rater reliability(23). Rasch analysis has also verified the scaling and scoring procedures. Correlation has been demonstrated with the Life-Satisfaction Index(69). More recently it has been validated for use in stroke patients(70).

Lynne Turner-Stokes. July 2005

(23, 69, 70)

3.6 General Health/Mood

3.6.1 General Health Questionnaire - version GHQ-12 or GHQ-22(25)

"This is a widely used, well-validated measure of good reliability. It is simple and quick to use. There are various versions derived from the original 60-question version, including a 28-, and 22- and a 12-question version. It can be used to measure stress on carers. As with all other measures of depression, its validity when used with neurologically disabled patients needs to be proved; many cannot complete it, which reduces its utility".

Wade, DT. Measurement in Neurological Rehabilitation. OUP 1992

(71-73)

3.7 Pain

3.7.1 VAS scales and numeric rating scales

A variety of symptoms including pain, mood etc may be assessed using a visual or numeric rating scale – usually scored 0 – 10. This is theoretically useful for dysphasic patients providing that they have good enough comprehension to understand instructions, and the cognitive function to be able recall and to translate their symptoms into the dimensions of the scale. There is good evidence for reliability in those patients who can complete them.

However, patients with visuo-spatial neglect may have difficulty with horizontal scales(74-77). Pre-screening is recommended and a tool (the AbilityQ) is available for that purpose(77)

Lynne Turner-Stokes. July 2005

(74-77).

3.8 Depression

The recommendations for assessment and measurement of depression are taken from the BSRM/RCP Concise Guidance for use of anti-depressant medication following acquired brain injury.

3.8.1 Depression Intensity Scale Circles (DISCs)(29)

The DISCs is a 6-point scale using vertical array of circles. It is designed to be a simplified rating scale for use in patients with ABI. It has been validated in stroke and ABI(29)

Freely available from authors

Lynne Turner-Stokes. July 2005

(29)

3.8.2 Signs of Depression Scale (SDSS)(30)

A 6-item scale with Yes/No answers recording the behavioural features which may represent depression in patients who cannot speak for themselves. The SDSS is suitable as a crude screening tool(30, 78, 79). However, validity/reliability have yet to be fully established.

Freely available from authors

Lynne Turner-Stokes. July 2005

(30, 78, 79).

3.8.3 Geriatric Depression Scale(31)

A 30-item self-completion or interview scale with with yes/no answers. It is designed for older adults and also excludes somatic items.

The GDS is quite widely used, and there is some validation in stroke(80, 81). A short form version is available using only 15 items as above, but is not yet well validated with stroke patients.

Freely available – recommended in the BSRM/RCP concise guidance on Depression following ABI.

Lynne Turner-Stokes. July 2005
(31, 80, 81).

3.8.4 Hospital Anxiety and Depression Scale (HAD)(32)

Self report scale – 14 items. 7 items on anxiety, and 7 items on depression

Specifically designed for use with hospitalised, medically ill patients, this scale attempts to overcome bias caused by somatic complaints which feature in most other inventories. Also it covers depression and anxiety. Easy to use and score, and very widely used and validated for many conditions(82, 83). There is some validation in the context of stroke(84, 85) but more work is needed on validity and reliability in the context of other brain-injured patients."

Copyright protected

Lynne Turner-Stokes. July 2005
(82-85)

3.8.5 Beck Depression Inventory BDI-II(33)

A self report scale with 21 items, which may be used to form basis for an interview, and maps well onto the American Psychiatric Association DSM-IV criteria. It is widely used and validated, including in stroke research(86, 87). A short-form version (the BDU Fastscreen) consists of 7 items designed to pick up cognitive features of depression only (i.e. seeks to avoid the confounding effect of somatic symptoms which may cross over with brain injury and other conditions). However, the short form is not yet validated for patients with stroke or other ABI. Copyright protected

Lynne Turner-Stokes. July 2005
(33, 86, 87)

3.9 Musculoskeletal/Chronic Pain Rehabilitation

3.9.1 Oswestry Low Back Pain Disability Questionnaire (ODQ)(26)

Developed originally in the 1980s, the Oswestry Low Back Pain Disability Questionnaire appears to have validity as an outcome measure for the treatment of low back pain(88, 89), although the Rowland-Morris Activity Scale appears to be more sensitive(90). The ODQ may have greater discriminant validity when combined with the McGill Pain Questionnaire(91). A Neck Disability Index derived from it is also shown to have good reliability and internal consistency(92).

Lynne Turner-Stokes. July 2005
(26, 88-92)

3.9.2 McGill Pain Score(27)

The McGill pain questionnaire has been very widely used and translated as a standard assessment of pain in a large range of conditions. Reliability, validity and responsiveness of this and other instruments in different cultures and languages has been extensively reviewed by Naughton and Wiklund(93). The value of verbal pain questionnaires over visual analogue scales is still a matter for debate(94), but much depends on whether the investigator is interested in the pain itself or in its impact on functional activities. If the latter is the issue, scales such as the assessment, and the newer multi-dimensional pain inventories such as the

Westhaven Multi-dimensional Pain Inventory (MDPI) (96) provide insights into the psychological strategies employed by the individual to combat the pain.
Lynne Turner-Stokes. July 2005
(93-96)

3.10 Carers

3.10.1 Care-giver's Strain Index(34)

"A short measure specifically designed to assess strain on the carer. Its validity was well-tested in the original paper(34)" Wade, DT. *Measurement in Neurological Rehabilitation*. OUP 1992
It has since been used in a number of studies to assess carer strain in the context of care of the elderly, stroke and intractable pain(97-99)
Lynne Turner-Stokes 2005
(34, 97-99)

3.11 Spinal Cord Injury

3.11.1 ASIA (American Spinal Injury Association) International Standards for Neurological Classification of Spinal Cord injury.

A standardised method of neurological assessment and format for classification following spinal cord injury. There is a recommended neurological examination, both sensory and motor and details on defining Neurological level and ASIA Impairment Grade. The validity and reliability are well documented. Training is required prior to use. Training videos and manuals are available from ASIA for a small fee. www.asia-spinalinjury.org (100)

3.11.2 Frankel Scale.

Still used in some units, although most now use ASIA. The Frankel scale is a global scale defining the grades of spinal cord injury. Its validity and reliability are untested.(101)

References

1. Turner-Stokes L, Turner-Stokes T. The use of standardized outcome measures in rehabilitation centres in the UK. *Clinical Rehabilitation*. 1997;11(4):306-13.
2. Demeurisse G, Demol O, Robaye E. Motor evaluation in vascular hemiplegia. *European Neurology* 1980;19:382-389.
3. Carr JH, Shepherd RB, Nordholm L, Lynne D. Investigation of a new motor assessment scale for stroke patients. *Physical Therapy* 1985;65:175-180.
4. Wade DT, Langton Hewer R. Functional abilities after stroke: measurement, natural history and prognosis. *Journal of Neurology, Neurosurgery and Psychiatry* 1987;50:177-182.
5. Hanspal RS. Mobility grades in amputee rehabilitation. *Clin Rehabil* 1991;5:345.
6. Collen FM, Wade DT, Robb GF, Bradshaw CM. The Rivermead Mobility Index: a further development of the Rivermead Motor Assessment. *International Disability Studies* 1991;13.
7. Collen FM, Wade DT, Bradshaw CM. Mobility after stroke: reliability of measures of impairment and disability. *International Disability Studies* 1990;12:6-9.
8. Holden MK, Gill KM, Magliozzi MR. Gait assessment for neurologically impaired patients. Standards for outcome assessment. *Physical Therapy* 1986;66:1530-1539.
9. Ryall NH, Eyres SB, Neumann VC, Bhakta BB, Tennant A. The SIGAM mobility grades: a new population-specific measure for lower limb amputees. *Disabil Rehabil*. 2003 Aug 5;25(15):833-44.
10. Mathiowetz V, Weber K, Kashman N, Volland G. Adult norms for the nine-hole peg test of finger dexterity. *Occupational Therapy Journal of Research* 1985;5:24-37.
11. De Souza LH, Langton-Hewer R, Miller S. Assessment of recovery of arm control in hemiplegic stroke patients. Arm function test. *International Rehabilitation Medicine* 1980;2:3-9.
12. Wade DT, Collin C. The Barthel ADL index: a standard measure of physical disability? *International Disability Studies* 1988;10:64-67.
13. Turner-Stokes L, Nyein K, Turner-Stokes T, Gatehouse C. The UK FIM+FAM: development and evaluation. *Functional Assessment Measure*. *Clinical Rehabilitation*. 1999;13(4):277-87.
14. Kirwan JR, Reeback JS. Stanford Health Assessment Questionnaire modified to assess disability in British patients with rheumatoid arthritis. *British Journal of Rheumatology* 1986;25:206-209.

15. Turner-Stokes L, Tonge P, Nyein K, Hunter M, Nielson S, Robinson I. The Northwick Park Dependency Score (NPDS): a measure of nursing dependency in rehabilitation. *Clinical Rehabilitation*. 1998;12(4):304-18.
16. Turner-Stokes L, Nyein K, Halliwell D. The Northwick Park Care Needs Assessment (NPCNA): a directly costable outcome measure in rehabilitation.[comment]. *Clinical Rehabilitation*. 1999;13(3):253-67.
17. Nyein K, Turner-Stokes L. Sensitivity and predictive value of the Northwick Park Care Needs Assessment (NPCNA) as a measure of Care Needs in the Community. In: Society for Research in Rehabilitation; 1999; Southampton: Clin Rehabil; 1999. p. 482-491.
18. Holbrook M, Skilbeck CE. An activities index for use with stroke patients. *Age and Ageing* 1983;12:166-170.
19. Nouri FM, Lincoln NB. An extended activities of daily living scale for stroke patients. *Clinical Rehabilitation* 1987;1:301-305.
20. Powell JH, Beckers K, Greenwood RJ. Measuring progress and outcome in community rehabilitation after brain injury with a new assessment instrument - the Bicro-39 scales. *Arch Phys Med Rehabil* 1998;79(10):1213-25.
21. Law M, Baptiste S, McColl M, Opzoomer A, Polatajko H, Pollock N. The Canadian occupational performance measure: an outcome measure for occupational therapy. *Canadian Journal of Occupational Therapy Revue Canadienne d Ergotherapie* 1990;57(2):82-7.
22. Harwood RH, Rogers A, Dickinson E, Ebrahim S. Measuring handicap - the London Handicap Scale. A new outcome measure in chronic disease. *Quality in Healthcare* 1994;3:11-16.
23. Whiteneck GG, Charlifue SW, Gerhart KA, Overholser JD, Richardson GN. Quantifying handicap: a new measure of long-term rehabilitation outcomes (see comments). *Archives of Physical Medicine and Rehabilitation* 1992;73(6):519-26.
24. Neugarten BL, Havinghurst RJ, Tobin SS. The measurement of life satisfaction. *Journal of Gerontology* 1961;16:134-143.
25. Cooper P, Osborn M, Gath D, Feggetter G. Evaluation of a modified self-report measure of social adjustment. *Brit J Psychiatry* 1982;141:68-75.
26. Fairbank JC, Couper J, Davies JB, O'Brien JP. The Oswestry low back pain disability questionnaire. *Physiotherapy* 1980;66(8):271-3.
27. Melzack R. The McGill Pain Questionnaire: major properties and scoring methods. *Pain* 1975;1:277-99.
28. Mahoney J, Drinka TJK, Abler R, Gunter-Hunt G, Matthews C, Gravenstein S, et al. Screening for depression: Single question versus GDS. *Journal of the American Geriatrics Society* 1994;42(9):1006-1008.
29. Turner-Stokes L, Kalmus M, Hirani D, Clegg F. The Depression Intensity Scale Circles: Initial evaluation of a simple assessment tool for depression in the context of brain injury. *JNNP*. In press 2004.
30. Hammond MF, O'Keeffe ST, Barer DH. Development and validation of a brief observer-rated screening scale for depression in elderly medical patients. *Age Ageing* 2000;29:511-515.
31. Sheikh JI, Yesavage JA. Geriatric Depression Scale: recent evidence and development of a shorter version. *Clin Gerontol* 1986;5:165-172.
32. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica* 1983;67:361-370.
33. Beck AT, Ward CH, Mendelssohn MJ, Erbaugh J. An inventory for measuring depression. *Archives of General Psychiatry* 1961;4:561-571.
34. Robinson BC. Validation of a caregiver strain index. *Journal of Gerontology* 1983;38:344-348.
35. Collin C, Wade DT. Assessing motor impairment after stroke: a pilot reliability study. *J Neurol Neurosurg Psychiatry* 1990;53:576-9.
36. Parker VM, Wade DT, Langton-Hewer R. Loss of arm function after stroke: measurement, frequency and recovery. *International Rehabilitation Medicine* 1986;8:69-73.
37. Wade DT, Langton-Hewer R. Motor loss and swallowing difficulty after stroke: frequency, recovery and prognosis. *Acta Neurol Scand* 1987;76:50-54.
38. Loewen SC, Anderson BA. Reliability of the modified Motor Assessment Scale and the Barthel Index. *Physical Therapy* 1988;68:1007-81.
39. Poole JL, Whitney SL. Motor Assessment Scale for Stroke Patients: concurrent validity and interrater reliability. *Arch Phys Med Rehabil* 1988;69:195-7.
40. Bradstater ME, De Bruin H, Gowland C, Clarke BM. Hemiplegic gait: analysis of temporal variables. *Arch Phys Med Rehabil* 1983;64:583-7.
41. Bohannon RW, Andrews AW. Correlation of knee extensor muscle torque and spasticity with gait speed in patient with stroke. *Arch Phys Med Rehabil* 1990;71:330-3.

42. Holden MK, Gill KM, Magliozzi MR, Nathan J, Piehl-Baker L. Clinical gait assessment in the neurologically impaired: reliability and meaningfulness. *Physical Therapy* 1984;64:35-40.
43. Goodkin R, Hertsgaard D, Seminary J. Upper extremity function in multiple sclerosis: improving assessment sensitivity with box-and-block and nine-hole peg tests. *Arch Phys Med Rehabil* 1988;69:850-4.
44. Heller A, Wade DT, Wood VA, Sunderland A, Langton-Hewer R. Arm function after stroke: measurement and recovery over the first three months. *J Neurol Neurosurg Psychiatry* 1987;50:714-9.
45. Berglund K, Fugl-Meyer AR. Upper extremity function in hemiplegia: cross-validation of two assessment methods. *Scand J Rehabil Med* 1986;18:155-7.
46. Wade DT, Langton-Hewer R, V.A. W, Skilbeck CE, Ismail IM. The hemiplegic arm after stroke: measurement and recovery. *J Neurol Neurosurg Psychiatry* 1983;46:521-4.
47. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Maryland State Medical Journal* 1965;14:61-5.
48. Collin C, Wade DT, Davis S, Horne V. The Barthel ADL Index: a reliability study. *International Disability Studies* 1988;10:61-3.
49. Hamilton BB, Granger CV, Sherwin FS, Zielezny M, Tashman JS. A uniform national data system for medical rehabilitation. In: Fuhrer JM, editor. *Rehabilitation outcomes: analysis and measurement*. Baltimore: Brookes; 1987. p. 137-147.
50. Hall KM, Hamilton BB, Gordon WA, Zasler ND. Characteristics and comparisons of functional assessment indices: Disability rating scale, functional independence measure, and functional assessment measure. *Journal of Head Trauma Rehabilitation* 1993;8(2):60-74.
51. McPherson KM, Pentland B, Cudmore SF, Prescott RJ. An inter-rater reliability study of the Functional Assessment Measure (FIM + FAM). *Disability & Rehabilitation* 1996;18(7):341-347.
52. Alcott D, Dixon K, Swann R. The reliability of the items of the functional assessment measure (FAM): Differences in abstractness between FAM items. *Disability & Rehabilitation* 1997;19(9):355-358.
53. Hatfield A, Hunt S, Wade DT. The Northwick Park Dependency Score and its relationship to nursing hours in neurological rehabilitation. *Journal of Rehabilitation Medicine* 2003;35(3):116-20.
54. Post MW, Visser-Meily JM, Gispens LS. Measuring nursing needs of stroke patients in clinical rehabilitation: a comparison of validity and sensitivity to change between the Northwick Park Dependency Score and the Barthel Index. *Clinical Rehabilitation* 2002;16(2):182-9.
55. Wade DT, Legh-Smith J, Langton-Hewer R. Social activities after stroke: measurement and natural history using the Frenchay Activities Index. *Int Rehabil Medicine* 1985;7:176-81.
56. Carpenter L, Baker GA, Tyldesley B. The use of the Canadian occupational performance measure as an outcome of a pain management program. *Canadian Journal of Occupational Therapy Revue Canadienne d Ergotherapie* 2001;68(1):16-22.
57. Cup EH, Scholte op Reimer WJ, Thijssen MC, van Kuyk-Minis MA. Reliability and validity of the Canadian Occupational Performance Measure in stroke patients. *Clinical Rehabilitation* 2003;17(4):402-9.
58. Carswell A, McColl MA, Baptiste S, Law M, Polatajko H, Pollock N. The Canadian Occupational Performance Measure: a research and clinical literature review. *Canadian Journal of Occupational Therapy Revue Canadienne d Ergotherapie* 2004;71(4):210-22.
59. Dedding C, Cardol M, Eyssen IC, Dekker J, Beelen A. Validity of the Canadian Occupational Performance Measure: a client-centred outcome measurement. *Clinical Rehabilitation* 2004;18(6):660-7.
60. McColl MA, Paterson M, Davies D, Doubt L, Law M. Validity and community utility of the Canadian Occupational Performance Measure. *Canadian Journal of Occupational Therapy Revue Canadienne d Ergotherapie* 2000;67(1):22-30.
61. Toomey M, Nicholson D, Carswell A. The clinical utility of the Canadian Occupational Performance Measure. *Canadian Journal of Occupational Therapy Revue Canadienne d Ergotherapie* 1995;62(5):242-9.
62. Harwood RH, Carr AJ, Thompson PW, Ebrahim S. Handicap in inflammatory arthritis. *British Journal of Rheumatology* 1996;35(9):891-7.
63. Thompson AJ. Measuring handicap in multiple sclerosis. *Multiple Sclerosis* 1999;5(4):260-2.
64. Harwood RH, Prince M, Mann A, Ebrahim S. Associations between diagnoses, impairments, disability and handicap in a population of elderly people. *International Journal of Epidemiology* 1998;27(2):261-8.
65. Jenkinson C, Mant J, Carter J, Wade D, Winner S. The London handicap scale: a re-evaluation of its validity using standard scoring and simple summation. *Journal of Neurology, Neurosurgery & Psychiatry* 2000;68(3):365-7.
66. Adams DL. Analysis of a life satisfaction index. *J Gerontol* 1969;24:470-4.

67. Hoyt DR, Creech JC. The life satisfaction index: a methodological and theoretical critique. *J Gerontol* 1983;38:111-6.
68. Wood V, Wylie ML, Sheafor B. Analysis of a short self-report measure of life satisfaction: correlation with rater judgements. *J Gerontol* 1969;24:465-9.
69. Fuhrer MJ, Rintala DH, Hart KA, Clearman R, Young ME. Relationship of life satisfaction to impairment, disability, and handicap among persons with spinal cord injury living in the community. *Archives of Physical Medicine & Rehabilitation* 1992;73(6):552-7.
70. Segal ME, Schall RR. Assessing handicap of stroke survivors. A validation study of the Craig Handicap Assessment and Reporting Technique. *American Journal of Physical Medicine and Rehabilitation* 1995;74(4):276-286.
71. Goldberg DP, Hillier VF. A scaled version of the General Health Questionnaire. *Psychological Medicine* 1979;9:139-145.
72. DePaulo JR, Folstein MF, Gordon B. Psychiatric screening on a neurological ward. *Psychological Medicine* 1980;10:125-132.
73. Wade DT, Legh-Smith J, Langton-Hewer R. Effects of living with and looking after survivors after stroke. *Brit Med J* 1986;293:418-20.
74. Breivik EK, Skoglund LA. Comparison of present pain intensity assessments on horizontally and vertically oriented visual analogue scales. *Methods & Findings in Experimental & Clinical Pharmacology*. 1998;20(8):719-24.
75. Price CIM, Curless RH, Rodgers H. Can stroke patients use visual analogue scales? *Stroke* 1999;30:1357-1361.
76. Stephenson NL, Herman JA. Pain measurement: a comparison using horizontal and vertical visual analogue scales. *Applied Nursing Research*. 2000;13(3):157-8.
77. Turner-Stokes L, Rusconi S. Screening for ability to complete a questionnaire: a preliminary evaluation of the AbilityQ and ShoulderQ for assessing shoulder pain in stroke patients. *Clinical Rehabilitation* 2003;17(2):150-157.
78. Groom MJ, Lincoln NB, Francis VM, Stephan TF. Assessing mood in patients with multiple sclerosis. *Clinical Rehabilitation*. 2003;17(8):847-57.
79. Watkins C, Leathley M, Daniels L, Dickinson H, Lightbody CE, van den Broek M, et al. The signs of depression scale in stroke: how useful are nurses observations? *Clinical Rehabilitation* 2001;15:447-457.
80. Agrell B, Dehlin O. Comparison of six depression rating scales in geriatric stroke patients. *Stroke* 1989;20(9):1190-4.
81. Lieberman D, Galinsky D, Fried V, Grinshpun Y, Mytlis N, Tylis R. Geriatric Depression Screening Scale (GDS) in patients hospitalized for physical rehabilitation. *International Journal of Geriatric Psychiatry* 1999;14(7):549-55.
82. Herrmann C. International experience with the Hospital Anxiety and Depression Scale A review of validation data and clinical results. *J Psychosom Res* 1997;42:17-41.
83. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale; an updated review. *J Psychiat Res* 2002;52:69-77.
84. Johnson G, Burvill PW, Anderson CS, Jamrozik K, Stewart-Wynne EG, Chakera TMH. Screening instruments for depression and anxiety following stroke: Experience in the Perth community stroke study. *Acta Psychiatr Scand* 1995;91(4):252-257.
85. O'Rourke S, MacHale S, Signorini D, Dennis M. Detecting psychiatric morbidity after stroke: comparison of the GHQ and the HAD Scale. *Stroke* 1998;29(5):980-5.
86. Leentjens AF, Verhey FR, Luijckx GJ, Troost J. The validity of the Beck Depression Inventory as a screening and diagnostic instrument for depression in patients with Parkinson's disease. *Movement Disorders*. 2000;15(6):1221-4.
87. Aben I, Verhey F, Lousberg R, Lodder J, Honig A. Validity of the beck depression inventory, hospital anxiety and depression scale, SCL-90, and hamilton depression rating scale as screening instruments for depression in stroke patients. *Psychosomatics*. 2002;43(5):386-93.
88. Delitto A, Cibulka MT, Erhard RE, Bowling RW, Tenhula JA. Evidence for use of an extension-mobilization category in acute low back syndrome: a prescriptive validation pilot study [see comments]. *Physical Therapy* 1993;73(4):216-22; discussion 223-8.
89. Little DG, MacDonald D. The use of the percentage change in Oswestry Disability Index score as an outcome measure in lumbar spinal surgery. *Spine* 1994;19(19):2139-43.
90. Hsieh CY, Phillips RB, Adams AH, Pope MH. Functional outcomes of low back pain: comparison of four treatment groups in a randomized controlled trial [see comments]. *Journal of Manipulative & Physiological Therapeutics* 1992;15(1):4-9.

91. Haas M, Nyiendo J. Diagnostic utility of the McGill Pain Questionnaire and the Oswestry Disability Questionnaire for classification of low back pain syndromes. *Journal of Manipulative & Physiological Therapeutics* 1992;15(2):90-8.
92. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity [published erratum appears in *J Manipulative Physiol Ther* 1992 Jan;15(1):following Table of Contents]. *Journal of Manipulative & Physiological Therapeutics* 1991;14(7):409-15.
93. Naughton MJ, Wiklund I. A critical review of dimension-specific measures of health-related quality of life in cross-cultural research. *Quality of Life Research* 1993;2(6):397-432.
94. Flaherty SA. Pain measurement tools for clinical practice and research. *AANA Journal* 1996;64(2):133-40.
95. Charlton JRH. Measuring Disability in a Longitudinal Survey. In: Peach Pa, editor. *Disablement in the Community*. Oxford: Oxford University Press; 1989. p. 62-80.
96. Kerns RD, Turk DC, Rudy TE. The West-Haven Yale Multi-dimensional Pain Inventory (WHYMPI). *Pain* 1985;23:245-256.
97. Marchi-Jones S, Murphy JF, Rousseau P. Caring for the caregivers. *Journal of Gerontological Nursing* 1996;22(8):7-13.
98. Miaskowski C, Zimmer EF, Barrett KM, Dibble SL, Wallhagen M. Differences in patients' and family caregivers' perceptions of the pain experience influence patient and caregiver outcomes. *Pain* 1997;72(1-2):217-26.
99. Wilkinson PR, Wolfe CD, Warburton FG, Rudd AG, Howard RS, Ross-Russell RW, et al. A long-term follow-up of stroke patients. *Stroke* 1997;28(3):507-12.
100. International Standards for Neurological Classification of Spinal Cord Injury. Revised 2002. Available from www.asia-spinalinjury.org
101. Frankel HL et al 1969. The value of postural reduction in the initial management of closed injuries of the spine with paraplegia and tetraplegia. *Paraplegia*, 7, 179-92