

Is the Barthel scale still useful 50 years after its first publication?

Czy w 50 lat po opublikowaniu Skala Barthel jest wciąż przydatna?

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Key words

ADL, Barthel Index, Barthel scale, clinimetrics

Abstract

It has been 50 years since, in February 1965, Florence Mahoney and Dorothea Barthel published an article entitled “Functional evaluation: the Barthel Index”. Since then, the Barthel scale, also known as the Basic ADL Index (BI), Barthel Score and Maryland Disability Index, is one of the most well-known ADL scales (Activities of Daily Living) and is still popular. This simple scale is still used by the representatives of a number of medical workers for many purposes, including the assessment of the results of treatment, rehabilitation, prognosis, assessment of self-reliance, assessment of needs for care and for determining the degree of disabilities. Based on a review of the literature and our own experience, this article presents the advantages and disadvantages of the Barthel Index, including its usefulness and place among other scales assessing the activities of daily living.

Słowa kluczowe

czynności życia codziennego, indeks Barthel, klinimetria, skala Barthel, skale kliniczne

Streszczenie

Mińło 50 lat, kiedy to w lutym 1965 r. Florence Mahoney i Dorothea Barthel opublikowały artykuł zatytułowany *Functional evaluation: the Barthel Index*. Od tej pory skala Barthel, występująca również jako Basic ADL Index (BI), Barthel Score i Maryland Disability Index, należy do najbardziej znanych skal ADL (czynności życia codziennego, ang. *Activities of Daily Living*) i wciąż jest popularna. Ta prosta skala wykorzystywana jest ciągle przez przedstawicieli zawodów medycznych do wielu celów, w tym oceny wyników leczenia, rehabilitacji, prognozowania, oceny samodzielności, oszacowania potrzeb co do opieki i do celów orzecznictwa. Na podstawie przeglądu piśmiennictwa i własnego doświadczenia w artykule tym przedstawiono zalety i wady skali Barthel, jej przydatność i miejsce wśród innych skal, oceniających czynności życia codziennego.

INTRODUCTION

In February 2015, it was 50 years since the Barthel scale, the most well-known and still popular ADL (Activities of Daily Living) scale, was published. The authors of the initial article entitled “Functional evaluation: the Barthel Index”, published in the *Maryland State Medical Journal*, Issue 14, were: Florence Mahoney, a physician; and Dorothea Barthel, a physiotherapist¹.

Subsequent literature also refers to the BI as: the Basic ADL Index (BI), the Barthel Score and the Maryland Disability Index. In the above-mentioned article, the authors stated that they began using the BI in 1955, for persons with chronic illnesses in the Maryland state hospitals: Montebello State Hospital, Deer’s Head Hospital and Western Maryland Hospital.

Clinimetrics

The term ‘clinimetrics’ was used for the first time by Feinstein, an American internist, in 1983²; and was then expanded by Asplund, the co-author of the Scandinavian Neurological Stroke Scale, in 1987³. The term refers to the measurement of clinical phenomena occurring in patients. Clinimetrics is a specific field of medical knowledge that focuses on developing and evaluating

The individual division on this paper was as follows: a – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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lating certain clinical indices, and uses numerous characteristic methods that are closely related to psychometrics.

The oldest and the most developed area of clinimetrics is that of stroke scales^{4,5}. The scoring scales used for evaluating the results of rehabilitation can be classified into three main groups: deficiency scales; functional scales; and scales evaluating the quality of life⁶. The first group of scales yields a score that results from physical examinations.

For rehabilitation, a functional evaluation can be the most important aspect. Over the last 30 years, several dozen different kinds of scoring scales aimed at assessing persons with neurological illnesses (post-stroke, or resulting from a traumatic brain injury, multiple sclerosis, Parkinson's disease, spinal cord damage, spine diseases, or dementia) as well as numerous modifications of these scales have been developed. An 'ideal' scale should be reliable in all cases, sensitive, communicative, easy to conduct, test-retest reliable, and should indicate potential changes in the health condition in subsequent examinations. However, due to the complexity of symptoms resulting from damage to the nervous system and the consequences of this damage, constructing an ideal scale is impossible.

The value of a scale is therefore established through a quantitative and qualitative evaluation. Such an evaluation should take into consideration the scale's: structure, number and kind of evaluated parameters, reliability, credibility, accessibility, communicativeness, clinical usefulness, simplicity to conduct, application possibilities, practical applications, uniformity, test-retest reliability, sensitivity (the ability to translate clinical phenomena into statistically significant scoring), consistency (inter-rater reliability), reactivity to changes of a clinical condition, and its ability to differentiate between groups of patients. In practice, the effectiveness of using a scale depends not only on the structure of a given scale, but also on the training and experience of the observers (assessors).

Contrary to appearances, clinimetrics is not a dead science. Researchers are continuing to develop new scales, and many of the previous scales are being subject to different modifications. Scales that are used to evaluate the patient's self-reliance in performing the

activities of daily living (in short, ADL) are usually generic (universal) scales, which can be used to conduct the functional assessment of patients in numerous illnesses. These functional scales are used for evaluating treatment results, determining the qualification for rehabilitation, evaluating rehabilitation results, making long-term prognoses, assessing the patient's self-reliance (including self-maintenance), evaluating the level of disability and the necessity to provide someone with care, as well as for preparing medical reports. These scales are also necessary in scientific research. Moreover, the elements of an ADL evaluation are used in questionnaires assessing the quality of life dependent on health.

The Barthel scale

The Barthel scale evaluates the patient's ability to perform 10 basic activities of daily living. Every activity can receive up to four points. These activities are: feeding, getting out of bed, performing personal hygiene, using the toilet, bathing, moving, ascending and descending stairs, dressing and undressing, maintaining continence of the bowels, and controlling the bladder. The lower the patient's level of self-reliance is, the lower the score. In later years, many modifications to the scale have appeared, including abbreviated versions – a three-item short form, four-item form, and five-item short form; as well as versions expanded to 15, 16 and 17 activities. However, these variations have not been popular^{7,8}, although for a short period of time a proposition by Hobart and Thompson gained popularity. Their scale was limited to five actions: transferring, bathing, toilet use, ascending and descending the stairs, and mobility⁹. In 1979-1981, Granger presented two versions of the Barthel scale, extended to 15 items, which he called the Modified Barthel Index. The version from 1979 included the assessment of eating and drinking as two separate activities; while the version from 1981 combined eating and drinking into one item, and in turn, added dressing after toilet use to the list¹⁰. Lazar et al. proposed the following interpretation of the results: 0-19 points – a fully dependent patient; 20-59 – requiring considerable assistance; 60-79 – able to move in a wheelchair with assistance; 80-89 – able to use a wheelchair independen-

tly; 90-99 – walks but requires some assistance; and 100 – indicating full self-reliance¹¹. Granger et al. considered a score of 60 points or less as the threshold for dependency; 40 points or less as a score indicating considerable dependency with a significantly reduced likelihood of independent living in a community; and below 20 as full dependency regarding self-maintenance and mobility. As a result of later studies, these authors reached the conclusion that the 15-item Barthel scale should not be used as the only scale for predicting treatment results¹⁰.

Currently, there are two scoring systems for the Barthel scale that are used equally: a 0-1-2-3 gradation (so that the final total result ranges from 0 to 20); and a 0-5-10-15 gradation (so that the final result ranges then between 1 and 100 points). In 1989, Shah et al. described the Modified Scoring for Barthel Index, in which they expanded the scoring to 12 points, which distinguished as many as nine possibilities: 0,1,2,3,4,5,8,10 and 12 points. Currently, the sum of the points still ranges from 0 to 100¹². The rights to use the BI belong to the Maryland State Medical Society (MSMS). Although the BI can now be used without the consent of the MSMS for non-commercial purposes, all of the modifications and the right to use it for commercial purposes still requires the consent of this society.

Although the literature has described the application of the Barthel scale in many different diseases, the National Institute of Neurological Disorders and Strokes (NINDS) recommends using it in the case of just five illnesses: multiple sclerosis, strokes (especially during the first months), amyotrophic lateral sclerosis, progressive muscular dystrophy and Friedreich's ataxia (http://www.commondataelements.ninds.nih.gov/Doc/NOC/Barthel_Index_NOC_Public_Domain.pdf). Despite this recommendation, the scale continues to be used for thousands of illnesses and is still very popular. This is evidenced by typing the search string "Barthel Index" in PubMed, the largest Internet database encompassing scientific articles on medicine and biology, which yields 3700 results; and a search of the Google database will yield as many as 363 000 results!

It is worth pointing out here that the cultural validation of the BI has been conducted for only six languages, and so far Polish is not among



them. This suggests that the value of scientific research using the Polish version of the BI is low. The knowledge about this scale in Poland is also poor (as was clearly proven by the literature mistaking Dorothea Barthel for a man, and referring to the research tool in Polish as the *Barthela* scale¹).

In scientific literature, there are many reports assessing the usefulness of the Barthel scale. These reports prove that the scale is characterised by a degree of high internal consistency, test-retest reliability, and inter-rater reliability, as well as a high correlation with other scales. Nonetheless, many authors believe that the usefulness of the tool for clinical studies is limited¹³⁻⁴¹.

The Barthel scale has many advantages: it is easy to use (completing the form takes 3-5 minutes); and the maximum total score of 100 points allows users to express the changes in the patients' self-reliance as percentages. The weakness of this scale is primarily that the evaluation of individual activities varies too greatly (two activities are evaluated on a scale of 0 and 5 points; six are evaluated on a scale of 0, 5 and 10 points; and two are evaluated on a scale of 0, 5, 10 and 15 points) and speech is not assessed. The scale also loses its sensitivity at its extreme points, i.e. for the most severely ill persons (the floor effect) and the most fit patients (the ceiling effect). Furthermore, all proposals for dividing patients into groups according to their level of disability are only arbitrary.

Despite its many limitations, the Barthel Index is still frequently used by physicians, nurses, occupational therapists and managers, as well as by patients for their own self-evaluation (through a telephone interview).

An investigation of the inter-rater reliability of the Dutch version of the Barthel Index was conducted in 1994 by Rob de Haan et al. on 60 patients and with three observers. This study yielded internal consistency values, (Kappa values) from 0.50 to 1.0, which proved to be the lowest for the assessment of the personal hygiene of the participants, who obtained a total score of below 20 points (out of the maximum total of 32 points on the scale), and was the highest for the assessment of the bladder and bowel control¹⁵.

The version of the Barthel Index currently recommended by the NINDS is available on the following Internet site:

<http://www.strokecenter.org/wp-content/uploads/2011/08/barthel.pdf>.

Other ADL scales

Among the alternative scales to the Barthel scale, also used to evaluate the simple activities of daily living, the following should be mentioned: the scales by Carrol, Katz and Kenny; and the ADL scales used for internal purposes in rehabilitation centres. Out of the 113 identified ADL scales, Lindeboom et al., found 27 basic ADL scales (24%) intended for use in the field of neurology. The basic domains such as mobility and self-maintenance were included in 44%-81% of these scales⁴².

It seems that the simplest ADL scale is the Katz Basic ADL Index, published in 1963. The Katz Index evaluates six of the simplest activities of daily living on a 0-1 scale. These activities are: bathing, dressing, toileting, transferring, continence and feeding⁴³.

From the scales used in the rehabilitation centres, it is worth mentioning the Rehabilitation Institute of Chicago Functional Assessment Scale, used in the Rehabilitation Institute of Chicago; and the Sunnaas ADL Index, used in the Sunnaas Rehabilitation Hospital in Nesoddtangen. The latter evaluates 12 activities on a four-point scale, where each activity is ascribed from 0 to 3 points⁴⁴. The Rivermead ADL scale used in the Rivermead Rehabilitation Centre, described by Whiting and Lincoln in 1980 and revalidated in 1990, is *de facto* an instrumental ADL scale⁴⁵. Also, three specific scales are used to evaluate the basic ADL for dementia patients. These are: the Blessed Dementia Scale; the Bristol Scale; and the Functional Activity Questionnaire (FAQ)⁴⁶.

Donaldson compared 25 different ADL scales in 1973⁴⁷. Apart from the above-mentioned ones, this analysis comprised the scales developed by: Carrol, Christopherson and Swantz, Dinnerstein, Gauger, Gersten, Gordon, Groomes, Hoberman, Hoff, Kelman, Lawton and Brody, Linn, Moskowitz, New, Pool and Brown, Rinzler, Schoening, Scranton, and Slater

and Sokolow. The analysis of these 25 scales showed that among 20 evaluated activities, dressing, transferring, bathing and feeding were the most frequently taken into consideration; while writing, housekeeping and assessments of feelings occurred less frequently. In five of the scales, dressing, bathing, cleaning, feeding and personal hygiene were assessed jointly under the name "self-maintenance"⁴⁷. The scale by Sister Elisabeth Kenny, the "Kenny Self-Care Evaluation", might be considered as the most highly-developed one, and cannot be considered as a basic ADL scale⁴⁸.

Currently, the most popular scale is the Functional Independence Measure (FIM); however, its use is limited due to the fact that it requires purchasing the licence⁴⁹. The Functional Index "Repty", the use of which is not restricted, is a modification of the FIM scale⁵⁰. Also, in 1998, Hoening et al. developed a modified version of the FIM, using the first 13 items of the scale with a four-point scoring system, and called it the "13-item Self-Reported Functional Measure" (SRFM)⁵. Furthermore, the FIM is often combined with the FAM (the Functional Assessment Measure), the latter of which, was described by Hal et al. in 1993, comprises 12 items⁵.

The first author of this paper prepared his own simplified version of the FIM scale, which he called The Functional Index "Repty" (FIR). His modifications included the three last items concerning social awareness (interpersonal contacts, solving problems and memory), which were rejected as items that could not be evaluated by ascribing points, and instead belonged to the sphere of specialist psychological and sociological tests. The numerical graduations were raised from one to two points, so that instead of using scores of 7, 6, 5, 4, 3, 2 and 1, the scale uses scores of 7, 5, 3 and 1. This scale is simple and easy to implement. The minimal number of points that the respondents can obtain is 15 and the maximum score is 105⁵⁰⁻⁵².

Despite the growing popularity of the International Classification of Functioning (ICF), it cannot replace a simple and universal scale. However, using any scale, even the simplest

¹ In Polish language endings of surname and declension of surnames reflect the gender



one, requires at least a short amount of training.

The place of the Barthel scale in clinimetrics

The scales for evaluating a patient's independence while performing the activities of daily living (ADL) can be divided into simple scales (e.g. the Barthel scale) that assess basic activities (basic ADL); and expanded scales, also referred to as instrumental ADL scales.

The latter, that is the Instrumental (Extended) ADL scales, are a link between functional scales and the scales evaluating the patients' quality of life. Usually, these extended scales concern some of the more complex activities performed at home; however, some of these scales also deal with out-of-home activities. The most well-known instrumental ADL scales are: the Nottingham scale; the Rivermead scale; the Hamrin scale; the PGC scale; the Lawton scale; the Katz scale; the Rosser and Kind scale; and the Frenchay Activities Index⁵.

Conflict of interest: none declare

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REPORT

Report from the 17th World Confederation for Physical Therapy (WCPT) 2015 Congress in Singapore¹

Between 1 and 4 May 2015, I participated in the World Confederation for Physical Therapy Congress (WCPT) 2015 in Singapore. The Congress took place at the Suntec Singapore Convention and Exhibition Centre, and attracted 3500 attendants. In total, 572 oral reports were given and 1578 posters were presented. Furthermore, 25 focused symposia, 11 panel discussions, 18 seminars and 36 networking session were organised. The level of discussions varied. I found the reports concerning the application of new post-stroke rehabilitation methods to be the most interesting, and especially the session entitled 'Best practice for arm recovery post-stroke: an international application', presented by Professors Steven Wolf from Atlanta, Gert Kwakkel from Amsterdam, Mark Bayley from Toronto and Michelle McDonnell from Adelaide. At the poster session, I presented a study entitled 'Effects of gait training with partial body-weight support (PBWS) in the early stage after a stroke – a preliminary report' (by Jarosław Szczygieł and Józef Opara).

The World Confederation for Physical Therapy brings together approximately 23 thousand physical therapists from all over the world. It was announced that the outgoing WCPT President, Marilyn Moffat, has been succeeded by Emma Stokes from Dublin. The next congress will be held between 2 and 4 July 2017 in Cape Town.

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