

The use of functionality scales in patients with Post-Polio Syndrome

Aline Simão Helou^{1,*}, Anna Elisa Basto Ramos¹, Acary Souza Bulle Oliveira², Abrahão Augusto Juviano Quadros³ and Francis Meire Fávero⁴

¹Universidade Federal de São Paulo (UNIFESP). Escola Paulista de Medicina (EPM). Rua Pedro de Toledo, 650. Vila Clementino. São Paulo-SP, Brazil (CEP 04039-002).
*Email: aline.helou@unifesp.br.

² Universidade Federal de São Paulo. Escola Paulista de Medicina. Setor de Doenças Neuromusculares (UNIFESP/EPM). Rua Pedro de Toledo, 650. Vila Clementino. São Paulo-SP, Brazil (CEP 04039-002).

³Universidade Federal de São Paulo (UNIFESP). Escola Paulista de Medicina (EPM). Setor Doenças Neuromusculares. Ambulatório de Síndrome Pós-Poliomielite. Rua Pedro de Toledo, 650. Vila Clementino. São Paulo-SP, Brazil (CEP 04039-002).

⁴Universidade Federal de São Paulo (UNIFESP). Escola Paulista de Medicina (EPM). Curso de Especialização em Neurologia Funcional. Rua Pedro de Toledo, 650. Vila Clementino. São Paulo-SP, Brazil (CEP 04039-002).

Abstract. Post-Polio Syndrome (PPS) is a neurological disease, resulting in the decrease of the neuromuscular functions being characterized by a set of clinical manifestations that occur in individuals who had acute paralytic poliomyelitis. The patients with PPS begin to present new limitations on the performance of their ADLs and, at the same time, tend to ignore them, continuing their daily work with greater physical effort. The need for a functional evaluation is therefore necessary to find out where the commitments are in the ADLs and to help them without aggravating the degenerative PPS. To identify the main functional assessment scales used in individuals with PPS. A study review of the literature was performed on the functional scales used in patients with PPS described in the articles in the database. We found 12 functional scales in activities of daily living, as follows: Nottingham Health Profile (NHP), International Classification of Impairments, Disability's and Handicaps (ICIDH), Functional Status Questionnaire (FSQ), Physical Activity Scale for the Elderly (PASE), Sunnas ADL Index, Katz Index, Falls Efficacy Scale (FES), ADLs-Staircase, Barthel Index, Functional Independence Measure (FIM), Older Adult Resource Survey (OARS), and Self-Reporter ADL. None of the 12 scales mentioned in our study is validated for the use in patients with PPS, the most scales found in the literatures reviewed in this research were NHP and ICIDH. Therefore, we found 9 scales validated in Brazil, Barthel Index, Functional Independence Measure (FIM), Functional Status Questionnaire (FSQ), Falls Efficacy Scale (FES), Nottingham Health Profile (NHP),

Received
May 6, 2019

Accepted
July 28, 2019

Available online
August 1, 2019

Released
August 31, 2019



Full Text Article



ORCID

0000-0001-9904-7674
Aline Simão Helou

International Classification of Impairments, Disability's and Handicaps (ICIDH), Older Adult Resource Survey (OARS), Katz Index and Self-Reporter ADL.

Keyword: Postpolio Syndrome; ADLs; Activities of daily living; Daily activities in polio; Postpolio activities of daily living; Activities of daily living postpoliomyelitis.

0000-0002-6986-1937
Anna Elisa Basto Ramos

0000-0003-0658-0432
Acary Souza Bulle Oliveira

0000-0001-8197-5915
Abrahão Augusto Juviano Quadros

0000-0001-8063-8167
Francis Meire Fávero

Introduction

Post-Polio Syndrome (PPS) is a neurological disease, characterized by the appearance of new weakness, generalized muscular fatigue, culminating to a physical decline less resistance), neuromuscular functions as well as muscle-skeletal and psychosocial (Maynard and Headley, 2000; Oliveira and Maynard, 2002).

Such situation produces, therefore, a group of clinical reports that happens in individuals who had acute paralyzed poliomyelitis characterized by the new weakness and fatigue, muscular pain, new muscular atrophy, dysphagia, breathing difficulties, cold intolerance, cramps, fasciculation's and sleeping disorder. These new symptoms usually happen after a period of functional and neurological stability, of at least fifteen years, after the first involvement of the polyomyelitis (Agre et al., 1991; Maynard and Headley, 2000; Oliveira and Maynard, 2002).

The theory which is mostly accepted nowadays is the one that informs the new motor units enervating the muscles in the PPS cannot keep the increase for the metabolic activity for which they have been submitted for so many years after a long period of prolonged stability of Poliomyelitis Sequel. Such giants motor units, submitted to an overload soonest begin a progressive degeneration and as a consequence, occur a slow increase of weakness and a fast muscle fatigability (Maynard and Headley, 2000).

Most polio survivors face difficulties to manage their ADLs which are defined as basic actions for the human being's survival such as self-care, actions and behavior that provide social integration. The maximum autonomy of the person with disability and their social integration begin in the family context and are objective of training in activities of daily living (Sunnerhagen and Grimby, 2001).

Literatures report that the effects of PPS in the ADLs can be easily seen during the walk. Also the individuals reported some difficulties to lift, carry things or pick them up off the floor (Ahlström and Karlsson, 2000). Usual methods for a functional evaluation are defined with a direct observation (performance tests) and with questionnaires self-applied or conceived face to face for interviews by means of a number of scales that measure the main dimension component. Such scales are designed as "functional evaluation methods" (Dinger et al., 2004).

In accordance with the literature, patients with PPS face new limitations during their ADLs and, at the same time, they try to avoid them at the very beginning of the disease, doing their work tasks with greater effort (Nollet et al., 2003).

The aim of the study of these scales is to evaluate the functionality used in the patients with PPS as well as to analyze the aspect of functionality in the scales found.

Method

A narrative review of literature was performed on the most functional scales that has been applied in patients with PPS described in scientific articles from 2006 to 2016.

The respective research has been applied in the PPS Clinic-Neuromuscular Diseases, Neurology and Neurosurgery Department of the Escola Paulista de Medicina (UNIFESP-EPM). Data basis: Bireme, Pubmed, Chocrane, Google acadêmico, Lilacs, Scielo, Medline, Adolec, and Blackwell-Synergy.

Words used to the research in data basis were: postpolio syndrome, postpoliomyelitis syndrome, ADLs (activities of daily living), daily activities in polio, post poliomyelitis syndrome, postpolio, postpoliomyelitis, ADLs postpolio, ADLs postpoliomyelitis and functional scales.

Results

Searching for specific literature, it can be noted that a great deal of instruments intend to evaluate the functional aspect.

Were found 12 scales on activities of daily living that have been related to PPS, Such scales are Nottingham Health Profile (NHP), International Classification of Impairments, Disability's and Handicaps (ICIDH), Functional Status Questionnaire (FSQ), Physical Activity Scale for the Elderly (PASE), Sunnaas Index, Katz Index, Falls Efficacy Scale (FES), ADLs-Staircase, Barthel Index, Functional Independence Measure (FIM), Older Adult Resource Survey (OARS), and Self-Reporter ADL.

In accordance with the revised scales, Nottingham Health Profile (NHP) and International Classification of Impairments, Disability's and Handicaps (ICIDH) are the ones mostly founded.

Some of the above mentioned scales refer to a total sum and just in case it is not duly summed, the score must change leading to foreseen interventions.

None of the mentioned scales refers to the patients with PPS.

The Table 1 shows the results, as follows: scales, authors and year of publication.

Table 1. Description of the instruments, authors and year of publication.

Scale	Author
Nottingham Health Profile (NHP)	Willén and Grimby (1978)
	Hunt et al. (1981)
	Grimby (1996)
	Nollet et al. (1999)
	Thorén-Jönsson et al. (2001)
	Willén et al. (2001)
	Nollet et al (2003)
	Horemans et al. (2004)
	Teixeira-Salmela et al. (2004)
	Horemans et al. (2005)
On et al. (2006)	

Table 1. Description of the instruments, authors and year of publication.

Scale	Author
International Classification of Impairments, Disability's and Handicaps (ICIDH)	Einarsson and Grimby (1990)
	Einarsson (1991)
	Heerkens et al. (1994)
	Nollet et al. (1999)
	Burguer and Marincek (2002)
	Kumakura et al. (2002)
	Farbu et al. (2003)
Functional Status Questionnaire (FSQ)	Jette and Cleary (1987)
	Einarsson and Grimby (1990)
	Einarsson (1991)
	Söderback et al. (1993)
	Grimby et al. (1994)
	Sunnerhagen et al. (1995)
	Grimby (1996)
Physical Activity Scale for the Elderly (PASE)	Willén and Grimby (1978)
	Willén et al. (1990)
	Willén et al. (2001)
	Dinger et al. (2004)
	Gonzalez (2005)
	Gonzalez et al. (2006)
Sunnaas Index	Heerkens et al. (1994)
	Kling et al. (2002)
	Schanke et al. (2002)
	Strumse et al. (2003)
Katz index	Einarsson and Grimby (1990)
	Einarsson (1991)
	Grimby (1996)
	O'Sullivan and Schmitz (2003)
ADL-Staircase	Sonn and Svensson (1997)
	Thorén and Grimby (2001)
Barthel Index	Trojan (1995)
	Claesson and Svensson (2001)
Functional Independence Measure (FIM)	Diard et al. (1994)
	Paolinelli et al. (2001)
Older Adult Resource Survey (OARS)	Fillenbaum (1985)
	Kemp et al. (1997)
Falls Efficacy scale (FES)	Hellstrom et al. (2002)
	LehmannK. et al (2006)
Self-Reporter ADL	Alstrom and Karlsson (1997)
	Alstrom and Karlsson (2000)
	Paixao Jr. and Reichenheim (2005)

Discussion

Patients with PPS face daily difficulties such as to go up and down stairs, mobility, walking, carry things, pick and lift things off the floor (Ahlström et al., 2000; Nollet et al., 2003).

The largest involvement of individuals with PPS is related to lower members and that's why an evaluation with specific instruments is necessary. At first, in order to meet with the best scale, all the characteristics of the individuals disease and its incapacities must be known in relation to the functionality (Halstead et al., 1995).

Nottingham Health Profile (NHP) also known as second version, being the first Nottingham Health Index, it is a tool used to discuss physical, emotional and social aspects. The part I has 38 questions that analyze the degrees of discomfort and distress in 6 dimensions: energy, physical mobility, pain, sleep, social isolation and emotional. The score is from 0 to 100, the higher is the score the greater the severity of the problem. The part II have 7 questions related to health problems such as: work, domestic life, sexual, leisure and vacation (Hunt et al., 1981).

This scale was adjusted and translated in Brazil by Teixeira-Salmela et al. (2004). This questionnaire shows the health status of the individual and not the functional aspect which is specific for the population with Post-Polio Syndrome.

International Classification of Impairments Disability's and Handicaps (ICIDH) is very used by therapists to analysis their patients' complains and incapacities (Heerkens et al., 1994). Include 6 items to evaluate the social living (orientation, physical independence, mobility, work, social relationship and financial independence). Each item has a score from 0 to 8, where 0 = none and 8 =

extremely severe. This scale places an important emphasis on the functionality aspect, therefore we should take into account that functionality is not the only aspect to be evaluate in this scale (Einarsson and Grimby, 1990; Kumakura et al., 2002).

Functional status Questionnaire (FSQ) is a self-administered scale with 34 items in simple scales of 6 items: (health satisfaction, social life, sexual satisfaction, work, lying down and restriction in daily activity) and also questions on BADL, IADL and mental health. The score varies between 0-100. We note that have a several sub items, we suppose that a trained professional should evaluate the functionality deficits what would imply in clinical attendance. The referred scale does not have as the main subject its functionality but treats it as a sub item (Jette and Cleary, 1987; Einarsson, 1991; Söderback et al., 1993; Gil, 1998).

Physical Activity Scale for the Elderly (PASE) is a questionnaire referred to physical activities that can be done either by the own person or by the interviewer. This questionnaire refers to elderly way of living because it measures some activities as follows: free time, domestic services and physical activity. The questionnaire has 26 questions about clinical physical activity and the sub-scale refers to the activity during free time for the following items: walking (light, moderate, and heavy) for fun or sports: muscle strength and endurance. This sub-scale for domestic services also includes work done at home, as follows: repairs, gardening, yardcare.

The occupational sub-scale asks for the activity related to the work as volunteer or for employees its score varies from 0-400, with values of frequency and weight. As higher the score is, higher is the level of activity (Willén and Grimby, 1978; Dinger et al., 2004).

This scale evaluates the quality of life and the development of daily activities of elderly people therefore in a PPS clinic it can be seen medium aged and young people and otherwise it does not refer to a complex scale of functionality but it can omit important information that could lead to a good treatment.

Sunnaas ADL Index is measured with 12 activities. It has been developed by occupational therapists at The Sunnaas Rehabilitation Hospital, in Norway and provides that these occupational therapists evaluate their patients as dependent or independents (Kling et al., 2002). This 12 items are eating, continence, internal and external transfer, toileting behavior, dressing/undressing, daily hygiene, cooking, bath/shower, domestic services, communication (Heerkens et al., 1994).

For each activity there is a score from 0-3 and the maximum to 36. As higher is the score, more independent is the person. Eleven of the twelve activities are divided into 3 sub scales according to the frequency of help needed (dependent 0-1): Sub-scale I: Help all the time; Sub-scale II: 2-3 times a day; Sub-scale III: 1-2 times a week. The communication is the only item not in the sub-scales. It is more used in patients with PPS, CVA, Spinal cord injury and TBI (Kling et al., 2002).

This scale is also used in PPS but due its complexity regarding the application once have several sub items, what could be misunderstood as by the patient as by the interviewer and the main aspect it is not the functionality.

Katz Index refers to 6 basic items for activities of daily living: bath, clothing, toileting, transfers, continence, feeding. Both direct views as patient self-report for a period of 2 weeks, the interviewer checks each activity without human aid. A 0 score is given if no activity was done or any human aid was applied. The scores of the activities match themselves in order to build a

scale in grades by letters (A-G) in increased dependence order. A score B means that the patient is independent and able to do all the 6 ADL basic items (except one). On the other hand a score D means that the patient is independent, exception for bathing, dressing and other different task (O'Sullivan and Schmitz, 2003). Has been developed for internal patients and later to other communities. Nevertheless there is a disadvantage, the item walking it is not included, and for the rehabilitation clinics can be not helpful since it is an important aspect of the functional evaluation (O'Sullivan and Schmitz, 2003).

Falls Efficacy Scale (FES) is an evaluation tool in the development of activities, including 13 items of daily living. The scale is divided in two sub-scales: BADL e IADL, and each one has 6 activities and one more item referring to go up and down the stairs. The score varies from de 0 to 10, whereas: 0 the individual do not fell safe to do the activities and 10 completely safe. The total sum can reach 130 points (Hellstrom et al., 2002; Lehmann et al., 2006). This is a simple scale that does not require much time to be applied, with few questions and of great help to patients with PPS.

ADL-Staircase tool reaches 4 activities of daily living (I-ADL) as follows: cleaning, shopping, transfer and cooking combined with 6 personal activities of daily living (P-ADL): bathing, dressing, toileting, feeding, continence and transfer. The ability to do each activity is evaluated in one scale of three scores: independent, half dependent and dependent (Sonn and Svensson, 1997).

Concerning the dependency it means that another person is involved direct or not. People living together are evaluated as independents when they are alone doing the activities and dependent if the other person is involved in other activities. Activities can be ordered in scales of ADL from the most independents to dependents and its

score between 0-9/10 = independent in all activities and 9 = dependent for all activities. When the item continence is included in the scale, the score will be 0-10. People who were reported as "others" which means difficult activities to be point out in the scale (Sonn and Svensson, 1997). Although there is a good context regarding evaluation of functionality, it reaches other items that may be or may be not included in the evaluation such as the continence, nevertheless has not been seen in any other literature that shows importance regarding functionality evaluation.

Barthel Index is a scale that measures the grade of assistance requested by an individual in 10 items regarding ADL and that involves mobility and personal care. Levels of measurement are limited to a complete independence or help needed. This index is applied in individuals who are being rehabilitated and each item of development is evaluated in ordinal scales with a specific number of scores for each level or classification, and individual who need aid to eat, should get 5 points. The independence to eat would get 10 points. The total score varies from 0 to 100. Between 0 to 100 the sum of all the scores is calculated, that 0 refers to a complete dependency in all 10 activities and 100 total independency in all activities (Trojan and Cashman, 1995; Claesson and Svensson, 2001).

There are still some deficits regarding functional evaluation of the patient with PPS and as the scales applied are translated they are not validated to PPS, but it was, at first, previously validated to be used in children and nowadays we can note the appliance of this scale in the literature in patients with cerebrovascular diseases. Also it has been applied in monitoring functional changes in individuals who are being rehabilitated (Claesson and Svensson, 2001). However, it does not have as a priority the evaluation of the

functionality only, leading to believe that the evaluation of the patient's functionality may not be accurate and therefore care difficulties must be taken into account.

Functional Independence Measure (FIM) is an indicator of disability that measures the incapacity of care given by a third person to a disabled patient and includes 18 activities of daily living that are measured in a scale of 7 levels, being level 1 completely dependent and 7 completely independent (Paolinelli et al., 2001).

The items of FIM can be summed up in order to have a FIM-total and the values can vary from 18 to 126 points. It can also be disaggregated a FIM-motor, summing the first thirteen items from 13 to 91 and the FIM-cognitive that represents the five last items from 5 to 35. The items were grouped in two major domains (motor and cognitive) and six sub-scales (ADL, sphincter, transference, mobility, communication and cognitive). The total FIM was disaggregated into six specific domains: self-care, sphincter control, transfers, locomotion, communication and cognitive (Diard et al., 1994; Paolinelli et al., 2001).

It can be seen that FIM-total is used in many pathologies and that a great percentage is applied in patients with spinal cord injury and vascular hemiplegia. It can be seen that FIM does not have a real aim to evaluate the functionality of the patients with PPS but being very useful and accurate to other pathologies.

Older Adult Resource Survey (OARS) reached seven items, as follows: use the telephone, travel, shopping, cooking, household, drink medicines and financial care. Individuals are considered dependent with aid or if the activity cannot be finished. It can be self-administered or done by an interviewer (Fillenbaum, 1985). This is a very simple scale such as the number of questions and what make us doubt regarding if this could be sufficient for a good evaluation.

Self Reporter ADL include 31 items relate to activities of daily living scored by 0= no difficulty, success, but with some difficulty 0.5, insufficient 1.0, no activity performance (Ahlström and Gunnarsson, 1996; Paixao Jr. and Reichenheim, 2005). This is a scale referring to a certain number of items for a good evaluation regarding functionality but as it can be, no literature shows if there is an effective evaluation on PPS patients.

Dencker et al. (2015) in his study used scores of the Swedish MFI-20 valid scale total and subscale and also reliable measures of fatigue in persons with post polio syndrome once as far as it is concerned the functionality of the scale tends to evaluate the fatigue.

The fatigue can be either central or peripheral being one of the most incapacitating symptoms and the conclusion of our study is to emphasize that patients should be advised about the practice of supervised exercises, changes in the daily living style and energy saving in order to reduce the excess of the metabolic load thus providing improvement in the symptoms and also improving its functionality (Motta et al. 2018, 2019). On the other hand (Vasconcelos Jr., 2006) developed a study using three fatigue scales, showing that Post-polio fatigue is one of the most disabling symptoms and that can influence directly in the daily life activities. Such scales have been developed to evaluate fatigue including a small approach in its functionality, as well.

According to the studies in this review, we agree that the decreasing of the functionality is related to the fatigue. Also, recently, a study evaluating the functionality regarding the FIM scale in those patients with post-polio syndrome submitted to the use of L-Carnitine and

Piracetam showed no statistical difference on the improvement of functionality although the patients reported they felt more comfortable to perform their tasks when being free of the fatigue symptoms patients with post-polio syndrome show some cronical deformities due to physical sequelae that can be noticed in the clinics. Professional assistance should be carried out as well as prescription of appropriated orthoses instead of avoiding their deformities, whereas taking into account the exception on the difficulties faced during the tasks of ADLs, it is necessary to evaluate the aspect of the functionality.

It can be noticed that none of the instruments evaluate the functionality but most of them measure the cognitive aspect increasing the time of applicability and the patient evaluation. Also, considering the need for a more accurate evaluation and that the scales found were only applied in elderly people without PPS, after this study, we can taken into account there is interest in the elaboration of a specific scale for the approach of the functionality in patients with Post-Polio Syndrome.

Nine scales have been found in Brazil, Nottingham Health Profile (NHP), International Classification of Impairments Disability's and Handcaps (ICIDH), Functional Status Questionnaire (FSQ), Katz Index, Barthel Index, Functional Independence Measure (FIM) (Medida de Independência Funcional (MIF) as it is translated to Portuguese), Older Adult Resource Survey (OARS), Falls Efficacy Scale (FES), Self-Reporter ADL, Nottingham Health Profile (NHP) and International Classification of Impairments Disability's and Handcaps (ICIDH), were the scales most found in the revised studies of our research.

The Table 2 describes all the instruments founded in this study according author and year of validation.

Tabela 2. Description of the instruments, author and year of the validation

Scale	Author
Nottingham Health Profile (NHP)	Hunt, et al. (1985), Teixeira et al. (2004)
International Classification of Impairments, Disability's and Handicaps (ICIDH)	WHO (1980), OMS (2003)
Functional Status Questionnaire (FSQ)	Jette, et al. (1986), Gil (1998)
Physical Activity Scale for the Elderly (PASE)	Washburn et al. (1993)
Sunnaas Index	Vardeberg et al. (1991)
Katz Index	Brorsson and Asberg (1984), Lino et al. (2008)
ADL-Staircase	Jakobsson (2008)
Barthel Index	Collin et al. (1998), Minosso et al. (2010)
Functional Independence Measure (FIM)	Dodds et al. (1993), Riberto et al. (2004)
Older Adult Resource Survey (OARS)	Fillenbaum and Smyer (1981), Blay et al. 1988)
Falls Efficacy Scale (FES)	Tinetti et al. (1990), Camargos et al. (2010)
Self-Report ADL	Edwards (1990), Nigri et al. (2007)

Conclusion

The data of this study show there is not any consensus on the literature regarding what is best the functional scale to be applied. None of the scales mentioned in this study is validated to be used in patients with Syndrome Post Poliomyelitis which raises doubts concerning the correct appliance in PPS patients who need more precise evaluation in the functionally aspect.

As far it is understood the result for a best evaluation is the one that gets a great number of items although it would imply in the time of appliance in a clinic. Due to the functional difficulties faced by the patients with Post-Polio Syndrome we suggest that a scale should be elaborated regarding only about functionality, with objective and discretion questions, taking into account the time and not limited to a single domain.

Conflicts of interest

Authors declare that they have no conflict of interests.

Referências

Agre, J. C.; Rodrigues, A. A.; Tafel, J. A. Late effects of polio: Critical review of the literature on neuromuscular function. **Archives of Physical Medicine and Rehabilitation**, v. 72, no. 11, p. 923-931, 1991. [https://doi.org/10.1016/0003-9993\(91\)90013-9](https://doi.org/10.1016/0003-9993(91)90013-9)

Ahlström, G.; Gunnarsson, L. G. Disability and quality of life in individuals with muscular dystrophy. **Scandinavian Journal of Rehabilitation Medicine**, v. 28, no. 3, p. 147-157, 1996.

Ahlström, G.; Karlsson, U. Disability and quality of life in individuals with Postpolio Syndrome. **Disability and Rehabilitation**, v. 22, no. 9, p. 416-422, 2000. <https://doi.org/10.1080/096382800406031>

- Blay, S. L.; Ramos, L. R.; Mari, J. J. Validity of a Brazilian version of the Older Americans Resources and Services (OARS) Mental Health Screening Questionnaire. **The American Geriatrics Society**, v. 36, no. 8, p. 687-692, 1988. <https://doi.org/10.1111/j.1532-5415.1988.tb07169.x>
- Brorsson, B.; Asberg, K. H. Katz Index of Independence in ADL. Reliability and validity in short-term care. **Scandinavian Journal of Rehabilitation Medicine**, v. 16, no. 3, p. 125-132, 1984.
- Burger, H.; Marinček, C. The influence of Post-Polio Syndrome on independence and life satisfaction. **Disability and Rehabilitation**, v. 22 n. 7, p. 318-322, 2000. <https://doi.org/10.1080/096382800296674>
- Camargos, F. F. O.; Dias, R. C.; Dias, J. M. D.; Freire, M. T. F. Cross-cultural adaptation and evaluation of the psychometric properties of the Falls Efficacy Scale - International Among Elderly Brazilians (FES-I-BRAZIL). **Brazilian Journal of Physical Therapy**, v. 14, no. 3, p. 237-243, 2010. <https://doi.org/10.1590/S1413-35552010000300010>
- Claesson, L.; Svensson, E. Measures of order consistency between paired ordinal data: Application to the functional independence measure and Sunnaas Index of ADL. **Journal of Rehabilitation Medicine**, v. 33, no. 3, p. 137-144, 2001. <https://doi.org/10.1080/165019701750166014>
- Collin, C.; Wade, D. T.; Davies, S.; Horne, V. The Barthel ADL Index: A reliability study. **Journal International Disability Studies**, v. 10, no. 2, p. 61-63, 1988. <https://doi.org/10.3109/09638288809164103>
- Dencker, A.; Sunnerhagen, K. S.; Taft, C.; Lundgren-Nilsson, A. Multidimensional fatigue inventory and post-polio syndrome: A Rasch analysis. **Health and Quality of Life Outcomes**, 13:20, 2015. <https://doi.org/10.1186/s12955-015-0213-9>
- Diard, C.; Ravaud, J.-F.; Held, J.-P. French survey of postpolio sequelae: Risk factors study and medical social outcome. **American Journal of Physical Medicine & Rehabilitation**, v. 73, no. 4, p. 264-267, 1994.
- Dinger, M. K.; Oman, F.; Taylor, E. L.; Vesely, S. K.; Able, J. Stability and convergent validity of the Physical Activity Scale for the Elderly (PASE). **The Journal of Sports Medicine and Physical Fitness**, v. 44, no. 2, p. 186-192, 2004
- Dodds, T. A.; Martin, D. P.; Stolov, W. C.; Deyo, R. A. A validation of the functional independence measurement and its performance among rehabilitation in patients. **Archives of Physical Medicine and Rehabilitation**, v. 74, no. 5, p. 531-536, 1993. [https://doi.org/10.1016/0003-9993\(93\)90119-U](https://doi.org/10.1016/0003-9993(93)90119-U)
- Edwards, M. M. The reliability and validity of self-report activities of daily living scales. **Canadian Journal of Occupational Therapy**, v. 57, no. 5, p. 273-278, 1990. <https://doi.org/10.1177/000841749005700507>
- Einarsson, G. Muscle adaptation and disability in late poliomyelitis. **Scandinavian Journal of Rehabilitation Medicine Supplement**, v. 25, p. 1-76, 1991.
- Einarsson, G.; Grimby, G. Disability and handicap in late poliomyelitis. **Scandinavian Journal of Rehabilitation Medicine**, v. 22, p. 113-121, 1990.
- Farbu, E.; Rekan, T.; Gilhus, N. E. Post-Polio Syndrome and total health status in a prospective hospital study. **European Journal of Neurology**, v. 10, p. 407-413, 2003. <https://doi.org/10.1046/j.1468-1331.2003.00613.x>
- Fillenbaum, G. G. Screening the elderly: A brief instrumental activities of daily living measure. **Journal of the American Geriatrics Society**, v. 33, no. 10, p. 698-706, 1985. <https://doi.org/10.1111/j.1532-5415.1985.tb01779.x>
- Fillenbaum, G. G.; Smyer, M. A. The development, validity, and reliability of the Oars Multidimensional Functional Assessment Questionnaire. **Journal of Gerontology**, v. 36, no. 4, p. 428-434, 1981. <https://doi.org/10.1093/geronj/36.4.428>
- Gil, J. A. **Qualidade de vida/estado funcional em doentes com problemas lombares - Adaptação e validação cultural do Functional Status Questionnaire**. Coimbra: Faculdade de Economia, Universidade de Coimbra; 1998. (Master thesis).
- Gonzalez, H. **The Post-Polio Syndrome: Studies of immunology and immunomodulatory intervention**. Stockholm,

Sweden: Karolinska Institute, 2005. (Master thesis).

Gonzalez, H.; Sunnerhagen, K. S.; Sjöberg I.; Kaponides, G.; Olsson, T.; Borg, K. Intravenous immunoglobulin for Post-Polio Syndrome: A randomised controlled trial. **The Lancet Neurology**, v. 5, no. 6, p. 493-500, 2006. [https://doi.org/10.1016/S1474-4422\(06\)70447-1](https://doi.org/10.1016/S1474-4422(06)70447-1)

Halstead, L.; Gawne, A. C.; Pham, B. T. National rehabilitation hospital limb classification for exercise, research, and clinical trials in post-polio patients. **Annals of the New York Academy of Sciences**, v. 753, no. 1, p. 343-353, 1995. <https://doi.org/10.1111/j.1749-6632.1995.tb27560.x>

Heerkens, Y. F.; Brandsma, J. W.; Lakerveld-Heyl, K.; Ravensberg, C. D. Impairments and disabilities: The difference: Proposal for adjustment of the International Classification of Impairments, Disabilities, and Handicap. **Physical Therapy**, v. 74, no. 5, p. 430-442, 1994. <https://doi.org/10.1093/ptj/74.5.430>

Hellstrom, K.; Lindmark, B.; Fugl-Meyer, A. The Falls-Efficacy Scale, Swedish version: Does it reflect clinically meaningful changes after stroke? **Disability and Rehabilitation**, v. 24, no. 9, p. 471-481, 2002. <https://doi.org/10.1080/09638280110105259>

Helou, A. S. **Avaliação da independência funcional em pacientes com Síndrome Pós-Poliomielite submetidos ao uso de L-Carnitina e Piracetam**. São Paulo: Universidade Federal de São Paulo, Escola Paulista de Medicina, 2017. (Master thesis).

Horemans, H. L. D.; Bussmann, J. B. J.; Beelen, A.; Stam, H. J.; Nollet, F. Walking in Postpoliomyelitis Syndrome: The relationships between time-scored tests, walking in daily life and perceived mobility problems. **Journal of Rehabilitation Medicine**, v. 37 no. 3, p. 142-146, 2005.

Horemans, H. L.; Nollet, F.; Beelen, A.; Lankhorst, G. J. A comparison of 4 questionnaires to measure fatigue in Postpoliomyelitis Syndrome. **Archives of Physical Medicine and Rehabilitation**, v. 85, no. 3, p. 392-398, 2004. <https://doi.org/10.1016/j.apmr.2003.06.007>

Hunt, S. M.; McEwen, J.; McKenna, S. P. Measuring health status: A new tool for

clinicians and epidemiologists. **The Journal of the Royal College of General Practitioners**, v. 35, no. 273, p. 185-188, 1985.

Hunt, S. M.; McKenna, S. P.; McEwen, J.; Williams, J.; Papp, E. The Nottingham Health Profile: Subjective health status and medical consultations. **Social Science & Medicine. Part A: Medical Psychology & Medical Sociology**, v. 15, no. 3, Pt. 1, p. 221-229, 1981. [https://doi.org/10.1016/0271-7123\(81\)90005-5](https://doi.org/10.1016/0271-7123(81)90005-5)

Jakobsson, U. The ADL-Staircase: Further validation. **International Journal of Rehabilitation Research**, v. 31, no. 1, p. 85-88, 2008. <https://doi.org/10.1097/MRR.0b013e3282f45166>

Jette, A. M.; Cleary, P. D. Functional disability assessment. **Physical Therapy**, v. 67, no. 12, p. 1854-1859, 1987. <https://doi.org/10.1093/ptj/67.12.1854>

Jette, A. M.; Davies, A. R.; Cleary, P. D.; Calkins, D. R.; Rubenstein, L. V.; Fink, A.; Kosecoff, J.; Young, R. T.; Brook, R. H.; Delbanco, T. L. The Functional Status Questionnaire: Reliability and validity when used in primary care. **Journal of General Internal Medicine**, v. 1, no. 3, p. 143-149, 1986. <https://doi.org/10.1007/bf02602324>

Kemp, B. J.; Brad, M. A.; Campbell, M. L. Depression and life satisfaction in aging polio survivors versus age-matched controls: Relation to Postpolio Syndrome, family functioning, and attitude toward disability. **Archives of Physical Medicine and Rehabilitation**, v. 78, no. 2, p. 187-192, 1997. [https://doi.org/10.1016/S0003-9993\(97\)90262-8](https://doi.org/10.1016/S0003-9993(97)90262-8)

Kling, C.; Persson, A.; Gardulf, A. The ADL ability and use of technical aids in persons with late effects of polio. **The American Journal of Occupational Therapy**, v. 56, no. 4, p. 457-461, 2002. <https://doi.org/10.5014/ajot.56.4.457>

Kumakura, N.; Takayanagi, M.; Hasegawa, T.; Ihara, K.; Yano, H.; Kimizuka, M. Self-assessed secondary difficulties among paralytic poliomyelitis and spinal cord injury survivors in Japan. **Archives of Physical Medicine and Rehabilitation**, v. 83, p. 1245-1251, 2002. <https://doi.org/10.1053/apmr.2002.34273>

Lehmann, K.; Sunnerhagen, K. S.; Willén, C. Postural control in persons with late effects

- of polio. **Acta Neurologica Scandinava**, v. 113, p. 55-61, 2006. <https://doi.org/10.1111/j.1600-0404.2006.00443.x>
- Lino, V. T. S.; Pereira, S. R. M.; Camacho, L. A. B.; Filho, S. T. R.; Buksman, S. Adaptação transcultural da Escala de Independência em Atividades da Vida Diária (Escala de Katz). **Cadernos de Saúde Pública**, v. 24, no. 1, p. 103-112, 2008. <https://doi.org/10.1590/S0102-311X2008000100010>
- Maynard, F. M.; Headley, J. L. (Eds.). **Manual acerca dos efeitos tardios da poliomielite, para médicos e sobreviventes**. Lisboa: Associação Pós-Pólio de Portugal, 2000. (Coleção Rumos e Perspectivas, 1).
- Minosso, J. S. M.; Amendola, F.; Alvarenga, M. R. M.; Oliveira, M. A. C. Validation of the Barthel Index in elderly patients attended in outpatient clinics, in Brazil. **Acta Paulista de Enfermagem**, v. 23, n. 2, p. 218-223, 2010. <https://doi.org/10.1590/S0103-2100201000200011>
- Motta, M. P.; Quadros, A. A. J.; Conti, M. S. B.; Oliveira, A. S. B. Post-Polio Syndrome. **Brazilian Journal of Biological Sciences**, v. 5, no. 11, p. 631-639, 2018. <https://doi.org/10.21472/bjbs.051102>
- Motta, M. P.; Quadros, A. A. J.; Ferreira, L. S.; Oliveira, A. S. B. Fatigue in Post-Polio Syndrome. **Brazilian Journal of Biological Sciences**, v. 6, no. 12, p. 17-25, 2019. <https://doi.org/10.21472/bjbs.061203>
- Nigri, P. Z.; Peccin, M. S.; Almeida, G. J. M.; Cohen, M. Translation, validation and cultural adaptation of the 'activities of daily living scale' - ADLS. **Acta Ortopédica Brasileira**, v. 15, no. 2, p. 101-104, 2007. <https://doi.org/10.1590/S1413-78522007000200009>
- Nollet, F.; Beelen, A.; Twisk, J. W.; Lankhorst, G. J.; De Visser, M. Perceived health and physical functioning in Postpoliomyelitis Syndrome: A 6-year prospective follow-up study. **Archives of Physical Medicine and Rehabilitation**, v. 84, no. 7, p. 1048-1056, 2003. [https://doi.org/10.1016/S0003-9993\(03\)00108-4](https://doi.org/10.1016/S0003-9993(03)00108-4)
- O'Sullivan, S. B.; Schmitz, T. J. **Fisioterapia avaliação e tratamento**. 4. ed. São Paulo: Manole, 2003.
- Oliveira, A. S. B.; Maynard, F. M. Síndrome Pós-Poliomielite: aspectos neurológicos. **Revista Neurociências**, v. 10, no. 1, p. 31-34, 2002.
- OMS - Organização Mundial de Saúde. **CID-10 - Classificação de Doenças em Português**. 9. ed. rev. São Paulo: EDUSP, 2003.
- On, A. Y.; Oncu, J.; Atamaz, F.; Durmaz, B. Impact of pos-polio-related fatigue on quality of life. **Journal of Rehabilitation Medicine**, v. 38, no. 5, p. 329-332, 2006. <https://doi.org/10.1080/16501970600722395>
- Paixao Jr., C. M. P.; Reichenheim, M. E. A review of functional status evaluation instruments in the elderly. **Cadernos de Saúde Pública**, v. 21, no. 1, p. 7-19, 2005. <https://doi.org/10.1590/S0102-311X200500100002>
- Paolinelli, C.; González, P.; Doniez, M. E.; Donoso, T.; Salinas, V. Instrumento de evaluación funcional de la discapacidad en rehabilitación. Estudio de confiabilidad y experiencia clínica con el uso del Functional Independence Measure. **Revista Médica de Chile**, v. 129, no. 1, p. 23-31, 2001. <https://doi.org/10.4067/S0034-9887200100100004>
- Riberto, M.; Miyazaki, M. H.; Jucá, S. S. H.; Sakamoto, H.; Pinto, P. P. N.; Battistella, L. R. Validação da versão brasileira da Medida de Independência Funcional. **Acta Fisiátrica**, v. 11, no. 2, p. 72-76, 2004. <https://doi.org/10.5935/0104-7795.2004.0003>
- Schanke, A.-K.; Stanghelle, J. K.; Stein, A.; Opheim, A.; Strom, V.; Solbakk, A.-K. Mild versus severe fatigue in polio survivors: Special characteristics. **Journal Disability and Rehabilitation**, v. 34, p. 134-140, 2002.
- Söderback, I.; Schult, M. L.; Nordemar, R. Assessment of the patients with chronic back pain using the 'Functional Status Questionnaire'. **Scandinavian Journal of Rehabilitation Medicine**, v. 25, no. 3, p. 139-143, 1993.
- Sonn, U.; Svensson, E. Measures of individual and group changes in ordered categorical data: Application to the ADL-Staircase. **Scandinavian Journal of Rehabilitation Medicine**, v. 29, no. 4, p. 233-242, 1997.
- Strumse, Y. A. S.; Stanghelle, J. K.; Utne P.; Svendsby, E. K. Treatment of patients with Postpolio Syndrome in a warm climate. **Journal Disability and Rehabilitation**,

v. 25, no. 2, p. 77-84, 2009. <https://doi.org/10.1080/dre.25.2.77.84>

Sunnerhagen, K. S.; Grimby G. Muscular effects in late polio. **Acta Physiologica Scandinava**, v. 171, no. 3, p. 335-340, 2001. <https://doi.org/10.1046/j.1365-201x.2001.00836.x>

Teixeira, S. L. F.; Magalhães, L. C.; Souza, A. C.; Lima, M. C.; Lima, R. C. M.; Goulart, F. Adaptação do Perfil de Saúde de Nottingham: um instrumento simples de avaliação da qualidade de vida. **Cadernos de Saúde Pública**, v. 20, no. 4, p. 905-914, 2004. <https://doi.org/10.1590/S0102-311X200400400004>

Tinetti, M. E.; Richman, D.; Powell, L. Falls efficacy as a measure of fear of falling. **Journal of Gerontology**, v. 45, no. 6, p. 239-243, 1990. <https://doi.org/10.1093/geronj/45.6.P239>

Trojan, D. A.; Cashman, N R. An open trial of pyridostigmine in Post-Poliomyelitis Syndrome. **Canadian Journal of Neurological Sciences**, v. 22, no. 3, p. 223-227, 1995. <https://doi.org/10.1017/S0317167100039883>

Vardeberg, K.; Kolsrud, M.; Laberg, T. Sunnaas Index of ADL. **World Federation of Occupational Therapists Bulletin**, v. 24, no 1, p. 30-35, 1991. <https://doi.org/10.1080/14473828.1991.11785249>

Vasconcelos Jr, O. M.; Prokhorenko, O. A.; Kelley, K. F.; Vo, A. H.; Olsen, C. H.; Dalakas, M. C.; Halstead, L. S.; Jabbari, B.; Campbell, W. W. A Comparison of fatigue scales in Postpoliomyelitis Syndrome. **Archives of Physical Medicine and Rehabilitation**, v. 87, no. 9, p. 1213-1217, 2006. <https://doi.org/10.1016/j.apmr.2006.06.009>

Washburn, R. A.; Smith, K. W.; Jette, A. M.; Janney, C. A. The Physical Activity Scale for the Elderly (PASE): Development and evaluation. **Journal of Clinical Epidemiology**, v. 46, no. 2, p. 153-162, 1993. [https://doi.org/10.1016/0895-4356\(93\)90053-4](https://doi.org/10.1016/0895-4356(93)90053-4)

WHO - World Health Organization. **International classification of impairments, disabilities, and handicaps: A manual of classification relating to the consequences of disease**, published in accordance with resolution WHA29.35 of the Twenty-ninth World Health Assembly, May 1976. Geneva: WHO, 1980.

Willén, C.; Grimby G. Pain, physical activity, and disability in individuals with late effects of polio. **Archives of Physical Medicine and Rehabilitation**, v. 79, p. 915-919, 1978. [https://doi.org/10.1016/S0003-9993\(98\)90087-9](https://doi.org/10.1016/S0003-9993(98)90087-9)

Willén, C.; Sunnerhagen, K. S.; Grimby G. Dynamic water exercise in individuals with late poliomyelitis. **Archives of Physical Medicine and Rehabilitation**, v. 82, p. 66-72, 2001.

Willén, C.; Sunnerhagen, K. S. Physical performance in individuals with late effects of Polio. **Scandinavian Journal of Rehabilitation Medicine**, v. 31, p. 244-249, 1999.



License information: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.