

Validation of the Barthel Index in elderly patients attended in outpatient clinics, in Brazil*

Validação, no Brasil, do Índice de Barthel em idosos atendidos em ambulatorios

Validación, en Brasil, del índice de Barthel en pacientes ancianos atendidos en ambulatorios clínicos

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ABSTRACT

Objective: To validate the Barthel Index for elderly patients being attended in outpatient clinics in Brazil through analysis of reliability and validity. **Methods:** To prove the reliability, it was used the internal consistency and to verify its validity was used the factor analysis and the validity criterions of convergence and discriminancy. **Results:** The reliability calculated with the alpha of Cronbach presented the value of 0.90 for the total scale. The validity analysis of convergent criterion, using the Functional Independence Measure, identified a satisfactory correlation for most areas. In the factor analysis, which retained only one domain and the 10 items of the original scale, the variance explained was 63.8%. **Conclusion:** The results recommend its use for evaluating the functional ability of elderly patients being treated in outpatient care in Brazil.

Keywords: Validation studies; Activities of daily living; Aged; Geriatric assessment

RESUMO

Objetivo: Validar o Índice de Barthel para idosos atendidos em ambulatorios, no Brasil, por meio de análises de confiabilidade e validade. **Métodos:** Para comprovação da confiabilidade, utilizou-se a consistência interna e, para a verificação da validade, a análise fatorial e as validades de critério convergente e discriminante. **Resultados:** A confiabilidade, estimada pelo alfa de Cronbach, apresentou o valor de 0,90 para a escala total. A análise da validade de critério convergente, utilizando a Medida de Independência Funcional, identificou correlação satisfatória para a maioria dos domínios. Na análise fatorial, que manteve apenas um domínio e os 10 itens da escala original, a variância explicada foi de 63,8%. **Conclusão:** Os resultados permitem recomendar sua utilização para avaliar a capacidade funcional de idosos em atendimento ambulatorial no Brasil.

Descritores: Estudos de validação; Atividades cotidianas; Idoso; Avaliação geriátrica

RESUMEN

Objetivo: Validar el índice de Barthel para personas ancianas atendidos en ambulatorios clínicos, en Brasil, a través del análisis de fiabilidad y validez. **Métodos:** Para probar la fiabilidad, se utilizó la consistencia interna y para verificar su validez el análisis factorial y los criterios de validez convergente y discriminante. **Resultados:** La fiabilidad estimada por el alfa de Cronbach, mostró el valor de 0,90 para la escala total. El análisis de la validez de criterio convergente, por medio de la Medida de Independencia Funcional, identificó una correlación satisfactoria para la mayoría de las áreas. En el análisis factorial, que sólo conservó un dominio y los 10 ítems de la escala original, la varianza explicada fue de 63,8%. **Conclusión:** Los resultados permiten recomendar su utilización para evaluar la capacidad funcional de los pacientes de edad avanzada en la atención ambulatoria en Brasil.

Descriptores: Estudios de validación; Actividades cotidianas; Anciano; Evaluación geriátrica

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INTRODUCTION

A relevant increase of the elderly population can be observed in the world and also in Brazil. Such condition can be explained by the articulation of mechanisms decreasing mortality and birth rates in a certain population, which can be named demographic transition⁽¹⁾.

Due to the demographic transition, the morbimortality profile is changing. Acute cases are being replaced by chronic processes of wearing out and disease, bringing impacts to the healthcare system. Individually, the increase of human life expectation brings on a complex situation, many times experienced by people who are not yet part of the elderly population: the wish to live longer and longer coexists with the fear of reaching such goal with incapacities and dependencies.

The assessment of physical, psychological, social, and cultural conditions in the elderly population allows their health needs to be understood. The information generated may subsidize the implementation of programs, planning of healthcare strategies and interventions that are appropriate to such population group's reality.

There are countless instruments to assess the elderly functional state and many of them are applied with no previous study of their psychometric measures. The choice of the appropriate instrument certainly depends on the operational environment and the study objects. However, the correct selection implies formally knowing the validity and reliability results of the chosen instrument⁽²⁾.

The Barthel Index is a worldwide used instrument to assess functional independence and mobility. A review study on the elderly functional study assessment instruments⁽³⁾, from 2004, identified this index as one of the most used instruments to assess daily life activities. In 2007, another study⁽⁴⁾ confirmed that, in Brazil, there are no population-based studies that have used such index.

Prior to the present study proposal, a bibliographic search was performed in the Health Virtual Library database – Bireme (Medline, Lilacs, Cochrane Library and SciELO), PeriEnf (School of Nursing – USP) and in the Digital Library for theses and dissertations of Universidade de São Paulo, between the years of 1998 and 2008, aiming to identify articles written in Portuguese, resulting from studies performed with human beings at any age, which utilized the Barthel Index. From the 32 studies found, only two⁽⁵⁻⁶⁾ mentioned transcultural adaptation or validation processes of the instrument to our country. Bearing in mind the *completeness* concept, regarding the accumulation and intensity of an instrument reliability or validity in the literature⁽⁷⁾, it was possible to verify the need for more detailed studies that had a wider coverage to ratify the reproducibility, reliability and validation of such scale.

Therefore, the present study objective was to validate the Barthel Index for ambulatory treated elderly in Brazil, through validity and reliability analyses. This instrument is widely used in national studies and governmental publications, with a compatible translation, easy verification, and an association with the original language. The version published in 2004⁽⁵⁾ was used

after being compared to the original one.

METHODS

Population

The population studied was comprised of elderly people, having as inclusion criteria: ages equal or superior to 60 years old, both sexes, with some or no dependence degree, being treated at the Healthcare Center Paula Souza of the Public Health College of Universidade de São Paulo, and that agreed to participate on the research by signing the Informed Consent Term. The exclusion criteria were: patients that were not able to verbally communicate refused to participate, or did not accept signing the Informed Consent Term.

As a general rule for instruments validation, the largest possible sample is recommended, of ten subjects by instrument item⁽⁸⁾. Such proportion is also recommended when the factorial analysis is used⁽⁹⁾, which is the case of this study. Therefore, the convenience sample had 100 elderly, resulting in 10 subjects by item.

The data collection was performed from May to September 2007. The functional capacity assessment instruments, Barthel Index and Functional Independence Measurement, were applied to the patients either before or after their geriatric appointments.

The social-demographic data collected were: age (years), sex, marital status, schooling (years of completed studies), economic activity (active or inactive – retired or pensioner), occupation prior to retirement, family income (net income in Reais), *per capita* income, and number of people in the house.

Barthel Index

The Barthel Index belongs to the daily life activity (DLAs) assessment field and measures the functional independence at personal care, mobility, locomotion and excretion. In the original version, each item is scored according to the patient's ability to perform activities either independently, with some help, or completely depending on help. A general scoring is comprised by attributing points to each category, depending on the time and assistance needed by each patient. Points vary from 0 to 100, in 5 point intervals, and the higher the scoring the more patients are independent⁽⁷⁾.

The version used assesses the functional independence in ten activities: feeding, bathing, grooming, dressing, bowel and bladder care, toilet use, transfers, ambulation, and stair climbing. The classification of each activity is described in the instrument original elaboration⁽¹⁰⁾, according to the following descriptions:

The "Feeding" activity assessment is related to the action of directing food from the plate (or similar) to the mouth, the ability to use cutlery, as well as eating in a reasonable time. Elderly people who needed assistance were classified as "assistance dependent", and those who could not bring food to their mouth from the plate were defined as "dependent".

"Bathing" refers to the usage of a shower or bathtub, and washing the body in any of them. The elderly needing other people's help in any of these functions were classified as "dependent".

In order to assess the function “Dressing”, the action of taking clothes from a wardrobe and getting dressed are considered. Underwear, external clothes, zippers, buttons, and belts are considered “clothes”. Putting on shoes is not assessed. Elderly who needed help, but who could perform at least half the activities in a reasonable time received the “assistance dependent” classification. If they could not accomplish such condition, they were considered “dependent”.

The “Grooming” activity assessment is related to the ability of washing face and hands, brush the teeth, and shave with no help. The elderly considered “dependent” were the ones who needed any type of assistance from others during these activities.

The function “Bowel care” refers to the absence of incontinence episodes. The elderly who did not present involuntary excretion, besides being able to use suppositories and enemas by themselves, if necessary, were classified as “continent”. When the elderly subjects needed help or presented fecal incontinence, the classification was “occasional incontinence”.

As to the “Bladder care” function, the elderly who did not present involuntary urinary incontinence, and were able to deal with the urinary catheter by themselves were considered “continent”. Those who presented scarce incontinence episodes or who could not deal with the catheter and other devices without help were considered “occasional incontinent”.

The function “Toilet use” is assessed according to the ability to use the toilet for excretion, as well as to put clothes back on and clean one’s self. The elderly who needed help to keep balance or to get cleaned were considered “assistance dependent”. The elderly considered “dependent” were the ones who received direct assistance from another person and did not perform the function, as well as those using commodes or bed pans.

The function “Transfers” is assessed by the ability to move from the bed to a chair and from a chair back to the bed. The elderly who needed supervision or support to perform the transfer were classified as “minimum help dependent”. The elderly considered “greatly dependent” were the ones who could sit down, but needed total assistance for the transfer. The elderly considered “dependent” were the ones who could neither sit down nor collaborate during transfers.

In order to assess “Ambulation”, anyone able to walk without help for 50 meters is considered “independent”, even if they use the help of a walking stick, crutches, prosthesis, or a walker. The elderly classified as “assistance dependent” were the ones who can walk 50 meters, but need help or supervision.

The “Climbing stairs” item concerns the capacity to go up and down stairs without help or supervision, even if the elderly person needs crutches, a walking stick, or handrail support. The elderly considered “assistance dependent” were the ones who needed physical help or supervision when coming up or down stairs.

Functional Independence Measure

The Function Independence Measure – FIM – translated into Portuguese in the year 2000⁽¹¹⁾ was used as a golden standard. It has been approved by a validation process in the year of 2004⁽¹²⁾, and has been used in Brazil both in ambulatories⁽¹³⁾ and hospital and rehabilitation units⁽¹⁴⁾.

FIM is a widely and internationally used instrument to assess the functional capacity and differs from others due to the cognitive assessment. The scale is comprised of 18 categories, grouped in six dimensions: self-care, sphincter control, transfers, locomotion, communication, and social-cognition. Each item ranges between scores 1 to 7, where 1 corresponds to total dependence and 7 total independence. Each dimension is analyzed by the sum of the items that comprise it⁽⁷⁻¹¹⁾. Two domains are described in this instrument: the motor domain, regarding self-care, sphincter control, transfers, and locomotion; and the cognitive domain, which comprises the communication and social cognition dimensions⁽¹²⁾.

The FIM total score is obtained by the sum of each dimension scoring, which can range between 18 and 126 points. Up to 18 points, the elder person is considered completely dependent; from 19 to 60 points, the subject is considered with modified dependence, receiving up to 50% assistance in an activity; from 61 to 103, the subject is considered with modified dependence, receiving up to 25% assistance in an activity; and from 104 to 126 points, equivalent to complete/modified independence.

The “Self-care” dimension groups categories such as eating, personal hygiene, bathing, getting dressed above the waist, getting dressed below the waist, and using the toilet. The sphincter control dimension groups the categories of urine and excrement control. The bed-chair transfers, toilet, and shower/bathtub are part of the “Transfers” dimension. The dimension “Locomotion” covers items such locomotion and going up and down stairs. The “Communication” dimension covers the comprehension and expression items, and the “Social Cognition” dimension, the social interaction, problem resolution, and memory items.

Validity and reliability data analysis

First, the *Kolmogorov-Smirnov* test was used to assess the variables normal distribution adherence, and no variables presented normal distribution ($p < 0,05$). Therefore, non-parametric tests were performed.

The reliability was assessed by the internal consistency, estimated by the Cronbach alpha coefficient, considering each factor/domain and the whole scale. The contribution of each item was considered in order to rate the domain reliability. The index may vary from 0 to 1, and the higher the value, the more the scale is reliable⁽¹⁵⁾. Values above 0.80 are considered satisfactory⁽¹⁶⁾.

The validity was measured through the convergent criteria validation, factorial analysis, and the discriminant validation. The factorial analysis allows domains or factors to be confirmed, as well as the items in each factor/domain. Such analysis is based in the correlation between two items. The *Kaiser-Meyer-Olkin Measure of Sampling Adequacy* test was performed so as to measure the data adequacy for the factorial analysis. The result of 0,857 ($p < 0,01$) indicates that the sample size was adequate⁽¹⁵⁾.

The convergent criteria validity was analyzed by the Spearman correlation coefficients between the Barthel Index and the Functional Independence Measure. The scoring average of three elderly age brackets were compared in order to reach the discriminant validity: 60 to 69 years old, 70 to 79 years old, and

80 years old, using the average difference Kruskal-Wallis test.

Ethical Aspects

All participants were informed about the research objectives and the data confidentiality, according to the terms of Resolution N°196/96, and signed the Informed Consent Term. This project was submitted to and approved by the Committee of Ethics and Research of the School of Nursing, USP (Legal Opinion n°577/2006), as well as by the Healthcare Center management.

RESULTS

Patients Characterization

Most of the elderly interviewed were females (68%). The average age was 75.3 years old ($sd = 7.3$), and the minimum and maximum ages were 60 and 92 years old respectively. The schooling average found was 7.5 years of studies ($sd = 5.3$), and the minimum and maximum number of schooling years were 0 and 19, respectively. As to the *per capita* income, the average was R\$ 885.5 ($sd = 1.1$), corresponding to 2.3 minimum wages at the time the study was conducted. The minimum income found was R\$ 57.10 and the maximum was R\$ 6000.00. Other social-demographic characteristics regarding the subjects studied were gathered in Table 1.

Table 1 – Social-Demographic characteristics of the interviewed elders. São Paulo, 2008

Variables	n(%)
Sex	
Male	32
Female	68
Marital status	
Single	35
Married	34
Widowed	13
Separated/divorced	17
Ignored	1
Active Economic Condition	
Active	10
Inactive	6
Retired	45
Retired and working	21
Pensioner	13
Pensioner and working	4
Ignored	1

Barthel Index

Concerning the “Feeding” activity, 93% of the elderly were independent, around 60% needed assistance and only 1% was comprised of dependent subjects. As to “Grooming”, 4% of the Elderly were dependent, and regarding “Bathing”, 7% were dependent, that is, did not bath by themselves or required assistance to wash parts of their bodies. Regarding “Dressing”, 4% were dependents, and 5% needed assistance.

With regard to the “Bowl care” function, 3% of the elderly were incontinent, and 1%, occasional incontinent. Concerning the “Bladder care”, 13% were incontinent, and 11%, occasional incontinent. As to “Toilet use”, 3% were dependent, and 2%

needed help at some points in the process.

The results for “Ambulation” verified that 2% of the elderly were dependent, 1% was independent using the wheelchair, and 14% needed minimum help. Regarding “Climbing Stairs”, 8% of the subjects were dependent, and 7% needed help. As to the “Transfers”, 1% of the subjects were dependent, 2% needed great help, and 5% needed minimum help.

The patients’ general classification according to the dependence level in Barthel Index demonstrated that the elderly interviewed were mostly independent, for 63% of them did not need any help to perform daily life basic activities; 23% presented moderate dependence; 9%, light dependence; 3% severe dependence; and 2%, total dependence.

Functional Independence Measure

The patients’ classification according to their dependence level in the FIM demonstrates that there was a concentration in the “complete independence”, which means that 90% of the elderly did not need help, 3% needed up to 50% help performing daily life basic activities, and 7% needed help of up to 25% performing the activities.

Internal consistency analysis - reliability

The scale reliability was verified by its internal consistency, analyzed through Cronbach alpha. All the correlations between items were positive and significantly different from zero, which indicates that a scale with such items makes sense, for they measure the same attribute. The total scale alpha obtained for the 10 items was 0.90, which indicates great reliability and confirmed the items homogeneity. The removal of any of the instrument items did not result in significantly internal consistency improvement, which suggests that the Brazilian version of the Barthel Index should maintain the same items as the original in English (Table 2).

Table 2 – Barthel Index Internal Consistency Analysis (Cronbach Alpha). São Paulo, 2008

Domain	Correlation Domain/ Total	Alpha de Cronbach (for deleted domain)
Eating	0,71	0,88
Bathing	0,82	0,88
Getting dressed	0,72	0,88
Personal hygiene	0,78	0,89
Intestinal excretion	0,72	0,89
Vesical excretion	0,40	0,92
Using Toilet	0,84	0,88
Bed-chair transfer	0,76	0,88
Deambulation	0,85	0,87
Going up and down stairs	0,62	0,89

Convergent criteria validation

The convergent criteria validation is related to the application of two equivalent instruments, at the same time, with the same individuals’ sample, and an analysis of the obtained scores or scores comparison through an area specialist assessment.

All FIM items presented significant correlation coefficients with the Barthel Index, according to Table 3. The communication

and cognition domains had the worst relationship, once the Barthel Index does not have any items to assess such functions.

Table 3 – Spearman Correlation between the Functional Independence Measurement – FIM and the Barthel Index. São Paulo, 2008

MIF domains	Barthel index
	$r_{sp}(p)$
Self care	0,50 (<0,01)
Sfincter control	0,62 (<0,01)
Mobility/ transfer	0,42 (<0,01)
Locomotion	0,57 (<0,01)
Communication	0,20 (0,046)
Cognition	0,38 (<0,01)
MIF Total	0,64 (<0,01)

Discriminant Validation

Concerning the Discriminant validation test, three elderly age brackets scoring average were compared. The average for the age bracket ranging from 60 to 69 years old was 96.4 (sd = 7.4); from 70 to 79 years old, it was 93.1 (sd=18.5), and among the subjects in the age bracket after 80 years old, 90.1 (sd = 17.1).

Chi-Square test

After the chi-square test application, a significant statistical difference was observed ($p=0,021$) among the age brackets.

Factorial Analysis

Based on the factorial analysis, it was possible to verify that the items are grouped in only one domain. Table 4 demonstrates that the items are correlated either in a moderate or strong way among each other, except for “Vesical excretion”, and “Stairs”. With only one domain, the explained variance is 63.86%, which is considered appropriate⁽¹⁵⁾.

The sample of 100 patients divided by the number of items results in ten⁽¹⁰⁾ subjects by item, in compliance with is recommended for the instrument validation⁽⁸⁾.

DISCUSSION

The Barthel Index belongs to the DLAs assessment field and measures de functional independence regarding self care and mobility. It was developed in order to monitor the

performance of inpatients staying in the hospital for a prolonged time, with paralysis conditions, either before or after the treatment, and to indicate the necessary healthcare. In rehabilitation scenarios, it has been used to forecast the admittance time, estimate prognosis, anticipate consequences of the discharge and as an assessment instrument^(7,10).

According to authors⁽⁷⁾, the items in the questionnaire were chosen in order to indicate the level of necessary care. The instrument values system for each item reflects the relative importance of each inability type, according to the care needed by the individual and the ability to have social experiences.

In international studies, the Barthel Index is one of the instruments to assess DLAs that presents consistent reliability and validity results⁽³⁾. In this investigation, the reliability observed for the total scale was excellent and the values obtained were close to the ones observed for the original scale validation in other studies⁽¹⁷⁾, which also analyzed and confirmed the scale reliability. The results indicate that the version in Portuguese kept the original scale reliability. A study with 976 patients who had had strokes reported correlations between 0.73 and 0.77, obtained between the Barthel Index and a functional capacity assessment scale⁽¹⁸⁾.

In order to verify the convergent validity, the present study explored the correlations between the Barthel Index and the FIM. The correlations obtained were significant, even with the weak magnitude in relation to social cognition and the communication domain reduced practical value, once the Barthel Index does not have any items to assess such functions.

The factorial analysis of the translated scale confirmed a domain structure in the original scale and the factorial loading was considered good. In comparison with international studies that assessed the FIM and Barthel Index validity and reliability, as mentioned above, the present study proved the Portuguese version of such instruments is reliable and valid.

CONCLUSION

The study reached the proposed objective with regard to the analysis of reliability and validity of the Barthel Index for elderly people treated in ambulatories, in the Brazilian context. The statistical analysis revealed that such version of the Barthel Index is reliable. The reliability study found an alpha Cronbach value of 0.90 for the complete scale. The convergent validity analysis,

Table 4 – Correlation matrix among the Barthel Index items in factorial analysis. São Paulo, 2008

Itens	1	2	3	4	5	6	7	8	9	10
1	1,00	0,57	0,82	0,78	0,50	0,33	0,57	0,65	0,66	0,38
2	0,57	1,00	0,72	0,74	0,61	0,30	0,80	0,79	0,73	0,60
3	0,82	0,72	1,00	0,87	0,46	0,30	0,62	0,67	0,62	0,40
4	0,78	0,74	0,87	1,00	0,54	0,33	0,65	0,73	0,65	0,42
5	0,50	0,61	0,46	0,54	1,00	0,38	0,88	0,57	0,73	0,48
6	0,33	0,30	0,30	0,33	0,38	1,00	0,43	0,24	0,35	0,35
7	0,57	0,80	0,62	0,65	0,88	0,43	1,00	0,67	0,80	0,54
8	0,65	0,79	0,67	0,73	0,57	0,24	0,67	1,00	0,76	0,55
9	0,66	0,73	0,62	0,65	0,73	0,35	0,80	0,76	1,00	0,69
10	0,38	0,60	0,40	0,42	0,48	0,35	0,54	0,55	0,69	1,00

using the Functional Independence Measurement, found a satisfactory correlation with most of its domains, except for the mobility in transfers, communication, and social cognition. The factorial analysis for the translated scale confirmed a domain structure in the original scale and the factorial load was considered

good, which was confirmed by the moderate or strong items correlation, apart from the vesical and intestinal excretion. Such findings allow the Barthel Index to be recommended for the elderly functional assessment in Brazilian ambulatories, so as to subsidize their healthcare needs assessment.

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