

Validity of Katz Index to assess dependency in patients on oncology treatment

Validade do Índice de Katz para avaliar a dependência em pacientes em tratamento oncológico

Validez del Índice de Katz para evaluar la dependencia de pacientes en tratamiento oncológico

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Abstract

Objective: To analyze construct validity of the Katz Index for patients with cancer diagnoses.

Methods: Psychometric study, performed to evaluate evidences of validity of the Brazilian version of the Katz Index in patients with cancer diagnoses. The study was conducted in 691 hospitalized patients between April and June 2016. Data was analyzed by Exploratory and Confirmatory Factor Analysis. Reliability was assessed by Cronbach's Alpha and McDonald's Omega.

Results: Participants were mostly women (72.6%), with a mean age of 53.7 ± 13.28 years; 55.3% reported that they did not need caregivers, and 56.6% did not have caregivers. Of the 42.5% who need help, predominant caregiver was a relative (39.6%). Exploratory and Confirmatory Factor Analysis evidenced that Katz Index is a unidimensional instrument, valid and reliable to assess dependency in this population, with a good variance and no evidence of multicollinearity or need of revision ($KMO=0.89437$; χ^2 Bartlett=3337.2 $p<0.001$; UNICO=0.999, EC=0.974; MIREAL=0.122). Katz Index explains 97.72% of the phenomenon and results indicate good adjustment of the model, acceptable level of residuals and good reliability ($G-H=0.986$; α -Cronbach=0.970560; Ω -McDonald=0.971787) to assess independence to basic activity daily living in patients with cancer diagnoses.

Conclusion: The Brazilian version of the Katz Index presents excellent evidences of construct validity and reliability in its Brazilian version, and may be used as a clinical instrument to assess dependency of patients on oncology treatment.

Resumo

Objetivo: Analisar a validade de constructo do Índice de Katz para pacientes com diagnóstico de câncer.

Método: Estudo psicométrico realizado para avaliar as evidências da validade da versão brasileira do Índice de Katz em pacientes com diagnóstico de câncer. Estudo realizado com 691 pacientes hospitalizados entre abril e junho de 2016. Os dados foram analisados por análise fatorial exploratória e confirmatória. A confiabilidade foi avaliada pelo alfa de Cronbach e ômega de McDonald.

Resultado: Os participantes eram em sua maioria mulheres (72,6%), média de idade de $53,7 \pm 13,28$ anos; 55,3% dos pacientes relataram não precisar de cuidador, e 56,6% não tinham cuidador. Dos 42,5% que precisavam de ajuda, o cuidador predominante foi um familiar (39,6%). A análise fatorial exploratória e confirmatória evidenciou que o Índice de Katz é um instrumento unidimensional, válido e confiável para avaliar

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a dependência nesta população, com boa variância e sem evidência de multicolinearidade ou necessidade de revisão ($KMO=0,89437$; teste de Bartlett $\chi^2=3337,2$ $p<0,001$; $UNICO=0,999$, $EC=0,974$; $MIREAL=0,122$). O Índice de Katz explica 97,72% do fenômeno e os resultados indicam bom ajuste do modelo, nível aceitável de resíduos e boa confiabilidade ($G-H=0,986$; α -Cronbach= $0,970560$; Ω -McDonald= $0,971787$) para avaliar a independência para atividades de vida diária básicas em pacientes com diagnóstico de câncer.

Conclusão: A versão brasileira do Índice de Katz apresenta excelentes evidências da validade de constructo e confiabilidade, podendo ser utilizada como instrumento clínico para avaliar a dependência de pacientes em tratamento oncológico.

Resumen

Objetivo: Analizar la validez de constructo del Índice de Katz para pacientes con diagnóstico de cáncer.

Método: Estudio psicométrico realizado para evaluar las evidencias de la validez de la versión brasileña del Índice de Katz de pacientes con diagnóstico de cáncer. Estudio realizado con 691 pacientes hospitalizados entre abril y junio de 2016. Los datos fueron analizados por análisis factorial exploratorio y confirmatorio. La fiabilidad fue evaluada por el alfa de Cronbach y omega de McDonald.

Resultado: Los participantes eran en su mayoría mujeres (72,6 %), edad promedio de $53,7 \pm 13,28$ años; el 55,3 % de los pacientes relató que no necesitaba cuidador, y el 56,6 % no tenía cuidador. Del 42,5 % que necesitaba ayuda, el cuidador predominante fue un familiar (39,6 %). El análisis factorial exploratorio y confirmatorio evidenció que el Índice de Katz es un instrumento unidimensional, válido y confiable para evaluar la dependencia de esta población, con una buena varianza y sin evidencia de multicolinealidad ni necesidad de revisión ($KMO=0,89437$; prueba de Bartlett $\chi^2=3337,2$ $p<0,001$; $UNICO=0,999$, $EC=0,974$; $MIREAL=0,122$). El Índice de Katz explica el 97,72 % del fenómeno y los resultados indican una buena adaptación del modelo, un nivel aceptable de residuos y buena fiabilidad ($G-H=0,986$; α -Cronbach= $0,970560$; Ω -McDonald= $0,971787$) para evaluar la independencia de AVD básicas en pacientes con diagnóstico de cáncer.

Conclusión: La versión brasileña del Índice de Katz presenta excelentes evidencias de la validez de constructo y fiabilidad, por lo que puede ser utilizada como instrumento clínico para evaluar la dependencia de pacientes en tratamiento oncológico.

Introduction

Cancer accounts to over than 12% of all global causes of death, representing seven million people per year. Over the world, neoplasm incidence grows following aging of population due to the increase of life expectancy, with 19.3 million new cases and almost 10 million deaths from cancer in 2020.⁽¹⁾ This is a public health problem, especially among low and lower middle incoming countries, where it is expected that, in the next decades, the impact of cancer on the population will represent about 80% of the more than 28,4 million new cases estimated for the world in 2040.^(1,2)

Due to the possibility of early detection, advances in screening and effective therapies, people are living longer with chronic diseases such as cancer, as such with its consequences. This population increasingly reports symptom burden, exercise intolerance, and physical deconditioning, with the possibility of functional limitations and biopsychosocial changes.^(3,4)

Cancer may also impact on the ability to manage activity daily living (ADL), also described as physical ADLs or basic ADLs, collectively describe fundamental skills needed to independently manage physical needs, or to care of oneself, including eating, bathing/personal hygiene, toileting/

continence, dressing, and mobility or transferring/ambulating.⁽⁴⁻⁶⁾ The identification of problems and needs among 56% of disabled hospitalized patients with cancer diagnoses, specially related to dressing (60%), bathing (50%), transfer (40%), personal hygiene (20%) and eating (10%).⁽⁷⁾

The definition of ADLs is more comprehensive than the capacity of decision-making, but embrace the possibility of independently carry out of basic skills and to engage in personal care,^(5,8) in addition to be essential to live independently within society.⁽⁴⁾

In the context of cancer occurrence, it is expected that one-third of adult patients have difficulties to perform ADLs and half of them require any assistance to do that, being mobility and continence the most ADL affected described.^(4,9) Also, Impaired ADL performance was already associated with lower health related quality of life, influencing multiple domains in health and wellness.⁽¹⁰⁾ ADLs disability can be different between patients, according to cancer type, age, and stage.⁽⁹⁾

Patients with advanced cancer receiving palliative care may present higher prevalence of dependence for ADL. Difficulties of bathing (72,9%), dressing (56,9%), going to toilet (55%), transfer (56,6%) and feeding (38,7%) among this population are described.⁽¹¹⁾ Assessing patients' needs is considered a critical step to plan patient-centered cancer care.⁽¹²⁾

Also, to promote rehabilitation addressing functional independence, it is imperative to improve assistance with professionals skilled in functional assessment within cancer services. Interventions focused on physical functioning, fatigue and pain has been described as helpful to enhance ADL, being the Katz Index (KI) one of the most commonly used tool to perform this assessment.^(4,13)

An oncological comprehensive assessment of the ADLs disabilities and of elements that may impact on daily functioning is fundamental for and to design strategies for health care.^(9,14)

In a 6-item scale developed to evaluate functioning in patients with chronic diseases, considering bathing, dressing, toileting, transfer, continence and feeding, with three options of answers: 1 – the subject performs the specific activity without any assistance (independent); 0.5 –with partial assistance (partially dependent); or 0 – he/she needs full assistance to perform it (dependent). In a global score from 0 to 6, KI ranks subjects for each item and gives a total score corresponding to overall performance: independent (=6 points), partially dependent (3 – 5 points) and dependent (< 2 points).^(8,15-18)

Considering the use of the KI other groups⁽¹⁹⁾ and the need to access this population using validated and reliable instruments,⁽²⁰⁾ it is imperative to evaluate ante to describe the psychometric properties of the scale for its use in patients with cancer diagnoses, considering its potential to assess the level of dependency among these patients and to perform health supportive care planning.

The aim of the present study was to analyze construct validity of the Katz Index for patients with cancer diagnoses.

Methods

A psychometric study was performed to evaluate evidences of validity of the Brazilian version of the KI⁽¹⁶⁾ in patients on oncology treatment.

A convenience sampling procedure was adopted, estimating a minimum of 20 patients for each of the items of the Katz Index and to obtain a factor

loading of 0.30.⁽²¹⁾ Inclusion criteria comprised age equal or greater than 18 years; diagnosis of cancer, regardless of etiology or treatment phase, in outpatient care, hospitalization, chemotherapy and radiotherapy units; and satisfactory physical and emotional conditions to answer to the instrument of data collection at the time of the interview.

Data collection was performed after research protocol approval by the Research Ethics Committee from the Escola de Enfermagem – Universidade de São Paulo (#1.400.151). All participants signed a written consent form before interview and received information about study objectives, as possible risks and benefits. All procedures followed current Brazilian regulation on research involving human beings.

Data were collected with face-to-face interview in the period between April and June 2016. Interviews were conducted by trained research assistants, under responsible researcher supervision, who were all nursing under graduation students.

A collect data form was filled with sociodemographic and clinical variables, as age, gender, marital status, religion/beliefs, occupation, care needs, presence of caregiver, tumor site, surgery, chemotherapy, radiotherapy, period of diagnosis and therapy, need of care support.

To the purpose of this study, the Katz Index was filled by the participant and total scores and each scale item score were analyzed.

The Katz Index or Index for Activities of Daily Living consists of a 6-item scale and was developed to measure the physical functioning of patients with chronic illness.^(8,15,16) Several theories and measurement instruments were developed since then. Katz et al. demonstrated that the recovery of the functional performance of six activities considered basic in the daily life of disabled elderly people (bathing, dressing, going to the bathroom, transferring, being continent and eating) was like the sequence observed in the child's development process.^(8,15,16)

Evidence of construct validity was observed by Factor Analysis. The Exploratory Factor Analysis (EFA) was conducted based on the matrix of polychoric correlations of the items, with Robust Unweighted Least Squares (RULS) extraction method and Promin rotation.⁽²¹⁾

Polychoric correlations are stronger and produce a better fit to theoretical model when there is a violation of the assumption of multivariate normality of the data.^(22,23) The Unweighted Least Squares (RULS) is considered a robust extraction method for variables of ordinal natures, with non-normal data and residual and measurement error control.⁽²⁴⁾ Promin is an oblique rotation method that allows the correlation between the correlated factors.^(25,26)

A Kaiser-Meyer-Olkin (KMO) ≥ 0.70 and a significant Bartlett Index ($p < 0.05$) were considered to verify sampling adequacy for factor analyses.⁽²⁷⁾

Parallel Analysis (PA), performed using the Optimal Implementation of Parallel Analysis technique, based in polychoric correlations, was used to evaluate factor retention and how much of the variance of the observed variables is explained by the factors, and Communality was used to verify how much the variance of an item can be predicted from the other items.⁽²⁵⁾ PA with confidence interval (CI) of 95% was used to ensure stronger solutions to identify the appropriate number of factors to extract.^(21,27) The model was accepted if factor load was >0.50 , communalities >0.40 and total variance explained by the factor solution $>60\%$.⁽²⁷⁾

Unidimensional Congruence (UniCo) > 0.95 , Explained Common Variance (ECV) > 0.85 , Mean of Item Residual Absolute Loadings (MIREAL) < 0.30 were considered adequate to confirm whether Katz Index as a one-dimensional tool.^(25,27,28)

Confirmatory Factor Analysis (CFA) was performed using mean – and variance – adjusted least square method (WLSMV). Model fit was analyzed by inspecting fit indexes, modification indexes and correlational residuals. Adequacy of a good model fit were non-significant Chi-squared ($\chi^2 > 0.05$), Goodness of Fit Index (GFI) ≥ 0.95 , Adjusted Goodness of Fit Index (AGFI) ≥ 0.95 , Normed Fit Index (NFI) ≥ 0.95 , Comparative Fit Index (CFI) ≥ 0.95 , Root Mean Square Error of Approximation (RMSEA) ≤ 0.07 , Root Mean Square of Residuals (RMSR) < 0.03 and Weighted Root Mean Square Residual (WRMR) < 1.0 .⁽²⁵⁾

To determine the extent to which the set of variables is consistent in what it intend to measure, construct reliability was verified using the Cronbach's

alpha and McDonald's Omega, with good general internal consistency if $\alpha > 0.70$ and $\Omega > 0.90$.⁽¹⁹⁾ Katz would be considered reliable if Generalized H Index (G-H) > 0.80 .⁽²⁸⁾

For all statistical tests, the significance level was 5%. Statistical analyses were performed using IBM SPSS Statistics (v.22, SPSS An IBM Company, Chicago, IL) and Factor 10.8.04 for Windows 64-bits.

Results

Total sample consisted of 691 participants who were mostly women (72.6%) with a mean age of 53.7 ± 13.28 years. There is predominance of elementary education (43.0%). Most of the patients live with a partner (54.5%), declared to be of the Catholic religion (49.6%) and are unemployed (29.8%), followed by retirees (27.9%). Most patients (55.3%) reported that they did not need caregivers, 56.6% did not have caregivers. Of the 42.5% who need help, a relative is the predominant caregiver (39.6%). Among the total number of patients interviewed, 315 (45.6%) were in the chemotherapy service, 181 (26.2%) in the outpatient clinic, 173 (25.0%) in the hospitalization unit and 22 (3.2%) in the radiotherapy service. About 18.0% of the patients needed some help to answer the questions. The most frequent tumor is found in the reproductive system (55.9%), with a predominance of female breast cancer (33.9%), followed by the digestive system (17.7%), with the stomach tumor (6.3%). Regarding the type of treatment, 56.1% of the patients were submitted to surgery and 60.8% to the chemotherapy. Most patients presented diagnosis (74.4%) and treatment (54.0%) time over than six months.

Exploratory Factor Analysis

There was no missing data. All response options were endorsed (min = 1 max = 3), showing distribution across the potential range of responses. Skewness (1.864 – 2.693) and kurtosis (1.765 – 5.654) for all items met the distributional requirements to conduct the EFA and the CFA using maximum likelihood.

Results of EFA to identify the structural model of the Katz Index to assess dependency in patients on oncology treatment lead to evidences of construct structure, with approximately 115 cases per item.

The Kaiser-Meyer-Olkin (KMO) = 0.89437 and Bartlett's sphericity test = 3337.2 ($p < 0.001$) showed the sample adequacy for the factor analysis.

Parallel analysis performed by polychoric correlation matrices indicated that the instrument is unidimensional and explains 96.72% of the phenomenon. The values of UniCo (0.999), ECV (0.974) and MIREAL (0.122) corroborate with the evidence of construct structure for a one-dimensional health measurement tool. The factor loads are as described in table 1.

Table 1. Factor solution of Katz Index (n=691)

Variable	Factor solution	
	Factor 1	Communality
1 Feeding	0,958	0.919
2 Continenence	0.954	0.911
3 Transferring	0.982	0.964
4 Going to toilet	0.974	0.949
5 Dressing	0.778	0.605
6 Bathing	0.876	0.767

Factor solution indicated factor loading greater than 0.50 for all items, with high values of communalities (> 0.95).

Confirmatory factor analysis

There are excellent evidences of fit adjustment of a unidimensional model, as appointed in table 2.

Table 2. Confirmatory Factor Analysis of Katz Index (n=691)

	values	p-value
χ^2	16,681	0,056
GFI	1.000	
AGFI	0.999	
NNFI	0.998	
CFI	0.999	
RMSEA (Confidence Interval 95%)	0.035 (0.01-0.05)	
RMSR	0,018	
WRMR	0,026	

χ^2 - Chi-square test; GFI - Goodness of Fit Index; AGFI - Adjusted Goodness of Fit Index; NNFI - Non-Normed Fit Index; CFI - Comparative Fit Index; RMSEA - Root Mean Square Error of Approximation; RMSR - Root Mean Square of Residuals; WRMR - Weighted Root Mean Square Residual

All results indicate good adjustment of the model and acceptable level of residuals to assess independence to basic ADL in patients with cancer

diagnoses using the Katz Index. Thus, the instrument pointed an excellent index G-H 0.986, and good reliability to Cronbach's $\alpha = 0.97$ and McDonald's $\Omega = 0.97$.

Discussion

Results demonstrated that Katz Index for patients with cancer diagnoses have great evidences of construct validity and reliability. Evidences of validity were confirmed by EFA and CFA, multivariate statistical methods recommended in the specialized literature for the development and validation of psychological theories and measurement. EFA indicates the unidimensionality of a well-defined structure and CFA confirmed that the instrument in the three-point scale fits the hypothetical model.^(25,27)

The investigation of whether a questionnaire measures a latent construct consists of an interest of researchers, once psychosocial measurement has a fundamental role in a variety of clinical evaluation and research studies, such as in education, psychology, behavioral science, and health.^(29,30) Besides, its relevant to properly interpreting the results and making valid inferences about the phenomenon.⁽²⁹⁾

The psychometric analysis indicates that the Brazilian version of the KI is valid and reliable assess dependency in this population, in a unidimensional instrument, with a good variance, no evidence of multicollinearity or need of revision.⁽²⁵⁾

Studies report about one-third and half of adults with cancer have experience changes in their functional status, with difficulty or requiring assistance to perform basic and instrumental ADLs, according to the type of tumor and its stage.^(4,31-34) This construct is essential to access disabilities and to plan patient's rehabilitation focused on functional independence, once it consists in an important difficulty and/or impairment,⁽⁴⁾ with difficulties for its evaluation.

Independence to perform ADLs is a concern for patients and it is, identified as a need of supportive care. But it does not receive so much attention in some cases as for lung cancer diagnose, being cause of frustration.⁽³⁵⁾ These activities have been also

studied as a possibility of occupational therapy to improve patients' performance and satisfaction in oncology setting.⁽³⁶⁾

In this context, methods to assess evidences of validity information are necessary. The Katz Index has proven to be valid and reliable in populations with different chronic conditions, from different locations worldwide,^(19,37,38) which indicates stability of its structure. The evaluation of its evidence of validity Index in patients on oncology treatment provides new evidence of structure validity.

Literature indicates that unidimensional tools may have limited capacity to identify aspects of strength or need and to be adapted to individual client needs in some constructs.⁽³⁹⁾ But unidimensionality has been showed as a good quality of the KI, since it is easy to be used, with good evidences of validity, reliability, and replicability, as also observed by the results of EFA, CFA and G-H index in this study.

It has been also demonstrated that there is an interest to use this tool to evaluate patients with cancer, with the possibility to investigate patients' symptoms and needs many types of cancer with the same health measurement tool.^(4,40-42)

Considering that changes in ADL in patients with cancer can occur in different levels, with few studies describing personal hygiene, walking and transfers as the mostly affect areas, and also predictor of quality of life and mortality, the validation of an instrument to provide reliable confirms the implication this study results for clinical practice.

In a structure of a 6-item scale, KI indicates to be a good option, once measurement tools in short versions may alleviate the burden on patients with chronic conditions, increasing response rates.

Conclusion

The Brazilian version of the Katz Index presents excellent evidences of construct validity and reliability as a clinical unidimensional instrument that can be used to assess dependency in patients on oncology treatment.

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Collaborations

Gallasch CH, Vieira HWD, Lucchesi PAO, Balbinotti MAA, Rebutini F and Ferretti-Rebutini REL collaborated with the conception of the study, analysis and data interpretation, also writing the article, and critically revising and approving relevant intellectual content for the final version to be published.

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