ADAPTATION AND VALIDATION OF DIZZINESS HANDICAP INVENTORY INTO ROMANIAN LANGUAGE

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Abstract: *Introduction: vertigo and dizziness are frequent symptoms in current ear, nose and throat (ENT) practice. Self-perception of health can be assessed by questionnaires like Dizziness Handicap Inventory (DHI), a quality of life questionnaire widely used by specialists. Our aims were: the translation, adaptation and validation of this questionnaire into Romanian language. Materials and methods: the questionnaire was translated into Romanian and applied to a group of 50 patients complaining of dizziness. The patients were requested to fill out the SF-36 questionnaire, too. Results: Cronbach's alpha coefficient showed a high value of internal consistency of 0.86. Corrected Item-Total Correlation ranged from 0.24 to 0.74. A satisfactory degree of test-retest reliability value was found for the total score. External validity was tested by Pearson correlation between total score and subscales of DHI-Ro and SF-36 scores. Conclusions: The DHI-Ro is a disease-specific, health-related quality-of-life questionnaire translated and linguistically adapted for Romanian-speaking patients with an acceptable reliability and external validity.*

INTRODUCTION

In our everyday practice in the emergency room, we meet patients with vertigo, dizziness and balance disorders of various causes, including vestibular disorders, neurological, cardiovascular and psychological causes. Vertigo, dizziness and instability affect individuals' confidence in their balance. Many patients are unable to work or carry out daily activities; some of them are unable to leave their home, leading to social isolation, functional disability, falls and trauma or nursing home placement.(1,2,3,4)

Evaluation of these patients requires a battery of tests for spontaneous or induced symptoms, in order to assess the clinical manifestations of vestibular syndrome, but the patient's subjective perception of the impact of the disease on his or her daily life, specifically the health-related quality of life, can only be estimated through questionnaires.(5)

There are two main ways to measure quality of life: one specific to a certain disease and one nonspecific, or generic. Generic tools apply to several groups of subjects to assess all types of conditions, while specific instruments are intended for special populations and for distinct diseases or groups of diseases.(6)

Among the tools mostly used for assessing the degree of disability caused by the vestibular syndrome is the Dizziness Handicap Inventory (DHI) questionnaire, developed in 1990 by Jacobson and Newman, a specific questionnaire investigating the effect of vertigo and dizziness on quality of life.(7)

This questionnaire has been used in numerous studies to determine the impact of balance disorders on the patient and also, to track the effects of medical treatment or vestibular rehabilitation.

PURPOSE

Currently, there are no validated questionnaires translated into the Romanian language, so our primary goal was to make a translation and a cross-cultural adaptation of the DHI questionnaire into Romanian, to analyze the reliability of the translated version and also, to evaluate the association between DHI and the SF-36 questionnaire.(8)

MATERIALS AND METHODS

Professor GP Jacobson, the author of the DHI questionnaire (7), was asked in an e-mail for his permission to translate an adaptation of the DHI questionnaire into Romanian.

The DHI questionnaire comprises 25 items divided into three areas: the physical subdomain, consisting of 7 questions with a maximum of 28 possible points; the functional subdomain, 9 questions with 36 maximum points; and the emotional subdomain, also 9 questions and 36 maximum points. The higher the score, the more severe the degree of disability.(9) For each question, the subject may choose from 3 answers: "yes" (4 points), "sometimes" (2 points) and "no" (0 points). The final score ranges from 0 (no disability) to 100 points (severe disability). The original version of the DHI demonstrated good validity, internal consistency (Cronbach's alpha: 0.72-0.89) and test-retest reliability (r=0.92-0.97) investigated on a study population with different etiology of dizziness and unsteadiness.(7)

The DHI questionnaire was translated and adapted into Romanian language according to the international guidelines for self-reported questionnaires through a process of reviews and modifications.(10,11) Two independent translators made separate translations, and after the discrepancies were resolved the draft was translated back from Romanian into English.(10) We obtained the final version through reconciling translations by adjusting the Romanian version to resolve the differences.

The questionnaire was then tested on 10 Romanian-speaking patients complaining of dizziness. They did not report significant difficulties in understanding or in filling out

the questionnaire.

The study group consisted of 50 patients who were referred to the ENT outpatient clinic between April 2014 and September 2014. We included in the study 67 patients who complained of dizziness, vertigo or balance disorders of various etiologies. All of them were over the age of 18 and able to fill in the questionnaire. Patients filled in the DHI-Ro and the SF-36 questionnaires in the first 3 days of hospitalization. All of the included patients gave their signed consent to participate in this study. Eight patients refused to participate in the study or were not able to fill out the questionnaire because of their general condition or for reasons of education. Four patients missed the one-week follow-up visit and five patients were not present in the one-month follow-up visit, and thus we also excluded them from the study group. To check the test-retest reliability, a second test was performed one week after the first assessment.

We also excluded patients with balance disorders due to cardiopulmonary diseases, musculoskeletal paralysis, cerebellar ataxia, extrapyramidal disorder or sensory disturbances. Patients with psychiatric disorders, dementia or blindness were also omitted.

The study was approved by the Ethics Committee of "Iuliu Haţieganu" University of Medicine and Pharmacy, in accordance with the Declaration of Helsinki, and all patients signed the specific informed consent forms.

The Romanian version of SF-36 contains 36 items, divided into 8 sub-domains: physical function (10 questions), physical role (4 questions), body pain (2 items), general health (5 questions), vitality (4 items), social functioning (2 items), emotional role (4 item) and mental health (5 items). Each sub-domain has a score and the total score ranges from 0 to 100, with a high score indicating good general health and a low score poor general health.(8)

We performed descriptive statistics for baseline characteristics of the study population, and for DHI-Ro and SF-36 score distributions. We assessed the internal consistency by calculating the Cronbach's alpha coefficient for the total scores and for the 3 subdomain scores, where a value higher than 0.8 is recommended.(10) We also estimated the Cronbach's alpha with each item excluded, and the corrected item-total correlations (CI-TC) and the difference should be less than 0.1. The CI-CT should be more than 0.20.(10,11)

Test-retest reliability was determined by the correlation between the scores obtained on the two administrations of the test. For this purpose, there was used the Pearson product-moment correlation coefficient, which should be greater than 0.4 for a moderate correlation or greater than 0.7 for a high correlation and strong relationship. The intraclass correlation coefficient was evaluated with a two-way random model, single measurement, absolute agreement type intraclass correlation coefficient ($ICC_{2,1}$) (12) and a value more than 0.75 was considered "good".(13) Cronbachs' alpha for single items represents the homogeneity between test-retest results.

For assessing the agreement between the two measurement, test and retest, we used the Bland-Altman plots. It is expected that the 95% limits include 95% of differences between the two measurements.(14)

The Kaiser-Meyer-Olkin should be greater than 0.6 for a satisfactory factor analysis.(15,16) The Bartlett's test of sphericity should be significant with p less than 0.05.(17) After testing the sampling adequacy, we performed the Principal Component Analysis and selected the Varimax orthogonal rotation (11,12,18) in order to compare the loadings of variables. To decide which factor should be

retained, we used the Paralell Analysis.(19) The total score of DHI-Ro and its subscales were correlated to the Short Form Health Survey (SF-36) in order to investigate the external validity of DHI-Ro questionnaire. The data were analysed using the SPSS version 17.0 computer software.

RESULTS
Demographic and clinical data of the patients

The mean total DHI-Ro score was 41.20 (SD 18.21) for the pilot group. In the study group 38% of patients had unilateral peripheral vestibular dysfunction, 40% had central vestibular dysfunction and 22% had dizziness of unknown etiology. Mean age of patients was 47.8±15.63 (21,78), 62% female and 38% male. For the study group, the mean total score for DHI-Ro was 49.56 (SD 20.02) ranging between 2 and 90, out of a maximum of 100. The mean score for the functional domain was 20.72 (SD 9.35), for the physical domain 15.32 (SD 5.65) and for the emotional domain 13.52 (SD 8.83).

For the Romanian SF-36, the mean total score was 49.52 (SD 19.06), ranging between 16.53 and 88.03 out of a maximum total score of 100.

DHI-Ro scores were higher in women, 52.93 (19.38), than in men, 44.50 (20.38), and were correlated with patient age, with a Pearson coefficient of 0.355 (p=0.011), for the total score. The emotional subscale (r=0.40, p=0.004) and functional subscale (r=0.37, p=0.007) were significantly correlated with patient age, unlike the physical subscale (r=0.02, p>0.05).

Internal consistency

Using descriptive statistics, a possible floor and ceiling effect was evaluated and ruled out. For both DHI-Ro and SF-36 questionnaire, the distribution was normal; the Shapiro-Wilk coefficient was 0.278 for DHI-Ro and 0.217 for SF-36.

Cronbach's alpha coefficient, which is a measurement of internal consistency, showed a high value of 0.86 for the entire test, and the values for each item and subscale are displayed in table no. 1. Also, we compared these values with the original English DHI and with the German and Italian versions.

Table no. 1. Cronbach's alpha coefficient for the total score of DHI and for the three subscales, for Romanian version, compared with the original version (7), with the German (20) and Italian versions (9).

Cronbach's α	Total	Physical	Emotional	Functional
DHI-RO	0.86	0.72	0.74	0.77
DHI-IT	0.92	0.75	0.84	0.82
DHI-G	0.90	0.71	0.82	0.80
DHI-US	0.89	0.78	0.72	0.85

The Corrected Item-Total Correlation between each item and the total score investigated the internal consistency and the strength of the relationship between an individual item and all remaining items.(18) For DHI-Ro total score and its subscales, CI-TC ranged from 0.24 (items 5 and 13) to 0.74 (item 9); Cronbach's alpha coefficient if an item was deleted ranged from 0.845 (item 9) to 0.868 (items 5, 8, 13, 18, 20 and 22) (table no. 2).

Test-retest reliability

Pearson correlation coefficient for test-retest reliability was 0.95 for the total tests and also for the emotional subscale, 0.83 for the physical subscale and 0.95 for the functional subscale, with p=0.00 for each coefficient. The test-retest correlation coefficients for each item are presented in table no. 2.

CLINICAL ASPECTS

Table no. 2. Corrected item-total correlation coefficients for total score of the original DHI (7), and Romanian version; CI-IT coefficients for the three subscales of Romanian version of DHI, which exceeded 0.20 for all the items; The last columns represent the test-retest reliability correlation coefficient (r) for each item, intraclass correlation coefficient with 95% Confidence Interval and Cronbach's alpha (CA) for each item. (F=functional, P =physical, E=emotional

Sub scale	Item	DHI	DHI-Ro F	DHI-Ro P	DHI-Ro E	Cronbach's alpha if item deleted	Test-retest Pearson Correl. (r)	ICC	95%CI	CA
P1	Does looking up increase your problem?	0.54	0.55			0.86	0.740	0.739	0.58-0.84	0.84
E2	Because of your problem, do you feel frustrated?	0.34		0.28		0.86	0.937	0.935	0.88-0.96	0.96
F3	Because of your problem, do you restrict your travel for business or recreation?	0.76			0.44	0.86	0.966	0.968	0.93-0.98	0.98
P4	Does walking down the aisle of a supermarket increase your problem?	0.39	0.40			0.86	0.873	0.855	0.72-0.92	0.93
F5	Because of your problem, do you have difficulty getting into or out of bed?	0.50			0.24	0.86	0.911	0.899	0.81-0.94	0.95
F6	Does your problem significantly restrict your participation in social activities such as going out to dinner, going to movies, dancing, or to parties?	0.69			0.57	0.85	0.852	0.818	0.62-0.90	0.91
F7	Because of your problem, do you have difficulty reading?	0.44			0.46	0.86	0.942	0.929	0.87-0.96	0.96
P8	Does performing more ambitious activities like sports, dancing, household chores (sweeping or putting dishes away) increase your problem?	0.54	0.20			0.86	0.818	0.784	0.58-0.88	0.90
E9	Because of your problem, are you afraid to leave your home without having someone accompany you?	0.43		0.68		0.84	0.924	0.900	0.80-0.94	0.95
E10	Because of your problem, have you been embarrassed in front of others?	0.46		0.27		0.84	0.816	0.794	0.63-0.88	0.89
P11	Do quick movements of your head increase your problem?	0.51	0.38			0.86	0.658	0.640	0.43-0.78	0.79
F12	Because of your problem, do you avoid heights?	0.49			0.46	0.86	0.834	0.812	0.66-0.89	0.90
P13	Does turning over in bed increase your problem?	0.43	0.36			0.86	0.696	0.627	0.32-0.79	0.81
F14	Because of your problem, is it difficult for you to do strenuous housework or 0.30yard work?	0.58			0.56	0.86	0.821	0.797	0.63-0.88	0.90
E15	Because of your problem, are you afraid people may think you are intoxicated?	0.30		0.25		0.86	0.968	0.967	0.94-0.98	0.98
F16	Because of your problem, is it difficult for you to go for a walk by yourself?	0.62			0.54	0.85	0.934	0.931	0.88-0.96	0.96
P17	Does walking down a sidewalk increase your problem?	0.58	0.49			0.86	0.604	0.553	0.28-0.73	0.75
E18	Because of your problem, is it difficult for you to concentrate?	0.49		0.21		0.86	0.946	0.939	0.89-0.96	0.97
F19	Because of your problem, is it difficult for you to walk around your house in the dark?	0.48			0.41	0.86	0.938	0.930	0.87-0.96	0.96
E20	Because of your problem, are you afraid to stay home alone?	0.27		0.20		0.86	0.943	0.924	0.86-0.95	0.96
E21	Because of your problem, do you feel handicapped?	0.41		0.53		0.86	0.932	0.921	0.85-0.95	0.96
E22	Has your problem placed stress on your relationship with members of your family or friends?	0.46		0.36		0.86	0.955	0.946	0.90-0.96	0.97
E23	Because of your problem, are you depressed?	0.41		0.64		0.86	0.973	0.972	0.95-0.98	0.98
F24	Does your problem interfere with your job or household responsibilities?	0.56			0.37	0.86	0.854	0.829	0.67-0.90	0.92
P25	Does bending over increase your problem?	0.57	0.59			0.86	0.723	0.720	0.55-0.83	0.83

Internal validity determination
**Factor analysis**

Prior to performing the PCA, we assessed the suitability of the data for factor analysis. The correlation matrix revealed the presence of many coefficients of 0.3 and above. Kaiser-Meyer-Olkin value was 0.61, and Bartlett's test of sphericity was significant, supporting the factoriability of the correlation matrix. Principal component analysis revealed the presence of eight components with eigenvalues exceeding 1, explaining 71.60% of the variance. An inspection of scree plot revealed a break after the second factor and another break after the eighth factor. To decide which factor should be retained, we used the Paralell Analysis and only three factors were selected with eigenvalues exceeding the corresponding values for a randomly generated date matrix of the same size (25 variables x 50 repondents). The three factors explained 43.67% of the variance. The residuals were less than 0.05 in 61%. To aid the interpretation of the three components, Varimax rotation was performed. The first factor consisted of 10 factors where 4 of them had factor loadings >0.6 (2E, 9E, 23E, 3F). The second

factor had 9 items, where 3 of these had factor loadings >0.6 (19 F, 8P, 14F) and the third factor had 6 items, 3 of them having factor loadings >0.6 (13P, 25P, 1P). The first factor had mostly emotional items, the second had mostly functional items and the third factor had physical items.

Figure no. 1. Bland-Altman plot for test and retest variables, with 95% limits of agreement is a scatter diagram of the differences plotted against the mean of the test and retest measurements. The mean difference was 7.00 points (95%CI 5.25 to 8.74), SD 6.13, DHI total score test mean=49.56 (95%CI 43.86 to 55.25), SD 20.02 and DHI total score retest mean=42.56 (95%CI 37.29 to 47.82), SD 18.53. The correlation between difference and average was 0.24, p=0.08. The histogram showed a normal distribution of differences. The limits of agreement were calculated using the formula LA=7.00 ± 1.96*6.13 (-5.04,19.04)
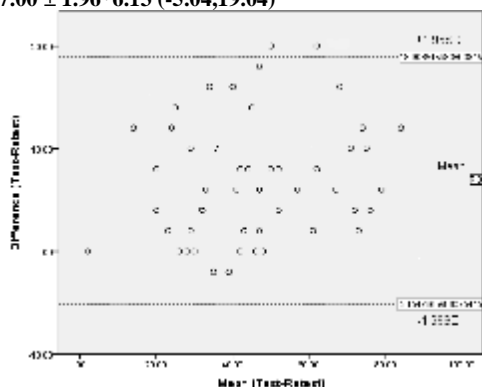
External validity determination

The external validity of the Romanian version was tested by the Pearson correlation between the DHI-Ro total score and its subscales and the Romanian version of the validated SF-36 and its subscales. The correlation between the total score of the two surveys was -0.536 (p=0.00), where SF-36 had a higher value the better the patient's general condition was, while DHI had a higher value the worse the patient's condition was. The correlations between the SF-36 and its subscales and DHI-Ro and its subscales are presented in table no. 3.

Table no. 3. Pearson correlation between the total score and subscales of DHI-Ro and Romanian version of SF-36 questionnaire and its subscales

Pearson Correlation	DHI Total	Physical	Emotional	Functional
SF-36 Total	**-0.53****	-0.15	**-0.56****	**-0.53****
Physical function	**-0.58****	-0.24	**-0.56****	**-0.56****
Physical role	**-0.34***	-0.03	**-0.36***	**-0.38***
Body pain	-0.08	0.01	-0.13	-0.04
General Health	**-0.37****	-0.26	**-0.31***	**-0.36***
Vitality	-0.27	0.08	**-0.39****	-0.27
Social functioning	**-0.27***	0.04	**-0.39****	-0.25
Emotional role	**-0.27***	-0.06	**-0.33***	-0.24
Mental health	**-0.29***	0.00	**-0.33***	**-0.31***
** Correlation is significant at p<0.01				
* Correlation is significant at p<0.05				

DISCUSSIONS

The aim of this study was to accomplish the cross-cultural translation and adaptation of the original DHI questionnaire for a Romanian-speaking population and to analyse the internal consistency and some aspects of the validity of the translation.

The questionnaire was translated and culturally adapted according to the guidelines, then, it was applied to the study group consisting of 50 patients, 20 men and 30 women,

with a mean age of 47.8 years and a range of 21-78 years. The study addressed patients with dizziness, vertigo or imbalance, referred to our emergency department.

The Romanian version of the DHI questionnaire showed satisfactory internal consistency, comparable to the original version. The Cronbach's alpha coefficient ranged between 0.72 and 0.86 for the total score and the three subscores, exceeding the level of 0.70. Corrected item-total correlation values exceeded 0.20, with twelve items ranging between 0.20 and 0.39, indicating an acceptable discrimination. The remaining items with values over 0.40 showed good discrimination (21), suggesting that all items can be retained.

The translated version of DHI has proven to be reliable, with the test-retest coefficient showing a satisfactory value of 0.85 for the total score though a lower value for the physical subscale, unlike the original version where the score was high for all subscales.(7) Other authors have reported low values for test-retest reliability, ranging between 0.64 and 0.85 in the Chinese version (5), or moderate kappa weighted coefficient values, as in the Turkish version.(22) In our study the emotional and the functional subscales had higher coefficients than the physical subscale.

For total DHI score the mean value of two measurement difference was 7 points (95%CI 5.25 to 8.74) and limits of agreement range from -5.04 to 19.04. This value is less than 18 points suggested by Jacobson and Newman (1990) (7) for the original version of the DHI. The reason could be the interval between the administrations of the two questionnaires which in our study was longer (one week) comparing to the original study.

We applied the principal component analysis (PCA), and our option was the three-factor solution. The first factor was represented predominantly by emotional items such as feeling frustration, fear of leaving the home unaccompanied, anxiety and depression caused by dizziness, or feeling stressed in relation with family and friends. The second factor comprised predominantly functional items such as difficulty walking around the house in the dark, doing housework or reading. The third factor had physical items such as complaints in turning over in bed, bending over or looking up. Our assessment did not reveal a clear division of items as in the original study. This may be related to the small size of our study group or to the inhomogeneity of the group, which was composed of patients with various causes of dizziness, some with greater emotional involvement, other more physically disabling. The results were different also in other studies, compared to the original version, and these differences might be explained by the methods used for analyses (exploratory factor analysis or principal component analysis), by sample size, translation or limitation in item construction.(10) These issues should be explored in another study with a larger group of patients.

The external validity of the DHI-Ro questionnaire was tested using the Pearson correlation between the DHI scores and the validated Romanian Medical Outcome Study 36-Item Short Form Health Survey (SF-36), which had negative value (-0.536), taking into account that DHI scores are higher when the patient's condition is worse while the SF-36 scores are greater when the patient's condition is better. The best correlation was found between the DHI-Ro emotional and functional scores and SF-36 total score, and also between the physical function of the SF-36 score and the DHI-Ro total score. General health assessed by SF-36 score was significantly correlated with the total score of DHI-Ro. DHI-Ro correlated also with physical role, social functioning, emotional role and mental health, p<0.05 for all of them. Fielder et al. (23) found a high association between the DHI total score and all eight subscores of SF-36, while in

another study (24) SF-36 scores showed variable correlations with DHI score.

Considering the results, we can establish that dizziness has a pronounced impact on the patient's emotional perception, with an important echo on the functional area, as dizziness interferes with the patient's daily activities. Unlike our results, the Italian study highlighted the impact of dizziness on the physical domain (9) more than on the emotional and functional domains, with the functional domain being more affected in the elderly. This latter distinction was also observed in our study.

Two of the limitations of our study may be the small number of patients and the heterogeneity of the group. A larger number of patients would allow for a detailed study of the factor analysis and test sensitivity. Our factor analysis has weaknesses due to the small sample size, lower than the recommended value, and the low value of variance, which was below 70%.

DHI is an important tool in assessing the impact of balance disorders on the patient's life. Their emotional impact is greater, as shown in this and other studies, sometimes in contrast to the physical and functional side. The questionnaire is relatively easy to complete and the three response categories are both an advantage in their ease and a disadvantage since they lack nuanced responses.

DHI-Ro is the first dizziness questionnaire validated in Romanian, and it presents a useful instrument to evaluate the patient's subjective perception.

CONCLUSIONS

The DHI-Ro is a disease-specific, health-related quality-of-life questionnaire that has been culturally translated and linguistically adapted for Romanian-speaking patients. The DHI-Ro has been shown to have an acceptable reliability and external validity and can be recommended in the assessment of disabilty in patients with vertigo, dizziness and unsteadiness.

Further studies are needed to analyze other indicators, as well as to use the DHI-Ro for more effective dizziness management and follow-up treatment efficiency.

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