Original Article

The Danish version of the Dizziness Handicap Inventory – translation and validation

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ABSTRACT

INTRODUCTION. The Dizziness Handicap Inventory (DHI) is a widely used patient-reported outcome measure assessing the impact of dizziness on daily life. A Danish version (DHI-DK) was developed to facilitate its use in Danish-speaking populations.

METHODS. The DHI was translated into Danish following standard cross-cultural adaptation procedures. The psychometric properties of the DHI-DK were evaluated in a sample of 100 patients with dizziness. Internal consistency was assessed using Cronbach's alpha, test–retest reliability with intraclass correlation coefficients (ICCs), and construct validity through correlations with the visual analogue scale (VAS).

RESULTS. The DHI-DK demonstrated high internal consistency (Cronbach's alpha = 0.88) and excellent test–retest reliability (ICC = 0.95). A strong correlation was observed between DHI-DK and VAS scores (r = 0.60, p < 0.001), supporting construct validity.

CONCLUSIONS. The DHI-DK is a reliable and valid instrument for assessing the self-perceived handicap due to dizziness in Danish-speaking patients. It is suitable for use in both clinical practice and research settings.

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Dizziness is a prevalent symptom affecting a substantial proportion of the population, with lifetime prevalence estimates ranging from 17% to 30% [1]. While dizziness may occur as a primary disorder, it is more frequently considered secondary to other underlying conditions. Multiple disease entities can cause dizziness, such as vestibular neuritis, Menière's disease, benign paroxysmal positional vertigo (BPPV), stroke, multiple sclerosis and others. Regardless of its aetiology, dizziness is associated with various adverse outcomes, including anxiety, depression and reduced quality of life [2].

There is a recognised need for both subjective and objective outcome measures to assess dizziness. Several questionnaires have been developed and applied in international research over the past three decades. However, none of these instruments have been validated or culturally adapted for use in a Danish setting.

The Dizziness Handicap Inventory (DHI) was developed by G. Jacobson in the 1990s as a psychometric tool to assess self-perceived dizziness [3]. The instrument has gained widespread acceptance and has been translated into several languages. Owing to its widespread use, the DHI has become an important outcome measure in

clinical and research settings.

The DHI assesses the perceived impact of dizziness across three subdomains: emotional (nine items), functional (nine items) and physical (seven items). Each item is scored as follows: 4 points for "yes", 2 points for "sometimes" and 0 points for "no", with a total score ranging from 0 to 100 [3]. Hence, the maximum subdomain scores are 36 for both emotional and functional and 28 for physical.

The aim of the present study was to make a subjective outcome measure available for clinical use by translating, culturally adapting and validating the DHI, thereby enabling the evaluation of treatment outcomes and facilitating comparisons between Danish and international research on dizziness.

Methods

License

A license was obtained from JAMA for the reuse of the original version of the DHI for the present study (Supplementary material p. 6). A Danish translation of the DHI was authorised by Prof. J.P. Jacobson in 2008 and was made available to Danish physical therapists through the Association of Danish Physiotherapists' home page. For research purposes, a new translation along with a full cross-cultural adaptation and validation were required.

Procedures

The translation process was conducted using the guidelines outlined in the report "Translation and Cultural Adaptation of Patient Reported Outcomes Measures – Principles of Good Practice" [4], in alignment with COSMIN standards for translating and adapting patient-reported outcome measures [5].

Most of the questionnaires were completed in paper format and subsequently entered into the Research Electronic Data Capture (REDCap) database. The questionnaires were excluded from the study if data were missing or answers were incomplete.

Participants

Between October 2021 and September 2023, 109 patients were recruited and completed the DHI-DK. Patients were recruited consecutively from the Vestibular Clinics at the Department of Otorhinolaryngology, University Hospital of Southern Denmark, Esbjerg, Denmark, and Gødstrup Hospital, Herning, Denmark.

The inclusion criteria included symptoms of vertigo or dizziness attributable to a vestibular disorder, persisting for at least one month. Eligible participants were aged between 18 and 85 years, independently mobile and able to understand Danish. A vestibular disorder was confirmed through a comprehensive neuro-otological examination performed by an ear-nose-throat (ENT) specialist. All patients provided written informed consent.

The exclusion criteria included symptoms of dizziness or unsteadiness attributable solely to neurological or cardiopulmonary conditions. Patients were also excluded if they presented with severe palsy, spasticity, cerebellar ataxia, extrapyramidal disorders, sensory loss, diagnosed dementia or blindness.

Translation

Forward and backwards translations of the DHI were performed by two bilingual native Danish-English speakers. The translations were reviewed in a multidisciplinary forum involving all contributors, and some minor changes to the DHI-DK were made.

The back translation revealed a potential issue with Item 23. The original item, 'Because of your problem, are

you depressed?' was rendered into Danish. However, in Danish, the term 'depressed' conveys a more severe mental health condition, so it was changed.

Cross-cultural adaptation

The instruction section of the DHI-DK was modified without altering the original meaning. The term "scale" was substituted by "questionnaire". The term "unsteadiness" was translated as "gait instability", though another option was "imbalance", which we chose. Additionally, we added "please answer *all* items by only one answer per item" since testing revealed some confusion by indicating more than one answer.

Overall, there were no significant differences between the DHI-DK and the original or other versions of the DHI.

Cognitive interviews and tests

The DHI-DK was tested on 14 informants: seven healthy volunteers and seven patients with dizziness. The participants were interviewed. If more than one informant provided feedback on the same item, that item was considered for revision. Only minor adjustments were made for the final DHI-DK ([Supplementary Material, p. 1](#)).

Measures

Study data were collected and managed using REDCap, which is a secure, web-based software platform that supports data capture for research studies [6].

The DHI-DK was administered alongside the Visual Analogue Scale for Dizziness (VAS-D) and a modified version of the Brief Symptoms Severity Score (Brief SSS). All patients were asked to complete the questionnaires again within the same week, preferably after three days, and they were provided with a stamped return envelope. Patients could complete the questionnaire either at home before their appointment or while waiting in the clinic.

The VAS-D is a 0-100 visual analogue scale: "How dizzy do you feel today?", where 0 indicates no dizziness and 100 represents the worst dizziness ever experienced.

The modified Brief SSS, ranging from 0 to 5 points, assesses changes in symptom severity and is used as a variable for comparing dizziness symptoms ([Supplementary Material p. 2](#)).

Statistics

All statistical analyses were conducted using STATA 18.0. (StataCorps LLS, Texas, USA). The data were presented with 95% confidence intervals, and the significance level was set at 0.05.

Data analysis

Baseline DHI-DK scores were analysed to detect potential floor or ceiling effects, defined as no more than 15% of patients achieving the lowest or the highest values. Internal consistency was assessed using Cronbach´s alpha, with values above 0.8 indicating good reliability. Test-retest reliability was evaluated by calculating the intraclass correlation coefficient (ICC) for the mean scores. A Bland-Altman plot was used to assess agreement between test and retest scores. Convergent validity between the DHI-DK, VAS and Brief SSS was assessed using Pearson's correlation coefficient. Correlation coefficients range from −1 to + 1, with values above 0.5 considered to indicate a strong positive correlation.

Trial registration: not relevant.

Results

A total of 148 patients were invited to complete the DHI-DK, VAS-D and Brief SSS questionnaires, of which 109 were returned and completed once. In all, 39 patients completed the questionnaires twice; of these, 33 returned fully completed sets. Among the 109 patients, 72 (66%) were female and 37 (34%) male. All patients had experienced dizziness and were diagnosed with a vestibular disorder (**Table 1**).

TABLE 1 Population characteristics[a].

	DHI-DK-1 (N = 109)	DHI-DK-2 (N = 33)
Age, mean ± SD (range), yrs	57.37 ± 14.50 (18-84)	51.55 ± 14.83 (22-77)
Gender, n (%)		
Female	72 (66)	21 (63.6)
Male	37 (34)	12 (36.4)
Diagnosis, n (%)		
BPPV	32 (29.4)	6 (18.2)
Menière's disease	28 (25.7)	10 (30.3)
Vestibular neuritis	5 (4.6)	
Vestibular migraine	4 (3.7)	2 (6.1)
PPPD	1 (0.9)	-
Unilateral vestibulopathy	14 (12.8)	8 (24.2)
Bilateral vestibulopathy	14 (12.8)	3 (9.1)
Other[b]	11 (10.1)	4 (12.1)

BPPV = benign paroxysmal positional vertigo; DHI-DK = Dizziness Handicap Inventory – Danish version; PPPD = persistent postural-perceptual dizziness; SD = standard deviation.
a) Questionnaires DHI-DK-1 and DHI-DK-2 were administered ≤ 2 weeks apart.
b) Includes vestibular schwannomas, congenital nystagmus and the probable diagnoses where an underlying vestibular cause was evident, but the precise aetiology was not identified in the chart.

Normal distribution of data

The normality of the DHI-DK data was assessed using the Shapiro-Wilk W test. The test yielded p = 0.12, indicating no significant deviation from normality. Thus, the data were considered normally distributed; a histogram of the DHI-DK total scores is presented in **Figure 1**.

FIGURE 1 Histogram of the Dizziness Handicap Inventory (DHI) – Danish version, total score, with a superimposed normal distribution curve illustrating the expected distribution under normality.
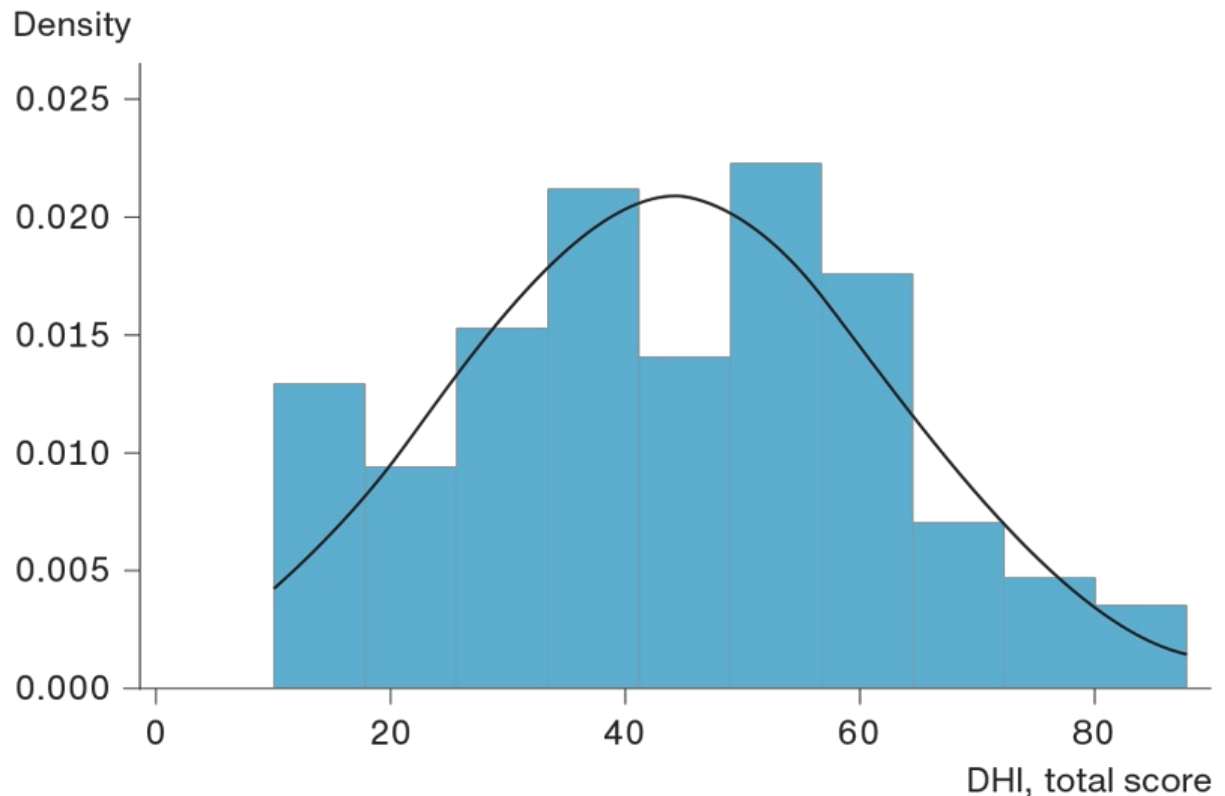
Reliability

A floor and ceiling effect of 14.3% was demonstrated.

The internal consistency of the 25 items in the DHI-DK scale total score calculated by Cronbach's alpha was 0.88, for the subdomains Physical 0.74, Emotional 0.77 and Functional 0.75 (**Table 2**). There were no outliers in the dataset. A Cronbach's alpha of 0.88 indicates good internal consistency between the items in the questionnaire.

TABLE 2 Cronbach´s alpha, total score and the subdomains of the Dizziness Handicap Inventory – Danish version.

Subscale	Cronbach's alpha	Items, n
Physical	0.74	7
Emotional	0.77	9
Functional	0.75	9
Total	0.88	25

The test-retest ICC, calculated using a one-way random-effects model, demonstrated an absolute agreement of the mean of 0.95 for the mean of the DHI, indicating a very high correlation. The Bland-Altman plot (**Figure 2**) displays a mean difference line close to zero, indicating excellent agreement between the test-retests of the DHI-DK and the DHI-DK-2. No patterns were observed in the Bland-Altman plot.

FIGURE 2 Bland-Altman plot of the Dizziness Handicap Inventory (DHI) – Danish version, total score. The plot shows that 31 of the 33 differences (94%) fall within the limits of agreement, as indicated by the dashed blue lines.
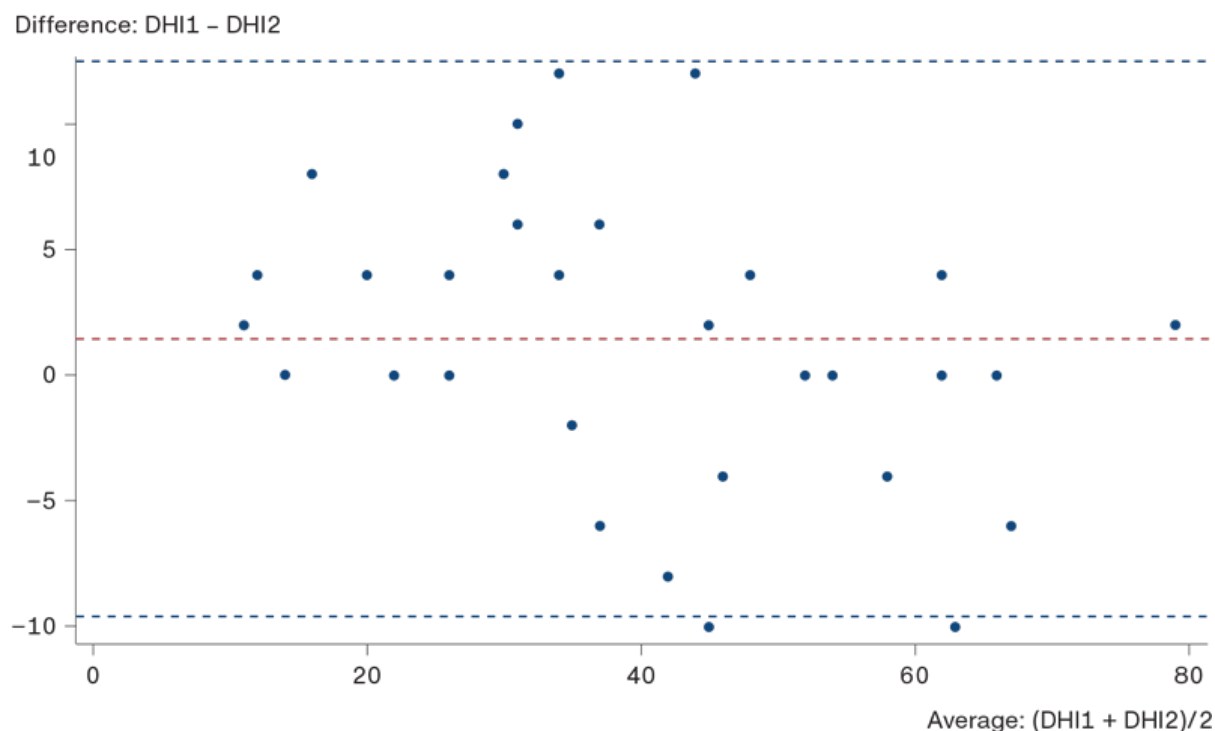
Validity

Convergent validity was demonstrated using Pearson's correlation. The DHI-DK was correlated to the VAS-D and had a moderate to strong positive correlation of 0.6 (p = 0.000). The DHI-DK was also correlated with the Brief-

SSS and had a moderate to strong positive correlation score of 0.54 (p = 0.000). The moderate to strong correlation suggests that the items are measuring the intended concept.

Discussion

The main aim of this study, which was to adapt a Danish version of the DHI-DK, was successfully accomplished, as shown by strong psychometric properties, including high Cronbach's alpha and ICCs. The DHI has been translated into numerous languages. A summary of the languages and their respective sample sizes, Cronbach's alpha values and ICCs is presented in Supplementary Material, Table 1.

In this study, we obtained a Cronbach's alpha of 0.88, which is consistent with the original DHI, where a value of 0.89 was reported. Translated versions of the DHI have reported Cronbach's alpha values ranging from 0.7 to 0.95, all indicating strong consistency between items (see Supplementary Material, Table 1). While the original DHI study did not report an ICC, it presented a Pearson product-moment correlation for the total DHI score (r = 0.97, p < 0.0001), indicating a strong and highly significant linear relationship between test and re-test scores [3]. In the present study, an ICC of 0.95 further supports the high test-retest reliability of the Danish version. ICC values for other DHI versions range from 0.70 to 0.98, reflecting a moderate to strong test-retest reliability across languages (see Supplementary Material, Table 1).

The Argentinian version of the DHI reported a moderate correlation between the VAS and the DHI (r = 0.59, p = 0.00), using Spearman's correlation coefficient [7]. In our study, we observed a correlation of 0.60 (p = 0.00) between the VAS and the DHI-DK, using Pearson's correlation coefficient, indicating strong convergent validity.

A review of the DHI found that the instrument demonstrates a high degree of cultural adaptability [8]. Additionally, comparisons of multiple language versions of the DHI with the original revealed no significant discrepancies in Cronbach's alpha or ICC values (Supplementary Material Table 1). This highlights the instrument's robustness and cross-cultural applicability. The importance of careful translation, cross-cultural adaptation and validation becomes particularly evident in contexts where dizziness is associated with negative emotions such as shame or stigma. For example, some translated versions of the DHI have linked dizziness to feelings of weakness and embarrassment. In the Persian version, the term "handicapped" was replaced to avoid eliciting negative emotions and defensive behaviours [9]. In contrast, the Danish version did not encounter such issues, suggesting that the translation process was culturally appropriate and well-aligned with local perceptions.

Despite the successful adaptation of the DHI-DK, there remains a clear need for additional tools for measuring and quantifying dizziness. To date, no other dizziness-related questionnaires have been translated into Danish, limiting opportunities for cross-instrument comparison. Some studies have employed alternative objective measures, such as gait, balance and additional equipment like Videonystagmography, video impulse testing and posturography. In the original 1991 study, the authors of the original DHI reported significant correlations between the DHI and posturography, and between the DHI and spontaneous nystagmus [10].

A limitation of this study, and others of its kind, is the absence of a universally accepted gold standard for measuring dizziness. A systematic review on the measurement properties of the DHI concluded: "The current evidence for a number of measurement properties of the DHI is suboptimal. Because of its widespread use and the lack of better alternatives, researchers can use the DHI when assessing the handicapping effects of dizziness, but they should be aware of its limitations" [11]. In the original DHI study, a change of 18 points was considered necessary to demonstrate a significant treatment effect and to reflect a true change in dizziness handicap following an intervention [3]. However, the present study did not assess the DHI-DK's ability to detect a clinically meaningful change or differentiate between sick and healthy individuals.

The development of the DHI-DK was warranted, and this study serves as a foundation for comparing Danish data from the DHI-DK with international datasets. However, further research is needed, particularly into the diagnostics and treatment of various types of dizziness.

Conclusions

The DHI-DK demonstrates strong reliability and validity as a patient-reported outcome measure for assessing dizziness. This study successfully translated, cross-culturally adapted and validated the DHI-DK for use in the Danish language, providing a reliable instrument for both clinical practice and research. The DHI-DK is now ready for clinical implementation and offers a valuable resource for assessing the impact of dizziness on patients' quality of life.

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Supplementary material: https://content.ugeskriftet.dk/sites/default/files/2025-06/a12240910-supplementary.pdf

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