ORIGINAL ARTICLE

Cross-cultural Adaptation and Validation of the Dizziness Handicap Inventory: Argentine Version


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Abstract
Introduction and objectives: The Dizziness Handicap Inventory is a useful tool for quantifying self-perceived handicap in patients with vertigo, dizziness or unsteadiness and its impact on daily living activities. The Dizziness Handicap Inventory identifies functional, physical and emotional disorders related to balance disturbance.

Our objective was to cross-culturally adapt the Peninsular Spanish version of the Dizziness Handicap Inventory for use in Argentina and validate the adapted Argentinian version.

Methods: We included both healthy subjects and patients with vertigo, dizziness or unsteadiness, aged 18–85 years, native Spanish-speaking Argentinians.

We introduced linguistic and cultural modifications to the Peninsular Spanish version to obtain the Argentinian one. This version was given twice to 108 patients, 24–72 h apart. Internal consistency, test–retest reliability and construct validity were assessed using a visual analogue scale, the Romberg test, the tandem Romberg test and the tandem gait test.

Results: We found high internal consistency (α=0.87) and very high test–retest reliability for the total Dizziness Handicap Inventory score (intraclass correlation coefficient: 0.98) and its subscales. The total Dizziness Handicap Inventory and the functional subscale were found to correlate significantly with the Romberg and tandem Romberg tests. The emotional subscale showed a significant correlation with the Romberg test and the eyes-open tandem Romberg test (p<.05).

Conclusions: The Argentinian version of the Dizziness Handicap Inventory proved to be a reliable and valid tool to quantify self-perceived handicap resulting from vertigo, dizziness or unsteadiness.

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Adaptación cultural y validación del Dizziness Handicap Inventory: versión Argentina

Resumen:

Introducción y objetivos: El Dizziness Handicap Inventory es una herramienta útil para cuantificar la autopercepción de la discapacidad en pacientes con vértigo, mareo o inestabilidad y su impacto en actividades de la vida diaria. El Dizziness Handicap Inventory identifica problemas de orden funcional, físico y emocional relacionados con trastornos del equilibrio.

Nuestro objetivo es realizar la adaptación cultural y validación del Dizziness Handicap Inventory al castellano argentino a partir de la versión española.

Métodos: Se incluyeron personas sanas y pacientes con vértigo, mareo o inestabilidad, de 18 a 85 años, argentinos nativos capaces de comprender castellano.

Sobre la versión española se realizaron modificaciones lingüísticas y culturales para obtener la versión argentina. Esta versión se administró a un grupo de 108 pacientes, 2 veces, en un lapso de 24 a 72 h.

Se evaluó consistencia interna, confiabilidad test–retest y validez de constructo a través de: Escala Visual Análoga, Romberg en tándem y marcha en tándem.

Resultados: Se encontró una alta consistencia interna (α=0.87), y muy alta confiabilidad test–retest del Dizziness Handicap Inventory total (coeficiente de correlación intraclase: 0.98) y sus subescalas. Se encontraron correlaciones significativas entre Romberg y el Romberg en tándem con el Dizziness Handicap Inventory total y la subescala funcional. La subescala emocional mostró una correlación significativa cuando se comparó con Romberg y Romberg en tándem ojos abiertos (p < 0.05).

Conclusiones: La versión argentina del Dizziness Handicap Inventory mostró ser una herramienta confiable y válida para cuantificar la autopercepción de la discapacidad debida a vértigo, mareo o inestabilidad.

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Introduction

Dizziness and vertigo are 2 of the most frequent reasons for consultation in medicine, affecting approximately 20%–30% of patients among the general population. Almost 20% of patients older than 60 years have experienced a severe enough episode of vertigo to affect activities of daily living (ADL).1

For this reason the use of an instrument which measures health in vestibular disorders is of great interest. This should provide information about the quality of life, functional capacity and subjective perception of health status by patients.2

Several questionnaires for the study of disability and handicap in patients with vestibular disorders have been developed in the United States and in England and their content depends on considerations or factors inherent to their own culture. One of the most relevant is the Dizziness Handicap Inventory (DHI) created by Jacobson and Newman in 1990.3

The DHI was created as a tool to quantify the effect of self-perceived disability in patients with vertigo, dizziness or instability, and the impact it causes on ADL.4,5

It has been observed that, when used in conjunction with a clinical history and physical examination, the DHI is useful to quantify the effects of medical and surgical interventions and rehabilitation.6

Vertigo is a symptom which can be caused by various aetiologies. It is characterised by an illusory sense of movement of the body relative to objects or vice versa. It is essential to recognise it, as it significantly affects the life of patients, causing disability, handicap and/or limitations in their ADL.2

Dizziness is an unpleasant, subjective sensation, which involves the environment and which can be referred by patients as insecurity, discomfort, numbness, confusion, disorientation or blurred vision.

Postural instability experienced by patients is due to a deficit in balance and righting reactions and an inadequate vestibulospinal reflex response, which does not allow a harmonious work of agonist and antagonist muscles.7

The physical disability caused by chronic dizziness, vertigo and physical instability can lead to irritability, loss of confidence, depression, panic and fear to leave the house. As a consequence, patients report difficulty to concentrate, memory loss and fatigue.8

Conventional tests are not appropriate to demonstrate the psychological interference, clinical symptoms or suffering of patients with dizziness.8 However, the DHI is more useful because it identifies specific functional, emotional and physical problems related to balance disorders. It enables an understanding of the degree or level of disability caused by the presence of symptoms observed from the perspective of the patients themselves. It also considers aspects which are not observed by the physician or objectively quantifiable by neurological exploration instruments.4

In order to use a measurement instrument or questionnaire in another culture it is not enough to obtain a mere, literal translation of the original version, since it will not retain the same level of reliability and validity.7 That is why the version created by Jacobson and Newman has been translated into several languages and adapted to different cultures, such as the Spanish (2000), Swedish (2003), Japanese (2004), Chinese (2004), French (2004), Mexican...

So far, no assessment tools for vestibular symptoms have been validated in Argentina. For this reason, we aim to conduct a cultural adaptation and validation of the DHI to Argentine Castilian, starting from the Spanish Peninsular Castilian version.

Methods

Cultural Adaptation

Based on the Spanish version of Perez et al., which proved to be reliable and valid, we created a modified version of the DHI. After obtaining permission from the author, we carried out those structural and linguistic changes which were considered necessary in order to ensure conceptual and semantic equivalence with the original version. In total, we modified 10 of the 25 questions, which were grouped by area (Appendix 1).

In order to obtain the final version, we evaluated a group of 40 patients, who were administered the DHI twice within a period of 24–72 h. In addition, they also completed a questionnaire to assess the difficulties they encountered in responding to it (Appendix 2).

After analysing the data collected, we obtained the final version of the DHI, which was administered to a larger group of patients in order to evaluate the metric characteristics of the survey (Appendix 3).

Patients

The study population consisted of 108 subjects recruited between May 2009 and February 2011.

We included Argentine-born, healthy subjects and patients, aged between 18 and 85 years, who were able to understand Spanish both orally and in writing. Patients were referred to the Kinesiology Service of Hospital Juan A. Fernández, to a specific clinic in the city of Buenos Aires specialising in the treatment of vestibulopathies due to vertigo, dizziness or unsteadiness.

We excluded those patients with severe visual disorders, diagnosed psychiatric disorders, benign paroxysmal positional vertigo, cognitive impairment and musculoskeletal or neurological motor disorders which prevented the completion of the evaluation.

We also eliminated those subjects whose questionnaires contained incomplete or doubtful responses and those who did not attend the second evaluation.

Questionnaire

The DHI is composed of 25 items, divided into 3 areas or subscales:

- Physical: evaluating the impact of the feeling of instability on motor capacity.

  The maximum score obtainable is 100, derived from 36 points on the emotional subscale (9 items), 36 points on the functional subscale (9 items) and 28 points on the physical subscale (7 items). Each question offers a choice of 3 possible answers: ''Yes'' (4 points), ''Sometimes'' (2 points) and ''No'' (0 points).

  The questionnaire establishes the following score for the functional and emotional aspects:

  - No disability: 0–14 points.
  - Moderate disability: 15–24 points.
  - Severe disability: 25 points or more.

  The physical aspect is assigned the following score:

  - No disability: 0–9 points.
  - Moderate disability: 10–16 points.
  - Severe disability: 17 points or more.

Validation

In order to perform the validation of a questionnaire, it is necessary to verify its metric characteristics: internal consistency, test-retest reliability and construct validity.

Internal consistency should be evaluated when a questionnaire is composed of different subscales, each of which purports to measure a different dimension of the phenomenon, that is, to measure whether items of the same attribute show homogeneity among them.

Test–retest reliability refers to the administration of a questionnaire to the same population on 2 separate occasions, expecting identical results.

Construct validity refers to the comparison of a questionnaire with other instruments which measure the same factors evaluated by the scale. In order to obtain it, we must compare the results of the DHI with those obtained in the following tests, which were conducted in the first assessment (Appendix 4).

Perception of dizziness or instability: patients were asked to mark their sensation of dizziness or instability at the time of evaluation on a visual analogue scale (VAS). This scale consisted of a straight line, measuring 100 mm, where 0 (zero) represented the absence of symptoms and 100 (one hundred) represented their highest perception.

Romberg with Jendrassik manoeuvre: patients were instructed to remain still, with both feet together, eyes closed and clapping hands (performing abduction of upper limbs to generate tension) for a period of 30 s. The test began when patients assumed the correct position and stopped when they moved their feet, lost the position of their upper limbs, opened their eyes or completed the period of 30 s. The test was considered negative if patients maintained the position for the established period. Otherwise, it was considered positive.

Romberg in tandem position: patients were instructed to remain still with one foot in front of the other (with the heel of one foot touching the tip of the other) for a period of 30 s. The Romberg test was performed with both
open eyes (ROE) and closed eyes (RCE), with a break of 15 s between both tests. Measurements were taken again after reversing the position of the feet (right or left), considering the foot placed behind for registration purposes. Timing started when patients assumed the correct position and indicated being prepared. They were allowed to choose which foot to put forward, and to switch between tests. The test was stopped whenever patients moved their feet or upper limbs, opened their eyes during the manoeuvre with closed eyes or reached the time limit. The test was considered negative if patients maintained the position for the established period. Otherwise, it was considered positive.12

Tandem gait: patients were asked to walk on a line, 15 cm wide, marked on the floor, by taking 10 steps in which the heel of one foot touched the tip of the other and with their eyes open. When performing them, subjects had to remain with their arms at their sides and looking straight ahead. The test was stopped if subjects looked at the floor, moved their upper limbs or planted one foot completely off the line. We recorded the number of steps performed correctly and consecutively. Subjects who were unable to perform 10 steps in the first test were allowed a second attempt. For the analysis of data we took into account the mean number of steps between both tests.13

Patients were asked to take off their shoes before starting the tests.

All evaluators underwent training prior to conducting the tests.

This study was approved by the Ethics Committee of our hospital and all patients gave their informed consent to participate in it.

Statistical Analysis

The DHI was taken at 2 points in time: time 1 (first measurement) and time 2 (second measurement).

In order to analyse the internal consistency, we calculated Cronbach’s alpha (α) on the measurements at time 1.

Test–retest reliability was calculated using the intraclass correlation coefficient (subscases and total) and the Kappa coefficient.

Lastly, we assessed construct validity by comparing the results of the DHI with Romberg manoeuvres, ROE (left and right), RCE (left and right), VAS and tandem gait, using the nonparametric Mann–Whitney U test (subscases and total). We also evaluated the correlation of the DHI (subscases and total) with the VAS and tandem gait tests using the nonparametric Spearman correlation coefficient (rs) on the measurements at time 1.

Statistical significance was considered for \( P \leq 0.05 \).

Results

We studied a sample of 108 subjects, 10 of whom were healthy. The study population consisted of 37 men and 71 women, with a mean age of 58 years (range between 23 and 85 years).

Among the patients examined, 51 suffered peripheral vestibular syndrome, 36 patients presented central vestibular pathology and 11 presented signs and symptoms of both locations, which were classified as mixed syndromes (Table 1).

The mean total DHI score at time 1 was 36 (range 0–94) and at time 2 it was 35 (range 0–100). The means for each subscale were 14, 10 and 14 for the physical, emotional and functional areas, respectively, at time 1. At time 2, the mean values were 13, 6 and 14 for the physical, emotional and functional areas, respectively (Table 2).

The DHI was shown to have high internal consistency in both total score (\( \alpha = 0.87 \)) and subscales (\( \alpha = 0.79 \) physical scale; \( \alpha = 0.85 \) emotional scale; \( \alpha = 0.83 \) functional scale), all with \( P < 0.001 \).

Table 3 shows the intraclass correlation coefficient (ICC) and confidence intervals for the analysis of the test–retest reliability of the total DHI and its subscales. The test–retest reliability of the total DHI (ICC: 0.98) and its subscales (physical scale ICC=0.94; emotional scale ICC=0.97; functional scale ICC=0.97) was very high (\( P < 0.001 \)).

Construct validity presented a significant correlation (\( P < 0.05 \)) between the Romberg with Jendrassik manoeuvre and the tandem Romberg with the total DHI and the

<table>
<thead>
<tr>
<th>Table 1 Baseline Data.</th>
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<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>Population, n</td>
</tr>
<tr>
<td>Patients</td>
</tr>
<tr>
<td>Healthy subjects</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Diagnosis (( n=98 ))</td>
</tr>
<tr>
<td>Central vestibular syndrome</td>
</tr>
<tr>
<td>Peripheral vestibular syndrome</td>
</tr>
<tr>
<td>Mixed syndrome</td>
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</table>

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<tr>
<th>Table 2 Results of the Dizziness Handicap Inventory at times 1 and 2 (subscale and total).</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHI 1</td>
</tr>
<tr>
<td>Physical</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

DHI: Dizziness Handicap Inventory.
functional subscale. Only the right RCE was not significant compared to the total DHI, although it showed a trend towards it. The emotional subscale had a significant correlation when compared with the Romberg with Jendrassik manoeuvre, right ROE and left ROE, and showed a trend towards significance when related to left RCE. The physical subscale only showed a trend towards significance when compared with right ROE (Table 4).

We found a moderate and direct correlation when comparing the VAS with the total DHI (rs: 0.58; P<.00) and its subscales. The correlation values obtained when comparing the total DHI (rs: −0.37; P<.00) and its subscales with tandem gait were low and indirect (Table 5).

Discussion

Evaluation of self-assessed quality of life of patients with vestibular symptoms is increasingly recognised as an important indicator of disability due to vertigo, dizziness or physical instability. The DHI is a reliable, valid and clinically useful tool for the measurement of self-perceived disability associated with multifactorial dizziness symptoms.

In our work, the DHI showed high internal consistency for both total score and subscales, yielding values comparable to those of the original version by Jacobson and Newman, which had internal consistency values of α=0.89 for the total DHI, α=0.85 for the functional subscale, α=0.72 for the emotional subscale and α=0.78 for the physical subscale.3

Comparing our results with the Spanish version of Pérez, the latter presented an internal consistency of α=0.92 for the total DHI, α=0.8 for the functional subscale, α=0.66 for the functional subscale and α=0.85 for the physical subscale.10

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Test–retest of the Dizziness Handicap Inventory (subcales and total).</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>DHI 1 vs DHI 2</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>Physical subscale</td>
<td>0.9473</td>
</tr>
<tr>
<td>Emotional subscale</td>
<td>0.9742</td>
</tr>
<tr>
<td>Functional subscale</td>
<td>0.9731</td>
</tr>
<tr>
<td>Total DHI</td>
<td>0.9842</td>
</tr>
<tr>
<td>95% CI: 95% confidence interval; DHI: Dizziness Handicap Inventory; ICC: Intraclass correlation coefficient.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Comparison of the Dizziness Handicap Inventory With the Romberg and Tandem Romberg tests.</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>DHI1p</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>Romberg</td>
<td>439.0</td>
</tr>
<tr>
<td>Right ROE</td>
<td>1090.5</td>
</tr>
<tr>
<td>Left ROE</td>
<td>1192.0</td>
</tr>
<tr>
<td>Right RCE</td>
<td>548.5</td>
</tr>
<tr>
<td>Left RCE</td>
<td>736.0</td>
</tr>
<tr>
<td>DHI: Dizziness Handicap Inventory; DHI1e: emotional subscale; DHI1f: functional subscale; DHI1p: physical subscale; DHI1t: total DHI; RCE: Romberg closed eyes; ROE: Romberg open eyes.</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Mann–Whitney U value.</td>
</tr>
<tr>
<td>b</td>
<td>Statistically significant difference.</td>
</tr>
</tbody>
</table>

Our internal consistency results were also similar to those of the Italian and Norwegian versions of the questionnaire.14,15

The test–retest reliability of the Argentine version showed similar results to those of the original version by Jacobson and Newman, which were ICC=0.97 for the DHI total, ICC=0.92 for the physical subscale, ICC=0.94 for the functional subscale and ICC=0.97 for the emotional subscale.3 The Dutch version by Vereeck et al. and the work by Enloe and Shields also showed similar results to ours (total DHI: ICC=0.99 and ICC=0.96, respectively).5,16

We should note that in both the study by Jacobson and in that by Vereeck, the retests were performed on the same day.16 However, in the work of Enloe and Shields the retest was assessed after a period of 24–48 h.3 We established the measurement of the second questionnaire between 24 and 72 h after the first test. This ample time period reduced the possibility of patients remembering their responses at time 1, although it also increased the possibility of changes taking place, mainly in the emotional subscale, which could affect the final results.

According to the work of Vereeck et al., functional balance tests including gait, such as the Dynamic Gait Index and the Timed Up and Go, correlated better with DHI scores than measurements of static balance. When they correlated the questionnaire with tandem gait, they obtained a weak
and indirect correlation with the total DHI. We found similar results in our work.\textsuperscript{12}

We found a moderate and direct correlation when comparing the total DHI with the VAS. These results were similar to those in the study by Vereeck et al.\textsuperscript{12}

In the same work, this author obtained correlation with total DHI score for the Romberg test with Jendrassik manoeuvre and tandem Romberg with open and closed eyes.\textsuperscript{12} We also found a correlation between the total score of the questionnaire and all Romberg tests conducted, except for right RCE, which showed a trend towards it. This same relationship was found with the functional subscale.

All the tests mentioned were used to relate the DHI with the capacity to perform balance tests, since, at present, there is no clinical trial considered as a "gold standard". However, we could have included other assessment tools, such as those recommended by Vereeck.

One weakness identified in our study was that the final version of the DHI could have been assessed by a committee of experts other than its authors.

The fact that a single evaluator recorded both the questionnaire and the clinical trials could be considered as a bias. However, since the DHI is a self-administered questionnaire, its results should not be affected by the evaluator.

A highlight of our work is its sample size, which is superior to other validation studies except for the Dutch version of the DHI, which had a sample size comparable to ours.\textsuperscript{16} It would have been interesting to include more healthy subjects within the sample, as one of the objectives of the study was to test the validity of the tool to discriminate the presence or absence of disability.

Since our results support the use of the Argentine version of the DHI, it would be interesting to measure sensitivity to change with this version, in order to test the effectiveness of vestibular rehabilitation and the impact of treatment on the daily life of patients.

It would also be interesting to expand the sample, in order to extend this version to the entire population of Argentina.

Conclusions

In this work, the DHI was culturally and linguistically adapted for use in the population of Argentina. The tool showed high internal consistency and very high test–retest reliability. Furthermore, the total DHI and the functional subscale also showed good construct validity.

These findings support the use of the Argentine version of the DHI, since it proved to be a reliable and valid tool to quantify self-perception of disability due to vertigo, dizziness or physical instability.

Conflict of Interests

The authors have no conflicts of interest to declare.

Acknowledgement

The authors wish to thank Dr. Nicolás Pérez Fernández for his valuable and generous collaboration.
Appendix 1. Argentine Version of the Dizziness Handicap Inventory (DHI).

Name and Surname: ................................................................. Date: .../.../....
Time: ..............

DIZZINESS HANDICAP INVENTORY

Instructions: The purpose of this scale is to identify the difficulties which you experience due to vertigo or physical instability. Please respond “Yes”, “No” or “Sometimes” to each question by marking your response with a cross. Please respond to each question depending on your vertigo or physical instability problem.

- Does lifting your head worsen your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does walking down the aisle of a supermarket worsen your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem become worse when you perform demanding activities, such as sports, dancing or carrying out household tasks (for example, sweeping the floor or washing dishes)?
  Yes ☐ Sometimes ☐ No ☐
- Do rapid head movements worsen your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem worsen when you turn in bed?
  Yes ☐ Sometimes ☐ No ☐
- Does walking down the street worsen your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem worsen when you bend over?
  Yes ☐ Sometimes ☐ No ☐
- Do you feel frustrated due to your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem cause you to feel afraid to leave the house without company?
  Yes ☐ Sometimes ☐ No ☐
- Has your problem led you to feel ashamed in front of others?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make you feel afraid that other people may think you are inebriated?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make it difficult for you to concentrate?
  Yes ☐ Sometimes ☐ No ☐
- Do you feel afraid to be home alone due to your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make you feel disabled?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make it difficult for you to maintain relationships with family and friends?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make you feel depressed?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem lead you to limit your business or pleasure travels?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make it difficult to lie down or get up from bed?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem significantly limit your participation in leisure activities (such as going out for dinner, going to the cinema, going dancing or attending parties)?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make it difficult to read?
  Yes ☐ Sometimes ☐ No ☐
- Do you avoid heights due to your problem?
  Yes ☐ Sometimes ☐ No ☐
- Do you find it difficult to carry out strenuous household tasks due to your problem?
  Yes ☐ Sometimes ☐ No ☐
- Do you find it difficult to go for a walk alone due to your problem?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem make it difficult to walk around your home in darkness?
  Yes ☐ Sometimes ☐ No ☐
- Does your problem have a negative influence on your responsibilities at home or at work?
  Yes ☐ Sometimes ☐ No ☐

Score: Total: .... Area 1: .... Area 2: .... Area 3: .......
Appendix 2. Questionnaire on the Difficulty of the Modified Version of the Dizziness Handicap Inventory (DHI).

Kinesiology Service, Hospital Juan A. Fernández

Name and Surname: …………………………………………………………………………..

1) Did you have any difficulties understanding the questions in the survey?

2) If so, which ones?

3) If so, why?
   Explain: ……………………………………………………………………………………
   ……………………………………………………………………………………………
   ……………………………………………………………………………………………
   ……………………………………………………………………………………………


Appendix 4. Patient Data Registry Sheet.

Cultural adaptation of the DHI: Argentine version

Personal information

Name and Surname: …………………………………………… Date: ………………..

Age: ………. Gender: ………. Time: ……………….

Referring physician: ………………………………………………………………………

Diagnosis: ……………………………………………………………………………

Associated pathologies: …………………………………………………………………

Measurements

Initial DHI: ……………………… Date: ………………..

DHI end: ……………………… Date: ………………..

EVA: ……………………… Date: ………………..

Romberg: ………………………

Eyes open: Left: Right:

Eyes Closed: Left: Right:

Run in tandem: …….. steps
References