

Content Comparison of Self-Report Measures Used in Vestibular Rehabilitation Based on the *International Classification of Functioning, Disability and Health*

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Background. Physical therapists should understand the content included in self-report questionnaires in order to choose the appropriate questionnaire for examination and follow-up purposes. The *International Classification of Functioning, Disability and Health* (ICF) provides a universal and standard language for the description of health and health-related states and can be used for the content comparison of self-report questionnaires.

Objective. The purpose of this study was to describe and compare the contents covered by 8 self-report measures used in vestibular rehabilitation based on the linkage of their content to the ICF.

Design. This was a cross-sectional study.

Method. Eight vestibular questionnaires were identified and linked to the ICF by 2 health care professionals according to established linking rules. Based on the linking, the contents of the 8 questionnaires were compared and the interobserver agreement between 2 raters was estimated using kappa coefficients.

Results. A total of 312 meaningful concepts from the 164 items of the 8 vestibular questionnaires were identified and linked to the ICF. The meaningful concepts identified were linked to 51 different ICF components: 19 categories of the component “body functions,” 30 categories of the component “activities and participation,” and 2 categories of the component “environmental factors.” Forty-two concepts could not be linked to any of the ICF components. The estimated kappa coefficients for 2 raters at the component and first and second levels of the ICF ranged from 0.83 to 0.96.

Limitations. The method of identifying vestibular measures was not based on a systematic search; instead, the most widely used instruments in the field of vestibular rehabilitation were selected. Thus, the study results are limited to the examined vestibular instruments.

Conclusion. Using the ICF as a theoretical framework was found to be useful for comparing the content of health status questionnaires, as well as for exploring the focus of the measures currently in use in vestibular rehabilitation.



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Vestibular deficits have been shown to manifest as a wide range of signs and symptoms, including dizziness, vertigo, and imbalance.¹ Vestibular disorders can result in debilitating physical and psychological consequences that impair an individual's activities of daily living (ADL) and health-related quality of life (HRQOL).¹

Examining functional limitation and disability in people with vestibular disorders is of interest to clinicians, researchers, and patients in order to describe limitations and to direct and monitor the effect of interventions. Therefore, several self-report measures have been developed in an attempt to quantify the potentially limiting effect of vestibular disorders on an individual's functional skills and ADL.²⁻⁵ However, the currently used vestibular questionnaires differ in their purposes and content.⁶ Some questionnaires, such as the Dizziness Handicap Inventory (DHI)⁴ and the UCLA Dizziness Questionnaire (UCLA-DQ)⁵ that examine the impact of dizziness on people's daily life, focus on the impact of a specific vestibular symptom on an individual's HRQOL. Most recently, the Prototype Questionnaire (PQ)⁶ and its refined version, the Vestibular Rehabilitation Benefit Questionnaire (VRBQ),⁷ were developed in an attempt to measure the effect of dizziness on HRQOL from a patient-oriented view. Likewise, the Vertigo Handicap Questionnaire (VHQ) is a symptom-specific questionnaire that

measures the disabling consequences associated with vestibular vertigo.⁵ Other vestibular questionnaires, such as the Activities-specific Balance Confidence (ABC) Scale,⁸ the Vestibular Disorders Activities of Daily Living (VADL) Scale,² and the Activity of Daily Living Questionnaire (ADLQ), are geared more toward ADL assessment.⁹

In order to select the appropriate measure that identifies the patient's specific problems, functional limitations, and disability, psychometric properties (reliability, stability, validity and responsiveness) usually are examined and compared among questionnaires. However, being able to examine and compare the content covered by each questionnaire is an aspect of validity that would provide information allowing clinicians and researchers to judge the appropriateness of the questionnaires to answer specific clinical questions. Therefore, this study focused on the content comparison aspect of the questionnaires used to measure func-

tional limitations in people with vestibular disorders. In order to achieve this comparison, a reference framework and established linking rules were needed to identify and compare the concepts that are contained in the questionnaires.

The *International Classification of Functioning, Disability and Health* (ICF), developed in 2001, offers a universal and standard language and theoretical framework for the description of health and health-related states that can be used for the content comparison process.¹⁰ The ICF adopts a biopsychosocial model in which functioning and disability are viewed as results of a complex interaction among its components: body functions, body structures, activities and participation, environmental factors, and personal factors.¹⁰

One of the main aims of the ICF is to provide a systematic coding scheme for health data.¹⁰ Therefore, the ICF provides a comprehensive list of cat-

The Bottom Line

What do we already know about this topic?

Many self-report instruments have been developed for use in the field of vestibular rehabilitation; however, the content of the measures based on *the International Classification of Functioning, Disability and Health* (ICF) is unknown.

What new information does this study offer?

Linking the self-report instruments to the ICF provides health care professionals and patients with a clear idea of the focus and content of each instrument.

If you're a patient, what might these findings mean for you?

During vestibular rehabilitation, you may be given several tests that ask you to self-report on various aspects of your health. The findings of this study may help you understand what aspects of your health these instruments focus on.



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Content Comparison of Self-Report Measures Used in Vestibular Rehabilitation

Table 1.

Summary of the Psychometric Properties (Reliability and Validity) of 6 of the Examined Questionnaires^a

Psychometrics	DHI	VHQ	ABC Scale	UCLA-DQ	VADL Scale	VRBQ
Internal consistency (α)	Total score=.89 Dimensions=.72-.85	Total score=.93 Dimensions=.75-.82	.96	Not evaluated	Total score=.97 Dimensions=.91-.96	Total score=.73 Dimensions=.74-.92
Test-retest reliability	r =.97 (total score) r =.92-.97 (dimensions)	No significant change	r =.92	Not evaluated	rc =1 (total score) rc =.87-.97 (dimensions)	ICC =.92 (total score) ICC =.94-.99 (dimensions)
Responsiveness	Scores not presented	Scores not presented	Not evaluated	Not evaluated	Not evaluated	Effect size=.035-0.67
Convergent validity	ρ =.53-.72 (DHI vs SF-36)	Not evaluated	r =-.64 (ABC Scale vs DHI) r =.84 (ABC Scale vs FES)	Not evaluated	ρ =.66, P <.001 (VADL Scale vs DHI)	r =.44 (VRBQ vs DHI) r =.45 (VRBQ vs VSS)
Discriminant validity	According to the number of dizziness episodes	Worse VHQ scores when the vertigo episode is recurrent instead of a single episode	Discriminates fallers from nonfallers in the previous year and patients with reduced mobility from patients without reduced mobility	Significant relationship between frequency and severity of dizziness on the other 3 items	Significant difference between patients and controls	r =-.27 to -.33 (VRBQ vs SF-36)

^a DHI=Dizziness Handicap Inventory, VHQ=Vertigo Handicap Questionnaire, FES=Falls Efficacy Scale, VSS=Vertigo Symptom Scale, ABC Scale=Activities-specific Balance Confidence Scale, UCLA-DQ=UCLA Dizziness Questionnaire, VADL Scale=Vestibular Disorders Activities of Daily Living Scale, VRBQ=Vestibular Rehabilitation Benefit Questionnaire, SF-36=Medical Outcomes Study 36-Item Short-Form Health Survey questionnaire, α =Cronbach α coefficient, r =Pearson correlation coefficient, rc =concordance correlation coefficient, ICC = intraclass correlation coefficient, ρ =Spearman correlation coefficient.

egories that can be linked to the meaningful concepts of the questionnaires' items. Rules to link health status measures to the ICF were proposed by Cieza et al in 2002¹¹ and were updated in 2005.¹² The content comparison process and the linking rules have been used in several research reports to link health-related questionnaires to the ICF in order to compare the content of HRQOL, work productivity, and low back pain questionnaires using the ICF as a standardized framework.¹³⁻¹⁵ However, the content of the questionnaires used in vestibular rehabilitation has not been compared.

The purpose of our study was to describe and compare the contents covered by 8 clinical self-report measures that are used in vestibular rehabilitation based on the linkage of their content to the ICF.

Materials and Method

Instruments

Because the aim of our study was to focus on clinical self-report measures used in vestibular rehabilitation, we decided to include the 3 questionnaires currently most widely used in vestibular rehabilitation: the DHI,⁴ the VHQ,⁵ and the ABC Scale.⁸ We also included the ADLQ⁹ and the VADL Scale² because of their focus on the affected ADL that are frequently reported by individuals with vestibular disorders to their clinicians. Additionally, we examined the UCLA-DQ,³ the PQ,⁶ and its refined version, the VRBQ,⁷ because of their focus on examining the HRQOL that is affected in people with vestibular disorders. A total of 164 items were reviewed from the selected instruments. A brief description of the available information of the selected instruments is presented below, including the aim, number of items or dimensions, item generation,

response scale, internal consistency, test-retest reliability, responsiveness, convergent validity, and discriminant validity. Table 1 provides a summary of the psychometric properties of 6 measures: DHI, VHQ, ABC Scale, UCLA-DQ, VADL Scale, and VRBQ. There was no available information about the psychometric properties of the ADL and the PQ to be presented in Table 1.

The DHI is a 25-item questionnaire that quantifies the impact of dizziness on daily life by evaluating the self-perceived handicap in patients with vestibular disorders.⁴ The DHI items were developed from interviews of patients with dizziness.⁴ Content analysis categorized the DHI items into 3 domains: functional, emotional, and physical aspects of dizziness and disequilibrium.⁴ The response scale used in the DHI is "yes/sometimes/no," scored as "4/2/0," respectively. The DHI was found to

have good internal consistency for the total score ($\alpha=.89$) and satisfactory internal consistency for the subscales ($\alpha=.72-.85$).⁴ The test-retest reliability of the DHI was high ($r=.97$).⁴ Additionally, the DHI was found to be responsive to change as an outcome measure in vestibular rehabilitation.¹⁶ There is evidence for discriminant validity based on the good relationships between the DHI scores and the number of episodes of dizziness.¹⁷ The total DHI score and 8 dimensions of the Medical Outcomes Study 36-Item Short-Form Health Survey questionnaire (SF-36) were found to be correlated (Spearman $r=.53-.72$, $P=.001$), demonstrating the convergent validity of the DHI.¹⁷

The VHQ is a 22-item questionnaire that measures the disabling consequences of vertigo on ADL, social life, and leisure.^{5,6,18} The VHQ was derived from in-depth interviews of 84 people with vestibular disorders.⁵ Factor analysis identified 4 dimensions of handicap that accounted for 63% of the variance. The VHQ items are scored using a 5-point scale from 0 (no handicap) to 4 (maximum handicap).⁵ The VHQ was found to have high internal consistency for the total score ($\alpha=.93$) and satisfactory internal consistency for the dimensions' scores ($\alpha=.75-.82$).⁵ The test-retest reliability after 6 months showed that there was no significant change ($P<.05$).⁵ The VHQ scores were found to be responsive in 14 patients who improved after 6 months.⁵ The discriminant validity was examined in patients with episodic vertigo and patients who experienced only a single vertigo episode. Patients with episodic vertigo had worse scores ($P<.03$) than patients with a single vertigo episode.⁵

The ABC Scale was developed to provide a description of activity difficulty and fear of falling in an older

population by expanding the Falls Efficacy Scale (FES).^{8,19} The ABC Scale has 16 items developed through the combined efforts of clinicians and older adults.⁸ The items include activities with various levels of difficulty that range from walking around the house to walking on icy sidewalks.⁸ The ABC Scale scores range from 0% (indicating no confidence) to 100% (indicating complete confidence) in performing a task without any difficulty.⁸ The ABC Scale was found to be internally consistent ($\alpha=.96$) and had good test-retest reliability, and the total score was stable over a 2-week interval ($r=.92$, $P<.001$).⁸ A strong correlation was found between the ABC Scale and the FES ($r=.84$, $P<.001$)⁸ and the DHI ($r=-.64$, $P<.0005$),²⁰ demonstrating convergent validity. Patients who reported a fall during the previous year had lower ABC Scale scores than patients who did not report a fall.⁸ Similarly, the ABC Scale score was able to distinguish among patients with reduced mobility.⁸ In another study, an ABC Scale score of less than 67% was found to indicate high risk for falling in older people.²¹

The UCLA-DQ is a 5-item scale that assesses the frequency and severity of dizziness, as well as the impact of dizziness on ADL and HRQOL.³ A 5-point Likert verbal scale is used for the UCLA-DQ items.³ A significant relationship was found between frequency of dizziness represented by the first item, severity of dizziness represented by the second item, and the other 3 items of the questionnaire ($P<.01$).^{3,18} Internal consistency, test-retest reliability, responsiveness, and convergent validity have not been tested.¹⁸

The ADLQ is a 7-item questionnaire that was developed by Black et al⁹ to be used as an outcome measure in a study that primarily assessed the effect of individualized vestibular

rehabilitation on symptoms, as well as daily activities of patients with peripheral vestibular disorders. The ADLQ scores indicated improvement in patients' status after individualized vestibular rehabilitation for patients with peripheral vestibular disorders.⁹ The reliability and validity of the ADLQ were not examined.

The VADL Scale was developed to assess self-perceived disablement in individuals with vestibular impairment.² The VADL Scale has 28 items that are grouped into 3 subscales: functional (basic self-maintenance tasks), ambulatory (mobility skills), and instrumental (higher-level or more socially complex tasks).² Patients can rate their self-perceived disablement level on a scale that ranges from 1 (independent) to 10 (too difficult, no longer performed).² The VADL Scale had high internal consistency for the total score ($\alpha \geq .97$) and for the dimensions' scores ($\alpha=.91-.96$).² Likewise, the VADL Scale had high test-retest reliability over 2 hours for the total score using the concordance correlation coefficient ($rc=1$) and for the dimensions' scores ($rc=.87-.97$).² In addition, the VADL Scale demonstrated good face validity as determined by a group of experts.² The VADL Scale scores were able to significantly discriminate between patients and controls ($P<.0001$).²² However, the VADL Scale did not distinguish patients with benign paroxysmal positional vertigo from patients with vestibulopathy.²² Convergent validity was demonstrated by the moderate correlation between the VADL Scale total score and the DHI total score (Spearman $\rho=.66$, $P<.001$).²² Responsiveness of the VADL Scale was not evaluated.

The PQ was developed in an attempt to measure the effect of dizziness on HRQOL from a patient-oriented view.⁶ The process of developing the items included collecting data

through interviews of 18 individuals with vestibular disorders, who were receiving vestibular rehabilitation, then analyzing the data. The data analysis of patients' interviews revealed 64 themes of HRQOL impact. Afterward, 35 items were selected as potential questionnaire items.⁶ The 35 potential items then were refined and validated for the development of the VRBQ.⁷

The VRBQ was developed as a refined version of the PQ. It comprises 22 items that are categorized into 3 groups: dizziness and anxiety (6 items), motion-provoked dizziness (5 items), and HRQOL (11 items).⁷ Each group of items has its own response scale; however, all scales consist of 7-point verbal scales.⁷ The internal consistency of the VRBQ was good for the total score ($\alpha=.73$) and good to excellent for the dimensions' scores ($\alpha=.74-.92$).⁷ The test-retest reliability over 24 hours revealed strong intraclass correlation coefficients (ICCs) for the VRBQ total score (ICC=.92) and the dimensions' scores (ICC=.94-.99).⁷ The responsiveness was investigated over 12 weeks of a vestibular rehabilitation program and found to have a moderate effect size (0.35-0.67) for the VRBQ, a small to moderate effect for the DHI and VSS, and a small effect for the SF-36.⁷ The convergent and discriminant validity of the VRBQ were measured by comparing it with the DHI, the Vertigo Symptom Scale (VSS), and the SF-36.⁷ The VRBQ total score was moderately correlated to the DHI total score ($r=.44$) and the VSS total score ($r=.45$), whereas the VRBQ total score was weakly correlated to the SF-36 mental and physical subscale scores ($r=-.27$ and $r=-.33$, respectively).⁷

The ICF consists of 2 parts, which are further subdivided into 2 components each.¹⁰ The first part deals with functioning and disability and

has 2 components: (1) body functions and structures and (2) activities and participation. The second part involves contextual factors that include environmental and personal factors. The coding system of the ICF follows a pattern in which all categories start with a letter (b, s, d, or e) denoting one of the ICF components—body functions (b), body structures (s), activities and participation (d), and environmental factors (e)—followed by a numeric code that starts with the chapter number or first ICF level (one digit) followed by the second ICF level (2 digits) and sometimes followed by the third and fourth ICF levels (one digit each).¹⁰ The following category in the second chapter of “body functions” provides an example of the levels of the coding system of the ICF:

b2: Sensory functions and pain (first level)

b240: Sensations associated with hearing and vestibular function (second level)

b2401: Dizziness (third level)

Procedure

Linkage of items to the ICF. The linking process was conducted in 2 stages by 2 trained health care professionals on the basis of the ICF classification¹⁰ and established linking rules.¹² In the first stage, each rater identified the meaningful concepts in each questionnaire item independently, including examples and response options. More than one meaningful concept may be identified from each item. For instance, item number 8 in the VRBQ (“lying down and/or turning over in bed makes me feel dizzy”) has 3 meaningful concepts: lying down (d410), turning over in bed (d410), and dizziness (b240). After determining the meaningful concepts for each item, the meaningful concepts were com-

pared between the 2 raters, a consensus among the meaningful concepts was discussed, and one list of meaningful concepts was used in the second stage of the linking process.

In the second stage, each meaningful concept was linked to an ICF category by identifying the most appropriate component, chapter number (first level), and second level of the category that most precisely described the meaning of the concept. At this point, the ICF codes for each rater were presented for the interobserver rating agreement calculation. The ICF categories selected by the 2 raters then were compared, and a consensus among the ICF codes was discussed. In case of disagreement between the 2 raters, a third expert in the ICF coding and the linking rules was consulted and made the final decision. A list of disagreed-upon concepts was provided to the third rater with the ICF codes selected by the first and second raters. The third rater selected one of the health care professional's ICF codes and provided the rationale for her choice.

Measuring the interobserver rating agreement. The interrater agreement between the health professionals regarding the component and first and second ICF levels was computed using Cohen kappa statistics. The Cohen kappa is a measure of agreement between 2 raters corrected for chance and ranges from 0 (no agreement) to 1 (perfect agreement).^{23,24} A kappa value of ≥ 0.75 indicates excellent agreement, a value of 0.4 to 0.74 indicates good agreement, and a value of < 0.4 indicates poor agreement.

Categories at the component and first and second ICF levels were converted to consecutive ordinal codes to allow for evaluation of agreement where no ICF association could be identified. The number of total ordi-

Table 2.

Number of Items, Meaningful Concepts Identified, Concepts Not Linked to the *International Classification of Functioning, Disability and Health* (ICF), and Concepts Referred to the ICF Components in the Questionnaires Used in Vestibular Rehabilitation^a

Factor	DHI	VHQ	ABC Scale	UCLA-DQ	ADLQ	VADL Scale	PQ	VRBQ
Total number of items	25	26	16	5	7	28	35	22
Total number of ICF concepts identified	42	50	23	18	9	41	79	50
Concepts not linked to the ICF	4	1	0	1	0	2	24	10
Body functions concepts	9	26	3	7	1	1	34	30
Activities and participation concepts	29	23	20	10	8	38	19	10
Environmental factors concepts	0	0	0	0	0	0	2	0

^a DHI=Dizziness Handicap Inventory, VHQ=Vertigo Handicap Questionnaire, ABC Scale=Activities-specific Balance Confidence Scale, UCLA-DQ=UCLA Dizziness Questionnaire, ADLQ=Activities of Daily Living Questionnaire, VADL Scale=Vestibular Disorders Activities of Daily Living Scale, PQ=Prototype Questionnaire, VRBQ=Vestibular Rehabilitation Benefit Questionnaire.

nal categories was 5 at the component level, 11 at the first ICF level, and 19 at the second ICF level.

There was no attempt to make inferences from the agreement beyond the 2 experts studied. Therefore, the precision of the agreement estimates (kappa 95% confidence intervals) was not reported. We used SPSS, version 16.0,* and Microsoft Excel 2008 for Macintosh, version 12.1.0,† for the statistical analysis of the Cohen kappa values.

Overall representation of each measure. The representation of each examined measure was clarified by calculating the percentages of concepts that are related to each ICF component (body functions, activities and participation, and environmental factors) and of concepts that did not map to the ICF to the total number of concepts identified. Clarifying the representation of each measure was the goal of our study. Knowledge of the ICF concepts included in commonly used vestibular measures may provide clinicians with an overview of what components are included in each measure.

* SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

† Microsoft Corporation, One Microsoft Way, Redmond, WA 98052-6399.

Results

Disagreement between the first and second raters occurred in 5 concepts: 1 from the DHI, 1 from the ABC Scale, and 3 from the PQ. The 5 concepts, along with the first and second health care professionals' chosen ICF codes, were presented and reviewed by the third rater. The third rater agreed with the first rater's chosen ICF code in 1 concept and with the second rater's chosen ICF codes in the other 4 concepts. The recommended codes by the third rater then were considered in the agreed-on list.

A total of 312 meaningful concepts from the 164 items of the 8 vestibular questionnaires were identified and linked to the ICF. The meaningful concepts identified were linked to 51 different ICF categories: 19 categories related to "body functions," 30 categories related to "activities and participation," and 2 categories related to "environmental factors." No concepts belonging to the "body structures" categories were linked. Table 2 shows the number of items, meaningful concepts, concepts not linked to the ICF, and concepts referred to the ICF components in the questionnaires used in vestibular rehabilitation. Forty-two out of 312 concepts (13%) could not be linked

to any of the ICF components (Tab. 3).

The kappa coefficients between the 2 raters at the component and first and second ICF levels indicated excellent interobserver agreement across the component and first and second levels of the ICF. The kappa coefficients were 0.83 at the component level, 0.87 at the chapter or first ICF level, and 0.96 at the second ICF level. Higher agreement was seen at the first (0.87) and second (0.96) ICF levels over the component level (0.83) due to the high frequency of test concepts where no codes could be identified.

The 51 ICF categories were mainly related to the "body functions" and "activities and participation" components of the ICF. Tables 4 and 5 represent the content comparison of the vestibular instruments using the ICF categories as a reference. The numbers in Tables 4 and 5 indicate how often each ICF category was addressed in the examined vestibular instruments.

Representation of Body Functions

"Sensations associated with hearing and vestibular function" and "emotional functions" were covered by

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Table 3.

All of the Concepts That Did Not Map to the *International Classification of Functioning, Disability and Health (ICF)*^a

Measures	Items	Assigned Codes
DHI	Does <i>looking up</i> increase your problem?	nd-ph
	Does <i>performing more ambitious activities</i> (eg, sports, dancing, household chores such as sweeping or putting dishes) away increase your problem?	nd-gh
	Do <i>quick movements of your head</i> increase your problem?	nd-ph
	Because of your problem, do you <i>avoid heights</i> ?	nc
UCLA-DQ	What impact does my condition have on the overall <i>quality of life</i> ? Examples: participating in social activities, sharing intimate relationships, making plans for the future, obtaining or maintaining work, and participating in leisure activities.	nd-qol
VADL Scale	<i>Moving in or out of the bathtub or shower.</i>	nd-ph nd-ph
PQ	I am so anxious about the dizziness that I feel one or more of: heart pounding or fluttering, hot or cold sweats, tingling or numbness, difficulty breathing, <i>faintness</i> .	hc
	<i>Looking up at the sky</i> makes me feel dizzy.	nd-ph
	<i>Moving my head from side to side</i> makes me feel dizzy.	nd-ph
	I have difficulty in one (or more) of these situations: open spaces (eg, crossing a wide road), <i>patterned floors</i> (eg, tiled shopping center), flashing lights or screens (eg, cinema), supermarket aisle.	nc nc
	I restrict my <i>head and body movement</i> .	nd-ph
	I have to find <i>special ways of doing things</i> .	nd
	<i>I prefer to have someone with me when I go out.</i>	nd
	I have <i>difficulty doing things</i> in my home or garden.	nd
	<i>I think there may be something seriously wrong with me.</i>	nd
	I need to <i>hold on to something for support</i> .	nc
	<i>I have restricted my participation in physical activities.</i>	nd-ph
	I need to be careful and/or <i>take things slowly</i> .	nd
	I am worried about hurting myself (falling over, <i>bumping into things</i> , crossing the road, driving).	nc
	<i>I prefer to stay in or near home.</i>	nc
	The dizziness is <i>affecting my independence</i> .	pf
	I prefer not to go to noisy and/or <i>crowded places</i> .	nc
	The dizziness is affecting my <i>quality of life</i> .	nd-qol
	I avoid some <i>activities, positions, or situations</i> .	nd-gh nd nd
	<i>I prefer not to be alone.</i>	nd
	<i>My balance feels worse in the dark or when my eyes are closed.</i>	nd-ph nd-ph
VRBQ	<i>Looking up at the sky</i> makes me feel dizzy.	nd-ph
	<i>Moving my head slowly from side to side</i> makes me feel dizzy.	nd-ph
	<i>Moving my head quickly from side to side</i> makes me feel dizzy.	nd-ph
	Compared with before the dizziness, <i>I feel comfortable going out alone.</i>	pf
	Compared with before the dizziness, <i>I need to hold on to something for support.</i>	nc
	Compared with before the dizziness, <i>I think my quality of life is good.</i>	nd-qol
	Compared with before the dizziness, I avoid some <i>activities, positions, or situations</i> .	nd-gh nd nd
	Compared with before the dizziness, <i>I feel stable in the dark or when my eyes are closed.</i>	nd-ph nd-ph

^a DHI=Dizziness Handicap Inventory, UCLA-DQ=UCLA Dizziness Questionnaire, VADL Scale=Vestibular Disorders Activities of Daily Living Scale, PQ=Prototype Questionnaire, VRBQ=Vestibular Rehabilitation Benefit Questionnaire, nc=not covered, nd=not definable, nd-gh=not definable-general health, nd-ph=not definable-physical health, nd-qol=not definable-quality of life, hc=health condition, pf=personal factors. The words in italics represent the concepts that did not map to the ICF.

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Table 4.

Frequencies Showing How Often “Body Functions” Categories Are Addressed in the Measures Linked to the *International Classification of Functioning, Disability and Health* (ICF)^a

ICF Category		DHI	VHQ	ABC Scale	UCLA-DQ	ADLQ	VADL Scale	PQ	VRBQ
b117	Intellectual functions		2						
b126	Temperament and personality functions		1	1				1	1
b140	Attention functions	1						1	
b144	Memory functions							1	1
b152	Emotional functions	7	8		1			4	1
b160	Thought functions							1	1
b164	Higher-level cognitive functions		1		1				
b215	Functions of structures adjoining the eye							1	
b230	Hearing functions				1				
b235	Vestibular functions			1				2	
b240	Sensations associated with hearing and vestibular function	1	13	1	4			16	20
b270	Sensory functions							1	
b280	Sensation of pain							1	
b410	Heart functions							1	1
b440	Respiration functions							1	2
b455	Exercise tolerance functions					1		1	
b640	Sexual functions						1		
b760	Control of voluntary movement functions		1						
b840	Sensation related to the skin							2	3

^a DHI=Dizziness Handicap Inventory, VHQ=Vertigo Handicap Questionnaire, ABC Scale=Activities-specific Balance Confidence Scale, UCLA-DQ=UCLA Dizziness Questionnaire, ADLQ=Activities of Daily Living Questionnaire, VADL Scale=Vestibular Disorders Activities of Daily Living Scale, PQ=Prototype Questionnaire, VRBQ=Vestibular Rehabilitation Benefit Questionnaire.

most of the examined questionnaires (Tab. 4). Dizziness, vertigo, spinning, and unsteadiness were the sensations associated with hearing and vestibular function covered mainly by the VRBQ (20 concepts), the PQ (16 concepts), and the VHQ (13 concepts). “Emotional functions” were covered mainly within the VHQ (8 concepts), the DHI (7 concepts), and the PQ (4 concepts). Feeling frustrated, afraid, embarrassed, depressed, anxious, worried, and happy were all linked to “emotional functions” because there is no separate category for different feelings in the ICF.

Representation of Activities and Participation

All 8 instruments include concepts that refer to the “mobility” chapter from the ICF, with different emphases (Tab. 5). “Walking” and “changing basic body position” categories from the “mobility” chapter are included most frequently by 6 out of 8 instruments (75%). All measures except the VRBQ include specific categories of the “domestic life” chapter, including mainly “doing housework” (63%) and “acquisition of goods and services (shopping)” (50%). All instruments except the ABC Scale and the VRBQ include the

“remunerative employment” category (75%) from the “major life areas” chapter. A considerable number of concepts in all instruments except the ABC Scale and the ADLQ refer to the “recreation and leisure” category (75%) from the “community, social, and civic life” chapter. Concepts that refer to the “self-care” chapter are covered mainly by the VADL Scale (5 concepts), the PQ (4 concepts), and the VRBQ (4 concepts). Categories from the first 2 chapters (“learning and applying knowledge” and “general tasks and demands”) plus the “interpersonal interactions and relationships” chap-

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Table 5.

Frequencies Showing How Often “Activities and Participation” Categories Are Addressed in the Measures Linked to the *International Classification of Functioning, Disability and Health (ICF)*^a

ICF Category		DHI	VHQ	ABC Scale	UCLA-DQ	ADLQ	VADL Scale	PQ	VRBQ
d163	Thinking		1						1
d166	Reading	1							
d230	Carrying out daily routine		2						
d240	Handling stress	1							
d410	Changing basic body position	4	2	3			3	3	3
d430	Lifting and carrying objects						1		
d440	Fine hand use			1					
d445	Hand and arm use			3			2		
d450	Walking	4	1	8		1	6	6	
d455	Moving around		1	2			2		
d460	Moving around in different locations		1						
d465	Moving around using equipment			2			2		
d470	Using transportation	1				1	1		
d475	Driving				1	1	1	1	
d5	Self-care				1			1	1
d510	Washing oneself						1	1	1
d520	Caring for body parts							1	1
d540	Dressing						4	1	1
d620	Acquisition of goods and services	1	1		1	2			
d630	Preparing meals						1		
d640	Doing housework	5	1	1		1	7		
d650	Caring for household objects	1	2			1		1	
d660	Assisting others				1		1		
d750	Informal social relationships	1	1						
d760	Family relationships	1	2						
d770	Intimate relationships				1				
d820	School education						1		
d845	Acquiring, keeping, and terminating a job				1				
d850	Remunerative employment	1	1		2	1	2	1	
d920	Recreation and leisure	8	7		2		3	3	2

^a DHI=Dizziness Handicap Inventory, VHQ=Vertigo Handicap Questionnaire, ABC Scale=Activities-specific Balance Confidence Scale, UCLA-DQ=UCLA Dizziness Questionnaire, ADLQ=Activities of Daily Living Questionnaire, VADL Scale=Vestibular Disorders Activities of Daily Living Scale, PQ=Prototype Questionnaire, VRBQ=Vestibular Rehabilitation Benefit Questionnaire.

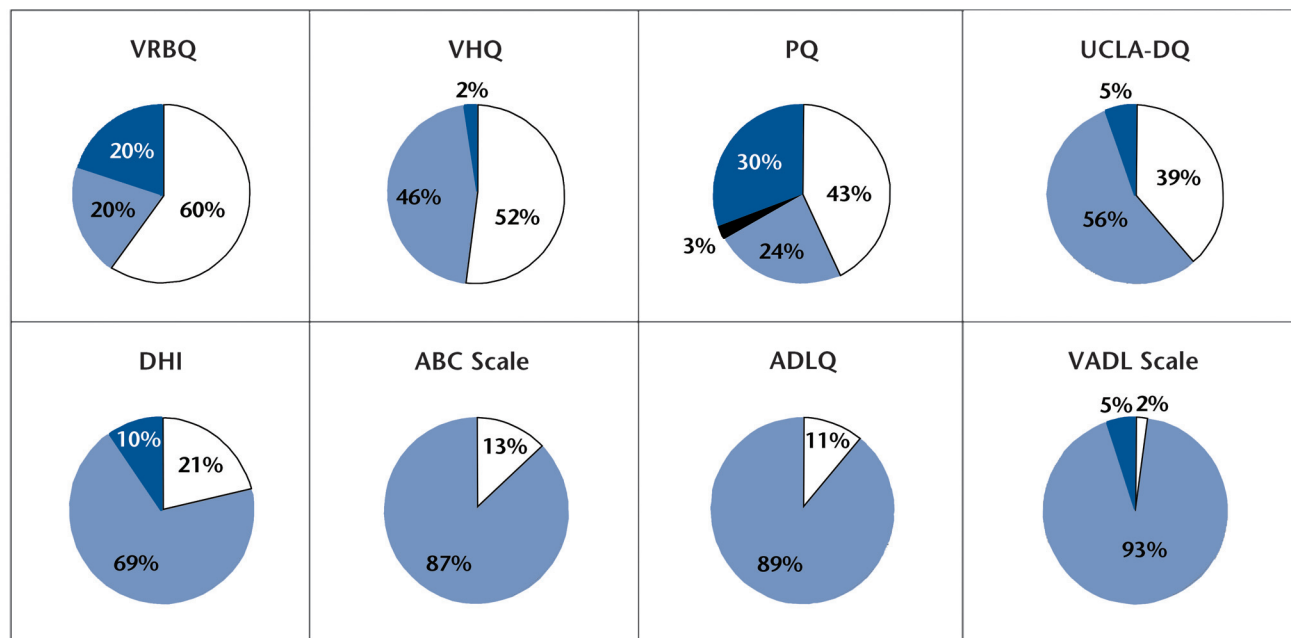
ter are covered mainly by the DHI and VHQ. No concepts referring to the third chapter (“communication”) were found in any of the examined instruments.

Representation of Environmental Factors

The PQ is the only measure that addresses some environmental factors. “Having difficulty with flashing lights” and “avoiding noisy places” were the 2 concepts in the PQ that

referred to the environmental factors. “Having difficulty with flashing lights” was linked to e240 (light), and “avoiding noisy places” was linked to e250 (sound).

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(White) Percentage=Number of “body functions” concepts/Total number of concepts identified.
 (Light blue) Percentage=Number of “activities and participation” concepts/Total number of concepts identified.
 (Black) Percentage=Number of “environmental factors” concepts/Total number of concepts identified.
 (Dark blue) Percentage=Number of concepts that did not map to the ICF/Total number of concepts identified.

Figure.

Percentages of concepts related to the “body functions,” “activities and participation,” and “environmental factors” components of the *International Classification of Functioning, Disability and Health* (ICF) and percentages of concepts that did not map to the ICF in each of the examined instruments. VRBQ=Vestibular Rehabilitation Benefit Questionnaire, VHQ=Vertigo Handicap Questionnaire, PQ=Prototype Questionnaire, UCLA-DQ=UCLA Dizziness Questionnaire, DHI=Dizziness Handicap Inventory, ABC Scale=Activities-specific Balance Confidence Scale, ADLQ=Activities of Daily Living Questionnaire, VADL Scale=Vestibular Disorders Activities of Daily Living Scale.

Representation of Concepts That Did Not Map to the ICF

Forty-two concepts from 5 questionnaires (UCLA-DQ, VADL Scale, DHI, VRBQ, and PQ) could not be linked to any of the ICF components. The UCLA-DQ had only 1 concept that did not map to the ICF, and it is about overall HRQOL. The VADL Scale had 2 concepts that did not map to the ICF within one item “Moving *in* or *out* of the bathtub or shower.” The DHI had 4 concepts that did not map to the ICF: 2 of them related to head movements, 1 about ambitious activities, and 1 about avoiding heights. The VRBQ had 11 concepts that did not map to the ICF: 3 of them related to head movements; 3 about avoiding certain activities, positions, or situations

within one item; 2 about feeling stable in the dark or when eyes are closed within one item; 1 about going out alone; 1 about holding on to something for support; and 1 about HRQOL. The PQ had 24 concepts that did not map to the ICF (Tab. 3). Table 3 presents all of the concepts that did not map to any of the ICF categories and the codes that were assigned to them according to the rules recommended by Cieza et al.¹³

Overall Summary of Components Representation in the Vestibular Measures

The VADL Scale, ADLQ, ABC Scale, DHI, and UCLA-DQ mainly focus on examining the “activities and participation” component of the ICF (Figure). The focus of the VRBQ,

VHQ, and PQ is more on the “body functions” component of the ICF (Figure).

Discussion

Using the ICF as a theoretical framework was found to be useful for comparing the content of health status questionnaires and for exploring the focus of the measures currently in use in vestibular rehabilitation. Based on the linkages, the 8 vestibular questionnaires were found to be comparable, with their focus on the “body functions” and “activities and participation” components of the ICF.

Clinicians and researchers need to take multiple factors into consideration when selecting the appropriate

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instrument to use,¹³ including the construct to be examined and the population of interest. By determining the construct and the population of interest, a number of instruments may be useful to the clinician. By understanding the content covered by the different measures, clinicians can make an informed choice of the most appropriate instrument.

The comparison of examined instruments based on the ICF revealed that “body functions” and “activities and participation” are the main components covered by the 8 instruments currently in use in vestibular rehabilitation. All examined measures have mixed concepts of body functions, activities and participation, and environmental factors, with different percentages within each instrument.

In the “body functions” component, “sensations associated with hearing and vestibular function” and “emotional functions” categories are frequently addressed by most of the examined instruments (75% each). These 2 categories refer to 2 important features in people with vestibular disorders: (1) the sensation of dizziness, vertigo, or imbalance that this population experiences and (2) the emotional problems that may be attributed to this sensation, such as feeling frustrated, afraid, depressed, worried, or anxious.

In the “activities and participation” area, all of the component’s chapters are covered by the examined questionnaires, with the exception of the “communication” chapter. Vestibular disorders usually do not affect communication skills. Some “activities and participation” chapters, however, are addressed heavily by most of the examined measures, including chapters related to mobility, domestic life, and community, social, and civic life.

The distinction between activities and participation concepts is one of the main controversial issues in the ICF.^{25,26} The ICF classified activities and participation as one component but gave each one of them different definitions and qualifiers, which has increased the ambiguity among the ICF users. Although the ICF provided 4 ways to distinguish between activities and participation, these rules are general and difficult to administer. Moreover, blending the activities and participation concepts was recommended by several studies.²⁷⁻³¹ Therefore, categorizing the activities and participation concepts identified from the examined instruments into separate “activities” and “participation” codes was outside of the scope of this study.

Environmental factors are infrequently addressed by the 8 examined instruments. Only 2 categories related to “light” and “sound” are included in the PQ, even though environmental factors have a potential effect on individuals with vestibular disorders.³²

The linkage also revealed that none of the examined instruments is specialized in one component of the ICF. Therefore, specialized instruments that quantify a single component and answer a specific question are needed. A specialized activities and participation instrument that quantifies the activity limitations and participation restrictions in people with vestibular disorders is needed because of the great effect of vestibular disorders on individuals’ activities and participation.¹ A specialized instrument that quantifies the environmental factors that are problematic for people with vestibular disorders also might be helpful.

The linking process conducted in this study was very helpful in discovering the focus of each questionnaire. Five of the examined questionnaires

(VADL Scale, ADLQ, ABC Scale, DHI, and UCLA-DQ) provide clinicians and researchers with information that is more related to the level of activity limitations and participation restrictions, with different emphases (Figure). The remainder of the examined instruments (VRBQ, VHQ, and PQ) provide clinicians and researchers with information that is more related to functional impairment (Figure). Having insight into the content covered by the questionnaires would help clinicians not only decide the appropriate measure to use but also correctly interpret the results and consequently design the intervention to address the person’s limitations. The results presented in the Figure could help clinicians to reduce redundant measures that provide the same information, thus improving efficiency for both themselves and the patient.

Excellent agreement was displayed by the health care professionals at the component and first and second ICF levels according to the kappa statistics. Factors affecting the psychometric properties of the ICF classifications in relation to existing HRQOL measures for people with vestibular disorders should be further studied.

Most of the meaningful concepts contained in the questionnaires’ items that could not be linked to any of the ICF categories were related to moving the head to look up or down as well as to questions about agoraphobia (a fear of leaving the home) (Tab. 3). Moving the head is a normal activity that individuals perform while looking to the sky, looking down to find something on the ground, or looking over the shoulder while driving to see traffic. These head movements often cause dizziness in people with vestibular disorders; consequently, they stabilize their head in

fear of triggering dizziness. The unlinked concepts above, such as “moving the head into different directions,” are important concepts that are not addressed in the ICF and might be added to a future revision of the ICF.

Study Limitations

Our method of selecting vestibular measures was not based on a systematic search; instead, we selected the most widely used measures in vestibular rehabilitation, as well as those that examine the affected ADL and HRQOL in people with vestibular disorders. Therefore, our review may not include all pertinent measures. Thus, the study results are limited to the examined vestibular instruments.

Conclusion

The 8 vestibular outcome measures studied consisted primarily of “body functions” and “activities and participation” items. Two experts demonstrated excellent agreement in rating the 8 vestibular outcome questionnaires. Clinicians reviewing the questionnaires may have a better idea of which concepts included in the ICF are part of each instrument.

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