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Different outcome measures and domains of functioning: 18 months follow-up of persons with dizziness

Abstract

Aims: To explore changes in different outcome measures in a follow-up of persons with dizziness, and to investigate if these changes indicate different domains of functioning.

Methodology: Sixty-eight persons with dizziness, mean age of 47 years, were included in an 18-months follow-up. Outcome measures used: the Vertigo Symptom Scale, Patient Specific Functional Scale, Disability Scale, Dizziness Handicap Inventory, and tests of Dynamic Visual Acuity, Single Leg Stance, and Walking Speeds.

Major findings: We found significant improvements in impairments indicated by outcome measures of dizziness and visual acuity, and in activity and participation indicated by outcome measures of standing balance, patient specific activities, disability, and quality of life. Similar patterns of change were also found in subgroup analyses, except in gender. Correlations between change-scores ranged r = 0 - 0.6. Significant correlations were found between change scores indicating body function and activity/participation ($0.3 \leq r \geq 5$). We found no correlations between self-report measures and tests.

Conclusion: Comprehensive use of outcome measures addressing body function, activity and participation appear to provide information of changes in different domains of functioning. To enable broad and meaningful follow-up of patients with long lasting dizziness, generic and condition specific measures, self-reports and tests in different domains of functioning could be further explored.

Key words: Vertigo Symptom Scale, Patient Specific Functional Scale, Disability Scale, Dizziness Handicap Inventory, Dynamic visual acuity

Background

The prevalence of dizziness in general populations mostly range between 16 and 30%, dependent on definitions and methods used (1-4). Dizziness is associated with other symptoms, conditions, diseases and use of medicines (3-5), and the prevalence increases with the number of other symptoms and conditions, as well as number of medicines used (3, 6). Dizziness often leads to impaired functional ability and quality of life (1, 7), and accounts for a considerable use of health services (1). Occupational difficulties are experienced by many (7, 8). Dizziness as such is a rare diagnosis of certified absence from work, while absence of eight weeks or more due to this symptom, is found to result in disability pension in about 25% after 5 years (9).

Studies indicate that about 20% to 70% of patients have persisting dizziness at 12 months follow-up or more (6, 8, 10, 11). Different patient groups, settings, length of observations, and follow-up measures could explain the broad range. Predictors of persistent dizziness are higher age; female gender; the origin of dizziness being vestibular neuronitis and vestibular migraine; inactivity and avoidance of situations that provoke dizziness; physical and mental co-morbidity; low self-rated health, and long duration of symptoms at the time of inclusion (8, 10-14).

The World Health Organization (WHO) presented the International Classification of Functioning, Disability, and Health (ICF) in 2001 (15) The theoretical model is neutral when it comes to causal relations between different domains of functioning. The health domains of the ICF comprise body structure and function (versus impairments), activity (versus limitations) and participation (versus restriction). Personal and environmental factors may have positive or negative effect on the health domains. WHO promoted the

use of outcome measures that address the different health domains and the use of subjective and objective measures (15). Associations between scores in measures of body function and structure, activity and participation are generally found to vary between correlations of 0.2 and 0.5 (16). These findings indicate that result from measures in one domain of functioning provides little information about other domains of functioning (16). Based on this, one might assume that patients with persisting symptoms and impairments still might improve in activity and participation.

In 2000, experts (17) in patients with dizziness suggested relevant assessments and outcome measures to these patients. In addition to insight in the history of dizziness and personal and environmental factors, clinical tests and self-reports comprised symptoms of dizziness, oculomotor and vestibular-ocular symptoms, proprioception, musculoskeletal status, balance and ambulation, disability, health status, and quality of life (17). The suggestions appeared to address body function/impairments, activity/ limitations, and participation/restrictions, as well as personal and environmental factors, in line with the theoretical framework of ICF (15).

In follow-ups ≥ 12 months in patients with dizziness, only a few studies report changes in different domains of functioning (8, 18, 19). Likewise, reports from follow-ups ≥ 12 months after vestibular rehabilitation comprise either self-reports or tests. Self-reported results include symptoms of dizziness and disability (20, 21), self-perceived handicap (22), and quality of life (23). Reports from tests include vestibular testing and/or tests of balance/gait (24-26). Application of outcome measures that address different domains of functioning as body structure and function, activity and participation, might provide broader indications of long term changes of functioning in persons with dizziness.

The aim of this study is to explore changes in different outcome measures in a long term follow-up of persons with dizziness, and to investigate if these changes indicate different domains of functioning.

Methods

Study sample

Persons from the region of Oslo and Akershus were recruited between September 2003 and December 2004 from general practice, medical specialist, and the National Insurance Administration (NIA). Inclusion criteria were patients with dizziness, age range 20-65 years, and ability to read and understand Norwegian. Exclusion criteria were individuals with recent cardio-vascular disease, neurological or other severe system diseases, and/or not being able to go through physical tests. Of the 96 included, 63 were recruited from NIA, 24 from medical specialist, and 6 from general practitioners. Three persons did not reply to the question of recruitment. Twenty-eight persons were lost to follow-up at 18 months, giving a final sample of 68 participants. Flowchart of participants and reasons for withdrawals is shown in Figure 1. Differences between participants and withdrawals at initial testing did not reach statistical significance as concerns characteristics, and average scores in questionnaires and tests.

All participants confirmed self-perceived dizziness and/or instability in the course of the last 14 days according to Numeric Rating Scales. Description of participants is shown in Table 1. About 2/3 were women, and the average age was 46.7 years. Time since onset of symptoms had a median of about 1 ¾ years, and all participants had dizziness that had lasted ≥ 4 months. Twenty-one persons (31%) were on varying percentage of sick leave at inclusion. Sick-leave/social security benefit due to dizziness in the total group,

had a median duration of six months (Table 1). The origin of dizziness was gathered from written medical information and self-reports, both presented by participants at initial evaluation. The information on origins of dizziness was categorized as vestibular, n = 44 (65%), non-vestibular, n = 15 (22%), and unknown, n = 9 (13%) (Table 2).

Procedure

The participants received self-administered questionnaires to be returned by mail prior to an appointment for interview and testing. Follow-ups were administered at 6, and 18 months, using the same procedure. Here, only results from 18 months follow-up are presented. The participants were informed about follow-up assessments, given information about results from outcome measures, and suggestions concerning physical activities. The same physiotherapist (the first author) interviewed and tested all participants.

Twenty-nine persons (43%) followed a 10 week group intervention program at the Outpatient Department at the Physiotherapy Program, Oslo University College. The second author carried out the group intervention. The other 39 participants followed treatment as usual, which included persons who continued ongoing treatment elsewhere uncontrolled by us, or got no specific treatment. The effect of intervention was not the focus of the present study.

Outcome measures

Inspired by the theoretical framework of the ICF, we chose different outcome measures assumed to address the domains of body function, activity and participation. Classification of the functional problems experienced by persons with dizziness

according to the ICF, had not been established. The following generic and condition specific measures were applied:

Numeric Rating Scale (0-10 points) (27) on perceived symptoms of dizziness and instability were used only at inclusion, where 0 indicated no dizziness/instability and 10 indicated the worse possible dizziness/instability perceived in the course of the last 14 days.

The *Vertigo Symptom Scale – Short Form* is a self-report questionnaire assessing perceived severity of symptoms during the last month (28). It includes 15 items in two subscales named "vertigo/balance" (8 items) and "autonomic/ anxiety" (7 items) (28). Five ordinal response categories range from "never" (score 0) to "very often (most days)" (score 4), with a total score ranging from 0 to 60 points (28). The Norwegian version has satisfactory measurement properties (29). The smallest detectable change (SDC) at group and individual level are ≥ 1.47 points (SDC_{group}), and ≥ 7.8 points (SDC_{ind}) (29). Cut-off values of "severe dizziness" is defined as ≥ 12 points (30). The Vertigo Symptom Scale was assumed to indicate body function/impairment according to the ICF chapters Mental functions (b1), Sensory functions (b2), and Neuromusculoskeletal and movement related functions (b7) (31).

The *Patient Specific Functional Scale* (32) is a generic scale of subjective functional limitations. The patient is asked to list up to 5 important activities that she/he has difficulties with, or is unable to perform because of her/his condition/problem, and rates the degree of problems with each activity on an 11-point scale: 0 (cannot perform) to 10 (can perform as before injury/ disease/ illness). At follow-up, the patient is asked to

score the current level of difficulty associated with each of the activities (32). An average score is estimated from the three first activities. Acceptable validity, test-retest reliability and responsiveness to change have been reported in patients with different dysfunction, but not in persons with dizziness (16). The smallest detectable change is 2 points in the average score and 3 points in a singular activity (90% CI) (16, 32). The condition was defined as "dizziness" in the present study, and the person was informed about his/her initial score in each activity. The Patient Specific Functional Scale was assumed to enable the participants to report components of activity/limitations and participation/restrictions according to the ICF chapter d (31).

The *Disability Scale* assesses functional ability in connection with dizziness (33), with one question: "Please mark the one statement that best describes your present situation". Six ordinal response categories range 'No disability; negligible symptoms' (score 0) to 'Long-term severe disability; unable to work for over 1 year or established permanent disability with compensation payment' (score 5) (33). Reliability of the scale has been demonstrated in patients with peripheral vestibular disorders, and a change of only one category indicates a significant change in disability (34). The Disability Scale was assumed to indicate components of participation/restrictions according to ICF categories in Domestic life (d6) and Major life areas (d8) (31).

The condition specific *Dizziness Handicap Inventory* assesses the impact of dizziness on physical, functional and emotional domains, interpreted as indications of quality of life and functional ability (35). A total score (0-100) is obtained by summing ordinal scale responses to 25 questions (Yes = 4, Sometimes = 2, No = 0) (35). The Norwegian version has satisfactory measurement properties of the total scale (36). Cut-off point for

'disability' versus 'no disability' is 29 points. The smallest detectable change (SDC) at group and individual level are ≥ 4 points (SDC_{group}), and ≥ 20 points (SDC_{ind}) (36). Minimally important change (MIC) in the inventory is found to be ≥ 11 points (36), and indicates the ability of an instrument to detect clinically important change, a real change in the concept being measured (37). The Dizziness Handicap Inventory was assumed to indicate components in body function/impairment, as well as activity/limitations and participation/restrictions according to the ICF chapters in Mental functions (b1), Mobility (d4), Domestic life (d6), Major life areas (d8), Community, social and civic life (d9) (31).

The *Dynamic Visual Acuity Test* measures the degradation of visual acuity that occurs with head movement, indicating the ability to see clearly during head movement (38). In patients with uncompensated, unilateral vestibular loss, dynamic visual acuity is known to degrade by three or four lines (39). An average improvement of more than 2 lines is reported following vestibular rehabilitation (40). We applied a clinical test, since the more reliable computerized equipment was not accessible at our clinic. The number of lines between the patient's performance with head still and head rotated were recorded, and the person's status was dichotomized into ≤ 3 lines versus ≥ 4 lines of difference. Dynamic Visual Acuity is assumed to indicate body function/impairment according to the ICF category b215 (31).

Single Leg Stance is a measure of standing balance (38). The average of two trials in each test was used, unless the participant reached 30 seconds in the first trial. In this study group the smallest detectable changes at group and individual levels were 1.45 seconds (SDC_{group}) and 12.53 seconds (SDC_{ind}) in the right leg, and 1.65 seconds

(SDC$_{group}$) and 14.04 (SDC$_{ind}$) in the left leg. The Single Leg Stance-eyes closed was assumed to indicate activity/limitation according to the ICF category Mobility d415 (31).

Walking speed is commonly used as a measure of functional balance (16, 38). Preferred walking speed has acceptable reliability in different patient populations (16), as well as in patients with peripheral vestibular disorders (34). Reference values are provided in healthy adults (41, 42). Fast walking speed is known to be a problem in patients with dizziness. Tests of preferred and fast walking speeds were applied, the average of two trials in each test was calculated to estimate average walking distance meters/second (m/s). In this study group the smallest detectable change in preferred walking speed at group and individual level were was 0.02 m/s (SDC$_{group}$) and 0.2 m/s (SDC$_{ind}$). This was in line with previous reports (34). The smallest detectable change in fast walking speed at group and individual level were 0.03 m/s (SDC$_{group}$) and 0.3 m/s (SDC$_{ind}$). Walking speeds were assumed to indicate activity/limitation according to the ICF category Mobility d450 (31).

Ethics

The study was recommended by the Norwegian Regional Committee for Medical Research Ethics and the Norwegian Social Science Data Services. The study was performed in accordance with the Helsinki Declaration. Written informed consent was obtained from all participants.

Statistical analyses

Questionnaires with missing values exceeding 30% were discarded, while missing values ≤ 30% of the items in a participant's questionnaire were imputed by the mode value of the respective participants scale or subscale**.** Missing values at 18 months in the single leg stance and fast walking speed were replaced

with respectively four and two values from the previous test at 6 months. Due to missing data that were not imputable, the number of participants in some analyses differed from sample size. Level of significance was set at p-value ≤ 0.05. Statistical analyses were performed with SPSS version 17.0 for Windows.

Descriptive statistics were used to examine demographic and test data. A large ceiling effect was found in trials of the Single Leg Stance with eyes open, where about 70 % of the participants reached the upper time limit. We found no floor or ceiling effect in the Single Leg Stance - eyes closed, which is thus presented. Distributions of scores were examined by Q-Q plots, by comparing mean, trimmed mean and median of the scales and subscales, and tests of normality. The scales are of ordinal nature, so all assumptions of normality were not met. Differences within and between groups were estimated by Wilcoxon Signed Ranks Test, Mann-Whitney test, and Kruskal-Wallis test in non-parametric data (43), and paired and independent t-tests, and ANOVA in parametric data (44).

Test-retest reliability was explored in this study group at initial evaluation. Two subsequent trials in the single leg stance and walking speeds were used. Relative reliability was calculated by intra-class correlation coefficients (ICC (1.1 and ICC (1.3)). Findings of the single leg stance –eyes closed showed $r > 0.7$, and walking speeds showed $r > 0.9$. Both were considered satisfactory according to proposals (45), p. 234. An indication of absolute reliability was calculated by within-subject standard deviation (S_w) (46, 47), Smallest detectable changes (SDC) were calculated.

Change is defined as scores at the initial test minus scores at 18 months. Standardized effect size of change (ES) was used to help interpret the magnitude of change. The effect size was calculated by paired t-tests, $ES = \sqrt{t^2 / t^2 +}$ degrees of freedom in parametric data (44), and by Wilcoxon Signed Ranks tests in non-parametric data, $ES = Z / \sqrt{n}$, where n denotes the total number of non-zero observations in the analyses) (43). Change scores are assumed to be normally distributed when $n > 20$ (48). Pearson's product moment correlation was used to examine associations between change scores. Guidelines proposed by Cohen (49) were used to evaluate the strength of correlations, and effect sizes. Low correlation (or small effect) is indicated by values 0.10 - 0.29; moderate correlation (or medium effect) by values 0.30 - 0.49; and high correlation (or large effect) by values 0.50 - 1.0.

Results

At initial evaluation the majority of participants had scores in outcome measures that indicated moderate to severe impairment in perceived dizziness, and moderate to severe limitations in activities and restrictions in participation according to the outcome measures, as shown in Table 3 and Table 4. Scores in the Vertigo Symptom Scale indicated that the participants had more trouble in the subscale "vertigo/balance" than in the subscale "autonomic/anxiety" (data not shown).

Changes in outcome measures at 18 months.

Statistical significant change in self-perceived symptoms (impairment) by the Vertigo Symptom Scale – short form at 18 months showed large effect size of difference (Table 3). The changes assumed to indicate improvement in body function were mainly in the subscale "vertigo/balance" (data not presented). The mean score of the Vertigo Symptom Scale – short form had turned below the cut-off points of "severe dizziness" (Table 3). Thirty-seven persons (54%) still reported "dizziness" at 18 months, of whom 21 (28%) reported severe dizziness (Table 4). Changes in the Dynamic Visual Acuity test, also assumed to indicate body function, improved by a median of two lines, just indicating a real change and large effects size of difference (Table 3). Thirty-one participants (46%) still had persisting problems with seeing clearly while moving their head (Table 4).

Findings in the Patient Specific Functional Scale, and the Disability Scale, assumed to indicate activity and participation, showed improvements with large effect sizes of difference (Table 3). The improvements in the Patient Specific Functional Scale were

found in physical activity and sports, work related activities, social and cultural life, transportation, and domestic work. Seven persons (10%) still reported severe limitations in personal important activities (Table 4). The median score of the Disability Scale had improved to “mild disability” (Table 3). We found that 11(16%) participants still had “severe disability” (Table 4). In tests assumed to indicate changes in activity, we found statistical significant improvement in the Single Leg Stance - eyes closed, and median effect size of difference (Table 3). Fifty-three persons (78%) did not reach the expected standing time of 30 seconds (data not shown). The change scores in walking speeds exceeded measurement error, but did not reach statistical significance. Low and medium effects sizes of difference were found (Table 3).

Findings of change in the composite measure, the Dizziness Handicap Inventory, showed statistical significant change. We found mean improvements with large effect size of difference (Table 3) assumed to indicate body function, activity and participation The mean score indicated “mild” impact of dizziness on quality of life. Five participants (7%) still had “severe” impact of dizziness on quality of life (Table 4).

In subgroup analyses, females showed significantly larger improvements in most self-report measures compared to men. No significant differences were found in subgroup analyses according to age, months since onset of dizziness, intervention, or between vestibular and non- vestibular dizziness.

Associations between change scores of different outcome measures.

We found high correlation between the Vertigo Symptom Scale assumed to indicate body function/impairments and the composite measure Dizziness Handicap Inventory

(Table 5). Significant moderate and high correlation were also found between change scores in the Vertigo Symptom Scale and measures assumed to indicate activity and participation, the Patient Specific Functional Scale, and the Disability Scale (Table 5). We found no correlation between change scores assumed to indicate body function/impairments: the Vertigo Symptom Scale and the Dynamic Visual Acuity test (Table 5). We found moderate correlation between the Dynamic Visual Acuity and two tests assumed to indicate activity/limitations, the Single leg Stance-eyes closed and preferred walking speed. No correlation was found between changes in the Vertigo Symptom Scale and tests that were assumed to indicate activity: the Single Leg Stance, and walking speeds (Table 5).

Correlations between changes in outcome measures assumed to indicate activity and participation showed moderate and high correlations (r = 0.3 - 0.6) (Table 5). The highest correlations were found between the Disability Scale and Dizziness Handicap Inventory, and between the Disability scale and the Patient Specific Functional Scale (Table 5). A high correlation was found between preferred and fast walking speed, also indicating activity. Generally, we found no correlations between self-reported measures, and tests (Table 5).

Discussion

In this follow-up study of persons with dizziness we found correlations between change-scores at 18 months ranging r = 0 - 0.6. Significant correlations were found between change scores of body function and activity/participation ($0.3 \leq r \geq 5$). We found no correlations between self-report measures and tests. We found significant improvements in impairments indicated by outcome measures of dizziness and visual

acuity, and in activity and participation indicated by outcome measures of standing balance, patient specific activities, disability, and quality of life. Similar patterns of change were also found in subgroup analyses except in gender.

Methodological issues

Number of participants lost to follow-up could represent a problem. However, no differences at initial testing, and the given reasons for withdrawals, led to the assumption that the withdrawals had minor influences on the results. The sample, only including adult up to 65 years old (mean age 46.7 years), represent results from adults, not elderly, in line with some other follow-up studies (11, 12, 14, 50-52). Since dizziness in this sample had lasted ≥ 4 months, the results might be generalizable to adult patients with long lasting dizziness, but not elderly patients.

Symptoms and signs of dizziness may indicate disorders/disruptions of many origins. This study included persons with different types of dizziness. Investigations used to determine the origin of dizziness might have varied, but diagnostics was not the focus of this study. Vestibular origins (65%) were most frequent in this study group. Subgroup analyses showed no statistical significant differences between diagnostic groups. Physiotherapy to patients with dizziness is based on symptoms, signs, and function, not necessarily diagnoses. Persons with the same diagnosis still present differences in functioning. Previous and more recent long-term follow-ups have included participants with different origin of dizziness (8, 11, 20, 21) as we did, as well as determined specific diagnostic groups (14, 18, 19, 51). The mixed origin of dizziness in our study could be perceived as a limitation, but could also be seen as being representative of patients seen in primary health care.

With a small sample size there might be a risk of both Type I and Type II errors. The null hypothesis of no difference between scores at initial evaluation and 18 months follow-up required a significance level of ≤ 0.05. Analyses performed in the total group (n=68) are assumed to be sufficient to test the 0-hypothesis. The additional subgroup analyses resulting in smaller sample sizes could be more vulnerable to errors. Analyses of change-scores in samples ≥ 20 is assumed to be sufficient according to experts (48).

To explore data from outcome measures we used different statistical methods. The results are evaluated in line with proposals by Marquis et al (53): by established measurement properties, magnitude of change by standardized effect size of difference, comparisons with known clinical change, previously determined cut-off points, and known-group references. By this we intended to illuminate limitations and strengths of the applied outcome measures. The varying information on measurement properties in several of the applied scales and tests, is a known challenge in evaluating change in general (16), and hence also in persons with dizziness (54). This might affect the internal validity of the results. Awareness of the strengths and limitations in existing outcome measures is necessary to interpret change. There is a need to promote further explorations of measurement properties in outcome measures in this patient group.

By informing about follow-up assessments, testing, and test results, as well as the benefits of physical activity at each evaluation session, the study might be seen as an intervention in itself. These factors probably influenced results in directions of improvements for all participants. Knowledge of assumed benefits and the fact that you are to be assessed again increases awareness. Additionally, information about your

condition might reduce fear of symptoms, and stimulate to increase the level of general activity.

The same trained physiotherapist (first author) interviewed, tested, collected and plotted data, which might constitute a possible bias. Being one assessor might, however, also have enabled higher reliability in assessments. The data registrations were performed twice allowing for comparisons and corrections, and data analyses were checked, and rechecked. The intention of the study was to explore changes in persons with dizziness in different domains of functioning by use of different outcome measures. The research interest did not favor any specific results. We consider the possible influence on results to be minimal.

Main results

In this long-term follow-up study by self-reports and physical tests in several domains of functioning concurrently, we found associations between change scores that were comparable to previous findings of associations between measures of body function and structure, and activity and participation (16). None of the questionnaires or tests in the present study seemed redundant, since the highest association was r = 0.6. Hence, the associations indicated that the outcome measures capture different domains of functioning and dimensions of change (55).

Improvements in body function indicated by self-perceived severity of symptoms (the Vertigo Symptom Scale – short form) showed no association to change scores in the test assumed to indicate body function, the Dynamic Visual Acuity test, or tests assumed to indicate activity as the Single Leg Stance and walking speeds. Symptoms of dizziness are assumed to reflect impairment somewhere in the vestibular system, and the physical

tests are assumed to provoke symptoms or reflect problems experienced by persons with symptoms of dizziness. Based on this, one could expect that changes in perceived symptoms of dizziness and the physical tests indicating impairment and activity would correlate. The lack of correlations found support that the different outcome measures address and capture different dimensions of change. Further, the findings support the need to apply both self-reports of symptoms and physical tests concurrently. Our findings are in line with previous findings, where results from vestibular function or balance tests do not differ between groups reporting improvement versus no improvement in dizziness (18, 19, 50).

Moderate correlations between improvements in body function indicated by dynamic visual acuity, and activity indicated by standing balance and preferred walking speed, could indicate central compensation in some persons, which enabled improvements in activity. About half of the participants still had remaining problems in the tests. This could be due to sequelae after vestibular disorders (54). The non-computerized Dynamic Visual Acuity test appeared to describe a relevant problem experienced by patients, as well as having the ability to capture change. Although significant, the change did not exceed the expected number of lines previously found following vestibular rehabilitation (40). The single leg stance appeared suitable to provide information about change in balance. It addresses a relevant functional problem experienced by persons with dizziness, and deserves attention in exercises and patient education to prevent falls. The non-significant changes in preferred walking speed could be explained by a conscious choice of a safer speed. The results were found to be within the 95% confidence interval of normal range according to a later review (42), and all participants were able to walk at speeds ranging from 0.71 to 1.38 m/s required to cross

street intersections in large cities (56). Knowledge about clinical important change in walking speeds could be useful to guide interpretations of change. Comprehensive measures of functional balance with elements of dual task should be included in follow-ups of this patient group.

The moderate and high correlations found between change scores of body function (Vertigo Symptom Scale) and activity/participation (Patient Specific Functional Scale, Disability Scale and the Dizziness Handicap Inventory) are comparable to previous findings of associations between these domains of function (16). The changes found could indicate improvement in the person's ability to cope with perceived symptoms. Managing symptoms and coping strategies are considered an important part of treatment of patients with chronic conditions (57). Improvements found might be a result of 'response shift', a result of modifications of expectations and adjustments of standards and change in values (58), as well as bodily adjustments and use of alternative strategies. Awareness is needed in evaluating the scores, since they might also reflect persisting problems with activities that have actually been dropped by the patient.

The use of the Patient Specific Functional Scale is to our knowledge reported for the first time in persons with dizziness. The scale appears to provide important information to the clinician, is highly relevant to the patients, and might support motivation in coping with dizziness. A person-oriented measure might contribute to determine patient oriented goals to benefit management. Exploration of measurement properties in this patient group is warranted.

The proportion of persons with persisting dizziness (impairment) at follow-up was high (53%), but within the range found in previous studies. The proportion with severe dizziness (28%), is in line with findings in some studies in persons with vestibular disorders (12, 19, 24, 59), but lower than findings at a balance clinic (11). We found few indications of "autonomic/anxiety", and psychiatric co-morbidity in the patient group, contrary to previous long term follow-ups in persons with persisting dizziness (10, 12, 59). The 21 persons reporting severe dizziness at follow-up included more persons than the proportion who reported severe limitations in activities and participation (≤ 11 persons), and fewer persons than the proportion who still had abnormal test results (≥ 32 persons). These findings at an individual level might further promote inclusion of broad assessments in these patients to capture the complexities of change in chronic dizziness.

This study was performed before the ICF core set for patients with vertigo, dizziness and balance disorders was designed (60). Our assumptions about outcome measures in patients with dizziness find support in the proposed core set. We welcome the work performed by this group (60), and await the following work related to developing outcome measures that are relevant for this patient group in different domains of functioning.

Conclusion

Measuring change in patients with long lasting/chronic conditions is a complex issue. Comprehensive use of outcome measures in line with the ICF, indicating changes in body function, activity and participation, appeared to provide information of changes in different domains of functioning. To enable broad and meaningful follow-up of patients

with long lasting dizziness, generic and condition specific measures, self-reports and tests in these domains of functioning could be further explored.

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Conflicts of interest: none to declare.

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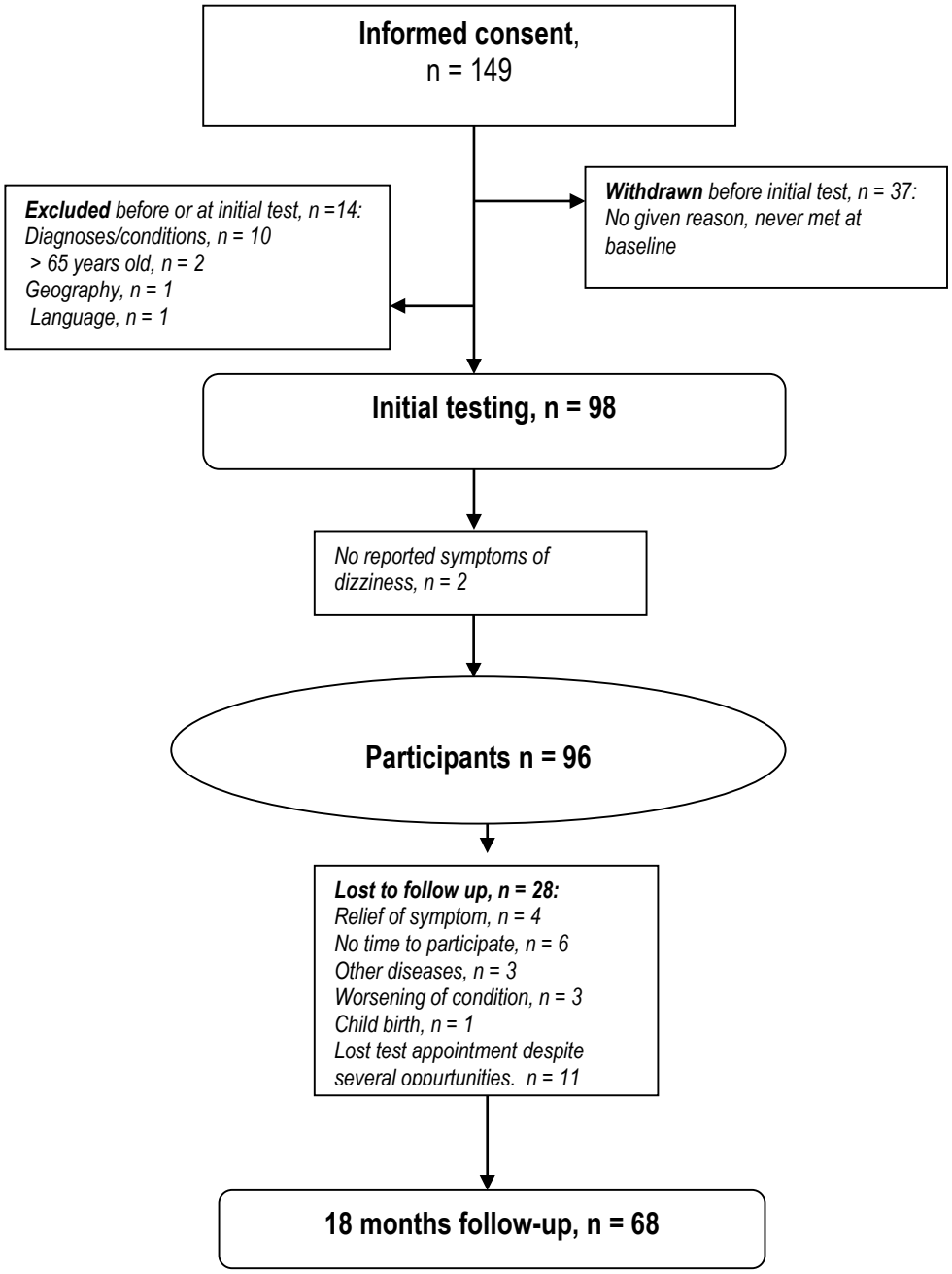

Figur 1. Flowchart of participants and withdrawals.

Tables

Table 1 – Description of participants.

Characteristics	Total group (n = 68)
Gender: female: n (% within group)	47 (69)
Age in years: mean (SD), min-max	46.7 (12.1), 26-64
Number of months since onset of symptoms: median (min-max)	21.5 (4 - 406)
Work status at present:	
Employed persons: n (%),	58 (85)
Employed on sick-leave: n (%)	21 (31)
Long term social security benefit: n (%)	7 (10)
Others n (%)	3 (4)
Number of months of sick-leave/ social security benefit due to dizziness: Median (min-max)	6.0 (0 - 45)
Number of conditions/diseases: mean (SD), min-max	1.6 (1.2), 0-5
Number of medicines used: mean (SD), min-max	1.3 (1.7), 0-9

Table 2 - Number of cases of vestibular, non-vestibular and unknown origin of dizziness (n=68)

	Origins of dizziness		No of cases (%)
Vestibular	*Benign Paroxysmal Positional Vertigo		6
	Dysfunction balance system		3
	Dysfunction vestibular nerve NOS		1
	Labyrinthitis		4
	Mb Meniere		1
	Sacculus disorder		1
	Vestibular dysfunction NOS		1
	Vestibular neuronitis: unilateral		19
	Vestibular neuronitis: bilateral		3
	Vestibular undecided		5
		Total no.	44 (65)
Non vestibular	Dizziness (excludet vestibular)		1
	Dizziness NOS		2
	Dizziness syndrome NOS		1
	Dizziness and imbalance NOS		1
	Epileptic attacks		1
	Mal DeBarquement		1
	Musculoskeletal disorders		5
	Sudden deafness		1
	Traumatic Brain Injury		1
	Vertigo NOS		1
		Total no.	15 (22)
Unknown	NOS	Total no.	9 (13)
Total			68 (100)

*One patient had Benign Paroxysmal Positional Vertigo and vestibular neuronitis, only counted once
NOS = No Other Specification

Table 3– Scores in outcome measures at initial evaluation and change scores at follow-up (N = 68)

	Initial scores	Difference at 18 months: change scores [c]	Effect Size of difference [d,e]
VSS –sf total [a]			
Mean (SD)	14.5 (9.6),	**4.6 (7.1)**	0.5 [d]
PSFS [a]			
Median (min, max)	6.0 (0, 10)	**1.7 (- 4, 9.67)**	0.7 [e]
DS [a]			
Median (min, max)	3.0 (0, 5)	**1.0 (- 3, 4)**	0.7 [e]
DHI [a]			
Mean (SD)	38.4 (18.6),	**11.6 (15.6)**	0.6 [d]
DVAT [a]			
Median (min, max)	5.0 (0, 9)	**2.0 (- 6, 6)**	0.5 [e]
SLS-EC-R [b]			
Mean (SD)	10.4 (9.1),	**- 3.0 (10.4)**	0.3 [d]
PWS [b]			
Mean (SD)	1.3 (0.3),	- 0.1 (0.2)	0.2 [d]
FWS [b]			
Mean (SD)	2.1 (0.3),	0.1 (0.3)	0.3 [d]

[a] Positive scores indicate improvement ;
[b] Negative scores indicate improvement;
[c] **Bold scores** indicate significant change, p-value < 0.05;
[d] Effect size of difference calculated from t-value in paired sample t-tests;
[e] Effect size of difference calculated from Z value in Wilcoxon Signed Ranks test

VSS-sf = Vertigo Symptom Scale- short form;
PSFS = Patient Specific Functional Scale;
DS = Disability Scale;
DHI = Dizziness Handicap Inventory;
DVAT = Dynamic Visual Acuity Test;
SLS-EC-R = Single Leg Stance, Eyes closed, Right leg;
PWS = Preferred Walking Speed m/s;
FWS = Fast Walking Speed m/s

Table 4 - Distribution of scores according to severity in outcome measures at inclusion and follow-up (N=68).

Measures	Categories	Initial test n (%)*	Follow-up n (%)
VSS-sf:			
'Dizziness'	≤ 11 points	30 (45)	46 (68)
'Severe dizziness'	≥ 12 points	37 (54)	21 (28)
	n (%)	67 (99)	67 (96)
PSFS:			
As before	0 points	11 (16)	16 (24)
Small limitations	1 - 3 points	8 (12)	29 (43)
Moderate limitations	4 - 6 points	22 (32)	15 (22)
Severe limitations	7 - 10 points	27 (40)	7 (10)
	n (%)	68 (100)	67 (99)
DS:			
No disability	0-1 points	18 (27)	38 (56)
Mild and moderate	2-3 points	30 (44)	19 (28)
Severe disability	4-5 points	20 (29)	11 (16)
	n (%)	68 (100)	68 (100)
DHI:			
Mild	0-30 points	26 (38)	41 (60)
Moderate	31-60 points	31 (46)	19 (28)
Severe	61-100 points	10 (15)	5 (7)
	n (%)	67 (99)	64 (96)
DVAT	≤ 3 lines	14 (21)	32 (47)
	≥ 4 lines	50 (74)	31 (46)
	n (%)	64 (94)	63 (93)

VSS-sf = Vertigo Symptoms Scale – short form;
PSFS = Patient Specific Functional Scale;
DS = Disability Scale;
DHI = Dizziness Handicap Inventory;
DVAT = Dynamic Visual Acuity test.

Table 5 – Associations between change scores in different outcome measures (Pearson's correlation coefficient: r) (N = 68).

Outcome Measures:	Vertigo Symptom Scale – short form	Patient Specific Functional Scale	Disability Scale	Dizziness Handicap Inventory	Dynamic Visual Acuity test	Single leg stance - right - eyes closed	Preferred walking speed	Fast walking speed
Vertigo Symptom Scale – short form	1							
Patient Specific Functional Scale	**0.4 ****	1						
Disability Scale	**0.5 *****	**0.5 *****	1					
Dizziness Handicap Inventory	**0.5 *****	**0.3 ***	**0.6 *****	1				
Dynamic Visual Acuity test	- 0.1	- 0.02	- 0.02	0.2	1			
Single leg stance –right – eyes closed	0.004	- 0.2	0.01	- 0.02	**- 0.3 ***	1		
Preferred walking speed	- 0.1	- 0.1	- 0.1	- 0.1	**- 0.3 ***	0.2	1	
Fast walking speed	- 0.1	0.02	- 0.1	- 0.03	0.1	- 0.1	**0.5 *****	1

Bold scores indicate significant change
* = p-value ≤ 0.05; ** = p-value < 0.01; *** = p-value < 0.001