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Concurrent validity and responsiveness to change of the vestibular screening tool

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ABSTRACT

Background: Vestibular disorders are common in the Emergency Department and valid tools are required to screen for vestibular disorders and monitor outcomes. The aim was to determine the new vestibular screening tool’s (VST) concurrent validity with the dizziness handicap inventory (DHI), responsiveness to change in symptoms after vestibular rehabilitation across the continuum of care and the minimal clinically important difference.

Method: Longitudinal prospective study undertaken with adults (n = 195) presenting to hospital with non-emergent dizziness (mean age = 64.4 ± 15.4 years; female = 59.5%). The VST and DHI were completed concurrently at three assessment points: initial, discharge and 3-month follow-up. Physiotherapy tests categorised people (vestibular / non-vestibular). People in the vestibular group were offered treatment.

Results: The VST demonstrated moderate to high associations with DHI total (r = .673 - .768) with DHI physical sub-category scores (r = .759 - .809) at each assessment-point. The mean change scores for both measures significantly decreased across the continuum of care (p ≤ 0.05) with a clinically meaningful VST change score of 2-points determined. Across the care pathway, moderate to high associations presented between changes in VST and DHI total scores (r = .697-.709).

Conclusion: The VST demonstrates concurrent validity with the DHI and is responsive to change following vestibular rehabilitation intervention. The VST could be clinically useful in a hospital setting.

KEY WORDS

Vestibular Diseases; dizziness; vertigo
INTRODUCTION

Vestibular disorders are common clinical manifestations in the emergency department (ED)\(^1\). Vestibular disorders have been reported as high as 45% as an underlying cause of people complaining of dizziness\(^2\). Individuals with dizziness are more frequently being referred to physiotherapy for assessment and treatment. Valid and reliable tools are required for use in busy, acute hospital settings to screen for vestibular disorders and monitor physiotherapy clinical outcomes post treatment.

It is useful to work with screening tools that are indicative of vestibular dysfunction, and enable a person’s responsiveness to treatment to be recorded\(^3\). Clinical tools need to be easy to use, quick to administer when assessing the nature of self-reported dizziness symptomology, and validated for use in the acute hospital setting. A tool would be particularly useful if it demonstrated responsiveness to interventions, allowing documentation of change in a persons’ subjective impairment as they respond to treatment.

A new tool, the vestibular screening tool (VST) has been shown to be a valid and reliable tool to screen for non-emergent vestibular disorders when people with dizziness present to ED or acute hospital settings\(^4\). The VST is a unidimensional tool with strong construct validity, high inter-rater and intra-rater reliability, and discriminative validity for identifying vestibular disorders for use in the acute hospital setting\(^4\). The 4-item VST is scored out of eight (8) with the cut-off score (≥ 4 / 8) indicative of the likely presence of vestibular dysfunction. However, investigations of concurrent validity, responsiveness to change, and minimal clinically important difference (MCID) of the VST have not been established.

Concurrent validity of the VST with self-report instruments related to dizziness impairment and impact on daily activities and participation, such as the dizziness handicap inventory (DHI) is worthy of investigating to further validate the VST. Concurrent validity can be defined as using a criterion test to compare the results of the outcome measure being tested\(^5\), where both outcome measures are examined at the same time. The DHI provides information about self-perceived dizziness impairment, and due to widespread use and documented reliability and validity, it is commonly selected to report outcomes of vestibular physiotherapy (VPT). Therefore,
to determine concurrent validity of the VST, the universally utilised DHI was used as the criterion test.

The VST’s responsiveness to change has also not been investigated. Responsiveness is the ability of an instrument to measure a meaningful or clinically important change when change has occurred. Two types of responsiveness to change are internal and external. Internal responsiveness characterises the ability of a measure to change over a particular pre-specified period when a known efficacious treatment can be applied. VPT was chosen as the known efficacious treatment to determine internal responsiveness of the VST. For people with a vestibular disorder, there is a consistent body of evidence, including a large number of randomised controlled trials that support the efficacy of VPT. Therefore it is hypothesised that VST scores will decrease after VPT intervention, informing internal responsiveness.

External responsiveness reflects the extent to which changes in a measure over a specified time frame relate to corresponding changes in a reference measure of health status. The reference measure is particularly useful when it is accepted as an indicator of meaningful and important change in the condition of a person. Therefore, the DHI was selected as the reference measure to test external responsiveness of the VST. Unlike internal responsiveness, the external responsiveness of a measure is not dependent on the treatments under investigation; therefore it has meaning in a wider range of settings. It is hypothesised that VST scores will decrease as DHI scores decrease with moderate to high associations determined.

Data from this study will allow us to demonstrate the MCID for the VST. MCID (as defined in Section 3.2.4) is important as although small changes in clinical measures may be statistically significant, they may not be meaningful clinically.

If concurrent validity of the VST with the DHI, and responsiveness to change after VPT intervention is established with people presenting with non-emergent vestibular dysfunction to the hospital setting, the value of using the VST as a quick measure of subjective dizziness impairment and response to treatment would be strengthened. Thus, this study aimed to: 1) establish concurrent validity of the VST by testing the association with the DHI (total and sub-categories) in people with dizziness referred directly from the ED / acute hospital setting to the vestibular service, at initial,
discharge and follow-up assessment; 2) determine the internal and external responsiveness of the VST, and 3) investigate if a MCID could be identified for the VST.

MATERIALS AND METHODS

Design
A longitudinal, observational prospective study was undertaken.

Participants and Setting
People (>18 years) complaining of dizziness who presented to ED of a metropolitan hospital were included. Following triage, dizziness was the confirmed presenting complaint as documented by the triage team in ED. People were excluded: if a known cardiac condition or stroke requiring emergency medical management was the cause of their hospital presentation; inability to provide informed consent (intoxication, mental disability, language barrier); or if injuries or musculoskeletal conditions limited diagnostic assessment. Informed written consent was gained with participants. Ethical approvals were gained by the relevant institutions.

Outcome Measures
Primary measures included the VST and the DHI. The VST items were scored (0-8) with a higher score indicative of a vestibular disorder. The DHI is a 25-item questionnaire (0-100) split into three categories: functional, physical and emotional. It is used to evaluate dizziness impairment and vestibular dysfunction and indicates the effect of symptoms on participation and quality of life. Higher scores are indicative of greater vestibular dysfunction. The DHI is sensitive to change after VPT for those with primary vestibular deficits.

Protocol and intervention
The VST and DHI were completed concurrently with participants on presentation to hospital or during the initial physiotherapy vestibular assessment. Initial assessments were completed with participants whilst in hospital or in the out-patient vestibular service after discharge from hospital. The VST was administered verbally and the DHI either verbally or completed independently. Assistance was offered if the participant had difficulty completing the questionnaires.
A vestibular diagnosis was made when a positive clinical test was consistent with presenting history and the medical officer’s opinion. A diagnostic vestibular assessment confirmed a vestibular disorder and included: comprehensive subjective examination, oculomotor examination (spontaneous nystagmus presence, smooth pursuit, gaze evoked nystagmus, saccadic eye movements, skew deviation), vestibular ocular reflex tests (head impulse test, head shaking nystagmus), and positional testing (HPD test and head roll test) completed with video Frenzel equipment. Table I summarises the vestibular disorders identified along with the relevant diagnostic tests used in the assessment.

Participants that did not fit these criteria were categorised as ‘non-vestibular’. If it was unclear if symptoms were from a vestibular origin or not, an ‘unspecified’ diagnosis was given and participants were referred for ongoing specialist assessment (audiology / ear nose throat / neurology). Demographic data recorded included gender, age, and self-reported falls in the past 12 months.

Customised VPT was offered to all people deemed to have a vestibular dysfunction. Efficacious management included repositioning manoeuvres for benign paroxysmal positional vertigo (BPPV), compensatory responses (for positional or motion provoked symptoms), adaptation for visual-vestibular interaction (gaze stabilisation), compensation (such as visual or somatosensory) and postural control exercises, falls prevention, (re)conditioning activities, functional / occupational retraining and psychological support as required. A discharge assessment was completed on the final day of treatment and a follow-up assessment was undertaken three-months after discharge from VPT. The VST and DHI were repeated concurrently as part of the discharge and follow-up assessments.

Concurrent validity analysis

Associations between the VST and DHI total and sub-category scores were calculated using Spearman rank order correlations at initial, discharge and follow-up assessments. Given the limited range in VST scoring (0-8), a conservative approach to determining concurrent validity was adopted. Correlation coefficient values were classified as follows: 0.40-0.70: moderate correlation, and 0.75-1.00: high correlation.

Internal responsiveness analysis
Means, SD and ranges of scores of the VST, DHI and DHI sub-categories completed at initial, discharge and follow-up assessment were reported. Paired t-tests were completed between initial and discharge VST scores, discharge and follow-up VST scores and initial and follow-up VST scores to determine if a statistically significant change in the VST occurred (and was maintained) after VPT. Paired t-tests are most frequently used to demonstrate internal responsiveness \(^7\).

**External responsiveness analysis**
To determine external responsiveness of the VST, the changes in VST and DHI (total and sub-category) scores between the assessment points (initial, discharge and follow-up) were presented as mean differences, SE of the mean differences. Correlations between the change in VST scores and the change in DHI total and sub-category scores were calculated using linear regression analysis. Linear regression analyses were completed for changes in VST and changes in DHI scores from initial to discharge assessments and between discharge and follow-up assessments to determine the degree one measure changed compared to the other at different time points \(^7\).

**Minimal clinically important difference analysis**
The anchor-based method was used, which compares a person’s change score with another measure of clinically relevant change \(^{13,25}\). Linear regression analysis showed the degree to which the VST score changed compared to the DHI to determine the MCID of the VST \(^{26,27}\). Significance level was set at \(p < 0.05\). Data were analysed using the SPSS statistical package (Version 22).

**RESULTS**
One-hundred and ninety-five subjects who presented to hospital with dizziness (July 2013 – April 2015) were enrolled in this study (demographics and characteristics in Table II).

One-hundred and sixty-six participants (86.13%) completed the VST and DHI concurrently whilst they were in hospital. Another 29 participants (14.87%) completed the questionnaires concurrently after being discharged from hospital. Initial diagnostic assessment was completed either whilst in hospital (\(n = 112, 57.44\%\)) or within an average of 22.04 days (3-77 days) of presenting to hospital (\(n = 83, 42.56\%\)).
Concurrent validity of VST and DHI

Table III reports the moderate to high associations between the VST scores and DHI total and sub-category scores completed at initial, discharge and follow-up assessment for the total group. Data from the vestibular diagnostic group showed that the associations between the VST and the DHI (total and sub-category) scores were similar to those yielded by the total group (p ≤ 0.05).

Two participants with vestibular migraine had BPPV and four participants with vestibular neuritis developed BPPV across the treatment period. Of the vestibular group (n = 151), 106 (70.0%) completed a discharge assessment and 85 (80.2%) of those who completed a discharge assessment also completed a three-month follow-up assessment. Subjects who did not complete a discharge assessment, either reported resolution of symptoms or did not wish to return for ongoing treatment.

Internal responsiveness results

Table IV displays VST and DHI (and sub-category) scores following VPT and at follow-up for the vestibular diagnostic group.

VST and DHI scores significantly reduced between pre and post VPT intervention in individuals who presented to hospital with a vestibular disorder (p = 0.000), and remained significantly lower three months after completion of the VPT intervention (p = 0.000). Improvements in VST, DHI and DHI sub-category scores post-intervention were maintained at 3-months (p > 0.05).

External responsiveness results

Figure 1 illustrates mean change in scores (mean difference, SE of the mean difference score) between initial to discharge, discharge to follow-up assessment. Mean change scores showed an improvement between initial and discharge assessment (decreased scores), maintained at follow-up assessment at 3-months post discharge. Overall, the scores mean change decreased from initial to discharge and follow-up assessments.

Moderate to high associations were determined (See Table V) between changes in VST scores and changes in DHI scores from initial to discharge assessment after VPT intervention and from discharge assessment to three-month follow-up assessment.
MCID results

Figure 2 displays the high association between the change in VST scores and changes in DHI scores after VPT intervention. Linear regression analysis showed the degree to which the VST score changed compared to the DHI (Figure 2). This analysis determined that a change in the VST score by 1 point (SE = 0.374) is equivalent to a change in the DHI score by 11.63 points (SE = 0.07).

DISCUSSION

This study determined concurrent validity between the VST and DHI and that the VST is responsive to change in symptoms after VPT intervention, similar to the changes in DHI scores. Moderate to high associations between the VST with the DHI (and sub-category scores) were identified across the pathway of care (initial, discharge post-VPT intervention and 3-month follow-up assessments) for individuals who initially presented to hospital with dizziness complaints for whom emergent conditions were excluded. Associations were higher for DHI physical and functional sub-categories compared to the moderate association with the emotional sub-category. The higher association with the DHI physical sub-category is not surprising considering the VST items were sourced predominantly from the physical domain of the DHI, in combination with items from the Vestibular Rehabilitation Benefit Questionnaire.

The finding that the VST demonstrates concurrent validity with the DHI is important as the DHI is recognised as a valuable and useful instrument for informing clinical outcomes related to dizziness impairment and is widely reported in clinical research. Various cut-off scores for severity of dizziness have been utilised for the DHI scale. Scores above 26 / 100 represent significant self-report impairment, DHI scores between 31-60 indicate moderate severity, and those above 50 / 100 have been shown to predict BPPV. The initial assessment scores, which revealed a mean VST score of 5.90 / 8 and a mean DHI score of 51.50 / 100, are consistent with the initial validation study on the VST, which found that a VST score of four (4) or greater (≥4 / 8) indicated likely presence of a vestibular dysfunction. The current study provides further confirmation that higher scores on the VST are likely to be indicative of people with vestibular dysfunction, when people present to hospital with non-emergent complaints of dizziness.
As the VST has a moderate to high association with the DHI, it is likely that VST scores could be associated with reduced balance confidence, functional limitations, falls and lower quality of life, as these relationships have been demonstrated with the DHI. A future study could explore the relationship between VST scores and an individual’s balance confidence and functional impairment. This may be of particular benefit when utilizing the VST with community-dwelling individuals who have presented to hospital.

Our findings confirmed our hypotheses that the VST would demonstrate internal and external responsiveness across the continuum of care, in line with recommendations of Husteda and colleagues. The VST showed improvement in dizziness symptoms after VPT intervention, a requirement for internal responsiveness. This may be explained by the efficacy of VPT intervention but this hypothesis warrants further study. The improvement in VST scores was maintained at three months.

Our findings also indicate that the VST demonstrated external responsiveness to change in dizziness impairment, in line with the DHI. The moderate to high associations between mean changes in scores after VPT, of the VST with the DHI (and for the DHI sub-categories) from initial to discharge, discharge to follow-up and initial to follow-up assessments was expected given the findings presented. The DHI has been shown to be sensitive to change in symptoms post VPT intervention when BPPV presents. The high association between the mean changes in scores of both the VST and the DHI across the treatment period confirmed that the VST was responsive to change in symptoms post VPT when people presented to hospital with non-emergent dizziness complaints.

The current study indicated that a 2-point change on the VST is needed before a clinically important change occurs. Our results show a change of one point on the VST equates to a change of 11.63 on the DHI. As change of at least 18 points on the DHI (95% confidence interval) is required for a true change in self-perceived impairment post intervention to occur, this suggests that a change of at least 1.55 points (ie 2 points) (95% confidence interval) on the VST would be required for a true change in self-perceived impairment post intervention to occur. While this aspect requires further investigation, this is a valuable finding, supporting the view that
changes in VST scores can be utilised to guide clinically meaningful improvements and can be replicated by other investigators in future research.\(^7\)

For the clinician, the VST could be considered a quick measure of subjective dizziness impairment, for screening people with dizziness for a vestibular dysfunction, or as a measure of change in a person’s response to VPT treatment. The clinician should note that the VST might not reflect changes in all health domains – particularly the emotional domain of dizziness impairment. Comprehensive measures of quality of life and the impact of dizziness impairment on a person are still recommended in a non-acute setting. Rather than replace comprehensive measures, the VST offers a brief, quick measure that can be used in busy clinics and hospital settings as well as guide referral to vestibular services.

**Study limitations**

There were a reasonable number of people with missing data at the follow-up assessments. Whilst all attempts were made to avoid this however this is a pragmatic study. The results may have been impacted however we are confident in the results as linear mixed models were used, allowing all data that was collected to be used in the analysis. An experienced vestibular physiotherapist using video Frenzel equipment, in agreement with the treating medical officer, completed the diagnostic categorisation. However, an ear nose throat specialist or neurologist did not routinely assess participants, nor were laboratory tests utilized. The VST does not attempt to exclude a central disorder such as stroke, nor discriminate between central and peripheral vestibular disorders. As the VST was only utilised by a physiotherapist further validation studies could involve medical officers and other health professionals. Further testing involving the VST could also occur in other hospital departments and community settings.

**CONCLUSION**

This study demonstrated concurrent validity of the VST and DHI with highest associations achieved between the physical domain of the DHI and VST. The VST demonstrated responsiveness to change following VPT intervention, with the improvement in line with the DHI response. The VST could be considered for use as a quick measure of subjective dizziness impairment and to measure responsiveness to
change in symptoms after VPT treatment with individuals who present to hospital
with non-emergent dizziness complaint,

REFERENCES


NOTES

Authors’ contributions – Authors listed.

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Conflicts of interest – Nil

Congresses – Nil

Acknowledgements – Nil

TABLES

Table I Use of clinical assessment tests to inform vestibular diagnostic categorisation.

<table>
<thead>
<tr>
<th>Diagnostic groups</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign paroxysmal positional vertigo</td>
<td>Positive Hallpike Dix / supine head roll test&lt;sup&gt;18&lt;/sup&gt;</td>
</tr>
<tr>
<td>Acute vestibular neuritis, unilateral / bilateral vestibular hypofunction</td>
<td>Positive head impulse test / video head impulse test consistent with history or positive caloric result&lt;sup&gt;19&lt;/sup&gt;</td>
</tr>
<tr>
<td>Meniere’s disease</td>
<td>Episodic symptoms of fluctuant hearing loss, vertigo, tinnitus or blockage of the ear confirmed by a specialist&lt;sup&gt;20&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vestibular migraine</td>
<td>Migraine headaches as per international headache criteria and vestibular symptoms of imbalance, vertigo, dizziness or unsteadiness&lt;sup&gt;21&lt;/sup&gt;</td>
</tr>
<tr>
<td>Central vestibular</td>
<td>Head impulse, nystagmus, test of skew (HINTS) in context of acute vestibular syndrome&lt;sup&gt;22&lt;/sup&gt;; or pure down-beating / up-beating / torsional nystagmus, with vestibular symptoms as diagnosed as central by a specialist.</td>
</tr>
<tr>
<td>Unspecified vestibular</td>
<td>Vestibular symptoms including vertigo requiring further specialist assessment</td>
</tr>
<tr>
<td>Motion sensitivity</td>
<td>Moderate to severe score on the motion sensitivity quotient without other diagnosis&lt;sup&gt;23&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Table II Demographics and clinical characteristics of participants

<table>
<thead>
<tr>
<th>Demographic characteristic</th>
<th>Total Group (N = 195)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD, range) (y)</td>
<td>64.43 (15.36, 19.13 – 94.96)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>116 (59.5%)</td>
</tr>
<tr>
<td>Self-reported falls in past 12 months, n (%)</td>
<td>57 / 189 (29.2%)</td>
</tr>
<tr>
<td>Independent gait, n (%)</td>
<td>152 / 179 (77.9%)</td>
</tr>
<tr>
<td>Vestibular: n (%)</td>
<td></td>
</tr>
<tr>
<td>• BPPV</td>
<td>78 (40.0%)</td>
</tr>
<tr>
<td>• Vestibular neuritis</td>
<td>27 (13.9)</td>
</tr>
<tr>
<td>• Unilateral vestibular hypofunction</td>
<td>13 (6.7)</td>
</tr>
<tr>
<td>• Bilateral vestibular hypofunction</td>
<td>3 (1.5%)</td>
</tr>
<tr>
<td>• Vestibular migraine</td>
<td>7 (3.6%)</td>
</tr>
<tr>
<td>• Meniere’s disease</td>
<td>5 (1.5%)</td>
</tr>
<tr>
<td>• Central</td>
<td>4 (2.1%)</td>
</tr>
<tr>
<td>• Motion sensitivity</td>
<td>5 (2.6%)</td>
</tr>
<tr>
<td>• Unspecified vestibular</td>
<td>11 (5.6%)</td>
</tr>
<tr>
<td>Non-vestibular, n (%)</td>
<td>42 (21.0)</td>
</tr>
<tr>
<td>Unspecified, n (%)</td>
<td>2 (1.0%)</td>
</tr>
</tbody>
</table>

Self-reported dizziness for total group: initial assessment mean (SD, range):

- VST 4.72 (2.65, 0-8)
- DHI 44.90 (28.50, 0-100)
- DHI physical sub-category 14.52 (8.98, 0-28)
- DHI functional sub-category 17.45 (11.25, 0-36)
- DHI emotional sub-category 12.93 (10.51, 0-36)

Abbreviations: BPPV, benign paroxysmal positional vertigo; DHI, dizziness handicap inventory; VST, vestibular screening tool
Table III Association of the VST with the DHI, a measure of dizziness impairment, at three assessment time-points for the total group.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Initial VST</th>
<th>Discharge VST</th>
<th>Follow-up VST</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHI total</td>
<td>.768**</td>
<td>.673**</td>
<td>.744**</td>
</tr>
<tr>
<td>DHI physical</td>
<td>.809**</td>
<td>.759**</td>
<td>.808**</td>
</tr>
<tr>
<td>DHI functional</td>
<td>.714**</td>
<td>.504**</td>
<td>.736**</td>
</tr>
<tr>
<td>DHI emotional</td>
<td>.632**</td>
<td>.415**</td>
<td>.621**</td>
</tr>
</tbody>
</table>

Abbreviations: DHI, dizziness handicap inventory. ** ≤ 0.001

Table IV Means, SD and ranges of VST, DHI (and sub-category) scores for the vestibular diagnostic group on initial assessment and after VPT intervention at discharge and follow-up assessments.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Initial</th>
<th>Discharge</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>range</td>
</tr>
<tr>
<td>VST (/ 8)</td>
<td>5.90</td>
<td>2.17</td>
<td>0 - 8</td>
</tr>
<tr>
<td>DHI total (/ 100)</td>
<td>51.50</td>
<td>26.97</td>
<td>0 - 100</td>
</tr>
<tr>
<td>DHI physical (/ 28)</td>
<td>16.60</td>
<td>8.53</td>
<td>0 - 28</td>
</tr>
<tr>
<td>DHI functional (/ 36)</td>
<td>19.87</td>
<td>10.70</td>
<td>0 - 36</td>
</tr>
<tr>
<td>DHI emotional (/ 36)</td>
<td>15.03</td>
<td>10.34</td>
<td>0 - 36</td>
</tr>
</tbody>
</table>

Abbreviations: DHI, dizziness handicap inventory; VST, vestibular screening tool
Table V Correlation of the change in VST and DHI scores between assessment time-points to determine external responsiveness

<table>
<thead>
<tr>
<th></th>
<th>Initial – Discharge VST</th>
<th>Discharge – Follow-up VST</th>
<th>Initial – Follow-up VST</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHI Total</td>
<td>.709**</td>
<td>.709**</td>
<td>.697**</td>
</tr>
<tr>
<td>DHI Physical</td>
<td>.758**</td>
<td>.701**</td>
<td>.738**</td>
</tr>
<tr>
<td>DHI Functional</td>
<td>.582**</td>
<td>.709**</td>
<td>.657**</td>
</tr>
<tr>
<td>DHI Emotional</td>
<td>.595**</td>
<td>.582**</td>
<td>.568**</td>
</tr>
</tbody>
</table>

Abbreviations: DHI, dizziness handicap inventory; VST, vestibular screening tool.

**p ≤ 0.001, *p ≤ 0.005
TITLES OF FIGURES

Figure 1 Mean change of the VST and DHI (and DHI sub-categories) scores across the continuum of care.

Figure 2 Associations of the change in VST and DHI scores from initial to discharge assessment for people with a vestibular disorder.
Abbreviations: DHI, dizziness handicap inventory; VST, vestibular screening tool

Figure 1 Mean change of the VST and DHI (and DHI sub-categories) scores across the continuum of care.
Abbreviations: DHI, dizziness handicap inventory; VST, vestibular screening tool

Figure 2 Associations of the change in VST and DHI scores from initial to discharge assessment for people with a vestibular disorder.