Criterion-Related Validity of a Self-Administrated Modified Vertigo Symptom Scale (MVSS)

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ABSTRACT: Vertigo Symptom Scale (VSS) by Yardley et al. (1992) is a disease specific questionnaire used widely in clinical settings. It is conducted in English and has been translated into seven other languages: Dutch, French, German, Spanish, Swedish, Turkish and Malay. It has been acknowledged as a good subjective tool to determine the severity of balance disorders. The aim of this study was to validate the English language version of the Modified VSS (MVSS) using criterion-related validity via Pearson’s correlation. Ninety seven patients were selected from an age range of 18-75 years, with a mean age of 47.92 (S.D=13.17). These patients were divided into two different groups: Group 1(Untreated patients, newly referred with dizziness symptom) and Group 2 (Treated dizzy patients, seen as follow-ups who have completed a minimum of 3 months balance exercises). They were asked to fill in the English language version of VSS and MVSS. Pearson’s correlation was used for concurrent validity. Significant positive correlations (p< 0.0001) between VSS and MVSS for both groups with r= 0.92 for group 1 and r = 0.93 for group 2 were found. In each version, significant and high, or positive correlations, between those three different subscales in group 1 and 2 consecutively, were observed: vertigo r= 0.87 and r=0.88, somatic anxiety r=0.76 and r= 0.85 and autonomic subscale r=0.82 and r= 0.91. For predictive validity of MVSS, dichotomous outcome measure was used to perform McNemar’s test. Both questionnaires were able to discriminate the clinical conditions of the patient’s symptom into mild or severe. In conclusion, MVSS, which is the shortened and simplified version of VSS, is simpler, easier to administer, and easier to
understand. The findings herein also provide some good psychometric properties of the MVSS. It is suggested that this questionnaire be considered for use and implementation in clinical evaluation of vertigo and for future research purposes.

**Keywords:** Clinical assessment translation, criterion-related validity, vertigo, Vertigo Symptom Scale

**Introduction**

Subjective outcome measures are important elements in clinical practice especially for chronic and complicated disorders due to their impacts on a patient’s life including physical, social and psychological aspects. Over the last two and half decades, several specific disease questionnaires have been developed for dizziness. In this study we used one of the more established questionnaires with good validity and reliability values as our reference: the 34 items Vertigo Symptom Scale (VSS) by Yardley *et al.* (1992).

VSS is one of the subjective tools that has been validated amongst the UK population (Yardley *et al*., 1992; Yardley *et al*., 1998) and it has been translated into seven others languages: Dutch, French, German, and Spanish, Swedish, Turkish and Malay (Yardley *et al*., 1994; Yardley *et al*., 1999; Zuraida *et al*., 2010). VSS has also been used extensively for research purposes (Yardley *et al*., 1998; Guerraz *et al*., 2001) and it is sensitive enough, where the two main subscales: vertigo and somatic anxiety are able to show discrimination between the symptomatic and healthy patients (Yardley *et al*., 1998; Guerraz *et al*., 2001; Söderman, *et al*., 2002). Most of the currently available questionnaires have limitations, including excessively long or complex, and cause unacceptable patient burden, especially to the elderly.

Apart from the Short Form VSS by Yardley *et al.* (1998) none of the current questionnaires have demonstrated to have adequate construct validity and/or reliability. Historically, there was a shortened (15-item) validated version of the VSS developed by Yardley *et al.* (1998) and it has been used in several studies as a disease-specific instrument to assess patients’ symptoms (Kroenke *et al*., 2000; Söderman *et al*., 2002). The analysis of this Short Form VSS confirmed
that it had good reliability with alpha coefficient of 0.88 and the test-retest reliability of 0.60, where the time repeated was six months after the first test.

However, in the same year, a slightly shorter version was developed. This Modified VSS (MVSS) by Davies et al. (1998 unpublished) was introduced to the clinical setting. The extraction of items was from factor analysis - a method widely used in the shortening process (Pappas, 2003). Results from this analysis allowed selected items from the first eight factors (i.e. groups of homogeneous questions) with high Eigenvalues and high loading factor to be identified. These questions were then selected and used as items in the Modified VSS.

Thus, the number of items were reduced from 34 (the original VSS) to 14 (on the new, shorter MVSS). For Subscale 1 (vertigo severity / duration) the items were reduced from 17 to 6; for Subscale 2 (autonomic symptoms) from 8 to 4 items; and for Subscale 3 (somatisation symptoms) from 9 to 4 items. Factor analysis was part of the validation process to prove that the questionnaire was able to classify clusters of symptoms into three different sub-scales measuring: 1) balance disorder, 2) somatic anxiety, and 3) autonomic arousal, in a way that was different from the original VSS which classified symptoms into four sub-scales (Yardley et al., 2002).

To ensure applicability, once a new instrument or tool has been developed, the next step is to know its validity and reliability. This is ethically sound and it provides an evidence of rigour in research before practitioners are able to implement and use the new instrument as a guideline and assessment tool. For this study, validity is described as the “degree with which the measured value reflects the characteristic it intends to measure” (Lewis, 2004). Generally, in order to test the validity there are two main construct (or translation) validity methods. The first is the subjective method, which includes face and content validity (Roach, 2006). The second is the objective method (or criterion-related) that includes known groups, convergent, predictive, concurrent and discriminant validity (Roach, 2006).

The purpose of our research was to validate the English language version of the MVSS. Our contestation is that the MVSS is equally valid as the original VSS for rating patients’ symptoms
of balance dysfunction, somatic anxiety and autonomic arousal. Since its development, no confirmatory factor analysis study or other validation study has been done to provide evidence or the establishment of validity and reliability values. Construct validity has already been achieved in part via a factor analysis among 114 patients with dizziness (Davies et al., 1998 unpublished). For this study, we attempted to establish the criterion-related validity of the MVSS, in particular, the English language version. We hope that this self-administered MVSS will be suitable for use by clinicians as a guide and assessment in the management of patients with vestibular-related disorders.

**Subjects and Methods**

*Subjects*

As the instrument is for the specific use of vestibular-related disorders, the selection of research respondents was hence purposive. The inclusion criteria were 1) patient with symptoms of vestibular disorders, and 2) 18 years old and above. The exclusion criteria were: patients, who after assessment were 1) found not to have a vestibular disorder, 2) had central causes of dizziness, or had progressive vestibular disorders i.e. Meniere’s disease, and 3) age <18 and >75 years old. From this initial screening, 110 patients were invited to participate in our study. These patients had been attending the Neuro-otology department of the National Hospital for Neurology & Neurosurgery, Queen Square, London.

The subjects were purposively grouped into group 1 and group 2. Patients who were placed into Group 1 were the untreated patients newly referred with dizziness. Patients who were placed into Group 2 were individuals who were clinically referred as treated dizzy patients, seen as follow-ups who have completed a minimum of three months balance exercises (i.e. Customised Cawthorne Cooksey Exercises, or Cawthorne Cooksey Exercises). Both groups were asked to complete the VSS and MVSS instruments.

Among these patients, only 97 cases (from both group 1 and 2) returned and completed the VSS and MVSS instruments, yielding a return rate of 88%. All the involved patients were from an
age range of 18-75 years, with a mean age of 47.92 (S.D=13.17). The means age for group 1 was 49 (S.D =13.84) and group 2 = 46.92(S.D=12.58). The ratio for male to female in group 1 was 2:3 and group 2 was 1:4 (Table 1 is referred). 66% (28 cases) of all newly referred cases (group 1) were women. 75% (41 cases) of follow-up cases were women.

Outcome measures

As the main aim of our study was to test for the criterion-related validity of the Modified VSS compared to VSS, the instruments used in this sampling were:

1. VSS by Yardley et al. (1992) (appendix 1).
2. MVSS by Davies et al. (1998 unpublished) (appendix 2).

As mentioned previously, the MVSS (Davies et. al., 1998 unpublished) only contained 14 items. Generally both instruments were able to distinguish patients’ complaints of dizziness and vertigo into three major subscales:

(a) Balance disorder dysfunction (e.g., dizziness, vertigo, postural instability, and falling)
(b) Somatic anxiety (e.g., diverse pains and somatic sensations)
(c) Autonomic arousal (e.g., sweating, pounding heart, breathing difficulties, and fainting)

Methods

During a clinic visit, the patient was approached and informed about this current study. Once information regarding the nature and scope of this study was given in both written and verbal versions, the patient was invited to participate. After obtaining written consent, the VSS and MSS were given to the participants who fulfilled the inclusion and exclusion criteria.

In terms of ethical considerations, the study was approved by the Ethic Committee National Hospital Neurology and Neurosurgery (NHNN) with the reference number 06/Q0512/54. In addition, the format of the instruments did not contain patients’ identifiable information and
patients were assured of their anonymity. The participation in this study was voluntary without any monetary reward.

Statistical analysis

Descriptive and inferential statistical analyses were conducted using SPSS software version 20.0. To initiate inferential analysis, the total score for each VSS and MVSS was calculated from the sum of all items for each patient. In order to establish the concurrent validity between total score and each subscale (vertigo, somatic anxiety and autonomic) for VSS and MVSS in each group Pearson’s correlation was used. In order to assess the predictive validity of MVSS, dichotomous outcome measure was used prior to performing McNemar’s test.

Results

In order to assess the criterion-related validity the concurrent and predictive validity of MVSS was examined.

Concurrent validity of MVSS

For concurrent validity, Pearson’s correlation was used. We were also interested to see the correlation in each subscale (vertigo, somatic anxiety and autonomic) between the two version of VSS. After analysis, it was found that there are significant positive correlations (p< 0.0001) between VSS and MVSS for both groups with r= 0.92 for group 1 and r = 0.93 for group 2 (refer to figure 1).

Both VSS and MVSS divided the items into three subscales: vertigo, somatic anxiety, and autonomic. In this current study, there is evidence of significant and high, or positive correlation, between the three subscales in the VSS and MVSS (Figures 2, 3 and 4 are referred). For vertigo subscale, r= 0.87 was obtained for group 1 and r=0.88 was obtained for group 2. As for the somatic anxiety subscale, group 1 evidenced r=0.76 and group 2 evidenced r= 0.85. With regards to the autonomic subscale, r=0.82 and r= 0.91 were obtained by group 1 and group 2,
respectively. According to Mukaka (2012), when the size of correlation is between 0.70 and 0.90, it is interpreted as high positive correlation. When the values are above 0.90, it is interpreted as very high positive correlation.

*Predictive validity of Modified VSS*

For predictive validity of MVSS, we used the dichotomous outcome measure prior to conducting the McNemar’s test. The total score of both instruments were classified into two different symptoms scores: mild or severe severity. The determination of category was based on certain fix range or cut off (Table 1). The outcomes showed that both instruments were able to discriminate the clinical conditions of the patient’s symptoms into either in the mild or severe severity symptom scale.

Using McNamer’s test, a comparison of the following two proportions found that % +ve for VSS = 65% and % -ve for MVSS = 68% with a difference = 3%. The Confidence Interval (CI) of 95 is (-2%, 8%) for the difference in the +ve rate between the instruments. Due to small numbers in some cells, P = 0.45. It emerged that there is no evidence to suggest that the VSS is any better than the MVS in making a diagnosis. With a P value of 0.45, we cannot reject the null hypothesis; therefore we assume that VSS and MVSS are similar.

The test also showed that MVSS has high sensitivity and specificity which are 92% and 94%, respectively. Apart from that, the Positive predictive value is 15.4 and the Negative predictive value is 12.34 (Table 2).

Kappa 0.838 indicates that there is an almost perfect agreement between MVSS and VSS in term of their ability to categorized and allocated patients’ clinical condition into mild or severe severity symptom score. This finding supports that there is no significant difference between the two different versions of the instrument. The lack of difference was not due to chance or effect of sample size.
Discussion

Prior to the development of this modified version, both clinicians and patients had difficulty in interpreting the meaning of some items in the original VSS. It was also likely that the patient interpreted symptoms differently compared to the attending clinician. MVSS reduced item ambiguity and made it easier for patients to confirm the presence of symptoms without the need for lengthy explanations.

The above findings provide some evidence of psychometric validity for the MVSS. This information is essential for clinicians. It directly impacts diagnosis and case management. The information may also be of use in vertigo-related research. Despite having different number of items, the high correlations in both instruments indicate that both versions are able to assess patients’ clinical condition similarly. For practical application, this indicates that the MVSS with 14 items is able to save time and assess patients’ current clinical condition as accurately as the VSS with 34 items.

In addition, there are high correlation values in each subscale of vertigo, somatic anxiety, and autonomic. The values ranged between high positive correlation and very high positive correlation. This indicates that in terms of the overall concurrent validity and of each subscale for the MVSS is very good. The division of scores into these three scales enables a more patient-specific treatment module to be formulated. For example, if the vertigo subscale had the highest scores, it would indicate a need to focus treatment on the vertigo subscale items compared to autonomic symptoms.

The McNemar’s Test was conducted with a continuity correction of $P = 0.45$, so the null hypothesis could not be rejected and therefore was assumed to be true. This adds support that the Modified VSS is as good as the VSS. Both versions are quite similar in term of their sensitivity in evaluating and categorizing specific vertigo clinical symptoms. According to the dichotomous outcome measure and the McNamer’s test findings, the predictive validity of MVSS is similar compared to the VSS. Furthermore, the findings indicate that the MVSS has high sensitivity and specificity in term of assessing a patient’s condition.
Conclusion

In conclusion, MVSS, which is a shortened and simplified version of VSS, is comparatively more beneficial for use. High values in criterion-related validity of the MVSS were evidenced herein. Thus, the aim of the study was achieved. It is hoped that this MVSS, with only 14 items, will be of more practical value for clinicians, patients, and researchers.

Acknowledgments

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References


Appendix 1:

VERTIGO SYMPTOM SCALE BY (YARDLEY *et al.*, 1992)

This questionnaire is part of a study looking at how people are affected by dizziness. We hope that it will help us to understand how dizziness interferes with everyday activities and how we can best help people overcome these difficulties. We expect that the questionnaire will take about 5 minutes to complete but we would like you to state the actual time taken. The answer will remain completely confidential. Thank you for your co-operation.

We would first like to ask you a few questions:

What is your name?
How old were you at your last birthday?
Are you male or female?
What is your current contact number?

The following questions ask about the type of symptoms you experience and how many times you have experienced each of the symptoms listed below during the past 12 months (or since the vertigo started, if you have had vertigo for less than one year).

The meanings of the number responses are:
0 Never
1 A few times (1-3 times a year)
2 Several times (4-12 times a year)
3 Quite often (on average more than once a month)
4 Very often (on average, more than once a week)

How often do you have the following symptoms?
1. A feeling that things are spinning or moving around, lasting:(please answer all the categories)
   a) Less than two minutes 0 1 2 3 4
   b) Up to 20 minutes 0 1 2 3 4
   c) 20 minutes to 1 hour 0 1 2 3 4
   d) Several hours 0 1 2 3 4
   e) More than 12 hours 0 1 2 3 4
2. Pains in the heart or chest region 0 1 2 3 4
3. Hot or cold spells 0 1 2 3 4
4. Unsteadiness so severe that you actually fall 0 1 2 3 4
5. Nausea (feeling sick), stomach churning 0 1 2 3 4
6. Tension/soreness in your muscles 0 1 2 3 4
7. A feeling of being light-headed, “swimmy” or giddy, lasting (please answer all the categories):
   a) Less than two minutes
   b) Up to 20 minutes
   c) 20 minutes to 1 hour
   d) Several hours
   e) More than 12 hours

8. Trembling, shivering

9. Feeling of pressure in the ear(s)

10. Heart pounding or fluttering

11. Vomiting

12. Heavy feeling in arms or legs

13. Visual disturbances (e.g. blurring spots before the eyes)

14. Headache or feeling of pressure in the head

15. Unable to walk or stand properly without support

16. Difficulty breathing, short of breath

17. Loss of concentration or memory

18. Feeling unsteady about to lose balance, lasting:( please answer all the categories)
   a) Less than two minutes
   b) Up to 20 minutes
   c) 20 minutes to 1 hour
   d) Several hours
   e) More than 12 hours

19. Tingling, prickling or numbness in parts of the body

20. Pains in the lower part of your back

21. Excessive sweating

22. Feeling faint, about to black out
Appendix 2
Modified Vertigo Symptom Scale (Davies, et al., 1998)

Non-Validated Questionnaire

Version: 2
Date: 22/06/2006
Patient ID:

This questionnaire is part of a study looking at how people are affected by dizziness. We hope that it will help us to understand how dizziness interferes with everyday activities and how we can best help people overcome these difficulties. We expect that the questionnaire will take about 5 minutes to complete but we would like you to state the actual time taken. The answers will remain completely confidential. Thank you for your co-operation.

We would like to ask you a few questions:

What is your hospital number? ..................................................

How old were you at your last birthday? .................................

Are you male or female? ...........................................................

What is your current contact number? ......................................

The following questions are designed about the sort of dizziness you experience and how it affects you. Please answer the questions by circling the appropriate responses for the period of the last 12 months or since the vertigo started (if you have had vertigo for less than one year) i.e.:

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| 1. | Do you have a feeling that things are spinning or moving around you lasting for less than 2 minutes? | 0 | 1 | 2 | 3 | 4 |
| 2. | Do you have feeling of pressure in the ear(s)? | 0 | 1 | 2 | 3 | 4 |
| 3. | Do you have attacks of trembling and shivering? | 0 | 1 | 2 | 3 | 4 |
| 4. | Do you have feelings of being light-headed, “swimmy” or giddy, lasting more than 12 hours? | 0 | 1 | 2 | 3 | 4 |
| 5. | Do you have difficulty breathing or a feeling short of breath? | 0 | 1 | 2 | 3 | 4 |
6. Do you feel excessively sweaty?  
7. Do you have a feeling that things are spinning or moving around? lasting for several minutes to 1 hour?  
8. Vomiting  
9. Do you have a headaches or feeling of pressure in the head?  
10. Do you feel unsteady or about to lose balance for more than 12 hours?  
11. Do you have feeling tingling, prickling or numbness in parts of the body?  
12. Do you have feeling unsteady about to lose balance for less than 2 minutes?  
13. Do you have pains in your heart or chest region?  
14. Do you have feelings of being light-headed, “swimmy” or giddy, lasting several minutes to 1 hour?  

Thank you for your participation.