University of Southampton
Faculty of Engineering, Science and Mathematics
Institute of Sound and Vibration Research
Hearing and Balance Centre

Development of a Quality of Life Outcome Measure for Vestibular Rehabilitation

June, 2005

by

Anna Morris

Supervised by
Professor Mark Lutman, Hearing and Balance Centre
Professor Lucy Yardley, School of Psychology

ABSTRACT

FACULTY OF ENGINEERING, SCIENCE AND MATHEMATICS
INSTITUTE OF SOUND AND VIBRATION RESEARCH

Doctor of Philosophy

DEVELOPMENT OF A QUALITY OF LIFE OUTCOME MEASURE FOR VESTIBULAR REHABILITATION

by Anna Morris

Dizziness is a common complaint accounting for a significant proportion of medical consultations. Patients presenting with dizziness frequently report associated psychological consequences and lifestyle restrictions that have implications for quality of life. Vestibular rehabilitation aims to address the symptoms and consequences of dizziness and in most cases is the appropriate approach to management. Performance measures of outcome are inappropriate in this context and self-report measures are considered the most suitable indicators of rehabilitative success. Self-report measures of dizziness are available but have not been developed specifically to measure rehabilitation outcome and no single measure addresses the full range of dizziness impact. A need is identified for a suitable outcome measure for vestibular rehabilitation. In the area of self-report measures, there is debate about the most appropriate method of measuring change. Some favour a before and after 'state' approach while others favour a direct measure of 'change'. Previous research suggests that 'state' measures may be confounded by response shift bias. A suitable outcome measure for vestibular rehabilitation should use the approach to measuring change that is most appropriate in this context

The aim of the present study was to develop a validated and responsive self-report measure of outcome from vestibular rehabilitation. It was considered that an appropriate outcome measure should capture the aspects of dizziness impact that are relevant to patients. It was intended that the measure should also be convenient for routine clinical use. A further aim was to compare 'state' and 'change' methods of measuring self-reported change in the context of vestibular rehabilitation, in terms of responsiveness and bias.

A new questionnaire, the Vestibular Rehabilitation Benefit Questionnaire (VRBQ), was developed over three phases of work focusing on i) generation, ii) refinement and iii) validation, using data from a total of 297 patients. A preliminary list of questionnaire items was generated through qualitative analysis of interview data provided by patients undergoing vestibular rehabilitation. Following this, a cross-sectional study of patients undergoing vestibular rehabilitation provided quantitative data that allowed further refinement of the preliminary item list. Finally, a longitudinal study of patients undergoing vestibular rehabilitation provided data to investigate the validity and responsiveness of the new questionnaire. Data from the longitudinal study also allowed comparison of 'state' and 'change' methods of measuring self-reported change.

Factor analysis revealed an underlying structure of four subscales measuring Dizziness, Anxiety, Motion-Provoked Dizziness and Quality of Life. The four subscales were found to be reliable and the construct validity of the new questionnaire was demonstrated. Effect size estimates obtained from the longitudinal study indicated that the VRBQ was more responsive to change than alternative measures of dizziness impact or health-related quality of life. The psychometric profiles of 'state' and 'change' formats suggested that direct 'change' measures were affected by social desirability bias in this context.

A patient-driven disease-specific quality of life measure of outcome from vestibular rehabilitation has been developed. The questionnaire, the Vestibular Rehabilitation Benefit Questionnaire, appears to be valid, reliable and responsive. The questionnaire is concise, psychometrically robust, and addresses most areas of dizziness impact, providing a convenient tool for a variety of roles in clinic, research and audit. Findings from the present study provide preliminary evidence that response shift biases are minimal in the context of dizziness and vestibular rehabilitation when using the 'state' approach to measuring change. However, direct 'change' measures may suffer from social desirability bias and are not recommended.

Acknowledgements

I would like to acknowledge the contribution of all those who have helped me to complete this thesis:

Firstly, I would like to thank my supervisors, Professors Mark Lutman and Lucy Yardley, for their expertise and guidance. Thanks also to Mum who bravely agreed to act as 'second coder' of the qualitative data, and made a fantastic job of it.

This work would not have been possible without the help of the many clinicians and patients at participating hospitals and I am very grateful for their contribution. Special thanks go to Chris Wood - without Chris's enthusiasm and dedication to the cause this thesis may never have been completed, or at least would have taken an awful lot longer.

I would like to thank my family, friends and colleagues whose support and encouragement have been greatly appreciated. Pete, Dawesy, Nom, Ben, Jane and Emma are amongst the many people who have kept my spirits up. Andrew, you missed the long-haul but you were there for the party at the end – thank you for being lovely and for laughing at my jokes.

Finally, I want to thank Mum and Dad for their bottomless pit of love and support despite my chequered relationship with the education system – you gave me the confidence and determination to do this.

Table of Contents

Chapter One. Introduction

Chapter Two. Review of the Literature

Chapter Three. Questionnaire Development (Phase I)

Chapter Four. Questionnaire Refinement (Phase II)

Chapter Five. Questionnaire Validation (Phase III)

Chapter Six. Measuring Change: A Comparison of Methods

Chapter Seven. Summary

List of Tables

List of Figures

List of Appendices

Chapter One. Introduction

1.1. Overview

Most cases of dizziness are idiopathic (Hazlett *et al*, 1996) yet the condition has been shown to have a significant impact on health-related quality of life (Honrubia *et al*, 1996). The World Health Organization's International Classification of Functioning, Disability and Health explicitly recognises that the impact of a condition is not contingent on aetiology (WHO, 2002). Population studies provide estimates of dizziness in the community of around 20-40% (Patrick and Peach, 1989; Stephens, 1990; Yardley *et al*, 1998a; Booth, 2000); approximately half of those who have experienced dizziness report associated handicap, anxiety or avoidance behaviour (Yardley *et al*, 1998a). This suggests there may be an unmet need for intervention aimed at reducing the effects of dizziness on quality of life. Clinic samples report higher levels of impact with around two thirds presenting with concurrent psychiatric symptoms (McKenna *et al*, 1991; Eagger *et al*, 1992).

The association between dizziness and autonomic nervous system symptoms is well-documented and has both psychological and neurological bases. Research suggests that symptoms of anxiety, negative beliefs about dizziness and avoidance behaviour play an important role in sustaining dizziness and are the best predictors of both the level of handicap and prognosis (Hagnebo *et al*, 1997; Yardley 1994a). Addressing these aspects of the problem will, therefore, be important in reducing quality of life impact and are germane to measures of treatment success.

Vestibular rehabilitation is a commonly used approach to treatment for dizzy patients that aims to reduce the impact of dizziness on quality of life (Shumway-Cook and Horak, 1989; Yardley and Luxon, 1994; Giardi and Konrad, 1998). In vestibular rehabilitation, neurological mechanisms to overcome symptoms are stimulated by a structured exercise programme (Herdman and Whitney, 2000), and psychological factors which influence symptoms and handicap are addressed through formal or informal counselling (Yardley 1994b). Research evidence shows that vestibular rehabilitation improves both functional balance performance and self-reported dizziness (Horak *et al*, 1992; Krebs *et al*, 1993; Shepard *et al*, 1993; Shepard and Telian, 1995; Shumway-Cook *et al*, 1996; Cowland *et al*, 1998; Yardley *et al*, 1998d;

Cohen and Kimball, 2003; Krebs *et al*, 2003), although there is no single instrument that is widely recognised as a suitable measure of outcome. Measures of treatment success have many applications that are relevant to patients, clinicians, researchers and purchasers of healthcare services (Fielder *et al*, 1996). Outcome measures play an important role in guiding patient management and indicating the need for onward referral (Berger *et al*, 1981; Gatehouse, 1999a). A valid measure of outcome is vital to provide the evidence of treatment efficacy needed to support funding proposals for new services or service development, compare treatment regimes and monitor quality standards.

An assumption of the present study is that objective measures of physiological status are inappropriate methods for measuring outcome from vestibular rehabilitation. The rationale of this assumption is that measurements of physiological status neglect the aspects of dizziness impact which research evidence shows are the best predictors of quality of life impact, i.e psychological and psychosocial aspects (Jacobson and Newman, 1990; Clark *et al*, 1993; Newman and Jacobson, 1993; Yardley *et al*, 1992a; Yardley *et al*, 1994a; Yardley, 1994b; Kinney *et al*, 1997; Yardley *et al*, 1998a, Bamiou, 1999).. Furthermore, a wealth of research evidence indicates a poor relationship between objective measures and the individual's experience of dizziness where evidence of dysfunction is commonly absent (Jacobson and Newman, 1990; Yardley *et al*, 1992a; Clark *et al*, 1993; Yardley *et al*, 1994a; Yardley, 1994b; Yardley *et al*, 1995; Yardley *et al*, 1998b; Jacobson and McCaslin, 2003). Measures of functional performance may play a role in assessing improvements in balance ability but are inappropriate measures of outcome in isolation as they do not address the full range of dizziness impact. It is assumed, therefore, that subjective evaluation offers the most appropriate approach to assessing the impact of dizziness on the individual, and changes in impact resulting from intervention. Research shows clinician ratings of quality of life to be inconsistent with patient perception of benefit (Bowling, 1991; Honrubia *et al*, 1996). Consequently a self-report measure, which assesses all aspects of quality of life impact, is considered the most appropriate method of evaluating benefit from vestibular rehabilitation.

Generic health-related quality of life questionnaires tend to be lengthy and unresponsive to subtle therapeutic benefits in specific conditions (Lynn *et al*, 1999;

Enloe and Shields, 1997; Gatehouse, 1998). A number of questionnaires specific to dizziness are available and several have been well validated in the role of assessing dizziness handicap. However, no single measure captures all areas of quality of life impact, none have been designed for the specific purpose of evaluating intervention benefit and many are not based on issues of concern to the patient population. A need is identified for a psychometrically robust and responsive patient-oriented measure of quality of life benefit from vestibular rehabilitation.

A number of assumptions guided the aims of the present research and are outlined below. It is felt that the characteristics of an appropriate outcome measure for a given treatment should taken into account the nature of the treatment in question and the profile of the patient population being treated. Vestibular rehabilitation is not a strictly prescribed method; the content of treatment programmes varies depending on the approach of the clinician and the characteristics of the patients. In this context, it is considered that a useful outcome measure should be sensitive to both small and large degrees of change in all areas of function that may improve with therapy. This means that, as well as measuring marked changes in symptoms and quality of life impact in patients where there is scope for radical improvement, the measure should also detect changes in patients where only small degrees of change are possible. Similarly the *nature* of treatment effect may vary depending on the characteristics of the patient's problems and the approach of the therapist. A useful measure should be sensitive to changes in different aspects of treatment effect whether that is changes in symptoms, well-being or life functioning. These considerations underpin the methods that are used in the present work to develop a measure of vestibular rehabilitation benefit.

There are two possible methods of measuring self-reported change. A 'change' questionnaire asks patients how much they have changed since treatment began, whereas a 'state' questionnaire asks them to report on their status at the time of completion and the amount of change is *derived* by comparing measurements taken before and after treatment. Research evidence regarding the most appropriate approach is conflicting. Some researchers suggest that a 'change' measure optimises sensitivity to intervention benefit (Gatehouse, 1999), although this approach is potentially confounded by retrospective reporting bias and social desirability responding (Sprangers, 1989). Before and after measures of 'state' may mitigate these disadvantages but evidence suggests that these measurements may be biased by changes in internal standards known as 'response shifts' (Howard *et al*, 1979; Sprangers, 1989). To minimise bias in the measurement of quality of life benefit from vestibular rehabilitation, the method of measuring change should be considered carefully. In developing a new questionnaire, an opportunity arises in the present study to compare the two approaches to measuring change in the context of vestibular rehabilitation.

This thesis is separated into three parts. In Phase I, qualitative methods are used to generate descriptions of quality of life changes resulting from dizziness and vestibular rehabilitation from the patient population. This process aims to encompass the full range of pre-therapy handicap experienced by patients, and embraces quality of life changes in patients treated by different approaches. From analysis of these descriptions, a number of items are developed, forming a preliminary version of a questionnaire to measure quality of life change. The second phase focuses on refinement of the questionnaire by collecting data to guide reduction of the number of items to a clinically viable number providing the most useful information. A preliminary field test to generate comments on face validity, is followed by a larger field test to provide data for tests of internal consistency and item reduction. Exploratory factor analysis establishes the subscale structure within the data. The final phase, Phase III, describes a large scale trial to assess validity, test-retest reliability and responsiveness of the questionnaire in relation to existing measures of dizziness and related constructs. The final phase also provides data for the comparison of 'state' and 'change' approaches to measuring change in the context of vestibular rehabilitation.

1.2. Original Contribution to Knowledge

This thesis makes a number of original contributions to the body of knowledge in the areas of dizziness impact and measurement of benefit from vestibular rehabilitation:

- Exploratory investigation to establish a comprehensive list of quality of life aspects affected by dizziness from the perspective of patients through in-depth semi-structured interviews (data collection, analysis and results described in Chapter Three)
- Developed, refined and validated a list of questions that reflect aspects of quality of life affected by dizziness through empirical analysis of qualitative and quantitative data provided by 297 patients (processes described in detail in Chapters Three, Four and Five)
- Preliminary investigation into the phenomenon of response shift bias in the context of measuring changes in dizziness over time (rationale and methodology are described in Chapter Five, analysis and interpretation of results are presented in Chapter Six)
- Empirical comparison of two approaches to measuring change in the context of vestibular rehabilitation (rationale and methodology are described in Chapter Five, analysis and interpretation of results are presented in Chapter Six)
- Preliminary examination of evidence regarding the areas of quality of life impact where most change is measured (results presented and discussed in Chapter Five)
- Propose a new outcome measure for vestibular rehabilitation that is founded in the concerns of patients and is comprehensive in its coverage of the areas affected by dizziness; assessment of its validity, reliability and responsiveness; appraisal of its practical advantages over existing alternatives (properties of new measure summarised in Chapter Seven)

Chapter Two. Review of the Literature

The following chapter provides an overview of the literature surrounding dizziness, vestibular rehabilitation and the measurement of change. A comprehensive search was undertaken to identify relevant literature using internet search tools appropriate to the area of study, predominantly the United States National Library of Medicine index of biomedical articles (PubMed). This strategy was used to identify the majority of the literature and further literature was identified by reviewing the references of the most relevant papers.

2.1. Dizziness and Quality of Life

2.1.1. Definitions

2.1.1.1. Vertigo and dizziness

Vertigo describes the illusion of movement of the self or the environment which is usually, although not strictly, rotatory[1]. Vertiginous symptoms are most commonly associated with unilateral peripheral vestibular pathology, but may also result from disturbances of the vestibular nuclei, the brainstem or the visual system (Wright, 1988).

Oscillopsia refers to the relatively rare sensation that the environment is moving up and down, most commonly when walking. It arises when head motion is too rapid for eye movement to be fully controlled by the visual and proprioceptive systems in the event of bilateral vestibular failure.

Other terms commonly used to describe feelings of dysequilibrium include dizziness, unsteadiness, light-headedness and giddiness. In a study of 99 patients with evidence of peripheral vestibular disorder, 78% reported feelings other than vertigo including light-headedness, a 'swimmy' sensation, giddiness and unsteadiness (Mendel *et al*, 1999). Variations in the terminology used to describe a balance complaint may be related to the type of feeling experienced as well as individual differences in vocabulary.

---

[1] This scientific definition is distinct from the common usage of vertigo to describe a fear of heights.

For the purposes of this study the term dizziness will be used to denote all sensations of imbalance and is not used to imply anything about the nature or aetiology of the experience.

2.1.1.2. Models of disability

The World Health Organization (WHO) describes the two main models of disability that have been used to characterise the concept of disability and how it should be managed (WHO, 2002). The 'medical model' characterises disability as a feature of the individual person that is caused by a disease or other health condition. Using this model, healthcare is provided by professionals to remove or 'correct' the underlying health condition which causes the individual to be disabled. The 'social model' of disability conceptualises disability as a problem created by the social context it exists within. Disability is seen as something which is created by barriers in the environment, either physical or attitudinal. Hence, it is these socially-constructed barriers, rather than the individual, that should be modified to alleviate the disability.

The WHO argues that both models have strengths but that neither model is entirely adequate in isolation. They suggest that disability is an interaction between the individual and the context within which the individual exists and that intervention based on either or both models can be appropriate.

The model from which health conditions and their impact is viewed has implications for selecting appropriate intervention, and consequently for measuring intervention outcome.

2.1.1.3. Descriptions of health states and their consequences

The WHO's International Classification of Functioning, Disability and Health (WHO, 2002), known as ICF, sets out a classification system for health and health-related states that provides a standard language and framework for the description of health and its consequences. The classification system provides a common currency for use internationally in research, clinical, educational and policy-making contexts.

Health states are described in terms of *parts, components, domains* and *categories. Part* 1) Functioning and Disability, is subdivided into two *components* i) Body

Functions and Structures and ii) Activities and Participation, and *part* 2) Contextual Factors is also divided into two *components* i) Environmental Factors and ii) Personal Factors . The term 'functioning' describes non-problematic aspects of health and 'disability' describes problematic areas encompassing impairment, activity limitations and participation restriction. An individual's functioning and disability are seen as a dynamic interaction between health conditions (i.e. diseases and disorders) and the context in which they occur. Diseases and disorders, that is diagnostic categories of health states, are described elsewhere in the WHO International Classification of Disease, now in its tenth edition (ICD-10; WHO, 1992); only the functioning and disability associated with disease or disorder are described in ICF.

This approach to health classification, where it is explicitly recognised that the impact of a problem is not contingent on aetiology, is particularly appropriate to a condition such as dizziness. Furthermore, the classification system facilitates description of health states allowing for the fact that two individuals with the same disease may have very different functional states and that two individuals who function similarly do not necessarily suffer with the same disease. Dizziness can arise from a variety of aetiologies although diagnosis often remains unconfirmed and even when identified, evidence suggests that there is a poor relationship between aetiology and the impact of the condition on the individual. This issue is explored in Section 2.1.2.3 below.

Health and health-related states are characterised by identification of the appropriate code which is arrived at by moving through the hierarchy of *parts*, *components*, *domains* and finally *categories* which are the unit of classification. For example, to classify the sensation of dizziness the user identifies this as an aspect of *part* 1) Functioning and Disability and within this selects the *component* of Body Functions and Structures. Within this level of the classification system is *domain* b235 Vestibular functions and within this is the unit of classification, *category* b2401 Dizziness. Categories are qualified by a numeric code which denotes magnitude which, where appropriate and available, is linked to percentiles of population data. The second *component* of Functioning and Disability describes Activities and Participation and is broken down into nine *domains:* Learning and Applying Knowledge, General Tasks and Demands, Communication, Mobility, Self-Care, Domestic Life, Interpersonal Interactions and Relationships, Major Life Areas, Community, Social and Civic Life. The literature concerning the impact of dizziness suggests that all areas may be affected, with the possible exceptions of two domains (Learning and Applying Knowledge and Communication).

The second *part*, Contextual Factors, acknowledges both the positive and negative role that the physical, social and attitudinal world may have in determining the impact of a health condition. By incorporating these influences, the classification system embraces the social model of disability and attempts to synthesise social and medical models to provide a broad perspective of health and its consequences for the individual and society. Medical and social models of disability are described above in Section 2.1.1.2.

Although the WHO now classifies health states and their consequences according to the system described above, for consistency with conventions in literature which predates ICF, the terms impairment, disability and handicap are sometimes used in the present work. These terms are used in accordance with the definitions set out by the WHO's previous system for classification, the International Classification of Impairments, Disabilities and Handicaps (WHO, 1980). Impairment refers to disturbances at the level of the organ resulting in loss of anatomical structure or psychological function; disability refers to disturbances in function at the level of the person where an impairment causes restricted ability to perform activities within the normal human range; handicap refers to a disturbance in social role functioning where an impairment or disability limits the fulfilment of a role that is considered normal within the social and cultural environment of the individual.

2.1.1.4. Health-related quality of life

The World Health Organization defines quality of life as an individual's perception of their position in life viewed within the context of their cultural values, expectations and concerns (WHOQOL Group, 1993). They state that the notion of life satisfaction relative to social norms is multi-faceted and may be influenced by physical health, psychological state, level of independence and social relationships.

Health-related quality of life is distinct from quality of life in that it does not incorporate issues of income and housing (Bowling, 1991); however, it is considered as broader than a biomedical phenomenon (Lerner, 1973). It is a dynamic concept referring to the impact of perceived physical, psychological and social well-being on the ability to live a fulfilling life (Bowling, 1991). Statements referring to 'health and personal safety' were the most frequently endorsed by participants rating areas seen to be critical to quality of life (Flanagan, 1982). In a study of dizziness and quality of life Hagnebo *et al* (1997) found a correlation between total present discomfort and reduced life satisfaction indicating that health is an influential component of quality of life which can be compromised by dizziness.

2.1.2. Dizziness

A discussion of dizziness and its consequences for the individual is given below.

2.1.2.1. Prevalence and incidence

Recent research indicates that dizziness is a common complaint. In a recent study (Booth, 2000), 40% of a population sample reported dizziness, of whom 45% reported material quality of life impact. Other studies reveal prevalence rates of a similar magnitude. In a GP practice sample, 23% of over 2000 subjects reported dizziness in the last month (Yardley *et al*, 1998a). Half of these subjects described a degree of associated handicap, 46% experienced anxiety and avoidance behaviour (compared with only 13% in the non-dizzy sample), 40% suffered occupational difficulties, 30% had suffered for longer than five years and 30% had experienced true vertigo. Other studies reveal self-reported dizziness in 25% of a rural population sample aged 50-65 years (Stephens, 1990) and 20% in a London population sample aged 25-64 years (Patrick and Peach, 1989).

In the UK, 0.7% of GP consultations are accounted for by complaints about dizziness (Bird *et al*, 1999) with eight in every 1000 people seeking help each year (Jayarajan and Rajenderkumar, 2003). In the US, dizziness is the third most common new complaint in a general outpatient clinic (Hazlett *et al*, 1996).

2.1.2.2. Causes of dizziness

Hazlett *et al* (1996) suggest that around 80% of dizziness in a general outpatient department is idiopathic. Research findings summarised in Section 2.1.2.3 below indicate a poor relationship between aetiology and handicap and, in most cases, aetiology does not influence treatment approach or predict outcome. For these reasons aetiology is not considered to be an important factor in relation to the present study and, therefore, a full discussion of causes is beyond the scope of this thesis. Briefly, otological causes of imbalance may be associated with the middle or inner ear or the neural connection emanating from the vestibular apparatus. Causes of dizziness originating in the inner ear fall into two broad categories: those resulting from trauma and those resulting from pathophysiological processes. Non-otological causes of dizziness may arise from the peripheral nervous system, the central nervous system or the vascular system. Peripheral neuropathies resulting in reduced sensation from the feet or ankles may cause a feeling of general unsteadiness.

2.1.2.3. Consequences of dizziness

In the literature relating to dizziness and its effect on the individual, references to psychological and psychiatric sequelae are abundant and are traceable back to 1770 (Jacob, 1988). Several authors report significantly raised prevalence of concurrent psychiatric symptoms (Coker *et al*, 1989; McKenna *et al*, 1991; Eagger *et al*, 1992; Sullivan *et al*, 1993; Yardley *et al*, 1998b; Mendel *et al*, 1999) specifically anxiety[2] (Yardley *et al*, 1992a; Honrubia *et al*, 1996); panic disorder[3] (Eagger *et al*, 1992; Sullivan *et al*, 1993); personality disorder (Coker *et al*, 1989; Brightwell and Abramson, 1975); phobias (Hallam and Stephens, 1985; Yardley *et al*, 1998a); particularly agoraphobia (Eagger *et al*, 1992); depression (Eagger *et al*, 1992; Kroenke *et al*, 1993; Sullivan *et al*, 1993; Honrubia *et al*, 1996) and somatisation disorder[4] (Hallam and Stephens, 1985; Yardley *et al*, 1992a; Kroenke *et al*, 1993; Sullivan *et al*, 1993). The incidence of psychiatric symptoms in dizzy patients is in the order of two-thirds (McKenna *et al*, 1991; Eagger *et al*, 1992), with one-sixth being diagnosed as having significant psychiatric disturbance (Eagger *et al*, 1992).

---

[2] Anxiety refers to a feeling of apprehension and fear which may have physical manifestations including an increased heart rate, hyperventilation and sweating.

[3] Panic disorder describes extreme episodes of anxiety associated with intense physical symptoms which may include dizziness.

[4] Somatisation describes a tendency to experience and report bodily symptoms which have no physical basis. Somatisation disorder is an extreme manifestation of this with specific psychiatric diagnostic criteria. Somatisation is referred to throughout the thesis as a general tendency rather than a diagnosed psychiatric condition.

The presence of concurrent anxiety or depression in dizzy patients predicts greater quality of life impact (Honrubia *et al*, 1996).

Research suggest that there is little association between objective tests of balance function in terms of evidence of vestibular disorder, its apparent severity, and patient psychological characteristics (Jacobson and Newman, 1990; Yardley *et al*, 1992a; Clark *et al*, 1993; Yardley *et al*, 1994a; Yardley, 1994b; Yardley *et al*, 1995; Yardley *et al*, 1998b). Honrubia *et al* (1996) found the impact of dizziness on daily activities to be unrelated to diagnostic category. Although evidence of vestibular dysfunction and aetiology appear unrelated to the impact on the individual, research findings indicate that some characteristics of the dizziness may affect the experience of psychological sequelae. Duration is influential (Mendel *et al*, 1999) where patients who have experienced dizziness for a longer period suffer less somatic anxiety, fewer psychosocial consequences and less handicap. Patients suffering frequent short-term dizziness were reported to experience significantly more symptoms of somatic anxiety. These findings suggest that processes of adaptation, which may include coping strategies, help to mitigate the impact of dizziness over time. Demographic characteristics may also affect the degree of psychological impact. Age appears to have a negative affect where greater psychosocial impact and anxiety are experienced by younger people and females are more likely to suffer autonomic symptoms (Yardley, 1994b; Mendel *et al*, 1999). Another influence on the degree of dizziness impact is the beliefs associated with the condition and its possible implications, and the way individuals modify their behaviour in light of these beliefs. The main themes arising from research concerning the beliefs of dizzy patients are fear of losing control (Yardley, 1994b), and the public discrediting which may result from this (Hallam and Stephens, 1985), fear of serious illness (Hallam and Stephens, 1985; Yardley, 1994b), fear of having a serious attack (Yardley, 1994b) and fear of falling (Hallam and Stephens, 1985). Nobbs (1987) suggests that fears may arise from the absence of a firm diagnosis or the lack of factual evidence regarding the prognosis. In the absence of this information the individual focuses on the possible negative implications and long term effects of their condition resulting in fear, anxiety and frustration.

The relationship between symptoms of dizziness and anxiety is complex and circular involving both psychological and neurological mechanisms. The unpredictable nature of the dizziness often results in anticipatory disability which causes individuals to modify their lifestyle (Yardley, 1994a). Even in the absence of the actual symptoms, individuals may self-impose psychosocial disability by limiting their travel and social commitments and, paradoxically, retard the process of central compensation by restricting physical activity. The mechanisms and catalysts for central nervous system compensation are described below in Section 2.1.3.2. Hagnebo *et al* (1997) report that 74% of their dizzy subjects avoided activities and situations. Restriction of activity further enhances the level of psychosocial disability by causing the loss of valued roles, pastimes and a supportive social network (Yardley, 1994a) thus augmenting feelings of isolation and anxiety. Thus, an escalating cycle can arise whereby negative beliefs about dizziness cause restriction of physical and social activity, resulting in restriction of movement necessary to stimulate neurophysiological adaptation, thus maintaining the symptoms of dizziness and associated anxiety which reinforce negative beliefs.

In addition to the relationship between negative beliefs, behavioural responses and the consequent retardation of CNS compensation, there is also evidence of a neurological basis for the link between dizziness and anxiety. Symptoms of anxiety include syncope (a feeling of faintness) and hyperventilation which increase vestibular sensitivity (Jacob, 1988). Hyperventilation itself induces somatic symptoms including disorientation and studies have shown increases in body sway of healthy individuals following hyperventilation (Yardley and Redfern, 2001). Balaban and Thayer (2001) provide a comprehensive description of the shared neural circuits for processing vestibular information, autonomic functions, emotional responses and anxiety. The vestibular nuclei, in the lower brainstem, have strong links with the parabrachial nucleus which contains the neural networks involved in generating emotional, affective and physiological manifestations of fear and anxiety including changes in heart rate, perspiration, hyperventilation, piloerection (hairs standing on end), and somatic motor responses including avoidance of certain movements. The parabrachial nucleus is also known to mediate conditioned aversion responses to patterns of sensory stimuli such as the learned fear and avoidance responses associated with particular movements or environments commonly seen in dizziness.

Research shows that it is the psychological and somatic sequelae of dizziness, described above, rather than the dizziness itself which contribute most significantly to handicap (Yardley *et al*, 1992a). Responses to the Dizziness Beliefs Scale (described in Section 2.5.1.4 below), a questionnaire to assess negative beliefs and fears about dizziness, were found to be significantly related to self-reported handicap even after controlling for self-reported symptom severity and anxiety. This is consistent with the finding that the degree of handicap experienced does not correlate well with traditional measures of severity (Yardley *et al*, 1994a). Concerns about being perceived as incompetent and fear of social embarrassment have been found to be the most closely associated with handicap (Yardley, 1994b). Likewise, the SF-36 generic health-related quality of life questionnaire classifies patients with Meniere's disease as suffering from a 'minor medical' complaint on physical aspects of the scale including physical function, bodily health and role limitation due to physical problems, and a 'major medical' problem on dimensions which measure social function, role limitation due to emotional problems and vitality subscales (Kinney *et al*, 1997). The authors suggest that this indicates that treatment should not only aim to control symptoms but also to minimise the emotional impact of the condition.

The implication of these findings is that the extent to which dizziness becomes a chronic handicapping problem impacting upon quality of life is more dependent on factors extra to the vestibular system than to disease profile (Jacobson and Newman, 1990; Clark *et al*, 1993; Newman and Jacobson, 1993; Yardley *et al*, 1998a). This raises the issue of a dizzy patient 'personality profile' where certain psychological characteristics are thought to predispose some individuals towards dizziness or, at least, handicapping dizziness (Hallam and Stephens, 1985; Mendel *et al*, 1999). Other researchers, however, have found the prevalence of personality disorders to be comparable to the general population for dizzy patients experiencing a period of remission (Yardley *et al*, 1994a). This is related to the debate in the literature as to whether the relationship between dizziness and anxiety is psychosomatic or somatopsychic. Those who advocate a somatopsychic view include Yardley *et al* (1995) who report that the majority of dizzy patients suffering from panic or phobic symptoms experienced these symptoms following the onset of their dizziness and that no predisposition towards anxiety can be identified (Eagger *et al*, 1992; Yardley *et al*, 1992a). Eagger *et al* (1992) performed a retrospective study of psychological symptoms associated with dizziness and found none to have pre-dated the dizziness.

Conversely, Sullivan *et al* (1993) suggests that where psychological symptoms such as depression and somatisation disorder exist, dizziness may be a common secondary complaint. Jacob (1988) exposed normal subjects to simulations of dizziness and concludes that the absence of panic reactions confirms that anxiety in dizziness is due to predisposing personality factors. It should be noted, however, that many elements of the anxiety experienced by dizzy patients such as fear of serious illness and fear of public discrediting would not be relevant to healthy subjects participating in an experiment in a controlled environment. Some argue that the precise nature of the cause-effect relationship between dizziness and psychological disturbance remains unclear (Hagnebo *et al*, 1997) and that both psychosomatic and somatopsychic mechanisms may be involved in a feedback loop (Jacob, 1988).

In summary, a wealth of research evidence suggests that the handicap associated with dizziness is complex and is primarily influenced by factors other than the status of the vestibular system. These factors may include the psychological characteristics, lifestyle, environment, expectations, general health and coping skills of the individual (Newman and Jacobson, 1993; Bamiou *et al*, 1999). These findings have implications for the management of dizziness and for measuring success in a way that is meaningful.

2.1.3. Treatments for dizziness

2.1.3.1. Medical and surgical

A brief summary of medical and surgical approaches to the management of dizziness is given below; a full discussion beyond the scope of this thesis. The interested reader is referred to La Rouere (1997) and Brandt (2000) for a more comprehensive overview of medical and surgical management.

Surgical techniques generally boast high success rates but are only indicated for certain conditions. In many cases, surgery achieves success by permanent destruction of vestibular function on one side thus removing the potential for symptoms caused by changes in the symmetry of vestibular activity. Furthermore, due to the risks associated with any surgical procedure, particularly intra-cranial, this option is rarely considered until viable alternatives have been exhausted. If indicated, the severity and frequency of symptoms as well as the patient's hearing status and lifestyle must be considered before proceeding with surgery. Surgical options fall into two broad categories: destructive and preservative, referring to whether hearing is destroyed or preserved. Destructive surgery is more decisive in abolishing vestibular symptoms but is not considered appropriate for those with useful hearing or where there is a possibility that the vestibular system of the second ear may become affected.

Medical management of dizziness is dominated by use of vestibular suppressants and vasodilators. Vestibular suppressants offer symptomatic relief by reducing CNS sensitivity to vestibular signals which in turn suppresses connections to neural centres which produce sensations of nausea. Vestibular suppressants are also used to reduce symptoms of motion sickness. Alternatively, nausea associated with dizziness may be managed with anti-emetic drugs which act directly on the medullary centre which controls nausea and vomiting. Meniere's disease is commonly managed with long-term use of vasodilators. Vasodilators are intended to help prevent the build-up of endolymph which leads to an acute Meniere's attack by enhancing the micro-circulation of the inner ear. However, several authors have commented that the use of medication can produce undesirable side effects and that the use of vestibular suppressants in particular may be counterproductive in the long term as they retard CNS compensation (Horak *et al*, 1992; Yardley *et al*, 1998c). Furthermore, due to strong placebo effects in dizzy patients the most benign approach to intervention is recommended (Yardley *et al*, 1998c).

2.1.3.2. Vestibular rehabilitation

Vestibular rehabilitation is considered the most suitable management for chronic dizziness caused by vestibular dysfunction provided sinister pathology and contraindications have been excluded (Yardley and Luxon, 1994; Shumway-Cook and Horak, 1989; Giardi and Konrad, 1998). Contraindications include confirmed or suspected perilymph fistulae, vertebro-basilar insufficiency and severe cervical damage. The aim of vestibular rehabilitation is to reduce motion-provoked or residual dizziness but it does not affect the severity or frequency of acute vertiginous episodes by addressing the underlying pathology. Dizzy patients suffering from CNS lesions may be suitable candidates for vestibular rehabilitation but their prognosis may be less favourable (Giardi and Konrad, 1998)

Exercises designed to promote recovery from dizziness have been described since the 1940s (Cawthorne, 1944; Cooksey, 1946). The mechanism of recovery may vary depending on the nature of the individual's difficulties and the type of exercise programme prescribed. Mechanisms of recovery are described by Herdman and Whitney (2000) and are summarised below. Different types of exercise programme and some of the factors involved in designing a programme are also described. For the purposes of the present research 'vestibular rehabilitation' is defined as any programme of exercises designed to facilitate the reduction of symptoms and/or disabilities associated with dizziness, with or without additional techniques to address the psychological aspects of dizziness impact.

Following a unilateral vestibular failure, the tonic firing rate of the vestibular neurons is asymmetric for 3-14 days until the vestibular nuclei (located in the lower brainstem) recalibrates the interpretation of the signal coming from the two sides so that effective symmetry is restored. This corresponds to the acute phase of symptoms during which the patient will report constant dizziness. This spontaneous neural recalibration occurs only under static conditions. During head movement the asymmetry in neural firing disrupts the CNS interpretation of the incoming signal, resulting in a reduction in the gain of the vestibular-ocular reflex (VOR), particularly when the head is moving towards the weaker side. For stable vision during head movement or walking the vestibular-ocular reflex should respond with a gain of unity. Over time, the neural response to head movement also recalibrates so that the VOR gain is restored and the symptoms associated with an imperfect VOR gain resolve. This system is referred to as vestibular *adaptation* and is thought to be stimulated by the movement of images on the retina (retinal slip) which initiate error signals which in turn stimulate the CNS to adapt its response to head movement in order to minimise slippage. Adaptation does not occur unless facilitated by visual input and head movement stimulation. Sensations of dizziness are also thought to reduce in response to repeated exposure to specific symptom-provoking movements. This is referred to as *habituation* although the mechanisms which facilitate this type of recovery are not well understood. A final mechanism for the recovery of functional ability following a vestibular deficit is the *substitution* of other techniques for controlling gaze and postural stability. Where the VOR is impaired or absent, gaze stability can be improved through greater reliance on smooth pursuit and saccadic eye movements and by contributions from proprioceptive information arising from the neck (cervico-ocular reflex). However, these systems are not helpful for generating compensatory eye movements at frequencies above 1 Hz whereas under normal circumstances the VOR operates up to 20 Hz. Postural stability can be achieved under most sensory conditions by reliance on visual and somatosensory information alone. However, in the absence of vestibular information stability will be compromised in environments where visual or somatosensory inputs are absent or reduced, such as in the dark or on a compliant surface. Difficulty in these environments is commonly reported by dizzy patients.

Initially, the exercises provoke symptoms of dizziness and the patient must be aware that their symptoms may worsen before improving (Shumway-Cook *et al*, 1996). As the process of recovery occurs the symptoms are reduced or eliminated and the state of compensation can usually be maintained by leading an active lifestyle. Periods of 'decompensation' may be experienced during times of stress, tiredness or illness when symptoms of dizziness or unsteadiness may temporarily return.

Vestibular rehabilitation programmes may be generic or tailored to the particular movements that provoke the individual's symptoms. A generic vestibular rehabilitation programme would consist of a number of exercises given to all patients who are judged to be suitable candidates for rehabilitation. The exercises would usually be given to the patient in diagram form and would often be the exercises originally prescribed by Cawthorne (1944) and Cooksey (1946), or at least based on these. Exercises to encourage relaxation, such as breathing exercises, may also be added to a generic programme. A tailored programme would usually focus on the specific movements that provoke the patient's symptoms, based on reports from the patient. The number of exercises, the number of repetitions of each exercise performed in a session, and the number of sessions per day that the clinician prescribes would vary depending on the nature and severity of the patients symptoms and other factors related to the patient such as the patient's lifestyle and level of distress. Giardi and Konrad (1998) suggest that the clinician should consider a number of other variables when designing a therapeutic programme including the capacity of the other sensory systems involved in balance, the integrity of central systems and motor skills, age, memory and cognitive ability. Cohen and Kimball (2003) suggest that to maximise compliance it is important to tailor a programme of exercises to the individual's problems in daily life. A tailored programme may also include features designed to address the overall impact of the dizziness, as well as reducing the symptoms. This may take the form of formal or informal counselling or, where appropriate, a more structured approach to addressing psychological symptoms such as techniques based on the principles of cognitive behavioural therapy. Some authors report that greater success can be achieved with tailored programmes in comparison to a generic programme of Cawthorne-Cooksey exercises (Szturm *et al*, 1994; Shumway-Cook *et al*, 1996). This may be partially due to the greater face-validity of tailored programmes which may in turn increase compliance.

2.1.3.3. Efficacy of vestibular rehabilitation

A number of clinical trials offer empirical support for the efficacy of vestibular rehabilitation with improvement rates typically reported around 80% (Horak *et al*, 1992; Krebs *et al*, 1993; Shepard *et al*, 1993; Shepard and Telian, 1995; Shumway-Cook *et al*, 1996; Cowland *et al*, 1998; Yardley *et al*, 1998d; Cohen and Kimball, 2003; Krebs *et al*, 2003). Inclusion of a control group is particularly vital in the domain of dizziness because of the possibility of spontaneous remission and the potential influence of placebo effects (Shumway-Cook *et al*, 1996).

Evidence that exercises promote recovery of both self-reported symptoms and functional performance, has been provided by several authors. Subjects undergoing a vestibular rehabilitation exercise programme improved significantly on self-report measures and posturography whereas subjects who took part in a programme of general conditioning exercises or took anti-dizziness medication (vestibular suppressants) did not (Horak, 1992). Interestingly, subjects in the medication and general conditioning exercise groups reported subjective improvement (albeit less than the vestibular rehabilitation group) but did not improve on functional measures. Similarly, Shepard and Telian (1995) found that subjects in a general exercise group as well as a vestibular rehabilitation exercise group reported improvement of symptoms (64% and 85% of subjects respectively) whereas only subjects in the vestibular rehabilitation group showed improvement on dynamic posturography. Krebs *et al* (1993) report a similar pattern of results in a trial of vestibular rehabilitation for patients with bilateral vestibular hypofunction. These results support the efficacy of vestibular rehabilitation over alternative approaches in improving self-perceived dizziness and functional balance ability. However, they also indicate that self-report measures are potentially confounded by positive bias. Yardley *et al* (1998d) also found improvement of 67 dizzy subjects randomly assigned to vestibular rehabilitation compared with 76 controls on performance measures of balance ability and subjective measures of symptoms, anxiety, depression and handicap. These results did not indicate perceived improvement in untreated controls which may be explained by the absence of an 'apparent' treatment regime such as general conditioning exercises.

In a prospective study of vestibular rehabilitation, Cohen and Kimball (2003) found the most dramatic changes were in the domain of symptoms (rather than handicap) in the first 30-45 days with more gradual changes occurring until follow-up at six months. Dizziness handicap, as measured by the Vertigo Handicap Questionnaire (described in Section 2.5.1.2), did not change over the six-month study period. No relationship has been found between the amount of benefit from vestibular rehabilitation and demographic characteristics such as age or gender (Bamiou *et al*, 2000; Cohen and Kimball, 2003). Research suggests that early initiation of vestibular rehabilitation exercises is related to better outcomes. Bamiou *et al* (2000) found that the amount of time elapsed between the onset of dizziness and the initiation of Cawthorne-Cooksey exercises was a negative predictor of outcome.

Whilst it has been shown to be an effective treatment, El-Kashlan (1998a) proposes that widespread implementation of vestibular rehabilitation programmes will depend on finding a reliable and inexpensive method of monitoring and assessing outcome.

2.1.3.4. Psychological intervention

Research evidence linking psychological symptoms and the degree of handicap experienced implies that intervention aimed purely at the management of vestibular symptoms may be ineffective if concurrent problems are not addressed (Eagger *et al*, 1992; Kinney *et al*, 1997).

Sullivan *et al* (1993) advise that concurrent psychological disorders should be ruled out before proceeding with rehabilitation whereas Yardley (1994b) advocate an approach which deals with primary symptoms of dizziness and secondary anxiety symptoms concurrently. They assert that symptom perception is a major factor in determining if an individual will experience handicap associated with their dizziness and consequently they recommend a programme containing elements of cognitive-behavioural therapy (Yardley, 1994b; Yardley *et al*, 1998a). Likewise, Hazlett *et al* (1996) found mood and stress to be the second largest factor in dizziness handicap, over symptom severity, and consequently suggest a psychological element to treatment. Measures of anxiety before treatment were found to predict recovery at seven months post-treatment better than measures of balance function (Yardley *et al*, 1994a). Using multiple regression, Yardley *et al* (2001) found beliefs about dizziness to be a significant predictor of changes in handicap over the course of treatment.

An element of psychological rehabilitation is often considered an integral part of the vestibular rehabilitation programme as maladaptive coping strategies can only be reversed if self-imposed restrictions and learned-helplessness[5] are also addressed (Yardley *et al*, 1992c). Therapy benefit can be optimised by reassuring explanations of the symptoms, encouraging expectations of improvement and enhancing the patient's confidence in their own coping abilities (Yardley *et al*, 1998c). Vestibular rehabilitation guided by a therapist provides a safe environment for patients to test the validity of their fears about the potential consequences of dizziness and may, in turn, help to break down the cycle of avoidance behaviour which inhibits recovery and reinforces negative beliefs. Yardley *et al* (2001) found a significant improvement in negative perceptions of dizziness and its consequences (using the Dizziness Beliefs Scale, described in Section 2.5.1.4 below) in subjects assigned to a treatment group and no change in the no-treatment control group. This implies that treatment can positively influence negative beliefs about dizziness, which research has shown to be a major predictor of handicap.

---

[5] Learned-helplessness refers to a failure to attempt to cope in a situation where the individual has previously attempted to cope and failed.

Management of anxiety symptoms may also be achieved by teaching techniques for controlling physiological arousal (Yardley *et al*, 1994a). This may help the patient to break the escalating cycle of dizziness, anxiety and autonomic nervous system symptoms.

The present study proceeds on the basis that vestibular rehabilitation, which may include elements to address psychological consequences, is the primary mode of treatment for dizziness in most cases; subsequent discussion of measuring treatment outcome focuses on measures of outcome that are appropriate to vestibular rehabilitation.

2.2. Measuring Treatment Outcome

Valid and reliable measures of post-intervention outcome are required for clinical and research purposes. In clinical practice, outcome measures are used to demonstrate efficacy and cost-effectiveness for purchasers, providers and patients (Fielder *et al*, 1996). Outcome data can also be used to guide the management of individual patients, in audit, to aid the allocation of funding and the development of policy, services and quality standards (Bergner *et al*, 1981; Gatehouse, 1999a). In research, patient groups or treatment strategies can be evaluated comparatively with a common outcome measure. The outcome, that is the effect of therapy, may be defined objectively in terms of the disease state or subjectively in terms of the patients' views of their symptoms or their condition in the broader context of their lives.

Whatever the mode of the outcome measure, in order to perform some or all of the functions outlined above the measure must possess certain characteristics. Essential features include validity, reliability and sensitivity to change. For use in the clinical context, the measure should also have face validity and be applicable to patient management. These properties, how they relate to potential measures of vestibular rehabilitation outcome, and how they can be assessed are discussed below.

2.2.1. Objective measures

Traditional measures of outcome in health care typically include mortality and morbidity data. In non-life threatening conditions mortality rates are inappropriate measures of successful intervention and more subtle indicators of benefit are required (Bergner *et al*, 1981).

In the area of dizziness, objective measures of post-treatment outcome may include the results of any procedure which tests physiological or functional status. Traditional tests of the balance system comprise assessment of the vestibulo-ocular reflex (VOR) via measurement of spontaneous and evoked nystagmus, caloric and rotational responses, and assessment of the vestibulo-spinal reflex (VSR) through clinical tests (qualitative) or posturography (quantitative). Whilst these tests may be useful in a diagnostic context, research evidence suggests that they do not correlate well with subjective complaints of dizziness. Hallam and Stephens (1985) found no correlation between complaints of dizziness and clinical tests of the VSR, spontaneous and gaze-evoked nystagmus. Likewise, Yardley *et al* (1998b) found that tests of audiological, vestibular and oculomotor function did not discriminate dizzy subjects from age and sex-matched controls although dizzy subjects performed significantly worse on computerised dynamic posturography (CDP). Newman and Jacobson (1993) found there to be no relationship between rotational and caloric tests of the VOR and self-reported dizziness handicap although they too found a relationship between subjective dizziness and CDP. Moreover, research summarised in Section 2.1.2.3 above indicates that factors external to the vestibular system are most influential in determining the impact of the condition on the individual.

In addition to the poor relationship between objective evidence and subjective perceptions of dizziness and dizziness impact, many of the available tests assess aspects of the balance system that would not be expected to change in response to vestibular rehabilitation. Vestibular rehabilitation aims to stimulate compensatory mechanisms at the CNS level which adapt to a stable peripheral asymmetry, rather than aiming to restore peripheral vestibular function. Therefore, direct measures of peripheral function such as the caloric test may elicit misleading results (Jacobson and Newman, 1990) and as such are inappropriate measures of therapeutic benefit. Perez *et al* (2003) state that conventional physiologic definitions of compensation, based on caloric and rotating chair assessments, are inadequate for describing disability and handicap. Their research findings indicate that patients defined as 'compensated' by caloric and rotating chair tests view themselves as being as handicapped as patients who are defined as 'uncompensated'. This conclusion is supported by Jacobson and McCaslin's (2003) retrospective review of 122 patient records which revealed no agreement between caloric and rotating chair results and self-report measures.

Most traditional tests of balance function do not provide accurate and sensitive information about functional status (Shumway-Cook *et al*, 1996). Computerised dynamic posturography (CDP), however, assesses the functional status of the balance system as a whole and thus includes information on the state of compensation. CDP may, therefore, offer a more appropriate measure of therapeutic benefit. Research findings indicate that CDP may be useful for following the time course of postural adaptation after unilateral vestibular destruction (Black *et al*, 1989) or for establishing the goals of rehabilitation and subsequent outcome (Burgneay and Munro, 1997). Other researchers, however, find only weak relationships between posturography and measures of self-perceived dizziness severity, disability and handicap (Perez *et al*, 2003). Gill-Body *et al* (2000) found only 13% of the variance in a subjective measure of dizziness impact (the Dizziness Handicap Inventory, described in Section 2.5.1.1 below) to be explained by measures of postural control including computerised dynamic posturography. This suggests that a postural control measure may usefully contribute to assessment of treatment outcome but in isolation does not capture the full extent of dizziness impact.

2.2.2. Subjective measures

An alternative method of assessing the success of intervention is to seek the views of the patient. The importance of patient input to the evaluation of therapy is highlighted by evidence of the discrepancy between patient and clinician judgement of therapeutic success (Bowling, 1991; Honrubia *et al* 1996). Subjective measures are particularly appropriate in conditions (such as dizziness) where a person may perceive themselves as being ill even in the absence of objective evidence of disease, and when mortality is not an issue (Robinson *et al*, 1996). Moreover, the definition of health as the absence of disease may be seen as limited (Bowling, 1991) and, therefore, the use of subjective measures may be appropriate even where reliable objective measures are available. This reflects a shift in health care philosophy from a strict medical model approach of ‘curing disease’ to a more holistic approach aimed at minimising the impact of disease on everyday life. The use of patient-oriented measures also reflects the increasing accountability of health care providers and the influence of patient views on health care policy development (Robinson *et al*, 1996). The use of self-report measures can also help to identify the specific needs of the patient and guide their care accordingly (Mendel *et al*, 1999).

Subjective data can be collected in a number of ways but for purposes where it is desirable to quantify subjective input, this is achieved through administration of a questionnaire. Questionnaires vary in focus from concentrating on a particular aspect of a condition, for example a symptom check list, or focusing more broadly on 'quality of life' by incorporating a greater psychosocial dimension. Some suggest that interventions aimed at chronic conditions should focus on psychosocial impact as well as physical symptoms particularly where conditions are not life-threatening but are life-altering (Bowling, 1991; Kinney *et al*, 1997). Quality of life measures are also thought to benefit the rehabilitation process by focusing the clinician's attention on the overall well-being of the individual (Flanagan, 1982). Suitable outcome measures should be closely linked to the aims of rehabilitation, namely symptom management and quality of life improvement (Fielder *et al*, 1996). Measures of technical success are, therefore, insufficient in isolation and the quality of life of the patient should provide the basis of measures of benefit (Gatehouse, 1998). In the domain of dizziness, the use of quality of life measures would be particularly appropriate since all of the factors that influence quality of life, as stated by the WHO (WHOQOL Group, 1993), may be compromised in the dizzy patient: physical health, psychological state, level of independence, social relationships and the relationship of individuals to their environment.

Subjective measures of disease impact and therapeutic benefit may be generic or tailored to the condition of interest. Generic measures of health status can be applied across populations with different conditions and usually have normal values for comparison to the symptom-free population. Measures of health status or intervention benefit which can be applied across healthcare conditions may play a useful role in justifying resource allocations within health services (Gatehouse, 1997). However, in order to apply to all health conditions generic questionnaires are often lengthy which compromises their convenience for routine clinical use. A further disadvantage is that the items are necessarily more removed from the specific difficulties associated with a particular condition and consequently less responsive to changes than condition-specific measures (Lynn *et al*, 1999; Enloe and Shields, 1997; Gatehouse, 1998). Whatever the focus of the questionnaire, the culture of clinical governance and audit demands that subjective measures must be psychometrically valid and clinically useful (Gatehouse, 1999a).

2.2.3. Methods of measuring change

Although in some contexts and for some purposes subjective measures provide the most meaningful information, the subjective nature of the data means that they are potentially influenced by bias from a multitude of sources. Whilst these biases should not be seen to render subjective data invalid, users of subjective data, like all types of data, should be aware of potential limitations. Awareness of the potential limitations may influence the way that subjective change is measured and the interpretation of outcome data in research or clinical practice. Potential sources of bias associated with different approaches to measuring subjective change are summarised below.

There are two alternative methods for measuring subjective change. Individuals may be asked directly to assess how much they feel their condition has changed since the onset of a treatment programme. This is known as the 'change' technique. Alternatively, the amount of change may be derived by comparing a self-report measure of status taken *before* intervention with the same measure repeated *after* intervention. This is known as the 'state' technique.

Gatehouse (1997) contends that the 'change' method is inherently more sensitive to change than the 'state' method and thus has the greatest power to detect differences between different levels of technical success. The same author, working in the areas of hearing aids, suggests that 'change' measures are most suitable for comparative evaluation of different technical solutions in relation to resource implications (Gatehouse 1997). This type of evaluation is not considered relevant to vestibular rehabilitation services since technical solutions do not play a role in this type of treatment. However, a potential weakness of the 'change' approach that is relevant to vestibular rehabilitation is that by explicitly asking patients how much they have benefited from treatment, responses may be influenced by the desire to reflect kindly on the treatment or treating clinician by reporting improvement (Sprangers, 1989).

Bias resulting from a conscious or unconscious desire to present a favourable result is referred to as 'social desirability bias' or 'impression management'. Social desirability bias refers to a general, and probably unconscious, tendency to endorse statements which produce a socially acceptable impression (Streiner and Norman, 1989). Impression management refers to a more deliberate tactic of responding in a way which communicates a message of the respondent's choice (Sprangers, 1989). Impression management may operate as either a positive or negative bias; however, it is reasonable to assume in the current context that impression management will predominantly act as a positive bias. Patients are often reluctant to express dissatisfaction with treatment services because they feel grateful for the professional attention they have received even when this may not have been successful (Robinson *et al* 1996). Although the concepts of social desirability bias and impression management are subtly distinct, they have a similar biasing effect on subjective data. Further references to 'social desirability bias' throughout this work are intended to capture the influence of both conscious and unconscious positive influences on questionnaire scores. A further criticism of the 'change' method is that it requires a retrospective judgement and as such the results may be influenced by memory bias. De Meyer *et al* (1986), however, argue that all subjective measures are retrospective as they all rely on comparison with past experience, and as such all formats of measurement, not only 'change', are potentially influenced by memory bias. Another potential weakness of explicitly asking how much change has occurred over a course of treatment is the possibility of bias introduced by the effects of cognitive dissonance[6]. Sprangers (1989) suggests that when subjects exert effort to improve they may report greater improvement than is justified according to objective assessments.

The alternative method for assessing subjective change is the 'state' technique. This method requires the patient to respond to reflect their status at the time of completion and, therefore, is in principle free from retrospective reporting bias. It is also felt that by *deriving* the amount of change rather than asking for a direct assessment of benefit, the patient does not have such an explicit opportunity for over-stating the benefit of

---

[6] Cognitive dissonance refers to the existence of conflicting beliefs, attitudes or behaviours within a person. The conflict is resolved by modifying belief patterns to be consistent with, or to justify, behaviour.

treatment through social desirability responding. Gatehouse (1997) suggests that the 'state' method is more appropriate than the 'change' method when the aim is to assess the effectiveness of the treatment in restoring the patient's function to a level comparable with the general population. It may be argued that the aims of vestibular rehabilitation are more consistent with this aspiration than in discriminating between levels of 'technical success' (where the same author proposes the 'change' method to be most appropriate). However, research suggests that the 'state' method may be confounded by different sources of bias. An assumption of the 'state' technique is that this provides a common metric between the patient's before and after status. This assumption is challenged by authors who suggest that the internal standards which guide an individuals responses to questionnaire items may change over the course of treatment (Howard *et al*, 1979; Sprangers, 1989). A change in internal standards is referred to as a 'response shift' and, if present, renders comparison of measurements taken at different points in time invalid. The literature relating to response shift and its implications is summarised below.

2.2.3.1. Response shift

Sprangers and Schwartz (1999) propose a working definition of response shift as a change in self-evaluation of the target construct (in this context the target construct is health-related quality of life) as a result of one or more of the following: changes in the individual's internal standards of measurement for quality of life (recalibration), changes in the definition of quality of life (reconceptualisation), changes in the relative value of different components of quality of life (reprioritisation).

Changes in quality of life derived by comparison of before and after 'state' measures may not be valid if internal standards are not common to the two measures. Research into response shifts in an educational context concluded that the success of interventions may be under-estimated by use of before and after 'state' measures (Howard *et al*, 1979; Sprangers 1989; Levinson, 1990). Conversely, Howard *et al* (1987) state that if health outcome is measured using a conventional 'before-after' methodology quality of life may appear to be restored without any actual change in function. Using the medical model of healthcare where symptoms are alleviated by addressing the disease process, response shifts may be viewed as a source of bias in the measurement of change. However, using a different philosophy of healthcare, or in conditions where aetiology cannot be identified or treated, response shift may be a desirable outcome of intervention. Indeed in certain contexts such as terminal illness, adaptation to the condition (i.e. a response shift) may be regarded as an explicit aim (Sprangers and Schwartz, 1999). In vestibular rehabilitation, it may be argued that inducing a response shift by challenging the patient's negative beliefs about dizziness may facilitate reduction of symptoms and consequently handicap.

Sprangers and Schwartz (1999) hypothesise that response shifts are more likely to occur in subjective areas, such as pain or fatigue, than areas which are assessed using more objective anchors, such as aspects of physical function and work-related disability. Wilson (1999) also suggests that self-assessment in activities of daily living such as walking up stairs are unlikely to be confounded by shifts in internal values whereas general perceptions about health are highly susceptible to response shifts. Dizziness handicap occurs across many different areas of life but arguably the greatest impacts are in areas which the authors quoted above would describe as subjective and hence more prone to response shifts. However, research findings reveal a relationship between dizziness and somatisation and this is a condition where Wilson (1999) argues that 'normal' adaptation to symptoms does not occur. She proposes that somatisation is characterised by inflexible perceptions about physical symptoms and resistance to reassurance from health care professionals and consequently response shifts will not be measured in these patients.

Response shifts may occur simply with the passage of time and maturation of the individual although changes in health are thought to prompt more significant cognitive, behavioural or affective changes which may consequently change standards, values or conceptualisation of quality of life (Sprangers and Schwartz, 1999). Experimental evidence shows that response shifts only occur when a change is measured, that is, when treatment is effective (Howard *et al* 1979; Sprangers 1989). Treatment may catalyse response shifts, especially where treatment aims to promote accommodation to the illness (Sprangers and Schwartz, 1999) or in some way alter the patient's understanding of the target construct (Howard *et al*, 1979). It may be argued that vestibular rehabilitation aims to reduce dizziness handicap by modifying the patient's beliefs about and reaction to the symptoms. If response shifts are catalysed by treatment, comparison between treatment and control groups may not be valid and this may lead to inaccurate conclusions about the efficacy of treatment regimes. Research suggests that social comparisons provide another catalyst for response shifts (Schwartz and Sprangers 1999) as individuals reappraise their own status in comparison to others who they may perceive as being better or worse off than themselves.

Howard *et al* (1987) state that, if ignored, response shifts can bias evaluation of interventions but, if measured, can provide useful additional information on treatment outcome. Wilson (1999) suggests that for those interested in measuring the impact of intervention the goal is to demonstrate that 'true' change has occurred. She states that this requires potential influences from recalibration or redefinition to be measured and, if present, adjusted for. A number of other authors also recommend measurement of response shifts in research designed to evaluate interventions to avoid this confounding conclusions about the effectiveness of the intervention (Howard *et al*, 1987; Sprangers 1989). The 'then-test' can be built in to the design of prospective research to measure the presence of a response shift. The 'then-test' is completed at the end of a treatment programme and provides data on subjects' perception of their status at beginning of treatment (hence the questions refer to 'then'). Because the 'then-test' is completed at the same time as the 'after' measure the internal standards are judged to be the same and comparison of the 'after' measure with the 'then-test' provides a measure of change which is theoretically unconfounded by response shift (Howard *et al*, 1979). The comparison between 'then' and 'after' measures has been shown to correlate more highly with performance measures of intervention effect than the conventional before-after comparison (Howard *et al*, 1979) and some authors recommend this as the most powerful method of detecting change even where a response shift has not been identified (Sprangers, 1989). These authors state that comparison of the 'then-test' with the 'before' measure provides an estimate of response shift.

However, the 'then-test' is not without its own limitations. As a retrospective measure it may be subject to the same influence of memory bias over which 'change' measures face criticism. In an experiment designed to investigate the relationship between memory bias and apparent response shifts, subjects could not recall their 'before' scores when completing 'after' and 'then' measures at the end of an intervention

(Sprangers, 1989). This suggests that memory bias may be an alternative explanation for apparent response shifts. Howard *et al* (1979), however, found the opposite: subjects in a treatment group were able to recall their 'before' scores but often reassessed themselves retrospectively with the 'then' measure. These conscious reappraisals are attributed to true response shifts. Another potential source of bias in the 'then-test' is social desirability. The 'then-test' is administered at the same time as the 'after' measure to ensure equal internal standards and, therefore, it is possible for subjects to manipulate their responses to reflect a positive result. The possibility that differences between 'then' and 'after' measures may be biased by social desirability responding was reviewed by Sprangers (1989). She evaluated eight placebo-controlled studies and concluded that only one provided evidence to support this hypothesis. Similarly, Levinson (1990) rejected social desirability responding as an alternative explanation for differences between 'after' and 'then' measures as no differences were revealed on items unrelated to the intervention context, which were included specifically to investigate the phenomenon of social desirability responding. Furthermore, evidence presented above that 'after-then' comparisons are correlated with objective measures suggest this comparison provides a valid measure of treatment effect. However, a study comparing 'before-after', 'after-then' and direct 'change' approaches to measuring change concluded that the 'before-after' comparison was least influenced by social desirability. The use of a 'before' measure has also been found to affect subsequent 'after' and 'then' measures (Hoogstraten, 1979). The proposed reasons for this are that the 'before' measure draws attention to particular aspects of the construct being measured or the intervention programme, which may influence later responses either through social desirability responding or by focusing the subject's attention and through this actually facilitating change in these areas. However, experimental evidence shows that either the presence or implied presence of an objective measure of function taken alongside the 'before' measure reduces response shifts (Sprangers, 1989). The hypothesised mechanism for this finding is that subjects are less likely to over- or under-rate their level of function before treatment if they believe there is some objective method of verifying their self-report. Schwartz and Sprangers (1999) suggest that it may be useful for future research to focus on algebraic deconstruction of different aspects of response shift although they acknowledge that this approach may be fraught with limitations.

In order to provide an estimate of the biases described above, Sprangers (1989) and Sprangers and Schwartz (1999) recommend the inclusion of a placebo treatment condition to assess social desirability, a no-treatment condition to assess the effect of the passage of time and a performance measure to distinguish objective from subjective change.

2.3. Questionnaire Construction

The construction of a new questionnaire involves consideration of many issues relating to the content, length, structure, scoring and administration. These factors are discussed below.

2.3.1. Questionnaire items

The item content of a questionnaire depends on the purpose of the instrument. Guyatt *et al* (1986) suggest that the items of a quality of life instrument should be based on what patients feel is important. If the instrument is intended to be responsive the items should be based on variables which may improve with time and be relevant to specific treatment aims (Guyatt *et al*, 1986; Deyo and Centor, 1986).

Initially, a large pool of items may be generated from semi-structured patient interview (Guyatt *et al*, 1986; Yardley *et al*, 1992b), consultation with relevant professionals, existing questionnaires, review of the literature concerning natural history and potential therapeutic benefits (Guyatt *et al* and Hazlett *et al*, 1996) or a combination of methods. Patient interviews are considered critical where the issues of concern to the patient are paramount as clinicians' prediction of this may be inaccurate (Streiner and Norman, 1989). The initial pool of items should be sufficiently large to tap the full range of issues related to the domain of interest. The item pool is subsequently reduced by applying inclusion criteria to questionnaire data collected in a preliminary field trial. The criteria for inclusion may be subjective or objective (statistical), or both. Statistical criteria may include the deletion of all items demonstrating low variance and high skewness and those that were infrequently endorsed (Kirshner and Guyatt, 1985; Hazlett *et al*, 1996). Subjective criteria may relate to areas which the literature suggests are important to patients or are central to the aims of a particular intervention.

Scales with fewer items tend to be less reliable and greater reliability can be achieved by including multiple items referring to the same aspect of the attribute (Streiner and Norman, 1989). A larger number of items referring to a particular aspect of the attribute reduces the impact of spurious responding on the overall score for that aspect (or subscale) and, hence, increases the reliability of the measurement. In terms of the practicality of an instrument, a large number of items will be expensive if administered by clinician interview or may be off-putting to the respondent if administered by self-completion. Furthermore, even if administered by self-completion, it may take longer for the clinician to score and interpret and hence be impractical to use in limited in clinical time where computer scoring is not available.

2.3.2. Subscales

Subscales help to inform the user about the areas measured by a multi-factorial scale and provide information to the clinician concerning the areas where difficulties or benefits are perceived (Robinson *et al*, 1996). This may help the clinician identify the most appropriate focus for treatment and may guide the clinician as to the areas of treatment which produce results, both with an individual and within their patient population as a whole. Where the attribute of interest is multi-dimensional a group of statistical techniques referred to as factor analysis may be used to identify groups of items which can be construed as tapping the same aspect of the attribute. In questionnaire development, factor analysis is commonly used to explore the pattern of responses to aid the development of meaningful subscales (Bowling, 1995). Principal components analysis (PCA) is a commonly used method of factor analysis intended to reveal underlying structures in the data. The technique is used to reduce a set of items into a smaller number of factors that account for a large proportion of the variance (Lewis-Beck, 1994). The analysis elicits an Eigen value for each factor, which represents the power of the component or factor to account for variation between subjects. Conventionally, an Eigen value greater than one is used as the criterion for determining meaningful factors. Rotating the axes can help to identify clearer solutions by locating positions of the axes where the correlations between extracted components (i.e. factors) are minimised, that is, the set of items in a factor are shown more clearly to be distinct from items in other factors.

In subscale construction, the correlations between items within a subscale should be stronger than the correlations with items in other subscales. If an item correlates well with more than one subscale it may tap a multi-dimensional construct. Depending on the intended purpose of the subscales, the item may be retained within the subscale to which it relates most strongly, or if cross-correlation is unacceptable within the scale the item may be disregarded or reworded to tap a single dimension and re-analysed (Streiner and Norman, 1989). Assessment of inter-item correlations to determine the internal reliability of subscales is discussed in Section 2.4.2.1.

2.3.3. Response options and scoring

The number of response options available depends partly on the aims of the instrument. A dichotomous option is the most simple and overcomes individual differences in interpretation of value judgements such as 'mild' or 'very mild', although these differences may be of less concern where intra-subject changes are of primary interest. However, dichotomous response options fail to harness some potentially useful information and offer poor sensitivity to change (Kirshner and Guyatt, 1985; Streiner and Norman, 1989). Furthermore, if more precise information is required after data collection, dichotomous response options do not offer any flexibility whereas if post-hoc analysis requires responses to be dichotomised, a greater number of response options can be reduced retrospectively (Streiner and Norman, 1989; Honrubia *et al*, 1996). For greater precision and responsiveness, Streiner and Norman (1989) recommend a minimum of 5 and a maximum of 15 options or a visual-analogue scale, although too many options may render the distinctions meaningless (Bowling, 1991). Streiner and Norman (1989) suggest that caution should be applied when using visual-analogue scales (VAS) as an illusion of precision is implied whereas in fact VAS responses have been shown to correlate highly with results from only three discrete response options. Guyatt *et al* (1986) suggest that a 7-10 point Likert scale or visual-analogue scale is suitable for detecting small changes in status.

Selecting an odd or even number of response options will depend on the intentions of the scale. If a neutral response is acceptable or desirable an odd number is recommended. An even number is necessary if a definite opinion in either direction is required (Streiner and Norman, 1989).

The order of response options may be varied to avoid the ‘halo effect’, where subjects form an overall impression then respond to each item identically. For example, in a situation where subjects feel they have improved overall, if all questions are phrased so that the response option 'agree strongly' reflects improvement they may circle the same response option for all items without attending to the subject of each item. A format that varies the phrasing of the questions so that a response such as 'agree strongly' reflects improvement for some items and deterioration for other items encourages the respondent to read and consider each item individually. However, varying the position of positive and negative response options may in some circumstances cause confusion and render results unreliable (Streiner and Norman, 1989).

In assigning scores to individual items and response options, scores may be weighted equally or unequally. Some items may carry a greater weight if they are considered more central to the construct of interest (Bowling, 1991). If all items hold equal weight, the overall score may be hard to interpret as it may be achieved via very different routes. For example, a given score on a questionnaire assessing the functional and psychological impact of a physically disabling condition may be achieved by being mobile and emotionally distressed or immobile and emotionally content. The use of subscales can aid interpretation where the attribute of interest is multi-dimensional. An indirect method of achieving weighting is to include more items referring to core dimensions of the attribute.

2.3.4. Administering the questionnaire

In the clinical context, questionnaire data can be collected using one of two approaches: individuals can complete the questionnaire themselves or clinicians can guide them through the questionnaire in an interview format. Streiner and Norman (1989) give an overview of the advantages and disadvantages of different approaches. An interview-format led by the clinician has the advantage of reducing the number of items omitted, ensuring that the patient answers for themselves rather than being influenced by family members and being accessible to those with poor literacy or who have English as a second language. The clinician can also gauge if an individual is having difficulty understanding the sense of an item and may be able to help them to understand it using different phrasing rather than leaving the item out. However, rephrasing should be used with caution as minor changes in wording can lead to substantial changes in subject response (Flanagan, 1982). This point is emphasised by Streiner and Norman (1989) who suggest that an inadequately trained interviewer may distort the meaning of a question or misinterpret the intended response. The interviewer may also influence responses through their expectations about the patient or bias about the subject matter. The use of face-to-face interviews is also disadvantaged by increasing both the cost of administering a questionnaire, and the tendency towards socially desirable responses. The alternative is for patients to complete the questionnaire themselves thus reducing social desirability responding, interviewer bias and the investment of clinician time. The disadvantage of self-completion is the increased likelihood of omitting items or giving an invalid response such as circling more than one response option.

2.4. Questionnaire Validation

To interpret questionnaire results in a meaningful way, it is crucial for clinicians and researchers to know the characteristics of the measurement tool they are using. When a new questionnaire is developed, data should be collected to establish that the questionnaire measures what it intends to, produces consistent results over time in the absence of change and is sensitivity enough to reflect both small and large changes in patient status. These properties and methods of assessing them are described below.

2.4.1. Validity

The validity of an instrument essentially refers to whether it measures what it claims to measure. There are different aspects of validity which may be established subjectively or empirically, as appropriate.

2.4.1.1. Content validity

Content validity largely refers to relevance and coverage (Streiner and Norman, 1989). It demands that all aspects of the domain of interest are embodied in the scale and that there are no items which do not relate to the target domain. The only exception to this may be items that are unrelated or would not be expected to change with therapy that are added specifically to check for a general tendency to endorse items.

Face validity, a sub-type of content validity (Bowling, 1991), is a subjective concept which refers to whether the instrument *appears* to measure the target construct. For an outcome measure to be practical the information it collects should be seen to be appropriate and relevant to both patient and clinician (Gatehouse, 1999b). Face validity can be assessed during preliminary field trials where patients are asked to comment on the apparent relevance and ease of understanding of the items. Guyatt *et al* (1986) suggest that a group of around 20 patients is sufficient for this purpose.

2.4.1.2. Criterion validity

Criterion validity describes the requirement that a new measure should correlate with other measures of the attribute of interest which are employed as the 'gold standard'. New instruments which imitate an existing measure may be considered useful if they have some advantage over the existing measure such as being simpler, cheaper or quicker to use. Most newly developed instruments aim to measure something which has previously been inaccessible via traditional methods and consequently a gold standard is often unavailable. A single gold standard does not exist for measures of quality of life and may not necessarily be desirable as health status is complex and multi-dimensional (Bergner, 1989). Tests of construct validity can be used in the absence of a suitable gold standard (Guyatt *et al*, 1986).

2.4.1.3. Construct validity

Assessing construct validity is an alternative method of validating a new questionnaire by attempting to verify that the construct tapped by the instrument is the intended one. This can be evaluated by comparing the properties of the new questionnaire with established measures of related constructs. This is distinct from criterion validity where the comparison is made between the new measure and an established measure of the *same* attribute. Where the new instrument aims to tap a multi-dimensional attribute, construct validity can be tested by comparing the new instrument with several separate instruments which each tap one of the dimensions.

Construct validity can be sub-divided into convergent and discriminant validity, where convergent validity requires the measure to correlate with measures of related constructs, and discriminant validity requires that the scale does not correlate with measures of variables which are not of interest. Caution is required in the interpretation of correlations with related measures; if the relationship is too strong this may indicate that the construct tapped by the new instrument is the same as that tapped by the comparison measure. For example, if a measure of dizziness handicap shows a near-perfect correlation with a validated measure of anxiety this may indicate that the dizziness handicap measure actually only taps the anxiety component of dizziness handicap and as such is inadequate at measuring all aspects of dizziness handicap.

2.4.2. Reliability

A useful measure must be reliable both internally and be stable over time in the results it produces.

2.4.2.1. Internal consistency

Internal consistency refers to the homogeneity of items within a scale or within a subscale if the overall scale is multi-dimensional. Tests of internal consistency provide a reliability coefficient, Cronbach's alpha (α) which implies the degree to which the items tap the same construct. The statistic depends partly on the number of items and partly on the average inter-item correlation (Nunally, 1978). Where items refer to subtly different aspects of a construct, responses to the different aspects may not correlate well and thus the items will show a low value of Cronbach's α. Alternatively, a low value of Cronbach’s α may be due to an insufficient number of items referring to the construct in question because of the relatively large influence of spurious responses on the average inter-item correlation. A high value of Cronbach's α indicates that the instrument consistently taps a homogenous construct (Jacobson and Newman, 1990). Where the construct of interest is multi-dimensional, tests of internal consistency are more appropriately applied to individual subscales.

2.4.2.2. Test-retest reliability

A clinically useful instrument should elicit the same results on repeat administration where the condition is unchanged (Guyatt *et al*, 1986). This is essential to ensure that true changes in score are attributable to genuine changes in the condition rather than inherent variability of the measure employed. Test-retest reliability can be defined statistically as the ratio of variance in the score attributable to 'true' differences compared to the total variance in scores. This can be assessed by repeated administration of a questionnaire to patients whose condition is believed to be stable (i.e. not receiving treatment or experiencing anything else which would be expected to influence their condition). The ratio of inter- and intra-subject variability in scores is compared through Pearson's Product Moment Correlation Coefficient. A limitation of this approach is that if all subjects changed equally between the first and second administrations, the correlation would suggest a strong relationship and thus be falsely interpreted as high test-retest reliability (Guyatt *et al*, 1986). An alternative method of assessing test-retest reliability is to use an intra-class correlation. This method takes account of systematic score changes over time by comparing the inter-subject variability to the total variance (Deyo *et al*, 1991). If individual subjects give consistent judgements across time, that is the measure is reliable, the total variance will be dominated by inter-subject variance and the intra-class correlation will be strong.

Where an instrument is designed to measure changes within the individual over time, reliability across subjects is of less interest and attention should focus on test-retest reliability within the individual over time. In this instance statistical tests that use comparison of inter- and intra-subject variability, such as the Pearson's coefficient, may provide misleading results.

2.4.3. Responsiveness

The responsiveness of an instrument is defined as its ability to detect clinically important change when this has occurred (Guyatt *et al*, 1986). This information is relevant to those receiving, providing and purchasing therapeutic services in clinical situations (Kazis *et al*, 1989) and should be known before an instrument can be employed as an outcome measure (Kirshner and Guyatt, 1985). Establishing responsiveness also has valuable research applications in assisting sample size calculation.

Evaluating responsiveness can be problematic as the changes the scale is trying to detect may be quite subtle since dramatic changes are unlikely in chronic conditions (Deyo and Inui, 1984). The first obstacle, therefore, is in defining what constitutes the minimal clinically important change. There may not be a consensus on what is the smallest meaningful change and often this will not be synonymous with statistically significant change (Kazis *et al*, 1989). The issue is further complicated by the fact that the threshold of what is considered to be the minimal clinically important change will vary with both the intervention and the individual patient. Deyo *et al* (1991) refer to clinically important changes as those changes which patients and clinicians think are discernible and important. Likewise, Jaeschke *et al* (1989) believe it to be the smallest difference in score in the area of interest which patients perceive as beneficial. In the domain of traditional test procedures the same authors suggest that the clinically important differences are assessed by applying clinical experience to discern what is meaningful and what is a trivial change. This method is scientifically inadequate as the subjective nature means that interpretation may not be repeatable between times or clinicians, and for new measures the knowledge required for interpretation will only be acquired with vast experience.

Developing a tool which is responsive to changes in self-perceived quality of life following intervention may be problematic as the importance of daily activities will vary between patients. Some authors suggest that rehabilitative relevance and responsiveness may be enhanced by including activities nominated by the individual (Guyatt, 1987; Gatehouse, 1999a). This approach also benefits from increased face validity and is well utilised by patients. Where patients were offered the option of nominating situations they find difficult, 100% added one or more situation and 65% added four (Gatehouse, 1999a). However, assessing the psychometric properties of a questionnaire is problematic when the item content varies with each respondent. Guyatt (1987) suggests that reliability can be established by assessing the consistency of ratings through repeated administration of the questionnaire prior to intervention. In routine clinical practice this approach would not be practical.

Various methods of assessing responsiveness have been described in the literature. One method is to compare the intra-subject variability of baseline scores with the magnitude of score change when a treatment of known efficacy is applied (Guyatt, 1987, Deyo *et al*, 1991). However, caution should be applied in using this method as ineffective treatment will result in the responsiveness of the scale being underestimated. Score changes attributable to learning and non-specific effects can be estimated by examining the standard deviation of score changes in stable patients in a no-treatment and/or placebo group. Where a treatment of known efficacy is unavailable responsiveness must be established in a similar manner as validity in the absence of a gold standard, by comparing score changes to related measures of functional or physiological status (Kirshner and Guyatt, 1985; Deyo *et al*, 1991).

Some authors (Deyo and Centor, 1986; Deyo *et al*, 1991) have applied signal detection theory to the problem of assessing responsiveness whereby questionnaires are viewed as distinguishing changed from unchanged patients. Where a gold standard is available for external verification of a change in condition, receiver operating characteristic (ROC) curves can be used to describe how sensitive and specific a given score change is in dichotomising the sample (Deyo *et al*, 1991). The authors describe an example where a low score change may be highly sensitive but have poor specificity as unchanged patients may show a small degree of non-specific score variability. Conversely a high score change is likely to show good specificity as few unchanged patients would demonstrate a large score change, but low sensitivity as many who had genuinely changed may not show sufficient score difference to be identified as such. The optimum balance between sensitivity and specificity can be established by examining several cut off points. The advocates of this approach do, however, acknowledge the significant limitation that the method does not preserve information regarding the magnitude of improvement which some may see as the essence of responsiveness. A further limitation is that a suitable gold standard is essential to this method but may not be available in some contexts. However, in the absence of a traditional physiological measure, Deyo and Inui (1984) used patient and clinician perception of change as the gold standard and were deemed improved when both parties agreed to this effect. This approach is limited as the judgement may be influenced by many factors other than genuine therapeutic benefit and may not be repeatable. Such factors include: different clinicians may emphasise different factors in assessing whether the patient had improved, different clinicians will relate differently to patients, the clinician's opinion is based at least in part on the reports of the patient so that the two judgements are not independent, patient reports may be influenced by the desire to please their clinician, and clinicians may be unaware of psychosocial changes.

Kazis *et al* (1989) and Deyo *et al* (1991) advocate the use of effect size estimates as an indicator of responsivenes. They assert that the units of measurement are meaningless unless the user has some idea of the magnitude of change to expect. Additionally, effect sizes provide standard metrics that facilitate meta-analyses and allow comparison between dissimilar measures, such as questionnaires with traditional measures of physiological function (Kazis *et al*, 1989). The effect size method relates mean score changes to the standard deviation of scores. The amount of change required to reach a given effect size threshold depends on the number of items in the scale, the number of response options and the standard deviation of scores. As a general guideline, researchers suggest that an effect size of 0.20 represents a small change, 0.50 a moderate change and 0.80 a large change, although they recommend that specific effect size benchmarks should be developed for particular instruments or interventions (Cohen, 1969). The effect size method can also be adapted for data which are highly skewed by using non-parametric statistics such as medians and inter-quartiles. One limitation of this method is that effect sizes for treatment and placebo groups are calculated separately so are not directly comparable.

Jaeschke *et al* (1989) in consultation with a team of experienced clinicians developed broad criteria for interpreting score changes in instruments designed to assess chronic heart and lung disease. They assert that the minimal clinically important difference is inextricably linked with the number of items and response options. Guidelines emerging from statistical analysis corresponded closely to the intuitive estimates of the clinicians. They recommend that a mean change of 0.5 points per item is required, and for a subscale with five items and a range of seven response options per item (subscale score range of 30 points) a score change of three points reaches the threshold of minimal clinically important difference.

Many of the properties required of a questionnaire are inter-related. Reproducibility is a pre-requisite for responsiveness so that changes can be reliably attributed to therapeutic benefit (Guyatt *et al*, 1986). Responsiveness can also be seen as evidence of validity if the magnitude and direction of score change are considered appropriate. The process of validating therapeutic regimes and the instruments which measure their efficacy is a circular one. An instrument with established responsiveness can be used to evaluate the efficacy of new treatments. However, as assessing instrument responsiveness is based partly on its behaviour when established treatments are applied, clinicians must be mindful that the new treatment is evaluated indirectly against the standards set by the old treatment.

2.5. Review of Questionnaires used with Dizzy Populations

Questionnaires are either specific to the condition of interest or are applicable to all health conditions (generic). The development and validation of both disease-specific and generic questionnaires that have been used with dizzy patients is described below. A summary of clinical trials using these questionnaires is also given; some of the described trials were designed to assess the properties of questionnaires whereas other trials used the questionnaires for diagnosis or to measure outcome.

2.5.1. Disease-specific questionnaires

Questionnaires which have been developed to assess dizziness symptoms and associated disability and handicap are described below.

2.5.1.1. The Dizziness Handicap Inventory

The Dizziness Handicap Inventory (DHI) was developed by Newman and Jacobson and published in 1990. The authors' intention was to provide an addition to the conventional vestibular assessment battery that would quantify the handicapping effects of vestibular dysfunction as perceived by the patient. The authors focus on the ability of the DHI to *measure* handicap, emphasising that previous questionnaires in this domain provide no more than a symptom check-list to aid history taking. They suggest that previous attempts to quantify the effects of intervention only made use of information about the frequency of symptoms (in patients with Meniere's disease) and as such overlooked the global impact of the condition.

The DHI is recommended as a measure of handicap to be used before and after intervention to aid validation of rehabilitation regimes via quantification of self-perceived benefit. There are three subscales within the DHI which aim to capture 'Functional', 'Emotional' and 'Physical' aspects of dizziness impact as discrete entities. Each item has three response options, "yes" (4 points), "sometimes" (2 points) and "no" (0 points). Initially, 37 items were selected from case history reports on the basis of content and face validity as judged by the authors. The 37-item prototype was administered to 63 consecutive patients referred for vestibular assessment. Following this field trial, items were removed from the inventory where replication occurred, or where the item was not universally applicable (e.g. only applied to those who were previously able to drive) or where low item-total correlations were observed, although some items with low correlations were simply moved to another subscale. Cronbach's α values for the final 25-item scale and the three subscales are high: α=0.89 Total, α=0.85 Functional subscale, α=0.72 Emotional subscale, α=0.78 Physical subscale.

Further data were collected from a subject sample of 106 who were divided into three groups based on frequency of symptoms (n=39 less than 12 episodes in the previous 12 months, n=51 greater than 12 episodes in the previous 12 months, n=16 continuous symptoms). A statistically significant increase in Total, Functional and Emotional Subscale scores was observed as frequency of symptoms increased. Previously, the authors suggested that information regarding the frequency of symptoms to be inadequate in assessing the degree of impact on an individual's life. However, their own analysis has shown that the functional and emotional impact of vestibular disease is systematically predicted by the frequency of occurrence, suggesting that they may be closely related. The absence of a predictive relationship between the frequency of symptoms and the Physical Subscale may be explained by the fact that these items refer predominantly to positional provocation of symptoms. Once an individual learns that such positions provoke their symptoms, these movements and positions may be avoided altogether, thus actively controlling the frequency of positionally-induced symptoms independent of the frequency of spontaneous vestibular episodes.

Test-retest reliability was assessed with a group of 14 patients before and after vestibular testing within the same day. This indicated high correlations for the Total (r=0.97) and all subscales (Physical r=0.92, Functional r=0.94, Emotional r=0.97). The authors state that the standard error of 6.23 means that a change of 18 points out of a possible 100 (total score) would be sufficient to indicate a true change in an individual with 95% confidence. No attempt was made to assess the construct validity of the DHI. This may be due to the authors' assertion that the DHI is a unique tool which taps constructs not assessed by any other tool in the vestibular test battery. However, a generic measure of health-related quality of life could have been employed to quantify aspects of the impact of disease which would have provided a useful test of validity. The final version of the DHI is reported to have high internal consistency, good test-retest reliability and a simple scoring system. The authors suggest that it may be used for planning and evaluating therapy although no assessment of responsiveness was undertaken. They also suggest that it may be used as an indicator of the need for psychological intervention where symptoms are infrequent but self-perceived handicap remains high.

A screening version of the DHI (the DHI-S) was later developed by one of the original authors (Jacobson and Calder, 1998). The intention was to select 10 items to reduce administration time to approximately 5 minutes to encourage usage by specialist clinicians or to indicate the need for audiological referral to primary care givers. The 10 items with the highest item-total correlations were selected, 4 Functional, 4 Emotional and 2 Physical, and tested on 281 consecutive patients who completed both the DHI and the DHI-S on the same day. A DHI/DHI-S correlation of $r=0.86$ ($p<0.001$) was achieved. The test-retest reliability of the DHI-S was also assessed by repeat application to $n=45$ subjects. A correlation of $r=0.95$ ($p<0.001$) between first and second applications was revealed. A difference of 4 out of a possible 40 points is required to indicate change with 95% confidence.

The DHI is arguably the most well-used measure of dizziness handicap in both research and clinical practice. However, there are significant limitations, summarised below. In a condition where, as the DHI authors acknowledge, self-perception is paramount it appears incongruous that the items were selected from the responses to interviews directed by clinicians containing questions perceived as relevant by professionals. As these questions presumably comprise those used in a standard clinical history, a scale developed from these items may to some extent provide a quantification of the history. No items are included to assess fears and anxieties associated with dizziness (Yardley *et al*, 1992c) despite the fact that research strongly indicates that these aspects are major predictors of handicap. A major limitation which is commonly commented on anecdotally by clinicians is the flawed logic of the scoring system. Achieving a high score, thus reflecting high disability, rests on the assumption that patients persist in continuing the activities described in the questionnaire. It is known that avoidance behaviour is common in dizziness (Yardley *et al*, 1998a) and those who restrict their activities may be more handicapped by their condition but will achieve a low score on items relating to those activities which they no longer undertake. This problem in the scoring is compounded by the effect that resumption of activities has on scores as treatment begins to take effect. Someone who avoids several movements or activities may achieve a falsely low score by selecting 'no' to questions about the situations that enhance dizziness before treatment. As they resume these activities over the course of treatment they may select 'yes' to the same questions thus achieving a higher score which implies a deterioration since the beginning of treatment. This problem could be solved by better wording or a fourth response option where patients can indicate which movements or activities they no longer attempt. A further criticism of the DHI scoring system is that the use of three response options limits the potential for reflecting small degrees of change and may not capture the full range of disability experienced by patients, particularly at the higher end of the disability spectrum (Cohen *et al*, 2000).

Further criticism of the DHI relates to the subscale structure imposed by the original authors. Studies using factor analysis have questioned the validity of the three subscales (Enloe and Shields, 1997; Asmundson *et al*, 1999; Booth, 2000). The multi-dimensional nature of the DHI is supported by these other researchers but they suggest that the use of Functional, Emotional and Physical Subscales to describe these dimensions is invalid and misleading. Enloe and Shields (1997) assert that the DHI factor structure is invalid as 55% of the variance in Functional subscale is accounted for by the Emotional subscale and the remaining 45% is accounted for in the Physical subscale. Asmundson *et al* (1999) applied factor analysis to DHI data collected from 95 patients and describe both a two-factor and a three-factor solution. The two-factor solution suggests that the 25 items fall into two consistent and independent factors which are uncorrelated and account for 48% of the variance: General Functional Limitations (23 items) and Postural Difficulties (2 items). The three-factor solution separates the General Functional Limitations factor into Disability in Activities in Daily Living and Phobic Avoidance. Similarly, Booth (2000) used factor analysis to examine the subscale structure of the DHI and revealed a three-factor solution which is largely consistent with the three-factor solution proposed by Asmundson *et al.* The factors in this analysis were interpreted as Restriction of Familiar Activities, Agoraphobia and Postural Difficulties. These analyses suggest that the original subscale structure of the DHI is invalid and that attention to subscale scores may lead to anomalous conclusions about the nature of the patient's difficulties. However, it should be noted that both Asmundson and Booth's analysis lends some support to the original Physical subscale as this matches closely with the subscales labelled Postural Difficulties in their analyses.

2.5.1.2. The Vertigo Handicap Questionnaire

The Vertigo Handicap Questionnaire, developed by Yardley and Putman (1992), is based on statements about the effects of vertigo recorded from 23 patients in an open-ended interview study by Yardley *et al* (1992b). The most common statements were categorised, generating 46 summary statements which were posted to 100 dizzy patients (84 responded). Analysis revealed a reliability score of $\alpha=0.95$. The scale was reduced to 25 items by removal of items with poor item-total correlations (inconsistent with other items), low standard deviation (poor discrimination), abnormal response distribution (ambiguous) and highly correlated items (replication). The final 25-item version maintained high reliability ($\alpha=0.93$). Each item has five response options ranging from 0 (never) to 4 (always).

A subscale of Anxiety and Depression (3 items, $\alpha=0.86$) was isolated before further analysis so that the relative contribution of other factors to this subscale could be analysed via multiple regression. Principal components analysis suggested that 5 factors could account for 68% of the variance in the remaining 22 items. The fifth factor was subsequently removed on the basis of overlapping content. Multiple regression revealed that three of the four subscales (Restriction of Activities, Social Anxieties, Fears About Vertigo) contributed significantly to Anxiety and Depression and that the fourth (Severity of Vertigo) did not. Further analysis revealed Restriction of Activities to be determined predominantly by Fears About Vertigo. However, the authors suggest that the VHQ factor structure is not stable (personal communication; Yardley, 1999).

Re-administration of the VHQ to 40 of the original sample after 6 months yielded complete data from 27 subjects. These data were analysed for sensitivity to change and test-retest reliability. Patients who reported an improvement in symptoms achieved total scores that were significantly lower than on first administration ($n=14$, $t=2.30$, $p<0.05$), and the scores of those who reported no change were not significantly different ($n=13$, $t=1.58$, $p>0.05$). Further studies, summarised in Section 2.5.3, however, suggest that the VHQ may not be responsive to therapeutic changes.

Analysis of independent variables including age, sex, longevity of vertigo and diagnostic category revealed that no systematic relationship exists between VHQ score and any of these factors. This supports similar conclusions drawn by Jacobson and Newman (1990) from analysis of demographic variables and DHI score.

The primary goal of the VHQ was to provide quantification of the model of psychosocial consequences of vertigo proposed from the interview study data. The authors suggest that the VHQ may help to elucidate those aspects of vertigo and its consequences which cause some individuals to perceive greater handicap than others suffering similar illness or disability. This may in turn reveal the need for practical or psychological intervention. Furthermore, it may be used as a before and after measure of therapy benefit, including psychological intervention.

2.5.1.3. The Vertigo Symptom Scale

Following development of the VHQ, the Vertigo Symptom Scale (VSS) was developed by the same first author (Yardley *et al*, 1992c). It was designed as an independent but complementary scale to measure the severity of vertigo and secondary symptoms of anxiety, in terms of the number and duration of vertiginous episodes, autonomic symptoms and somatisation. The VHQ and VSS may be used in conjunction to aid assessment of the relative influence of vertigo and anxiety on self-reported handicap.

The initial 36 items were based on descriptions in the literature and from the interview study that provided the basis for VHQ items (Yardley *et al*, 1992b). The VHQ, The Hospital Anxiety and Depression scale (HAD) and Spielberger's Trait Anxiety Inventory (STAI-T) were employed to provide concurrent measures of anxiety to assist isolation of this component and to provide tests of external validity. The 36-item preliminary version was administered to 127 patients. From these data, positional items were removed as they showed poor discrimination and composite items were calculated to assess duration of symptoms, reducing these items from 15 to six. The remaining 27 items comprised eight factors explaining 67.5% of the variance, although scree plot inspection revealed that three factors explained 43.8%. The first two factors were characterised by items relating to 1) anxiety and 2) symptoms of a vertiginous attack. The items in the third factor related to symptoms of short-duration dizziness. As these symptoms are commonly a residual effect of the symptoms characterised by the second factor, the authors did not feel that it would be sufficiently useful or meaningful to distinguish these items by including them as a third factor in its own right. Instead, the first two factors were selected to give the questionnaire a two-subscale structure which is further subdivided for more detailed analysis; the third factor was incorporated into the subscale derived from the second factor. The two main subscales are 1) Anxiety and Autonomic Symptom Scale ($\alpha=0.83$), which is further divided into Somatisation ($\alpha=0.78$) and Autonomic ($\alpha=0.75$) Subscales and 2) Vertigo Scale ($\alpha=0.88$), further divided into Vertigo Attacks ($\alpha=0.83$) and Vertigo of Short Duration ($\alpha=0.87$) Subscales. Analysis of data from a cross-cultural validation of the VSS yielded a very similar pattern of results which provide support for the subscale structure presented in the original study (Yardley *et al*, 1999). Test-retest reliability was assessed in the original development study with a sub-sample of 44 patient. All scales and subscales showed high correlations ($r\geq0.89$) between the first and second administrations which were 24 hours apart.

Tests of validity revealed that scores on both VSS subscales were equally associated with VHQ score indicating that both vertigo and secondary symptoms impact upon the individual's life. Vertigo Scale score was significantly higher in those in the diagnostic category 'spontaneous episodic vertigo', but no association was found with measures of anxiety. Anxiety and Autonomic subscale score correlated with state and trait anxiety. These analyses confirm that anxiety components were successfully isolated from true vertigo, allowing the clinician to calculate a ratio score between the two subscales. This ratio implies the degree of true vertiginous symptoms in comparison to secondary exacerbating symptoms to determine which is the larger component. This separation could potentially prove a useful measure of intervention efficacy by allowing the distinction of direct improvement in vertigo and benefit from a reduction in anxiety-related symptoms. However, as the VSS investigates the nature and severity of symptoms over the previous year, it is unsuitable as an outcome measure for most rehabilitation programmes which last only a few weeks or months. A short version of the VSS was developed in a study led by the first author of the VSS (Yardley *et al*, 1998d). The VSSsf uses 15 of the original VSS items with 5 response options referring to how frequently symptoms have been experienced over the past month. Research described in Section 2.5.3 below suggests that the VSSsf is sensitive to changes in symptoms following treatment.

2.5.1.4. Dizziness Beliefs Scale

Also by the same author as the VHQ and the VSS is the Dizziness Beliefs Scale (Yardley, 1994b). . The DBS was designed to assess negative beliefs about the potential consequences of dizziness and to investigate the relationship between beliefs and self-perceived handicap. The scale consists of 17 items based on the clinical experience of the author, each with a 5-point Likert response scale. Three subscales, 'loss of control', 'serious illness' and 'severe attack' were identified by factor analysis of data from 107 subjects. Test re-test reliability, internal consistency, validity and responsiveness are not reported. Since this scale aims to assess an aspect of dizziness handicap which had not previously been assessed suitable measures of construct validity may not be available.

2.5.1.5. UCLA Dizziness Questionnaire

Developed at the University of California, Los Angeles (UCLA) by Honrubia *et al* (1996), the UCLA-DQ uses 5 items to assess the severity and frequency of dizziness and the impact that it has on an individual's life. The method of item generation is not described although the authors report that preliminary versions were tested on volunteer patients and discussed with other professionals. The authors state that they intended all items to be equally applicable to patients with all types of dizziness (not only vertigo).

The five items address frequency, severity, fear of dizziness, the effect dizziness has on daily activities and overall quality of life. Each item has 5 response options. The use of a single item for each domain that the questionnaire assesses will have implications for the internal consistency of the scale. Each response will dictate the score attributed to that domain and therefore any spurious responses will have a profound impact on the conclusions drawn by the measure. The impact of spurious responses which may cause a misleading conclusion to be drawn can be reduced by including several items which tap the same construct. Tests of internal consistency, such as Cronbach's α, aim to statistically capture this property of a measure but are not described for this questionnaire.

The scale was validated using a group of 343 patients. The patients were recruited from a balance disorders support group and were suffering with balance disorders of varying pathology including some of suspected psychogenic origin. The source of subjects may have resulted in a biased sample as patients actively seeking support may be more handicapped or more likely to over-report symptoms. The questionnaire was completed by patients and their physicians separately along with previously validated measures of depression and anxiety, the Generalised Contentment Scale (GCS) and the Clinical Anxiety Scale (CAS). Significant scores on the GCS and CAS were related to higher impact on activities of daily life, quality of life and fear of dizziness. These findings imply a degree of construct validity.

Analysis of questionnaires completed by the clinician versus self-assessment questionnaire scores revealed that clinicians' estimations of quality of life impact differed as a result of overlooking the influence of anxiety and/or depression: the clinician only considered the frequency of the patient's balance disorder in estimating the effect on quality of life. This finding provides support for the use of self-assessment instruments when assessing the impact of a condition on the patient's quality of life.

The authors recommend the UCLA-DQ as a measure of physical, functional and emotional impact which contributes useful information to the process of rehabilitation programme development. They also suggest that it may aid prediction of therapy outcome although they do not indicate that it should be used as a measure of intervention benefit. Test-retest reliability, internal consistency and responsiveness are not reported.

2.5.1.6. Dizzy Factor Inventory,

The Dizzy Factor Inventory was developed by Hazlett *et al* (1996) to address the lack of psychometrically robust self-report instruments for the assessment of dizziness. An initial item pool of 88 items (each with 5 response options) was generated by modification of items from the Multidimensional Pain Inventory (Kerns *et al*, 1985) to apply to dizzy patients, plus the 25 items of the DHI and some additional items added based on the clinical experience of the authors. The authors criticise the developers of the DHI for basing their subscale structure on an *a priori* assumption about how the items group together. However, the developers of the DFI divided their initial item pool into three sections which appear to be based on an *a priori* assumption rather than empirical analysis. Within the three sections, factor analysis was applied to reveal the structure of the data collected from 184 patients. The original item pool was halved to 44 items by reviewing the statistical properties of each item and removing those that met specified criteria such as low endorsement, high skew or low variance. The retained items remain in three sections, Symptoms, Significant Other's Responses and Activities, which are further subdivided into factors revealed by factor analysis. Section A, 'Symptoms', consists of seven factors: Interference, Emotional Distress, Symptom severity, Imbalance/Avoidance, Positional Vertigo, Concentration Difficulty and Social Embarrassment. Section B, 'Significant Other's Responses', consists of three factors: Solicitous, Punishing and Distracting. Section C, 'Activities', also consists of three factors: Household Chores, Getting Out Activities and Vigorous Activities.

The authors suggest that an advantage of the DFI is that different factors are expected to be differently related to diagnostic categories and treatment approaches and thus be useful as part of the diagnostic process and in making decisions about treatment. This expectation, however, is yet to be supported by experimental evidence. The authors do not suggest a role for the DFI in measuring treatment outcome.

Tests of construct validity, test-retest reliability, internal consistency and responsiveness are not described.

2.5.2. Other questionnaires

A number of questionnaires which were not developed specifically for use with dizzy patients have been used to assess the impact of dizziness. Questionnaires which are not specific to dizziness but have been compared to disease-specific questionnaires described above, or which have been used to measure outcome from treatment for dizziness are described below.

2.5.2.1. The Activities-Specific Balance Confidence Scale

The Activities-specific Balance Confidence Scale (ABC) was developed by Powell and Myers (1995) to quantify the fear of falling experienced by elderly people in performing activities of daily living. The sixteen items were developed by a team of 15 professionals (Occupational Therapists and Physiotherapists) and 12 physiotherapy outpatients >65 years of age. Respondents are asked to rate their level of confidence for each task on a percentage scale where 0% indicates no confidence and 100% indicates total confidence in performing the task without balance being compromised. Psychometric testing was performed on 25 people (>65 years) living in the community with varying degrees of mobility. High internal consistency ($\alpha=0.96$) was demonstrated and good test-retest reliability ($r=0.92$). The validity and responsiveness of the ABC was good in comparison to the Falls Efficacy Scale (Whitney *et al*, 1998).

2.5.2.2. The Index of Activities of Daily Living

The Index of Activities of Daily Living (Index ADL) was originally developed from observation of daily activities in hip-fracture patients to allow systematic study of treatment and prognosis for the elderly and the chronically ill (Katz, 1963). Performance is ranked by an observer in terms of dependence in six functions namely bathing, dressing, toilet, transfer, continence and feeding. Each item is assessed on an A-G scale and from this an overall score is summed from 'A' meaning totally independent in all aspects to 'G' meaning totally dependent in all aspects. The index was applied to 1001 individuals in four patient categories. A significant relationship was found between patients scoring poorly (D-G) and those receiving attendance allowance, implying construct validity in that other methods of related constructs reach similar conclusions. The authors suggest that it may be used to plan care needs and as a useful guide to progress in treatment. Later, the original authors propose that it may be used to describe illness in terms of functional limitations in conditions where other objective measures are not available or are unhelpful (Katz *et al*, 1970). This observation clarifies its potential application to the domain of dizziness which often remains idiopathic even after extensive investigations.

Concerns that all aspects of the ADL were not relevant to dizzy patients led Cohen and Kimball (2000) to develop a version specific to dizzy patients, the Vestibular Disorders ADL (VADL). The original ADL was reviewed by a panel of professionals who judged whether each item was relevant to dizzy patients. The items were assigned to Functional, Ambulation and Instrumental subscales, also by a panel of professionals. The final list of 28 items, with 10 response options per item, was administered to 94 patients referred for vestibular rehabilitation. The scale was found to be internally consistent with Cronbach's values ranging from α=0.89-0.96 for each item. High test-retest reliability ($r \geq 0.87$) of all subscales was established over a two-hour period; the authors acknowledge the limitation of this method as patients may recall their responses over such a short period. Whilst the use of 10 response options potentially offers good sensitivity to small changes in function, it may be argued that the verbal descriptors attached to each response level may not be interpreted as ordinal. This suggestion is reinforced by the results of Cohen and Kimball's (2000) study which show a preponderance of responses at levels 1 (Independent) and 4 (Slower, Cautious, More Careful) with much fewer responses to the intermediate levels between 1 and 4 (2: Uncomfortable, No Change in Ability; 3: Decreased Ability, No Change in Manner of Performance) as these descriptors do not relate well to the nature of difficulties experience by dizzy patients. The authors recommend the VADL as a tool to assist treatment planning by providing a basis for discussion with patients and their families for setting therapeutic goals, and for assessing response to treatment. A further study by Cohen *et al* (2000) describes the validity of the VADL in comparison to the DHI and posturography. This study revealed the VADL to distinguish between patients and healthy controls but not between patients with chronic vestibulopathy and patients with Benign Paroxysmal Positional Vertigo. The

VADL correlated moderately with the DHI and weakly with posturography. The authors report that the VADL is sensitive to higher levels of disability than the DHI and this is attributed to the greater number of response options. The responsiveness of the VADL to changes over time is not reported.

2.5.2.3. The MOS 36-Item Short Form Health Survey (SF-36)

Developed by Ware and Sherbourne (1992), the Medical Outcomes Study 36-item Short Form Health Survey (SF-36) assesses eight health concepts which are not specific to any particular condition but are intended to capture aspects of function and well-being which apply across health conditions: physical functioning, role limitation due to physical problems, role limitation due to emotional problems, social functioning, pain, mental health, energy and vitality and general health perceptions. The SF-36 is intended for use as a measure in clinical practice, research trials, health policy evaluation and general population surveys (Ware *et al*, 1992). The objective of the developers was to produce a scale which was as psychometrically robust as longer generic scales but with the minimum items possible to capture the concepts relevant to accepted definitions of health. Items were generated from a review of pre-existing generic measures of health status which were considered to be comprehensive in their assessment of perceptions about physical, mental and social well-being but too long for practical purposes. Since its development it has become a well-established measure used widely to assess the impact of a variety of health conditions and to measure treatment outcome. Normative data are available for comparison with the unaffected population including UK-based normative data (Jenkinson *et al*, 1993)

The response format varies from question to question with the number of options ranging from two to six. This has advantages in preventing uniform response patterns but means that some items are potentially more sensitive to smaller degrees of change than others. High response rates from large scale population surveys using the SF-36 suggest that respondents find it easy to complete (Jenkinson *et al*, 1993). Scores for the eight subscales allow assessment of the specific nature of impact of a given condition and two overall summary scores, the Physical Summary Score and Mental Summary Score, provide a more general overview of the level of impact. There is no single overall score. Scoring is complicated with formulae given for transformation of each summary score to a 0-100 scale where 0 indicates good health and 100 indicates poor health.

Assessment of validity with reference to other established questionnaire measures (Brazier *et al*, 1992) and clinical measures of health status (McHorney *et al*, 1993) supports the validity of the eight subscales and two summary scores. Data from a randomly-selected UK population sample of around 9000 adults indicates good internal consistency for the eight subscales: physical functioning α=0.90, role limitation due to physical problems α=0.88, role limitation due to emotional problems α=0.80, social functioning α=0.76, pain α=0.82, mental health α=0.83, energy and vitality α=0.85 and general health perceptions α=0.80 (Jenkinson *et al*, 1993). There do not appear to be any data on the test-retest reliability of the SF-36.

It has been suggested that the items of the SF-36 refer to less severe levels of impact than its predecessors and is, therefore, more sensitive to lower levels of disability (Brazier *et al*, 1992). It is reasonable to assume that this should also mean greater sensitivity to smaller changes although assessment of responsiveness is not reported. Results of validation studies indicate sensitivity to large differences in the impact of different health conditions but further work is needed to examine the relationship between the SF-36 and disease-specific measures to gauge its ability in detecting more subtle differences (McHorney, 1993). Enloe and Shields (1997) report test-retest reliability of $r \geq 0.64$ for the eight dimension scores of the SF-36 with dizzy patients. No analyses of internal are reported in the original development papers.

2.5.2.4. The Sickness Impact Profile

The Sickness Impact Profile (SIP) was developed in the United States as a self-report measure of health status, specifically aimed at outcome assessment, that can be applied to those with all types and severity of illness regardless of demographic or cultural characteristics (Bergner *et al*, 1976). Items were derived from descriptions of illness and consequent behavioural dysfunction from patients, carers health care professionals and healthy individuals. The SIP initially contained over 300 items which were reduced via item-cluster analysis to 136 items in 12 domains which were divided into two dimensions: Physical and Psychosocial (Bergner *et al*, 1981).

Response options are dichotomous. Large scale field trials conducted in 1973, 1974 and 1976 revealed test-retest reliability of the overall score r=0.88-0.92 and internal consistency α=0.94-0.97.

The validity of the SIP in comparison to other measures has been established in a variety of contexts including hip surgery (Stucki *et al*, 1995), renal insufficiency (Essink-Bot *et al*, 1997), injured workers (Beaton *et al*, 1996) and rheumatoid arthritis (Sullivan *et al*, 1990). The items focus on behavioural parameters rather than perceptions and this is presented by some as an advantage as behavioural ratings are considered more reliable as they are anchored to more objective barometers than internalised aspects such as feelings and perceptions (Wilson, 1999; Booth, 2000). However, in a condition where emotional response and beliefs about the condition contribute significantly to handicap, a tool which excludes these aspects may be seen a limited. Specifically, when selecting an instrument to guide rehabilitative efforts a questionnaire which provides some indication of the nature and origin of the individuals problems may be more useful than one which simply describes the behavioural manifestations of those problems.

The main limitations of the SIP suggested in the literature are its length and poor sensitivity. The large number of items and the fact that it is usually administered by interview taking 20-30 minutes has led to suggestions that it is impractical for routine clinical use (de Bruin *et al*, 1994; Robinson *et al*, 1996). The dichotomous response options mean than small degrees of change are not reflected (Jette, 1980).

A British version of the SIP, the Functional Limitations Profile (FLP) was developed by Charlton (1983). The wording was modified to apply to the British population and the scale was restructured based on statistical analysis of item groupings. Evidence suggests the FLP is repeatable over a 48-hour period (Charlton *et al*, 1983) and a six-month period (Hutchinson and Hutchinson, 1995). Construct validity in relation to disease-specific measures in a sample of patients suffering with multiple sclerosis was established by Hutchinson and Hutchinson (1995). The responsiveness of both the SIP and the FLP remain to be clearly demonstrated (Booth, 2000).

Using data collected with the FLP, Booth (2000) developed a disease-specific version for dizzy patients, the Dizziness Impact Profile. Factor analysis distributed items amongst three dimensions of Psychological, Physical and Social well-being. High test-retest reliability and internal consistency were reported for the three dimensions and construct validity was established in relation to the DHI. Floor effects found with the FLP were addressed by removal of items which were not relevant to dizzy patients. Two versions of the DIP were proposed, one with 35 items and one with 50. The 50-item version was found to be more sensitive to mild consequences of dizziness. Booth suggests that the DIP is not suitable as a measure of individual progress over the course of treatment but may offer useful information regarding the nature and degree of changes at the group level.

2.5.3. Use of questionnaires in studies of dizzy patients

The questionnaires described above have all been used to assess the impact of dizziness or the effects of treatment for dizziness. Some studies use only one of the questionnaires described whereas others use several and are able to compare their properties. The findings and comparisons are described below.

The DHI was used as a before and after measure in a prospective study of Vestibular rehabilitation in eight patients (Krebs *et al*, 1993). DHI scores did not differ between the experimental and control groups either before or after the vestibular rehabilitation programme, but there were significant differences within both groups between time 1 (before) and time 2 (after). Previous research has demonstrated that the DHI has high test-retest reliability (Newman and Jacobson, 1990) which suggests that the changes detected by the DHI in this study occur irrespective of whether treatment is applied. However, in view of the small sample size the results of this study should be treated with caution. Similarly, Cowland *et al* (1998) used the DHI as a treatment outcome measure with 37 dizzy patients. The total, Functional subscale and Physical subscale scores all showed significant improvement following treatment. Seventy-eight per cent of the sample showed some degree of improvement (mean improvement 13.86 points) although only 35% improved by ≥18 points which is the recommended minimum change for 95% confidence (Jacobson and Newman, 1991). The authors state that the DHI is a useful tool in assessing efficacy of vestibular rehabilitation.

However, the absence of a control group in this study prevents comparison of these findings with those of Krebs *et al* (1993).

El-Kashlan *et al* (1998) used the DHI and an in-house scale of symptoms and disability to measure changes in balance function following surgical removal of acoustic neuroma in 81 patients. In this study, the DHI was found to correlate with objective tests of balance function, including the caloric test (DHI Physical and Emotional subscales), abnormal positional nystagmus (DHI total, Emotional and Functional subscales) and abnormal rotatory chair testing (DHI total and all subscales). Pre-operative disability and symptom scores were correlated with post-operative disability and symptom scores and all subscales of the DHI. The results suggest that pre- and post-operative disability are related on several measures and that this may help in identifying need for post-operative rehabilitation. The authors acknowledge the methodological limitations of this study, including the use of retrospective recall which may be unreliable, and the low response rate (37%) which means that the sample may be biased. The relationship between the DHI and objective measures of balance function demonstrated in this study implies that the DHI is a valid measure of balance function which may be used as a proxy for objective measures. It may be advantageous to substitute a subjective measure for an objective one in certain circumstances. For example, a subjective measure may be quicker and cheaper to apply and may be used with patients who cannot take part in objective testing for a variety of reasons. However, the results of this study should be viewed with caution in the light of the limitations of the study and the wealth of research findings that indicate a poor relationship between objective measures and self-reports of dizziness.

The DHI and the SF-36 were applied to a group of 95 dizzy patients by Enloe and Shields (1997). Good test-retest correlations were found for all subscales within both the SF-36 and the DHI (DHI, $r \geq 0.79$; SF-36 $r \geq 0.64$) which supports Jacobson and Newman's (1991) finding. All DHI and SF-36 subscale scores improved after 6-8 weeks of therapy with most marked improvement on the Functional subscale of the DHI and in the Role Limitation - Physical and Social Function subscales of the SF-36. Measures of responsiveness revealed the DHI to be more sensitive to change than the

SF-36, although the average change following therapy was 11.94 points, which again falls below the original authors' recommended minimum of 18 points to detect change. It should be noted that, as a generic measure, the SF-36 measures the impact of health problems other than dizziness which would not be expected to change in response to treatment for dizziness. Booth (2000) found that 78% of patients seeking treatment for dizziness also reported other health problems. Therefore, it is not necessarily valid to conclude that the SF-36 is less responsive than the DHI as a measurement tool, simply that when measuring the specific effects of dizziness the DHI showed greater change. This is true of all comparisons between generic and disease-specific measures. Whilst this may be an alternative explanation for results which imply poor sensitivity of generic measures, it highlights the need for disease-specific measures for clinical and research purposes where changes in the impact of a specific condition may be masked by the impact of unrelated health conditions. In clinical practice, the use of a generic measure may cause a clinician to continue treating a patient who has already improved to a satisfactory degree on the dimension they are treating. In research trials the use of generic measures may result in underestimation of treatment effect in individuals suffering with several health conditions that impact on their quality of life.

In both the DHI and the SF-36, questions relating to physical function were the most responsive (DHI Physical subscale and SF-36 Physical Function scale). However, a control group was not used in this study so it cannot be assumed that this measured change was due to responsiveness to therapy. The SF-36 also showed greater floor and ceiling effects than the DHI which may limit the precision and hence clinical utility of a scale. Overall, correlations between the DHI and SF-36 were weak. The exceptions to this were a strong correlation between the DHI Emotional subscale and the SF-36 Social Function subscale ($r=0.71$) and moderate correlations were found between the DHI Functional subscale and the SF-36 Physical Summary score ($r=0.54$) and the Mental Summary score ($r=0.54$). The authors suggest that their results indicate that the DHI and SF-36 provide different information about health status so may be used to complement one another rather than interchangeably. Fielder *et al* (1996) found a moderate correlation between the DHI and the SF-36 in a sample of 42 dizzy patients. Correlations for the eight dimensions ranged between $r=0.53$ and $r=0.72$ and were all significant ($p<0.001$). Their study found that dizzy patients scored below the population norms in seven of the eight dimensions of the SF-36 (Mental Health was the exception). However, the results were only significant for women on Role Function - Physical and Energy and Vitality and for men Role Function - Physical and Social Function. The authors state that these results may indicate the SF-36 to be a suitable measure of outcome in treatment for dizziness. They suggest that further work is required to assess the sensitivity of the SF-36 to changes in the impact of dizziness on health-related quality of life. Kinney *et al* (1997) also used the SF-36 to assess the quality of life impact of Meniere's disease and found that suffers were categorised as having a 'minor medical' complaint on physical aspects of the scale including Physical Function, Pain and Role Limitation due to Physical problems, and a 'major medical' problem on Social Function, Role Limitation due to Emotional Problems and Energy and Vitality dimensions. It should be noted that Meniere's disease includes symptoms of tinnitus, aural fullness and hearing loss as well as dizziness so it cannot be assumed that the quality of life impact of Meniere's disease is comparable to those suffering only with dizziness.

Whitney *et al* (1999) compared the Activities-specific Balance Confidence Scale (Powell and Myers, 1995, see Section 2.5.2.1), a self-assessment of balance-related disability in the elderly with the Dizziness Handicap Inventory. The study aimed to establish if self-reported disability and handicap scores were consistent between the two scales in a group of 71 patients with vestibular pathology. The two scales showed a moderate correlation (r=0.64), with no marked differences in patient groups in two different age band, ≤64 years (r=0.68) and ≥ 65 years (r=0.64), suggesting that in this population the problems reported are related to the vestibular complaint rather than age. The findings of this study indicate that the ABC is a valid measure of disability due to dizziness, and supports suggestions that the DHI elicits information regarding disability, as well as or instead of, handicap.

Bamiou *et al* (1999) used the DHI and the UCLA-DQ in a retrospective study of dizziness following surgical removal of acoustic neuroma in 237 patients. The DHI and UCLA-DQ scores were highly correlated, consequently the authors suggest that either the DHI or UCLA-DQ may be used to help identify those needing post-operative rehabilitation. In a retrospective study of dysequilibrium in 237 patient after surgical removal of acoustic neuroma, Lynn *et al* (1999) also showed a strong correlation between the UCLA-DQ and the DHI.

Comparison of the DHI with the FLP in a study by Booth (2000) found weak or moderate correlations on all dimensions. Analysis of the FLP in this study revealed good test-retest reliability and high internal consistency for all dimensions except work, eating and sleep. Consistent with previous research, the greatest impact was on the psychosocial dimension with highest scores on scales assessing sleep, alertness and recreation. Floor effects were reported in several dimensions with between 60 and 100% of respondents scoring 0 on mobility, eating, work and communication. Subjects frequently reported other health problems and their influence was reflected in FLP scores. Mendel at al (1999) used the SIP along with disease-specific measures to characterise the quality of life impact of dizziness on 99 patients. SIP scores of the dizzy patients fell below the level of healthy controls on all dimensions with the least impact on eating and the physical dimension and most impact on recreation.

A short form of the VHQ (14 items) and a short form of the VSS (15 items) were used as self-assessment outcome measures alongside clinical tests of balance ability in a randomized controlled trial of vestibular rehabilitation (Yardley *et al*, 1998d). The VHQ did not show a statistically significant difference between baseline and follow-up scores of treatment-group subjects. The VSS and clinical tests used in the study did show a significant difference at follow-up of the treatment group, but not the control group. According to Howard *et al*'s (1993) phase model of treatment effect, symptoms are expected to change in the early part of therapy with changes in handicap taking longer to occur. This is a possible explanation for the absence of significant change in VHQ scores as Howard's model of therapy is supported by studies specific to dizziness which found the greatest change to occur in symptoms in the first 6-7 weeks (Cohen and Kimball, 2003). However, the study followed patients over a six month period which may be argued is a sufficient period for changes in handicap to occur; an alternative explanation for the findings is that the VHQ is not responsive to change.

The results of Yardley *et al*'s study indicate that the VSS is responsive to change and these results are supported by Brookes *et al* (1994). They used the VSS as a measured of symptom severity before and after surgical intervention for the relief of dizziness in 13 patients with a variety of conditions, predominantly Meniere's disease and acoustic neuroma. Statistical analyses were not applied to before and after VSS data but score trends showed marked decrease in self-perceived symptoms post-operatively. The study also showed VSS scores to be correlated with abnormality and asymmetry on self-rotation, a performance test which reflects the individual's sensitivity to left and right rotational vestibular stimulation.

Cohen (1992) used ADL to assess performance on daily tasks as an indicator of the individual's tolerance for head movement and, therefore, as a barometer of treatment success. ADL scores before and after vestibular rehabilitation were significantly different in sixteen patients with vestibular and brainstem lesions. Subjects were asked retrospectively to rate their level of functioning on ADL tasks before their dizziness started, during the period when they suffered with dizziness but before they started rehabilitation and 6-8 weeks after starting rehabilitation. Statistical analysis of scores revealed significant effects between the three periods although the retrospective experimental design employed may be subject to bias from memory or social desirability responding. The author suggests that measures of functional performance in daily life reveal more about patient status than physiological measures and capture something which is of greater importance to patients than physiological barometers. However, although these results suggest that rehabilitation was beneficial in improving function in certain areas of daily life, this may not extend to other areas of life not assessed by ADL and if used in isolation this type of assessment does not capture the full impact in terms of psychological factors and overall quality of life. Booth (2000) comments that an outcome measure which neglects these aspects of dizziness impact will not reflect psychological benefits of therapy when dizziness and consequent disabilities persist.

2.5.4. Summary of questionnaire review

Several questionnaires, both disease-specific and generic, have been well-validated and shown to be useful measures of aspects of dizziness or its impact. The SF-36 is a well-used measure which provides potentially useful information on the comparison of dizzy patients to the normal population or to patients with other conditions. However, its complex scoring system does not lend itself to routine clinical use. Furthermore, the fact that the items do not address the problems particular to the dizzy patient means that the information will be of limited use to the clinician in gauging the profile of dizziness impact on the individual patient and guiding their management. The generic nature of the items may also mean that small but meaningful levels of disability or degrees of change are not registered. Some of these arguments also apply to the SIP and its disease-specific derivation, the Dizziness Impact Profile. The responsiveness of the DIP is likely to be limited by both its dichotomous response format and its neglect of important aspects of dizziness impact which may change with intervention.

For the purposes of measuring treatment benefit, a measure that is specific to the problems of the condition is considered to be most appropriate. The psychometric properties of the Dizziness Handicap Inventory are well-documented and it has been used extensively to measure the subjective impact of dizziness. It is short enough to be practical for routine clinical use and scoring is simple to perform. The interpretation of the scoring, however, is based at least in part on the subscale structure which claims to provide assessment of the impact of dizziness on functional, emotional and physical realms. This structure has been questioned by several researchers and so the clinician cannot rely on the DHI to provide a valid measure of the different aspects of dizziness which may be important to guide management or indicate appropriate referral. Evidence of the responsiveness of the DHI is equivocal and further work is required to establish this. The use of only three response options may limit the potential for reflecting small degrees of change. A perceived limitation of the DHI is that the items are based on professional opinion rather than patient concerns. The Vertigo Handicap Questionnaire was developed to fulfil a similar role to the DHI and is based on patient interviews. The VHQ shares the advantage of a simple scoring system although the subscale structure is thought to be unreliable. The major limitations of the VHQ are that a full profile of its psychometric properties is not available in the literature and studies of treatment effect have indicated that it is not responsive to change. The UCLA Dizziness Questionnaire has been shown to correlate highly with the DHI which may suggest that it does not have a distinct role in addition to the DHI. It does, however, have the advantage of containing only five items which may make it useful as a convenient screening tool for those requiring further investigation in a particular domain, although the small number of items does have disadvantages in terms of reliability. Data on the internal consistency of the UCLA-DQ is not reported in the literature; further work is required to establish this along with test-retest reliability, validity and responsiveness. The psychometric properties of the Vertigo Symptom Scale are well documented and research suggests the short form (VSSsf) is sensitive to change. The items are based on patient interviews, the scoring is simple to complete and interpret and there is evidence that scores correlate with functional measures of balance ability. The VSS is thought to be a useful measure in the assessment of dizziness and anxiety but its role in measuring treatment outcome is limited by the fact that it addresses symptoms but not the impact of symptoms on the individual's functioning and participation. Likewise, the ABC and ADL appear to offer a useful contribution to the assessment of dizziness impact but address the functional impact and not symptoms or psychological consequences. These questionnaires do not capture the full range of dizziness impact and thus do not provide the multi-factor information that would aid management decisions. Moreover, if used as a measure of treatment outcome a measure which does not address all aspects of impact may overlook important changes. Similarly, the Dizziness Beliefs Scale assesses only one aspect of the impact of dizziness and whilst research shows negative beliefs to be an important factor in predicting treatment outcome, the psychometric properties of the DBS are currently unknown. Of the disease-specific questionnaires, the Dizzy Factor Inventory is arguably the only measure which addresses the full range of dizziness impact. The DFI, however, consists of 44 items which may limit its practicality for routine clinical use and is based on professional judgement and previous questionnaires rather than patient concerns. Further work is required to establish the psychometric properties of the DFI including responsiveness.

Table 2.1 Summary of questionnaires used with dizzy patients

Questionnaire	Items			Subscales		Psychometric properties			
	No.	Generation method	Response options	No.	Factor analysis	Internal consistency	Test-retest	Validity	Responsiveness
Disease-specific questionnaires:									
Dizziness Beliefs Scale (Yardley, 1994b)	17	Clinician	5	3	√	Not reported			
Dizzy Factor Inventory (Hazlett *et al*, 1996)	44	Existing measures & clinician	5	13	√	Not reported			
Dizziness Handicap Inventory (Jacobson and Newman, 1990)	25	Clinician	3	3	X	α=0.89	r=0.97	Not reported	√[a, b, c]
Dizziness Impact Profile (Booth, 2000)	35/ 50	Existing measure	2	3	√	α=0.85-0.91	r=0.80-0.87	√	X
UCLA-Dizziness Questionnaire (Honrubia *et al*, 1996)	5	Not reported	5	0	N/A	Not reported			
Vertigo Handicap Questionnaire (Yardley and Putnam, 1992)	25	Patient interviews	5	4	√	α=0.93	T-test - no sig change	Not reported	√
Vertigo Symptom Scale (Yardley *et al*, 1992c)	22	Patient interviews & literature	5	4	√	α=0.75-0.88	r≥0.89	√	√[d]
Vestibular Disorders Activities of Daily Living (Cohen and Kimball, 2000)	28	Clinician	10	3	X	α=0.89-0.96	r≥0.87	√	Not reported
Other questionnaires used with dizzy patients:									
Activities Specific Balance Confidence Scale (Powell and Myers, 1995)	16	Clinician and patient interviews	100 (% scale)	0	N/A	α=0.96	r=0.92	√	√
SF-36 (Ware and Sherbourne, 1992)	36	Existing measures	2-6	8	X	α=0.76-0.90	Not reported	√	Not reported
Sickness Impact Profile (Bergner *et al* 1976)	136	Patient & carer interviews	2	12	X	α=0.94-0.97	r≥0.88	√	Not reported

[a]Krebs *et al*, 1993; [b]Cowland *et al*, 1998; [c]Enloe and Shields, 1997; [d]Yardley *et al*, 1998d

Chapter Three. Questionnaire Development (Phase I)

3.1. Introduction

A central objective of the present research is to develop a measure of treatment benefit which focuses on the areas of dizziness impact which patients themselves identify as affecting their quality of life. Chapter Three describes an investigation into the areas in which patients perceive quality of life impact.

A fundamental assumption of the present research is that a data-driven (inductive) approach is most appropriate to address the absence of a suitable patient-oriented measure of therapy benefit. The data to inform the content of such a measure was, therefore, collected from the patient population with minimal influence from theory. This approach was intended to limit bias during data analysis and overcome some of the perceived limitations of existing instruments that have been guided by assumptions underpinned by theoretical knowledge.

The approach used in the development phase (Phase I) was influenced by the principles of Grounded Theory, a general methodology used in the social sciences to generate insights by a parallel process of qualitative data collection and analysis (Strauss and Corbin, 1998). The method distinguishes itself from other methods of investigation by its emphasis on generating theory from data rather than testing hypotheses or elaborating existing theory. Grounded Theory was used to influence the approach to data collection but the method of data analysis used was Thematic Analysis, a technique which draws on influences from Grounded Theory but is not necessarily used as a complete theory-building procedure. Thematic Analysis was considered the most appropriate technique as this enables the reliable identification of themes arising in the data.

3.2. Data Collection

3.2.1. Rationale

The collection of data from the patient population could have been approached in a number of ways. The intention was to collect data which genuinely reflected the concerns of the patients by seeking their own accounts of dizziness and vestibular rehabilitation. Therefore, any closed-set approach where response options were limited by the assumptions of the researcher, was considered inappropriate. The alternatives to closed-set approaches are an open-set questionnaire where patients provide written responses to open-ended questions, or face-to-face interviews.

The option of an open-set questionnaire was rejected for a variety of reasons, predominantly associated with the anticipated quality of data that can be collected using this method. Any method of data collection involving literacy is in danger of excluding a valuable contribution from sectors of society who are unable to, or prefer not to, participate in this type of research. Moreover, the written word is a more formal mode of communication and it was felt that this method would be less likely to elicit the most personal, and perhaps some of the most important, aspects of an individual's experience. The informality of spoken communication provides opportunities for tangents and levels of expression that may be considered inappropriate in writing. A further limitation of written questions is that they provide a single opportunity to stimulate the sharing of experiences, so in cases where the participant does not understand the wording or does not associate the wording with their own experiences, the opportunity to gain insight from that participant is lost. During face-to-face interviews, the presence of the researcher provides the possibility of rephrasing questions if it is felt that an inappropriate or incomplete account has been given, and allows for the possibility of revisiting an area of interest for clarification or expansion or to explore potentially sensitive issues. The strength of face-to-face interviews was highlighted in one interview during exploration of difficulties with taking care of the self and the home. The participant initially denied difficulty in this area but when the phrasing was modified it emerged that the interviewee was no longer able to care for herself to the extent that she had moved back to her parents' home to be cared for. If the original phrasing had been presented in written form, the extent of the impact on the interviewee's life would not have been revealed. Furthermore, where written questions are used, the themes to be explored are necessarily decided *a priori* and the opportunity to discover areas of concern not envisaged at the outset, is limited. However, it should be acknowledged that the interviewer may introduce an element of bias into the data collection process.

A significant disadvantage of face-to-face interviewing is the investment of time required. However, considering the marked advantages of the approach for the purposes of the present work, and the fact that the quality of the data collected at this stage is fundamental to the rest of the project, it was considered that interviews were the most appropriate method. Following completion of the interviews, it was felt that this method provides a richness and quality of data that could not have been achieved by means other than face-to-face contact.

3.2.2. Interviews

Interview volunteers were recruited by providing clinicians at three hospital audiology departments with Patient Information Sheets (Appendix 1) to distribute to patients with some experience of vestibular rehabilitation. Patients contacted the researcher directly if they were interested in participating and were then offered the choice of being interviewed at home or at the clinic where they were being treated. All of the volunteers preferred to be interviewed at home. Before commencing each interview, the interviewee gave formal written consent to being tape-recorded. Participants were assigned a subject number and an alias at interview which was used to identify them thereafter. Phase I was approved by the following research ethics committees: University of Southampton, Institute of Sound and Vibration Research Human Experimentation Safety and Ethics Committee (Human Sciences Group), East Berkshire Research Ethics Committee and the Royal Free Hospital and Medical School Local Research Ethics Committee.

Data collection must be standardised across individuals only if analysis intends to focus on differences, or similarities, between individual responses. In this stage of the research, the analysed data was intended to elucidate the range of problems experienced by dizzy patients and guide the content of a preliminary questionnaire. Analysis of inter-subject variability was not necessary or appropriate for this purpose. Furthermore, a flexible approach to interview content and the order of questions was seen as necessary to optimise the sharing of experiences that were most important to the individual and thus elicit data with genuine validity for the intended purpose. However, on reflection, the interviewer did not allow the interviews to progress in an entirely flexible manner in the early stage of data collection and this may have been to the detriment of the breadth of data collected.

The generation of theory that is truly grounded in data demands that data collection is concurrent with analysis, and that the process evolves with insights gained from analysis of early data. For the purposes of the present work, this means that whilst interview content was initially guided by previous work, the areas explored in subsequent interviews were also influenced by the data collected from previous participants. Previous research on the consequences of dizziness (Yardley *et al*, 1992b; Mendel *et al*, 1999) suggested that the initial interviews should explore the impact of dizziness on work, leisure activities and socialising, family relationships, independence and daily living, emotions and fears and self-imposed restrictions. Throughout the process of data collection it became clear that participants' feelings about the future were a consistent feature in the consequences of dizziness. Similarly, early data collection indicated that one vehicle participants used to reveal their own perspective on vestibular rehabilitation, was to express how they might advise a fellow sufferer considering entering a treatment programme. These two themes were added to the areas explored in subsequent interviews. Conversely, although previous research suggested that dizzy individuals may experience difficulty with family and close personal relationships, the data collected in the present work did not support this and therefore this topic was excluded from the interview guidelines in later data collection. The vocabulary used to elicit participants' experiences also evolved over the course of data collection. For example, after a number of interviews it became clear that people do not understand 'leisure activities' to refer to how they spend their spare time. This iterative method allowed the researcher to gain experience in analysis that usefully influenced the data collection process. For example, as the interviewer gained experience through analysis of early transcripts, the need to encourage interviewees to be explicit in their descriptions became clear. Natural discourse is rich with information that is tacitly understood through non-verbal lines of communication. However, unspoken understandings cannot be reliably interpreted outside the original context and, as a result, valuable insights are lost for lack of explicit evidence of intended meaning.

The grounded theory method prescribes that the researcher should continue data collection until no further data are required. The point of data saturation was identified when the data provided no new insights, that is when new coding categories ceased to emerge. In the present study data saturation was reached after 18 interviews.

A key characteristic of Grounded Theory is 'theoretical sampling'. The rationale for this is that in order to generate theory, data should not be collected from a random sample but a sample that is intentionally selected to provide representation of influential variables. The variables that may influence the data were guided by previous work and theory. For the present work, this meant that sampling was directed as far as possible to embrace participants who provided a diverse range of perspectives. It was anticipated that an individual's perspective on dizziness and vestibular rehabilitation would be influenced by their gender, age, social class, the approach of the treating therapist, and the aetiology and longevity of their dizziness. From the information provided by volunteers before actually participating, sampling could only be directed on the basis of the treating clinician, gender and, to a limited extent, social class. The pursuit of more comprehensive information on potential participants was not viable for ethical reasons. Similarly, it was not possible to acquire confidential data (such as diagnosis) concerning participants because of restricted access to patient records. The interviewees' gender, age and social class were assessed subjectively at interview. Theoretical sampling, although desirable in the present research, is only possible when the potential sample offers heterogeneity on the specified criteria. In practice, the majority of the participants were treated by the same clinician (n=14/78%) were female (n=16/89%), middle class and lived within a 5 mile radius of one another. The subjectively assessed participant age range is 30-80yrs where females: 30-40yrs, n=3 (16.5%); 40-50yrs, n=3 (16.5%); 50-60yrs, n=4 (22%); 60-70yrs, n=4 (22%); 70-80yrs, n=2 (11%) and males: 50-60yrs, n=1 (5.5%) and 60-70yrs, n=1 (5.5%). Wherever possible, male volunteers and patients treated by different clinicians were included, but this was limited by the number who volunteered. However, it may be argued that the bias of the sample towards middle-age, middle-class females is typical of the patient population. Subject samples participating in previous vestibular rehabilitation research are typically female dominated and mean ages tend toward the 6th decade (Cohen *et al*, 1992; Krebs *et al*, 1993). A social class bias is also typical in healthcare; research indicates an inverse relationship between socio-economic status and GP consultations (Beale *et al*, 2000).

This bias may be enhanced in the population receiving vestibular rehabilitation as provision in the UK is both sparse and low profile.

3.3. Data Analysis

3.3.1. Rationale

Data coding procedures offer a framework for methodical categorisation of qualitative data that facilitates sensitive and accurate analysis. The purpose of coding is to reveal patterns within the data and extract themes common across the sample. Thematic Analysis is a generic method of extracting themes from a data set. This method is not confined to a particular theoretical perspective; it may be employed with any approach to qualitative analysis (Boyatzis, 1998). In the present study Thematic Analysis facilitated simultaneous data reduction and categorisation of data into themes relevant to the aims of the study.

Whilst it has been established that the present enquiry is founded on an inductive philosophy, there were further methodological issues which influenced the outcome of the analysis. Coding can be performed from a manifest-content or latent-content perspective (Boyatzis, 1998). Manifest-content analysis involves categorising data based on transparent characteristics such as the vocabulary used or the type of experience described. Latent-content analysis aims to understand the data at a deeper level by analysing underlying meanings. For the present work a predominantly manifest-content analysis was considered most appropriate since the use of particular vocabulary or reference to a particular type of activity was sufficient to code the issues of interest to the present work without deeper levels of interpretation. Manifest-content analysis is also better suited to calculation of intra- and inter-coder reliability which provided an additional layer of rigour to the analysis. Furthermore, the subject matter of the interviews was not seen as personal to the extent where individuals may allude to sensitive issues rather than discussing them in a transparent fashion. However, although the data were read at a manifest-content level, some of the emerging codes may be seen as more typical of latent-content analysis. This resulted from the creation of abstract codes which incorporated a number of more concrete experiences, thus linking codes on the basis of an underlying theme. For example references to 'fear of crossing the road' and 'fear of driving' were abstracted in to a 'fear of physical harm' code based on the assumed underlying cause of fear.

An important factor in the outcome of a coding procedure is the unit of coding. Codes may be attached to single words, a meaningful unit of text, a line of text, a sentence, paragraph, or an entire interview. In connected speech, single words are rarely meaningful in isolation; lines of text are arbitrary markers that may not hold meaning independently, or may contain more than one meaningful segment; speakers do not formally divide their thoughts into sentences or paragraphs therefore such divisions must be imposed by the transcriber; whole interviews are an inappropriate unit of coding since specific areas of concern are of interest rather than the overall tone of the interview. Therefore, a meaningful unit of text, that is a group of words which could be understood standing alone, was considered the most appropriate coding unit for the purposes of the present work.

A further consideration was whether to operate an 'exclusive' or 'multiple' coding procedure (Boyatzis, 1998). Exclusive coding allows each unit of coding to be described by a single code while multiple coding allows an unlimited number of codes to be attached to each unit. The potential danger with multiple coding is that without strict prioritisation of coding, each unit of analysis could be interpreted as belonging to an impracticable number of codes, resulting in an almost meaningless analysis. Since the researcher lacked experience in coding procedures, the decision was not taken *a priori,* instead it was decided to use a flexible approach initially. During the coding procedure, multiple coding did not present the anticipated difficulties of ‘over-coding’ and it was felt that exclusive coding would have resulted in the loss of meaningful information.

3.3.2. Qualitative analysis

The coding procedure was carried out using Ethnograph software (version 5.5, Qualis Research, 1985), a package designed for computer-assisted qualitative data analysis. Each transcribed interview was contained in a text file which allowed the coder to attach a code label to a selected unit of text. During the coding process, a codebook file is created which allows the codes to be organised hierarchically into a code tree. A sample of a coded data file can be found in Appendix 2. The software allowed retrieval of segments of text labelled by a particular code or code sequence from all text files held in the directory. This allowed the coder to verify homogeneity of coded segments.

In developing a data-driven code, the coder compiles a Coding Manual (Appendix 2) which prescribes the method of coding. Ethnograph offers a 'memo' facility which allows the coder to attach (hidden) notes to the text where a significant event, such as change in code definition, occurs. This allowed detailed documentation of the evolution of the Coding Manual.

During development of the Coding Manual, the interview data were coded three times. During the first coding, the basis of the manual was developed. This was further refined in the second coding and applied to the data in the third. Repetitive coding of the complete data set should not, normally, be necessary. However, the inexperience of the researcher in the rigorous application of a coding procedure demanded repetition before the method was satisfactorily refined to allow confidence in the analysis. Codes were attached where the data contained themes relevant to the aims of the present study. Themes present in the data but not coded included references to perceived cause, other health problems, other health care experiences and social comparison. Terminology used to describe dizziness was not coded to prevent inappropriate coding caused by the misuse of medical terminology. References to 'vertigo', for example, were not coded unless accompanied by a description of the illusion of movement.

Seven main coding categories emerged from the data: Feelings of dizziness and associated symptoms or sensations; Personal limitations; Preferred environments; Practical and lifestyle restrictions; Feelings about living with dizziness; Vestibular Rehabilitation; Additional data tags (miscellaneous). Each main code category contained a number of code subcategories, totalling 31. The codes that were actually applied to the data fall under the 31 codes (the code attached to the data embodies main code category and code subcategory). The hierarchy of code categories can be seen in Table 3.1 and further details of the individual codes applied to the data can be found in the Data Coding Manual in Appendix 2. Some codes refer to a single construct such as 'confidence' or concrete experiences like the use of 'physical support' whilst other codes were abstracted to incorporate a larger number of related constructs. For example the code 'normal' referred to a range of experiences that were linked by the interviewee expressing desire to, or efforts to, behave in a fashion that did not appear unusual in public.

Table 3.1 Hierarchy of code categories and sub-categories emerging from Thematic Analysis of interview data

<table>
<tr><th colspan="42">Feelings of dizziness and associated symptoms or sensations</th></tr>
<tr><td colspan="7">Descriptions of dizziness</td><td colspan="7">Nausea</td><td colspan="7">Tiredness</td><td colspan="7">Frequency and duration</td><td colspan="7">Anxiety and panic</td><td colspan="7">Other associated symptoms</td></tr>
<tr><th colspan="42">Personal limitations</th></tr>
<tr><td colspan="21">Physical limitations</td><td colspan="21">Cognitive limitations</td></tr>
<tr><th colspan="42">Preferred environments</th></tr>
<tr><td colspan="14">Staying close to home</td><td colspan="14">Noise and crowds</td><td colspan="14">Visual environments</td></tr>
<tr><th colspan="42">Practical and lifestyle restrictions</th></tr>
<tr><td colspan="6">Work</td><td colspan="6">Caring for the self, home and others</td><td colspan="6">Getting from A-B</td><td colspan="6">Leisure and social activities</td><td colspan="6">Dependence</td><td colspan="6">Special methods and arrangements</td><td colspan="6">Global</td></tr>
<tr><th colspan="42">Feelings about living with dizziness</th></tr>
<tr><td colspan="6">Fear and worry</td><td colspan="6">Frustration</td><td colspan="6">Distress</td><td colspan="6">Confidence</td><td colspan="6">Public image</td><td colspan="6">Feelings about the future</td><td colspan="6">Expectations</td></tr>
<tr><th colspan="42">Vestibular rehabilitation</th></tr>
<tr><td colspan="14">Changes in symptoms and personal limitations</td><td colspan="14">Changes in lifestyle restrictions</td><td colspan="14">Psychological and therapeutic benefit</td></tr>
<tr><th colspan="42">Additional data tags</th></tr>
<tr><td colspan="14">Anticipation</td><td colspan="14">Provocation</td><td colspan="14">Comparison</td></tr>
</table>

In the data Coding Manual each code consisted of a label, an expanded definition of what the code referred to, criteria for when the code should (and sometimes should not) be applied and examples of when the code should (and sometimes should not) be applied. The coding labels, definitions and inclusion/exclusion criteria were intended to be transparent and intelligible to a person with no prior knowledge of the subject. Hence by adhering to the coding criteria outlined in the Coding Manual, classification of the data by any individual should yield uniform results. In a rigorous approach to realist[7] qualitative data categorisation, it is desirable to test the consistency of judgements across coders by asking a second individual to apply the Coding Manual to the data (Boyatzis, 1998). The second coder may be a colleague, an expert in the field, or a naive individual with no prior experience of the subject matter. In the present study, it was decided that the second coder should be a naive individual so that any implicit assumptions made during development of the code, based on prior theoretical knowledge of the subject, would be highlighted.

Since there are a large number of codes describing the interview data, it was decided that a second coder should classify the data by main code category and code subcategory only. To ask a naive individual to apply a method of classification involving 72 options for each unit of data, would place greater emphasis on testing the memory and the diligence of the individual rather than the adequacy of the method. The definitions of the codes applied to the data by the primary coder were presented in the Coding Manual as 'component meanings' of the code subcategory. This allowed the second coder to identify a definition that described each unit of data, but without having to select between a plethora of 'component meanings' for each unit of data. Where codes were self-explanatory they were used as examples to illustrate when a subcode should be applied rather than being presented as component meanings. For instance bending, lying, head movement and looking up are all individual codes but were presented in the Coding Manual as examples of when to code 'Physical actions'.

---

[7] Realism is a philosophical approach in the social sciences which argues that abstract concepts have a real existence and can be studied empirically.

The purpose of calculating the intra- and inter-coder reliability is to demonstrate consistency of judgements, or lack of, to provide support for the analysis offered, or data to inform modification of the Coding Manual if difficult codes are identified. Intra- and inter-coder reliability were calculated as the number of occasions when the two coders agreed on the same code as a percentage of the number of times when both coders specified a code. This calculation was performed for both category and subcategory levels of coding. Repeat coding of two transcribed interviews (approximately 10% of the data) reveals intra-coder reliability of 98.8% at the category level and 98.4% at the subcategory level. Coding of two complete transcribed interviews and three separate segments of text from the remaining interviews by a naive coder, revealed inter-coder reliability of 89.5% at the category level and 84.3% at the subcategory level. No particular pattern could be identified in the rare incidences where the two coders did not agree.

Boyatzis (1998) suggests that inter-coder consistency of 70% or more is acceptable. The high intra- and inter-coder reliability scores offer strong support for the reliability of the analysis presented. Consequently, the coded data was used to guide the preliminary questionnaire content without re-examination of the analysis.

3.4. Results

3.4.1. Transforming codes to questionnaire items

The outcome of the coding process is summarised in the item table in Appendix 2. To assist the reader in interpreting the table, the fields are described below.

The 'Domain' field categorised each item according to one of four quality of life domains: symptoms, disabilities, lifestyle restrictions and psychological impact. This categorisation was designed to ensure that all areas of impact were represented in the preliminary questionnaires. The domain breakdown of the preliminary questionnaire items was as follows: 5 symptom; 9 disability; 14 lifestyle; 7 psychological. The 'Range' field categorised each item according to subjective impression of the severity of lifestyle impact of that item. The descriptor 'mild' referred to motion-provoked symptoms and some concerns but no/minimal avoidance behaviour, 'moderate' referred to some lifestyle impact and/or, some psychological impact, and/or shows some avoidance but can continue with life to a reasonable extent, 'severe' referred to serious impact on lifestyle, considerable psychological impact, life is dominated by the problem/consequences. The purpose of this categorisation was to ensure that items across the range of impact were included in the preliminary questionnaires to facilitate sensitivity to changes in quality of life across the severity continuum. Whilst it was desirable that the majority of questionnaire items should allow reflection of a range of function through a range response options, some items were intentionally directed towards the polar extremes of the severity spectrum. The domain breakdown of the preliminary questionnaire items is as follows: 17 mild-severe; 15 moderate-severe; three severe. The 'Prevalence' field indicated how many of the 18 text files contained the code in question and incidence indicates how many times it was mentioned in total. Incidence was considered less relevant since thematic coding categorises, rather than quantifies, the data. However, the ratio of incidence to prevalence may provide some indication of spread. For example, low prevalence accompanied by high incidence suggests that an item is of considerable importance to a few individuals. The prevalence and incidence of concurrent provocation and anticipation tags was also indicated where appropriate. The 'Questionnaire' field lists which existing disease-specific questionnaires contain an item of similar content. This information indicates how the preliminary version compares to existing instruments and may be useful to verify the 'Domain', for instance whether an item appears in the Vertigo Symptom Scale or the Vertigo Handicap Questionnaire. The 'Notes' and 'In/exclusion' fields provide brief reasoning and a decision on whether the item was to be included or excluded from the preliminary questionnaire.

Sixty-seven of the 72 codes formed the basis of potential items and from this 36 items were selected for the preliminary questionnaires. The five codes that were not considered as potential items in themselves were 'provocation' and the codes associated with vestibular rehabilitation benefit. The 'provocation' code was not suitable as an item in itself as examples of provocation are diverse; the codes which referred to the actions which provoked the symptoms were more suitable as potential items. The frequency of 'provocation' as a co-occurring code is given in the table to differentiate codes associated with provocation from codes that co-occur with 'anticipation'. The four vestibular rehabilitation benefit codes were included in the Coding Manual to provide guidance as to the type of benefit derived from therapy in this particular sample and may be of interest in future work. However, they are not consequences of dizziness which can be tracked across a course of therapy, therefore they are not suitable as items. The content of vestibular rehabilitation benefit codes, that is, the problems that participants reported were alleviated by the treatment, are represented through antonyms in one of the other seven main categories.

Of the 35 items included in the preliminary version, 23 feature in one or more of the existing questionnaires. This indicates that approximately one third of the provisional item list arising from analysis of interview data addresses issues which have not been addressed by previous measurement tools. The importance of issues arising from interview analysis which appear in existing questionnaires is reinforced by the present analysis and it is seen as an advantage of the current work that these issues will be drawn together in a single questionnaire addressing all aspects of dizziness impact. Table 4.2 (Chapter Four, Section 4.3.2) indicates the items that appear in other questionnaires. Of the potential questionnaire items that were excluded from the preliminary version, six appear in other questionnaires, nine do not. Fourteen of the 35 items in the preliminary questionnaires feature in the Vertigo Handicap Questionnaire, 14 in the Dizziness Handicap Inventory, 9 in the Dizziness Impact Profile, 8 in the Dizzy Factor Inventory, 6 in the UCLA Dizziness Questionnaire and 6 in the Vertigo Symptom Scale. This is consistent with the 'domain' breakdown in the present analysis, which indicates an emphasis on handicap (lifestyle restrictions) with substantial representation of disability and a relatively minor influence of symptoms. This approach is supported by research that suggests a minor role of symptom severity in predicting the lifestyle impact of dizziness (Yardley and Putnam, 1992; Yardley *et al* 1994a).

Potential items were excluded from the preliminary questionnaire for a variety of reasons. For example, items that were referred to by interviewees in the context of severe acute episodes, such as persistent vomiting and the inability to walk, were excluded on the basis that patients are unlikely to attend clinic for treatment whilst experiencing these symptoms. Other reasons for exclusion included items which focused on issues such as how comfortable patients felt about asking for help or patients feeling that they needed to conceal the dizziness in front of others. Although these issues may be of concern to the dizzy population, and may indeed impact upon quality of life, these issues are not the focus of vestibular rehabilitation.

The effect of collecting data from a sample weighted towards a particular demographic profile can be seen to some extent in the data. Whilst this profile may largely reflect the majority of the patient population (as discussed in Section 3.1.2 above), eliciting a broad range of experiences was an important aspect of data collection so the homogeneity of the sample raises some concerns. The implications of collecting data from a potentially skewed sample, in particular, the heavy bias towards females and patients treated by a single therapist, were considered. A discussion of the possible areas of bias, and how they were taken into account in the transformation of analysed data to questionnaire items, follows below.

The social class bias may be reflected in the frequency of references to overseas travel. Since this item may exclude a component of the clinic population, more so in some geographical areas than others, this item was omitted from the preliminary questionnaire. The fact that a large component of the sample were of an age where childcare and employment are less likely to feature in their lives, may have influenced the prevalence of these issues in the data. This was considered in developing the questionnaire items and the decision was taken to word an item addressing these issues in as broad a manner as possible to embrace all forms of work, including home care and care of family members. The motivation for including an item referring to work was influenced by the fact that it is central to the lives of the people to whom it applies and also because it may provide useful information for those concerned with health care economics. The fact that 89% of the sample were female may have skewed the prevalence of references to conventional female roles such as housework and reduced prevalence of references to conventional male roles such as home maintenance. The wording of the questionnaire item resulting from references to difficulty with home care was selected to include home care activities both males and females traditionally participate. The prevalence of references to driving may have been biased to some extent by the social class and geographical location of the majority of the sample. The issue of driving whilst being irrelevant to some people's lives, is of critical importance for others. It was felt that the entire issue of driving should not be excluded from the questionnaire but was incorporated into an item that applied to as much of the population as possible. The item referred to concerns over coming to physical harm because of the dizziness where driving was given as one possible example. It was assumed that geographical factors also influenced the prevalence of reference to theme parks since one exists in the vicinity of the majority of the sample. Since this is a lifestyle issue of relatively minor importance to relatively few participants, and probably quite irrelevant to most people in the country, this item was excluded from the questionnaire. Any bias in the perspective of the participants caused by the treating therapist will not have influenced the questionnaire as items were based on analysis of the consequences of dizziness prior to treatment. Therefore, any skew in the degree or nature of benefit from treatment given by a therapist with a particular approach is unlikely to have filtered down to the questionnaire items.

The use of a potentially biased sample also had implications for the identification of data saturation. If the participants represented only a small sector of an otherwise broad spread of experience, there was a danger that the point of data saturation was identified prematurely. However, the final three interviewees were not treated by the same clinician as the majority of the sample; one of the final three interviewees was male; and one was very elderly whilst the other two were more representative of the age of the sample. The final three interviewees reported experiences typical of the previous participants and no new themes emerged. This provided a degree of confidence that the demographic profile of the sample did not markedly influence the content of the data.

3.4.2. Preliminary questionnaires

A secondary objective of the research project was to compare two methods of measuring subjective change ('state' and 'change' methods) and to this end two versions of a preliminary questionnaire were developed. The item content of the two versions was identical except for necessary differences associated with the question format.

The number of response options offered should be influenced by the purpose of instrument. A dichotomous option is the most simple and overcomes individual differences in interpretation of value judgements such as ‘mild’ or ‘very mild’. However, dichotomous response options do not harness potentially useful information and offer poor sensitivity to change (Kirshner and Guyatt, 1985; Streiner and Norman, 1989). For precision and responsiveness Streiner and Norman (1989) recommend between 5 and 15 options or a visual-analogue scale. However, too many options may render the distinctions meaningless (Bowling, 1991). Visual-analogue scales, in particular, can create an illusion of precision which has found to be invald (Streiner and Norman, 1989). Guyatt *et al* (1986) suggest that a 7-10 point Likert scale or visual-analogue scale is suitable for detecting small changes in status. An odd number of response options allows the respondent to adopt a neutral position. Although in some circumstances this is not desirable, when measuring change in patient status it was considered that a ‘no change’ option should be available.

Seven discrete response options were selected. This represented a compromise between ease of understanding and sensitivity to small changes. Individual differences in interpretation of value judgements such as 'mild' can be a concern when comparison between subjects is desirable; however, changes within the individual are of primary interest in the present study and so across-subject differences in interpretation are less of a concern.

Other disease-specific questionnaires that may be comparable offer fewer response options. The Vertigo Symptom Scale (Yardley *et al*, 1992c) and Vertigo Handicap Questionnaire (Yardley and Putnam, 1992) use five response options, asking the respondent how frequently things are experienced throughout the questionnaires. The UCLA-DQ (Honrubia *et al*, 1996) also offers five levels of response but the content of the options varies between frequency, severity and degree of impact. Similarly, the Dizzy Factor Inventory (Hazlett *et al*, 1996) uses five response options which vary throughout the questionnaire although the exact wording of the response options is not given in the literature. The Dizziness Handicap Inventory (Jacobson and Newman, 1990) offers three uniform response options throughout: yes, sometimes, no. The Dizziness Impact Profile (Booth, 2000) is based on the generic Functional Limitations Profile (Charlton, 1989) which uses a binary system where items are either endorsed or not endorsed.

In the present study, it was decided that identical response options would not be appropriate for all items and therefore the wording of response options should vary depending on the focus of the item. This had the additional benefit of discouraging subjects from answering identically to all items. A Likert response scale was used with some response options referring to frequency and some to severity with items grouped according to their response option for ease of understanding. To discourage uniform responding within a section, it was decided that either the items or the response options should be worded with some phrased positively and some phrased negatively. Since varying the position of positive and negative response options can cause confusion and render results unreliable (Streiner and Norman, 1989), response options remained uniform within a section and the polarity of questionnaire items was reversed instead. For example, instead of asking all questions in a negative fashion such as “I can no longer do...”, “I feel unable to...”, “I have restricted my...”, some items were phrased positively as in “I feel able to...”, “I can continue to...”. Again, this was designed to prevent subjects from agreeing with every item and to encourage careful reading of each item. Double-negative phrasing was avoided throughout both versions.

Both 'state' and 'change' formats of the preliminary questionnaires (Vestibular Rehabilitation Benefit Questionnaire, Version 1.0) can be found in Appendix 3.

3.5. Conclusions

Chapter Three describes the process of interviews and analysis used to characterise the impact of dizziness on quality of life perceived by sufferers. Interview data were categorised into themes that represent the areas of life where dizziness impact was perceived by the interview sample. The findings indicate that the quality of life impact of dizziness extends beyond the experience of unpleasant symptoms and difficulties directly associated with symptoms. The range of dizziness impact described by the interviewees indicates that quality of life is affected in many indirect ways related to lifestyle limitations and psychological distress beyond the immediate effects of the symptoms. This supports previous work and also reveals some areas of quality of life impact not addressed by existing measurement tools. These findings highlight the importance of measuring treatment success in terms of quality of life improvement rather than just symptoms. It also highlights the importance of developing patient-led measures of outcome rather than resting on assumptions of professionals.

The findings of this investigation are a pivotal component of the present research as they underpin the remainder of the work. Themes arising from interviews were used to derive a pool of 36 questionnaire items intended to measure the range of dizziness impact. Further stages of work are needed to examine the measurement properties of these preliminary questionnaire items.

Chapter Four. Questionnaire Refinement (Phase II)

4.1. Introduction

The second phase of work involved refinement of the preliminary questionnaires. The aim was to develop the preliminary item list into a revised list of questions that were psychometrically robust and able to provide clinically useful information. To achieve this, the refinement process was divided into two parts, subjective (face validity) and statistical refinement, each with a different purpose and a different approach.

Before collecting data for statistical refinement, it was important to undertake a subjective review to establish whether the format and contents of the questionnaires were acceptable to both clinicians and patients. It was envisaged that clinicians would be primarily concerned with the relevance of items to treatment goals, efficient use of clinical time and ease of scoring and interpretation. It was thought that patients would be concerned with relevance to problems experienced in daily life and ease of completion. Other interested parties may include healthcare management professionals who would be concerned with resource requirements, sensitivity to treatment benefit and their inter-relationship. Data for the evaluation of sensitivity to treatment benefit was collected in the final stage (Phase III) described in Chapter Five. Following an evaluation of face validity, data collection to allow analysis of the questionnaire's psychometric properties could proceed. Examining the psychometric properties of the items will inform the reduction of the number of items and reveal any underlying subscale structure in the data.

The two processes of refinement are outlined in greater detail below.

4.2. Face Validity

4.2.1. Rationale

The concept of face validity refers to whether the intended audience consider the questionnaire to be measuring the phenomenon of interest. The nature of face validity is subjective and may be unrelated to measurement characteristics which are described statistically. As such, some may view it as an unimportant property, yet user confidence in an instrument may be crucial to its success. In the current context, the phenomenon of interest is the impact of dizziness on quality of life and the intended audiences are dizzy patients and vestibular rehabilitation therapists. Patient and therapist confidence that the questionnaire is a valid and easy-to-use measure of dizziness impact will be a critical factor determining whether or not it is used in the real-life clinical environment. One aspect of face validity that is particularly important is the readability of questions and response options. If patients are unable to understand the nature of the question or the intended meaning of response choices, questions may be left incomplete or responses may be spurious. This will result in a meaningless score that does not reflect the individual's experience. Readability, and similar issues, can present a barrier to the clinical utility of a measure, yet are relatively simple to identify and resolve if time is invested in a proper review of face validity.

4.2.2. Data collection

The issue of face validity was addressed during a preliminary field trial of Version 1.0. Patients and clinicians were invited to comment on the relevance and ease of understanding of each item and the overall coverage of the questionnaire.

Four experts with an academic interest in vestibular rehabilitation, three of whom have clinical experience, were invited to comment on the preliminary questionnaires. Twelve patients who had previously participated in the project (interview subjects) were also asked to review the questionnaires. These subjects were used to provide a patient perspective on face validity and, furthermore, participant feedback on the results of a qualitative analysis is a recognised method of validating the analysis. The feedback regarding relevance and coverage may be biased by the fact that it was elicited from the same sample that provided the data underpinning the questionnaire items. However, since the interviewees did not report a homogenous profile of difficulties, their comments are considered useful and meaningful. The validity of patient input concerning readability should not be compromised by previous involvement.

The preliminary questionnaires, together with instructions for face validity reviewers, were posted to the 16 participants. Comments were returned as notes written directly on to the questionnaires, or in a letter. The response rate was 100%. The general tone of patient feedback was positive and endorsed the readability, relevance and coverage of the impact of dizziness on quality of life. Comments from both patient and expert reviewers also highlighted weaknesses that were addressed before further field testing. The modifications to Version 1.0 arising from the reviewers comments are summarised below.

4.2.3. Questionnaire modification

Comments arising from the face validity review of Version 1.0 (Appendix 3) prompted a number of modifications to the questionnaires resulting in Version 2.0 (Appendix 3). The changes were predominantly intended to clarify the instructions for completion: the time scale to be considered, exclusion of difficulties not caused by dizziness, how to respond to multi-faceted items, how to treat irrelevant items, examples of positively and negatively phrased items to highlight the need for careful reading.

The section regarding motion-provoked symptoms was expanded and instructions for completion were clarified. The items referring to symptom provocation following slow and quick head movements were clarified by specifying lateral movement and an additional item was added to probe the effect of vertical head movement. The items referring to lateral movement focus on adaptation of the vestibular-ocular reflex whilst symptom provocation from vertical changes in head position are characteristic of the symptoms of Benign Positional Paroxysmal Vertigo (BPPV).

Several of the patient reviewers completed the questionnaire, and their responses highlighted the need to request that *all* items are completed and that only *one* response option should be selected for each item.

Expert reviewers suggested that some items were somewhat specific and that they may not apply to all patients. For example, the item ‘I have continued to take part in activities like sports, dancing, playing with children’ may be inappropriate for an elderly person whose most physical activity is climbing the stairs. In response to these comments, items that may not apply to everyone were made less specific to encapsulate a wider audience. For example, the item ‘I have continued to take part in activities like sports, dancing, playing with children’ was modified to ‘I have continued to take part in physical activities'. The modified item includes all forms of physical activity which the individual can interpret in the context of their own life. The questionnaire should not necessarily aim to control individual differences in interpretation since the intention is to measure changes within individuals over time.

Comments from expert reviewers also prompted a review of the response options in Section 1 of the 'state' questionnaire (Version 1.0). One reviewer suggested that the wording could be simplified to use 'often' rather than 'frequently'.

The face validity review provided a constructive critique of Version 1.0 and consequent modifications should improve 'user friendliness' and minimise spurious response patterns. The structure of the questionnaire was modified in Version 2.0 to separate items relating to symptoms of dizziness from items relating to other aspects of quality of life. The motivation for the change was to group items for consistency of response options but also to make explicit that the questionnaire covers all of the areas of a disease-specific quality of life instrument.

4.2.4. Further modifications

A final review of Version 2.0 by the author resulted in further modifications to address concerns remaining after the face validity review. The concerns which remained related to: appropriate response format for Section 2 of the 'change' questionnaire, length and complexity of instructions for completion (both formats), balance of positively and negatively phrased items. Version 2.1 (see Appendix 3) emerged from these further modifications.

The interpretation of response options (agree strongly–disagree strongly) in Section 2 of the 'change' questionnaire was not considered clear . For example, disagreement with a statement such as 'Since the vestibular rehabilitation, I have more difficulty walking' does not necessarily reflect improvement. Degrees of disagreement ('disagree', 'disagree quite strongly', 'disagree very strongly') are not unambiguous indicators of levels of improvement; an alternative interpretation may be degrees of certainty about *not* having *more* difficulty walking. The Section 2 response options were, therefore, altered to a format with less ambiguous interpretation to aid readability: a lot more-a lot less. This response format also allowed closer alignment of 'state' and 'change' formats. Item phrasing and polarity was then uniform across 'state' and 'change' formats with the only variation being in the carrier phrase ‘Compared to before the dizziness started’ and ‘Compared to before the vestibular rehabilitation’. Differences in response patterns to Section 2 items could then be more confidently attributed to differences in 'state' or 'change' format without influence from phrasing variables. The altered phrasing allowed greater flexibility in selecting the polarity of each item (positive or negative phrasing); half of the items were phrased positively in Version 2.1.

A concern regarding the response options in Section 2 of the 'state' questionnaire Version 2.1 was that the comparison with the pre-dizzy state is now explicit. This may invite criticisms that even the 'state' format is subject to retrospective reporting bias. However, since disease specific questionnaires aimed at measuring therapy benefit intend only to measure the impact caused by the condition of interest, a comparison with the pre-dizzy state is implicit. DeMeyer *et al* (1986) argue that all subjective measures are retrospective as they all rely on comparison with past experience even where this is not explicit in the phrasing of the question. Some questionnaires, such as the Vestibular Disorders Activities of Daily Living scale make the comparison to the pre-morbid state explicit in the instructions for completion (Cohen and Kimball, 2000).

Item 3 of Version 2.0, “Since the dizziness started, I feel the need to hold on to something for support”, was transferred from Section 1 (Symptoms) to Section 2 (Quality of Life) in Version 2.1 since the item describes a phenomenon which may be seen to reflect something about the individual's reaction to the dizziness, such as a loss of confidence, rather than necessarily reflecting an actual symptom.

Instructions for completion were reduced, simplified and aligned as closely as possible across the two formats.

4.3. Statistical Item Reduction

4.3.1. Rationale

Following face validity review and subsequent modification of the preliminary questionnaires, data were collected with Version 2.1 to allow statistical analysis of the items

The questionnaires consisted of 36 of items arising from analysis of interview data. By virtue of their origin, the items covered a broad range of issues that were relevant to the experience of patients. However, this was simply the starting point for developing a questionnaire in which each item is a useful measure of quality of life change that could be easily used in a clinical context. A clinically useful questionnaire should not demand unreasonable time resources, and the number of items should not be onerous for the patient. Therefore, it was decided that the preliminary item list should be reduced to around 20 items whilst retaining comprehensive coverage of the issues and sensitivity to the full range of quality of life impact. To facilitate this reduction, data were collected to allow analysis of each item with a view to excluding approximately half.

Statistical criteria for item exclusion included very high correlations between items, indicating redundancy of one or more items, and very poor or very frequent endorsement of an item (low variance) indicating floor or ceiling effects. Subjective screening of the items would also be necessary to ensure that the final item list was sensitive to the full range of quality of life impact experienced by patients. The final item list should show good internal consistency to demonstrate that the questionnaire measures aspects of the same construct, rather than a series of unrelated constructs. The final item list would be subjected to factor analysis to establish if items group together statistically in a way that can be meaningfully interpreted.

4.3.2. Data collection

Data were collected from patients undergoing vestibular rehabilitation at one of 11 participating NHS centres in the UK. The participating centres were selected from a larger number of centres who volunteered to collect data after being approached by letter. The centres were selected to provide representation of the diverse range of vestibular rehabilitation offered in the UK. This included representation from the many professional groups providing vestibular rehabilitation and the range of approaches used (generic and tailored programmes, informal counselling and formal psychological methods and a range of follow-up arrangements).

Data were collected from 155 subjects. The sample size was determined by the requirements that must be met before factor analysis should be applied. Howitt and Cramer (2000) recommend that data are collected from a sample equal to four or five times the number of independent variables (in this case, 36 questionnaire items). Potential subjects were patients reaching the end of a programme of vestibular rehabilitation, or patients who had considerable experience of vestibular rehabilitation. The recruitment criteria did not dictate that suitable subjects were those who had been discharged following completion of a vestibular rehabilitation programme, since it is possible that this would introduce an element of bias. For example, depending on the treatment policy of the clinic, it may be that patients are only discharged when they are deemed to have successfully completed a programme of therapy.

Follow-up of non-respondents was considered an important part of the experimental design for two reasons. Firstly, a single follow-up of non-respondents was shown to increase the response rate by over 20% in a recent study of dizziness (Booth, 2000). A higher response rate was desirable to increase the range of patient experiences captured by the data which would, in turn, enhance the applicability of the final instrument to the clinic population. Secondly, a follow-up allowed analysis of the response patterns of first and second time respondents to examine trends that may be important to the future use of the questionnaire. For example, if first-time respondents showed a trend towards higher benefit scores than second-time respondents, this may imply that the questionnaire refinement process was based on data from those who have benefited most from treatment. This would have implications for the applicability of the questionnaire to patients across the range of benefit and may alter the interpretation of questionnaire scores. Conversely, if no systematic differences were observed this would provide support for the validity of the questionnaire for patients across the range of benefit.

Principles of confidentiality prevent researchers external to the NHS from obtaining personal or medical details of individuals from NHS records without the patients' specific consent. This presented difficulties for contacting those who did not return the questionnaire. The following procedure was designed to allow follow-up of non-respondents within those constraints. Participating clinics were supplied with a batch of coded patient information packs (the Patient Information Sheet can be found in Appendix 1) which clinicians gave to suitable patients[8]. Patients who were interested in participating returned the accompanying consent form directly to the principal researcher who distributed a questionnaire pack by post. When questionnaires were not returned within one month, a second questionnaire was sent; first and second time respondents were identified by coding to allow comparison of the two sub-samples. This procedure did not allow for the follow-up of potential participants who chose not to return the consent form. However, the number of patients who chose not to return the consent form was calculated from the number of questionnaires distributed by each clinic

4.3.3. Analysis procedures

The aim of Phase II was to distil the preliminary questionnaires down to a smaller number of items that provided the most useful information in a time-restricted environment. It was intended that the retained items would form an instrument that was both psychometrically robust and offered useful information to the clinician. The need for psychometric robustness demands that the instrument is internally consistent and the most informative items are those that discriminate between individuals with differing levels of the trait being measured. Furthermore, the division of items into meaningful subscales may simplify interpretation of response patterns and consequently enhance clinical usefulness. Subscales were identified by exploratory factor analysis, a statistical procedure which identifies clusters of items that are correlated.

---

[8] Selection criteria were that the clinician judged patients to have English as their first language and they were thought to be competent to complete a questionnaire.

The items that were most effective in discriminating between the majority of respondents (as revealed by high response variance) were retained, whilst items that showed low response variance were removed. However, a small number of items that displayed low response variance were retained to provide a useful measure of the extremes. To illustrate, an item describing a situation that is of difficulty only to the most severely disabled individual would attract a uniform response from the majority of respondents (a floor effect). Although endorsement of such an item would be rare, it was important to include items that identify the most severely disabled individuals. At the opposite end of the spectrum, an item describing a situation of difficulty to almost all dizzy individuals would be endorsed by the majority of respondents in a uniform fashion (a ceiling effect). Whilst such an item may be considered of limited use because it does not discriminate between those with low, moderate and severe levels of disability such an item can allow detection of improvement in individuals who suffer minimal disability at the outset of treatment. Items that correlate strongly with another item may be removed from the questionnaire as the information they provide is duplicated and, therefore, redundant. Following division of the items into meaningful subscales and reduction of the number of items, the internal consistency of the overall scale, and the subscales, was established.

To allow estimation of an appropriate sample size for Phase III, a preliminary calculation of the test-retest reliability of the new questionnaire was made using Phase II data. Phase II participants were asked to complete one of the questionnaires (*either* 'state' *or* 'change') on a second occasion approximately one month after the first completion. This allowed calculation of the test-rest reliability of the individual items that were selected to remain in the questionnaire.

Although the test-retest reliability of each item in the final questionnaire was established from Phase II data, the test-retest reliability of the whole instrument was re-assessed in Phase III. In its final form, the length, format and character of the questionnaire were different from the preliminary version used in Phase II. It cannot be assumed that the properties of individual items remain stable when the context in which they are presented is altered.

4.4. Results

Data were collected using Version 2.1 of both 'state' and 'change' questionnaires from 155 patients who were nearing completion of a vestibular rehabilitation programme. Table 4.1 below summarises the origin of the data by data collection site. Analysis of the data had three main goals: 1) to establish whether a subscale structure existed within the questionnaire items, 2) to reduce the number of items in the questionnaire from 36 to around 20, 3) to establish the internal consistency of the scale and subscales. Scores were derived from the questionnaires by attributing a negative value to any response that indicated dizziness impact (deterioration), zero to a response option that indicated no impact, and a positive value to any response option which implied an improvement. Items that refer to frequency or intensity of dizziness were scored from 0 (never or not at all dizzy) to -7 (constantly or extremely dizzy) and items that refer to abilities, participation or emotion were scored -3 (maximum deterioration) to +3 (maximum improvement),where 0 represents no change. This approach was taken to enable easy interpretation of final scores for both State and Change formats where 0 represents no impact (State) or no change (Change), a negative score represents deterioration and a positive score represents improvement.

It should be noted that the data did not fully meet conditions for normality and, therefore, non-parametric methods of analysis would usually be considered the most appropriate. Statistical advice, however, suggested that parametric statistical methods were not inappropriate based on inspection of histogram plots for each item. Analyses were conducted using data from post-therapy 'state' questionnaire scores, post-therapy 'change' questionnaire scores and the difference between 'state' and 'change' scores which provided a derived measure of pre-therapy impact. The derived measure of pre-therapy impact was necessary to distinguish areas where subjects had not improved because the treatment had not been effective from areas where subjects had not improved because they had never experienced difficulty.

Table 4.1 Summary of data collected by site

Site	Professional background of VR therapist	Complete data collected (number of subjects)
Bournemouth	Audiologist	2
Croydon	Hearing Therapist	52
Devon	Audiologist	8
Edinburgh	Physiotherapist	4
Frimley	Hearing Therapist	10
Leicester	Physiotherapist	44
London (NHS clinic)	Hearing Therapist	4
London (private clinic)	Physiotherapist	8
Stoke Mandeville	Hearing Therapist	16
Windsor	Physiotherapist/Hearing Therapist	2
York	Physiotherapist	5

4.4.1. Factor structure

Factor analysis using the Principal Components Analysis (PCA) technique with quartimax rotation suggested that the preliminary questionnaire measured three distinct factors in the impact of dizziness. Factor analysis is a method of revealing underlying structures in the data or hierarchically reducing items into a smaller number of coherent and consistent factors which account for a large proportion of the variance in that data (Lewis-Beck, 1994). PCA elicits Eigen values, which represent the power of the component or factor to account for variation between subjects. Conventionally, an Eigen value of >1 is used as the criterion for determining the number of factors accounting for the variance in the data. Rotating the axes helps to identify more easily interpreted factors by identifying rotations where the first few components reflect uncorrelated (orthogonal) aspects of the data.

Analysis of the three questionnaire scores ('state', 'change', 'difference') revealed a clear and interpretable subscale structure as follows: symptoms of *Dizziness and Anxiety* (2 items), *Motion-Provoked Symptoms* of dizziness (5 items) and implications for *Quality of Life* (29 items). Initially, analysis was performed on data from the 'state' questionnaire. The number of factors that should be extracted was not limited *a priori;* instead factors were extracted with the Eigen values >1. Items with a factor loading >0.5 were taken as members of a factor. The PCA was repeated with 'change' and 'difference' data and revealed a closely matching factor structure. Analysis of the 'difference' data revealed the same factor structure as 'state' and 'change' data with one ‘change’ data with one exception. Item 1 (I feel dizzy - this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc.) loaded highly on the *Quality of Life* factor rather than the *Dizziness and Anxiety* factor, which suggests there may be a weakness in the *Dizziness and Anxiety* factor. Confirmatory factor analysis of the data collected in the final experiment (Phase III) provided further evidence of the factor structure. Table 4.2 summarises the results of the Phase II factor analysis and Tables 4.3a, b and c show factor loadings for each item (State, Change and Difference Scores respectively).

Table 4.2 Summary of factors resulting from PCA with quartimax rotation (Version 2.1)

Questionnaire	Factor	Eigen value	% of variance explained	Factor label	Items (before reduction)	Notes
State	1	16.628	46.188	*Quality of Life*	8-36 (29 items)	Factor 3 consists of items relating to head-motion induced dizziness which also load on component 2 and have therefore been combined into a single factor
	2	2.671	7.421	*Motion-Provoked Symptoms*	3-7 (5 items)	
	3	See notes				
	4	1.494	4.150	*Dizziness and Anxiety*	1-2 (2 items)	
Change	1	15.571	43.253	*Quality of Life*	8-36 except 14 and 18 (27 items)	Factors 3 and 4 are predominantly noise with only 1 item loading >0.3
	2	2.962	8.228	*Motion-Provoked Symptoms*	3-7 (5 items)	
	3	See notes				
	4	See notes				
	5	1.379	3.830	*Dizziness and Anxiety*	1-2 (2 items)	
Difference	1	15.445	42.902	*Quality of Life*	1, 8-36 except 14 (28 items)	Factor 3 consists of items 14, 16 and 18, these items have been excluded as they have no obvious interpretation. Item 1 (dizziness) only loads moderately on the Dizziness and Anxiety factor (0.355) and loads higher on Quality of Life (0.473)
	2	3.414	9.482	*Motion-Provoked Symptoms*	3-7 (5 items)	
	3	See notes				
	4	1.225	3.402	*Dizziness and Anxiety*	2 (1 item)	

Table 4.3(a) Summary of factor loadings from PCA for 'state' questionnaire scores

	Factor			
Item	**1**	**2**	**3**	**4**
1	0.37	0.42	0.19	**0.56**
2	0.15	0.21	0.12	**0.85**
3	0.18	**0.78**	0.13	0.13
4	0.14	**0.80**	-0.02	0.03
5	0.25	**0.76**	0.27	0.07
6	0.06	**0.49**	0.75	0.16
7	0.19	**0.42**	0.74	0.18
8	**0.63**	0.12	-0.21	0.03
9	**0.74**	-0.01	-0.03	0.24
10	**0.79**	0.10	-0.02	0.03
11	**0.72**	-0.01	0.00	0.09
12	**0.84**	0.01	0.07	-0.04
13	**0.65**	0.06	0.03	-0.06
14	**0.64**	0.00	-0.08	-0.31
15	**0.82**	0.06	0.07	-0.16
16	**0.76**	0.18	0.08	-0.18
17	**0.84**	0.06	-0.08	0.05
18	**0.58**	0.28	0.00	-0.25
19	**0.63**	-0.02	0.09	0.01
20	**0.76**	-0.08	0.18	-0.04
21	**0.85**	0.09	-0.04	0.00
22	**0.76**	0.05	-0.02	-0.02
23	**0.87**	-0.04	0.03	-0.07
24	**0.85**	-0.03	0.07	0.03
25	**0.81**	-0.02	-0.04	-0.05
26	**0.81**	0.04	0.00	0.11
27	**0.79**	-0.05	-0.03	0.01
28	**0.74**	-0.03	0.09	0.05
29	**0.88**	-0.08	0.09	0.09
30	**0.75**	-0.08	0.01	0.16
31	**0.78**	-0.01	-0.03	0.14
32	**0.62**	0.05	-0.10	-0.07
33	**0.69**	0.04	-0.15	0.04
34	**0.59**	-0.08	0.50	-0.04
35	**0.60**	0.17	0.00	0.00
36	**0.83**	0.00	0.00	0.09

Bold text indicates items that are interpreted as belonging to that factor.

Table 4.3(b) Summary of factor loadings from PCA for 'change' questionnaire scores

	Factor				
Item	**1**	**2**	**3**	**4**	**5**
1	0.45	0.34	-0.23	0.12	**0.60**
2	0.49	0.27	0.08	-0.07	**0.56**
3	0.53	**0.66**	0.09	-0.08	-0.05
4	0.44	**0.55**	0.29	-0.35	0.17
5	0.55	**0.61**	-0.02	-0.11	0.10
6	0.51	**0.74**	-0.01	0.07	0.06
7	0.44	**0.72**	-0.12	0.14	0.09
8	**0.69**	0.10	0.00	0.04	-0.10
9	**0.70**	0.20	-0.09	0.13	0.07
10	**0.71**	0.14	-0.05	0.14	-0.02
11	**0.67**	0.16	0.30	-0.09	0.14
12	**0.70**	0.28	0.21	0.19	0.13
13	**0.68**	0.18	0.13	-0.01	0.01
14	0.31	0.01	0.75	0.10	-0.04
15	**0.71**	0.00	0.21	-0.15	0.15
16	**0.61**	0.28	0.27	0.30	-0.02
17	**0.74**	-0.03	0.03	0.04	-0.12
18	0.46	-0.02	0.18	0.60	0.02
19	**0.60**	-0.23	0.18	-0.25	0.17
20	**0.76**	-0.12	0.04	-0.20	0.13
21	**0.73**	-0.01	0.27	0.11	0.16
22	**0.61**	-0.16	-0.22	0.31	0.18
23	**0.71**	0.21	0.09	0.23	0.07
24	**0.76**	0.03	0.04	0.24	0.10
25	**0.72**	-0.11	0.09	-0.09	0.15
26	**0.72**	-0.04	-0.12	0.24	-0.36
27	**0.79**	-0.03	0.02	-0.26	-0.05
28	**0.75**	0.08	-0.15	-0.03	-0.22
29	**0.81**	-0.17	-0.19	-0.12	0.04
30	**0.75**	-0.13	-0.14	0.11	0.05
31	**0.74**	-0.18	-0.16	-0.20	0.01
32	**0.68**	0.04	-0.13	0.07	-0.20
33	**0.66**	0.13	-0.08	-0.10	-0.39
34	**0.72**	0.07	0.04	0.13	-0.16
35	**0.62**	0.16	-0.12	-0.27	-0.09
36	**0.76**	-0.09	-0.22	-0.01	0.03

Bold text indicates items that are interpreted as belonging to that factor.

Table 4.3(c) Summary of factor loadings from PCA for 'difference' scores

	Factor			
Item	**1**	**2**	**3**	**4**
1	**0.52**	0.31	0.05	0.27
2	0.33	0.33	-0.03	**0.59**
3	0.32	**0.71**	-0.10	-0.28
4	0.22	**0.75**	0.15	-0.02
5	0.33	**0.76**	-0.08	-0.13
6	0.32	**0.79**	-0.05	-0.07
7	0.41	**0.69**	-0.06	-0.04
8	**0.71**	-0.04	-0.14	-0.02
9	**0.70**	0.01	0.20	0.25
10	**0.78**	-0.10	0.08	-0.12
11	**0.75**	0.07	0.03	0.01
12	**0.76**	-0.09	0.15	-0.06
13	**0.64**	-0.06	0.00	-0.31
14	0.49	-0.09	0.55	-0.09
15	**0.76**	-0.13	-0.09	-0.10
16	**0.68**	0.04	0.49	-0.11
17	**0.79**	-0.10	-0.19	-0.03
18	**0.58**	-0.06	0.51	-0.12
19	**0.64**	-0.03	-0.04	0.33
20	**0.73**	-0.05	-0.16	0.09
21	**0.76**	0.00	0.29	0.10
22	**0.73**	-0.23	-0.07	-0.09
23	**0.76**	-0.10	0.33	-0.11
24	**0.82**	-0.12	0.14	0.14
25	**0.71**	-0.17	-0.23	-0.10
26	**0.73**	-0.07	-0.12	-0.09
27	**0.76**	-0.09	-0.31	0.03
28	**0.78**	-0.06	-0.25	-0.16
29	**0.83**	-0.13	-0.14	0.05
30	**0.78**	-0.18	-0.03	0.06
31	**0.73**	-0.01	0.06	0.31
32	**0.64**	-0.08	0.00	-0.27
33	**0.65**	-0.02	-0.18	-0.04
34	**0.56**	0.06	0.07	0.14
35	**0.64**	0.05	-0.24	0.04
36	**0.81**	-0.16	-0.30	0.00

Bold text indicates items that are interpreted as belonging to that factor.

4.4.2. Item reduction

Once the subscale structure was revealed, it was necessary to reduce the number of items in the questionnaire. All of the items in the *Dizziness and Anxiety* and *Motion-Provoked Dizziness* factors were retained. This was because the items were conceptually important and measured different types and severity of symptoms. Furthermore, since both subscales contained only a small number of items, further reduction may have compromised internal consistency. The remaining analysis, therefore, was aimed at reducing the total number of items in the *Quality of Life* factor from 29 items to around 10 items so that the total scale comprised around 20 items. Items were removed based on both statistical and subjective criteria. Statistical criteria for item removal involved examining correlations between items and inspection of response patterns to each item. Subjective criteria involved consideration of the conceptual importance of each item. The rationale for inclusion or exclusion of the 36 items is described in detail below and summarised in Table 4.5. Since only a third of items in the *Quality of Life* factor could be retained, emphasis was placed on identifying a strong rationale for inclusion or exclusion; many items were removed simply because there was no strong rationale for inclusion, in these cases the ‘rationale’ field is left blank.

Where responses to two items were systematically related, the items were providing very closely related information since the answer to one could be reliably predicted from the answer to the other. Because no additional information was provided one of the items was seen as redundant so was removed from the questionnaire. The Pearson’s Product Moment Correlation Co-efficient test was used to test for correlations in the data. This test was selected for consistency with previous analysis as it uses the same correlation matrix as Principal Components Analysis. Non-parametric tests of correlations (Spearman’s Rho) produced very similar patterns of correlations.

Of 1260 correlations, 95 were >0.6, seven were >0.7. Consistent with the results of PCA there were no moderate or strong correlations between items from different factors. A correlation of 0.6-0.7, whilst moderately strong, does not suggest that the two correlated items are providing the same information. Moderate correlations within a scale are necessary for internal consistency and this must be balanced against the need for items to provide information which is useful and independent from that provided by the other items. Where correlations between items were strongest one item was removed in most cases although some moderate correlations between the items remain. Table 4.4 summarises moderate (>0.6) and strong (>0.7) inter-item correlations; correlations are presented by item number so that those items showing correlations with many other items can be easily identified.

The pattern of responses to each item was reviewed to help inform the item reduction process. Histograms revealed the rates of endorsement of each response option to a given item. Items that produced uniform responses from the subject sample did not discriminate well between individuals and therefore provided information which was of limited use. Items that were endorsed by most subjects were seen as representing problems from which the majority of dizzy patients suffer and, by implication, the mild end of the impact continuum. Items that were endorsed by very few patients were seen as representing the more severe end of the continuum. Whilst the majority of the items should aim to discriminate between patients, it was desirable to retain a few items that refer to the lower and higher ends of the impact spectrum to ensure relevance to a wide range of patients. For this reason, two items with very high rates of endorsement (over two thirds of the sample) and two items with very low rates of endorsement (less than a third of the sample) were retained to safeguard sensitivity to extremes of impact. Other items with particularly low or high endorsement rates were removed from the scale. There were no items with moderate endorsement rates that weighted very strongly on a single response option. Items with a high rate of non-response were considered difficult for patients to understand so were removed from the questionnaire.

Some items were retained for Version 3.0 of the questionnaire because the items referred to aspects of dizziness impact that were considered to be conceptually important for a scale measuring vestibular rehabilitation benefit. Items which referred to travelling, confidence and concentration/memory were included because previous work (Yardley *et al*, 1998b; Mendel *et al*, 1999) and the early stages of the present study (Phase I interview study) highlighted these areas as common and distressing problems for dizzy people.

Table 4.4 Summary of inter-item correlations (Version 2.1)

Item no.	Correlates with item	Item no.	Correlates with item	Item no.	Correlates with item	Item no.	Correlates with item
3	6	16	23	24	36	**29**	**24**
4	5	16	18	**24**	**29**	29	25
5	4	17	10	24	30	29	26
5	6	17	22	24	31	29	27
5	7	17	24	24	36	29	30
6	3	17	25	25	17	29	31
6	5	17	26	25	22	29	32
7	5	**17**	**27**	25	24	29	36
8	10	17	28	25	26	30	9
8	15	17	29	25	28	30	10
8	36	17	30	25	29	30	15
9	10	17	33	25	30	30	17
9	30	17	36	**25**	**36**	30	20
10	8	18	16	26	15	30	22
10	9	20	15	26	17	30	23
10	12	20	28	26	24	30	24
10	17	**20**	**29**	26	25	30	25
10	29	20	30	26	29	30	27
10	30	21	12	26	36	30	29
10	36	21	16	**27**	**17**	30	31
11	12	21	12	27	24	30	36
11	28	21	23	27	28	31	21
11	29	21	31	27	29	31	24
11	36	22	17	27	30	31	29
12	10	22	25	27	33	31	30
12	11	22	28	**27**	**36**	32	29
12	15	**22**	**36**	28	11	33	17
12	21	22	29	28	15	33	27
12	23	22	30	28	17	36	10
12	24	23	12	28	20	36	11
12	29	23	16	28	22	36	15
15	8	23	21	28	25	36	17
15	12	23	24	28	27	36	8
15	20	23	29	**28**	**36**	**36**	**22**
15	24	23	30	29	10	36	24
15	26	24	12	29	11	36	25
15	28	24	15	29	12	**36**	**25**
15	29	24	17	29	15	36	26
15	30	24	23	29	17	**36**	**27**
15	36	24	25	**29**	**20**	**36**	**28**
15	26	24	26	29	22	36	29
16	21	24	27	29	23	36	30

Plain text indicates correlation >0.6, **bold text** indicates correlation >0.7

Response patterns were also examined in terms of how each item appeared to respond to therapy. Two items demonstrated deterioration with therapy in around 20% of this sample. Deterioration in these specific areas was considered to be caused by short-term effects of therapy and as such were excluded from the questionnaire to avoid masking other therapeutic effects. The items referred to 1) needing to be careful and/or take things slowly which in many cases will be advised by the treating clinician and 2) getting tired easily which is a likely consequence of performing exercises several times a day which provoke the symptoms and stimulate neural compensatory mechanisms.

An additional consideration in selecting items for inclusion was the importance of representing the three main areas of quality of life impact in the *Quality of Life* subscale, namely disability, handicap and emotional impact.

Table 4.5 Summary of Version 2.1 items and rationale for retention or removal

Item no./ other scales	Category	Endorsement rate	Retain	Rationale
1) I feel dizzy (this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc)				
DFI, UCLA-DQ, VSS	Symptoms	High (>60%)	√	Conceptually important/reliability of symptom subscale
2) 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 faintness (if you experience <u>more than one,</u> think about the one you have <u>most often)</u>				
VSS	Anxiety	High (>60%)	√	Conceptually important/reliability of symptom subscale
3) Bending over makes me feel				
	Symptoms	High (>60%)	√	Conceptually important/reliability of symptom subscale
4) Lying down and/or turning over in bed makes me feel				
	Symptoms	High (>60%)	√	Conceptually important/reliability of symptom subscale
5) Looking up at the sky makes me feel				
	Symptoms	High (>60%)	√	Conceptually important/reliability of symptom subscale
6) Moving my head <u>slowly</u> from side to side makes me feel				
	Symptoms	High (>60%)	√	Conceptually important/reliability of symptom subscale
7) Moving my head <u>quickly</u> from side to side makes me feel				
	Symptoms	High (>60%)	√	Conceptually important/reliability of symptom subscale
8) Compared to before the dizziness started, I feel comfortable travelling				
DHI, DIP, VHQ	Handicap	Moderate (40-59%)	√	Conceptually important
9) Compared to before the dizziness started, I find myself worrying				
UCLA-DQ, VHQ	Emotions	High (>60%)	X	
10) Compared to before the dizziness started, I feel confident				
VHQ	Emotions	High (>60%)	X	Conceptually important
11) Compared to before the dizziness started, I have difficulty in one (or more) of these situations: open spaces (like crossing a wide road), patterned floors (like a tiled floor in a shopping centre), flashing lights or screens (like in the cinema), supermarket aisle (if you have difficulty in <u>more than one</u> of these situations, think about the one that you have <u>most difficulty with)</u>				
	Disability	High (>60%)	X	High rate of non-response

Item no./ other scales	**Category**	**Endorsement rate**	**Retain**	**Rationale**
12) Compared to before the dizziness started, I have difficulty walking (this includes staggering, veering to one side, bumping into things, falling over)				
VSS	Disability	High (>60%)	X	
13) Compared to before the dizziness started, I move my head and body freely				
DFI, VHQ	Disability	High (>60%)	X	
14) Compared to before the dizziness started, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)				
DIP, UCLA-DQ	Handicap	Low (30-49%)	√	Very low endorsement rate (upper extreme of impact)
15) Compared to before the dizziness started, I feel able to do my normal job (include looking after your family or home if this is your job)				
DHI, UCLA-DQ, VHQ	Handicap	Moderate (40-59%)	X	High rate of non-response
16) Compared to before the dizziness started, I have to find special ways of doing things				
	Disability/ Handicap	Moderate (40-59%)	X	High rate of non-response
17) Compared to before the dizziness started, I feel comfortable going out alone				
DFI, DHI, VHQ	Emotions/ Handicap	Moderate (40-59%)	√	Correlates moderately with 13 items, item is consistent with overall scale
18) Compared to before the dizziness started, I have difficulty doing things in my home or garden				
DFI, DHI, DIP, UCLA-DQ, VHQ	Handicap	Moderate (40-59%)	X	
19) Compared to before the dizziness started, I think there may be something seriously wrong with me				
DIP, VHQ	Emotions	Moderate (40-59%)	X	High rate of non-response
20) Compared to before the dizziness started, I can concentrate and/or remember things				
VSS, DFI, DHI, DIP	Disability	Moderate (40-59%)	√	Conceptually important
21) Compared to before the dizziness started, I need to hold on to something for support				
VSS	Disability	High (>60%)	√	Very high endorsement rate (lower extreme of impact)
22) Compared to before the dizziness started, I take part in physical activities				
DHI, DIP, VHQ	Disability/ Handicap	Moderate (40-59%)	X	Redundant item, very strong correlation with item 36
23) Compared to before the dizziness started, I need to be careful and/or take things slowly				
	Disability/ Handicap	High (>60%)	X	High rate of deterioration with therapy
24) Compared to before the dizziness started, I am worried about hurting myself (for example falling over, bumping into things, crossing the road, driving)				
	Emotions	Moderate (40-59%)	X	Redundant item, very strong correlation with item 36
25) Compared to before the dizziness started, the distance I can walk is:				
DFI, DHI, DIP, VHQ	Disability	Moderate (40-59%)	X	Redundant item, very strong correlation with item 36
26) Compared to before the dizziness started, I prefer to stay in or near home				
DIP	Handicap	Moderate (40-59%)	X	
27) Compared to before the dizziness started, I feel independent				
	Emotions	Moderate (40-59%)	X	Redundant item, very strong

Item no./ other scales	Category	Endorsement rate	Retain	Rationale
				correlation with items 36 and 17
28) Compared to before the dizziness started, I am happy to go to noisy and/or crowded places				
	Handicap	Moderate (40-59%)	X	Redundant item, very strong correlation with item 36
29) Compared to before the dizziness started, I think my Quality of Life is good				
UCLA-DQ		High (>60%)	√	Correlates moderately with 12 items, item is consistent with overall scale
30) Compared to before the dizziness started, I get tired easily				
	Disability	Moderate (40-59%)	X	High rate of deterioration with therapy
31) Compared to before the dizziness started, I feel positive about the future				
	Emotions	Moderate (40-59%)	X	
32) Compared to before the dizziness started, I avoid some activities, positions or situations				
VHQ		High (>60%)	√	Very high endorsement rate (lower extreme of impact)
33) Compared to before the dizziness started, I am happy to be on my own				
DHI	Emotions/ Handicap	Low (30-49%)	√	Very low endorsement rate (upper extreme of impact)
34) Compared to before the dizziness started, I have trouble focusing my eyes				
VSS	Disability	Moderate (40-59%)	X	
35) Compared to before the dizziness started, I feel stable in the dark or when my eyes are closed				
DHI, DIP	Disability	Moderate (40-59%)	√	Conceptually important
36) Compared to before the dizziness started, I take part in social activities				
DHI, DIP, UCLA-DQ, VHQ	Handicap	Moderate (40-59%)	√	Correlates moderately with 15 items, item is consistent with scale

Item examples are from the 'state' questionnaire

4.4.3. Internal consistency

After item reduction, Version 3.0 of the questionnaire contained 18 items falling into three subscales: *Dizziness and Anxiety* (2 items), *Motion-Provoked Dizziness* (5 items) and *Quality of Life* (11 items). Internal consistency was tested to ensure that all of the questionnaire items were measuring aspects of the same phenomenon. Internal consistency is established by calculating Cronbach's Alpha (α) consistency coefficient which gives the mean of correlations between items. An item that is inconsistent with the rest of the items can be detected by a marked increase in the value of α when that item is removed from the computation. Calculation of Cronbach's α revealed that the questionnaire as a whole, along with the *Motion-Provoked Dizziness* and *Quality of Life* subscales, showed excellent internal consistency. The *Dizziness and Anxiety* subscale shows good internal consistency and the fact that this subscale was slightly less consistent was attributed to the small number of items (2).

Table 4.6 Summary of Cronbach's α for whole scale and subscales (Version 2.1)

Scale/subscale	**No. of items**	**Questionnaire**	**Cronbach's α**
Whole scale	18	State	0.89
Whole scale	18	Change	0.92
Dizziness and Anxiety	2	State	0.70
Dizziness and Anxiety	2	Change	0.72
Motion-Provoked Dizziness	5	State	0.84
Motion-Provoked Dizziness	5	Change	0.90
Quality of Life	11	State	0.92
Quality of Life	11	Change	0.89

4.4.4. Finalised questionnaire

Following review of Version 3.0 some minor modifications were made resulting in Version 3.1. The *Dizziness and Anxiety* subscale showed lower a Cronbach's α value than the other subscales and this was attributed to the fact there were only two items in this factor. To increase the internal consistency of the subscale, a further four items were added to guard against spurious responding. The anxiety item in Version 3.0 was a multi-factorial item, which referred to five different symptoms of panic. This item was separated into three items, therefore adding an additional two anxiety items to the subscale. Additionally, two items from the Vertigo Symptom Scale (Yardley *et al*, 1992c) referring to symptoms of dizziness were added. This could be regarded as compromising the integrity the final questionnaire since basing the items on the outcome of interview data is highlighted as a principal advantage of the questionnaire under development. However, it is argued that additional items are necessary to safeguard a sound psychometric profile, which is also a crucial property of a good outcome measure. Furthermore, the items added are from an existing questionnaire which was developed using interview data from a previous study (Yardley *et al*, 1992b) and as such do not represent a departure from the data-driven philosophy which underpins the present work.

Table 4.7(a) Dizziness and Anxiety subscale items (Version 3.0)

Symptom type	**Item**
Dizziness	I feel dizzy (this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc.)
Anxiety	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, faintness (if you experience more than one, think about the one that you have most often)

Table 4.7(b) Dizziness and Anxiety subscale items (Version 3.1)

Symptom type	**Item**
Dizziness	I feel dizzy
	I have a feeling that things are spinning or moving around*
	I feel unsteady, as though I may lose my balance*
Anxiety	I get a feeling of tingling, prickling or numbness in my body
	I feel as though my heart is pounding or fluttering
	I have difficulty breathing or feel short of breath

*items were duplicated from the Vertigo Symptom Scale (Yardley *et al*, 1992c)

Following modification, Version 3.1 consisted of 22 items: *Dizziness and Anxiety* (6), *Motion-Provoked Dizziness* (5) and *Quality of Life* (11).

4.4.5. Preliminary reliability estimate

The test-retest reliability of the preliminary questionnaires (Version 2.1) was calculated to inform sample size estimation for the final study (Phase III). The standard deviation of the score difference on replication was calculated for each item. The mean item standard deviation on replication is approximately 1.0. Details of the sample size estimation based on these data are given in Section 5.1.2.

4.5. Conclusions

Chapter Four describes a two-stage refinement of the provisional item list that emerged from the work described in Chapter Three. The preliminary questionnaire addressing many aspects of dizziness handicap, but with unknown psychometric properties, was examined first subjectively and secondly by statistical analysis.

Subjective analysis by user groups revealed limitations that led to improvements in face validity crucial to the use of a clinical instrument. Statistical analysis revealed an underlying structure in the questionnaire items and from this items were organised into an interpretable subscale structure. A scale consisting of a number of psychometrically sound subscales has potential advantages over single-dimension questionnaires or questionnaires with subscales that are not supported by patient response patterns. The provisional item list emerging from the work described in Chapter Three was considered too long for routine clinical use. Results of statistical analysis revealed that some questionnaire items provided overlapping information and some did not distinguish well between individuals within the sample. These findings informed a process of selecting the most useful items to include in a refined version of the questionnaire.

The refined questionnaire developed through processes described in Chapter Four contains 22 items organised into four subscales. Further work is needed to investigate the validity of the new measure in relation to existing measurement tools and to examine the properties of the identified subscales when presented to patients in the new format.

Chapter Five. Questionnaire Validation (Phase III)

5.1. Introduction

Following refinement of the 'state' and 'change' formats of the Vestibular Rehabilitation Benefit Questionnaire (VRBQ) in Phase II, it is necessary to investigate the measurement properties of the new instruments and to compare the new questionnaires with existing ones. The aim of this phase of work is to investigate the psychometric properties of the refined VRBQ State and VRBQ Change in a longitudinal study of subjects undergoing vestibular rehabilitation. Data from this experiment should characterise the usefulness of the new questionnaires for clinical and research applications. This characterisation should include an assessment of the validity and consistency of measurements made by the instrument and an appraisal of responsiveness to change. Examination of the factor structure within data collected with the refined questionnaires will test the subscale structure indicated by analysis described in Chapter Four.

A further aim of the longitudinal study is to provide data to allow comparison of 'state' and 'change' approaches to measuring change over time in the context of vestibular rehabilitation. Chapters Three and Four describe the development of two questionnaires, the VRBQ State and the VRBQ Change, to facilitate this comparison. The experimental design presented below was developed to achieve these aims.

5.2. Methodology

5.2.1. Rationale

Assessment of validity aimed to demonstrate whether the VRBQ State and VRBQ Change questionnaires truly measure the dimension of interest. In the present study, the dimensions of interest were the subjective sensation of dizziness and the self-perceived consequences for the individual's life. The dimensions of interest, therefore, could not be captured by any measurement method other than self-report. Validity, then, could only be assessed by comparing the new self-report questionnaire with other self-report measures such as existing self-report questionnaires which are established measures of the dimension of interest, or aspects of it. The validation of a new measure against an established measure when the established measure also lacks a suitable definitive reference for validation, is a universal limitation of questionnaire validation. In a situation where the presence, and certainly not the magnitude, of the dimension of interest cannot be verified by other means, this limitation is unavoidable. The circuitous approach to validation means that careful interpretation of the relationship between measures is required.

Consistency of measurements and sensitivity to changes in the dimension of interest are inter-dependent characteristics of a measurement tool. To be sensitive to true changes in the dimension of interest, consistent measurement in the absence of change is an essential pre-requisite. Hence, if an instrument provides consistent measurements in the absence of change, small changes in the measure may potentially be interpreted as small changes in the dimension of interest. Consistency of measurement is assessed by repeated application of the measure in an untreated, and hence assumed stable, group of subjects. For responsiveness, as with assessment of validity, the absence of other means of verifying the presence and magnitude of the dimension of interest means that responsiveness can only be assessed by comparison with established questionnaire measures. Again, the circuitous approach to assessment of responsiveness requires careful interpretation of the relationship between measures.

The established measures that are used for comparison are questionnaires that have been developed to measure related phenomena. The Dizziness Handicap Inventory (DHI), developed by Jacobson and Newman (1990), is a disease-specific measure of dizziness impact. The Vertigo Symptom Scale (VSS), developed by Yardley *et al* (1992c), is a measure of symptoms of dizziness and anxiety which may be used to estimate the contribution of each to the overall symptom profile. The short form of the questionnaire (VSS-sf) can be applied before intervention to guide the focus of intervention, or it may be used as a before and after measure of the impact of intervention on dizziness and anxiety. The DHI and VSS-sf are considered appropriate for validation of a new measure of vestibular rehabilitation benefit as they are the most commonly used measures in both clinical and research environments and their psychometric properties are well-documented. Furthermore, together they measure all aspects of dizziness and dizziness impact that are pertinent to a quality of life measure; that is, symptoms of dizziness and associated anxiety, disabilities, lifestyle restrictions and emotions. The Medical Outcomes Study Short Form 36 (SF-

36), developed by Ware and Sherbourne (1992), is a generic measure of health related quality of life questionnaire, which has been used extensively in research to measure the impact of a variety of conditions and measure the benefit of a variety of interventions. Since research suggests that some aspects of health-related quality of life measured by the SF-36 are affected by dizziness this is considered a useful part of a battery of measures to assess convergent and discriminant validity of the new questionnaire.

In addition to the assessment of validity, reliability and responsiveness, two questionnaires were developed in parallel to allow evaluation of different approaches to measuring change. The VRBQ State questionnaire provides a measure of the self-perceived impact of dizziness at the time of completion. A measurement is made before intervention and again after, and the difference between the two measurements is used to infer the degree of change that has occurred. There is debate in the literature regarding the validity of this approach. Some authors suggest that the difference between the two measurements does not only capture changes within the individual on the dimension of interest, in this case dizziness impact, but may also be contaminated by changes on other dimensions. Internal changes on dimensions other than the dimension of interest (but which are related to the dimension of interest) may influence the way an individual responds to questions about the dimension of interest and thus confound comparison of measures taken at different times. Changes outside the dimension of interest, but which potentially effect an individual’s response to a self-report measure of the dimension of interest, are referred to as response shifts. A more detailed discussion of the debate surrounding approaches to measuring change and the concept of response shift can be found in Chapter Two.

An alternative approach to measuring change, which avoids the problem of response shift bias, is to take the measurement at a single point in time. This method requires a questionnaire that poses direct questions about the amount of change experienced in the dimension of interest and that is applied after intervention. The VRBQ Change questionnaire has been developed in the present study to fulfil the role of a single application 'change' questionnaire. Whilst this method avoids the problem of changes in internal standards confounding comparison of measurements taken at different times, some authors suggest that retrospective measures are unreliable due to the effects of memory bias. The present study has been designed to elucidate whether response shifts are measurable in this context and whether response shift bias, if detected, amounts to a greater or lesser influence on questionnaire scores than memory bias.

Response shift may be detected by use of the 'then-test' which compares measurements taken at a given point in time, Time 1, with measurements taken at a later stage, Time 2, that refer back to Time 1. For example, an individual completes a questionnaire in January (Time 1) that asks a series of questions about how they are feeling. In May (Time 2), the individual is asked to complete the questionnaire again answering the questions to reflect how they were feeling in January (Time 1). Differences in questionnaire responses between Time 1 and Time2 are attributed to changes in the individual's perception that have occurred over time. The 'then-test' was used in the present study in both the treatment and no-treatment periods to allow estimation of the factors which influence response shifts. As the 'then-test' is itself a retrospective test, this may also be subject to memory bias and as such, retrospective reporting bias may be an alternative explanation for response shift (Howard, 1979). A method that attempts to distinguish 'true' response shift from retrospective reporting bias is to allow the subject to see their Time 1 responses when completing the 'then-test' at Time 2, so that any difference is an explicit and conscious reappraisal and cannot be attributed to failure of recall. In the present study a subgroup of subjects were given their initial questionnaire scores when completing the 'then-test' (the *seen* group) and the rest of the group completed the 'then-test' *unseen*. This allowed further estimation of the factors which influence questionnaire responding.

5.2.2. Data collection

Data were collected from five NHS clinics using Version 3.1 of the VRBQ (see Appendix 3). Using test-retest data from Phase II (Section 4.3.5) as a guide, a minimum sample of 64 was considered appropriate for the aims of the study. A standard deviation on replication of 1.0 gives an estimate of the standard deviation of differences of 1.4. Consistent with convention, sample size estimation was based on achieving 80% power; a sample size of n=64 will allow detection of a change of 0.5 scale points (on a scale of 7 points), with a power of 80%. For the aims of the present study, the detection of a 0.5 point change is considered to provide sufficiently accurate information.

Due to ethical difficulties of withholding potentially beneficial treatment, a no-treatment control group was not used. Instead, in centres with a waiting list, subjects acted as their own controls during the pre-treatment period whilst they were waiting for a vestibular rehabilitation appointment.

The participating centres were divided into two groups. Centres with a waiting list of longer than four weeks for a first vestibular rehabilitation appointment were assigned to Group A to investigate the test-retest reliability of the VRBQ State in the pre-treatment period. Clinicians posted an invitation to participate in the study (Patient Information Sheets can be found in Appendix 1) and the first batch of questionnaires four weeks before the first vestibular rehabilitation appointment. The first batch of questionnaires consisted of the VRBQ State, DHI, VSS-sf and SF-36. Those who returned the questionnaires were sent the second batch of questionnaires in the week preceding the first vestibular rehabilitation appointment. It was specified that patients should complete the second batch of questionnaires in the few days *before* the vestibular rehabilitation appointment so that small changes caused by the onset of therapy would not confound the results of the second application. Because of the critical timing for completion of the questionnaires in relation to their programme of therapy, patients who did not return the questionnaires were not pursued with reminder letters. The second batch of questionnaires replicated the first batch with the addition of the 'then-test' technique which was applied with the VRBQ (VRBQ Then, see Appendix 3). Data collection with the VRBQ Then in Group A allowed comparison of no-treatment and treatment groups for evidence of response shift. The post-treatment questionnaire package (VRBQ State, VRBQ Then, VRBQ Change, DHI, VSS-sf and SF-36) was sent to patients 12 weeks after the first vestibular rehabilitation appointment.

Participant centres with a waiting list of less than four weeks were assigned to Group B. Group B centres were not involved in investigating the pre-treatment test-retest reliability of the VRBQ State. In these centres, invitations to participate were distributed by the treating clinician at the first vestibular rehabilitation appointment.

Patients who wished to participate completed and returned the first batch of questionnaires (VRBQ State, DHI, VSS-sf, SF-36). The post-treatment questionnaire battery (VRBQ State, VRBQ Then, VRBQ Change, DHI, VSS-sf and SF-36) was sent to patients 12 weeks after the first appointment.

For all questionnaire applications, the VRBQ questionnaires were completed first. The rationale for this was that the experiment was designed specially to investigate the psychometric properties of the VRBQ and, therefore, it was considered important that subjects completed this questionnaire under conditions which most closely replicated the conditions it would be completed under in the clinical environment (i.e. not after having completed several other questionnaires which may influence the care and attention paid when responding). Where there was more than one format of the VRBQ the order was counterbalanced. The order of the remaining questionnaires, the DHI, VSS-sf and SF-36, was also counterbalanced so that any effect of completion order was evenly distributed across the questionnaires. Copies of all of the questionnaires used in the study can be found in Appendix 3. A summary of the Phase III protocol is found below in Table 5.1.

Table 5.1 Summary of Phase III experimental protocol

Time	Group A	Group B
0: pre-treatment (– 4 weeks)	VRBQ State DHI } VSS-sf }counterbalanced SF-36 }	------
1: baseline (start of treatment)	VRBQ State } VRBQ Then }counterbalanced VRBQ Change } DHI } VSS-sf }counterbalanced SF-36 }	VRBQ State DHI } VSS-sf }counterbalanced SF-36 }
2: post-treatment (+ 12 weeks)	VRBQ State } VRBQ Then* }counterbalanced VRBQ Change } DHI } VSS-sf }counterbalanced SF-36 }	VRBQ State } VRBQ Then }counterbalanced VRBQ Change } DHI } VSS-sf }counterbalanced SF-36 }

*A subgroup of Group A subjects, referred to as the *seen* group, were shown the responses to their baseline 'state' questionnaire when completing their post-treatment 'then-test'.

5.2.3. Data analysis

The aims of the Phase III experiment were to assess the psychometric properties of the new questionnaires, the Vestibular Rehabilitation Benefit Questionnaire in both 'state' and 'change' formats, and to compare the 'state' and 'change' methods of measurement.

5.2.3.1. Psychometric properties

Statistical methods were used to investigate the psychometric properties of the new questionnaires, both within themselves and in comparison to existing questionnaire measures.

The factor analysis procedure used in Phase II was repeated with Phase III data to investigate the subscale structure of the questionnaires. This involved application of Principal Components Analysis with quartimax rotation, extracting factors with an Eigen value of >1. More details of Principal Components Analysis can be found in Chapter Four, Section 4.3.1. The internal consistency of the questionnaires and subscales identified by Factor Analysis was examined using Cronbach's α as used in Phase II. Further details of the technique can be found in Chapter Four, Section 4.3.3.

Construct validity was investigated through examination of the pattern of correlations with existing questionnaire measures. Pearson's product moment correlation co-efficients were calculated for totals and subscales of 'state' and 'change' questionnaires in relation to total and subscale scores of the DHI, VSS-sf and SF-36.

Test-retest reliability was assessed by calculation of intra-class correlation coefficients between repeated application of the questionnaires in a no-treatment period.

The responsiveness of the questionnaires to changes in patient status over time was evaluated by calculation of effect size estimates for each questionnaire and by repeated measures analysis of variance (RM-ANOVA). Effect size is defined as the difference between two measures divided by the standard deviation of the difference (Howell, 1997). Calculation of effect size estimates allows comparison of questionnaires with different scoring algorithms by revealing the amount of change measured by a given questionnaire relative to random variation in scores across subjects. This calculation is appropriate where two measurements are taken and, therefore, a difference score can be derived to indicate change. In the present study, one of the questionnaires, the VRBQ Change, measures change retrospectively at a single point in time; in this case, it is not appropriate to calculate effect size. The measurement sensitivity of the VRBQ Change is considered separately, through comparison with the VRBQ State, in Chapter Six.

RM-ANOVA is a statistical technique which identifies whether measurement repetition causes a significant change in the data when a measurement is repeated two or more times. In this case the technique was applied to examine whether scores differed systematically with repeated application of the questionnaires in order to look for any significant effects on scores during treatment and no treatment periods. In cases where RM-ANOVA shows a significant effect of measurement repetition, paired t-tests reveal at which stage of the repetition the significant effect lay.

The results of the experiment to evaluate the psychometric properties of the VRBQ State and VRBQ Change are presented in Section 5.2 and discussed in Chapter Six.

5.2.3.2. Comparison of 'state' and 'change' methods

Comparison of 'state' and 'change' approaches to measuring change over time in this context was achieved by two methods: firstly, by comparative evaluation of the statistical analyses outlined above; secondly, by interpretation of questionnaire scores measured by different formats of the VRBQ at different points in time.

The focus of the first method was to compare the psychometric properties of the two formats of the VRBQ to identify any advantage of one format over the other. The focus of the second method was to examine the relationship between scores recorded at different times by different formats of the VRBQ to imply the contribution of response shift bias and memory bias to questionnaire responses. This involved comparison of 'then-test' scores at the end of both no-treatment and treatment periods to the 'state' questionnaire completed at the actual time to which the 'then-test' referred. Interpretation of results from subjects who completed the 'then-test' *seen* or *unseen* (the *seen* subgroup were given the results of their previous 'state' questionnaire when completing the 'then-test') also contributed to the analysis.

The findings of the experiment to compare methods of measuring change are presented and discussed in Chapter Six.

5.3. Results

5.3.1. Subjects and data

A total of 218 subjects began the study and complete data was collected from 124 subjects undergoing vestibular rehabilitation at five NHS clinics. Statistical analysis reveals that there are no significant or systematic differences between data from subjects who completed the study compared with data from subjects who did not complete the study. Two data collection protocols were used as described in Section 5.1.2 above. Subjects who completed Protocol A are referred to as Group A (n=40) and subjects who completed Protocol B are referred to as Group B (n=84). Access to subjects able to carry out Protocol A was restricted because of the minimum waiting list period necessary to allow a no-treatment control period. Six different questionnaires were used in total: three existing questionnaires, namely the Dizziness Handicap Inventory (DHI), the Vertigo Symptom Scale short form (VSS-sf) and the Medical Outcomes Study Short-Form 36 (SF-36) and three formats of the new Vestibular Rehabilitation Benefit Questionnaire (VRBQ) namely 'state', 'change' and 'then' formats (See Appendix 3). The questionnaires were applied repeatedly over time with Group A subjects completing a total of 16 questionnaires spread over three occasions over a 12-16 week period and Group B subjects completing 10 questionnaires over two occasions over approximately 12 weeks.

Missing data were generally very few when examined over the whole sample. With rare exceptions, all questionnaire items on all questionnaires had a completion rate of 97% or greater. Incidences of less than 97% completion were rare and were spread evenly across all questionnaires with the lowest completion rate for any given item being 93% for item 15 of the VRBQ. Where individual subjects had not completed a number of items on a given questionnaire the total score was only calculated if at least 50% of the items had been completed. The same criterion was applied to calculation of subscale scores and in cases where less than 50% of items in a subscale were completed average values for the subscale were substituted.

Results are reported for questionnaire totals and subscales only. The SF-36 does not have an overall total score, instead the Physical Summary and Mental Summary scores are used. Analysis of test-retest reliability was performed using data from Group A only (n=40), as data collected in a no-treatment period is a necessary for meaningful interpretation. Analysis of factor structure, internal consistency, construct validity and responsiveness to treatment include data from Group B (n=84). In these cases Group A and Group B data were initially analysed separately and later pooled into a single analyses (n=124) if significant differences were not observed in separate analyses. Where notable differences were observed in the initial analyses, Group A and Group B data are presented separately.

Although the data collected are ordinal, and parametric methods are usually not considered suitable for ordinal data, statistical advice suggested that parametric methods would be appropriate for these data. An assumption of parametric methods is that error terms in the underlying statistical model are normally distributed. Tests of skewness were applied to the data but did not reveal significant skew. To further verify the suitability of parametric methods some analyses were undertaken using both parametric and non-parametric methods. This revealed that the two approaches produced very similar patterns of results. In view of this and the fact that parametric methods generally offer more powerful analysis, parametric methods are used throughout.

Tables 5.2(a) and 5.2(b) below show the means and standard deviations of questionnaire total scores for all questionnaires at each application for Group A and Group B respectively. The possible score range is given for each questionnaire with the value representing the least disability shown first. The VRBQ State questionnaire shows negative values where the other questionnaires show positive values because of the nature of the scoring system which uses negative values to represent a deterioration in function in comparison with before the patient experienced their dizziness. The other 'state' questionnaires (i.e. the DHI, VSS-sf and SF-36) use positive scores to reflect disability. A percentage of the score which represents maximum disability for that questionnaire is also given for the four 'state' questionnaires. This allows comparison of the level of dizziness impact registered by each questionnaire relative to the others. The VRBQ Change questionnaire measures improvement or deterioration, rather than level of disability, so it is not appropriate to present a percentage disability for this questionnaire. Positive scores of the VRBQ Change represent improvement, negative scores represent deterioration and a value of zero reflects no change. Data collected using 'then-test' format of the VRBQ State questionnaire are not presented in this section but are dealt with separately in Chapter Six.

Table 5.2(a) Summary of Group A questionnaire scores (n=40)

	Time 0 (pre-treatment)		**Time 1 (baseline)**		**Time 2 (post-treatment)**	
	Mean (s.d)	**% disability**	**Mean (s.d)**	**% disability**	**Mean (s.d)**	**% disability**
VRBQ State (33 to –99)	–38.78 (9.22)	54.38%	–34.80 (10.13)	51.36%	–30.57 (11.87)	48.16%
DHI (0 to 100)	41.25 (22.91)	41.25%	37.95 (24.72)	37.95%	35.95 (25.64)	35.95%
VSS-sf (0 to 60)	19.20 (13.10)	32.00%	15.73 (12.96)	26.22%	13.13 (12.88)	21.88%
SF-36 Mental (100 to 0)	43.56 (10.72)	56.44%	44.95 (10.79)	55.05%	45.73 (10.86)	54.27%
SF-36 Physical (100 to 0)	44.88 (11.36)	55.12%	47.01 (10.30)	52.99%	48.19 (10.63)	51.81%
VRBQ Change (132 to –132)	▨	▨	15.35 (28.65)	▨	36.10 (43.83)	▨

Table 5.2(b) Summary of Group B questionnaire scores (n=84)

	Time 1 (baseline)		**Time 2 (post-treatment)**	
	Mean (S.D.)	**% disability**	**Mean (S.D.)**	**% disability**
VRBQ State (33 to –99)	–41.58 (11.32)	56.50%	–33.72 (12.01)	50.55%
DHI (0 to 100)	43.75 (21.65)	43.75%	33.19 (21.84)	33.19%
VSS-sf (0 to 60)	19.05 (11.45)	31.75%	13.14 (10.78)	21.90%
SF-36 mental (100 to 0)	42.74 (8.64)	57.28%	44.99 (9.56)	55.01%
SF-36 physical (100 to 0)	42.12 (11.91)	57.88%	45.10 (11.43)	54.90%
VRBQ Change (132 to –132)	▨	▨	13.52 (28.39)	▨

Means and standard deviations (in brackets) of questionnaire scores at each administration. The possible score range is given with the score representing least disability shown first. A percentage of the score representing maximum disability is given for 'state' questionnaires.

5.3.2. Subscale structure and internal consistency

VRBQ State and VRBQ Change questionnaires were analysed separately using Principal Components Analysis (PCA) with quartimax rotation, extracting factors with an Eigen value >1. The two analyses produced similar results. Factor analysis of Phase II data had produced a three-factor solution grouping items relating to 1) Dizziness and Anxiety, 2) Motion-Provoked Dizziness and 3) Quality of Life together into three separate subscales. Phase III data produced broadly similar results with the following exceptions. The factor loadings of the items in the 'change' questionnaire show four clear factors. The Motion-Provoked Dizziness and Quality of Life factors revealed in Phase 2 are unchanged but the Dizziness and Anxiety factor is separated into two factors with the Dizziness items loading clearly on one factor and the Anxiety items loading on another. The separation of Dizziness and Anxiety items is also revealed in analysis of the 'state' questionnaire. The Quality of Life subscale is also clearly supported by analysis of the 'state' questionnaire but the items relating to Motion-Provoked Dizziness do not load on any factor. Analysis of both 'state' and 'change' questionnaires revealed that items 14 and 19 cross-load on the Quality of Life factor and a further factor comprising just these two items. Item 14 asks patients to rate their difficulties in looking after themselves (e.g. hair-washing, teeth-cleaning, getting dressed) and item 19 asks about avoidance of particular activities, positions or situations. These two items may refer to some aspect of coping behaviour which is subtly distinct from other aspects of handicap and it will be interesting to observe the response patterns of these two items in future work involving this questionnaire.

Principal Components Analysis was performed separately on each application of the questionnaire in both subject groups but these separate analyses revealed substantially compatible patterns of results. The results presented in Table 5.3a show data from Group A and Table 5.3b shows data from Group B.

Table 5.3(a) Summary of VRBQ State Version 3.1 factors (n=124)

Component	Factor label	Eigen value	% of variance explained	Cumulative %	Items
1	Quality of Life	7.61	34.57	34.57	12-22
2	Dizziness	2.83	12.86	47.43	1,3,5
3	Anxiety	1.61	7.34	54.76	2,4,6

Table 5.3(b) Summary of VRBQ Change Version 3.1 factors (n=124)

Component	Factor label	Eigen value	% of variance explained	Cumulative %	Items
1	Quality of Life	7.70	35.00	35.00	12-22
2	Motion-provoked	4.68	21.27	56.27	7-11
3	Anxiety	2.10	9.54	65.80	2,4,6
4	Dizziness	1.22	5.56	71.36	1,3,5

To investigate the reliability of the four subscale structure suggested by Principal Components Analysis, Cronbach's test of internal consistency was applied. Internal consistency tends to be compromised in subscales with a small number of items because of the greater influence of spurious responding. The four-factor solution proposed by PCA comprised one subscale of eleven items (Quality of Life subscale), one subscale of five items (Motion-Provoked Dizziness subscale) and two subscales of three items each (Dizziness subscale and Anxiety subscale).

Table 5.4 below shows Cronbach's α values for the total and all subscales of both 'state' and 'change' questionnaires at each application. Alpha values for all subscales in both 'state' and 'change' questionnaires are high. Alpha values for the total score are high for the 'change' questionnaire and lower, but acceptable, for the 'state' questionnaire. As a multi-factorial scale, the scale total is not expected to show high internal consistency and the high overall internal consistency of the VRBQ Change is discussed in Chapter Six.

Alpha values are also given for the internal consistency of the VRBQ State total and VRBQ Change total with the items in the Motion-Provoked Dizziness subscale removed. In the 'state' questionnaire α values are markedly lowered by the inclusion of items relating to motion-provoked symptoms; this is consistent with the findings of PCA which revealed that these items do not relate closely to the other items.

Table 5.4 Cronbach's α values for totals and subscales of Version 3.1 (n=124)

	Total	Dizziness	Anxiety	Motion-provoked Dizziness	Quality of Life
State - time 0 (pre-treatment)	0.64 (0.86)	0.78	0.80	0.82	0.84
State - time 1 (baseline)	0.66 (0.87)	0.79	0.72	0.86	0.88
State - time 2 (post-treatment)	0.74 (0.92)	0.89	0.73	0.91	0.92
Change - time 1 (no-treatment period)	0.87 (0.88)	0.92	0.80	0.93	0.87
Change - time 2 (treatment period)	0.88 (0.87)	0.92	0.83	0.96	0.91

Values given are all Cronbach's α. Values given in parenthesis are α values for the total without items from the Motion-Provoked Dizziness subscale.

5.3.3. Construct validity

Construct validity is assessed through examination of the pattern of correlations with existing measures of related constructs. Table 5.5 summarises the pattern of predicted correlations based on previous research and theory. Group A and Group B data showed highly similar patterns of correlations and so the data were combined and analysis repeated with the full subject sample (n=124).

5.3.3.1. State questionnaires

Broadly speaking, the 'state' questionnaire correlates highly with the VSS-sf and DHI and less strongly with the SF-36. The pattern of correlations is consistent with predictions and supports the validity of the new questionnaire as a measure of the specific impact caused by dizziness.

Table 5.6 shows the correlations between each subscale at each application and the coefficient value boundaries used to categorise correlations as strong, moderate or weak. The correlations can be summarised as follows.

Vertigo Symptom Scale

The total score of the new questionnaire, the VRBQ, correlates moderately with the VSS-sf total and both the Vertigo and Anxiety subscales. The VRBQ Dizziness subscale correlates strongly with the VSS-sf total and Vertigo subscale and moderately with the VSS-sf Anxiety subscale. This supports the validity of the

VRBQ Dizziness subscale as a measure of vertigo or symptoms related to vertigo. It should be noted that two of the three items in the VRBQ Dizziness subscale were taken from the eight items in the Vertigo subscale of the VSS. The VRBQ Anxiety subscale correlates strongly with the VSS-sf total and VSS-sf Anxiety subscale and moderately with the VSS-sf Vertigo subscale. This supports the validity of the VRBQ Anxiety subscale as a measure of anxiety. The VRBQ Motion-Provoked Dizziness subscale correlates moderately with the VSS-sf total and both Vertigo and Anxiety subscales at Time 0 and Time 1 and strongly at Time 2. The pattern of strengthening correlations between the Motion-Provoked Dizziness subscale and other questionnaires over time is discussed in Section 5.4. below. The correlations with other questionnaires supports the validity of the Motion-Provoked Dizziness subscale as a measure of symptoms related to vertigo. The VRBQ Quality of Life subscale correlates moderately with the VSS-sf total and Vertigo subscale and shows weak-moderate correlation with the VSS-sf Anxiety subscale. This supports the validity of the Quality of Life subscale as a measure of the handicap associated with symptoms of dizziness and anxiety but not of dizziness or anxiety themselves.

The pattern of correlations with the VSS-sf is consistent with expectations and supports the validity of the VRBQ. In particular the pattern of results gives strong support to the convergent and discriminant validity of the Dizziness and Anxiety subscales of the new questionnaire.

Dizziness Handicap Inventory

When measured at Time 0, the VRBQ total score correlates moderately with the DHI total, Emotional subscale and Functional subscale and weakly with the Physical subscale. This supports the validity of the VRBQ total as a measure of dizziness impact. At Time 1 and Time 2 the correlations are weaker. The VRBQ Dizziness subscale shows moderate-strong correlations with the DHI total and Physical subscale and moderate correlations with the DHI Emotional and Functional subscales. This supports the convergent and discriminant validity of the VRBQ Dizziness subscale. The VRBQ Anxiety subscale correlates moderately with the total and all subscales of the DHI. The VRBQ Motion-Provoked Dizziness subscale shows moderate-strong correlation with the DHI total, strong correlation with the DHI Physical subscale and moderate correlation with the DHI Emotional and Functional subscales. This supports the convergent and discriminant validity of the VRBQ Motion-Provoked Dizziness subscale. These relationships become stronger at Time 2. This pattern of strengthening correlations over time is inconsistent with the change in relationship between the VRBQ total and DHI total and subscales which becomes weaker over time. This is discussed below in Section 5.4. The VRBQ Quality of Life subscale correlates strongly with the DHI total, Emotional and Functional subscales at Time 0, the correlations are moderate at Time 1 and weak at Time 2. This follows the same pattern as the relationship between the VRBQ total and the DHI which suggests that the results from the Quality of Life subscale (which forms half of the questionnaire items) are the main component in the relationship seen between the VRBQ total and the DHI total. The relationship between the VRBQ Quality of Life subscale and the DHI Physical subscale is weak, showing the discriminant validity of the Quality of Life subscale.

The correlations between the VRBQ and DHI subscales offer support for the convergent and discriminant validity of the VRBQ. In particular, appropriate relationships are seen in the correlations between the VRBQ Dizziness and Motion-Provoked Dizziness subscales and DHI Physical subscale and between the VRBQ Quality of Life subscale and the DHI Emotional and Functional subscales. However, it should be noted that previous research has suggested that the subscale structure of the DHI is not entirely valid (Enloe and Shields 1997; Asmundson *et al*, 1999; Booth, 2000) and as such the conclusions from these results should be treated with caution.

SF-36

The VRBQ total score correlates moderately with the SF-36 Physical Summary score at Time 0, but weakly at Time 1 and Time 2. Four of the eight subscales of the SF-36 also show this pattern: Role Function - Emotional, Social Function, Mental Health, Energy and Vitality. The pattern of weakening correlations over the course of the study may be attributed to the low sensitivity of the SF-36 to changes in the impact of dizziness over time in comparison to the VRBQ. This issue is discussed further in Section 5.4 below. The VRBQ Dizziness subscale shows a similar pattern of correlations, predominantly moderate at Time 0 and weak at Time 1 and Time 2, with the SF-36 Physical Summary score and four subscales (three the same as correlate with the total and one different): Social Function, Mental Health, Energy and Vitality, Pain. The SF-36 Social Function subscale also correlates moderately with the VRBQ Dizziness subscale at Time 2, as does the SF-36 Physical Function subscale. The VRBQ Anxiety subscale correlates moderately with both the Physical and Mental Summary scores of the SF-36 and seven of the eight subscales, the only subscale it does not correlate with is General Health Perceptions. Again the Motion-Provoked Dizziness subscale of the VRBQ reverses the pattern of correlations by being more correlated with the SF-36 at the end of treatment than at the beginning. All correlations between the Motion-Provoked Dizziness subscale and the SF-36 subscales are weak at Time 0 and Time 1, moderate correlations are observed at Time 2 with the SF-36 Mental Summary score and the following four subscales: Physical function, Role function - physical, Social Function, Pain. The Quality of Life subscale shows the same pattern as the VRBQ total and Dizziness subscales where correlations are moderate at Time 0 and weak at subsequent applications. The moderate correlations at Time 0 are as follows: Physical Summary score, Social Function, Mental Health, Energy and Vitality.

All subscales of the SF-36 showed some degree of correlation with the VRBQ with the exception of the General Health Perceptions subscale. Three of the ten components of the SF-36 (two summary scores and eight subscales) showed moderate correlations with all VRBQ subscales except the Motion-Provoked Dizziness Subscale (which appears to behave differently from the other subscales in a number of ways): the Physical Summary score, Mental Health subscale and the Energy and Vitality subscale. The SF-36 Mental Summary score shows moderate correlations with all VRBQ subscales except the Quality of Life subscale. The component of the VRBQ which most consistently shows a relationship with components of the SF-36 is the VRBQ Anxiety subscale which is an interesting finding suggesting that the SF-36 is most sensitive to the psychological symptoms caused by dizziness rather than the functional limitations or overall quality of life impact as may have been expected.

To summarise the correlations between the SF-36 and the VRBQ, the correlations which are observed are moderate or weak, no strong correlations are observed and correlations become weaker over the course of the study reflecting a lack of sensitivity to change as shown by other analyses in Section 5.2.5. The pattern of correlations is generally consistent with expectations (see Table 5.5) as the SF-36 is a measure of health-related quality of life which is somewhat removed from the specific difficulties caused by dizziness and therefore these findings support the discriminant validity of the VRBQ.

5.3.3.2. Change questionnaire

The VRBQ Change questionnaire is not directly comparable to the scores of the 'state' format questionnaires because of the nature of the question asked in each format. To assess construct validity correlations were examined between the VRBQ Change scores and the change scores derived from the before-after difference measured by the existing 'state' questionnaires (DHI, VSS-sf and SF-36).

Table 5.6(b) shows the results of Pearson's product moment correlation coefficient calculations. Analysis shows that correlations between the VRBQ Change questionnaire and derived change scores from 'state' questionnaires, where present, are weak. In general there is no correlation between the VRBQ Change questionnaire and the other questionnaires in the no treatment period, as would be expected since there are no systematic changes within the subject group. In the treatment period there are a small number of correlations of note. The Dizziness and Quality of Life subscales of the VRBQ Change questionnaire show moderate correlation with the derived change measured by the VSS-sf total and Vertigo subscale. The Dizziness subscale also shows a moderate correlation with VSS-sf Anxiety subscale. The Quality of Life subscale shows a moderate correlation with the total and Physical subscale of the DHI.

The weak relationship between the VRBQ Change questionnaire and existing measures of related constructs may be partly due differences inherent in the two approaches to the measurement of change. The present study aims to compare the two approaches to measuring change, none the less it is a limitation of the study that there are no pre-existing 'change' format measures that could be used to assess the validity of the VRBQ Change.

Table 5.5 Summary of predicted correlations between VRBQ and existing questionnaires

	VRBQ Total	Dizziness Subscale	Anxiety Subscale	Motion-Provoked Dizziness Subscale	Quality of Life Subscale
DHI Total	Moderate-strong	Moderate-strong	Moderate	Moderate-strong	Strong
DHI Physical	Moderate-strong	Strong	Moderate	Strong	Moderate
DHI Emotional	Moderate-strong	Moderate	Moderate	Moderate	Moderate-strong
DHI Functional	Moderate-strong	Moderate	Moderate	Moderate	Moderate-strong
VSS-sf Total	Moderate-strong	Moderate-strong	Moderate-strong	Moderate-strong	Moderate
VSS-sf Vertigo	Moderate-strong	Strong	Moderate	Moderate-strong	Moderate
VSS-sf Anxiety	Moderate-strong	Moderate	Strong	Moderate-strong	Moderate
SF-36 Mental	Weak-moderate	Weak-moderate	Moderate	Weak-moderate	Moderate
SF-36 Physical	Weak-moderate	Moderate	Weak-moderate	Moderate	Weak-moderate
SF-36 Physical	Weak-moderate	Moderate	Weak	Moderate	Weak
SF-36 Role/Physical	Weak-moderate	Moderate	Weak	Moderate	Weak
SF-36 Role/Emotional	Weak-moderate	Weak	Weak-moderate	Weak	Moderate
SF-36 Social Function	Weak-moderate	Weak	Weak	Weak	Moderate
SF-36 Mental Health	Weak	Weak	Weak-moderate	Weak	Weak
SF-36 Energy and	Weak-moderate	Moderate	Weak	Weak	Weak
SF-36 Pain	Weak	Weak	Weak	Weak	Weak
SF-36 GHP	Weak	Weak	Weak	Weak	Weak

Table 5.6(a) Summary of correlations between VRBQ State 3.1 and existing questionnaires

	VRBQ State Total Score			**Dizziness Subscale**			**Anxiety Subscale**			**Motion-provoke Dizziness Subscale**			**Quality of Life Subscale**		
	Time 0 (n=96)	Time 1 (n=179)	Time 2 (n=124)	Time 0	Time 1	Time 2	Time 0	Time 1	Time 2	Time 0	Time 1	Time 2	Time 0	Time 1	Time 2
DHI Total	**–0.553**	**–0.376**	**–0.312**	**–0.593**	**–0.599**	**–0.608**	**–0.469**	**–0.457**	**–0.423**	**0.470**	**0.617**	**0.675**	**–0.647**	**–0.468**	**–0.365**
DHI physical	**–0.310**	**–0.169**	**–0.258**	**–0.652**	**–0.535**	**–0.633**	**–0.427**	**–0.274**	**–0.559**	**0.653**	**0.702**	**0.748**	**0.461**	**–0.349**	**–0.354**
DHI emotional	**–0.586**	**–0.404**	**–0.257**	**–0.469**	**–0.548**	**–0.546**	**–0.437**	**–0.472**	**–0.371**	**0.314**	**0.479**	**0.581**	**–0.638**	**–0.429**	**–0.289**
DHI functional	**–0.546**	**–0.391**	**–0.346**	**–0.542**	**–0.536**	**–0.537**	**–0.420**	**–0.447**	**–0.440**	**0.390**	**0.537**	**0.587**	**–0.621**	**–0.465**	**–0.379**
VSS-sf Total	**–0.510**	**–0.432**	**–0.515**	**–0.678**	**–0.655**	**–0.753**	**–0.604**	**–0.584**	**–0.637**	**0.524**	**0.546**	**0.753**	**–0.523**	**–0.422**	**–0.527**
VSS-sf Vertigo	**–0.456**	**–0.365**	**–0.456**	**–0.721**	**–0.675**	**–0.748**	**–0.384**	**–0.424**	**–0.495**	**0.517**	**0.579**	**0.722**	**–0.537**	**–0.415**	**–0.507**
VSS-sf Anxiety	**–0.476**	**–0.444**	**–0.500**	**–0.498**	**–0.508**	**–0.619**	**–0.747**	**–0.692**	**–0.705**	**0.432**	**0.403**	**0.613**	**–0.404**	**–0.356**	**–0.455**
SF-36 Mental	**0.306**	**0.281**	**0.275**	**0.349**	**0.313**	**0.411**	**0.400**	**0.360**	**0.503**	**–0.300**	**–0.313**	**–0.455**	**0.346**	**0.294**	**0.252**
SF-36 Physical	**0.549**	**0.271**	0.191	**0.501**	**0.340**	**0.328**	**0.370**	**0.478**	**0.287**	–0.215	**–0.335**	**–0.321**	**0.517**	**0.235**	*0.163*
SF-36 PF	**0.345**	**0.273**	**0.377**	**0.397**	**0.390**	**0.527**	**0.415**	**0.450**	**0.578**	**0.266**	**–0.386**	**–0.541**	**0.362**	**0.274**	**0.352**
SF-36 role/phy	**0.344**	**0.282**	**0.248**	0.240	**0.251**	**0.399**	0.225	**0.315**	**0.435**	*–0.177*	**–0.306**	**–0.445**	**0.391**	**0.320**	**0.237**
SF-36 role/emo	**0.435**	**0.248**	*0.165*	**0.371**	**0.343**	**0.344**	**0.366**	**0.480**	**0.346**	*–0.098*	**–0.323**	**–0.362**	**0.364**	**0.198**	*0.145*
SF-36 social	**0.469**	**0.285**	**0.233**	**0.453**	**0.293**	**0.450**	**0.388**	**0.423**	**0.376**	**–0.326**	**–0.361**	**–0.420**	**0.573**	**0.321**	0.221
SF-36 MH	**0.471**	**0.251**	**0.242**	**0.484**	**0.343**	**0.377**	**0.323**	**0.437**	**0.344**	**–0.228**	**–0.320**	**–0.375**	**0.31**	**0.207**	0.211
SF-36 E&V	**0.574**	**0.347**	**0.327**	**0.563**	**0.349**	**0.365**	**0.429**	**0.440**	**0.372**	**–0.335**	**–0.330**	**–0.340**	**0.550**	**0.330**	**0.280**
SF-36 pain	**0.329**	**0.253**	*0.154*	**0.458**	**0.386**	**0.375**	**0.510**	**0.461**	**0.430**	**–0.352**	**–0.371**	**–0.439**	**0.312**	**0.231**	*0.140*
SF-36 GHP	**0.342**	**0.275**	*0.160*	**0.345**	**0.258**	0.192	**0.297**	**0.355**	**0.343**	*–0.144*	–0.155	–0.205	**0.310**	**0.204**	*0.092*

Dark grey shading	Strong correlation (>0.6)	Normal text	Significant p<0.05	Time 0	pre-treatment measurement
Mid grey shading	Moderate correlation (0.4 - 0.6)	**Bold text**	Significant p<0.01	Time 1	baseline measurement
Light grey shading	Weak correlation (0.2 - 0.4)	*Italic text*	Not significant (p>0.05)	Time 2	post-treatment measurement
No shading	No correlation (<0.2)				

Table 5.6(b) Summary of correlations between VRBQ Change 3.1 and existing questionnaires

	VRBQ Change Total Score		**Dizziness Subscale**		**Anxiety Subscale**		**Motion-Provoked Dizziness Subscale**		**Quality of Life Subscale**	
	no-	**treatment**	**no-**	**treatment**	**no-**	**treatment**	**no-**	**treatment**	**no-**	**treatment**
DHI Total	*–0.003*	*–0.252*	*–0.187*	*–0.341*	*0.042*	*–0.197*	*–0.144*	*0.247*	*0.151*	*–0.429*
DHI physical	*0.005*	**–0.328**	*–0.140*	**–0.381**	*0.029*	0.235	*–0.040*	0.182	*0.084*	**–0.475**
DHI emotional	*0.000*	*–0.134*	*–0.148*	–0.224	*0.020*	*–0.110*	*–0.127*	**0.248**	*0.136*	**–0.307**
DHI functional	*–0.010*	–0.215	*–0.171*	**–0.298**	*0.051*	–0.182	*–0.167*	0.212	*0.145*	**–0.346**
VSS-sf Total	*–0.218*	**–0.329**	**–0.354**	**–0.425**	*–0.113*	**–0.333**	*0.011*	0.209	*–0.185*	**–0.443**
VSS-sf Vertigo	*–0.089*	**–0.308**	*–0.150*	**–0.428**	*–0.007*	**–0.282**	*–0.026*	0.207	*–0.073*	**–0.428**
VSS-sf Anxiety	*–0.249*	**–0.271**	**–0.424**	**–0.305**	*–0.158*	**–0.320**	*0.035*	*0.157*	*–0.214*	**–0.344**
SF-36 Mental	*0.037*	*0.136*	*–0.008*	0.197	*0.038*	**0.250**	*0.128*	*–0.111*	*–0.036*	*0.153*
SF-36 Physical	*–0.092*	*0.094*	*0.198*	*0.157*	*–0.113*	*0.160*	*0.042*	*–0.206*	*–0.221*	0.213
SF-36 PF	*–0.091*	*0.173*	*–0.006*	0.218	*–0.076*	0.231	*0.015*	*–0.133*	*–0.137*	**0.237**
SF-36 role/phy	*–0.035*	0.178	*0.080*	**0.286**	*0.144*	0.212	*–0.133*	*–0.126*	*–0.051*	0.209
SF-36 role/emo	*–0.037*	*0.070*	*0.142*	*0.162*	*–0.125*	*0.100*	*0.056*	*–0.145*	*–0.114*	*0.140*
SF-36 social	*0.023*	*0.153*	*0.048*	*0.170*	*–0.004*	*0.122*	*0.068*	*–0.129*	*–0.028*	**0.259**
SF-36 MH	*–0.121*	*0.127*	*0.186*	*0.147*	*–0.046*	**0.237**	*–0.018*	**–0.269**	*–0.246*	**0.288**
SF-36 E&V	*–0.137*	*0.066*	*0.079*	0.180	*–0.091*	**0.271**	*0.190*	–0.186	**–0.353**	*0.108*
SF-36 pain	*0.058*	*0.018*	*0.035*	*0.057*	*–0.063*	*0.150*	0.271	*–0.155*	*–0.075*	*0.086*
SF-36 GHP	*0.136*	*0.026*	*0.190*	*0.045*	*0.043*	0.225	*0.234*	*–0.144*	*–0.026*	*0.071*

DHI/VSS-sf/SF-36 scores are derived benefit scores: After score - Before score

Dark grey shading	Strong correlation (>0.6)
Mid grey shading	Moderate correlation (0.4 - 0.6)
Light grey shading	Weak correlation (0.2 - 0.4)
No shading	No correlation (<0.2)

Normal text	Significant p<0.05
Bold text	Significant p<0.01
Italic text	Not significant (p>0.05)

5.3.4. Test-retest reliability and clinically meaningful change

Test-retest reliability is conventionally established by examining the intra-class correlation between two applications of the questionnaire in a no-treatment period of around 24-48hrs (Enloe and Shields, 1997). This method takes account of systematic score changes over time by comparing the inter-subject variability to the total variance (Deyo *et al*, 1991). If individual subjects give consistent judgements across time the total variance will be dominated by inter-subject variance and the intra-class correlation will be strong, reflecting that the measure is reliable. Values close to 1 indicate close agreement between the two measures, values close to 0 indicate that the two measures do not agree. Test-retest data was collected with all questionnaires over the no-treatment period, where first and second completions were separated by around 5 weeks. The test-retest reliability of the VRBQ was also assessed over a 24 hour period.

The intra-class correlations between the first and second completion of all questionnaires over the no-treatment period (~5 weeks) were highly significant. The correlation coefficients are given in Table 5.7 below and can be described as follows: DHI, VSS-sf and SF-36 Mental Summary show very strong intra-class correlations, the SF-36 Physical Summary score shows a strong correlation and the VRBQ State and VRBQ Change show moderate correlations. The data presented are from Group A only.

Table 5.7 Summary of intra-class correlation coefficients of before and after no-treatment scores (n=40)

	Intra-class correlation value	**Significance**
VRBQ State	0.57	<0.001**
DHI	0.94	<0.001**
VSS-sf	0.90	<0.001**
SF-36 Mental	0.94	<0.001**
SF-36 Physical	0.76	<0.001**
VRBQ Change	0.65	<0.001**

** indicates correlation is significant at p<0.001

The weaker intra-class correlation shown by the VRBQ compared with the other questionnaires over a 5-week period is most likely attributable to the greater responsiveness of the VRBQ (see Section 5.2.5 below). Results of the test-retest reliability study over a 24-hour period are presented below and indicate that the VRBQ Total and Subscales have excellent reliability.

Table 5.8 Intra-class correlation coefficients of first and second completion VRBQ scores over a 24-hour period (n=20)

	Intra-class correlation value	**Significance**
Total	0.92	<0.001**
Dizziness subscale	0.99	<0.001**
Anxiety subscale	0.99	<0.001**
Motion-Provoked Dizziness subscale	0.98	<0.001**
Quality of Life subscale	0.94	<0.001**

** indicates correlation is significant at $p<0.001$

The mean score change on repetition over a period when change would not be expected to occur, such as a 24-hour period, indicates the magnitude of score change that implies 'true' change. The difference scores of 95% of the population will fall within two standard deviations either side of the mean, therefore, a difference greater than this value is assumed to represent a true difference. Table 5.9 below summarises the mean and standard deviation of score differences on repetition for total and subscale scores in the present study; these values provide an estimation of the magnitude of score change that can be interpreted as representing a clinically meaningful change when measured over the same period. Over a longer period of time the standard deviation of score differences may be different and the values representing the minimum score change presented below may not apply.

Table 5.9 Mean and standard deviation of score change on repetition and clinically meaningful change for VRBQ total and subscales

	Mean score change on repetition (standard deviation)	**Minimum score change interpreted as clinically meaningful*†**
Total	2.35 (3.30)	7
Dizziness subscale	0.50 (0.89)	2
Anxiety subscale	0.25 (0.44)	1
Motion-Provoked Dizziness subscale	1.35 (1.39)	3
Quality of Life subscale	1.85 (2.43)	5

*95% confidence interval, † rounded to nearest integer

5.3.5. Responsiveness

Responsiveness to change is a crucial property of a questionnaire designed to measure change over time and this property can be assessed in a number of ways. Table 5.10 shows the magnitude of change measured in treatment and no-treatment periods (Group A) in absolute values and expressed as a percentage of the score range of each questionnaire. Of the four 'state' questionnaires, the VRBQ is the only questionnaire to show more change in the treatment period than the no-treatment period. The DHI shows a similar amount of change to the VRBQ State, the VSS-sf shows the greatest change and the generic SF-36 shows the least change. The greater sensitivity to change of the disease-specific questionnaires is consistent with expectations and previous findings in the literature. The VRBQ Change questionnaire shows substantially more change than any of the other questionnaires and shows more change in the treatment period than the no-treatment period. The possible interpretations of this finding and other findings that show inconsistencies between the VRBQ Change and the four state questionnaires are discussed in Chapter Six. Figures 5.1 to 5.5 show individual subject scores during no-treatment and treatment periods for VRBQ total and subscales.

Table 5.10 Summary of improvement or decline in treatment and no treatment periods (n=40)

	Initial score	**Improvement (+) or decline (–) in no treatment period**	**Improvement (+) or decline (–) in treatment period**
VRBQ State (33 to –99)	–38.78	+3.98 (3.02%)	+4.23 (3.20%)
DHI (0 to 100)	41.25	+3.30 (3.30%)	+2.00 (2.00%)
VSS-sf (0 to 60)	19.20	+3.47 (5.78%)	+2.60 (4.33%)
SF-36 Mental (100 to 0)	43.56	+1.39 (1.39%)	+0.78 (0.78%)
SF-36 Physical (100 to 0)	44.88	+2.13 (2.13%)	+1.18 (1.18%)
VRBQ Change (132 to –132)	▨	+15.35 (5.81%)	+20.75 (7.86%)

Mean score compared to previous questionnaire score is given as a positive value to reflect improvement or a negative value to reflect decline. Improvement or decline is also shown as a % of possible score range (in brackets).

Figure 5.1 Individual subject scores over no-treatment and treatment periods: VRBQ Total

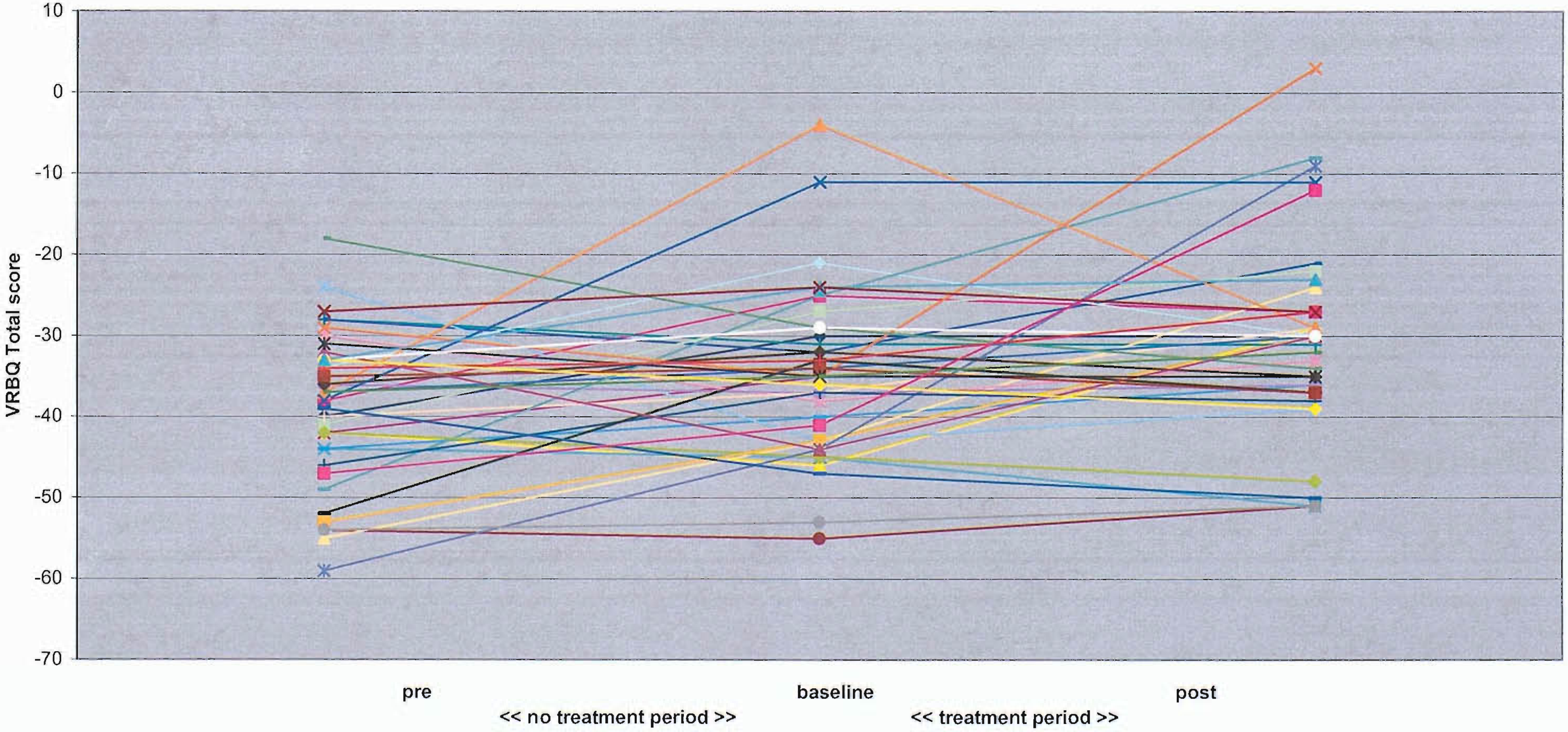


Figure 5.2 Individual subject scores over no-treatment and treatment periods:
VRBQ Dizziness subscale

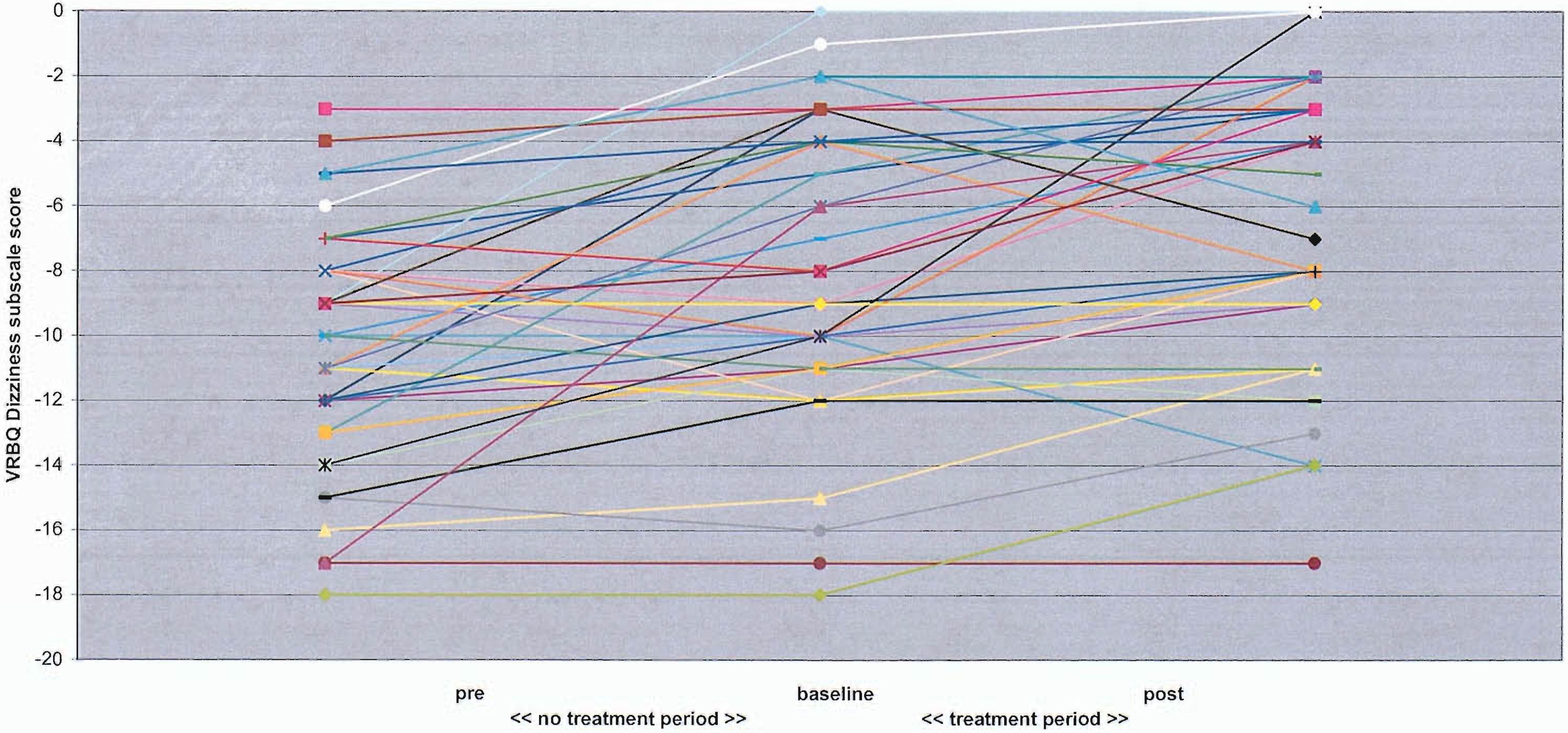


Figure 5.3 Individual subject scores over no-treatment and treatment periods: VRBQ Anxiety subscale

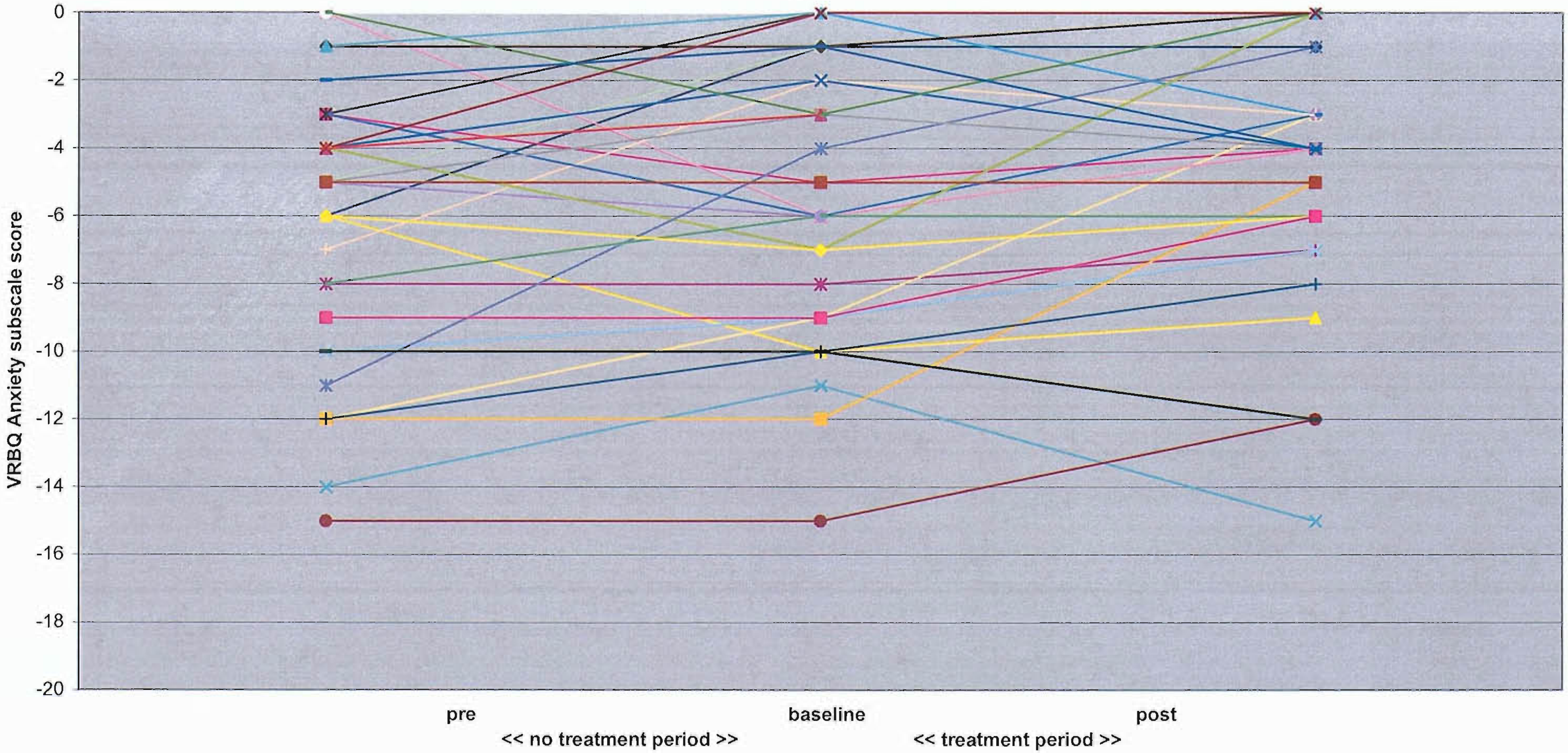


Figure 5.4 Individual subject scores over no-treatment and treatment periods: VRBQ Motion-Provoked Dizziness subscale

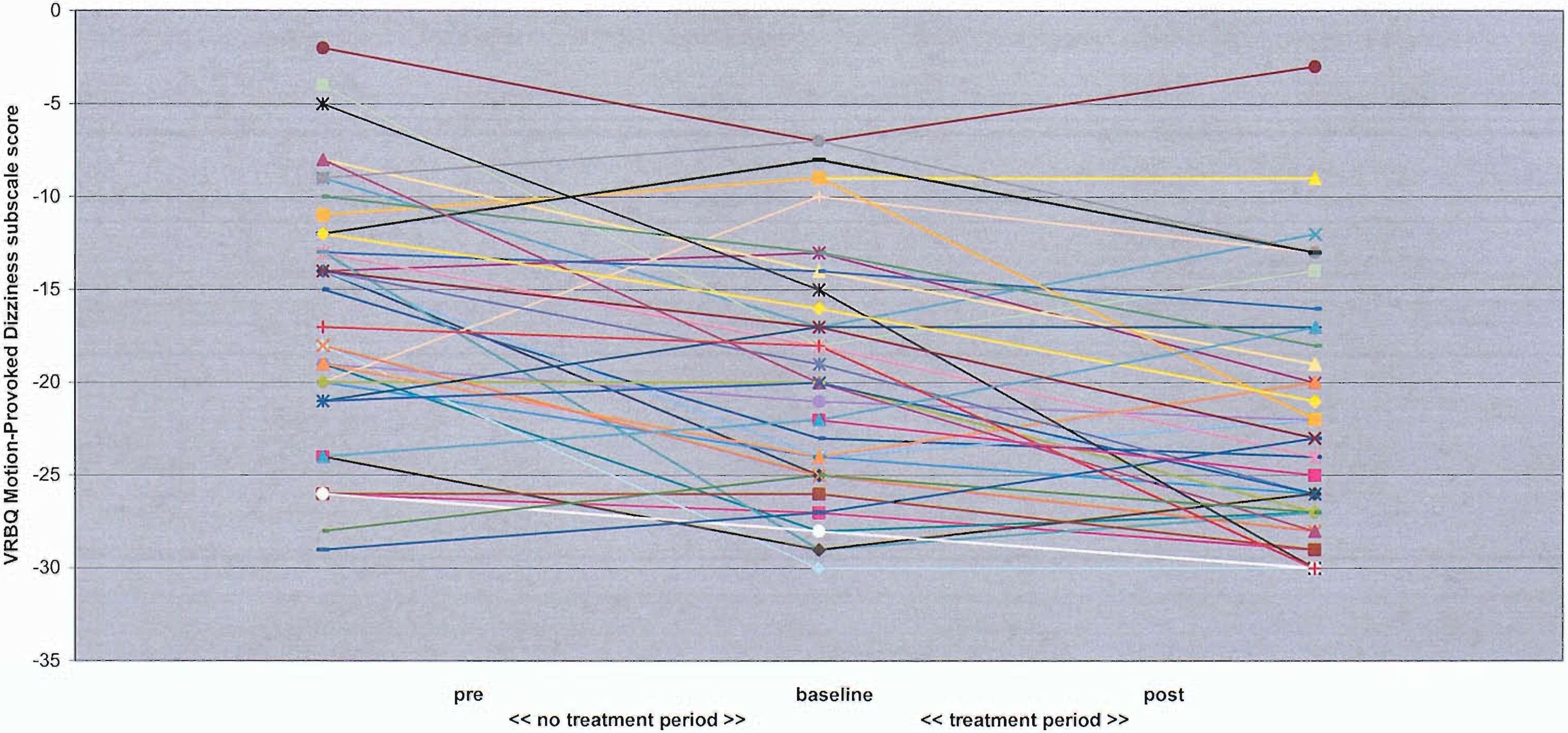
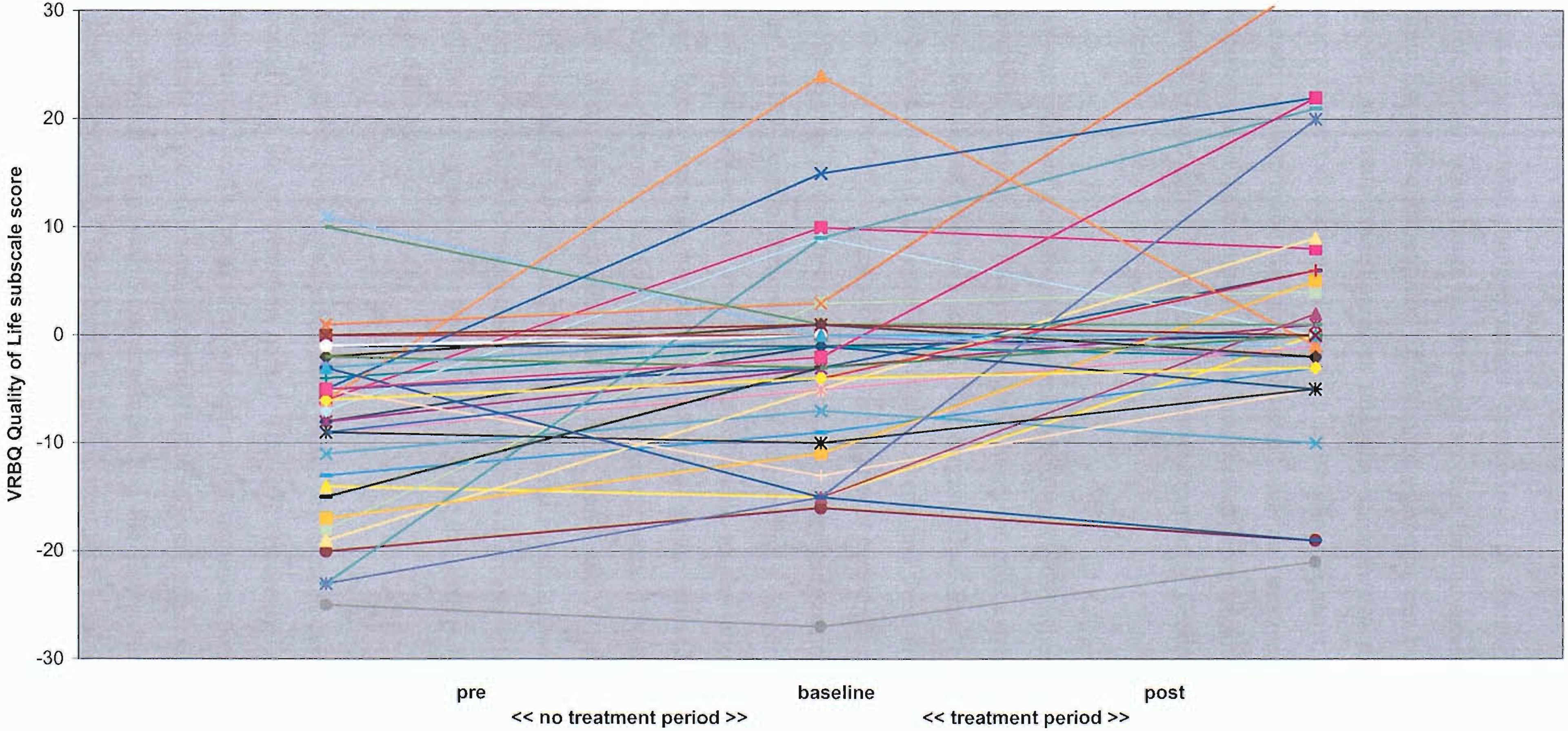


Figure 5.5 Individual subject scores over no-treatment and treatment periods: VRBQ Quality of Life subscale



The use of percentage score changes assists comparison of questionnaires by overcoming differences in score range but does not account for the spread of scores within the sample for each questionnaire. Effect size estimates can be used as a common metric for all 'state' questionnaires and also incorporates the standard deviation of scores in the calculation. Table 5.11 and Figure 5.6 show effect sizes measured by each questionnaire in the treatment and no treatment periods. Calculation of effect sizes in the treatment period produced different results for Group B subjects, therefore Group A and B data are presented separately. Group A data are described first, below.

Using the effect size estimate guidelines proposed by Cohen (1969) where an effect size of 0.2 is described as small, 0.5 moderate and 0.8 large, the effect sizes measured by all state questionnaires are relatively small. The largest effect sizes measured in Group A would be described as moderate by Cohen's criteria and these are measured by the VRBQ. Overall the effect sizes shown in the treatment period are consistently lower than the effect sizes in the no-treatment period in all questionnaires. This is also true of the VRBQ despite percentage scores suggesting a larger change in treatment than no-treatment periods and this is attributable to the larger standard deviation of scores in the treatment period. The pattern of greater effect sizes in the no-treatment period compared to the treatment period is most marked in the dizziness symptom subscales of the disease-specific questionnaires, that is the VRBQ Dizziness subscale, the VSS-sf Vertigo subscale and the DHI Physical subscale, and in the SF-36 Physical Summary score. The exceptions to the pattern of greater effect sizes in the no-treatment period compared to the treatment period are the anxiety subscales of both the VRBQ and the VSS-sf.

The SF-36 generally shows very small effect sizes which are in most cases lower in the treatment period than the no treatment period. The only effect sizes of note are measured by the General Health Perceptions subscale in the treatment period and the Mental Health subscale in the no-treatment period (both moderate effect sizes) and in the no-treatment period the Physical Summary score and the Energy and Vitality subscale (both small effect sizes). This finding is inconsistent with previous research by Enloe and Shields (1997) who found the greatest change to occur in the Role Limitation - Physical and Social Function scales.

For the 'state' questionnaires Group B data show greater effect sizes. VRBQ State scores show effect sizes an average of 0.3 higher than in Group A. Consistent with Group A data, the VRBQ Anxiety subscale shows the smallest effect size in Group B but the Dizziness subscale shows a considerably larger effect size both in absolute terms and relative to the other subscales. The DHI also shows an overall increase in effect size of around 0.3 in comparison to Group A and similarly shows a different pattern of results in terms of the relative effect sizes of the questionnaire subscales. The VSS-sf also shows an increase of 0.2-0.3 but, unlike the other questionnaires, Group B data show the same pattern of results with the Vertigo subscale showing the largest effect size and Anxiety subscale showing the smallest. The SF-36 similarly shows a general increase in effect sizes of around 0.2 with the exception of the General Health Perceptions subscale which showed an effect size of nearly 0.5 lower than in Group A.

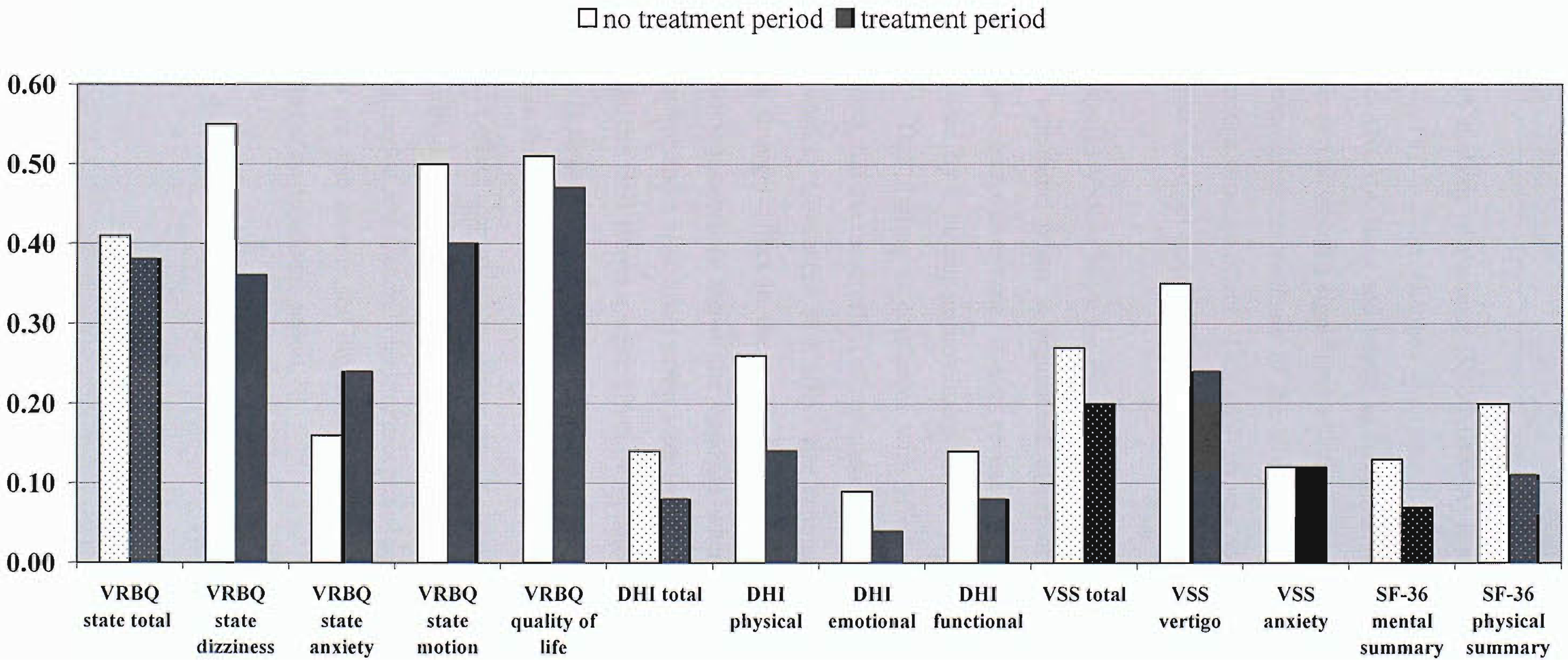
Table 5.11 Summary of effect sizes in treatment and no-treatment periods

	Group A (n=40)		**Group B (n=84)**
	No treatment period	**Treatment period**	**Treatment period**
VRBQ state total	0.41	0.38	0.67
VRBQ state dizziness	0.55	0.36	0.90
VRBQ state anxiety	0.16	0.24	0.39
VRBQ state motion-provoked	0.50	0.40	0.64
VRBQ quality of life	0.51	0.47	0.79
DHI total	0.14	0.08	0.49
DHI physical	0.26	0.14	0.39
DHI emotional	0.09	0.04	0.40
DHI functional	0.14	0.08	0.50
VSS-sf total	0.27	0.20	0.53
VSS-sf vertigo	0.35	0.24	0.59
VSS-sf anxiety	0.12	0.12	0.33
SF-36 mental summary	0.13	0.07	0.25
SF-36 physical summary	0.20	0.11	0.25
SF-36 physical function	0.16	0.05	0.22
SF-36 role function - physical	0.05	0.17	0.38
SF-36 role function - emotional	0.02	0.28	0.21
SF-36 social function	0.19	0.02	0.22
SF-36 mental health	0.40	0.05	0.27
SF-36 energy and vitality	0.24	0.19	0.34
SF-36 pain	0.18	0.10	0.12
SF-36 general health perceptions	0.16	0.69	0.21

Effect size estimate categories:
0.2-0.5 small (no shading)
0.5-0.8 moderate (light shading)
>0.8 large (dark shading)

Effect size formula:
Effect size = (μ before - μ after)/(ΣSD/2)

Figure 5.6 Effect sizes in treatment and no treatment periods (Group A, n=40)



Repeated measures analysis of variance (RM-ANOVA) is an alternative approach to evaluation of sensitivity to score changes over time. Table 5.12 below summarises the results of RM-ANOVA tests and t-tests in treatment and no-treatment periods. Significance levels reveal where a significant effect of repetition is observed and the F-statistic or T-value gives an estimate of the strength of the mean effect where a higher value suggests a stronger effect. This analysis was not applied to Group B data as pre-treatment data were not collected from Group B subjects.

Overall, the VRBQ and VSS-sf show the most significant and strongest mean effects of measurement repetition, where a significant effect of measurement repetition reflects a significant change over time. T-tests reveal that in the VSS-sf this effect is predominantly caused by a strong improvement in the Vertigo subscale in the no-treatment period. This finding is consistent with effect size estimates described above. T-tests reveal that the mean effect of repeated measurement with the VRBQ is strong for all subscales. Consistent with effect size estimates, the VRBQ Dizziness subscale shows a stronger effect in the no-treatment period than in the treatment period and the Anxiety subscale shows the opposite where there is no significant effect before treatment and a significant effect after treatment. Again consistent with effect size findings, the DHI shows a weak effect of repeated measurement over time (i.e. little change is measured over time), with any observed effects driven by the Physical subscale in the no-treatment period. The SF-36 also shows a similar pattern in this analysis as in effect size estimates where results show an overall weak effect of measurement repetition. The strongest effects are seen in the Mental Health subscale in the no-treatment period and General Health Perceptions in the treatment period and significant effects are also seen in the Physical Summary score and the Energy and Vitality subscale in the no-treatment period.

Table 5.12 Summary of RMANOVA and paired t-tests for before and after scores in treatment and no-treatment periods (n=40)

	Repeated Measures ANOVA			No treatment period t-test		Treatment period t-test	
	F statistic	**df**	**Sig**	**T value**	**Sig**	**T value**	**Sig**
VRBQ state total	**6.12**	38	**0.005**	*2.36*	*0.02*	*-2.30*	*0.03*
VRBQ state dizziness	**19.21**	38	**<0.001**	**4.34**	**<0.01**	**-3.35**	**<0.01**
VRBQ state anxiety	**6.29**	37	**0.004**	1.69	0.10	**-2.62**	**0.01**
VRBQ state motion-provoked	**15.11**	38	**<0.001**	**3.73**	**<0.01**	**4.17**	**<0.01**
VRBQ quality of life	**8.16**	37	**0.001**	**2.85**	**0.01**	**1.33**	**0.01**
DHI total	3.22	38	0.051	*2.25*	*0.03*	5.13	0.45
DHI physical	*4.42*	38	*0.019*	*2.46*	*0.02*	2.41	0.19
DHI emotional	0.76	38	0.474	1.24	0.22	1.09	0.63
DHI functional	3.04	38	0.060	1.52	0.14	2.46	0.33
VSS-sf total	**10.28**	38	**<0.001**	**2.86**	**0.01**	*4.85*	*0.02*
VSS-sf vertigo	**11.93**	38	**<0.001**	**3.07**	**<0.01**	*3.38*	*0.02*
VSS-sf anxiety	*3.67*	38	*0.035*	1.33	0.19	1.90	0.22
SF-36 mental summary	2.84	38	0.071	–1.77	0.09	1.06	0.40
SF-36 physical sum'ry	1.65	38	0.206	–1.42	0.16	2.40	0.51
SF-36 physical function	3.14	38	0.055	*–2.12*	*0.04*	2.74	0.50
SF-36 role - physical	1.12	38	0.337	–0.57	0.57	4.73	0.21
SF-36 role - emotional	1.67	37	0.202	0.13	0.90	1.89	0.09
SF-36 social function	1.54	38	0.227	–1.78	0.08	5.64	0.83
SF-36 mental health	**5.47**	38	**0.008**	**–3.19**	**<0.01**	7.40	0.75
SF-36 energy & vitality	**5.62**	38	**0.007**	*–2.21*	*0.03*	0.68	0.09
SF-36 pain	2.28	38	0.116	–1.57	0.12	3.27	0.39
SF-36 general health percept's	0.84	38	0.440	–1.31	0.20	**–6.71**	**<0.01**

Bold text indicates paired t-test comparison with pre score is significant at p≤0.01
Italic text indicates paired t-test comparison with pre score is significant at p≤0.05
Normal text indicates paired t-test comparison with pre score is not significant (p>0.05)

To summarise the statistical assessment of responsiveness, all methods of analysis show the VRBQ to have the greatest overall sensitivity to change over time. Notably, the VRBQ Dizziness and Motion-Provoked Dizziness subscales show greater responsiveness than the VSS-sf total and Vertigo subscale, the VRBQ Anxiety subscale shows greater responsiveness than the VSS-sf total and Anxiety subscale and the VRBQ Quality of Life subscale shows greater responsiveness than the DHI total or subscales.

Statistical analysis suggests that the VRBQ Change is more responsive to change than the VRBQ State. Moreover, the VRBQ Change shows greater responsiveness in the treatment period than the no-treatment period, the opposite of the pattern of responsiveness revealed by the 'state' format questionnaires. These findings are discussed below in Section 5.5.

5.4. Summary of Results

The questionnaire under development, the Vestibular Rehabilitation Benefit Questionnaire, was compared to two existing measures of dizziness impact, the Dizziness Handicap Inventory and the Vertigo Symptom Scale, and a generic measure of health-related quality of life, the SF-36. Data were collected from 124 vestibular rehabilitation patients in a longitudinal study lasting approximately 16 weeks. Two protocols were administered with subjects in Group A (n=40) completing questionnaires over a no-treatment period followed by a treatment period and Group B subjects (n=84) completing questionnaires only over the treatment period. Group A and B data collected in the treatment period did not reveal systematic differences on statistical analyses to assess subscale structure, internal consistency or construct validity. Effect size estimates to assess responsiveness, however, did reveal a different pattern of results where Group B data suggested a substantially larger treatment effect. This finding is discussed further in Section 5.5 below.

Statistical analysis reveals that the VRBQ structure has good overall internal consistency and excellent internal consistency of the four subscales: Dizziness, Anxiety, Motion-Provoked Dizziness and Quality of Life. This confirms that the VRBQ is a multi-factorial measure of symptoms of, or related to, dizziness and the disabilities and handicaps associated with these symptoms. Examination of the pattern of correlations with existing measures of dizziness impact supports the convergent and discriminant construct validity of the VRBQ. The test-retest reliability of the VRBQ State total and subscales is excellent. Assessment of the responsiveness of the four 'state' format questionnaires using a variety of statistical techniques indicates that the VRBQ State is the most sensitive to change over time. The overall responsiveness of the VRBQ State is greater than existing measures and, moreover, the individual subscales show greater power to detect change than the existing questionnaire or subscale which corresponds most closely to each of the VRBQ subscales.

5.5. Discussion of Results

An interesting feature of the results of the current study is the small effect of treatment. One possible interpretation of this finding is that vestibular rehabilitation is not an effective intervention. This interpretation is not consistent with the results of controlled trials of vestibular rehabilitation which show clear and significant effects of treatment using both subjective and objective measures (Horak *et al*, 1992; Shepard and Telian, 1995; Yardley *et al*, 1998d; Cohen and Kimball, 2003; Krebs *et al*, 2003). The majority of these studies, however, were performed using patients with objective evidence of vestibular dysfunction and in many cases excluded patients who did not fit the profile of those thought to be most suitable to benefit from vestibular rehabilitation (i.e. central vestibular disorders, Meniere's disease, concurrent psychiatric disorder, BPPV, unstable vestibulopathy, previous neurological disease or head injury). The sample used in the present study were unselected; all patients receiving vestibular rehabilitation at the participating clinics were eligible if the treating clinician considered that they were competent to complete a questionnaire. Thus the sample includes all patients that referring clinicians judged may benefit from vestibular rehabilitation and, consequently, represents the profile of patients who actually receive this treatment. The inclusion of all patients receiving treatment, as opposed to those most likely to benefit, may partially explain the small treatment effect measured in this sample.

Alternatively, the entry criteria of previous studies may have been met in the sample used in the present study, but vestibular rehabilitation was ineffective. Vestibular rehabilitation varies in content and emphasis depending on a variety of factors including the perceived needs of the patient and the approach of the clinician. It is possible that treatment provided to the participants of the present study focussed primarily on one aspect of vestibular rehabilitation which may not be as effective as when combined with other aspects of vestibular rehabilitation. For example, the potential benefits of counselling, reassurance and confidence-building may have little effect if they are not reinforced by concurrent improvements in symptoms. Since data were collected from external treatment centres, the content of vestibular rehabilitation sessions was uncontrolled.

A further possible explanation for the results of the present study is that vestibular rehabilitation was effective but the measures used were not sensitive to these changes. However, pre-treatment scores in the present study are comparable with pre-treatment DHI and SF-36 scores in studies where changes have been measured. To illustrate, mean DHI scores are typically in the range 36-54 before treatment (Enloe and Shields, 1997; Kinney *et al* 1997; Bamiou *et al*, 1999; Whitney *et al*, 1999; Gill-Body *et al*, 2000; Jacobson and McCaslin, 2003), changes in the order of 12-19 points are recorded in studies of treatment benefit (Cowland *et al* 1998; Krebs *et al* 1993; Enloe and Shields, 1997) and retrospective studies report post-treatment scores in the region of 17-27 (Lynn *et al*, 1999; El-Kashlan *et al*, 1998). Since the studies quoted vary in design, sample size and purpose, it is reasonable to assume that the consistency of scores provides confidence of validity. The mean pre-treatment scores in the present study are comparable to those quoted but do not appear to change over the course of treatment even though the time scale of the current study was equal to, or greater than, previous studies.

Another factor which may have contributed to the results of the present study is the experimental design. The present study was designed to compare the psychometric properties of a range of questionnaires rather than assess the efficacy of vestibular rehabilitation and as such lacks essential features of an appropriate design for this purpose. However, it is interesting that the effect sizes measured by all of the questionnaires are small and notably that they are smaller in the treatment period than the no-treatment period. This is particularly true of the subscales which measure symptoms of dizziness and provocation of dizziness in the three disease-specific questionnaires. This may indicate that the effect being measured in the no-treatment period reflects improvements afforded by natural recovery mechanisms. It may be that the small amount of improvement measured by these subscales in the treatment period is the continuation of natural recovery mechanisms which would be observed even in the absence of intervention. In addition to considering the possible explanation for the effect sizes in the present study, it is worth considering that the small effect sizes may mask patterns of results with different interpretations. For example, it may be that natural recovery in the average sample allows the individual to improve to a certain degree and then reaches a plateau until intervention is applied whereas the improvements afforded by treatment may continue beyond the time period used in the present study. However, in the present study greater improvement was measured in the no-treatment period than the treatment period despite the treatment period being much longer. Furthermore, previous research suggests than the benefits afforded by vestibular rehabilitation occur predominantly in the first 6-7 weeks (Yardley *et al*, 1998d; Cohen and Kimball, 2003).

A key difference in the design of the present study compared with other studies was that the same subjects were used as both treatment and no-treatment groups. It may be that subjects in treatment groups of other studies were inherently more likely to respond well to treatment thus producing results which reflected improvement. However, given that at least some of the studies randomized subjects to treatment and control groups, this is an unlikely explanation. The score changes in the present study appear to indicate that treatment has not been effective in this sample. However, since the experiment was designed for the purpose of questionnaire validation rather than to measure treatment effect, this conclusion should be treated with caution.

Another issue to consider in light of the finding that less change is measured as time passes, is the possibility that no 'true' change has occurred. The change recorded by the questionnaires may in fact reflect adaptation to the symptoms with adaptation occurring predominantly in the early period. However, this is a complex area of psychological research and a full discussion is beyond the scope of this thesis. Moreover, other research has produced results which suggest psychological adaptation produces results which are not consistent with the results of the present study. Using the 'then-test', Dibb (PhD thesis, 2004) found balance disordered subjects to retrospectively rate themselves as being worse than they did at pre-test (i.e. a positive response shift). This is the opposite of the pattern of 'then-test' results in the present study although in the present study observed differences were not statistically significant. The perception of improvement reflected by the 'then-test' results in Dibb's study was not matched by improvement on physical function items which used more objective barometers of status. This result is interpreted as suggesting that the response shift is attributable to adjustment to the symptoms rather than actual functional improvement.

In common with other studies (Cohen and Kimball, 2003) and predictions based on a theoretical model of the rehabilitation process (Howard *et al*, 1993), the present study found the greatest change to occur in symptoms of dizziness. However, in the present study these changes occurred predominantly in the no-treatment period. This finding may, in fact be consistent with Cohen and Kimball's findings, as they report these changes to occur predominantly in the first 4-6 weeks which mirrors the no-treatment control period used in the present study. It is possible that the changes measured by Cohen and Kimball were not attributable to the intervention. This would be consistent with other research which found improvement in subjects in general conditioning exercise groups as well as vestibular rehabilitation groups, although in all studies using a control group receiving medical treatment these subjects improved less than vestibular rehabilitation subjects.

It may have been expected that the subscales measuring symptoms of anxiety would improve most in the no-treatment period due to the effects of general reassurance from the referring clinician and the expectation of successful treatment. However the results do no support this assumption and, in fact, the anxiety subscales of both the VRBQ and the VSS-sf improve least in the no-treatment period and most in the treatment period relative to the no-treatment period. This suggests that symptoms of anxiety are most persistent in the absence of intervention and supports suggestions that treatment should include a strong component which addresses this aspect of dizziness impact (Yardley, 1994a; Yardley *et al*, 1998a).

In general, data from the two groups of subjects, Group A and Group B, produced very similar patterns of results. An exception to this was the larger effect sizes measured in Group B over the treatment period (Group B did not participate in a no-treatment period). One possible explanation for this difference is that Group A subjects reported small amounts of change at each stage in the process from referral for treatment through to the end of treatment. Group B, on the other hand, only had the opportunity to express change between the beginning and the end of treatment and may have used the questionnaires at baseline to reflect the full impact that their condition had imposed and used the questionnaires at the end of treatment to reflect the full degree of improvement since the beginning of the symptoms. Using a realist perspective, this would not be a viable explanation as questionnaire scores are taken as reflecting a 'true inner state' at the time of completion. Other researchers, however, believe that questionnaire scores cannot be understood to reflect objective reality and that the overall message communicated by a set of questionnaire responses must be interpreted in context to reveal their meaning and function (Yardley and Murray, 2004). Applying this perspective it may be possible to understand why Group B responses show an effect size in the treatment period which is approximately equivalent to the amount of change Group A responses show in the no-treatment and treatment periods added together. It should be noted that the majority of subjects in Group A and Group B were treated at the same clinic and, therefore, the delay between referral and treatment onset was equal and, therefore, issues related to the timing of treatment onset should not have influenced reported benefits. This pattern of results observed in the 'state' questionnaires does not hold true for the VRBQ Change. The results recorded by the VRBQ State and VRBQ Change questionnaires are compared and discussed in Chapter Six.

The results of factor analysis and tests of internal consistency indicate that four robust subscales emerge from the 22 items of the Vestibular Rehabilitation Benefit Questionnaire: Dizziness, Anxiety, Motion-Provoked Dizziness and Quality of Life. The separation of items into subscales may increase the clinical usefulness of the questionnaire by allowing the clinician to observe the relative contribution of different types of symptoms (general dizziness and unsteadiness, motion-provoked dizziness and psychological symptoms). This may help inform the direction of therapy in terms of whether specific movements are provoking the symptoms and whether it may be appropriate to include a psychological or relaxation component to the treatment programme. Furthermore, subscale scores will allow the clinician to observe the self-perceived severity of symptoms in comparison to the amount of handicap reported. This may indicate where the focus of treatment is needed (i.e. whether symptoms are the primary problem or whether symptoms make only a minor contribution and that self-imposed handicap is the larger component which therapy should aim to address). Over the course of treatment, subscale scores may indicate the need to involve other professionals such as a clinical psychologist if, for example, symptoms of dizziness were shown to have improved but anxiety and handicap persisted. The excellent test-retest reliability of the subscales suggests that they are suitable to be used individually to monitor changes in specific areas of difficulty. The test-retest reliability of the VRBQ total and subscales was, however, established over a 24-hour period. When questionnaires are repeated over a short period of time, subjects may recall their first-completion scores and consequently the two measures may not be truly independent assessments. This method of establishing test-retest reliability is, however, consistent with convention and compares with the methods used to assess the reliability of established questionnaires used in the present study (Newman and Jacobson,1990; Yardley *et al*, 1992c).

A notable finding of factor analysis and tests of internal consistency is that the items in the Motion-Provoked Dizziness subscale of the VRBQ State questionnaire are not consistent with the other items in the scale. Hazlett *et al* (1996) also report that items relating to positionally provoked symptoms were the only items which did not show a correlation with other items in their questionnaire, the Dizzy Factor Inventory. This is an interesting feature of the results and may reflect something about the nature of patient difficulties rather than being a feature of this specific questionnaire. Motion-provoked dizziness may be experienced by patients who do not experience other aspects of dizziness impact such as anxiety or significant handicap because of the nature of their condition. For example, patients who only experience symptoms in particular positions as in the condition Benign Paroxysmal Positional Vertigo (BPPV) may not experience the same level of anxiety and handicap as patients who experience a less predictable pattern of symptoms. Another reason that items relating to motion-provoked symptoms may behave differently to other items is that difficulty performing an action such as bending or moving the head quickly from side to side may persist longer than feelings of general dizziness and unsteadiness or the inability to take part in other aspects of life. The fact that items relating to motion-provoked dizziness do not stand out from the other items in the 'change' version as they do in the 'state' version is an interesting finding and is discussed in Chapter Six.

Another way in which the Motion-Provoked Dizziness subscale behaves differently to the other subscales is in the pattern of correlations with other questionnaires. The other VRBQ subscales show correlations with the DHI and SF-36 that are moderate before treatment but weak after. This is attributable to the relatively poor responsiveness of the DHI and SF-36 in comparison to VRBQ total and subscales, as despite being moderately correlated at baseline, score changes detected by the VRBQ are not matched by score changes on the other measures. The relatively poor responsiveness of the other scales also accounts for the poor correlations between the VRBQ Change and the before-after difference scores of the DHI, VSS-sf and SF-36. The Motion-Provoked Dizziness subscale, on the other hand, shows a different pattern where correlations with the three other measures, the DHI, VSS-sf and SF-36, are stronger after treatment than before. This may be because motion-provoked dizziness persists longer than other aspects of dizziness impact and this has the effect of improving the relationship between the post-treatment Motion-Provoked Dizziness subscale and the other measures which are less sensitive to change.

Another interesting observation from the pattern of correlations is that the SF-36 correlates most strongly and consistently with the Anxiety subscale of the VRBQ. This suggests that psychological distress about health influences responses to general questions about health and well-being. This explanation, however, is inconsistent with the observation that the Anxiety subscale, or in fact any other subscale, does not show any correlation with the General Health Perceptions subscale of the SF-36.

The data from the DHI subscales reveal patterns of results which show appropriate relationships with subscales of the other questionnaires. The DHI subscale which purports to measure symptoms and symptom provocation (Physical) shows a strong relationship with the VRBQ subscales which also aim to capture this (Dizziness and Motion-Provoked Dizziness) and a weaker relationship with other subscales. The DHI subscales which intend to measure emotional reactions and lifestyle restrictions (Emotional and Functional) show strong relationships with the equivalent VRBQ subscale (Quality of Life). This does not appear consistent with previous research which suggests that the DHI subscale structure is invalid (Enloe and Shields, 1997; Asmundson *et al*, 1999; Booth, 2000). No analysis was undertaken using the alternative subscale structures proposed by other authors because the purpose of the current study was to validate a new clinical instrument and, therefore, it was considered appropriate to use the DHI as it is most likely to be used in clinical practice (i.e. the original format).

A criticism of existing questionnaires used to measure change in the context of dizziness and vestibular rehabilitation is that they do not capture the phenomenon of avoidance behaviour. Furthermore, anecdotal reports from clinicians working in the area indicate that the scoring system of the DHI appears to reflect an increase in dizziness and dizziness impact when in fact the individual has merely started to participate in activities they had once avoided. The new questionnaire emerging from the present study has attempted to overcome this limitation in two ways. One method is to assess avoidance behaviour directly through a questionnaire item which asks specifically about avoidance of activities, positions or situations because of the dizziness. This, however, is only one item in a subscale of 11 items and as such will make a relatively minor contribution to the subscale score although it may be interesting for clinicians to observe the response to this item to highlight whether this is an issue that treatment needs to address. An additional feature of the new questionnaire is an explicit statement in the instructions to respondents indicating how to respond if the item refers to an activity they avoid. This is intended to overcome the limitation observed in other questionnaires where respondents claim that an activity does not cause dizziness because of avoidance behaviour and later report that it causes dizziness when the activity is resumed thus giving the false impression of a deterioration.

5.6. Limitations of the Study

Demographic information was not collected for the participants and in retrospect it may have been useful to describe the characteristics of the sample. Whilst the sample size would not have allowed for reliable analysis of subgroups based on demographic categories, it would have been useful to compare the sample characteristics with the sample characteristics described in comparable studies to aid interpretation of differences or similarities across research findings. The sample size for the longitudinal study was smaller than originally intended due to practical difficulties of collecting data over a no-treatment period.

Although the study was designed to evaluate the new questionnaire, a considerable limitation of the study was the lack of control over the vestibular rehabilitation process which lead to results with a number of possible interpretations. Previous studies of vestibular rehabilitation efficacy have controlled both the entry criteria and the content of rehabilitation sessions. If the present study had controlled these aspects of the study, a clearer interpretation of the emerging results may have been possible. Also related to the lack of control over the process is the possibility that the pre-treatment period did not represent a true control period. Whilst no formal treatment was provided during this period, referring clinicians may have provided general advice which promoted some of the physiological recovery mechanisms that treatment aims to stimulate and may have given general reassurance which alleviated some of the emotional impact of the condition. The study was designed predominantly to evaluate a new measure of vestibular rehabilitation outcome, rather than to assess the efficacy of the treatment and the limitations of the study are mostly related to constraints imposed by practical issues of access to patients or ethical issues of confidentiality.

5.7. Conclusions

The work presented in Chapter Five shows experimental evidence of the psychometric properties of the new questionnaires. The main conclusions from this work are that the new questionnaires have been found to be reliable and internally consistent, and are valid and responsive in comparison to existing tools. Analysis of the factor structure largely supports the conclusions presented in Chapter Four, with some refinement. The new questionnaires have psychometric advantages over existing questionnaires and many of the key aims of the work were satisfied by the results presented in Chapter Five.

The experiment was limited by the absence of control over the content of the vestibular rehabilitation programmes and the subjects participating in the study.

Whilst this was to some extent a deliberate feature of the design, it also led to difficulty in interpreting some aspects of the data. A further limitation is the absence of data relating to the demographic profile of the sample.

All questionnaires used in the study reflected a small degree of change over the period of measurement. Changes that were reflected in questionnaire scores occurred predominantly in the no-treatment period and predominantly in the area of symptoms. A number of possible interpretations of the results are discussed and little can be concluded about the responsiveness of the questionnaires from the results in light of the small treatment effects observed. It should be noted that the experiment was not designed to measure treatment effect and that this is a side-issue in relation to the aims of the present study.

Chapter Six. Measuring Change: A Comparison of Methods

6.1. Introduction

An objective of the present study was to compare alternative methods of measuring change over time, namely the before and after 'state' questionnaire format and the retrospective 'change' questionnaire format. The experimental design outlined in Chapter Five included collection of questionnaire data in a variety of formats ('state', 'change' and 'then') at several points in time over the period of the study. These data were analysed to infer the influence of response shift and memory bias on questionnaire responses; the results are presented and discussed below. Additionally, to help inform the comparison of 'state' and 'change' formats, the psychometric properties of both questionnaires are summarised and discussed below (results are presented in detail in Chapter Five).

6.2. Psychometric Properties of 'State' and 'Change' Formats

The results presented in detail in Chapter Five relating to the properties of VRBQ State and VRBQ Change formats are summarised and discussed below.

6.2.1. Summary of results

Principal Components Analysis revealed very similar subscale structure between the 'state' and 'change' formats of the VRBQ. Both formats revealed three factors described as Dizziness, Anxiety and Quality of Life. The only notable difference was the presence of a fourth factor described as Motion-Provoked Dizziness in the 'change' format. The items which grouped together to form this factor in the 'change' format did not group together or group with other items in a clear and interpretable way in the 'state' format. Further analysis showed the internal consistency of the 'state' total score to be compromised by inclusion of items relating to symptoms of motion-provoked dizziness which suggests that motion-provoked symptoms are reported differently to other aspects of dizziness impact. This finding is consistent with previous research findings (Hazlett *et al*, 1996) and was felt to reflect the characteristics of patient difficulties rather than a weakness of these items (see Chapter Five, Section 5.4) and consequently the Motion-Provoked Dizziness subscale was included in the VRBQ State format.

Different patterns of results between the 'state' and 'change' version were observed in analysis of correlations between the new VRBQ questionnaires and existing measures, the

DHI, VSS-sf and SF-36. The pattern of correlations between the VRBQ State and the DHI, VSS-sf and SF-36 were clear, interpretable and fitted with expectations from theory and previous research. The pattern of correlations between the VRBQ Change and derived change scores measured by the before-after difference of the DHI, VSS-sf and SF-36 were weak, particularly in the no-treatment period. Possible reasons for this pattern of results are discussed below.

The methods for assessing responsiveness to change, discussed in Chapter Five, were not suitable for the data collected with the VRBQ Change. The sensitivity of the VRBQ Change and VRBQ State is compared below through comparison of normalized scores.

Assessment of test-retest reliability was only performed using the VRBQ State questionnaire. The phrasing of the questions in the VRBQ Change questionnaire where subjects were asked to compare themselves to the time when they last completed the questionnaire meant that such an analysis was not appropriate for the 'change' questionnaire.

6.2.2. Normalized scores

In Chapter Five, effect sizes were used to compare the relative measurement sensitivity of the ‘state’ format questionnaires (VRBQ State, VSS, DHI, SF-36). The method used to establish effect size is not appropriate in the case of the VRBQ Change questionnaire, where a single measurement gives a ‘psychologically’ derived estimate of change in contrast to the arithmetically derived measurement of change achieved by comparing before and after ‘state’ measurements. To compare the relative measurement sensitivity of the VRBQ Change with the VRBQ State, a similar comparison to the effect size estimates can be made by calculating normalized scores for the two questionnaires. Normalization examines the size of the ‘signal’ (mean score change) in relation to the ‘noise’ (standard deviation of score changes); this allows comparison of the measurement sensitivity of ‘state’ and ‘change’ questionnaires, despite their different approaches to measurement. Table 6.1, below, summarises the normalized mean change scores for the VRBQ State and VRBQ Change in treatment and no-treatment periods.

Table 6.1 Summary of normalized mean change scores for VRBQ State and Change (Group A n=40)

	No treatment period	Treatment period
State total	0.41	0.38
State dizziness	0.55	0.36
State anxiety	0.16	0.24
State motion-provoked	0.50	0.40
State quality of life	0.51	0.47
Change total	0.54	0.82
Change dizziness	0.62	0.87
Change anxiety	0.59	0.72
Change motion-provoked	0.41	0.80
Change quality of life	0.20	0.57

Normalization formula:
Normalized score = (μ change score)/(SD of change score)
N.B. for VRBQ State change score is derived by before - after

The normalized mean change measured in the no-treatment period is roughly similar in magnitude across the two questionnaire formats. However, the amount of change reflected by the normalized mean change scores in the treatment period is substantially greater than in the no-treatment period. This is inconsistent with the pattern of results revealed by the other four questionnaires (VRBQ State as shown above; VSS, DHI and SF-36 as shown in Chapter Five).

6.2.3. Discussion of results

There are a number of ways in which the results recorded by the VRBQ State and VRBQ Change questionnaires differ. The study was designed so that the subject matter of the questionnaire items was identical and the only difference between 'state' and 'change' formats was necessary differences in the wording of the carrier phrase so that the items made sense in their respective formats. Therefore, differences in the results recorded by the two formats are attributed to the method of data collection.

The most notable difference was the greater normalized mean change recorded by the 'change' questionnaire and the clear difference between the amount of change measured in the no-treatment and treatment periods. The 'change' questionnaire shows a much greater change in the treatment period in contrast to the 'state' measures which show little difference or a greater change in the no-treatment period. Another notable difference is that items relating to motion-provoked symptoms behave consistently with the other items in the 'change' format but are inconsistent with other items in the 'state' format. When viewed together these differences in results between the 'state' and 'change' formats suggest that the results recorded by the 'change' version may reflect socially desirable responses. Social desirability responding may be more likely with 'change' format questionnaires as the format makes explicit what is being asked and what a socially desirable response might be. State format questions, on the other hand, calculate the amount of benefit by comparison with a measure taken at a different time and is hence less susceptible to manipulation to create a desired impression. In a format where responses are easily influenced by social desirability, results might be expected to show greater benefit after treatment than before treatment has begun, as seen in the results of the 'change' format questionnaire. The internal consistency of items relating to motion-provoked dizziness in the 'change' format contrasts with the results from analysis of the 'state' format. This may be further evidence of social desirability responding where respondents do not consider the precise subject matter of the individual item but respond to reflect an overall positive outcome (i.e. a 'halo effect'; Streiner and Norman, 1989).

Another notable difference between 'state' and 'change' formats is the relationship with the other questionnaires, the DHI, VSS-sf and SF-36. The correlations between the VRBQ State and existing questionnaires were in many cases strong and in all cases appropriate. The correlations between the VRBQ Change and existing measures were weak and did not show clearly interpretable patterns. This may be associated with the fact that the existing 'state' format questionnaires all measured greater change in the no-treatment period than in the treatment period, whereas the VRBQ Change measured less change in the no-treatment period. A possible interpretation of this is that the poor correlations are also attributable to VRBQ Change results being confounded by social desirability responding. This finding contrasts with Gatehouse's (1997) finding that 'change' measures correlate more highly than 'state' measures with results of objective tests which are unaffected by social desirability bias. Gatehouse's finding, however, contrasts with work that reports no material difference in the correlations between performance measures and subjective measures using 'state', 'change' and 'then' techniques (Sprangers, 1989). Social desirability bias may be more influential in areas where subjects are asked to report on sensations or events which are not clearly defined. The fact that Gatehouse was working in the area of hearing loss, which may be argued produces more clearly defined symptoms than dizziness, may contribute to the apparent differences in the influence of social desirability bias.

6.3. Response Shift and Memory Bias

To allow assessment of the influence of response shift bias and memory bias on questionnaire scores, measurements were taken using the VRBQ questionnaire in three formats: 'state', 'change' and 'then'. See Chapter Two, Section 2.2.3.1 for a description of the 'then-test' and Chapter Five Table 5.1 for a full description of the experimental design. All formats of the questionnaire can be found in Appendix 3.

6.3.1. Results

Using 'state', 'change' and 'then' questionnaires, measurements were taken over a no-treatment period and a treatment period to provide data on the factors that may influence response shift bias and memory bias. Examination of memory bias as a possible alternative explanation for an apparent response shift was planned for by inclusion of a subgroup who were shown their former 'state' score when completing the 'then-test' at a later stage (*seen* subgroup). Table 6.1 shows a summary of the 'state' and 'then' results over the no-treatment and treatment periods; results for *seen* and *unseen* groups are given separately. Figures 6.1 to 6.4 show individual subject scores over no treatment and treatment periods; results for *seen* and *unseen* groups are given separately.

Although patterns of differences between questionnaires are evident, it should be noted that differences between 'then' and 'pre-state'[9] scores were not statistically significant. In both the treatment and no-treatment periods there is a small trend towards reporting a lower 'then' score than the former 'state' score, where lower scores reflect lower disability. The interpretation of this pattern of results is that when making a retrospective judgement, subjects consistently report themselves as having been better at a previous point in time than they reported at that time. Subjects who completed all of the questionnaires without seeing any previous results (*unseen* group) show a greater difference between 'then' and 'pre-state' scores in the treatment period than the no-treatment period (i.e. there is a stronger response shift when treatment is applied). This is consistent with previous

---

[9] The 'state' questionnaire completed at the beginning of the test period in question is referred to as the 'pre-state' score, and the 'state' questionnaire completed at the end of the period in question is referred to as the 'post-state' score.

research findings (Howard *et al* 1979; Sprangers, 1989). The *seen* subgroup (who were shown their 'pre-state' score when completing the 'then-test') on the other hand, show a stronger response shift in the no-treatment period than in the treatment period. This finding is attributed to a desire amongst subjects in the *seen* group to show consistency with their former judgement and may suggest that in this study the small response shifts measured by the 'then-test' technique were at least partly attributable to memory bias rather than a conscious reassessment.

Table 6.2 Summary of treatment effect and response shift in treatment and no treatment periods

	Unseen Group (n=23)			Seen Group (n=17)		
	Pre	Then	Post	Pre	Then	Post
	No treatment period			No treatment period		
VRBQ state mean (standard deviation)	–38.97 (9.95)	–36.45 (10.85)	–33.61 (11.20)	–38.65 (8.44)	–34.12 (11.10)	–36.41 (8.54)
Difference from pre score (%)		+2.52 (+1.91%)	+5.36* (+4.06%)		+4.53% (+3.43%)	+2.24 (+1.70%)
Difference from post score (%)		+2.84 (+2.51%)			–2.29 (–1.73%)	
	Pre	Then	Post	Pre	Then	Post
	Treatment period			Treatment period		
VRBQ state mean (standard deviation)	–33.61 (11.20)	–26.91 (15.16)	–29.09 (13.86)	–36.41 (8.54)	–34.59 (9.28)	–32.59 (8.47)
Difference from pre score (%)		+6.70 (+5.10%)	+4.52 (+3.42%)		+1.82 (+1.38%)	+3.82* (+2.89%)
Difference from post score (%)		–2.18 (–1.65%)			+2.00 (+1.51%)	

All subjects completed the no-treatment period 'then-test' *unseen*, 17 subjects completed the treatment period 'then-test' with pre scores *seen*. Mean score compared to previous questionnaire score is given as a positive value (+) to reflect improvement or a negative value (–) to reflect deterioration. Improvement or deterioration is also shown as a % of possible score range (in brackets). * indicates paired t-test comparison with pre score is significant at $p<0.05$.

Figure 6.1 Individual subject scores for VRBQ Total over no-treatment period ('unseen' group, n=23)

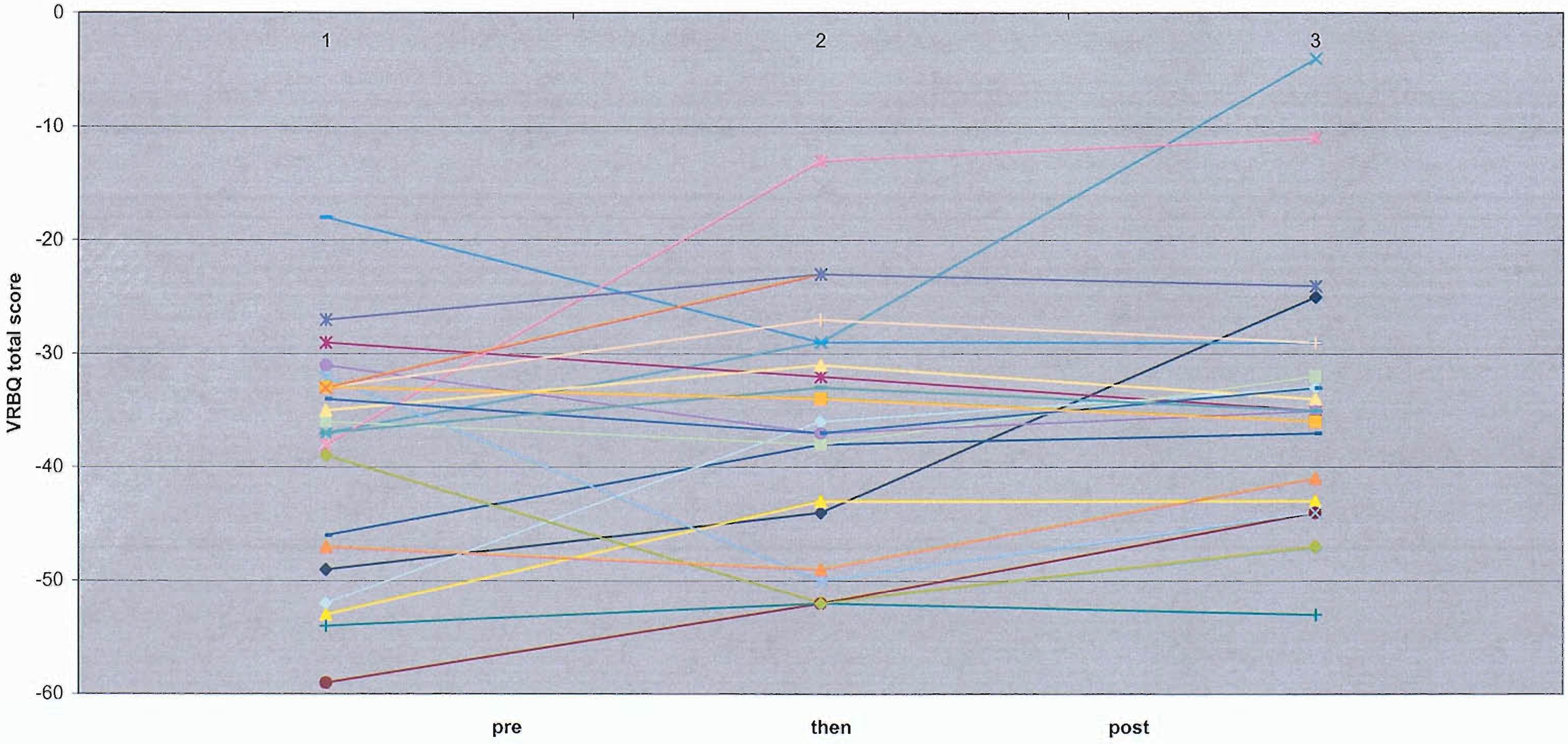


Figure 6.2 Individual subject scores for VRBQ Total over treatment period ('unseen' group, n=23)

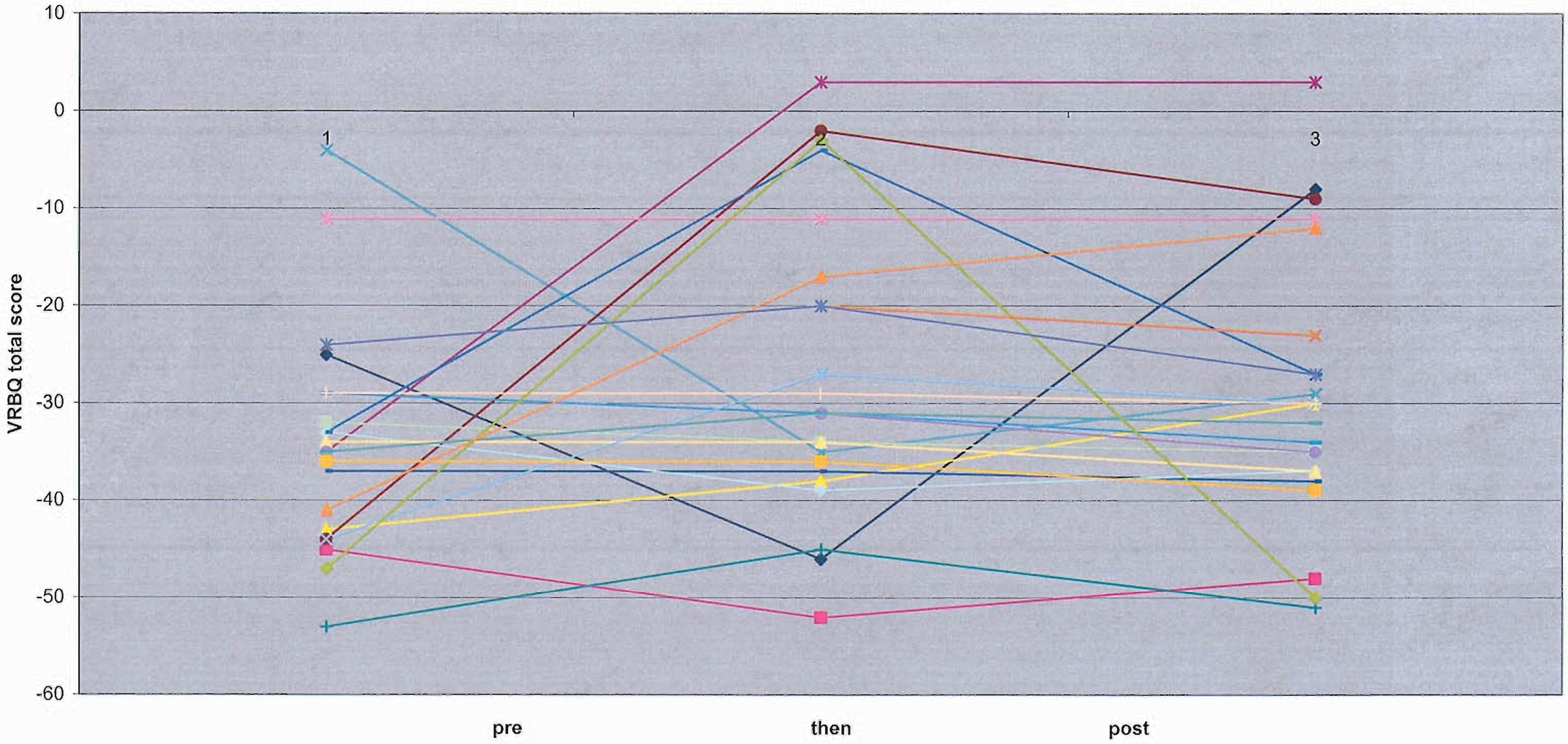


Figure 6.3 Individual subject scores for VRBQ Total over no-treatment period ('seen' group, n=17)

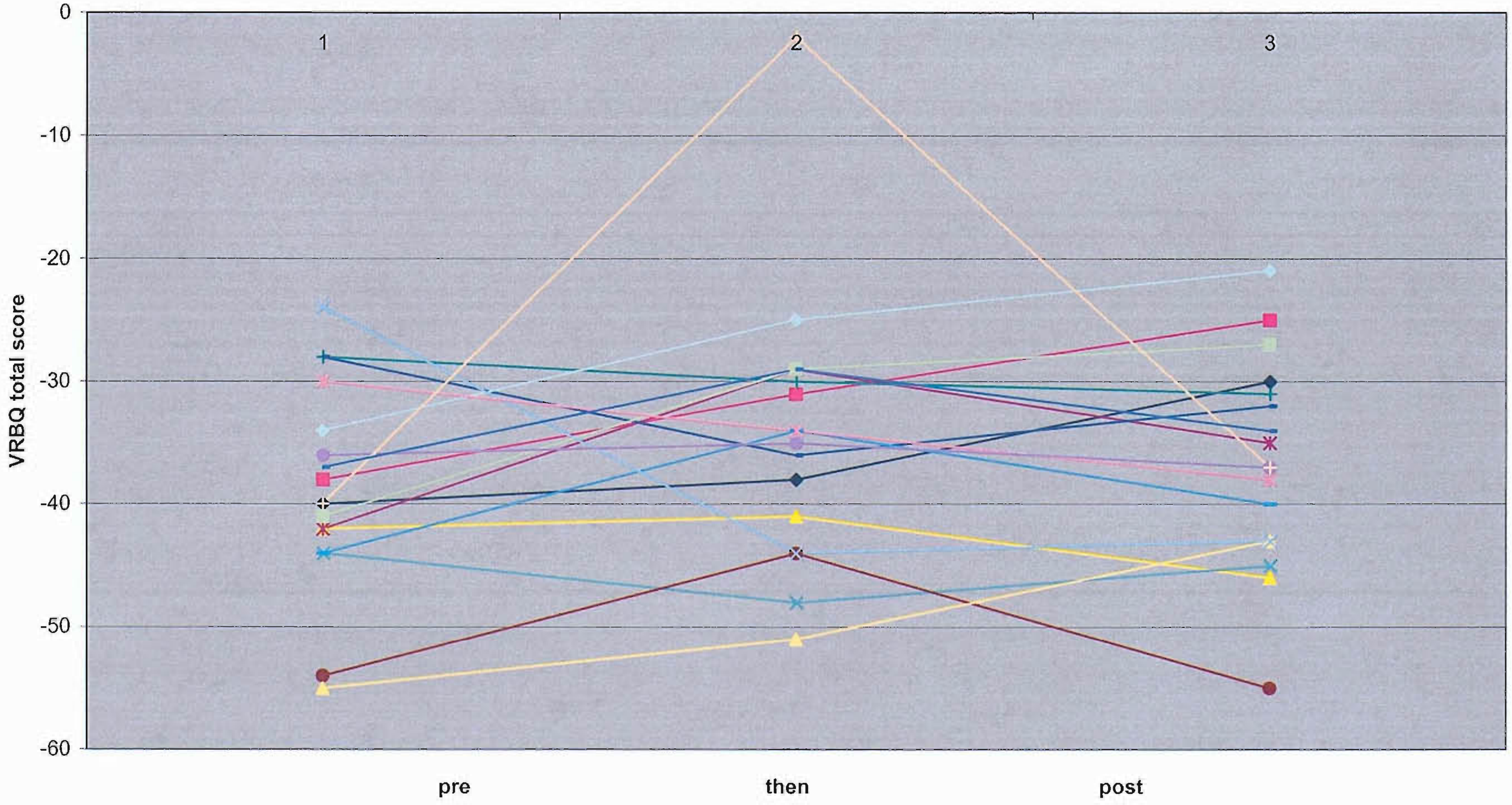
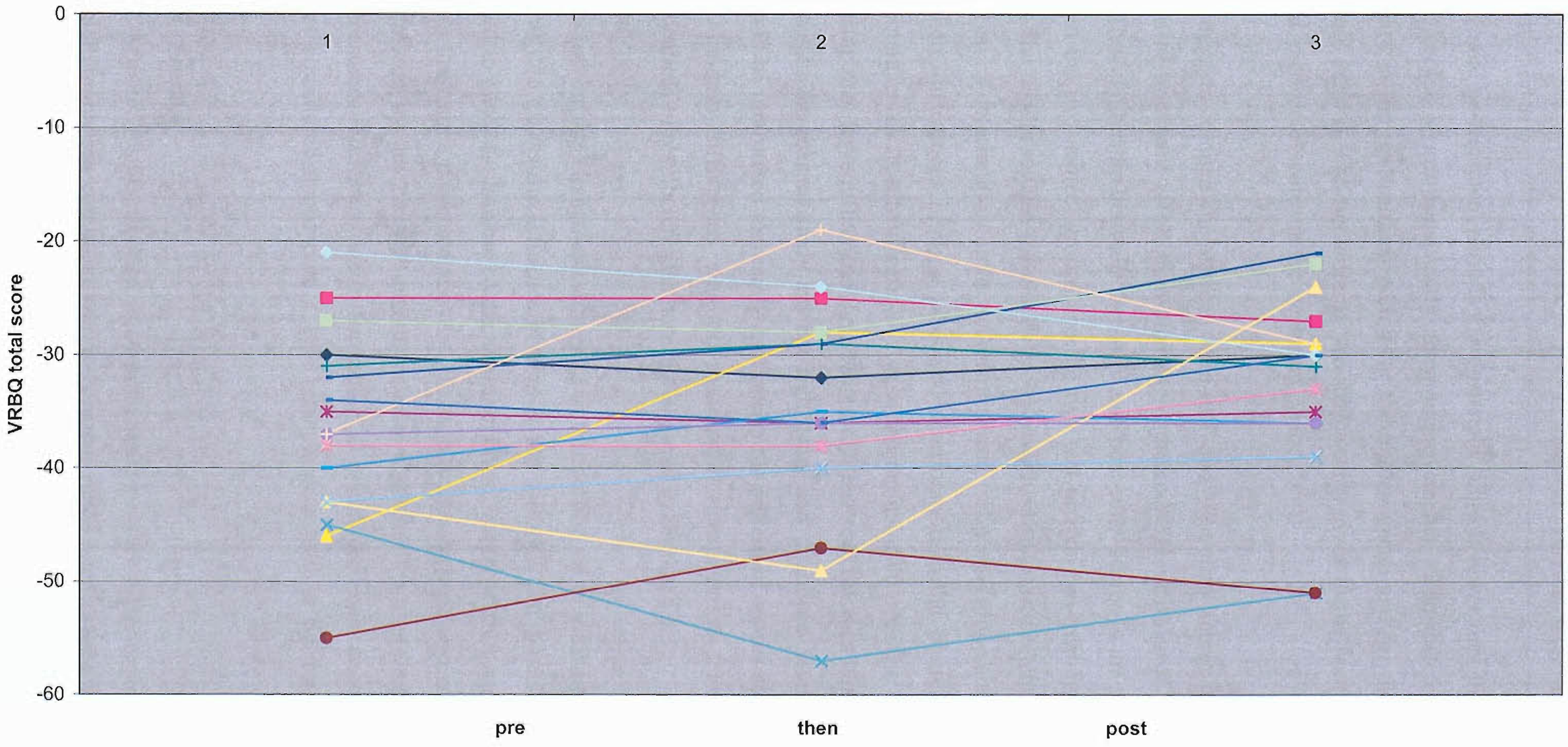


Figure 6.4 Individual subject scores for VRBQ Total over treatment period ('seen' group, n=17)



In both the treatment and no-treatment periods the 'post-state' score is lower than the 'pre-state' score (i.e. difference scores consistently show improvement). The difference is statistically significant in the no-treatment period for the *unseen* group and for the *seen* group in the treatment period. The reminder of 'pre-state' scores given to the *seen* group may have influenced 'post-state' scores in the treatment period.

Previous research suggests comparison between 'then-test' and 'post-state' scores to be a more valid measure of treatment effect than alternative methods (Howard *et al*, 1979; Sprangers, 1989). The relationship between 'then-test' and 'post-state' scores in the present study varies between the two subject groups and the two test periods (no-treatment and treatment periods). The results suggest the *unseen* group perceived an improvement in the no-treatment period and a deterioration in the treatment period. The *seen* group show the opposite pattern where differences imply a perceived deterioration in the no-treatment period and improvement in the treatment period. Again, the reminder of 'pre-state' scores given to the *seen* group may have influenced their scores. Differences between 'then-test' and 'post-state' scores in the present study are not significant and, therefore, tendencies within the data should be interpreted extremely cautiously; the pattern of results reported above may reflect random differences with no meaningful interpretation. Possible explanations for the pattern of results reported here are explored in Section 6.2.2.

No results are presented for the 'change' questionnaire in this section as no measurements were made specifically to assess the influence of bias in this format. The experimental design was structured to allow assessment of the contributions of response shift and 'true' treatment effect from the results presented above. This would allow comparison with the treatment effect measured by the 'change' questionnaire to elucidate the contribution of bias to the effect measured. However, due to the pattern of results presented above, this comparison was not considered appropriate. This issue is discussed in Section 6.2.2 below.

6.3.2. Discussion of results

Examination of the 'then-test' results revealed small differences between judgements made at the time of original completion compared with judgements made later looking back at that time. However, these results were not statistically significant and consequently this cannot be interpreted as a response shift. Previous research suggests that response shifts only occur when change occurs (Howard *et al*, 1979; Sprangers, 1989); the pattern of results in the present study is consistent with these findings as measured changes were either small or absent. Another possible explanation for the absence of a response shift is the relationship between dizziness and somatisation. It is hypothesised that the nature of somatisation means that it is likely to be resistant to response shifts (Wilson, 1999) and since research indicates co-occurrence of dizziness and somatisation (Hallam and Stephens, 1985; Yardley *et al*, 1992a; Kroenke *et al*, 1993; Sullivan *et al*, 1993), it is possible that response shifts do not occur in dizzy patients even when a treatment effect is observed.

If the small (but statistically insignificant) tendency towards 'pre-state'/'then' differences were interpreted as a response shift, previous research would recommend comparison of 'post-state'/'then' scores as a more valid measure of self-perceived change. However, in the present study comparisons of 'post-state' and 'then' results are not statistically significant and the general patterns revealed are not clearly interpretable: the *unseen* group appear to perceive improvement over the no-treatment period and deterioration over the treatment period; the *seen* group, on the other hand, appear to perceive deterioration over the no-treatment period and an improvement in the treatment period. This contradicts the results of effect size estimates and repeated measures analysis of variance performed on the sample as a whole, which show a greater improvement in the no-treatment than treatment period. Furthermore, given that subjects in the *seen* group had greater opportunity to manipulate their responses to produce a socially desirable outcome, this finding should be treated with caution. The finding in the *unseen* group of deterioration over the course of treatment does not fit with other findings in the present study and conflicts with previous research that suggests deterioration of the sample mean to be an extremely unlikely outcome. Since the post-then differences are not statistically significant, the results may be random and not hold any meaningful interpretation.

In examining the possible explanations for the pattern of results that emerged, a number of factors should be considered. The task required of subjects completing the 'then-test' is a complex one involving a double retrospective comparison. The first retrospective judgement is a comparison between the dizzy state and the pre-dizzy state. This comparison is implicit in all 'state' questionnaires which aim to assess the impact caused by the onset of a specific condition but the VRBQ State is unusual in that the phrasing of the questions makes this comparison explicit. The second retrospective judgement is made when completing the 'then-test'. In completing the 'then-test' with the VRBQ State, the subject is required to recall how they were at a former time in comparison to how they were at another former time. This explicit double-retrospective judgement entails a level of complexity which may yield unreliable results. Another factor which will have influenced the pattern of results is the relatively small sample size when subgroup data are analysed separately. Coupled with the small treatment effects measured in the present study, this may mean that more meaningful patterns of results are masked.

The inclusion of a subgroup who were shown their 'state' pre-test when completing the 'then-test' (the *seen* subgroup) was designed to aid interpretation of a response shift, if one was identified. The intention was to collect data to test the theory that a response shift is a conscious reappraisal of a former state by ensuring that failure of recall could not influence results. The overall pattern of results between the two subject groups over the two test periods is variable and the inclusion of the 'seen' subgroup does not enable meaningful interpretation. However, it is notable that the difference between 'then' scores and 'pre-state' scores is smaller in the *seen* group than the *unseen* group. This suggests that subjects in the *seen* group, who had the opportunity to make a conscious reappraisal of their former state, chose instead to respond in a way that showed consistency of judgements over time.

The absence of change inferred by the difference between 'post-state' and 'then' measures contrast with responses to the 'change' questionnaire. Since the 'change' measure asks subjects explicitly to gauge the amount of benefit derived from treatment and the 'post-state'/'then' difference would take greater thought and effort to consciously manipulate, differences between 'post-state'/'then' scores and 'change' measures are interpreted as evidence of social desirability bias in the 'change' measure.

6.4. Summary of Findings

The intended method of comparing 'state' and 'change' questionnaire formats was not considered appropriate with the set of results that emerged. The experiment was designed to allow assessment of changes recorded by a subjective measure and to derive the contribution from bias including response shift and memory bias. However, in view of the small changes observed in the present study, analysis of the contributions to a measured change was not appropriate. This meant that comparative evaluation of the psychometric properties was the only appropriate approach to assessing the relative merits of the two formats. Results emerging from the validation study showed substantial differences between the effects measured by the VRBQ Change and the other questionnaires, including the VRBQ State. Interpretation of the results as a whole suggested that responses to the VRBQ Change were influenced by social desirability bias and as such measurements made by this questionnaire should be treated with caution.

6.5. Limitations of the Approach

An unavoidable limitation of the study was that the existing measures used for validation were all 'state' format questionnaires. This meant that the VRBQ Change questionnaire was not compared to other questionnaires using the same measurement technique and so the weak relationship between the VRBQ Change and the existing measures is unsurprising.

An assumption of the present study that may be considered a limitation is the 'realist' approach to the measurement of self-perceived constructs. This approach assumes that questionnaire responses reflect a 'true inner state' which is referenced against common criteria and hence is comparable across individuals. In fact some research suggests that responses are referred to a range of internal and external criteria which may fluctuate in response to other factors and that the concept of a 'true inner state' has questionable validity as this may also fluctuate in response to other internal and external factors. Furthermore, the experimental design and proposed analysis of the final experiment was based on a model where questionnaire scores reflect 'true health' or 'true change', plus a range of possible biases which are treated as discrete constructs that are added together in a linear fashion. A further assumption underlying the proposed analysis was that by including a subgroup of subjects who completed the 'then-test' with their pre-state scores 'seen', the data could be used to infer whether a true response shift was measured or whether memory bias was an alternative explanation for an apparent response shift. Whilst it was necessary to consider the possibility of memory bias as a factor in apparent response shifts, it cannot be assumed that examining self-perception in this way is free from additional sources of bias related to the desire to appear consistent even when inconsistency is explicitly suggested as possible and acceptable. A further limitation of this aspect of the study was that the 'seen' condition was only applied during the treatment period.

Ideally, the experimental design would have included quantitative evaluation of placebo effects and social desirability bias. This would have meant the inclusion of a sham treatment and this was not possible for practical and ethical reasons.

6.6. Conclusions

The objective of this aspect of the research was to compare 'state' and 'change' approaches to measuring change through empirical analysis. An experiment was designed to achieve this and data were collected for analysis. Some aspects of the results were not clearly interpretable and this is considered likely to be due to a combination of factors related to the treatment effect and sample size. Comparison was, therefore, made by examination of the psychometric profile of the two formats. Inferences were made about the sources of differences and it was concluded that the data collected with the VRBQ Change may have been confounded by social desirability bias. Furthermore, because of the absence of an existing 'change' format questionnaire it was not possible to investigate the construct validity of the VRBQ Change as thoroughly as for the VRBQ State. Consequently, potential users of the VRBQ are likely to favour the VRBQ State as a more comprehensive profile of psychometric properties is available.

Further work is needed to investigate sources of measurement bias in this context, particularly in the area of response shift to provide further clarity on whether this may be a confounding factor.

Chapter Seven. Summary

7.1. Summary of Work

A new questionnaire has been developed to fulfil the role of an outcome measure for vestibular rehabilitation. The process was informed by a number of underlying principles: that the new measure should be based on the concerns of the patient population and be sufficiently psychometrically robust to provide useful information in clinical and research contexts whilst remaining convenient for routine use by patients and clinicians. Questionnaire items were generated from patient interviews and then subjected to analysis that reduced the questionnaire to a convenient number of the most useful items. The processes of generating items grounded in interview data and the rationale for selecting questionnaire items is well-documented; this degree of transparency is not usual in the field and is considered an advantage of the present study. A validation study compared the new questionnaire, the Vestibular Rehabilitation Benefit Questionnaire (VRBQ), to existing measures of related constructs in a longitudinal study of 124 patients receiving vestibular rehabilitation.

The changes measured in the present study were small and occurred predominantly in the no-treatment period. The small measured effect is not thought to be a property of the measurement tools but may have masked some meaningful patterns in the data which could potentially have contributed to the evaluation, particularly with respect to estimating sources of bias. Consistent with previous research and theoretical models of the treatment process, the present study found the greatest changes to occur in the domain of symptoms in the early period of data collection. The results of the present study suggest that symptoms of anxiety are the most resistant to improvement without intervention. This reinforces research findings which indicate the need for treatment to focus on the psychological consequences of dizziness.

The VRBQ has four internally consistent subscales, which provide information on the impact of dizziness in domains relating to Dizziness, Anxiety, Motion-Provoked Dizziness and Quality of Life. The use of subscales provides a more detailed profile of an individual's difficulties than an overall score and as such may be useful in directing therapy and assessing areas of improvement. The test-retest reliability of the individual subscales supports their use for assessing specific areas of change. The VRBQ State also shows good test-retest reliability as a whole scale. The relationships between the subscales of the VRBQ and existing measures provide support for the validity of the new measure.

The VRBQ was shown to be the most sensitive to change in the present study. Moreover, the VRBQ subscales relating to particular aspects of dizziness impact were more sensitive than subscales of questionnaires designed specifically to assess that aspect: Dizziness and Anxiety subscales are more sensitive to changes in these dimensions than the equivalent subscales of the Vertigo Symptom scale and the Quality of Life subscale is more sensitive to change than the subscales of the Dizziness Handicap Inventory. Therefore, the VRBQ assesses the full range of dizziness impact with greater sensitivity than alternative measures in approximately half the number of items of the DHI and VSS combined. The DHI was the least sensitive of the disease-specific measures, although it showed greater sensitivity than the generic SF-36. The greater sensitivity of the DHI in comparison to the SF-36 is attributable to the DHI Physical subscale as this was the only subscale which showed substantially greater responsiveness. Since the DHI Physical subscale relates to *symptoms* of dizziness, it appears that the lack of sensitivity of the SF-36 is attributable to its focus on the *consequences* of a health condition rather than the specific *symptoms*. This finding reinforces suggestions that it is the symptoms that change most in the early period of treatment and supports the case for condition-specific measures of treatment benefit for routine clinical purposes.

The study was designed to allow comparison of two versions of the VRBQ using 'state' and 'change' measurement approaches. However, the small treatment effect observed in the present study prevented analysis of the influences on measured changes. In the absence of objective measures to validate the two versions against, the psychometric profile of the two versions was used to imply the contribution of bias. The differences in the information provided by 'state' and 'change' formats were interpreted as highlighting the influence of social desirability in the responses to the 'change' questionnaire. In particular, the treatment effect measured by the 'change' questionnaire was considerably greater both in absolute terms and in comparison between treatment and control periods. The 'change' questionnaire suggested much greater improvement after treatment whereas the other four measures showed greater improvement before treatment began. Since the 'change' format is transparent in its request for an assessment of how useful treatment has been, this format is seen as susceptible to socially desirable patterns of responding. Furthermore, the items relating to motion-provoked dizziness were consistent with other items in the 'change' questionnaire whereas these items in the 'state' questionnaire related poorly to other items, a pattern of results which is supported by previous research. The consistency of items in the 'change' questionnaire suggests poor discrimination between items relating to different aspects of dizziness impact and lends further support to a hypothesis of social desirability bias. Weak correlations between the 'change' questionnaire and existing ('state') questionnaires are likely to be partly due to the different measurement techniques. None the less the validity of the VRBQ Change could not be established and this was attributed, at least in part, to bias inherent in the 'change' format.

Concerns that before and after 'state' measures are confounded by response shifts were investigated in the present study. The results did not reveal a response shift, and this is consistent with research which suggests response shifts only occur when treatment is effective. Alternative explanations for the absence of a measured response shift are the complexity of the double-retrospective task asked of subjects in the present study or the relationship between dizziness and somatisation which researchers hypothesise is resistant to response shifts. Based on the overall pattern of results that emerged from the validation study, the VRBQ State is the preferred version for future work.

7.2. Future Work

There is a great deal of scope for further work with the VRBQ. A randomized controlled trial of vestibular rehabilitation using the VRBQ as a measure of outcome would provide data with many uses. Firstly, it would provide evidence of the efficacy of vestibular rehabilitation for comparison with the findings of the present study, which shows a small effect in contrast with other research that shows greater effects. Furthermore, this type of study would allow a more controlled assessment of changes in a no-treatment group than was possible in the present study. Secondly, if significant changes were observed this would allow assessment of the responsiveness of the new instrument, which would provide indicators of score changes associated with significant improvement. The present study was only able to assess the relative responsiveness of the VRBQ in comparison to existing measures. A greater treatment effect would also allow further examination of response shift bias in this context, which may be revealed when greater changes occur than were observed in the present study. Performance measures such as posturography could be usefully included in future studies of response shift bias to examine the relationship between functional improvement and possible changes in internal values. The use of performance measures would also allow comparison with research evidence from other contexts which suggest the then-test/post-test comparison to be more closely related to objective measures of performance than pre-test/post-test comparisons even when response shifts are not observed.

Future studies of large groups of vestibular rehabilitation patients would allow analysis of the VRBQ in sub-samples of patients. It may be interesting to examine the outcome of vestibular rehabilitation for patients with differing levels of initial disability with a view to guiding prognosis. Analysis of rehabilitation outcome by diagnostic category may also provide useful information with respect to predicting outcome. It would be particularly interesting to collect VRBQ data from patients being treated for Benign Paroxysmal Positional Vertigo (BPPV). This would allow assessment of the responsiveness of the questionnaire in a group of patients who typically have a particular profile of symptoms and disabilities. Furthermore, the literature concerning treatment techniques for BPPV suggests high success rates and substantial treatment effects. A more marked treatment effect than shown in the present study would allow further assessment of the responsiveness of the VRBQ. If shown to be sensitive to changes in BPPV patients, the VRBQ may play a role in comparative evaluation of different management strategies. In other groups of patients also, research into the sensitivity of the VRBQ to different treatment regimes may reveal a role in service evaluation. The subscale score profile may be an additional factor influencing outcome that could usefully be investigated in large groups of patients. This information may indicate the need for a particular approach to rehabilitation or the need to involve other professionals.

7.3. Conclusions

The Vestibular Rehabilitation Benefit Questionnaire has been developed specifically to measure outcome from vestibular rehabilitation. Two formats were developed to allow comparison of techniques for measuring change in this context. In the absence of objective measures against which to validate the two formats, psychometric properties are compared. A longitudinal validation study of 124 patients undergoing vestibular rehabilitation revealed the 'state' format of the VRBQ to be a valid measure of dizziness impact which shows greater sensitivity to change in these patients than existing measures. The 'change' format of the VRBQ revealed a different pattern of psychometric properties from the 'state' format. It is inferred that differences in the psychometric profile of the two formats are attributable to social desirability bias inherent in the 'change' format. This suggests that measurements taken with the 'change' questionnaire cannot be relied upon to make valid clinical judgements. Response shift bias was not shown to confound comparison of before and after 'state' measures in the present study, although the absence of a response shift may be attributable to the small treatment effect.

The VRBQ appears to be a valid and responsive measure of dizziness impact with the potential to fulfil many useful roles. The items are based on patient concerns and consequently are directly relevant to the rehabilitative process. A concise and psychometrically robust questionnaire which addresses all of the main aspects of dizziness impact provides a valuable and convenient tool for guiding management and assessing outcome. Furthermore, the psychometric profile indicates the VRBQ is likely to be suitable for use in service audit and research contexts.

The present study reinforces previous findings that measured changes due to vestibular rehabilitation occur predominantly in the area of symptoms of dizziness. The results also underline the need for treatment programmes to address the psychological consequences of dizziness.

References

Asmundson, G.J.G, Stein, M.B. and Ireland, D. 1999. A factor analytic study of the dizziness handicap inventory: does it assess phobic avoidance in vestibular referrals? *Journal of Vestibular Research,* 9, 63-8.

Balaban, C.D and Thayer, J.F. 2001. Neurological bases for balance-anxiety links. *Journal of Anxiety Disorders*, 15, 53-79.

Bamiou, D.E., Davies, R.A., McKee, M and Luxon, L.M. 1999. The effect of severity of unilateral vestibular dysfunction on symptoms, disabilities and handicap in vertiginous patients. *Clinical Otolaryngology,* 24, 31-8.

Bamiou, D.E., Davies, R.A., McKee, M and Luxon, L.M. 2000. Symptoms, disability and handicap in unilateral peripheral vestibular disorders. *Scandinavian Audiology,* 29, 238-44.

Beale, N., Baker, N., Straker-Cook, D. 2000. Council tax valuation band as marker of deprivation and of general practice workload. *Public Health,* 114, 4, 260-4.

Beaton, D.E., Bombardier, C. and Hogg-Johnson, S.A. 1996. Measuring health in injured workers: a cross-sectional comparison of five generic health status instruments in workers with musculoskeletal injuries. *American Journal of Industrial Medicine*, 29, 6, 618-31.

Bergner, M., Bobbitt, R. A., Kressel, S., Pollard, W.E, Gilson, B.S. and Morris, J.R. 1976. The Sickness Impact Profile: conceptual formulation and methodology for the development of a heath status measure. *International Journal of Health Services Research,* 6, 3, 393-415.

Bergner, M., Bobbitt, R. A., Carter, W.B., and Gilson, B.S. 1981. The Sickness Impact Profile: development and final revision of a health status measure. *Medical Care,* XIX, 8, 787-806

Bird, J.C., Beynon, G.J., Prevost, A.T., Baguley, .D.M. 1998. An analysis of referral patterns for dizziness in the primary care setting. *British Journal of General Practice*, 48, 1828-32

Black, F.O., Shupert, C.L., Peterka, R.J. and Nashner, L.M. 1989. Effects of unilateral loss of vestibular function on the vestibular-ocular reflex and postural control. *Annals of Otology, Rhinology, and Laryngology*, 98, 11, 884-9.

Booth, R. L. 2000. Dizziness and quality of life in clinic and general population samples of dizzy individuals. PhD thesis, University of Southampton.

Bowling, A. 1991. *Measuring Health; A review of Quality of Life measurement scales.* Milton Keynes: Open University Press.

Bowling, A. 1995. *Measuring Disease.* Milton Keynes: Open University Press.

Boyatzis, R.E. 1998. *Transforming Qualitative Information: Thematic analysis and code development.* London: Sage Publications.

Brandt, T. 2000. Management of vestibular disorders. *Journal of Neurology,* 247, 491-99.

Brazier, J.E., Haprer, R., Jones, N.M.B., O' Cathain, A., Thomas, K.J., Usherwood, T. and Westlake, L. 1992. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. *British Medical Journal,* 305, 160-4.

Brightwell, D.R. and Abramson, M. 1975. Personality characteristics in patients with vertigo. *Archives of Otolaryngology,* 101, 6, 364-6.

Brookes, G.B., Faldon, M., Kanayama, T. and Gretsy, M.A. 1994. Recovery from unilateral vestibular nerve section in human subjects evaluated by physiological, psychological and questionnaire assessments. *Acta Otoloaryngolica,* Suppl 513, 40-8.

Burgneay, J. and Munro, K.J. 1997. Computerised dynamic posturography: a retrospective analysis of the first 200 patients tested at the ISVR Hearing and Balance Centre. *Journal of Audiological Medicine,* 6, 2, 79-89.

Charlton, J.R.H, Patrick D.L. and Peach, H. 1983. Use of multi-variate measures of disability in health surveys. *Journal of Epidemiology and Community Health,* 37, 296-304.

Charlton, J.R.H. 1989. Approaches to assessing disability, in *Disablement in the Community,* Patrick, D. L. and Peach, H. (Eds). Oxford: Oxford University Press.

Cawthorne, T. 1945 The physiological basis for head exercises. *Journal of the chartered society of physiotherapists,* April, 106-7.

Clark, M.R., Sullivan, M.D., Katon, W.J., Russo, J.E., Fischl M., Dobie, R.A. and Voorhees, R. 1993. Psychiatric and medical factors associated with disability in patients with dizziness. *Psychosomatics,* 34, 5, 409-415.

Cohen, H.S. and Kimball, K.T. 2000. Development of the Vestibular Disorders Activities of Daily Living scale. *Archives of Otolaryngology, Head and Neck Surgery,* 126, 881-7.

Cohen, H.S., Kimball, K.T and Adams, A.S. 2000. Application of the Vestibular Disorders Activities of Daily Living scale. *Laryngoscope,* 110, 1204-9..

Cohen, H.S. and Kimball, K.T. 2003. Increased independence and decreased vertigo after vestibular rehabilitation. *Otolaryngology, Head and Neck Surgery,* 128, 60-70.

Coker, N.J., Coker, R.R., Jenkins, H.A., Vincent, K.R. 1989. Psychological profile of patients with Meniere's disease. *Archives of Otolaryngology, Head and Neck Surgery,* 115, 11, 1355-7.

Cooksey, F.S. 1946. Rehabilitation in vestibular injuries. *Proceedings of the Royal Society of Medicine,* 39, 273-8.

Cowland, J.L., Wrisley, D.M., Walker, M., Strasnick, B. amd Jacobson, J.T. 1998. Efficacy of vestibular rehabilitation. *Otolaryngology, Head and Neck Surgery, 118, 49-54.*

De Bruin, A.F., Buys, M., de Witte, L.P. and Diederiks, J.P. 1994. The sickness impact profile: SIP68, a short generic version. First evaluation of the reliability and reproducibility. *Journal of Clinical Epidemiology*, 47, 8, 863-71.

Deyo, R.A. and Inui, T.S. 1984. Towards clinical applications of heath status measures: sensitivity of scales to clinically important changes. *Health Services Research,* 19, 3, 275-89.

Deyo, R.A. and Centor, R.M. 1986. Assessing the responsiveness of functional scales to clinical change: an analogy to diagnostic test performance. *Journal of Chronic Diseases,* 39, 11, 897-906.

Deyo, R.A., Diehr, P. and Patrick, D.L. 1991. Reproducibility and responsiveness of health status measures. *Controlled Clinical Trials,* 12, 142S-158S.

Dibb, B. 2004. Factors influencing adjustment to chronic illness and the role of the self-help group in this process. PhD thesis, University of Southampton.

Eagger, S., Luxon, L.M., Davies, R.A., Coelho, A., Ron, M.A. 1992. Psychiatric morbidity in patients with peripheral vestibular disorder: a clinical and neuro-otological study. *Journal of Neurology, Neurosurgery and Psychiatry,* 55, 383-387.

El-Kashlan, H.K., Shepard, N.T., Arts, H.A. and Telian, S.A. 1998. Disability from vestibular symptoms after acoustic neuroma resection. *The American Journal of Otology,* 19, 104-11.

Enloe, L.J. and Shields, R.K. 1997. Evaluation of health-related quality of life in individuals with vestibular disease using disease-specific and general outcome measures. *Physical Therapy,* 77, 9, 890-903.

Essink-Bot, M-L., Krabbe, P.F.M, Bonsel, G.J. and Aaronson, N.K. 1997. An empirical comparison of four generic health status measures. *Medical Care,* 35, 5, 522-37.

Flanagan, J.C. 1982. Measurement of quality of life: current state of the art. *Archives of Physical Medicine and Rehabilitation,* 63, 2, 56-9.

Fielder, H., Denholm, S.W., Lyons, R.A. and Fielder, C.P. 1996. Measurement of health status in patients with vertigo. *Clinical Otolaryngology,* 21, 124-6.

Gatehouse, S. 1997. *Outcome Measures for the Evaluation of Adult Hearing Aid Fittings and Services.* Scientific and Technical Report to the Department of Health, London.

Gatehouse, S. 1998. *The Glasgow Health Status Questionnaires Manual.*

Gatehouse, S. 1999a. Glasgow Hearing Aid Benefit Profile: derivation and validation of a client-centred outcome measure for hearing aid services. *Journal of the American Academy of Audiology,* 10, 80-103.

Gatehouse, S. 1999b. A self-report outcome measure for the evaluation of hearing aid fittings and services. *Health Bulletin,* 57, 6, 424-36.

Giardi, M and Konrad, H.R. 1998. Vestibular rehabilitation therapy for the patient with dizziness and balance disorders. *Otorhinolaryngology, Head and Neck Nursing,* 16, 4, 13-22.

Gill-Body, K.M., Beninato, M. and Krebs, D.E. 2000. Relationships among balance impairments, functional performance and disability in people with peripheral vestibular hypofunction. *Physical Therapy,* 80, 8, 748-58.

Guyatt, G.H., Bombardier, C., Tugwell, P. X. 1986. Meausuring change over time: assessing the usefulness of evaluative instruments. *Journal of Chronic Disease*, 40, 1717-178.

Hagnebo, C., Melin, L., Larsen, H.C., Lindberg, P., Lyttkens, L. and Scott, B. 1997, The influence of vertigo, hearing impairment and tinnitus on the daily life of Meniere patients. *Scandinavian Audiology,* 26, 69-76.

Hallam, R.S., and Stephens S. D. G. 1985. Vestibular disorders and emotional distress. *Journal of Psychosomatic Research*, 29, 407-413.

Hazlett, R. J., Tusa, R. J. and Waranch, H. R. 1996. Development of an Inventory for dizziness and related factors. *Journal of Behavioural Medicine*, 19, 73-85.

Herdman, S.J. and Whitney, S.L. 2000. Chapter 17: Treatment of vestibular hypofunction. In Herdman (Ed) *Vestibular Rehabilitation* (Second Edition). Philadelphia: F A Davis Company.

Honrubia, V., Bell, T. S., Harris, M. R., Baloh, R. W. and Fisher, L. M. 1996. Quantitative evaluation of dizziness characteristics and impact on Quality of Life. *The American Journal of Otology*, 17, 595-602.

Hoogstraten, J. 1979. Pre-testing as determinant of attitude change in in evaluation research. *Applied Psychological Measurement,* 3, 25-30.

Horak, F.B., Jones-Rycewicz, C., Black, F.O. and Shumway-Cook, A. 1992. Effects of vestibular rehabilitation on dizziness and imbalance. *Otolaryngology, Head and Neck Surgery,* 106, 175-80.

Howard, G.S., Ralph, K.M., Gulanick, N.A., Maxwell, S.E., Nance, D.W. and Gerber, S.K. 1979. Internal invalidity in pretest-posttest self-report evaluations and a re-evaluation of retrospective pretests. *Applied Psychological Measurement,* 3, 1, 1-23.

Howard, K.I., Lueger, M. S. Maling, M. S. and Martinovich, Z. 1993. A phase model of psychotherapy: causal mediation of outcome. *Journal of Consulting and Clinical Psychology,* 61, 678-685.

Howell, D.C. 1997. *Statistical Methods for Psychology (4th Edition).* Belmont, CA: Duxbury Press.

Howitt, D and Cramer, D. 2000. *An Introduction to Statistics in Psychology (Revised 2nd Edition).* Harlow, England: Prentice Hall.

Hutchinson, J. and Hutchinson, M. 1995. The Functional Limitations Profile may be a valid, reliable and sensitive measure of disability in Multiple Sclerosis. *Journal of Neurology,* 242, 650-7.

Jacob, D.G. 1988. Panic disorder and the vestibular system. *Psychiatric Clinics of North America,* 11, 2, 361-74.

Jacobson, G. P. and Newman, C. W. 1990. The development of the Dizziness Handicap Inventory. *Archives of Otolaryngology Head and Neck Surgery*, 116, 424-427.

Jacobson, G.P and Calder, J.H. 1998. A screening version of the Dizziness Handicap Inventory (DHI-S). *American Journal of Otology,* 19, 804-8.

Jacobson, G.P. and McCaslin, D.L. 2003. Agreement between functional and electrophysiologic measures in patients with unilateral peripheral vestibular system impairment. *Journal of the American Academy of Audiology*, 14, 5, 231-8.

Jaeschke, R., Singer, J. and Guyatt, G.H. 1989. Measurement of health status: ascertaining the minimal clinically important difference. *Controlled Clinical Trials*, 10, 4, 407-15.

Jayarajan, V. and Rajenderkumar, D. 2003. A survey of dizziness management in General Practice. *Journal of Laryngology and Otology*, 117, 8, 599-604.

Jenkinson, C., Coulter, A. and Wright, L. 1993. Short form 36 (SF-36) health survey questionnaire: normative data for adults of working age. *British Medical Journal,* 306, 1437-40.

Jette, A.M. Health status indicators: Their utility in chronic disease evaluation research. 1980. *Journal of Chronic Disease,* 33, 567-79.

Katz, S., Ford. A.B, Moskowitz, W.R, Jackson, B.A., Jaffe, M.W. 1963. The index of ADL: a: standardised measure of biological and psychosocial function. *Journal of the American Medical Association.* 185, 12, 914-919.

Katz, S., Downs, T.D., Cash, H.R. and Grotz, R.C. 1970. Progress in the development of the index of ADL. *The Gerontologist,* Spring, 1, 20-30.

Kazis, L.E., Anderson, J.J. and Meenan, R.F. 1989. Effect sizes for interpreting changes in health status. *Medical Care*, 27 (suppl), S178-89.

Kerns, R.D., Turk, D.C., Rudy, T.E. 1985. The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). *Pain*, 23, 4, 345-56.

Kinney, S.E., Sandridge, S.A. and Newman, C.W. 1997. Long term effects of Meniere's disease on hearing and quality of life. *The American Journal of Otology,* 18, 67-73.

Kirshner, B. and Guyatt G. 1985. A methodological framework for assessing health indices. *Journal of Chronic Disease*, 38, 27-36.

Krebs, D.E., Gill-Body, K.M., Riley, P.O. and Parker, S.W. 1993. Double-blind, placebo-controlled trial of rehabilitation for vestibular hypofunction: preliminary report. *Otolaryngology, Head and Neck Surgery,* 109, 735-41.

Krebs, D.E., Gill-Body, K.M., Parker, S.W., Ramirez, J.V. and Wernick-Robinson, M. 2003. Vestibular rehabilitation: useful but not universally so. *Otolaryngology, Head and Neck Surgery,* 128, 240-50.

LaRouere, M.J., Seidman, M.D., and Kartush, J.M. 1997. Medical and surgical treatment of vertigo, in Jacobson, G.P., Newman, C.W. and Kartush, J.M (Eds) *Handbook of Balance Function Testing.* London: Singluar Publishing Group Inc.

Lerner, M. 1973. Conceptualization of health and well-being. *Health Services Research,* 8, 6-12.

Levinson, W., Gordon, G. and Skeff, K. 1990. Retrospective versus actual pre-course assessments. *Evaluation and the Health Professions,* 13, 4, 445-452.

Lewis-Beck, M.S. 1994. *Factor Analysis and Related Techniques.* London: Sage Publications.

Lynn, S.G., Driscoll, C.L.W., Harner, S.G., Beatty, C.W. and Atkinson, E.J. 1999. Assessment of dysequilibrium after acoustic neuroma removal. *The American Journal of Otology,* 20, 484-94.

McHorney, C.A., Ware, J.E. and Raczek, A.E. 1993. The MOS 36-item short form health survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Medical Care*, 31, 3, 247-263.

McKenna, L., Hallam, R. S. and Hinchcliffe, R. 1991. The prevalence of psychological disturbance in neuro-otology outpatients. *Clinical Otolaryngology*, 16, 452-456.

Mendel, B., Bergenius, J and Langius, A. 1999. Dizziness symptom severity and impact on daily living as perceived by patients suffering from peripheral vestibular disorder. *Clinical Otolaryngology*, 24, 286-293.

Newman, C. W and Jacobson G. P. 1993. Application of self-report scales in balance function handicap assessment and management. *Seminars in Hearing*, 14, 363-375.

Nobbs, M.B. 1987. Adjustment in Meniere's Disease, in *Adjustment to Acquired Hearing Loss.* Kyle J.G. (Ed). Bristol: University of Bristol Centre for Deaf Studies.

Nunnally, J. C. 1978. *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Patrick, D.L. and Peach, H. 1989. *Disablement in the community*. Oxford: Oxford University Press.

Perez, N., Martin, E. and Garcia-Tapia, R. 2003. Dizziness: relating the severity of vertigo to the degree of handicap by measuring vestibular impairment. *Otolaryngology, Head and Neck Surgery*, 128, 372-81.

Powell, L.E. and Myers, A.M. 1995. The Activites-specific Balance Confidence (ABC) Scale. *Journal of Gerontology*, 50A, 1, M28-34.

Qualis Research. 1985. *Ethnograph v5.5 for Windows*. Denver: Qualis Research Associates.

Robinson, K., Gatehouse, S. and Browning, G.G. 1996. Measuring patient benefit from otorhinolaryngological surgery and therapy. *Annals of Otology, Rhinology and Laryngology*, 105, 6,415-22

Schwartz, C.E. and Sprangers, M.A.G. 1999.Methodological approaches for assessing response shift in longitudinal health-related quality-of-life research. *Social Science and Medicine*, 48, 11, 1531-48.

Scturm, T. 1994. Comparison of different exercises programs in the treatment of patients with chronic peripheral vestibular disorder. *Journal of Vestibular Research*, 4, 461.

Shepard, N.T., Telian, S.A., Smith-Wheelock, M. and Raj, A. 1993. Vestibular and balance rehabilitation therapy. *Annals of Otolology Rhinology and Laryngology* ,102, 198.

Shepard, N.T. and Telian, S.A. 1995. Programmatic vestibular rehabilitation. *Otolaryngology, Head and Neck Surgery*, 112, 173.

Shumway-Cook, A and Horak, F.B: 1989. Vestibular rehabilitation: an exercise approach to managing symptoms of vestibular dysfunction. *Seminars in Hearing*, 10, 196.

Sprangers, M. 1989. Response shift and the retrospective pretest. PhD thesis, University of Amsterdam.

Sprangers, M.A.G and Schwartz, C.E. 1999. Integrating response shift into health-related quality of life research: a theoretical model. *Social Science and Medicine*, 48, 11, 1507-1515.

Stephens, S.D.G. 1990. Auditory and vestibular rehabilitation in the adult. *Horizons in Medicine*, 2, 220-228

Strauss, A. and Corbin, J. 1998. Chapter 7. Strategies of qualitative inquiry in *Grounded Theory Methodology: An Overview*. Denzin, N.K. and Lincoln, Y.S. (Eds). London: Sage Publications.

Streiner, D.L. and Norman, G. R. 1989. *Health Measurement Scales, A Practical Guide to Their Use and Development*. Oxford: Oxford University Press.

Stucki, G, Liang, M.H., Phillips, C and Katz, J.N. 1995. The Short-Form 36 is preferable to the SIP as a generic health status measure in patients undergoing elective total hip arthroplasty. *Arthritis Care and Research*, 8, 174-81.

Sullivan, M., Ahlmen, M. and Bjelle, A. 1990. Health status assessment in rheumatoid arthritis I: Further work on the validity of the Sickness Impact Profile. *Journal of Rheumatology,* 17, 439-47.

Sullivan, M., Clark, M.R., Katon, W.J., Fischl, M., Russo, J., Dobie, R.A. and Voorhees, R. 1993. Psychiatric and otologic diagnoses in patients complaining of dizziness. *Archives of International Medicine*, 153, 1479-85.

Ware, J.E and Donald Sherbourne, C. 1992. The MOS 36-item short form health survey (SF-36): I. Conceptual framework and item selection. *Medical Care,* 30, 6, 473-481.

Whitney, S.L, Hudak, M.T. and Marchetti, G.F. 1999. The activities-specific balance confidence scale and the dizziness handicap inventory: a comparison. *Journal of Vestibular Research*, 9, 253-59.

WHOQOL Group. 1993. Study protocol for the *World Health Organization* project to develop a quality of life assessment instrument (WHOQOL). *Quality of Life Research*, 2, 153-159.

Wilson, I.B. 1999. Clinical understanding and clinical implications of response shift. *Social Science and Medicine,* 48, 11, 1577-88.

World Health Organization . 2002. *International Classification of Functioning, Disability and Health (ICF).*

Wright, T. 1988. *A Guide to Disorders of Balance.* Kent: Croom Helm.

Yardley , L and Putnam, J. 1992. Quantitative analysis of factors contributing to handicap and distress in vertiginous patients: a questionnaire study. *Clinical Otoloaryngolgy*, 17, 231-236.

Yardley, L., Verchuur, C., Masson, E., Luxon, L and Haake, N. 1992a. Somatic and psychological factors contributing to handicap in people with vertigo. *British Journal of Audiology, 26, 283-90.*

Yardley, L. Todd, A.M, Lacoudraye-Harter, M. M. and Ingham, R. 1992b. Psychosocial consequences of recurrent vertigo. *Psychology and Health*, 6, 85-96.

Yardley, L., Masson, E., Verschuur, C., Haake, N. and Luxon, L. 1992c. Symptoms anxiety and handicap in dizzy patients: development of the vertigo symptom scale. *Journal for Psychosomatic Research,* 36, 731-741.

Yardley, L. 1994a. Prediction of handicap and emotional distress in patients with recurrent vertigo: symptoms, coping strategies, control beliefs and reciprocal causation. *Social Science and Medicine,* 39, 4, 573-81.

Yardley, L. 1994b. Contribution of symptoms and beliefs to handicap in people with vertigo: a longitudinal study. *British Journal of Clinical Psychology,* 33, 101-113.

Yardley, L and Luxon, L. 1994. Treating dizziness with vestibular rehabilitation. *British Medical Journal,* 308, 1252-3.

Yardley, L., Luxon, L.M and Haake, N.P. 1994a. A longitudinal study of symptoms, anxiety and subjective well-being in patients with vertigo. *Clinical Otolaryngology,* 19, 109-116.

Yardley, L., Luxon, L., Bird, J., Lear, S. and Britton, J. 1994b. Vestibular and posturographic test results in pople with symptoms of panic and agoraphobia. *Journal of Audiological Medicine,* 3, 48-65.

Yardley, L., Britton, J., Lear, S., Bird, J. and Luxon, L. 1995. Relationship between balance system function and agoraphobic avoidance. *Behavioural Research and Therapy, 33, 4, 435-9.*

Yardley, L., Owen, N., Nazareth, I. And Luxon, L. 1998a. Prevalence and presentation of dizziness in a general practice community sample of working age people. *British Journal of General Practice,* 48, 1131-5.

Yardley, L., Burgneay, J., Nazareth, I., Luxon, L.1998b. Neuro-otological and psychiatric abnormalities in a community sample of people with dizziness: a blind controlled investigation. *Journal of Neurology, Neurosurgery and Psychiatry*, 65, 679-684.

Yardley, L, Burgneay, J., Andersson, G., Owen, N., Nazareth, I. And Luxon, L. 1998c. Feasibility and effectiveness of providing vestibular rehabilitation for dizzy patients in the community. *Clinical Otolaryngology, 23, 442-8.*

Yardley, L. Beech, S. Zander, L., Evans, T. and Weinman, J. 1998d. A randomised controlled trial of exercise therapy for dizziness and vertigo in primary care. *British Journal of General Practice*, 48, 1136-1140.

Yardley, L., Medina, S.M.G., Jurado, C.S., Morales, T.P., Martinez, R.A. and Villegas, H.E. 1999. Relationship between physical and psychsocial dysfunction in Mexican patients with vertigo: a cross-cultural validation of the Vertigo Symptom Scale. *Journal of Psychosomatic Research,* 46, 1, 63-74.

Yardley, L., Beech, S. and Weinman, J. 2001. Influence of beliefs about the consequences of dizziness on handicap in people dizziness, and the effect of therapy on beliefs. *Journal of Psychosomatic Research,* 50, 1, 1-6.

Yardley, L and Redfern, M.S. 2001. Psychological factors influencing recovery form balance disorders. *Journal of Anxiety Disorders*, 15, 107-119.

Yardley, L. and Murray, M. 2004. Chapter 6: Qualitative analysis of talk and text: discourse and narrative analysis. In Marks, D.F. and Yardley, L. *Research Methods for Clinical and Health Psychology.* London: Sage Publication

Appendix 1

Patient Information Sheets

Phase I
Phase II
Phase III

Phase I Patient Information Sheet

Dizziness and Vestibular Rehabilitation Interview Study

I am a researcher at the University of Southampton Hearing and Balance Centre working under the supervision of Professor Mark Lutman and Dr Lucy Yardley. I would like to interview people suffering with dizziness who have had, or are about to start, vestibular rehabilitation. The aim of the study is to find out more about changes in quality of life caused by dizziness and vestibular rehabilitation. Eventually, the information will contribute to a questionnaire which will be used to measure how much a person has benefited from the treatment.

The interviews will be on a one-to-one basis and I will ask you to talk about your experience of dizziness. The interviews will probably take about an hour and can take place in the clinic where you have your rehabilitation or in your home, whichever you prefer. If the interview takes place outside your home, your travel expenses will be reimbursed by the University.

With your permission, the interview will be tape-recorded, although no-one except the interviewer will know your identity. After the interview is complete, all information will be kept anonymous and confidential. Verbatim quotes may be used in publications resulting from this study, but any identifying details will be removed or changed to protect your anonymity.

Whether or not you decide to take part will not affect your medical care now, or in the future. If you decide to take part you may withdraw at any time without giving a reason.

If you would like to take part, please contact me by returning the reply slip in the **FREEPOST** envelope attached. I will contact you by telephone to arrange an interview.

If you would like to know more before you decide, you can contact me on 023 80594968.

Thank you for your time.

Anna Morris

--✂--

I would like to take part in the study and would prefer to be interviewed:

at the clinic. Name and location of clinic ....
or, at home

My contact details are: Name ....
Address ....
....
....
Telephone number ....

Times that I am always available/unavailable (delete)............ ....

Phase II Patient Information Sheet

Vestibular Rehabilitation Questionnaire Study

Patient Information Sheet

I am a researcher at the University of Southampton Hearing and Balance Centre working under the supervision of Professor Mark Lutman and Dr Lucy Yardley.

I am looking for people who have had Vestibular Rehabilitation who may consider completing two questionnaires which are part of a PhD research project into treatment for dizziness. The study is funded by the University of Southampton and has been approved by three research ethics committees (University of Southampton, the NHS Multi-Centre Research Ethics Committee and your hospital's own Research Ethics Committee)

Vestibular Rehabilitation is the therapy you have received for your dizziness. It includes a programme of exercises and sometimes some counselling or relaxation therapy. This Information Sheet is being given to patients who have had Vestibular Rehabilitation at your hospital, and at 11 other hospitals in the UK.

At this stage I am not asking you to decide whether or not you would like to take part, I am just asking if I can send you the questionnaires (because of the Data Protection Act, the hospital cannot give me your address without your permission).

If you agree to let me send you the questionnaires, please fill in the Consent Form and return it in the FREEPOST envelope. I will then send you two questionnaires and a copy of the Consent Form for you to keep.

The questionnaires ask about changes in your dizziness and changes in your life since having the Vestibular Rehabilitation. **You will not have to return the questionnaires if you decide that you do not want to**. If you decide not to return them, I will send the questionnaires to you again about a month later. If you do not return the questionnaires after this, I will not contact you again.

If you would like to ask any questions before deciding, please contact me on the number below.

Thank you for your time.

Anna Morris
Audiological Scientist/Research Student
(023) 8059-2903

Phase III Patient Information Sheet (Group A)

Vestibular Rehabilitation Questionnaire Study

Patient Information Sheet

I am Anna Morris, a researcher at the University of Southampton Hearing and Balance Centre, working under the supervision of Professor Mark Lutman and Dr Lucy Yardley. I am looking for people who are going to have Vestibular Rehabilitation, who would be willing to complete a set of questionnaires on three occasions over the next few months. You will be asked to complete 16 questionnaires in total.

Vestibular Rehabilitation is the treatment you are going to have for your dizziness. It includes a programme of exercises and sometimes some counselling or relaxation therapy. The questionnaires will ask about your dizziness and your quality of life before and after having Vestibular Rehabilitation. This information sheet is being given to all patients who are going to have Vestibular Rehabilitation at your hospital, and at 5 other hospitals in the UK.

The research is part of a PhD project to develop a questionnaire which measures how much Vestibular Rehabilitation helps people. The questionnaire that is being developed is called the Vestibular Rehabilitation Benefit Questionnaire and this is one of several questionnaires you will be asked to complete if you decide to take part. The study is funded by the University of Southampton and has been approved by three research ethics committees (University of Southampton, the NHS Multi-Centre Research Ethics Committee and your hospital's own Research Ethics Committee). The research is not connected to the hospital where you will have your Vestibular Rehabilitation and whether you take part or not will have no influence on the standard of care you receive now or in the future. If you would like to know the outcome of the research, you can contact either myself or your Vestibular Rehabilitation therapist who will be informed of the results when the project has finished.

If you think you would like to take part, please look at the Instructions for Completing Questionnaires sheet. You will then complete the questionnaires and Consent Form 1 and return them to me in the FREEPOST envelope. Even after you have signed Consent Form 1, you are still free to withdraw from the project at any time without giving a reason.

If you return the questionnaires to me, I will send another set of questionnaires to you in a few weeks time. I will also send you a copy of Consent Form 1 once I have signed it, for you to keep for your own records.

If you would like to ask any questions before deciding, please contact me on the number below.

Thank you for your time.

Anna Morris
Audiological Scientist/Research Student
(023) 8059-2842

Phase III Patient Information Sheet (Group B)

Vestibular Rehabilitation Questionnaire Study

Patient Information Sheet

I am Anna Morris, a researcher at the University of Southampton Hearing and Balance Centre, working under the supervision of Professor Mark Lutman and Dr Lucy Yardley. I am looking for people who are going to have Vestibular Rehabilitation, who would be willing to complete a set of questionnaires on three occasions over the next few months. You will be asked to complete 11 questionnaires in total.

Vestibular Rehabilitation is the treatment you are going to have for your dizziness. It includes a programme of exercises and sometimes some counselling or relaxation therapy. The questionnaires will ask about your dizziness and your quality of life before and after having Vestibular Rehabilitation. This information sheet is being given to all patients who are going to have Vestibular Rehabilitation at your hospital, and at 5 other hospitals in the UK.

The research is part of a PhD project to develop a questionnaire which measures how much Vestibular Rehabilitation helps people. The questionnaire that is being developed is called the Vestibular Rehabilitation Benefit Questionnaire and this is one of several questionnaires you will be asked to complete if you decide to take part. The study is funded by the University of Southampton and has been approved by three research ethics committees (University of Southampton, the NHS Multi-Centre Research Ethics Committee and your hospital's own Research Ethics Committee). The research is not connected to the hospital where you will have your Vestibular Rehabilitation and whether you take part or not will have no influence on the standard of care you receive now or in the future. If you would like to know the outcome of the research, you can contact either myself or your Vestibular Rehabilitation therapist who will be informed of the results when the project has finished.

If you think you would like to take part, please look at the Instructions for Completing Questionnaires sheet. You will then complete the questionnaires and Consent Form 1 and return them to me in the FREEPOST envelope. Even after you have signed Consent Form 1, you are still free to withdraw from the project at any time without giving a reason.

If you return the questionnaires to me, I will send another set of questionnaires to you in a few weeks time. I will also send you a copy of Consent Form 1 once I have signed it, for you to keep for your own records.

If you would like to ask any questions before deciding, please contact me on the number below.

Thank you for your time.

Anna Morris
Audiological Scientist/Research Student
(023) 8059-2842

Appendix 2

Qualitative Data analysis

Sample coded data file
Data Coding Manual
Summary table of codes

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 1
Subject 15: Christina, female, 35yrs       1
  (31.8.00)                                2

So can you tall me if any changes have     4
  ocurred in your life since the           5
  dizziness first started?                 6

#-LIFE CHANG
Everything has changed in my life since    8  -#
$-STOPPED
  the dizziness first started.  It's       9  -#-$
  stopped me doing everything almost,     10    |
  from going out to working, it's         11    -$
#-NEAR HOME
  completely made me a prisoner I feel    12  -#
$-CONFIDENCE
  in the home and I've lost all my        13  -#-$
  confidence really, that's the biggest   14    |
#-COMPARISON
  thing it's taken away becausse I used   15  -#-$
  a very outgoing, quite sporty person    16  |
$-DOWN
  and I do nothing now, so... and it's    17  -#-$
  made me very miserable really, it's     18    -$
!-OTHERWORRY
  caused me a lot of anxiety so yes, my   19 !
#-LIFE CHANG
  life has completely changes in the      20  -#
  last 6 months, 7 months.  It started a  21  -#
  little bit before that.  I happened to  22
  have a couple of days feeling a little  23
  bit dizzy and not worry about it        24
  really, I just thought it would go      25
  away and then new years eve I became    26
  very dizzy and again I just thought     27
  nothing to worry about, returned to     28
  school, because I'm a teacher and it    29
#-FEAR RESP
  didn't go away and I became quite       30  -#
  anxiious because I wasn't coping very   31  |
$-OTHER PHYS
  well in school and then one day I just  32  -#-$
  ouldn't get out of bed, I was           33    |
  literally so dizzy I couldn't get out   34    |
  of bed, called the doctor, they said I  35    -$
  was anxious and I said it's dizziness   36
  and they said the anxiety is causing    37
  the dizziness and I said no, the        38
  dizziness is causing the anxiety so     39
  they prescribed some anti-depressants   40
  which obviously didn't take away the    41
  dizziness and it's carried on, the      42
  dizziness has carried on and nobody     43
  has found, has really found what the    44
  problem, what the initial problem is.   45


Do want to tell me how it has affected    48
  your work?                              49

#-STOPPED
Well I haven't worked.  I've been off     51  -#
  school since February the first as a    52  |
  teacher, and I'm now half pay which     53  -#
#-COMPARISON
  upsets me greatly and just because I    54  -#
  want to get back to having a normal     55  |
  life again because school, my work is   56  |
  part of that, school starts again on    57  -#
  Monday and I wanted to try and get      58
  back.  I've been in for a few days and  59
  tried to cope but it's very very        60
#-FRE/DUR
```

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 2
  difficult because I'm just dizzy the     61  -#
  whole time, the whole time.              62  -#

More specifically how does it affect you   64
  at work?                                 65

It's just, all the time it't there and     67
  when you have 27 children to cope with   68
  it's quite difficult just moving about   69
  the class room, just sitting still       70
  with the children working with them      71
  but again yesterday I went into school   72
  and I had to put up wall displays and    73
#-OTHER PHYS
  I tried to climb up on benches and I     74  -#
  couldn't, I was so dizzy.  It's          75  -#
  always... it never goes away from        76
  being there even though I can try and    77
  concentrate on other things it           78
  actually always infringes on what I'm    79
  doing so it's completely affected my     80
  work and I really feel as though i've    81
  got to get back to work on Monday and    82
  I don't know how I'm going to do it, I   83
  just don't know how I'm going to cope    84
  but I don't want to lose my job and I    85
  love teaching.                           86

Can you tell me a bit about the anxiety    88
  and the emotions you've been             89
  experiencing?                            90

#-ANX/PANIC
The anxiety comes on, especially in the    92  -#
  morning when I first wake up, I'm very   93   |
  anxious then because I know as soon as   94  -#
  I get up the dizziness is going to be    95
  there, it is actually there when I'm     96
  lying down but I can cope with it more   97
  when I'm lying down.  It is there also   98
  when I'm sleeping which makes me wake    99
  up sometimes in a hot sweat because I   100
  realise how dizzy I've been when I'm    101
#-ANX/PANIC  #-NO CONTROL
  sleeping.  The anxiety is, it           102  -#
  increases when  I go out because I      103   |
  feel that I'm not in control really     104   |
  because of the dizziness so if I'm      105  -#
  walking down the road on my own or      106
  even if I'm with someone alse and I'm   107
#-PHYS HARM  $-ANTICIPATE
  extremely dizzy it makes me feel        108  -#-$
  anxious because I think 'am I going to  109   | |
  fall over?', all the possibilitites     110  -# |
  you think of 'can I cope with the       111     |
!-CROSS ROAD
  bus?' 'can I cross the road?' and all   112 !   |
#-ANX/PANIC  #-PROVOKE
  these things come into my mind and I'm  113  -#-$
  sure that may even increase the         114   |
  dizziness, the anxiety, but it          115  -#
  certainly wasn't what started it.  I    116
  went on holiday last week and the       117
  anxiety completely went away but the    118
  dizziness was still there, I had a      119
#-EFF/CON/SL
  good holiday, but I was continually     120  -#
  having to watch my step if we were      121   |
  walking or, whatever we were doing, I   122  -#
#-ANX/PANIC
  was still aware but the anxiety went,   123  -#
  however the anxiety has returned quite  124   |
$-OTHER SYMP
```

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 3
  a bit this week and cuases me to feel   125    |-$
  quite faint with it so I've got the     126    | |
  dizziness and the faintness and they    127    | |
  soprt of merge in to one really.        128   -#-$

You said about being dizzy outside,       130
  you've been dizzy in public places      131
  then?                                   132

Yes, it's all the time, it never goes     134
  away.                                   135

And how do you feel when you've been      137
  dizzy outside?                          138

#-PHYS HARM  #-ACCOMPANY
Very, very, very scared, I mean it makes  140  -#
  me very nervous, falling over, not      141   |
  being able to cope with being ut there  142   |
  on my own, but even when I'm with       143  -#
  outher people and I'm dizzy outside     144
#-NO CONTROL
  it's a feeling of not actually being    145  -#
  in control and it's just such a         146  -#
  horrible feeling, it's a very hard      147
#-OTHER DESC
  feeling to describe, it's like being    148  -#
  drunk all the time without actually     149   |
  having... it's that sort of             150  -#
!-LIGHTHEAD
  lightheadedness and that swimming       151 !
#-VISUAL
  feeling, and things move as I walk      152  -#
  around or as I sit down everyhting is   153   |
  moving around, it's very hard to        154   |
  actually focus and get from one place   155   |
  to another.                             156  -#

You mentioned earlier that it had         158
  affected you going out, can you tell    159
  me more about how your social life has  160
  been affected?                          161

Well I don't have one anymore really.  I  163
  try and go out.. if people ring me up   164
  and ask me for a meal or to go for a    165
  drink or something I will try and do    166
#-ENERGETIC
  that, I used to play golf, obviously I  167  -#
  can't do that anymore at all because    168  -#
#-BENDING    #-PROVOKE
  out there I'm bending down and it       169  -#
$-ENERGETIC
  comes on very very bad.  I used to      170  -#-$
  dance a lot, go dancing, I haven't      171     -$
  done that since before Christmas and    172
!-CINE/THEAT
  theatre and cinema I just don't like    173 !
  being in places like that because       174
  again I feel hemmed in, just feeling    175
#-VISUAL
  [unintelligible] screen makes me feel   176  -#
  very very very dizzy.  For a long time  177   |
  I couldn't watch television but I've    178  -#
  always been able to read which is       179
  really strange, I can actually focus    180
#-SOCIALISE
  more on the page, so socail life is     181  -#
  very difficult and I've found it hard   182   |
  to keep up with friends because         183  -#
  theyonly ask you so many times to do    184
  things and then they give up asking     185
  you and I know in a way I've got to     186
```

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 4
  keep contact with people, but it's      187
  extremely difficult because they want   188
#-WALKING
  to all... I was in a walking group, we  189  -#
  used to walk 5 or 6 miles and I         190  -#
#-CONFIDENCE #-ANTICIPATE
  just... well I suppose I could do it    191  -#
  but I don't have the confidence to do   192  -#
  it, the dizziness has taken that away   193
#-NEAR HOME
  from me so it has completely... as I    194  -#
  say made me a prisoner, I feel, in my   195   |
  own home.                               196  -#

Are there any other things that you wuld  198
  have done previously that you now       199
  don't do?                               200

I didn't used to read a lot but I do now  202
  because that's something I can do,      203
!-ENERGETIC  !-WALKING
  dancing, golf, walking, I was out       204 !
#-EVES OUT
  practically every single night doing    205  -#
  things especially in the summer,        206   |
  summer nights I'd be out at             207   |
  barbeqaues.. I had a really good socail 208  -#
!-ENERGETIC
  life , I played badminton, all thngs    209 !
#-LIFE CHANG
  like this and it's all just completely  210  -#
  stopped, and I haven't because of the   211   |
  dizziness I haven't even got the        212  -#
  enthusiasm or I haven't wanted to do    213
  them.                                   214

Can you tell me a bit more about that?    216

#-CONFIDENCE
Just because again because I've lost the  218  -#
  confidence to do them, and it just      219  -#
  never goes away, if it went away I      220
  think may be I  think may be I would    221
  start to try and take it up again and   222
  I really really want to and sometimes   223
  I'm really positive but other times     224
  like today, I'm feeling quite negative  225
  abut things and I think that makes a    226
  big difference to my day, when I get    227
#-OTHER SYMP
  up, this morning I felt very very       228  -#
  faint all the time, so I've had a very  229  -#
  negative feeling about today,           230
  sometimes I get up and I feel quite     231
  positive I think OK I'm going to be     232
  able to cope with things and I usually  233
#-EFF/CON/SL
  can, I can do it but it's such a        234  -#
  struggle, such an effort to do it, but  235  -#
  today I've not wanted to do anything,   236
  I haven't been out, sat in the garden,  237
  just hoped that I'd get some respite    238
  from this sometime.                     239

You mentioned that walking is something   241
  you don't do anymore.  Do you feel      242
  that the dizziness has affected your    243
  travel habit in other ways?             244

#-HOLIDAYS   #-ANTICIPATE
I mean I was supposed to be going to      246  -#
  Egypt at Easter, that will have to be   247   |
  cancelled and I've already paid for     248  -#
```

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 5
  that so obviously I won't get any       249
  money back, every holiday I've been     250
  abroad, I lived in Norway for 3 years   251
  a few years ago and at least once a     252
  year I'd fly back there to see          253
  friends, so yeah, completely.  I went   254
  on holiday and got in the car and we    255
#-TRAVEL       #-ACCOMPANY
  travelled down to Wales but without     256  -#
  the car and without someone driving me  257   |
  and taking me there's no way I would    258   |
  have had a holiday this year and I      259  -#
  only went on that sort of holiday       260
$-ANTICIPATE $-CONFIDENCE $-HOLIDAYS
  because going abroad is out of the      261    -$
  question, I would not feel confident    262     |
  about going to a foreign country        263     |
  incase something happened even though   264    -$
  it might not,  not about flying, I'm    265
  not worried about flying.               266

You're not concerned about flying, what   268
  about other modes of transport?         269

I'm OK in the car, I wasn't to start      271
  with but I've got used to that, I'm     272
  obviously having to get buses,          273
  sometimes I'm fine on the bus,          274
  sometimes I'm not it just depends on    275
  how dizzy I am and also it depends on   276
#-METHODS
  where I sit on the bus, if I'm sitting  277  -#
  front ways quite near the front I'm     278   |
$-PROVOKE      $-TRAVEL      $-VISUAL
  OK, but anywhere near the back the      279  -#-$
  movement makes everything go up and     280    -$
  down very strongly again sometimes      281
#-ANTICIPATE #-OTHERWORRY
  when I'm on my own on the bus I do      282  -#
  feel quite nervous, 'am I going to get  283   |
  out of the bus?', 'supposing something  284   |
  happens on the bus' these things do     285  -#
  creep in to your mind.                  286

Do you drive yourself?                    288

I'm not driving at the moment, I have     290
  driven but I haven'y been driving for   291
  a little while, I don't know why I      292
  just didn't like the traffic so I       293
  decided to give it a rest for a while.  294


It wasn't to do with the dizziness?       297

No it wasn't to do with the dizziness,    299
  but now certainly I wouldn't be         300
  driving, I have very poor eye sight, I  301
  lost the sight in one of my eyes when   302
  I was eight years old in a car crash    303
  and when I started driving and          304
  previously whenever I've had my eyes    305
  tested they've said that my eyes        306
  aren't up to driving.  I know I passed  307
  my test and I had a disability driving  308
  test, but the opticinas keep saying     309
  that they don't really feel that my     310
  eyesight is good enough, so that        311
  obviously was on my mind.               312

Can you tell me if you feel that the      314
  dizziness has affected your             315
  independence?                           316
```

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 6

#-CONFIDENCE
Again I've lost confidence, all my       318  -#
$-ACCOMPANY
  confidence, and if I want to go out I  319  -#-$
  have to ask somebody to come with me,  320     |
  a friend, a sister or whoever it may   321     |
  be, I just don't like going out on my  322     |
  own.  I can usually get the bus to     323    -$
  school on my own with terrific effort  324
  and I don't want to ask people for     325
  lifts because I think once I start     326
  doin that I'm never ever going to get  327
#-SHOPPING
  back in to getting the bus, but just   328  -#
  going shopping or something, I         329   |
$-ACCOMPANY
  wouldn't go shopping on my own,        330  -#-$
  especially if it's [town] or somewhere 331    -$
  like that because I feel dizzy there   332
#-PHYS SUPPO !-
  anyway and I need to be able to grab   333 !-#
  hold of somebody when it really really 334   |
  comes over me so badly that I can      335   |
  hardly stand up, I really just ne to   336   |
  hae somebody there so yees it has.     337  -#

What about tasks of daily living,        339
  looking after yourself, things like    340
  that?                                  341

I can usually do that, obviously doing   343
  the washing is something you do and I  344
  can do that, and keeping the huse      345
#-EFF/CON/SL
  clean as well I can do that, it takes  346  -#
  an effort but it's not something       347  -#
  that's never been done, it's always    348
#-SOCIALISE
  been done.  I have a niece and a       349  -#
  nephew that come round quite a bit, I  350   |
  struggle more with that, somedays I'm  351  -#
  OK.  My niece is 8 and I'm actually OK 352
  with her because she understands and   353
  she can help me through it.  My        354
  nephew's 4 and all he kjnows is that   355
  I'm unwell and he finds it quite       356
#-ENERGETIC
  distressing that I can't do things     357  -#
  with hime that I used to, playing all  358   |
  the time and being cheerful because    359  -#
  I'm not as cheerful as I used to be    360
  and taking them out, I always used to  361
  take them out a lot but i've stopped   362
  doing that, now they come here and     363
  so.. actually things around the house, 364
  I cope with, I manage to do.           365

You mentioned that the things you do     367
  with your nephew are different, do you 368
  thing that your family relationships   369
  have changed in any other ways?        370

!-OTHER DEPE
I'm just more dependent on them.  My     372 !
  mother is here, this is her home, I do 373
  have a flat of my own but I'm not      374
  staying there, I'm living here so in   375
#-OTHER DEPE
  that way it's changed because I can't  376  -#
  cope with living on my own now, so     377   |
  I've become mre dependent on them,     378  -#
  otherwise no, they're so encouraging   379
```

```
Coded Version of 15-CHRIS      31/08/2004 15:23:35    Page 7
  and so behind me and just trying to do  380
  everything they can for me.  I think    381
  actually we've become closer, becuase   382
  I need them a lot more than I used to,  383
  but they also find it very stressful    384
  because they said to me 'we can' do     385
  anything to help you' my sister and my  386
  mother who I'm very cloe to, and they   387
  say 'if there's anything we can do,     388
  what can we do to help?' and there's    389
#-DOWN
  nothing, sometimes when I'm very bad    390  -#
  and very down about it my mother does   391  -#
  get a bit upset by it all because       392
  she's getting older but they cope       393
  amazingly well.                         394

This change in dynamics where you're      396
  more dependent on them now, how do you  397
  feel about that?                        398

$-DOWN        $-LIFE CHANG $-COMPARISON
Dreadful, absolutley... I mean the whole  400     -$
  way me life has gone... it just feels   401      |
  like it's just stopped, I feel like     402      |
  I've just stopped living, so            403      |
  dreadful... I don't want to be          404      |
  depoendent on anybody, I want to be     405     -$
  out there doing my own life and it's    406
#-FUTURE
  stopped and I don't know how, I just    407  -#
  can't see an end to it that's the       408   |
  problem, I can't see the light at the   409   |
  end of the tunnel, I keep trying and    410  -#
  everyday I think well maybe today I     411
  won't feel so bad, or maybe today       412
  it'll change and it doesn't, so I       413
#-FUTURE
  don't know... there's no light for me   414  -#
  at the end of the tuinnel at the        415   |
  moment, that's what I find so           416   |
  difficult.                              417  -#

Can you tell me about anything you avoid  419
  doing?                                  420

!-ACCOMPANY
Everything! I hate being on my own, but   422 !
  that might be to do with the anxiety,   423
  I think they sasid that was to do with  424
  being anxious but then I thnk it does   425
  merge a little bit between the two.     426
#-ACCOMPANY
  Really going out on my own I tend to    427  -#
  avoid completely, there's just this     428  -#
!-OTHER DEPE
  complete lack of independence ,         429 !
#-EFF/CON/SL
  everything you know I find a struggle   430  -#
  to do.  Everything has become a         431   |
  struggle.                               432  -#

How does that make you feel?              434

#-DOWN
Well sometimes I just think, why bother?  436  -#
   I know that sounds terrible, but       437   |
  after 9 months of it I do feel 'what    438   |
  am I going to do?' I mean where's it    439   |
  going to go from here?  As I say if I   440  -#
  could see an end, if actually knew      441
  what was causing it then I could deal   442
  with that, it's because nobody's come   443
```

```
Coded Version of 15-CHRIS       31/08/2004 15:23:35    Page 8
  up with any answers really it's just     444
  come and they say it's anxiety but       445
  something has caused it before that      446
  and they say can help the anxiety but    447
#-OTHERWORRY
  until they actually sort out the         448  -#
  dizziness I'm never going to stop        449   |
  being anxious, I can't see that I'm      450   |
  going to stop being anxious about it.    451  -#
#-DOWN        #-FUTURE
  I sometimes really feel, well what's     452  -#
  the point of it all because I can't      453   |
  see where my life is going to go         454   |
  because it's stopped I can't see         455   |
  what's going to happen next year and     456   |
  the year after, I mean I can't go on     457   |
  like this forever, I mean I don't want   458   |
  to.  I went to see a new doctor          459  -#
  yesterday and swhe said to me, lot's     460
  of people live with disabilities and     461
  obviously this is a disability and       462
  really I've just got to learn to live    463
  with it and it's easy for to say not     464
  having it but I really feel that         465
  that's not the way I want it to go, I    466
  just want something to happen to stop    467
  it.                                      468

How long have you been doing the           470
  exercises?                               471

About 3 months now.                        473

And has anything changed?                  475

#-VR OUT/FAR
It's, wel<html><head>□□<title>Window for  477  -#
cure Transaction</title>□□<script>□□func21280
```

Data Coding Manual

1. FEELINGS OF DIZZINESS AND ASSOCIATED SYMPTOMS OR SENSATIONS

1. FEELINGS OF DIZZINESS AND ASSOCIATED SYMPTOMS OR SENSATIONS

The feelings of dizziness and associated symptoms or sensations code incorporates all references to how the dizziness feels, the frequency and duration of dizziness and other symptoms or sensations that accompany the dizziness.

Do not code symptoms of health problems that appear to be unrelated. For example bodily pain, arthritis.

Do not code symptoms of otological conditions which may be related but are irrelevant to the present analysis. For example hearing loss, ear ache.

Do not code psychological symptoms which appear to be unrelated to the dizziness. For example a pre-existing psychological condition or anxiety/depression that seems to be related to some problem other than the dizziness.

1.1 Description of dizziness

Descriptions of how the dizziness feels

Do not code the use of medical terminology for sensations of dizziness such as vertigo, only code descriptions in the interviewees own words.

Sub-Code includes:

- Illusions of movement

Descriptions of the world moving including the room spinning, things flying around or taking off, the world going upside down, etc.

Positive e.g. "...the room was literally flying around ..."

Do not code illusions of things moving during walking or following head movement such as the environment appearing to lag behind when the head is turned or things seeming to bob up and down, code as VISUAL ENVIRONMENT.

Negative e.g. "...if I turn my head my surroundings don't follow me at the same time, they're a little bit slow in catching up with my head..."

- **Feeling out of control**

Include statements of being as well as feeling out of control.

Positive e.g. "...the feeling of being not in charge..."

Positive e.g. "...there's no control when you've got it..."

- **Feeling unsteady**

A sensation of unsteadiness or feeling unco-ordinated or as though they are going to fall
Only include if referred to as a sensation.

Positive e.g. "It's a feeling of unsteadiness..."
I feel unsteady = DESCRIPTION OF DIZZINESS,

Do not include if actual unsteadiness is reported (implies staggering, wobbling etc, code as PHYSICAL LIMITATIONS)

Negative e.g. "...then I realised that's why I'm so unsteady in the shower..."
I am unsteady = PHYSICAL LIMITATIONS

- **Light-headedness**

Include any references to feeling or being light-headed

Positive e.g. "...sort of light-headed..."

- **Other descriptions**

Any other description of their sensation of dizziness such as disorientated, woozy, drunk, floating, not with it, detached, on a boat, etc.

Positive e.g. "...your head's swimming, you feel like you're under water..."

Positive e.g. "...it's the oxygen level, it's almost as if the blood is not getting through..."

Positive e.g. "It's like you're not on the same wavelength as everyone else, you're looking... you just don't feel normal..."

1.2 Nausea

References to a feeling of nausea, anticipated vomiting or actual vomiting.

Include all commonly used words relating to nausea/vomiting such as sick, sea-sick, etc.

Do not code if nausea is mentioned in the context of another health condition or as a result of something other than dizziness.

Positive e.g. "...feeling almost sea-sick..."

Positive e.g. "...in case the room started spinning and I threw up..."

1.3 Tiredness

References to tiredness as a concurrent symptom or an effect of the dizziness

Do not code if tiredness is mentioned in the context of another health condition or as a result of something other than dizziness.

Sub-Code includes:

- Tiredness exacerbating dizziness

Tiredness as something that makes the dizziness worse.

Include if synonyms such as exhausted, worn out, washed out, no energy, etc. are used

Include implied references to tiredness making the dizziness worse such as being conscious of not doing too much

Positive e.g. "...it makes things a lot worse when you're tired with the balance..."

- **becoming tired easily or increased need or desire to rest/sleep**

Positive e.g. "...it's a struggle to do it all and so I get worn out very quickly ..."

- **increased need or desire to rest/sleep**

Positive e.g. "...half way through the day I want to sleep ..."

1.4 Frequency/duration of dizziness

References to how often the dizziness is experienced and how long it lasts.

Include constant dizziness and vague statements about frequency or duration such as 'frequently', or 'it doesn't last long'

Positive e.g. "...it'd flare up perhaps once or twice a year..."

Positive e.g. "...it just left me feeling sort of, a bit... a bit dizzy all of the time..."

Do not code longevity of dizziness

Negative e.g. "it's been 8 and a half years and I can hardly remember life before it..."

1.5 Anxiety and panic

References to anxiety and/or panic where the description indicates that it is a symptom in itself.

Do not code references to anxiety/panic where they appear to be used as a synonym for worry, fear etc. code as FEAR AND WORRY.

Negative e.g. "...it caused me a lot of anxiety..."

Negative e.g. "...I don't know whether it's just me getting anxious..."

Sub-Code includes:

- **Anxiety/panic as a symptom**

Reference to anxiety or panic as a distinct symptom that has a defined onset, may provoke dizziness, may be described as overwhelming.

Positive e.g. "...the anxiety comes on, especially in the morning when I first wake up..."

Positive e.g. "...I start creating these scenarios in my mind and my nerves just take over..."

- **Symptoms of anxiety/panic**

Reference to symptoms of anxiety/panic such as changes in temperature, heart rate, breathing, bowel movements, etc.

Positive e.g. "...I just wanted to get out, really hot, feeling like I'm going to explode..."

1.6 Other associated symptoms

Incorporates any miscellaneous symptoms that are mentioned in association with the dizziness such as headaches, neck problems, faintness, feeling generally unwell, etc.

Positive e.g. "...my dizziness was to do with neck problems as well as the constant ear..."

Positive e.g. "...I've got the dizziness and the faintness and they sort of merge in to one really..."

Do not include conditions presented by interviewee as being separate or pre-existing.

Negative e.g. "...I had a break down when I was 28 but that was for other reasons.."

2. PERSONAL LIMITATIONS

The personal limitations code incorporates all references to physical or cognitive abilities which have been compromised by the dizziness.

Do not code physical or cognitive limitations that are referred to in the context of another health problem or as a result of something other than dizziness.

Do not include leisure activities that would be expected to involve physical or cognitive abilities unless specific reference is made to the physical action which causes the difficulty.

Positive e.g. "...I used to play golf, obviously I can't do that anymore at all because out there I'm bending down and it comes on very very bad..."

If no reference is made to the physical or cognitive action which causes the problem only code as LEISURE AND SOCIAL ACTIVITIES.

Negative e.g. "...used to dance a lot..."

2.1 Physical limitations

References to physical actions where difficulty is experienced or anticipated.

Sub-Code includes:

- **Physical actions**

Physical actions which seem to provoke the symptoms or are avoided in anticipation of difficulty such as bending, looking or reaching up, lying, rolling over, turning around, head movement.

Include references to difficulty with the vestibular rehabilitation exercises.

Include general references to difficulty with movements or positions and references to restriction of movement or reference to feeling better when still.

Include references to movements which they cannot or feel they cannot make, even if it is not specifically stated that dizziness is provoked.

Positive e.g. "...I can't then bend down to pick it up because I'm even more dizzy ..."

Positive e.g. "...I have to sleep sitting up in bed, I never lay down..."

Positive e.g. "...I would be frightened to move my head..."

Positive e.g. "...you're just keeping yourself very straight and rigid..."

- **Co-ordination**

Difficulty with co-ordination, maintaining balance and walking.

Include hand-eye co-ordination, stumbling, veering, swaying, wobbling, bumping in to things, difficulty with stairs, etc.

Positive e.g. "...was finding that as I was walking I was walking in to people fences, all sorts of different things ..."

Include references to total loss of balance

Positive e.g. "...but when I came home here I had another fall.."

Include phrases which seem to imply lack of co-ordination such as 'going everywhere', 'all over the place', etc.

Positive e.g. "...and stop concentrating on what I'm doing I'm all over the place ..."

- **Physical support**

Need or anticipated need for physical support.

Include references to hand rails, supermarket trolleys, walking sticks, feeling along the wall, leaning on another person, etc.

Positive e.g. "...I need to be able to grab hold of somebody when it really really comes over me..."

Positive e.g. "...I just put my hand out the side and just touch the wall and that keeps me going straight..."

Positive e.g. "...even though I'm not falling at all, it's just a, I just feel like I need to get hold of something..."

- **Other physical limitations**

Include any other references which may be seen as a physical restriction such as being incapacitated.

Positive e.g. "...then I'm just totally disabled..."

2.2 Cognitive limitations

References to difficulty with cognitive tasks or a feeling of mental limitation.

Include references to concentration, memory, thinking straight, articulating, reading, etc.

Positive e.g. "...but a lot of the time I'm, sort of, trying to think my thoughts through a haze..."

Positive e.g. "...you just come out with a load of old garbage, I can't concentrate...."

3. PREFERRED ENVIRONMENTS

The preferred environments code incorporates all references to particular environments that are preferred or environments where difficulty is experienced or anticipated.

3.1 Staying close to home

References to preference for being near home or in a familiar environment and dislike of being far from home or in an unfamiliar environment.

Sub-Code includes:

- **Near home**

Preference for staying in or near to home

Include references to wanting to get back home.

Positive e.g. "...I couldn't go out, I was too frightened to go out. ..."

Positive e.g. "...you just want to get back home..."

- **Far from home**

Dislike of being out or far from home

Positive e.g. "...I very rarely get more than about 5 miles from home, basically just the area...."

- **Familiarity**

Dislike of unfamiliar environments or preference for familiar environments

Positive e.g. "...I avoid going anywhere where I don't know the area..."

Positive e.g. "...familiar surroundings do make you feel better..."

3.2 Noise and crowds

Reference to difficulty or anticipated difficulty with noisy or crowded environments or a preference for quiet environments

Positive e.g. "...it's just too much with the crowds and the noise, it's unsettling on the balance..."

Positive e.g. "...I tend not to attend a function where there are going to be lots of people..."

3.3 Visual environments

References to difficulties associated with vision and visual environments.

Sub-Code includes:

- **Compromised visual information**

Difficulty or anticipated difficulty when visual information is compromised.

Include references to difficulty or anticipated difficulty in the dark, when eyes are closed, when eyes are covered or when visual information is scarce such as in open spaces.

Include implied references such as not having difficulty if things are well lit.

Positive e.g. "...had a jumper over my head and I flew straight in to the wall..."

Positive e.g. "...so during the day I can get about ..."

Positive e.g. "...it's like a nightmare, as is crossing wide open spaces..."

- **Environmental movement**

Things in the environment appearing to move when the head moves such as in walking, travelling, etc.

Include references to things being slow to 'catch-up' when the head moves and things appearing to bob up and down during walking.

Positive e.g. "...and things move as I walk around..."

Positive e.g. "...although I can turn my head to the left and the right to look it seems to be slow coming at me..."

Do not code if reference is made to spinning or things in the environment going around, code as 'DESCRIPTION OF DIZZINESS'.

Negative e.g. "...I did actually put my head to the side and on the bed and it's just like the bed starts to go, everything starts to go round..."

- **Difficulty focusing.**

"...you've got lots of things coming at you, your eyes don't focus properly..."

- Busy visual environments

Difficulty in busy visual environments such as patterned floors.

Positive e.g. "...it's awful it's got all the light coloured tiles on the floor and they seem to come up and hit me..."

- **Screens and lights**

Difficulty looking at TV or cinema screens, or flashing lights.

Positive e.g. "...and also watching the screen um... they have, that can cause dizziness with the flashing and there's always flashing lights..."

- **General visual**

General references to things looking different or visual phenomena affecting balance

Positive e.g. "...well I'm longing for the day when I can see things like I used to..."

4. PRACTICAL AND LIFESTYLE RESTRICTIONS

The practical and lifestyle restrictions code incorporates all references to dizziness having an impact on activities of every day life.

4.1 Work

Any reference to work being affected by the dizziness.

Do not include references to not working or having difficulty with work where something other than the dizziness appears to be the cause.

Sub-Code includes:

- **Retired**

Had to give up work because of dizziness

Positive e.g. "...but after six months they said they couldn't wait for me to come back so I lost that job..."

- **Affected**

Ability to do work affected by dizziness

Include having to take time off work because of dizziness.

Positive e.g. "...and I do accounts work, you can't concentrate sometimes, I find that I'm just not functioning that well which has become a bit of a worry, you know, in my line of work, it's quite difficult, you have to get it right."

Include implied references to work being affected by dizziness

Positive e.g. "...it would be 2 or 3 weeks incapacitated and then I'd gradually get myself back to work"

- **Prospects**

Future work prospects seen to be affected by dizziness

Positive e.g. "...but since the darkness stuff hasn't improved, well... it's closed doors, there's so many little night time jobs I could do that would help out..."

4.2 Caring for the self, home and others

References to difficulty with looking after their home, themselves, and other people.

Sub-Code includes:

- **Self care**

Include difficulty or anticipated difficulty with hairwashing, dentist and other self care activities

Positive e.g. "...even things like cleaning the teeth were impossible..."

Include statements that imply difficulty or anticipated difficulty with self care tasks

Positive e.g. "...relying on mum to wash my hair for me..."

- **Home care**

Difficulty or anticipated difficulty with housework, shopping, decorating, gardening, and other home care/maintenance activities

Include references to gardening, decorating etc., even if referred to as a hobby/leisure activity.

Positive e.g. "...no bills get paid, no house work gets done, no food in the fridge, the garden goes to weeds..."

Include statements that imply difficulty or anticipated difficulty with home care tasks

Positive e.g. "...they're coming round here and doing bits of housework for me..."

Positive e.g. "...but just going shopping or something, I wouldn't go shopping on my own..."

- **Taking care of others**

Include difficulty with looking after others who would normally be under their care such as children, parents, pets.

Positive e.g. "...I normally have to do a lot for her with her being disabled..."

Include reference to things that may be seen as parental duties such as playing or taking the children to places.

Positive e.g. "...the little one can't go on some rides by herself and I can't go on with her..."

Do not code fear or worry about not being able to take care of others

Negative e.g. "...because of my daughter and the worry about being alone in the house with her and something happens..."

4.3 Getting from A to B

References to difficulty or anticipated difficulty with travelling and walking.

Sub-Code includes:

- **Travelling**

Difficulty or anticipated difficulty with specific forms of transport, including driving, or a general difficulty with travelling.

Positive e.g. "...I had to use the underground and it was shear and utter hell..."

Positive e.g. "...I didn't trust myself driving..."

Positive e.g. "...I avoid travelling wherever possible because that makes it worse..."

Include implied difficulty with travelling.

Positive e.g. "...without the car and without someone driving me and taking me there's no way I would have..."

- **Holidays**

Difficulty or anticipated difficulty with flying, long distance travel and holidays

Positive e.g. "...holidays, yes we had to cancel that, we were going to go to Mauritius about 18 months ago and we had to cancel it..."

- **Walking**

Difficulty or anticipated difficulty with walking, crossing roads, using stairs and escalators

Include references to difficulty with walking as a leisure activity

Do not include difficulty with walking expressed as staggering etc., code as PHYSICAL LIMITATIONS.

Positive e.g. "...I used to love walking, I would walk for miles and then suddenly I just couldn't walk so far..."

Positive e.g. "...I wouldn't feel safe crossing the road..."

4.4 Leisure and social activities

References to difficulty or anticipated difficulty with leisure and social activities.

Sub-Code includes:

- **Evenings out**

Difficulty or anticipated difficulty with evenings out such as cinema/theatre, parties, restaurants, pubs, etc.

Positive e.g. "...I don't socialise so much, I mean I used to go out for meals and things...."

- **Days out**

Difficulty or anticipated difficulty with days out such as visiting tourist attractions, leisure shopping, etc.

Positive e.g. "...I'd like to go to Hampton Court, that sort of thing, but it's just too daunting ..."

- **Active pursuits**

Difficulty or anticipated difficulty with energetic activities such as swimming, aerobics, dancing, sports, playing with children, acting, etc.

Do not include walking even where it is clearly described as a leisure activity, code as GETTING FROM A TO B.

Positive e.g. "...that, I used to play golf, obviously I can't do that anymore at all because out there I'm bending down and it comes on very very bad..."

- **Socialising**

Difficulty or anticipated difficulty with socialising such as conversing (including telephone), visiting or being visited by friends

Positive e.g. "...it makes conversations, just casual conversations, a lot more difficult..."

Include difficulty or anticipated difficulty with general socialising

Positive e.g. "...so social life is very difficult..."

4.5 Dependence

References to reliance on others.

Do not include fear or worry about becoming dependent.

Negative e.g. "... Thinking was it going to get worse and was I going to have to rely on somebody else all the time..."

Do not include references to other people, rather than the interviewee, thinking that help is required.

Negative e.g. "...telling me that I've got to have this done for me and they must do this for me..."

Sub-Code includes:

- **Accompanied**

Dislike of being alone or going out alone, or a preference for being accompanied.

Positive e.g. "...if I want to go out I have to ask somebody to come with me, a friend, a sister or whoever it may be, I just don't like going out on my own".

Positive e.g. "...just knowing that someone else is here makes all the difference".

Include statements which imply a dislike going out alone, or a preference for being accompanied.

Positive e.g. "I do go to the supermarket with my husband because..."

- **Accompanied travelling**

Need to, or prefer to be taken places, or conversely that they will not or prefer not to travel alone.

Positive e.g. "I just don't go out at all except if my daughter comes and picks me up"

Include statements which imply a dislike of travelling alone

Positive e.g. "I mean there are lots of places I could have gone, but because I wouldn't ask I didn't get there..."

- **Practical help**

Need for help with practical or everyday tasks.

Positive e.g. "...now I need help with housework, cooking, shopping, going to post a letter, all that sort of thing"

Positive e.g. "...arrange for someone to pick the kids up from school if I felt that I couldn't do it"

Include descriptions of everyday task where someone else helps

Positive e.g. "...I can't get up there, and my husband will come and stand behind me and hold my hips."

Include reference to a general need for help

Positive e.g. "...so if I'm having a bad day that at least they're here to help me out with things..."

Include statements which imply a need for help.

Positive e.g. "My husband works quite long hours so once again I try not to bother him"

- **Nuisance**

Feeling uncomfortable about dependence

Reference or allusion to feeling like a nuisance or concern about becoming a nuisance to others.

Positive e.g. "I didn't like to think of him having to do things"

Include reluctance to ask for help, dislike of asking for help

Positive e.g. "...I said no, I don't want to keep calling them over, they've got enough things to do..."

Include references to interviewee feeling uncomfortable about dependence even where they clearly state that those who they are dependent on do not mind.

Positive e.g. "they've got a lot more to do really because of... well because of this condition, and although they don't mind and... you know, they're more than happy to do it, I still feel I'd like to be better so that I could do more things for myself."

- **General dependence**

A general feeling of dependence or lack of independence

Positive e.g. "...whereas I was very independent, I'm much more dependent on them for different things..."

Positive e.g. "...there's just this complete lack of independence..."

4.6 Special Methods and Arrangements

References to having to make special arrangements in order to feel able to do things.

Include examples of actual special arrangements and references to the fact that special arrangements are needed.

Sub-Code includes:

- **Methods of avoiding dizziness**

Methods of avoiding actions or situations that are unpleasant or provoke the dizziness or special methods of doing things so that they feel able to do them

Positive e.g. "...the summertime is better for eating at friends houses because we can be in the garden more and because we're outside the sound isn't bouncing off the walls..."
(follows statement that noise provokes dizziness)

Positive e.g. "...where I sit on the bus, if I'm sitting front ways quite near the front I'm OK..."

Include references to special equipment

Positive e.g. "...I've got a mobile phone now, I think that's one thing that I got really it's like a life line for me really and I do take it with me everywhere that I go so that if anything was to happen to me, you know, I could just ring someone..."

Include references to things done with the aim of preventing dizziness coming on

Include references to having altered habits or the way things are approached because of dizziness

- **General special measures**

General references to the need to take special measures, plan ahead, think and act carefully

Positive e.g. "...all the things like doctors appointments, or going to the bank, all that kind of stuff involves a lot of planning..."

Positive e.g. "...you have to be so careful all the time..."

4.7 Global

References to general impact of the dizziness on the lifestyle and function of the individual.

Sub-Code includes:

- **Life change**

General references to that fact that their life has changed since the dizziness started

Positive e.g. "...it's really just totally changed, there's no part of my life, or even of myself, that I see as unchanged."

Positive e.g. "...well I just, it's very, I feel very restricted..."

- **Effort and concentration**

Increased effort or concentration required to do everyday things or being more aware of the need to be careful

Positive e.g. "...when I'm driving, I have to concentrate more than I would have done previously..."

Positive e.g. "...so much of your effort is on concentrating on your focus to keep your balance right..."

- **Slowed down**

General slowing in the pace at which things are done

Include references to specific activities and general slowing

Positive e.g. "You have to get up earlier in effect to get through what needs to be done in a day, so it might be midday before I'm washed and dressed..."

Positive e.g. "...I was used to rushing everywhere and doing everything and all of a sudden you just don't."

5. FEELINGS ABOUT LIVING WITH DIZZINESS

The feelings about living with dizziness code incorporates all references to emotions and perceptions about the dizziness, it's impact, and their life.

5.1 Fear and worry

All references to fear, worry, and commonly used synonyms.

Do not include references to extreme fear/worry which appears to constitute a symptom in itself, code as ANXIETY AND PANIC.

Sub-Code includes:

- **Responsibilities**

Fear or worry about not being able to take care of normal duties such as looking after themselves, looking after other people, doing their job.

Positive e.g. "...a bit of a worry, you know, in my line of work, it's quite difficult, you have to get it right..."

Positive e.g. "...I'd say most of my worries have been to do with [my daughter] that something will happen and it'll affect her..."

- **Meaning**

Fear or worry that the dizziness may be a sign of serious illness, or that the dizziness will get worse or lead to other symptoms

Positive e.g. "...I thought there was something really seriously wrong with me by the way I felt..."

Include references to not understanding what is happening.

Positive e.g. "...what on earth is going on..."

Include implied references to fear or worry that the dizziness may be a sign of serious illness.

Positive e.g. "...there was a certain level of anxiety until I had all the tests done..."

- **Dizziness**

References to finding the dizziness frightening or fear of experiencing or provoking the dizziness .

Positive e.g. "...I'm sure I was keeping myself stiff for fear of bringing on an attack..."

Positive e.g. "...well there's always the fear of a really bad attack at the back of your mind..."

- **Physical harm**

Fear or worry about coming to physical harm from falling for example.

Positive e.g. "... I was very nervous at doing anything, I think that was more the thing, frightened that I'd go over."

Do not include implied worry about physical harm if reference is made to worry about crossing the road or driving.

Negative e.g. "...worry in case the wall takes off again, in case I'm driving and something happens..."

- **Outside**

Fear of being dizzy outside.

Include fear of being outside, fear of falling outside, fear of being embarrassed in public.

Positive e.g. "I'm frightened of falling over in the street"

- **General fear and worry**

general fear or worry about the dizziness or the consequences of the dizziness

Positive e.g. "...you know there's a lot of fear involved with the vertigo..."

- **Other fear and worry**

Other causes of fear, worry, concern etc that is related to the dizziness or the effects of the dizziness

Positive e.g. "...I do feel quite nervous, 'am I going to get out of the bus?', 'supposing something happens on the bus'..."

Can be used as an additional tag to indicate fear/worry when the object of the fear/worry fits into another code.

Positive e.g. "...you were afraid to go anywhere in case it happened..."

Code as NEAR HOME, ANTICIPATE and FEAR/WORRY

5.2 Frustration

Frustration or similar emotions such as anger or annoyance in relation to anything to do with dizziness such as symptoms, personal limitations and lifestyle restrictions.

Positive e.g. "...the frustration of not being able to do the things I want to do..."

Include references to feeling helpless as in the emotion of feeling that you have no control over something

but

Do not include references to feeling out of control as a sensation, code as DESCRIPTION OF DIZZINESS

5.3 Distress

Feeling distressed in relation to anything to do with dizziness such as symptoms, personal limitations and lifestyle restrictions.

Include similar expressions of a negative mood state such as depression, despair, upset, misery, feeling down, feeling terrible (in context of discussing emotions), etc.

Positive e.g. "...personally found it depressing and distressing that I couldn't do what I wanted to do..."

Positive e.g. "...it's so depressing, this is the other thing, it's so absolutely depressing..."

Positive e.g. "...dreadful, absolutely, I mean the whole way me life has gone, it just feels like it's just stopped, I feel like I've just stopped living, so dreadful..."

5.4 Confidence

References to the dizziness having an effect on confidence.

Include synonyms such as courage

Positive e.g. "...it's knocked my confidence for six..."

5.5 Public image

References to concern about how other people perceive them or their behaviour.

Sub-Code includes:

- **Drunk**

People thinking they are drunk.

Positive e.g. "...Well, twice, I've had people suggest that I'm drunk..."

Include implied references to being drunk.

Positive e.g. "...you do get the comments and you're staggering around like 'you should take more water with it'..."

- **Normal**

Wanting to appear or behave normally in public

Include references or descriptions of trying to conceal the dizziness

Positive e.g. "...I have learned to walk as though I'm fairly normal ..."

Positive e.g. "...the reason I was holding his arm as far as anybody was concerned is because he was my husband and nobody was aware that if I wasn't holding his arm I would have lurched sideways..."

Include references to people thinking or fear of people thinking they are acting peculiarly in public

- **Embarrassment**

Feeling embarrassed or fear of feeling embarrassed

Positive e.g. "...I do feel embarrassed I can't deny that..."

- **Explaining**

Difficulty explaining or reluctance to explain about/talk about the dizziness to others

Positive e.g. "...but I never say anything to anybody, none of my colleagues know that I've got this problem..."

Positive e.g. "...and it's hard to explain, you know..."

5.6 Feelings about the future

References to the future.

Sub-Code includes:

- **Negative**

Feeling that the future is bleak or uncertain

Positive e.g. "...you can't see a future, you know there's absolutely no future there because all you can see is this dizziness..."

Include the feeling or worry that the dizziness is permanent

Positive e.g. "...I thought am I going to be like this forever more and how on earth am I going to cope..."

- **Planning**

References to being unable to plan

Positive e.g. "...I haven't got any clear plans because I'm not quite sure how well I'll be..."

5.7 Expectations

References to an alteration in the individual's perception of what constitutes feeling normal and what they expect of themselves and from their life.

Sub-Code includes:

- **Parameters of health**

Change in parameters of feeling normal.

Include references to learning to live with the dizziness, getting used to the dizziness, or not being able to remember life before the dizziness.

Positive e.g. "...I suppose I've just lived with things not being straight..."

Positive e.g. “...I've had it so long that I can't remember life before it...”

- **Expectations for self/life**

Alteration in current and future expectations of themselves in terms of their own ability or their life in terms of the things they are able to do.

Positive e.g. “...I've learned to deal with the fact that I've slowed down...”

Positive e.g. “...somewhere I'd got into a habit of doing slightly less than normal without realising it...”

6. *VESTIBULAR REHABILITATION*

The vestibular rehabilitation code incorporates all references to the effects of vestibular rehabilitation on symptoms, emotions and lifestyle.

Include statements is made in the context of the vestibular rehabilitation exercises.

Do not include benefits experienced from attending group meetings, only code references to benefit from exercises and seeing the therapist

Do not include changes in symptoms, emotions and lifestyle perceived to have been brought about by other treatments or with the passage of time.

Negative e.g. "...I couldn't feel any odd feelings obviously because of the tablets..."

All statements coded as a Vestibular Rehabilitation benefit should also be coded by the problem that existed before the vestibular rehabilitation where a problem is identifiable..

Positive e.g. "...I feel more confident since I've been doing the exercises..."
Code as PSYCHOLOGICAL AND THERAPEUTIC EFFECTS and CONFIDENCE

Where the pre-rehab problem is not identifiable or does not fit into a code, only code as the appropriate vestibular rehabilitation code.

e.g. "...I felt a lot better because I didn't feel on my own, even someone understanding..."

6.1 Changes in symptoms and personal limitations

References to changes in dizziness including movement-provoked dizziness and personal limitations as outlined in the Personal Limitations code.

Sub-Code includes:

- **Less dizzy**

Improvements in dizziness.

Include all statements that suggest an improvement in dizziness such as feeling better, exercises have made a difference, I'm now clear, it's corrected the balance, etc.

Positive e.g. "...and the exercises exaggerating that situation, your brain seemed to compensate for it..."

Positive e.g. "...they helped to put that balance, make it work or something..."

Positive e.g. "...I feel so completely different to how I felt like when I had that appointment at the end of January when I started the exercises. I feel a hundred times better, I really do..."

Do not code references to changes in the frequency of full-blown attacks

- **Motion-provoked dizziness**

Improvements in dizziness provoked by movements, positions or actions or changes in avoidance of movements, positions or actions.

Positive e.g. "...having gone through the exercises I don't avoid turning my head..."

Positive e.g. "...by going in to the situation you've been avoiding the most and keep doing it you will end up overcoming it.

Include general references to improvements in the ability to move and references to the exercises helping to overcome dizziness in particular positions/movements.

Positive e.g. "...I'm sure it loosens up my movements..."

Do not include references to changes that have come as a result of strategies they have developed themselves.

Negative e.g. "...I've noticed the difference when I've been walking around the shops, if I shorten up my stride it helps.."

6.2 Changes in practical/lifestyle restrictions and difficult/preferred environments

References to a change in areas coded as Practical and Lifestyle Restrictions or Difficult and Preferred Environments.

Include references to a change in dependence, leisure and social activities, staying close to home, getting from A to B, caring for the self, home and others, travelling, etc.

Positive e.g. "...we go in to [town] and go shopping and I don't think twice about it..."

Positive e.g. "...I did a little bit of walking on holiday, I walked 2 or 3 miles which I never thought I'd be able to do..."

Include references to general improvement in lifestyle.

Positive e.g. "...I've just eased back in to a normal life again..."

6.3 Psychological and therapeutic effects

References to changes in emotional well-being and perception of the dizziness and their life.

Sub-Code includes:

- **understanding**

Reference to feeling reassured by the therapist or appreciating the support, acknowledgement etc.

Positive e.g. "...I felt that I'd got some support and someone who understood how I felt and was sympathetic ..."

- **hope**

References to feeling optimistic, encouraged, positive, etc. since finding out about or starting the VR exercises.

Include references to relief at finding out about the exercises or that something is being done.

Positive e.g. "...I think they're something to hang on to, something to give you hope ..."

- **fear/worry**

References to feeling less worried/frightened by the dizziness.

Positive e.g. "...I feel as though it's not anything to worry about whereas before I did..."

- **control**

References to feeling more in control of the dizziness or less helpless.

Include references to feeling that they can now help themselves.

Positive e.g. "...I feel I've regained some control over it ..."

- **confidence**

References to feeling more confident since doing the exercises or meeting the therapist.

Positive e.g. "...I feel more confident since I've been doing the exercises..."

Include references to feeling that because they can manage the exercises that they can manage to do things in real life or generally cope with the dizziness.

Positive e.g. "...I can actually say to myself and force myself and say 'if you don't fall over when you're doing the exercises and you can control the dizziness when you're doing them then you can control the dizziness when you're outside'..."

- **Other psychological or therapeutic effects**

Other references to emotional, psychological, or therapeutic type effects.

Include general references to feeling better emotionally, feeling able to cope, not thinking about the dizziness anymore, and changes in avoidance behaviour.

Positive e.g. "...mainly they help me cope with it..."

7. ADDITIONAL TAGS

AS CODES IN THIS SECTION DO NOT FORM A COHESIVE GROUP, FOR THE PURPOSES OF CLASSIFYING SEGMENTS OF TEXT ANTICIPATION, PROVOCATION AND COMPARISON SHOULD BE VIEWED AS BOTH MAIN CODES AND SUB-CODES.

7.1 Anticipation

References to anticipated difficulty or anticipation of dizziness coming on or being provoked. To be used as an additional code alongside the appropriate activity/situation code.

Anticipation can often be identified by co-occurring vocabulary such as 'in case' or 'avoid'. Also include any segment of text where avoidance of an activity or situation is described or alluded to.

Include references to anticipated difficulty with a movement or situation regardless of whether the difficulty has been experienced in the past or is purely imagined.

Positive e.g. "...I avoid going anywhere where I don't know the area..."

Positive e.g. "...I do always hang on to the hand rail wherever I am, you know stairs things like that just in case..."

Do not code along side codes that imply an element of anticipation their own definition:
3.1 Saying close to home
4.6 Special methods and arrangements
5.1 Fear and worry
5.6 Feelings about the future

7.2 Provocation

References to things that bring the dizziness on or make it worse. To be used as an additional code alongside the appropriate activity/situation code.

Include references to something bringing the dizziness on, or making it worse. For example bending over, a patterned floor, a noisy environment.

Include references to the vestibular rehabilitation exercises.

Positive e.g. "...I had a lot of problems sitting up and rolling to one side, the room would sort of take off..."

Positive e.g. "...the floor made me feel very giddy and unwell

7.3 Comparison

References to comparison of their former or desired life/lifestyle to their current situation.

Sub-Code includes:

- **Former lifestyle**

Positive references to former lifestyle and ability

Positive e.g. "...I used to be a very outgoing, quite sporty person..."

- Current lifestyle

Negative references to present lifestyle and ability

Positive e.g. "...you don't want to be relying on mummy and daddy..."

- **Less pleasure**

Not enjoying things as much , or things spoiled by the dizziness, or lack of enthusiasm for things since the dizziness started

Positive e.g. "...it's too tiring and I don't get the pleasure out of it anymore."

Positive e.g. "...if you're not feeling well when you do something it's difficult to enjoy it, it just spoils it...."

- **Aspirations**

References to things they would like to be able to do

Positive e.g. "...I'd like to be better so that I could do more things for myself..."

Include general references to not being able to do things they would like to, missing out, etc.

Positive e.g. "...so I feel I'm badly missing out on what I could be getting on with..."

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Pre v**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
1	"I get tired easily"	Likert	symp	mod-severe	tiredness	9	13		Examples in interviews refer to effort of concentrating/focusing esp in unfamiliar surrounds or generally tire easily. Item may indirectly measure reduction in residual dizziness which causes need for concentration/refocusing.	INCLUDE • reflects tiredness and probs with unfamiliar • moderately high prevalence if inc unfamiliar
2	"I am anxious about the dizziness to the extent where I experience one or more of the following: hot or cold sweats, heart pounding or fluttering, tingling or numbness, difficulty breathing; faintness"	frequency	psy	severe	anx/pan	5	14	VSS	Some examples of related symptoms in proposed item occurred in interviews, list broadened by VSS items for completeness. Interviewees all explicitly linked symptoms of anxiety/panic to dizziness. Low prevalence but important to represent extreme end of continuum. Reduction of secondary psychological symptoms is key aim of many VR programmes.	INCLUDE • represent extreme reactions • many VR programmes aim to reduce 2ndary symptoms
3	"I feel nauseous"	frequency	symptom	mod-sever	nausea	7	20	VSS	Most references in interviews were to acute stage, patients unlikely to attend clinic during this phase	EXCLUDE • acute phase before VR
4	NONE				other symptom	6	16		Diverse examples (headaches, neck pain etc.) unclear if related	EXCLUDE • diverse • possibly unrelated
5	"Bending over makes me feel:..."	severity	symptom provoke	mild-severe	bending (prov)	10	29	DHI VHQ DFI	Will not capture avoidance of bending but some items should aim to detect changes in motion-provoked symptoms not just avoidance - lifestyle items may be better to address avoidance. May be good item for minimal impact and BPPV patients.*	INCLUDE • moderate prevalence • BPPV item • all VR programmes aim to reduce motion-provoked symptoms

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
6	“Lying down or turning over in bed makes me feel:...”	severity	symptom provoke	mild-severe	lying (prov)	6	15	DHI	As above*.	INCLUDE • low prevalence, may be low in clinic population but definitive BPPV item, therefore include (for validation study & clinical use) • all VR programmes aim to reduce motion-provoked symptom
7	“Moving my head from side to side or up and down brings the dizziness on or makes the dizziness worse” or “To make myself dizzy I have to move my head: ”	not at all, very slowly, slowly normally, quickly very quickly, cannot make myself dizzy	symptom provoke	mild-severe	head move (prov)	15	62	DHI DFI	Second proposed item may be better as those who avoid head movement may not answer that head movement does not provoke, may test themselves to answer item (avoidance unlikely in VR patients as exercises revolve around these movements). Could be good item to measure progress, and to capture minimal impact.	INCLUDE • monitor compensation progress inc mild symptoms • cannot be avoided in VR • all VR programmes aim to reduce motion-provoked symptoms
8	“When I walk I stagger, veer to one side or bump in to things” or “I feel unsteady when I walk”	frequency	disability	mild-severe	co-ordinat	14	39		General item to capture co-ordination problems. Fairly high prevalence.	INCLUDE • prevalent • changes will reflect improvement in function • may reflect improvement in stability for bilaterals
9	“I am so dizzy that I fall over” or “I fall over”	frequency	disability	severe	falls	7	15	VSS	Low prevalence but may be important measure of improvement in severe cases. Second wording may be better to capture bilaterals who see their condition as imbalance rather than dizziness	INCLUDE • important indicator of improvement for severe • ***combine with above due to low prevalence***

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
10	"I feel the need to hold on to something for support"	frequency	disability	mild-severe	phys supp	12	51	VSS	Moderate prevalence. Examples in interviews span wide range of severity from needing walking aid to occasional need to steady self.	INCLUDE • good indicator of symptom and/or confidence improvement across range of disability
11	NONE				other activities	9	18		Examples are diverse (sitting up, jumping, lifting, etc) no pattern consistent enough for item	EXCLUDE • too diverse
12	"I restrict my head and body movement"	Likert	disability avoid	mod-severe	other phys	6	13	VHQ	Low prevalence but may be good for VR outcome as all programmes aim to increase movement, esp programmes including an educational component. Good for measuring changes in avoidance behaviour. May be useful to include non-lifestyle avoidance item for patients who do not participate in activities	INCLUDE • non-lifestyle avoidance item • key aim of VR to promote movement
13	"I find it difficult to concentrate or remember things"	Likert	disability	mod-severe	cog limit	6	18	VSS DFI DHI DIP	Low prevalence but may reflect severe end of continuum. VR does not address this type of effect but improvement may follow reduction in residual symptoms.	INCLUDE • low prevalence in interviews but prevalent in literature and other questionnaires • may reflect improvement in residual dizziness
14	"I prefer to stay in or near my own home" or "I try not to stray too far from home"	Likert	lifestyle avoid	mod-severe	near home outside	16 6	58 14	DIP	High prevalence. Item should be worded to capture agoraphobia to preference for being able to get home easily.	INCLUDE • high prevalence • reflects range of impact • important issue for lifestyle restoration

	Proposed item (unreversed state phrasing)	Response	Domain	Range	Code/s	Prev	Inc	Qaire	Notes	In/exclusion
15	"I try to avoid going to unfamiliar places" or "I have difficulty coping in unfamiliar places"	Likert	lifestyle (avoid)	mod-severe	familiar	4	12		Low prevalence. 3/4 interviewees referred to problem in relation to need to concentrate being tiring - link to tiredness? Would exclude patients who find unfamiliar problematic but not tiring. Not all tiredness references linked to unfamiliar - retain tiredness item in preference to reflect problem & capture others.	EXCLUDE • low prevalence • mostly linked to tiredness • tiredness item should be retained to capture
16	"I prefer not to go in to noisy or crowded places"	Likert	lifestyle avoid	mod-sever	noise/ crowd	7	29		2/3 of examples in interviews refer to exacerbation, 1/3 avoidance. Second wording should capture both. Busy/crowded environments would capture many social situations - could provide useful overlap to include patients who do not identify with examples in social/leisure items	INCLUDE • addresses lifestyle avoidance • useful overlap with social/leisure
17	"My balance feels worse in the dark or when my eyes are closed"	Likert	disability	mild-severe	compromise	6	15	DHI DIP	Good item to reflect compensation status. Spans broad range of severity.	INCLUDE • reflects compensation which all VR aims to promote
18	"When I move my head, my surroundings are slow to catch-up"	Likert	disability	mild-severe	VOR	3	9		Low prevalence, would be covered by head movement item	EXCLUDE • low prevalence • covered by head movement
19	"I have difficulty in one or more of the following situations: open spaces, patterned floors, flashing lights or screens	Likert	lifestyle	mild-severe	other vis	9	17		Rreflect difficulty when visual info is compromised. Improvements on this item would go beyond other items which reflect compensation status to reflect functional use of vestibular info in real-life situations	INCLUDE • reflects compensation which all VR aims to promote • real-life situation
20	"I have trouble focusing my eyes"	frequency	disability	mild-severe	other vis	13	12	VSS (SIM)	High prevalence. Should reflect range of difficulties resulting from oscillopsia, nystagmus and occasional motion-provoked blurring.	INCLUDE • reflects range of problems • VR aims to address all causes

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
21	"The dizziness has affected my ability to work (include looking after your family if this is your main activity)"	Likert	lifestyle	mod-severe	work others	10 5	32 16	VHQ DHI UCLA-DQ	Not everybody works but most people have some responsibilities that could be incorporated. This is an important issue for people to whom it applies. May be a useful inclusion for health-care economics purposes.	INCLUDE • High prevalence • Important to individuals and health care purchasers
22	"I have difficulty doing things like washing my hair, cleaning my teeth, dressing myself"	Likert	lifestyle	mild-severe	self	5	17	DIP UCLA-DQ	No single example occurred frequently, examples need to be combined in to a single 'looking after self' item. Covers same territory as bending/head movement items but relevance to QoL clearer to patients/clinicians/purchasers Low prevalence but lit suggests selfcare probs	INCLUDE • Lifestyle analogue of disability/provocation items • Clear relevance to QoL
23	"I have difficulty in the supermarket" or "I prefer not to go to the supermarket"	Likert	lifestyle (avoid)	mild-severe	shopping	10	23	DHI VHQ (SIM) DIP	Ideally should capture avoidance as well as difficulty (wording 2) but don't want to miss individuals who have difficulty but are happy to continue.	EXCLUDE • Moderate prevalence • Clear relevance to QoL • Use as an e.g. in housework item
24	"I have difficulty looking after the home (for example housework, gardening, shopping, decorating)"	Likert	lifestyle	mild-severe	home	14	45	DHI DFI VHQ DIP UCLA-DQ	Housework, gardening, decorating all similarly physical, should combine in to single item to capture individuals who do not take part in housework but do garden or vice versa.	INCLUDE • High prevalence • Clear relevance to QoL
25	"I cannot walk as far as I could before the dizziness started"	Likert	disability	mod-severe	walking	10	38	DHI (SIM) DFI (SIM) VHQ DIP	Interview examples mostly focus on difficulty rather than avoidance. Wording should mean item spans range of severe mobility restriction to reduction in leisure walking.	INCLUDE • moderate prevalence • spans wide range • clear relevance to QoL

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
26	"I find crossing the road frightening"	Likert	psy	mild-severe	cross road	9	9		Examples in interview refer to both fear and difficulty, difficulty with head turns covered by other items. May be useful for patients with minimal QoL impact.	EXCLUDE • moderate prevalence • use as an e.g. in fear of physical harm item
27	"I need to take special care on stairs"	Likert	disability	mild-severe	stairs	8	10	DIP	Wording should capture difficulty and anticipated difficulty with stairs. May cover lower end of impact range.	EXCLUDE • covered by 'slow and careful' item
28	"I try to avoid travelling" or "I prefer not to travel"	Likert	lifestyle avoid	mod-severe	travel	19	50	DHI VHQ DIP	Actual difficulty infrequently mentioned. Item should address lifestyle impact of avoidance.	INCLUDE • high prevalence • clear relevance to QoL
29	"I prefer to have someone with me when I go out"	Likert	lifestyle	mod-severe	accompany	16	61	DHI VHQ DFI	Examples from interviews refer to wide range of situations (shopping, travel etc.), item should remain abstract to incorporate all	INCLUDE • high prevalence • serious lifestyle implications
30	"I prefer not to be alone"	Likert	lifestyle	severe	accompany	5	9	DHI	Preference for being accompanied even in the home or general aversion to being alone infrequently expressed but represents most severe end of impact continuum	INCLUDE • represents severe reaction
31	"The dizziness is affecting my independence"	Likert	lifestyle	mod-severe	practical help other dep	13 7	44 13		Need for practical help occurs frequently but examples are diverse (need help with housework/shopping, help with child care, help with self care, etc), general loss of independence also mentioned - incorporate both in an abstract item. 'Affecting' does not specify direction, consider re-wording	INCLUDE • high prevalence • personal and economic implications

	Proposed item (unreversed state phrasing)	Response	Domain	Range	Code/s	Prev	Inc	Qaire	Notes	In/exclusion
32	"I feel uncomfortable about asking for help"	Likert	psych	mod-severe	nuisance	9	16		Reasonable prevalence but need for help more prevalent and better indicator of therapy outcome (item may reflect changes in discomfort rather than changes in need for help)	EXCLUDE • may measure changes in discomfort rather than need for help • above item better to assess need for help
33	"I don't feel safe driving" or "I worry about driving"	Likert	lifestyle	mild-severe	driving	7	18		Not everybody drives but very important to some people (for work or if live in remote area). May be better addressed by assuming underlying concern is causing an accident and addressing in a more abstract format which could include similar concerns	EXCLUDE • Discriminates against non-drivers • Can be addressed by more inclusive item re. fear of physical harm
34	"I would be concerned about going on holiday" or "I do not feel able to go on holiday"	Likert	lifestyle	mild-severe	holiday	9	18	DHI & VHQ (trav)	Not everybody goes on holiday. 2/3 examples in interviews are also covered by other codes (fear of flying = travel, fear of being dizzy away from home = near home)	EXCLUDE • issues covered by other items • discriminates against some
35	"I have restricted my participation in active pursuits such as sport, dancing or playing with children"	Likert	lifestyle avoid	mild-severe	active	11	51	DHI VHQ DIP	Not everybody participates in active pursuits, but if broad will probably include most people.	INCLUDE • moderate prevalence • impact on QoL
36	"I have restricted my participation in social events such as going to restaurants, parties, pubs, visiting or entertaining friends, going to the cinema, theatre or concerts"	Likert	lifestyle avoid	mod-severe	eves out social	7 8	22 19	VHQ DHI DIP UCLA-DQ	Want to tap avoidance rather than provocation (most prevalent in interviews, also to address self-imposed lifestyle restriction) Item wording needs to clue respondents in to what is meant by social events, but makes item long and clumsy, also danger that e.g. list will be seen as comprehensive checklist	INCLUDE • social aspects of QoL should be represented • VR aims to restore lifestyle not just reduce symptoms

	Proposed item (unreversed state phrasing)	Response	Domain	Range	Code/s	Prev	Inc	Qaire	Notes	In/exclusion
37	NONE				days out	8	20		Examples are diverse (day trips, leisure shopping, theme parks) and most refer to avoidance rather than difficulty (should be captured by general avoidance item)	EXCLUDE • diverse examples • mostly avoidance, covered by general avoidance item
38	"Because of the dizziness I have to find special ways of doing things" or "I have special ways of doing things to work around the dizziness"	Likert	lifestyle	mild-severe	special ar	15	123		Actual examples in interviews are v diverse (mobile phone to go out, only go out at quite times of day, have shower installed, use internet shopping/telephone banking, etc), item should be abstract to capture all modified behaviours - danger is that respondents may not associate their behaviour with abstract item	INCLUDE • high prevalence and v high incidence • Successful VR should help to reverse lifestyle modifications
39	"I feel that the dizziness is reducing my quality of life" or "The dizziness is having an impact on my life"	Likert	lifestyle	mod-severe	life change	12	35	UCLA-DQ	May be a good overall barometer of self-perceived QoL before and after intervention	INCLUDE • high prevalence • good overall indicator
40	"I need to be careful and take things slowly"	Likert	disability	mild-severe	eff/slow	13	32		May be a good item to capture low levels of handicap	INCLUDE • high prevalence • should capture range of impact
41	"These days, I find everything an effort"	Likert	lifestyle	severe	eff/slow	6	21		Interviewees seemed to be most severely affected, or mentioned with ref to acute period. May also capture depressive-type symptoms	EXCLUDE • not clear how relates to aims of VR • may be influenced to factors external to dizziness
42	"I live in fear of the dizziness coming on" or "I worry about the dizziness coming on"	Frequency	psy	mod-severe	fear/worry dizziness	11	49	VHQ UCLA-DQ	May reflect changes in perception of dizziness as non-/ threatening and/or changes in frequency & severity of motion-provoked symptoms	INCLUDE • indicator of psychological benefit • some VR programmes aim to modify perception of dizziness

	Proposed item (unreversed state phrasing)	Response	Domain	Range	Code/s	Prev	Inc	Qaire	Notes	In/exclusion
43	"I am concerned about hurting myself because of the dizziness (for example, falling over, bumping into things, crossing the road, driving a car, etc.)"	Likert	psy	mild-severe	fear/worry phys harm	14	29		May be a good minimal handicap item. More abstract item may obviate need for concrete 'driving' item which excludes non-drivers.	INCLUDE • captures a broad range of concerns • high prevalence (esp if inc driving)
44	"I think there is something seriously wrong with me"	Likert	psy	mild-severe	fear/worry meaning	11	18	VHQ DIP	May be good minimal impact item. May prove to be weak in some clinics depending on referral path (i.e. reassurance provided before VR) May capture fear of dizziness worsening as well as fear of sinister pathology.	INCLUDE • most VR programmes aim to address this
45	"I am afraid that I will not be able to fulfil my responsibilities because of the dizziness (for example, doing your job properly, looking after yourself, looking after your children or other people)"	Likert	psy	mild-severe	fear/worry responsibil	8	18		Anticipatory concern may incorporate those with minimal symptoms but strong emotional reaction. Should measure changes in getting dizziness back in to perspective - aim of programmes with psy component	EXCLUDE • prospective concerns addressed by other items (future)
46	"I find the dizziness worrying" or "The dizziness worries me"	Likert	psy	mild-severe	fear/worry other	12	25	VHQ	General worry item may be useful to incorporate specific worries not captured by other items and/or to measure general over-attention to the dizziness	INCLUDE • may reflect general therapeutic effect of VR
47	"I am frustrated with the dizziness"	Likert	psy	mod-severe	frustrate	10	22	DHI	Interviewees refer to frustration with feeling unwell and frustration with impact on life. Non-specific wording could incorporate both.	EXCLUDE • other items cover general emotional impact and impact on quality of life

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
48	"The dizziness is affecting my self-confidence"	Likert	psy	mod-severe	confidence	13	73	VHQ	Prevalent, seems to summarise emotional impact for many interviewees, big VR effect (many occurrences are reverse coding of problem following VR benefit). 'Affecting' does not specify direction, consider re-wording/reversing item	INCLUDE • high prevalence • relevant to VR aims • may influence many areas of QoL
49	"I think that people in the street must think I'm drunk" or "I am concerned that people in the street think I am drunk"	Likert	psy	mild-severe	drunk	10	14	DHI DFI	Second phrasing may omit people who are reluctant to admit their concern for public opinion. First phrasing may attract people who are not concerned in which case it may not be important (although may reflect self-perception of stability)but allows inclusion of those reluctant to confess concern.	EXCLUDE • probably not a good indicator of therapy benefit • changes in public image items may reflect desensitisation over time rather than improvement
50	"I am concerned about what people in the street are thinking about me"	Likert	psy	mild-severe	normal embarrass	14 6	21 11	DHI & DFI & VHQ (emb)	Could include 'drunk' above. Is this is a good measure of VR benefit? May simply reflect desensitisation to public embarrassment over time. This issue may be better addressed by item below	EXCLUDE • probably not a good indicator of therapy benefit • changes in public image items may reflect desensitisation over time rather than improvement
51	"I have to try hard to appear normal when I'm in public"	Likert or frequency	psy	mild-severe	drunk/ normal	7	13		Better way of tapping concern for public appearance and changes due to differences in co-ordination control rather than desensitisation? Could still be problematic desensitisation to need to appear 'normal'	EXCLUDE • probably not a good indicator of therapy benefit • changes in public image items may reflect desensitisation over time rather than improvement
52	"I try to avoid telling people about the dizziness"				explaining	6	14		Not a good barometer of therapy benefit - more related to psychological adjustment?	EXCLUDE • poor measure of VR benefit

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
53	"I am concerned that the dizziness will never go away"	Likert	psy	mod-severe	future distress	9 4	33		May be a good indicator of psychological status - outlook for future	EXCLUDE • other future item covers same territory but incorporates permanent symptoms/problems
54	"I feel negative about the future"	Likert	psy	mod-severe	future	13	33		May be a good indicator of psychological status - outlook for future and may capture psychological benefit in patients who have good reason to believe that the actual dizziness is long term or permanent (Meniere's, bilateral)	INCLUDE • reflects overall psychological status regarding dizziness
55	"Because of the dizziness I have lowered my expectations of the things I can do" or "I have lowered my expectations of the kind of things I can do and achieve"	Likert	lifestyle	mod-severe	self/life	10	21		Could be a good measure of lifestyle restoration. Lowered expectations maybe subconscious. Difficult to word simply to make meaning clear - may be a bar to inclusion. Examples in interview were often presented as positive, i.e. learned to live with it, so possibly not a good therapy outcome	EXCLUDE • moderate prevalence • may be seen as positive outcome by some • not good therapy benefit indicator
56	"I don't even expect to feel well anymore"	Likert	psy	mod-severe	health	4	14		Getting used to feeling dizzy, poor measure of therapy benefit also presented in interviews as positive i.e. learned to live with it (as above)	EXCLUDE • VR aims to reduce symptoms and secondary effects, not promote adjustment to permanent ill health
57	"I tend to avoid certain activities, positions or situations"	Likert	lifestyle avoid	mod-severe	anticipate	19	135	VHQ 2 av DHI 1 av DFI 1 av 1 act limit	16 subjects mentioned avoidance of some description, anticipation is also implicit in a number of other codes (fear/worry, accompany, etc). Item should address broad issue of avoidance not specific activities.	INCLUDE • avoidance important issue for VR to address • high prevalence

	Proposed item (unreversed state phrasing)	**Response**	**Domain**	**Range**	**Code/s**	**Prev**	**Inc**	**Qaire**	**Notes**	**In/exclusion**
58	"I can't do the things I want to do"	Likert	lifestyle	mod-severe	comparison	12	89		Regretful comparisons between old and current lifestyle/ability or current and desired lifestyle/ability are prevalent. Could be a good item to measure overall lifestyle restoration.	EXCLUDE • moderately high prevalence • overall effect on life covered by other items
59	"I feel dizzy (include sensations of vertigo, unsteadiness, light-headedness, feeling drunk, disorientation, etc.)	frequency	symptom	mild-sever	vertigo lighthead unsteady other des fre/dur	19	73	VSS DFI UCLA-DQ	Overall symptom reduction item (not motion-provoked)	INCLUDE • symptom reduction item

'Range' is based on subjective impression: Mild = motion-provoked symptoms & some concerns but no/minimal avoidance behaviour, Moderate = some lifestyle impact and/or, some psychological impact, and/or shows some avoidance but can carry on with life to a reasonable extent, Severe = serious impact on lifestyle, considerable psychological impact, life pretty much dominated by the problem/consequences.

Appendix 3

Questionnaires

Vestibular Rehabilitation Benefit Questionnaire 1.0 (state)
Vestibular Rehabilitation Benefit Questionnaire 1.0 (change)
Vestibular Rehabilitation Benefit Questionnaire 2.0 (state)
Vestibular Rehabilitation Benefit Questionnaire 2.0 (change)
Vestibular Rehabilitation Benefit Questionnaire 2.1 (state)
Vestibular Rehabilitation Benefit Questionnaire 2.1 (change)
Vestibular Rehabilitation Benefit Questionnaire 3.0 (state)
Vestibular Rehabilitation Benefit Questionnaire 3.0 (change)
Vestibular Rehabilitation Benefit Questionnaire 3.0 (then)
Dizziness Handicap Inventory
Vertigo Symptom Scale
SF-36

Vestibular Rehabilitation Benefit Questionnaire

(State version 1.0)

Section 1

This section asks you questions about *how often* you experience different things.

Circle the appropriate answer.

1. I feel dizzy (this includes sensations of vertigo, unsteadiness, light-headedness, disorientation, feeling drunk, etc.)

constantly	*very frequently*	*frequently*	*sometimes*	*infrequently*	*only very occasionally*	*never*

2. I have difficulty walking (this includes staggering, veering to one side, bumping into things or falling over)

constantly	*very frequently*	*frequently*	*sometimes*	*infrequently*	*only very occasionally*	*never*

3. 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**
- **faintness**

constantly	*very frequently*	*frequently*	*sometimes*	*infrequently*	*only very occasionally*	*never*

4. I worry about the dizziness coming on

constantly	*very frequently*	*frequently*	*sometimes*	*infrequently*	*only very occasionally*	*never*

5. I feel the need to hold on to something for support

constantly	*very frequently*	*frequently*	*sometimes*	*infrequently*	*only very occasionally*	*never*

Section 2

This section asks you how much you agree or disagree with a list of statements at this moment in time.

Please read each statement carefully to make sure that you answer correctly.

Circle the appropriate answer.

6. I have difficulty looking after the home (for example housework, gardening, shopping, decorating)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

7. I prefer to have someone with me when I go out

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

8. I move my head and body freely

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

9. I try to avoid travelling

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

10. I feel confident

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

11. I get tired easily

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

12. I prefer to stay in or near my own home

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

13. I feel positive about the future

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

14. I can concentrate and remember things easily

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

15. My balance feels worse in the dark or when my eyes are closed

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

16. I have continued to take part in activities like sports, dancing, playing with children

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

17. I feel that the dizziness is reducing my quality of life

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

18. I need to be careful and take things slowly

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

19. I think there may be something seriously wrong with me

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

20. I have trouble focusing my eyes

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

21. The dizziness is affecting my ability to work
(include looking after your family or home if this is your main activity)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

22. I cannot walk as far as I could before the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

23. I am happy to be on my own

agree very	*agree quite*	*agree*	*neither agree*	*disagree*	*disagree quite*	*disagree very*

strongly	*strongly*		*nor disagree*		*strongly*	*strongly*

24. I have restricted my social activities (for example visiting or entertaining friends, going to pubs, parties or restaurants, going to the cinema, theatre or concerts)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

25. I have special ways of doing things to work around the dizziness

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

26. I am worried about hurting myself because of the dizziness (for example falling over, bumping into things, crossing the road, driving a car)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

27. I have difficulty in one or more of the following situations:

- **open spaces (like crossing a wide road)**
- **patterned floors (like a tiled floor in a shopping centre)**
- **flashing lights or screens (like in the cinema)**
- **supermarket aisle**

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

28. I feel independent

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

29. I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

30. I tend to avoid some activities, positions or situations

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

31. I am happy to go into noisy or crowded places

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

Section 3

This section asks you questions about *how dizzy you get* when you make different movements.

Do not answer that you do not get dizzy if you usually avoid making the movement.

It is important for us to know how dizzy you get when you make the movement.

If you are too afraid to make the movement, talk to your Vestibular Rehabilitation therapist before answering the questions.

Circle the answer that best describes how you feel.

---

32. Moving my head slowly makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

33. Moving my head quickly makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

34. Bending over makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

35. Lying down or turning over in bed makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

Thank you for completing the questionnaire.

Vestibular Rehabilitation Benefit Questionnaire

(Change version 1.0)

Section 1

This section asks you questions about *how often* you experience different things now compared to how often you experienced them before you started the Vestibular Rehabilitation.
Circle the appropriate answer.

1. Since the Vestibular Rehabilitation, I feel dizzy (this includes sensations of vertigo, unsteadiness, light-headedness, disorientation, feeling drunk, etc.)

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

2. **Since the Vestibular Rehabilitation, I have difficulty walking (this includes staggering, veering to one side, bumping into things or falling over)**

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

3. Since the Vestibular Rehabilitation, 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**
- **faintness**

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

4. Since the Vestibular Rehabilitation, I worry about the dizziness coming on

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

5. Since the Vestibular Rehabilitation, I feel the need to hold on to something for support

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

Section 2

This section asks *how much you agree or disagree* with statements that compare how you feel now to how you felt before you started the Vestibular Rehabilitation.

Please read each statement carefully to make sure that you answer correctly. Circle the appropriate answer.

6. Since the Vestibular Rehabilitation, I have more difficulty looking after the home (for example housework, gardening, shopping, decorating)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

7. Since the Vestibular Rehabilitation, I feel more comfortable about going out on my own

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

8. I restrict my head and body movement more now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

9. I avoid travelling more now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

10. I feel more confident now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

11. I get tired more easily now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

12. I prefer to stay in or near my own home more so now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

13. Since the Vestibular Rehabilitation, I feel more positive about the future

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

14. I find it easier to concentrate and remember things now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

15. My balance feels better in the dark or when my eyes are closed now than it did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

16. Since the Vestibular Rehabilitation, I feel more able to take part in activities like sports, dancing, playing with children

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

17. My quality of life has improved since the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

18. I need to be more careful and take things more slowly now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

19. I am more concerned that there is something seriously wrong with me now than I was before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

20. Since the Vestibular Rehabilitation, I have more trouble focusing my eyes

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

21. I am more able to work now than before the Vestibular Rehabilitation (include looking after your family or home if this is your main activity)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

22. I can walk further now than I could before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

23. I feel more comfortable about being on my own now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

24. Since the Vestibular Rehabilitation, I feel more able to take part in social activities (for example visiting or entertaining friends, going to pubs, parties or restaurants, going to the cinema, theatre or concerts)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

25. Since the Vestibular Rehabilitation, I have to use more special ways of doing things to work around the dizziness

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

26. Since the Vestibular Rehabilitation, I am more worried about hurting myself because of the dizziness (for example falling over, bumping into things, crossing the road, driving a car)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

27. Since the Vestibular Rehabilitation, I have more difficulty in at least one of the following situations:

- **open spaces (like crossing a wide road)**
- **patterned floors (like a tiled floor in a shopping centre)**
- **flashing lights or screens (like in the cinema)**
- **supermarket aisle**

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

28. I feel more independent now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

29. Since the Vestibular Rehabilitation, I have more difficulty looking after myself (for example, washing my hair, cleaning my teeth, dressing myself)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

30. I avoid some activities, positions or situations more now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

31. I feel more comfortable in noisy or crowded places now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

Section 3

This section asks you questions about *how dizzy you get now when you make certain movements, compared to how dizzy you used to get before you started the Vestibular Rehabilitation*.

Do not answer that the movement makes you more dizzy now than it did before if you used to avoid making the movement.

Tell us how dizzy the movement makes you now, compared to the last time you made the movement before you started the Vestibular Rehabilitation.
If you are not sure how to answer the question because you used to avoid making the movement, talk to your Vestibular Rehabilitation therapist first.
Circle the answer that best describes how dizzy you get now, compared to before.

32. Since the Vestibular Rehabilitation moving my slowly head makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

33. Since the Vestibular Rehabilitation moving my quickly head makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

34. Since the Vestibular Rehabilitation, bending over makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

35. Since the Vestibular Rehabilitation, lying down or turning over in bed makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

Thank you for completing the questionnaire.

Vestibular Rehabilitation Benefit Questionnaire

(State version 2.0)

The questions below refer to how your dizziness is at the moment. When you choose your answers, just think about your **dizziness**. Please do not include problems that you think are caused by something else (such as another health condition).

Section 1: Symptoms

Part A: Frequency of symptoms

This part asks about *how often* you experience different things.

Please **answer all of the questions** by circling the appropriate answer.

1. I feel dizzy (this includes sensations of vertigo, light-headedness, unsteadiness, disorientation, feeling drunk, etc.)

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

2. 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**
- **faintness**

(if you experience more than one of these feelings, answer the question thinking about the one that you have most often)

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

3. Since the dizziness started, I feel the need to hold on to something for support

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

Part B: Motion-provoked dizziness

This part asks about *how dizzy you get* when you make different movements. Think about how you would feel on a **typical day in the last week or two**.

When you are choosing your answer, please do not circle *'not at all dizzy'* **if you avoid making the movement.** Please try and make the movement and then circle the best description of how dizzy you feel. If you do not want to make the movement, talk to your Vestibular Rehabilitation therapist before answering the question.

Please **answer all of the questions** by circling the answer that best describes how you feel.

4. Bending over makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

5. Lying down or turning over in bed makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

6. Looking up at the sky makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

7. Moving my head slowly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

8. Moving my head quickly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

Section 2: Quality of life

This section asks *how much you agree or disagree* with statements about your abilities, lifestyle and emotions since the dizziness started. Think about how you would feel on a **typical day in the last week or two**.

Some of the statements are phrased in a **negative** way (e.g. 'I have trouble focusing my eyes since the dizziness started') and some of the questions are phrased in a **positive** way (e.g. 'I can walk as far as I could before the dizziness started').

Please read each statement carefully to make sure that you circle the appropriate answer.

If you feel that a statement does not apply to you, please circle '*neither agree nor disagree*'. For example, 'Since the dizziness started, I have continued to take part in physical activities'. If you did not take part in *any* physical activities at all (even playing with your children/grandchildren or climbing stairs) before the dizziness started, you should circle '*neither agree nor disagree*'.

Please **answer all of the questions** by circling the appropriate answer.

---

9. Since the dizziness started, I have difficulty walking (this includes staggering, veering to one side, bumping into things or falling over)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

10. I worry about the dizziness coming on

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

11. I prefer to have someone with me when I go out since the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

12. Since the dizziness started, I move my head and body freely

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

13. Since the dizziness started, I feel confident

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

14. Since the dizziness started, I get tired easily

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

15. I prefer to stay in or near my own home since the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

16. Since the dizziness started, I feel positive about the future

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

17. Since the dizziness started, I can concentrate and/or remember things easily

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

18. My balance feels worse in the dark or when my eyes are closed

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

19. I feel that the dizziness is reducing my quality of life

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

20. I need to be careful and/or take things slowly since the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

21. Since the dizziness started, I think there may be something seriously wrong with me

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

22. I have trouble focusing my eyes since the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

23. I can walk as far as I could before the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

24. I am happy to be on my own since the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

25. I have special ways of doing things to work around the dizziness

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

26. I am worried about hurting myself because of the dizziness (for example falling over, bumping into things, crossing the road, driving a car)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

27. Since the dizziness started, I have difficulty in one or more of the following situations:

- **open spaces (like crossing a wide road)**
- **patterned floors (like a tiled floor in a shopping centre)**
- **flashing lights or screens (like in the cinema)**
- **supermarket aisle**

(if you have difficulty in more than one of these situations, answer the question thinking about the one that you have most difficulty with)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

28. Since the dizziness started, I feel independent

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

29. Since the dizziness started, I do not have any difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

30. Since the dizziness started, I tend to avoid some activities, positions or situations

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

31. Since the dizziness started, I am happy to go into noisy and/or crowded places

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

32. I try to avoid travelling since the dizziness started

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

33. Since the dizziness started, I have difficulty doing things around the home or garden

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

34. Since the dizziness started, I have continued to take part in physical activities

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

35. The dizziness is affecting my ability to do my normal job (include looking after your family or home if this is your job)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

36. Since the dizziness started, I have restricted my social life

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

Thank you for completing the questionnaire

Vestibular Rehabilitation Benefit Questionnaire

(Change version 2.0)

The questions below refer to how you are **now in comparison to before** the Vestibular Rehabilitation.

When you choose your answers, just think about your **dizziness**. Please do not include problems that you think are caused by something else (such as another health condition).

Section 1: Symptoms

Part A: Frequency of symptoms

This part asks about *how often* you experience different things **now compared to before** you started the Vestibular Rehabilitation.
If you feel that a question does not apply to you because you did not experience the symptom before Vestibular Rehabilitation, you should circle *'about the same as before'*.
Please **answer all of the questions** by circling the appropriate answer.

1. **Since the Vestibular Rehabilitation, I feel dizzy (this includes sensations of vertigo, light-headedness, unsteadiness, disorientation, feeling drunk, etc.)**

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

2. **Since the Vestibular Rehabilitation, 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**
   - **faintness**

(if you have experienced more than one of these feelings, answer the question thinking about the one that you have experienced most often)

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

3. **Since the Vestibular Rehabilitation, I feel the need to hold on to something for support**

much more often than before	*quite a bit more often than before*	*a little bit more often than before*	*about the same as before*	*a little less often than before*	*quite a bit less often than before*	*much less often than before*

Part B: Motion-provoked dizziness

This part asks about *how dizzy you get* when you make different movements **now compared to before** the Vestibular Rehabilitation.

When you choose your answer, **please do not circle** *'much more dizzy than before'* **if you avoided the movement** before you started Vestibular Rehabilitation. Think about the last time you made the movement before you started to avoid it and answer the question comparing how dizzy it made you then with how dizzy it makes you now. If you do not want to make the movement now, talk to your Vestibular Rehabilitation therapist before answering the question.
If you feel that a question does not apply to you because the movement did not make you dizzy even before Vestibular Rehabilitation, you should circle *'about the same as before'.*
Please **answer all of the questions** by circling the answer that best describes how you feel.

4. Since the Vestibular Rehabilitation, bending over makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

5. Since the Vestibular Rehabilitation, lying down orturning over in bed makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

6. Since the Vestibular Rehabilitation, looking up at the sky makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

7. Since the Vestibular Rehabilitation, moving my head slowly from side to side makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

8. Since the Vestibular Rehabilitation, moving my head quickly from side to side makes me feel

much more dizzy than before	*quite a bit more dizzy than before*	*a little bit more dizzy than before*	*about the same as before*	*a little less dizzy than before*	*quite a bit less dizzy than before*	*much less dizzy than before*

Section 2: Quality of life

This section asks *how much you agree or disagree* with statements that compare your abilities, lifestyle and emotions to before the Vestibular Rehabilitation.

Some of the statements are phrased in a **positive** way (e.g. 'I can walk further now than I could before the Vestibular Rehabilitation') and some of the questions are phrased in a **negative** way (e.g. 'Since the Vestibular Rehabilitation, I have more trouble focusing my eyes'). **Please read each statement carefully to make sure that you circle the appropriate answer.**

You may feel that a statement does not apply to you if your dizziness has never affected the area that the statement refers to. For example 'Since the Vestibular Rehabilitation, I feel more comfortable about going out on my own'. If you did not feel uncomfortable about going out on your own before the Vestibular Rehabilitation you should circle '*neither agree nor disagree*'.

You may also feel that a statement does not apply to you if it refers to a situation that does not occur in your life. For example 'Since the Vestibular Rehabilitation, I feel more able to take part in physical activities'. If you did not take part in *any* physical activities at all (even playing with your children/grandchildren or climbing stairs) before the Vestibular Rehabilitation, you should circle '*neither agree nor disagree*'.

Please **answer all of the questions** by circling the appropriate answer.

---

9. Since the Vestibular Rehabilitation, I have more difficulty walking (this includes staggering, veering to one side, bumping into things or falling over)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

10. I worry about the dizziness coming on more since the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

11. Since the Vestibular Rehabilitation, I feel more comfortable about going out on my own

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

---

12. I restrict my head and body movement more now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

13. I feel more confident now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

14. I get tired more easily now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

15. I prefer to stay in or near my own home more so now than before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

16. Since the Vestibular Rehabilitation, I feel more positive about the future

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

17. I find it easier to concentrate and/or remember things now than before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

18. My balance feels better in the dark or when my eyes are closed now compared to before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

19. My quality of life has improved since the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

20. I need to be more careful and/or take things more slowly since the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

21. I am more concerned that there is something seriously wrong with me now than before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

22. Since the Vestibular Rehabilitation, I have more trouble focusing my eyes

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

23. I can walk further now than I could before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

24. I feel more comfortable about being on my own now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

25. I have more special ways of doing things to work around the dizziness than before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

26. Since the Vestibular Rehabilitation, I am more worried about hurting myself because of the dizziness (for example falling over, bumping into things, crossing the road, driving a car)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

27. Since the Vestibular Rehabilitation, I have more difficulty in one or more of the following situations:

- **open spaces (like crossing a wide road)**
- **patterned floors (like a tiled floor in a shopping centre)**
- **flashing lights or screens (like in the cinema)**
- **supermarket aisle**

(if you have experienced difficulty in more than one of these situations, answer the question thinking about the one that you have had most difficulty with)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

28. I feel more independent now than before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

29. Since the Vestibular Rehabilitation, I have more difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

30. I avoid some activities, positions or situations more now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

31. I feel more comfortable in noisy and/or crowded places now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

32. I try to avoid travelling more now than I did before the Vestibular Rehabilitation

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

33. Since the Vestibular Rehabilitation, I have less difficulty doing things around the home or garden

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

34. Since the Vestibular Rehabilitation, I feel more able to take part in physical activities

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

35. Since the Vestibular Rehabilitation, the dizziness is having less affect on my ability to do my normal job (include looking after your family or home if this is your job)

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

36. Since the Vestibular Rehabilitation, I feel more able to take part in social activities

agree very strongly	*agree quite strongly*	*agree*	*neither agree nor disagree*	*disagree*	*disagree quite strongly*	*disagree very strongly*

Thank you for completing the questionnaire

Vestibular Rehabilitation Benefit Questionnaire

(State version 2.1)

The questions below refer to your **dizziness**. Think about how you would feel on a **typical day** in the last week or two. Please do not include problems that you think are caused by something else (such as another health condition).
Please **answer all of the questions** by circling **one** of the answer options.

Section 1 - Symptoms

Part A: This part asks about how often you experience different things.

1. I feel dizzy
(this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc.)

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

2. 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,
faintness

(if you experience more than one, think about the one that you have most often)

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

Part B: This part asks about how dizzy you get when you make certain movements.

Please do not circle *'not at all dizzy'* **if you avoid making the movement**. Please try the movement and then answer. If you do not want to try the movement, talk to your Vestibular Rehabilitation therapist before answering.

3. Bending over makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

4. Lying down and/or turning over in bed makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

5. Looking up at the sky makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

6. Moving my head slowly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

7. Moving my head quickly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

Section 2 - Quality of Life

This section asks you to compare your abilities, lifestyle and emotions to before the dizziness started.

Some of the statements are phrased in a way that suggests you have a problem (e.g. 'Compared to before the dizziness started, I have trouble focusing my eyes') and some of the questions are phrased in way that suggests you do *not* have a problem (e.g. 'Compared to before the dizziness started, I feel confident'). **Please read each one carefully to make sure that you circle the appropriate answer**.

If a question does not apply to you, please circle '*same as before*' rather than leaving it out.

---

8. Compared to before the dizziness started, I feel comfortable travelling

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

---

9. Compared to before the dizziness started, I find myself worrying

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

---

10. Compared to before the dizziness started, I feel confident

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

---

11. Compared to before the dizziness started, I have difficulty in one (or more) of these situations:

open spaces (like crossing a wide road),
patterned floors (like a tiled floor in a shopping centre),
flashing lights or screens (like in the cinema),
supermarket aisle

(if you have difficulty in more than one of these situations, think about the one that you have most difficulty with)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

---

12. Compared to before the dizziness started, I have difficulty walking (this includes staggering, veering to one side, bumping into things, falling over)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

---

13. Compared to before the dizziness started, I move my head and body freely

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

---

14. Compared to before the dizziness started, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to before the dizziness started, I feel able to do my normal job (include looking after your family or home if this is your job)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to before the dizziness started, I have to find special ways of doing things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to before the dizziness started, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to before the dizziness started, I have difficulty doing things in my home or garden

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

19. Compared to before the dizziness started, I think there may be something seriously wrong with me

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

20. Compared to before the dizziness started, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

21. Compared to before the dizziness started, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

22. Compared to before the dizziness started, I take part in physical activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

23. Compared to before the dizziness started, I need to be careful and/or take things slowly

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

24. Compared to before the dizziness started, I am worried about hurting myself (for example falling over, bumping into things, crossing the road, driving)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

25. Compared to before the dizziness started, the distance I can walk is:

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

26. Compared to before the dizziness started, I prefer to stay in or near home

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

27. Compared to before the dizziness started, I feel independent

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

28. Compared to before the dizziness started, I am happy to go to noisy and/or crowded places

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

29. Compared to before the dizziness started, I think my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

30. Compared to before the dizziness started, I get tired easily

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

31. Compared to before the dizziness started, I feel positive about the future

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

32. Compared to before the dizziness started, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

33. Compared to before the dizziness started, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

34. Compared to before the dizziness started, I have trouble focusing my eyes

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

35. Compared to before the dizziness started, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

36. Compared to before the dizziness started, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Thank you for completing the questionnaire

Vestibular Rehabilitation Benefit Questionnaire

(Change version 2.1)

The questions below refer to your **dizziness**. Think about how you felt on a **typical day before the Vestibular Rehabilitation compared to a typical day now** (in the last week or two). Please do not include problems that you think are caused by something else (such as another health condition).
Please **answer all of the questions** by circling **one** of the answer options.

Section 1 - Symptoms

Part A: This part asks about how often you experience different things **now compared to before the Vestibular Rehabilitation**.

1. **Compared to before the Vestibular Rehabilitation , I feel dizzy (this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc.)**

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

2. **Compared to before the Vestibular Rehabilitation , 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,
faintness

(if you experience <u>more than one</u>, think about the one that you have <u>most often</u>)

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

Part B: This part asks about how dizzy you get when you make certain movements **now compared to before the Vestibular Rehabilitation**.

Please do not circle *'much more dizzy than before'* **if you avoided the movement** before the Vestibular Rehabilitation. Compare how dizzy you felt last time you made the movement (before you started to avoid) with how dizzy the movement makes you <u>now</u>. If you still avoid the movement now, talk to your Vestibular Rehabilitation therapist before answering.
If a question does not apply because it did not make you feel dizzy even before the Vestibular Rehabilitation, please circle '*about the same as before*'.

3. **Bending over makes me feel**

much more dizzy	*quite a bit more dizzy*	*a little bit more dizzy*	*same as before*	*a little less dizzy*	*quite a bit less dizzy*	*much less dizzy*

4. **Lying down and/or turning over in bed makes me feel**

much more dizzy	*quite a bit more dizzy*	*a little bit more dizzy*	*same as before*	*a little less dizzy*	*quite a bit less dizzy*	*much less dizzy*

5. **Looking up at the sky makes me feel**

much more dizzy	*quite a bit more dizzy*	*a little bit more dizzy*	*same as before*	*a little less dizzy*	*quite a bit less dizzy*	*much less dizzy*

6. **Moving my head slowly from side to side makes me feel**

much more dizzy	*quite a bit more dizzy*	*a little bit more dizzy*	*same as before*	*a little less dizzy*	*quite a bit less dizzy*	*much less dizzy*

7. **Moving my head quickly from side to side makes me feel**

much more dizzy	*quite a bit more dizzy*	*a little bit more dizzy*	*same as before*	*a little less dizzy*	*quite a bit less dizzy*	*much less dizzy*

Section 2 - Quality of Life

This section asks about your abilities, lifestyle and emotions **compared to before the Vestibular Rehabilitation**.

Some of the statements are phrased in a way that suggests you have a problem (e.g. 'Compared to before the Vestibular Rehabilitation , I have trouble focusing my eyes') and some of the questions are phrased in way that suggests you do *not* have a problem (e.g. 'Compared to before the Vestibular Rehabilitation , I feel confident'). **Please read each one carefully to make sure that you circle the appropriate answer**.

If a question does not apply to you, please circle '*same as before*' rather than leaving it out.

8. **Compared to before the Vestibular Rehabilitation, I feel comfortable travelling**

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

9. **Compared to before the Vestibular Rehabilitation, I find myself worrying**

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

10. **Compared to before the Vestibular Rehabilitation, I feel confident**

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

11. **Compared to before the Vestibular Rehabilitation, I have difficulty in one (or more) of these situations:**

open spaces (like crossing a wide road),
patterned floors (like a tiled floor in a shopping centre),
flashing lights or screens (like in the cinema),
supermarket aisle

(if you have difficulty in more than one of these situations, think about the one that you have most difficulty with)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

12. Compared to before the Vestibular Rehabilitation, I have difficulty walking (this includes staggering, veering to one side, bumping into things, falling over)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

13. Compared to before the Vestibular Rehabilitation, I move my head and body freely

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

14. Compared to before the Vestibular Rehabilitation, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to before the Vestibular Rehabilitation, I feel able to do my normal job (include looking after your family or home if this is your job)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to before the Vestibular Rehabilitation, I have to find special ways of doing things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to before the Vestibular Rehabilitation, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to before the Vestibular Rehabilitation, I have difficulty doing things in my home or garden

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

19. Compared to before the Vestibular Rehabilitation, I think there may be something seriously wrong with me

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

20. Compared to before the Vestibular Rehabilitation, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

21. Compared to before the Vestibular Rehabilitation, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

22. Compared to before the Vestibular Rehabilitation, I take part in physical activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

23. Compared to before the Vestibular Rehabilitation, I need to be careful and/or take things slowly

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

24. Compared to before the Vestibular Rehabilitation, I am worried about hurting myself (for example falling over, bumping into things, crossing the road, driving)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

25. Compared to before the Vestibular Rehabilitation, the distance I can walk is:

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

26. Compared to before the Vestibular Rehabilitation, I prefer to stay in or near home

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

27. Compared to before the Vestibular Rehabilitation, I feel independent

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

28. Compared to before the Vestibular Rehabilitation, I am happy to go to noisy and/or crowded places

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

29. Compared to before the Vestibular Rehabilitation, I think my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

30. Compared to before the Vestibular Rehabilitation, I get tired easily

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

31. Compared to before the Vestibular Rehabilitation, I feel positive about the future

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

32. Compared to before the Vestibular Rehabilitation, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

33. Compared to before the Vestibular Rehabilitation, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

34. Compared to before the Vestibular Rehabilitation, I have trouble focusing my eyes

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

35. Compared to before the Vestibular Rehabilitation, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

36. Compared to before the Vestibular Rehabilitation, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Thank you for completing the questionnaire

Vestibular Rehabilitation Benefit Questionnaire

(State version 3.0)

The questions below refer to your **dizziness**. Think about how you would feel on a **typical day** in the last week or two. Please do not include problems that you think are caused by something else (such as another health condition).
Please **answer all of the questions** by circling **one** of the answer options.

Section 1 - Symptoms

Part A: This part asks about how often you experience different things.

1. I feel dizzy
(this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc.)

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

2. 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,
faintness

(if you experience more than one, think about the one that you have most often)

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

Part B: This part asks about how dizzy you get when you make certain movements.

Please do not circle *'not at all dizzy'* **if you avoid making the movement**. Please try the movement and then answer. If you do not want to try the movement, talk to your Vestibular Rehabilitation therapist before answering

3. Bending over makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

4. Lying down and/or turning over in bed makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

5. Looking up at the sky makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

6. Moving my head slowly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

7. Moving my head quickly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

Section 2 - Quality of Life

This section asks you to compare your abilities, lifestyle and emotions to before the dizziness started.

Some of the statements are phrased in a way that suggests you have a problem (e.g. ‘Compared to before the dizziness started, I have trouble focusing my eyes’) and some of the questions are phrased in way that suggests you do *not* have a problem (e.g. ‘Compared to before the dizziness started, I feel confident’). **Please read each one carefully to make sure that you circle the appropriate answer**.

If a question does not apply to you, please circle ‘*same as before*’ rather than leaving it out.

8. Compared to before the dizziness started, I feel comfortable travelling

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

9. Compared to before the dizziness started, I feel confident

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

10. Compared to before the dizziness started, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

11. Compared to before the dizziness started, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

12. Compared to before the dizziness started, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

13. Compared to before the dizziness started, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

14. Compared to before the dizziness started, I think my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to before the dizziness started, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to before the dizziness started, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to before the dizziness started, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to before the dizziness started, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Thank you for completing the questionnaire

Vestibular Rehabilitation Benefit Questionnaire

(Change format: Version 3.0)

The questions below refer to your **dizziness** on a **typical day** in the last week or two compared to a typical day last time you completed the questionnaires.
Please do not include problems that you think are caused by another condition.
Please answer **all** of the questions by circling **one** of the answer options.
Part A: This part asks about how often you experience different things **now compared to last time** you completed the questionnaires.

1. Compared to before the Vestibular Rehabilitation , I feel dizzy (this includes vertigo, light-headedness, unsteadiness, feeling drunk, etc.)

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

2. Compared to before the Vestibular Rehabilitation , 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,
faintness

(if you experience <u>more than one</u>, think about the one that you have <u>most often</u>)

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

Part B: This part asks about how dizzy you get when you make certain movements **now compared to last time** you completed the questionnaires. **Please do not circle** *'not at all dizzy'* **if you avoided the movement** last time you completed the questionnaires. Compare how dizzy you felt last time you made the movement (before you started to avoid it) with how it makes you feel now.

3. Compared to last time I completed the questionnaires, bending over makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

4. Compared to last time I completed the questionnaires, lying down and/or turning over in bed makes me feel

much more often	quite a bit more often	a little bit more often	same as before	a little less often	quite a bit less often	much less often

5. Compared to last time I completed the questionnaires, looking up at the sky makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

6. Compared to last time I completed the questionnaires, moving my head <u>slowly</u> from side to side makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

7. Compared to last time I completed the questionnaires, moving my head <u>quickly</u> from side to side makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

Part C: This part asks about your lifestyle and feelings **now compared to last time** you completed the questionnaires.

Please read each question carefully to make sure that you circle the right answer for you. Some of the questions are phrased in a way that suggests you have a problem (e.g. 'Compared to last time I completed the questionnaires, I have trouble focusing my eyes') but some of the questions are phrased in way that suggests you do *not* have a problem (e.g. 'Compared to last time I completed the questionnaires, I feel confident').

8. Compared to last time I completed the questionnaires, I feel comfortable travelling

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

9. Compared to last time I completed the questionnaires, I feel confident

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

10. Compared to last time I completed the questionnaires, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

11. Compared to last time I completed the questionnaires, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

12. Compared to last time I completed the questionnaires, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

13. Compared to last time I completed the questionnaires, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

14. Compared to last time I completed the questionnaires, I think my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to last time I completed the questionnaires, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to last time I completed the questionnaires, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to last time I completed the questionnaires, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to last time I completed the questionnaires, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Vestibular Rehabilitation Benefit Questionnaire [State]

Version 3.1

We want to know what your dizziness is like at the moment.

The questions in this questionnaire refer to your **dizziness** on a typical day in the last week or two.

Please do not include problems that you think are caused by another condition.

Please answer **all** of the questions by circling **one** of the answer options.

If any of the questions in Part C do not apply to you, please circle '*same as before*' rather than leaving it out.

Vestibular Rehabilitation Benefit Questionnaire

(State version 3.1)

The questions below refer to your **dizziness** on a **typical day** in the last week or two. Please do not include problems that you think are caused by another condition. Please answer **all** of the questions by circling **one** of the answer options.

Part A: This part asks about how often you experience different things

1. I feel dizzy

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

2. I get a feeling of tingling, prickling or numbness in my body

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

3. I have a feeling that things are spinning or moving around

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

4. I feel as though my heart is pounding or fluttering

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

5. I feel unsteady, as though I may lose my balance

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

6. I have difficulty breathing or feel short of breath

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

Part B: This part asks about how dizzy you get when you make certain movements. **Please do not circle** *'not at all dizzy'* **if you avoid making the movement**. Please try the movement and then answer or talk to your Vestibular Rehabilitation therapist before answering

7. Bending over makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

8. Lying down and/or turning over in bed makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

9. Looking up at the sky makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

10. Moving my head <u>slowly</u> from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

11. Moving my head <u>quickly</u> from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

Part C: This part asks about your lifestyle and feelings compared to before the dizziness started.

Please read each question carefully to make sure that you circle the right answer for you. Some of the questions are phrased in a way that suggests you have a problem (e.g. 'Compared to before the dizziness started, I have trouble focusing my eyes') but some of the questions are phrased in way that suggests you do *not* have a problem (e.g. 'Compared to before the dizziness started, I feel confident').

If a question does not apply to you, please circle '*same as before*' rather than leaving it out.

12. Compared to before the dizziness started, I feel comfortable travelling

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

13. Compared to before the dizziness started, I feel confident

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

14. Compared to before the dizziness started, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to before the dizziness started, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to before the dizziness started, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to before the dizziness started, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to before the dizziness started, I think my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

19. Compared to before the dizziness started, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

20. Compared to before the dizziness started, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

21. Compared to before the dizziness started, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

22. Compared to before the dizziness started, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Vestibular Rehabilitation Benefit Questionnaire [Change]

Version 3.1

We want to know how much you think you have changed since you last completed the questionnaires.

The questions in this questionnaire refer to your dizziness on a typical day in the last week or two compared to a typical day last time you completed the questionnaires.

You last completed the questionnaires on ....

Please do not include problems that you think are caused by another condition.

Please answer **all** of the questions by circling **one** of the answer options.

If any of the questions in Part C do not apply to you, please circle '*same as before*' rather than leaving it out.

Vestibular Rehabilitation Benefit Questionnaire

(Change version 3.1)

The questions below refer to your **dizziness** on a **typical day** in the last week or two compared to a typical day last time you completed the questionnaires.

Please do not include problems that you think are caused by another condition.

Please answer **all** of the questions by circling **one** of the answer options.

Part A: This part asks about how often you experience different things **now compared to last time** you completed the questionnaires.

1. Compared to last time I completed the questionnaires, I feel dizzy

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

2. Compared to last time I completed the questionnaires, I get a feeling of tingling, prickling or numbness in my body

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

3. Compared to last time I completed the questionnaires, I have a feeling that things are spinning or moving around

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

4. Compared to last time I completed the questionnaires, I feel as though my heart is pounding or fluttering

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

5. Compared to last time I completed the questionnaires, I feel unsteady, as though I may lose my balance

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

6. Compared to last time I completed the questionnaires, I have difficulty breathing or feel short of breath

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

Part B: This part asks about how dizzy you get when you make certain movements **now compared to last time** you completed the questionnaires.

Please do not circle *'not at all dizzy'* **if you avoided the movement** last time you completed the questionnaires. Compare how dizzy you felt last time you made the movement (before you started to avoid it) with how it makes you feel now.

7. Compared to last time I completed the questionnaires, bending over makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

8. Compared to last time I completed the questionnaires, lying down and/or turning over in bed makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

9. Compared to last time I completed the questionnaires, looking up at the sky makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

10. Compared to last time I completed the questionnaires, moving my head slowly from side to side makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

11. Compared to last time I completed the questionnaires, moving my head quickly from side to side makes me feel

much more often	*quite a bit more often*	*a little bit more often*	*same as before*	*a little less often*	*quite a bit less often*	*much less often*

Part C: This part asks about your lifestyle and feelings **now compared to last time** you completed the questionnaires.

Please read each question carefully to make sure that you circle the right answer for you. Some of the questions are phrased in a way that suggests you <u>have a problem</u> (e.g. 'Compared to last time I completed the questionnaires, I have trouble focusing my eyes') but some of the questions are phrased in way that suggests you <u>do *not* have a problem</u> (e.g. 'Compared to last time I completed the questionnaires, I feel confident').

12. Compared to last time I completed the questionnaires, I feel comfortable travelling

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

13. Compared to last time I completed the questionnaires, I feel confident

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

14. Compared to last time I completed the questionnaires, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to last time I completed the questionnaires, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to last time I completed the questionnaires, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to last time I completed the questionnaires, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to last time I completed the questionnaires, my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

19. Compared to last time I completed the questionnaires, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

20. Compared to last time I completed the questionnaires, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

21. Compared to last time I completed the questionnaires, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

22. Compared to last time I completed the questionnaires, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Vestibular Rehabilitation Benefit Questionnaire [Then]

Version 3.1

The instructions for this questionnaire are quite different to the others, please read the instructions very carefully.

We want you to remember how you felt on the day you completed the questionnaires last time (you last completed the questionnaires on ....)

Answer the questions thinking about how you felt back then.

(You do not have not remember what answers you gave last time, just think back to how you felt on .... when you are answering each question)

Please do not include problems that you think are caused by another condition.

Please answer **all** of the questions by circling **one** of the answer options.

If any of the questions in Part C do not apply to you, please circle '*same as before*' rather than leaving it out.

Vestibular Rehabilitation Benefit Questionnaire [Then/seen]

Version 3.1

The instructions for this questionnaire are quite different to the others, please read the instructions very carefully.

We want you to think back to how you felt on the day you completed the questionnaires last time (which was ....) and answer the questions thinking about how you felt back then.

A copy of the answers you gave on .... is attached to the back of this questionnaire.

You do not necessarily have to give the same answers as last time because your judgement about how you felt back then may have changed by now. For example, with hindsight you may think that you were worse back then than the answers you originally circled would suggest. Or, you may think that you were actually better back then than your original answers would suggest.

We want to see if your rating of how you were feeling back then has changed at all since you completed the questionnaire originally, or if it has stayed the same.

Please answer **all** of the questions by circling **one** of the answer options.

If any of the questions in Part C do not apply to you, please circle '*same as before*' rather than leaving it out.

Vestibular Rehabilitation Benefit Questionnaire

(Then version 3.1)

The questions below refer to your how your **dizziness** *was* on a **typical day** last time you completed the questionnaires. **Answer the questions thinking about how you felt back then.** Please do not include problems that you think are caused by another condition. Please answer **all** of the questions by circling **one** of the answer options.

Part A: This part asks about how often you experienced different things last time you completed the questionnaires

Remember how you felt when you completed the last set of questionnaires, then answer the following questions:

1. I feel dizzy

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

2. I get a feeling of tingling, prickling or numbness in my body

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

3. I have a feeling that things are spinning or moving around

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

4. I feel as though my heart is pounding or fluttering

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

5. I feel unsteady, as though I may lose my balance

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

6. I have difficulty breathing or feel short of breath

all the time	*very often*	*quite often*	*sometimes*	*not very often*	*only very occasionally*	*never*

Part B: This part asks about how dizzy you used to get when you made certain movements

Please do not circle *'not at all dizzy'* **if you avoided the movement last time you completed the questionnaires**. Try to remember how dizzy the movement made you last time you attempted it. **Keep remembering how you felt when you completed the last set of questionnaires, then answer the following questions:**

7. Bending over makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

8. Lying down and/or turning over in bed makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

9. Looking up at the sky makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

10. Moving my head slowly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

11. Moving my head quickly from side to side makes me feel

not at all dizzy	*very slightly dizzy*	*mildly dizzy*	*moderately dizzy*	*really quite dizzy*	*very dizzy*	*extremely dizzy*

Part C: This part asks about how your lifestyle and feelings were last time you completed the questionnaires compared to before you ever had the dizziness

Please read each question carefully to make sure that you circle the right answer for you. Some of the questions are phrased in a way that suggests you have a problem (e.g. 'Compared to before the dizziness started, I have trouble focusing my eyes') but some of the questions are phrased in way that suggests you do *not* have a problem (e.g. 'Compared to before the dizziness started, I feel confident').

If a question does not apply to you, please circle '*same as before*' rather than leaving it out.

Still remembering how you felt when you completed the last set of questionnaires, please answer the following questions:

12. Compared to before the dizziness started, I feel comfortable travelling

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

13. Compared to before the dizziness started, I feel confident

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

14. Compared to before the dizziness started, I have difficulty looking after myself (for example washing my hair, cleaning my teeth, dressing myself)

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

15. Compared to before the dizziness started, I feel comfortable going out alone

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

16. Compared to before the dizziness started, I can concentrate and/or remember things

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

17. Compared to before the dizziness started, I need to hold on to something for support

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

18. Compared to before the dizziness started, I think my Quality of Life is good

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

19. Compared to before the dizziness started, I avoid some activities, positions or situations

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

20. Compared to before the dizziness started, I am happy to be on my own

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

21. Compared to before the dizziness started, I feel stable in the dark or when my eyes are closed

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

22. Compared to before the dizziness started, I take part in social activities

a lot more	*quite a bit more*	*a little bit more*	*same as before*	*a little bit less*	*quite a bit less*	*a lot less*

Dizziness Handicap Inventory

The purpose of this scale is to identify difficulties that you might be experiencing because of your dizziness or unsteadiness. Please answer **YES, NO** or **SOMETIMES** to each question by ticking the appropriate box.

Answer each question as it pertains to your dizziness or unsteadiness problem only.

P1.	Does looking up increase your problem?	**Yes** ☐	**Sometimes** ☐	**No** ☐
E2.	Because of your problem do you feel frustrated?	**Yes** ☐	**Sometimes** ☐	**No** ☐
F3.	Because of your problem do you restrict your travel for business or recreation?	**Yes** ☐	**Sometimes** ☐	**No** ☐
P4.	Does walking down the aisle of a supermarket increase your problem?	**Yes** ☐	**Sometimes** ☐	**No** ☐
F5.	Because of your problem do you have difficulty getting into or out of bed?	**Yes** ☐	**Sometimes** ☐	**No** ☐
F6.	Does your problem significantly restrict your participation in social activities such as going out to dinner, movies, dancing or parties?	**Yes** ☐	**Sometimes** ☐	**No** ☐
F7.	Because of your problem do you have difficulty reading?	**Yes** ☐	**Sometimes** ☐	**No** ☐
P8.	Does performing more ambitious activities like sports, dancing, and household chores such as sweeping or putting dishes away increase your problem?	**Yes** ☐	**Sometimes** ☐	**No** ☐
E9.	Because of your problem are you afraid to leave your home without having someone accompany you?	**Yes** ☐	**Sometimes** ☐	**No** ☐
E10.	Because of your problem have you been embarrassed in front of others?	**Yes** ☐	**Sometimes** ☐	**No** ☐
P11.	Do quick movements of your head increase your problem?	**Yes** ☐	**Sometimes** ☐	**No** ☐

F12. Because of your problem do you avoid heights? **Yes** ☐ **Sometimes** ☐ **No** ☐

P13. Does turning over in bed increase your problem? **Yes** ☐ **Sometimes** ☐ **No** ☐

F14. Because of your problem is it difficult for you to do strenuous housework or gardening? **Yes** ☐ **Sometimes** ☐ **No** ☐

E15. Because of your problem are you afraid people may think you are intoxicated? **Yes** ☐ **Sometimes** ☐ **No** ☐

F16. Because of your problem is it difficult for you to go for a walk by yourself? **Yes** ☐ **Sometimes** ☐ **No** ☐

P17. Does walking down a road increase your problem? **Yes** ☐ **Sometimes** ☐ **No** ☐

E18. Because of your problem is it difficult to concentrate? **Yes** ☐ **Sometimes** ☐ **No** ☐

F19. Because of your problem is it difficult for you to walk around your home in the dark? **Yes** ☐ **Sometimes** ☐ **No** ☐

E20. Because of your problem are you afraid to stay home alone? **Yes** ☐ **Sometimes** ☐ **No** ☐

E21. Because of your problem do you feel handicapped? **Yes** ☐ **Sometimes** ☐ **No** ☐

E22. Has your problem placed stress on your relationship with members of your family or friends? **Yes** ☐ **Sometimes** ☐ **No** ☐

E23. Because of your problem are you depressed? **Yes** ☐ **Sometimes** ☐ **No** ☐

F24. Does your problem interfere with your job or household responsibilities? **Yes** ☐ **Sometimes** ☐ **No** ☐

P25. Does bending over increase your problem? **Yes** ☐ **Sometimes** ☐ **No** ☐

VERTIGO SYMPTOM SCALE (short form)

We would like to know what dizziness-related symptoms you have had just recently. Please circle the appropriate number to indicate about how many times you have experienced each of the symptoms listed below during the past month. The range of responses are:

0	1	2	3	4
Never	A few times	Several times	Quite often (every week)	Very often (most days)

How often **in the past month** have you had the following symptoms:

1.	A feeling that either you, or things around you, are spinning or moving, lasting less than 20 minutes	0	1	2	3	4
2.	Hot or cold spells	0	1	2	3	4
3.	Nausea (feeling sick), vomiting	0	1	2	3	4
4.	A feeling that either you, or things around you, are spinning or moving, lasting more than 20 minutes	0	1	2	3	4
5.	Heart pounding or fluttering	0	1	2	3	4
6.	A feeling of being dizzy, disorientated or "swimmy", lasting all day	0	1	2	3	4
7.	Headache, or feeling of pressure in the head	0	1	2	3	4
8.	Unable to stand or walk properly without support, veering or staggering to one side	0	1	2	3	4
9.	Difficulty breathing, short of breath	0	1	2	3	4
10.	Feeling unsteady, about to lose balance, lasting more than 20 minutes	0	1	2	3	4
11.	Excessive sweating	0	1	2	3	4
12.	Feeling faint, about to black out	0	1	2	3	4
13.	Feeling unsteady, about to lose balance, lasting less than 20 minutes	0	1	2	3	4
14.	Pains in the heart or chest region	0	1	2	3	4
15.	A feeling of being dizzy, disorientated or swimmy, lasting less than 20 minutes	0	1	2	3	4

The Short Form 36 Health Survey Questionnaire (SF-36)

The following questions ask for your views about your health, how you feel and how well you are able to do your usual activities. If you are unsure about how to answer any questions, please give the best answer you can and make any of your own comments if you like. Do not spend too much time in answering as your immediate response is likely to be the most accurate.

1. **In general**, would you say your health is:

(*Please tick* ***one*** *box*)

Excellent	☐
Very good	☐
Good	☐
Fair	☐
Poor	☐

2. **Compared to one year ago,** how would you rate your health in general now?

(*Please tick* ***one*** *box*)

Much better than one year ago	☐
Somewhat better than one year ago	☐
About the same	☐
Somewhat worse now than one year ago	☐
Much worse now than one year ago	☐

HEALTH AND DAILY ACTIVITIES

3. The following questions are about activities you might do during a typical day. Does your health limit you in these activities? If so, how much?

(*Please tick* ***one*** *box on each line*)

	Yes, limited a lot	**Yes, limited a little**	**No, not limited at all**
a) **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	☐	☐	☐
b) **Moderate activities**, such as moving a table, pushing a vacuum, bowling or playing golf	☐	☐	☐
c) Lifting or carrying groceries	☐	☐	☐
d) Climbing **several** flights of stairs	☐	☐	☐
e) Climbing **one** flight of stairs	☐	☐	☐
f) Bending, kneeling or stooping	☐	☐	☐
g) Walking **more than a mile**	☐	☐	☐
h) Walking **half a mile**	☐	☐	☐
i) Walking **100 yards**	☐	☐	☐
j) Bathing and dressing yourself	☐	☐	☐

4. During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

(*Please answer* ***Yes*** *or* ***No*** *to each question*)

	Yes	**No**
a) Cut down on the **amount of time** you spend on work or other activities	☐	☐
b) **Accomplished less** than you would like	☐	☐
c) Were limited in the **kind** of work or other activities	☐	☐
d) Had **difficulty** performing the work or other activities (eg. it took more effort)	☐	☐

5. During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

(*Please answer* ***Yes*** *or* ***No*** *to each question*)

	Yes	**No**
a) Cut down on the **amount of time** you spend on work or other activities	☐	☐
b) **Accomplished less** than you would like	☐	☐
c) Didn't do work or other activities as **carefully** as usual	☐	☐

6. During the **past 4 weeks**, to what extent have your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours or groups?

(*Please tick* ***one*** *box*)

Not at all ☐
Slightly ☐
Moderately ☐
Quite a bit ☐
Extremely ☐

7. How much **bodily pain** have you had during the **past 4 weeks**?

(*Please tick* ***one*** *box*)

None ☐
Very mild ☐
Mild ☐
Moderate ☐
Severe ☐
Very severe ☐

During the **past 4 weeks** how much did **pain** interfere with your normal work (including work both outside the home and housework)?

(*Please tick **one** box*)

Not at all ☐
A little bit ☐
Moderately ☐
Quite a bit ☐
Extremely ☐

YOUR FEELINGS

8. These questions are about how you feel and how things have been with you **during the past month.** (For each question please indicate the one answer that comes closest to the way you have been feeling).

(*Please tick **one** box on each line*)

How much time during **the last month:**	**All of the time**	**Most of the time**	**A good bit of time**	**Some of the time**	**A little of the time**	**None of the time**
a) Did you feel full of life	☐	☐	☐	☐	☐	☐
b) Have you been a very nervous person?	☐	☐	☐	☐	☐	☐
c) Have you felt so down in dumps that nothing could cheer you up?	☐	☐	☐	☐	☐	☐
d) Have you felt calm and peaceful?	☐	☐	☐	☐	☐	☐
e) Did you have a lot of energy?	☐	☐	☐	☐	☐	☐
f) Have you felt downhearted and low?	☐	☐	☐	☐	☐	☐
g) Did you feel worn out?	☐	☐	☐	☐	☐	☐
h) Have you been a happy person?	☐	☐	☐	☐	☐	☐
i) Did you feel tired?	☐	☐	☐	☐	☐	☐
j) Has your **health limited your social activities** (like visiting friends or close relatives)?	☐	☐	☐	☐	☐	☐

HEALTH IN GENERAL

9. Please choose the answer that best describes how **true** or **false** each of the following statements is for you.

(*Please tick **one** box on each line*)

Mostly

	Definitely true	**Mostly true**	**Not sure**	**Mostly false**	**false**
a) I seem to get ill more easily than other people	☐	☐	☐	☐	☐
b) I am as healthy as anybody I know	☐	☐	☐	☐	☐
c) I expect my health to get worse	☐	☐	☐	☐	☐
d) My health is excellent	☐	☐	☐	☐	☐