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# Survey of the Current Status of Vestibular Practices in the United States

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# SURVEY OF THE CURRENT STATUS OF VESTIBULAR CLINICAL PRACTICES IN THE UNITED STATES

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ABSTRACT

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The purpose of this capstone research project was to gain a better understanding of audiologists' practices and procedures related to vestibular assessment. Secondarily, it was of interest to determine what training and education is received by audiologists who perform vestibular testing. This study was developed to determine if variability exists, and if there are factors such as years of experience, work setting, education, geographical location that may relate to any variabilities found.

Participants surveyed were active members of the American Academy of Audiology (AAA) as contact information was obtained from the electronic member directory on the AAA website. Using Qualtrics, a survey was created and distributed via email to 825 potential participants. Of those, 144 responses were collected (17.5% response rate). The survey data was organized into six sections: General/Demographics, Training, Screening, Assessment, Rehabilitation, and Vestibular Testing in Children.

Descriptive analyses revealed large variability in vestibular practices among audiologists. Specifically, responses to questions regarding assessment protocols and rehabilitation methods were quite variable with respect to vascular screening prior to testing, order of testing, re-calibration during testing, and modifications to the physical maneuvers for vestibular rehabilitation. In the absence of universal guidelines and

standards, students, educators, and professionals may utilize these survey results as an informative tool regarding current practices in vestibular audiology.

TABLE OF CONTENTS

LIST OF TABLES

TABLE

LIST OF FIGURES

FIGURE

# CHAPTER I

## STATEMENT OF THE PROBLEM

Dizziness and vertigo are common complaints among adults and even children. The scope of practice of audiology has evolved to include the evaluation of vestibular function and the ability to conduct vestibular rehabilitation. Therefore, the role of the audiologist has become increasingly important for evaluation and provision of the appropriate intervention or rehabilitation for these patients.

The American Academy of Audiology (AAA) as well as the American Speech-Language-Hearing Association (ASHA) have published position statements regarding the audiologist's role in vestibular assessment; however, specific vestibular assessment techniques are not included. There is also scarcity of information about techniques for vestibular assessment available, with the exception of textbooks. The result is that one practicing audiologist may be performing different techniques when compared to another practicing audiologist.

Multiple surveys of audiologists' practices have been completed (Martin, Armstrong, & Champlin, 1994; Martin, Champlin, & Chambers, 1998; Martin & Forbis, 1978; Martin & Morris, 1989; Martin & Sides, 1985). The researchers were looking to gain more information about audiological practices in the United States by including general items over a variety of areas within audiology including immittance testing and vestibular testing. General audiological practices surveys provide an acceptable

overview; however, not as much detail is provided compared to a survey that primarily focuses on one topic area. Therefore, it is appropriate to conduct surveys of audiological practices in specific areas of audiology in order to examine if the practice patterns of clinicians are aligned with current research as well as to gain more knowledge regarding use of one method versus another. This information could also be an educational tool to help students become familiar with common practices.

In addition, audiologists who practice vestibular assessment and rehabilitation must obtain specific post-graduate continuing education (Hall & Miller, 2001). Vestibular assessment and rehabilitation are within the scope of practice of audiologists; however, it is important that individual audiologists have the appropriate knowledge and skills to perform such tasks.

Consequently, the purpose of this study was to gain a better understanding of audiologists' practices and procedures of vestibular assessment related to screening, assessment, and intervention of balance disorders and to gain a better understanding of what training and education audiologists who perform vestibular testing receive. This information may help determine suggestions for best practices for vestibular assessment and training in the future.

## Research Questions and Hypotheses

Q1 What are the common techniques and procedures related to screening, assessment, and intervention of vestibular disorders used by practicing audiologists in the United States?

H1 The survey results will show variability in common techniques and procedures among audiologists.

Q2 What training and education do audiologists who perform screening, assessment, and intervention of vestibular disorders receive?

H2 The survey results will show variability in training and education among audiologists.

Q3 Are techniques and procedures dependent on demographic factors (e.g. type of practice, years of experience, or regional location)?

H3 The survey results will show variability in techniques and procedures compared to demographic factors.

# CHAPTER II

# REVIEW OF THE LITERATURE

## Scope of Practice

The scope of practice determines processes, procedures, and actions that licensed individuals within various professions are permitted to perform in keeping with the terms of that individual's professional license (Klein, 2005). There are various healthcare professions that have defined scopes of practice. These professions include nursing, dentistry, pharmacy, medicine, physical therapy, and audiology, among others. The scope of practice for a profession provides guidelines for individual practitioners to ensure protection for the general public. It is important that these guidelines be regularly updated due to changes in technology and practices that may occur.

For audiologists, it is important to adhere to the scope of practice, and/or hold national certification as well as be licensed through a state (although not all states require licensure). National certification can be granted through a Certificate of Clinical Competence in Audiology (CCC-A) earned from the American Speech-Language-Hearing Association (ASHA), or an audiologist may be Board Certified in Audiology through the American Board of Audiology (ABA). Both national governing organizations (ASHA and AAA) publish position statements, guidelines, and a scope of practice for audiologists to abide by. A position statement is supported by available scientific evidence and/or expert opinion put forth by the governing organization that is consistent

with organizational goals and objectives (American Academy of Audiology [AAA], 2005). Practice guidelines are a defined set of recommended procedures based on available scientific evidence and/or expert opinion. These guidelines have been designed to yield specific outcomes (AAA, 2005). ASHA provides a position statement as well as practice guidelines for vestibular rehabilitation while AAA provides a position statement for the role of audiologists in the diagnosis and treatment of vestibular dysfunction. The scope of practice for audiologists can be found on both national organization websites.

**Scope of Practice for Audiologists**

> According to the AAA Scope of Practice, the definition of an audiologist is: A person, by virtue of academic degree, clinical training, and license to practice and/or professional credential, is uniquely qualified to provide a comprehensive array of professional services related to the prevention of hearing loss and the audiologic identification, assessment, diagnosis, and treatment of persons with impairment of auditory and vestibular function, and to the prevention of impairments associated with them. (AAA, 2004, p. 44).

AAA indicates that the scope of practice for audiologists is defined by the education, training, and knowledge of the professional who is licensed or credentialed to practice as an audiologist (AAA, 2004). Audiologists may also conduct and analyze research in normal and disordered auditory and vestibular function (AAA, 2004).

Both the AAA and ASHA scope of practice for audiologists include possible settings where audiologic and vestibular services may be performed. An audiologist may provide services in hospitals, clinics (such as an otolaryngology clinic), schools, private practices, universities, or other appropriate settings (AAA, 2004; American Speech-Language-Hearing Association [ASHA], 2003).

Also discussed in the scope of practice is the degree required to practice audiology. Audiologists can hold a master's or doctoral degree in audiology. New

applicants for American Board of Audiology certification must have a doctoral degree from an accredited university program beginning in 2007 while new applicants for CCC-A certification must have a doctoral degree from an accredited university program as of 2012 (Academy of Doctors of Audiology, n.d.).

Both the AAA and ASHA scope of practice for audiologists also include a statement outlining the inclusion of other necessary professions in common practice areas. This is the case for audiologists providing vestibular assessment and treatment, as these capacities are not only included in the scope of practice for audiologists but also for physical therapists.

## Scope of Practice for Physical Therapists

According to the physical therapist scope of practice published by the American Physical Therapy Association (APTA), which was last updated in 2014, physical therapy includes examining individuals with impairment, functional limitation, and disability in order to determine a diagnosis, prognosis, and intervention. Gait, locomotion, and balance testing are listed within a physical therapist's scope of practice (APTA, 2014). Providing therapeutic interventions is also included in a physical therapist's scope of practice. This may include, but is not limited to therapeutic exercise, electrotherapeutic modalities, functional training, and manual therapy techniques (APTA, 2014). Vestibular rehabilitation is included as a therapeutic intervention that is covered by the scope of practice for physical therapists.

**American Speech-Language**
**-Hearing Association Guidelines**

ASHA published guidelines related to the role of audiologists in vestibular rehabilitation in 1999. These guidelines were based on a model that was presented for physical and occupational therapists at the course *Vestibular Rehabilitation: A Competency-Based Course* sponsored by the Division of Physical Therapy at the University of Miami School of Medicine in March 1998. The guidelines were created to help audiologists better understand their role in vestibular and balance rehabilitation, which includes performing canalith repositioning maneuvers and serving as consultants to or members of multidisciplinary teams managing the patient with vestibular disorders. The guidelines include an overview of the education and training, knowledge and skills for the assessment and treatment of vestibular disorders, special precautions necessary and credentialing necessary to perform vestibular and balance rehabilitation.

In the assessment portion of the guidelines, an overview of specific knowledge and skills is discussed. According to the ASHA guidelines, audiologists are able to interpret and integrate vestibular tests and other data for diagnostic and functional assessment as well as possess the ability to perform and interpret a variety of clinical evaluations designed to diagnose patients with vestibular disorders (ASHA, 1999).

According to the ASHA guidelines, specific knowledge is necessary in order to successfully assess various vestibular disorders. A diagnosis of a vestibular disorder may warrant treatment performed by an audiologist. The audiologist must be knowledgeable in the theory, rationale, and procedures required to appropriately treat a patient suffering from a vestibular disorder (ASHA, 1999). The guidelines also state that the audiologist should take appropriate precautions when treating patients with vestibular disorders in

order to ensure patient safety and comfort (ASHA, 1999). It is recommended that additional and appropriate education and training be acquired beyond graduate level coursework to successfully perform vestibular rehabilitation because only a portion of the indicated knowledge and skills can be acquired through graduate level education. However, the guidelines listed above were published prior to the minimum education requirement being a clinical doctorate. During this time, the minimum education requirement was a master's degree.

**American Speech-Language -Hearing Position Statement**

In 1992, ASHA released a position statement related to balance system assessment. The purpose of the position was to:

> (a) Inform audiologists that performing balance assessment procedures is within the scope of practice of audiology; (b) identify the collection of procedures known as balance system assessment; (c) advise audiologists of the education, training, circumstances, and precautions that should be considered prior to undertaking the procedures; (d) provide guidance for audiologists as to the knowledge and skills that are required to perform balance system assessment; and (e) ultimately, to educate health care professionals, consumers, and members of the general public of the services offered by audiologists as qualified health care providers. (ASHA, 1992)

The position statement incorporates the appropriate education and training, precautions, as well as knowledge and skills needed to perform balance system assessment.

In the position statement, balance assessment is referred to as evaluation of the vestibular and related systems (somatosensory and visual) using a variety of balance tests including, but not limited to electronystagmography (ENG), rotation and posturography.

In order to perform balance system assessment, ASHA recommends that the audiologist receive the appropriate education through a program that covers all aspects of

balance assessment. Training should take place in a clinical setting affiliated with medical personnel. Appropriate precautions should be taken in order to ensure the safety and comfort of the patient throughout the assessment.

The proper knowledge and skills needed to perform balance system assessments include the ability to conduct calibration and function tests on the equipment, develop normative values for each test administered when necessary, have efficiency in performing the ENG test battery, conduct otoscopic examinations, as well as the ability to integrate all test results into reports and recommendations. The audiologist should also be able to interact with the appropriate rehabilitation personnel to develop a rehabilitation program when necessary.

**American Academy of Audiology**
**Position Statement**

The American Academy of Audiology released a position statement related to the audiologist's role in the diagnosis and treatment of vestibular disorders. The position statement includes information regarding the proper education and training, patient care and safety, suggested evaluation guidelines, treatment, professional referrals and consultations, as well as CPT coding and billing considerations (AAA, 2005).

An audiologist's education and training should be sufficient in order for proper performance and interpretation of vestibular function tests and treatment of patients to occur. Coursework should include pharmacology, medical disorders, anatomy and physiology of the vestibular system, patient case history and interview technique, test interpretation, clinical and electrophysiological test protocols, biomechanical aspects of equilibrium, therapy and treatment protocols, as well as clinical rotations with

audiologists specializing in vestibular assessment and treatment (AAA, 2005). The audiologist is responsible for keeping up to date on current practices and procedures.

Patient care and safety should be taken into consideration when performing vestibular assessment and treatment. AAA's position statement states that an audiologist should conduct a comprehensive medical and family history that includes a list of all medications the patient is taking that could influence test results. Case history should incorporate, but is not limited to, the nature and onset of symptoms, length of episodes or symptoms as well as frequency of episodes or symptoms. Case history should also include questions regarding associated symptoms, such as visual changes, that aggravate or worsen conditions (AAA, 2005). Vestibular assessment may include the following tests: videoculography (VOG), electronystagmography (ENG), videonystagmography (VNG), tests of dynamic visual acuity, tests of active and passive rotation, tests of postural ability, and vestibular evoked myogenic potentials (VEMP) (AAA, 2005).

The treatment of vestibular disorders is included in an audiologist's scope of practice (AAA, 2004; ASHA, 2003). Patients with vestibular disorders should undergo treatment that utilizes specific exercises to reduce vertigo and improve gaze and postural stability. Outcome measures should be completed prior to the start of treatment in order to create a baseline and should be repeated post-intervention. This allows audiologists to demonstrate the effectiveness of treatment efforts. It is also recommended that audiologists have a network of professional referrals and consultations available for patients who require additional medical, psychological, or therapeutic expertise.

There are three main coding systems that are used when submitting a claim for reimbursement. These coding systems include the *International Classification of*

*Diseases, 9th edition*, Clinical Modification (ICD-9-CM) codes, Current Procedural Terminology (CPT) codes and Healthcare Common Procedure Coding System (HCPCS) codes. ICD-9-CM codes are used for reporting diagnoses, disorders, conditions, and symptoms and are maintained by the U.S. Department of Health and Human Services, National Center for Health Statistics, and the Centers for Disease Control and Prevention. HCPCS codes are used for reporting supplies, equipment, devices, and some procedures and are maintained by the Centers for Medicare and Medicaid Services. CPT coding describes how to report procedures or services and is maintained by the American Medical Association (ASHA, n.d.a.; ASHA, n.d.b.). Vestibular assessment tests do include CPT coding for billing purposes. However, CPT coding does not encompass every test and procedure that an audiologist may choose to perform for vestibular assessment. This may prevent some audiologists from performing certain assessments that are not covered with a CPT code. At present, there is no CPT code for vestibular rehabilitation therapy (VRT), and the federal Medicare program does not reimburse for vestibular treatment provided by audiologists (AAA, 2005).

## Anatomy and Physiology

Vestibular disorders can manifest for a variety of reasons. These reasons may include disease, exposure to toxins, drugs, head trauma, or infections (Weber, 2008; AAA, 2005). Vestibular disorders can cause vertigo, dizziness or a disturbance of balance. Vertigo is a partial or complete loss of spatial orientation that causes the patient to experience a spinning sensation of oneself or of one's surrounding while a disturbance of balance is the inability to maintain balance, to stand upright, or to walk properly (Desmond, 2011). The term dizziness is often used to describe either condition. Balance

is maintained by coordination of three sensory systems: visual, proprioceptive (somatosensory), and vestibular.

The vestibular apparatus is located in the inner ear and consists of three semicircular canals (horizontal, anterior, and posterior), which are sensitive to angular accelerations of the head, and two otolith organs (utricle and saccule), which are sensitive to linear accelerations of the head. Together, the vestibular apparatus on each side of the head is able to respond to external stimuli related to the movement and orientation of the head in three-dimensional space (Jacobsen & Shepard, 2008). Neural messages regarding head motion and head position, along with visual and proprioceptive information, are sent to the brainstem, cerebellum, and cerebral cortex of the central nervous system in order for the brain to control eye movements and the muscles responsible for maintaining body posture, as well as provide the individual with a sense of orientation with respect to his/her environment (Riemann & Lephart, 2002). In order to maintain a clear visual image while the head is moving, the eyes elicit rapid compensatory eye movements in the opposite direction of the head rotation (Jacobsen & Shepard, 2008). This is referred to as the vestibulo-ocular reflex (VOR). The involuntary pattern of repeated eye movement that occurs due to the eyes moving relatively slowly in one direction then quickly returning to the midline is called nystagmus. Observing and/or recording the nystagmus under different conditions is an important part of the assessment of vestibular function and will be discussed in greater detail later in this chapter.

The vestibular system also has connections to the spinal motor system. The vestibulo-spinal reflex (VSR) controls the muscles connected to the upper and lower limbs, neck, and back in response to movements (Kramer, Jerger, & Mueller, 2014, p.

103-107). The purpose of this response is to help maintain posture and center of mass over an individual's base of support (Jacobsen & Shepard, 2008). The VSR is also important during the evaluation of the vestibular system.

## Vestibular Assessment

The purpose and methods for assessing the vestibular system have expanded as more information has been discovered about the vestibular system. When a patient arrives at the clinic complaining of dizziness, it may be difficult to determine what is causing the symptoms. The complaint may even span multiple medical specialties because symptoms may be due to medications or infections, or be headache-related in nature. Taking a thorough and complete case history can help the examiner define a possible etiology for a patient's complaint. This can be conducted by having the patient complete a case history form that asks questions regarding the duration of the symptoms, if certain events trigger the symptoms, or if anything can make the symptoms better or worse (Weber, 2008). A thorough case history is also critical because patients may have difficulty expressing symptoms beyond the simple description of being dizzy (Desmond, 2011). Dizziness questionnaires also allow the examiner to have greater insight prior to vestibular assessment.

### Dizziness Questionnaires

There are many options for audiologists or other professionals to use when it comes to dizziness questionnaires. Many questionnaires are self-assessments for the patient that evaluate frequency and intensity of symptoms, specific movements that trigger symptoms, daily life activities, emotional problems, and more. Several of the more commonly used questionnaires will be discussed here: Dizziness Handicap

Inventory (DHI), Vertigo Handicap Questionnaire (VHQ), Vertigo Symptom Scale (VSS), Activity Specific Balance Confidence Scale (ABC scale), UCLA Dizziness Questionnaire (UCLA-DQ), and the Vestibular Disorders Activities of Daily Living (VADL).

The DHI is the oldest and most widely used self-assessment available for patients with balance and dizziness complaints (Herdman & Clendaniel, 2014). The questionnaire includes 25 items and is divided into three different subscales including physical, emotional, and functional. The patient is asked to rate each question using a three-point scale of "yes" (4 points), "sometimes" (2 points), and "no" (0 points). Once the questionnaire is complete, the score is calculated. A score of 44 or greater is classified as having a severe dizziness handicap (McCaslin, 2013). The purpose of the questionnaire is to identify difficulties the patient may be experiencing due to his/her dizziness or unsteadiness. There is also a screening version of the questionnaire available that consists of ten questions (Jacobsen & Shepard, 2008).

The VHQ includes 22 questions and was created in order to identify social, psychological, and behavioral situations that patients with vestibular disorders may experience (Herdman & Clendaniel, 2014). The situations include possible limitations on physical and everyday activities that are caused by vertigo (Yardley & Putman, 1992). A five-point scale of 0 (no handicap/never) to 4 (maximum handicap/always) is used for patients to respond to questions regarding social anxieties, restriction of activities, fear of vertigo, and severity of vertigo attacks. Calculating a sum of the points and multiplying the sum by 25 determines the final percentage score.

The VSS includes 27 questions related to the symptoms experienced by patients with dizziness complaints. Patients answer questions using a 6-point scale from 0 (never) to five (very often/more than once a week). The questions are split into four subscales including somatization, autonomic symptoms, acute attacks of vertigo, and vertigo of short duration. Summing item scores and dividing it by the number of questions calculates the score. Higher scores indicate more frequent symptoms. This questionnaire asks questions regarding symptoms that occur over a long period of time. There is also a short-term symptoms questionnaire that includes items regarding the frequency and severity of symptoms within the last month (Yardley, Masson, Verschuur, Haacke, & Luxon, 1992). This questionnaire consists of 15 questions and includes the same scoring as the long-term symptoms questionnaire.

The UCLA-DQ consists of five items that assess the severity and frequency of dizziness, patient quality of life, the impact on everyday activity, and fear of dizziness (Honrubia, Bell, Harris, Baloh, & Fisher, 1996). This questionnaire is a multiple-choice survey with each question having four to five answers to choose from, ranging from lowest severity/impact to greatest severity/impact. The lowest severity/impact answers are scored given one point while the greatest severity/impact answers are scored given five points with the maximum score possible being 25 (Jacobsen & Shepard, 2008).

The VADL includes 28 questions that assess the impact of vestibular disorders on the patient's daily life (Herdman & Clendaniel, 2015). The questions cover three different domains: functional, ambulation, and instrumental. Questions are related to basic self-maintenance tasks, mobility skills, and higher level or more socially complex tasks that occur inside and outside of the home (Cohen & Kimball, 2000). The patients answer each

question with a score from 1 (independent) to 10 (too difficult/no longer perform that activity) as well as a Not Applicable option. A score is calculated for each subscale as well as a total score. The total score could range from 1-8, the functional subscale from 1 to 5, the ambulation subscale from 1 to 8, and the instrumental subscale from 1 to 10 (Cohen & Kimball, 2000).

The ABC Scale consists of 16 items involving the patient's confidence to perform balance-related activities, such as getting in and out of the car, reaching on tiptoes, and walking on icy sidewalks (Powell & Myers, 1995). The patients rate each item on an 11-point scale, from 0% percent confidence in performing the task to 100% confidence, with each point increasing by ten percentage points. The total score is calculated by finding the mean of all items (Herdman & Clendaniel, 2014).

The various dizziness questionnaires can assess different areas of concern for vestibular complaints. The DHI evaluates the frequency and intensity of symptoms, movements that trigger symptoms, and possible emotional problems associated with vestibular disorders. The VADL, VHQ, and ABC Scale assess the performance of daily life activities and patient quality of life. The UCLA-DQ can perform a rapid screening while the VSS assesses specific symptoms associated with vestibular disorders. Dizziness questionnaires are self-reported measures that provide unique data for the examiner that may not be presented by the patient otherwise.

**Electronystagmography/**
**Videonystagmography**

A vestibular system lesion can be assessed by evaluating spontaneous or induced nystagmus that is measured both qualitatively and quantitatively (Pietkiewicz, Pepas, Sulkowski, Zielinkska-Blizniewska, & Olszewski, 2012). There are multiple ways to

assess eye movements in relation to the vestibular system. Two tools that are used by audiologists for this type of assessment are electronystagmography (ENG) and videonystagmography (VNG).

The discovery of the corneo-retinal potential (CRP) created a useful way to measure eye movements. The ENG is based on the CRP measurement by positioning surface electrodes horizontally and vertically around the eye (Herdman & Clendaniel, 2014). This allows a CRP measurement to occur as the eye rotates toward or away from those electrodes (Herdman & Clendaniel, 2014). The ENG records and assesses these eye movements throughout various tests while computer software presents the results on a video monitor. The VNG records and displays eye movements as they are captured directly by infrared video goggles that include cameras mounted to either the top or side of the goggles (McCaslin, 2013, Pietkiewicz et al., 2012). The video system is able to track the eye because of the difference in contrast between the pupil and the iris (McCaslin, 2013). This ensures the tracking stays locked on the pupil of the eye as the eyes move. Both the ENG and VNG systems record horizontal eye movements as well as vertical eye movements while the VNG system can also record torsional, or rotational, eye movements (Gananca, Caovilla, & Gananca, 2010). Modern ENG and VNG systems are computerized and display targets using computer-controlled light-emitting diode (LED) displays (Markley, 2007). As a test battery, ENG and VNG both include measures of oculomotor function (gaze, smooth pursuit, and saccades), positional and positioning testing, and the caloric exam. These tests are performed while the examiner is observing for the presence of nystagmus.

**Gaze testing.** During this testing, also referred to as visual fixation testing, the patient is typically asked to fixate on a stationary target that is positioned at eye level at a distance of 1.0 to 1.5 meters (Myers, 2011). Horizontal and vertical eye movements are recorded during this testing and are evaluated for the presence of nystagmus or other abnormal eye movements. The target is moved 20 to 30 degrees to the right, left, up, and down (Myers, 2011). Each fixation may be held for 30 seconds, or longer if nystagmus is observed. Testing is repeated in each position with the fixation removed.

**Smooth pursuit testing.** Smooth pursuit testing includes the assessment of the patient's ability to track a moving target (Myers, 2011). The patient is instructed to follow a laser target that is typically moving in a sinusoidal pattern on the horizontal plane. The frequency of this pattern changes over time from .2 through .8 Hz (McCaslin, 2013). Patient's eye movements are evaluated and analyzed compared to the timing and accuracy of the target (El-Kashlan & Handelsman, 2008). The examiner is observing for symmetry and the target velocity versus the recorded eye velocity (gain). The patient's inability to track the target smoothly could indicate a pathology that involves the central nervous system (Markley, 2007).

**Saccade testing.** During saccade testing, the patient is asked to follow a laser target by shifting his/her gaze only while the head remains steady (Markley, 2007). Visual targets are presented in unpredictable locations in the horizontal plane as well as the vertical plane (McCaslin, 2013). This is referred to as the random saccade testing paradigm. The patient should be instructed to follow the target as quickly as possible, but not to anticipate the target (Myers, 2011). The examiner is observing the accuracy, speed of eye movement (velocity) and the difference in time between the initiation of eye

movement and the presentation of a new target could indicate a pathology that involves the central nervous system.

**Optokinetic testing.** Optokinetic testing is performed by having the patient view bars or dots of light as they move across the horizontal plane, both to the left and to the right while recording the patient's eye movements (Myers, 2011). The velocity at which the targets move can increase, varying from 20 to 60 degrees per second (Myers, 2011). Optokinetic tests require that the patient's field of vision be at least 90% taken up by the stimuli. Utilizing a light bar that is included commercially with ENG/VNG systems does not achieve full visual field stimulation that is necessary to perform optokinetic testing (El-Kashlan & Handelsman, 2008; McCaslin, 2013; Myers, 2011). Optokinetic responses that are elicited via a light bar are activating primarily the pursuit system. These responses are commonly referred to as "look" optokinetic responses. Optokinetic responses that are elicited using full-field visual stimulation are referred to as "stare" optokinetic responses (McCaslin, 2013). In order to elicit "stare" optokinetic responses, the stimulus is presented via projection on the wall of the room or inside a rotational chair enclosure (Myers, 2011). The examiner is observing the symmetry and gain for this testing. The gain of the patient's eye movements can change depending on the directions given to the patient by the examiner. If the examiner asks the patient to actively follow the moving target by asking them to "pick a dot and follow it across the bar then go back and pick up another dot and repeat," the gain will be larger than if the examiner simply asked the patient to look passively in the direction of the stimulus (Desmond, 2011). "Stare" optokinetic responses can also refer to the response when passive instruction is

given to the patient, while "look" involves the patient actively counting or following the stimuli (Kashou, Leguire, Roberts, Fogt, Smith, & Rogers, 2010).

**Positional testing.** The purpose of positional testing is to identify nystagmus that occurs during different head and body positions (Slattery, Sinks, & Goebel, 2011). The nystagmus can originate from the central vestibular system, the peripheral vestibular system, or be iatrogenic in nature (Myers, 2011). Positional testing is completed by recording the patient's eye movements while the patient assumes several positions that involve changing the position of the head and body relative to gravitational forces on the vestibular system. Each position may be repeated with vision and with vision denied. The patient should be given mental tasks during the test to ensure the patient is alert and to prevent suppression of the nystagmus (Markley, 2007). Throughout the different positions, the examiner is observing for nystagmus that was evoked by the static position change. Prior to the start of positional changes, the examiner should observe for spontaneous nystagmus while the patient is seated in the gaze center position with vision denied (Roberts & Gans, 2008a). If there is nystagmus present during the positional changes, the examiner should determine the direction of the nystagmus and if the patient has the ability to suppress the nystagmus while fixating on an object or not. This information can help the examiner determine if the site of lesion is peripheral or central in nature. If the patient is able to suppress the positional nystagmus with fixation then this is suggestive of a peripheral nervous system involvement, while an inability to suppress the nystagmus with fixation is suggestive of central nervous system involvement (Roberts & Gans, 2008a). Positional nystagmus may also be caused by medications, alcohol use and tobacco use. It is important for the examiner to limit the patient's use of these items

prior to vestibular assessment in order to gain more accurate information regarding the patient's vestibular system.

**Positioning testing**. Positioning testing includes the Dix-Hallpike maneuver, the horizontal head roll maneuver or various modifications to these tests in order to evaluate for a condition called benign paroxysmal positional vertigo (BPPV). Positioning tests require the patient to actively transition from one position to another while positional tests evaluate the vestibular system during stationary positions. BPPV is the most common form of vertigo seen in patients with vestibular disorders (Myers, 2011). Vertigo associated with BPPV includes positioning nystagmus that has a brief latency of only 15 to 45 seconds and fatigues upon repeated provocation (El-Kashlan & Handelsman, 2008). The test used most often to see if this disorder is present is called the Dix-Hallpike maneuver.

To perform this test, the patient is seated on the examination table so both feet are in front of him/her. Depending on which side is being tested, the examiner moves the patient's head 45 degrees to the right or left. The examiner then guides the patient back to a supine position with the patient's head lower than the patient's shoulders. The examiner should support the patient's head and neck at all times during the evaluation. When the patient's head is held to the right side at a 45-degree angle, the examiner is testing the right posterior canal. The patient is instructed to keep his or her eyes open throughout the testing. The supine position is held for 30-60 seconds, or until the vertigo has subsided. The patient is then moved back to the seated position and remains there for 30-60 seconds. The process is repeated for the opposite side (Slattery, Sinks, & Goebel,

2011). Depending on the protocol, the examiner may decide to repeat the process twice on the same side to see if the nystagmus response fatigues.

The Dix-Hallpike maneuver can be modified depending on patient needs. For a patient who has difficulty lying on his/her back, such as a woman who is pregnant or an individual with arthritis, the sidelying maneuver may be an appropriate solution (Myers, 2011). For this test, the patient is seated in the middle of the exam table facing the examiner. The examiner turns the patient's head 45 degrees away from the test ear while the patient is instructed to lie down so the test ear is closest to the table. While the patient is lying on his/her side, the patient is instructed to swing the legs up on the table so the patient is lying completely horizontal on his/her side. The process is then repeated on the other side. A fully supported Hallpike maneuver may be appropriate to use with patients who cannot complete the traditional Dix-Hallpike or the sidelying maneuver, such as individuals with arthritis or a hip injury (Myers, 2011). The fully supported Hallpike procedure is the same as the traditional Dix-Hallpike with the patient's head fully supported by the examiner, however, the head is not lower than the patient's shoulders.

The horizontal head roll test assesses the horizontal canals. For this test, the patient is in the supine position with the head elevated 30 degrees and supported by the examiner. The patient is instructed to keep his/her eyes open throughout the testing. If VNG testing is utilized, the visor should also be left open so the examiner can see the patient's eyes. The patient is turned 90 degrees to the right and is held in that position for at least 30 to 40 seconds (Myers, 2011; El-Kashlan & Handelsman, 2008). If nystagmus is observed, the patient will remain in this position until the nystagmus has stopped. The patient is then returned to the initial position before being quickly turned 90 degrees to

the left and is held in this position as indicated for the right ear (El-Kashlan & Handelsman, 2008). This test is recommended when horizontal semicircular canal BPPV is suspected (McCaslin, 2013).

Prior to conducting positional or positioning testing, the examiner should make sure the patient is clear of any arterial blockages in the neck. This can be completed by performing a vertebral artery screening test (VAST) prior to performing positional or positioning testing. The patient is asked to jut his/her chin outwards while turning the head to the right and tilting the head back. The examiner asks if the patient is experiencing lightheadedness, dizziness, nausea, blurred vision, or double vision while listening for slurred speech (Roberts & Gans, 2008a). The procedure is repeated with the patient's head to the left. If the vertebral artery screen test (VAST) is not performed, the patient may have decreased blood flow to the brain while performing different positional and positioning tests and stroke-like symptoms may occur (McCaslin, 2013).

**Caloric testing.** The purpose of the caloric evaluation is to equally stimulate each ear separately and compare the resulting nystagmus. This test provides the examiner with information regarding the integrity of the right and left horizontal semicircular canals as well as the superior vestibular nerves (McCaslin, 2013). There are two primary components that are involved with a caloric examination. The first component is that a vestibular nystagmus is generated following the irrigation of the external auditory canal with a caloric stimulus. This nystagmus builds into a crescendo and then slowly decreases. The examiner measures the peak amplitude of the nystagmus response. The heating or cooling of the external auditory canal causes transfer of thermal impulse to the fluids of the inner ear, which is based on the thermal convection phenomenon (Jalocha -

Kaczka, Pietkiewicz, Zielinkska-Blizniewska, Milonski, & Olszewski, 2014). Therefore, two temperatures are utilized during the caloric examination: 7 degrees Celsius above and below body temperature (44 degrees Celsius and 30 degrees Celsius) (Slattery, Sinks, & Goebel, 2011). The introduction of different temperatures in the external auditory canal causes a change in the density of endolymph in the inner ear, which causes the fluid to move in a similar manner to a slow horizontal head movement. This only occurs in one ear while the non-test ear registers no movement, resulting in nystagmus that lasts approximately one to two minutes or until the density of the endolymph returns to normal (Desmond, 2011). The second component of the caloric examination involves performing a measurement of the VOR suppression. This is completed once the caloric response peaks in amplitude. An attenuation of the amplitude of the nystagmus response should occur when a patient is instructed to fixate on a stationary target during the caloric response. This is referred to as VOR suppression, fixation suppression, or VOR cancellation (McCaslin, 2013). If the fixation does not reduce the strength of the caloric response then there may be central nervous system dysfunction occurring (Desmond, 2011). An ice water caloric examination may be necessary if the patient does not produce a measurable response through conventional caloric irrigation.

There are two different stimulants that can be used to complete a caloric evaluation, pressurized air or water (Myers, 2011). To perform either air caloric irrigation or water caloric irrigation, the patient is placed in the supine position with the head elevated by 30 degrees. This allows for the horizontal semicircular canal to be roughly perpendicular to the ground (McCaslin, 2013). Each ear is then tested using each temperature of either water or air. The Committee on Hearing Bioacoustics and

Biomechanics (CHABA) as well as the American National Standards Institute (ANSI) has recommended that caloric irrigation be performed in a specific order: right-ear warm stimulus, left-ear warm stimulus, right-ear cool stimulus, and left-ear cool stimulus. However, a study conducted by Lightfoot (2004) revealed that test order had no physiological adaptation of the caloric response and stated examiners are free to apply any order that he/she feels is most appropriate.

If water is being used for stimulation, the irrigation will continue for 25 seconds while the irrigation will continue for 60 seconds if air is the stimulation (McCaslin, 2013). Throughout the caloric testing, it is important that the patient stay alert and focused through mental tasking in order to obtain valid nystagmus results (Slattery, Sinks, & Goebel, 2011). Approximately 60 to 90 seconds after the irrigation is administered, the caloric response peaks. The second component of the exam, the VOR fixation suppression, should be administered immediately following the caloric response peak. This can be completed by introducing a light source in the goggles for VNG or if the examiner is using ENG, the patient should open his/her eyes and fixate on a stationary object. The nystagmus for each irrigation is recorded for approximately two minutes (Slattery, Sinks, & Goebel, 2011).

Throughout caloric testing, the examiner is observing the presence and symmetry of the responsiveness of the vestibular system. A patient with normal vestibular function is expected to have all four caloric responses equal in strength (Barin & Stockwell, 2002). One ear may appear to be weaker than the other ear; this is referred to as unilateral weakness. The examiner will have to determine if the unilateral weakness is considered abnormal by using a formula introduced by Jongkees and Philipszoon (1964). First, the

examiner must determine the peak velocity of the nystagmus for each caloric irrigation. The peak velocities of the two responses of the right ear are then summed together. The same is completed for the peak velocities of the two responses of the left ear. The sum of the two responses of the left ear is then subtracted from the sum of the two responses of the right ear. This total is divided by the sum of all four peak velocities and multiplied by 100 in order to equal a percentage. According to Karin and Stockwell (2002), a percentage greater than 25 is considered to be outside the normal limit.

**Rotary Chair**

Rotational testing is another option to include during vestibular assessment in order to evaluate the horizontal semicircular canals. This testing involves stimulating the vestibular system by turning the patient along an earth-vertical axis in a sinusoidal, pseudorandom, or constant velocity manner (El-Kashlan & Handelsman, 2008). Rotational testing allows the patient to have both labyrinths of the vestibular system tested at the same time. This type of testing usually includes two types of evaluations: sinusoidal testing and rotational step testing. For each of these tests, the patient is placed in darkness and his/her eye-movement responses to acceleration are recorded (Slattery, Sinks, & Goebel, 2011). This can be conducted by using infrared cameras or electrodes while the patient is enclosed to ensure complete darkness (El-Kashlan & Handelsman, 2008). The sinusoidal harmonic acceleration evaluation tests different velocities of the VOR while the step velocity evaluation uses an impulse stimulus that is delivered by a rapid acceleration of the chair.

**Sinusoidal harmonic acceleration evaluation**. The sinusoidal harmonic acceleration (SHA) evaluates the patient's eye-movements in response to rotation around

a vertical axis. The purpose of completing SHA testing is to increase the knowledge about the VOR's responsiveness across various head movements. The patient is secured in a chair in complete darkness with his/her head tilted approximately 30 degrees (Myers, 2011). The chair is calibrated to move in counterclockwise and clockwise rotations at various velocities. The patient is accelerated slowly in a rotating motion until the peak velocity is reached at 60 degrees per second. The chair then slows down before changing direction (El-Kashlan & Handelsman, 2008). Testing protocols vary from clinic to clinic; however, most clinics test between .02 and .64 Hz (Myers, 2011). The examiner should provide the patient with tasking opportunities in order to keep the patient alert.

Rotary chair tests are conducted in complete darkness to ensure that only the VOR is being examined. However, this will only evaluate the peripheral vestibular system. If the examiner needs to evaluate the central vestibular system, for example, in cases where the patient suffers from migraine-related dizziness or traumatic brain injury, introducing a visual fixation to SHA rotary evaluations may be beneficial. During a SHA evaluation, the patient is asked to focus on an LED light that is projected onto the enclosure wall. It is important that the point of light travels at the same speed as the rotary chair. A patient should have a reduction or elimination of nystagmus when fixating on the light (Desmond, 2011).

Another visual effect that can be introduced to traditional SHA tests is introducing a nonmoving OPK stimulus that is projected on to the enclosure wall. Nystagmus that was recorded during traditional SHA testing can be compared to nystagmus recorded with the introduction of the stationary OPK stimulus in order to rule out peripheral versus

central vestibular disorders. SHA testing is just one type of rotational chair assessment that evaluates the responsiveness of the vestibular system to various head movements.

**Step velocity evaluation.** The rotary chair can also be used to conduct a step velocity evaluation, also referred to as rotational step testing. The patient is seated in the chair with his/her head tilted forward approximately 30 degrees in complete darkness while the chair is rotated at a constant velocity of 60 degrees per second for a period of 45 to 60 seconds in one direction before quickly stopping (El-Kashlan & Handelsman, 2008). The patient's eye movements are observed throughout the testing and continue to be observed up to one minute after the chair has stopped moving (Slattery, Sinks, & Goebel, 2011). The process is then repeated with the chair rotating in the opposite direction. The patient should experience an initial burst of nystagmus in the direction of the rotation that should disappear as the patient maintains a constant velocity. Once the chair has stopped abruptly, the patient should experience another burst of nystagmus in the opposite direction. The initial nystagmus from the peak velocity of the chair is compared to the nystagmus generated after the chair has stopped moving (Myers, 2011).

## Computerized Dynamic Posturography

Computerized dynamic posturography (CDP) assesses the vestibular system by observing how well the patient can maintain balance in a variety of controlled conditions (Myers, 2011). This is completed by using force plate technology in order to measure the patient's center of balance in different situations (Herdman & Clendaniel, 2014). The force plate technology can both translate and rotate (Furman, 1995). CDP testing does not have diagnostic capabilities to localize a lesion or determine etiology; however, CDP is able to assess postural responses, document changes in responses, and identify

malingering (Furman, 1995; Herman & Clendaniel, 2014). Test batteries for CDP evaluations frequently consist of three tests: sensory organization test (SOT), the motor control test (MCT), and the adaptation test (ADT) (El-Kashlan & Handelsman, 2008; Myers, 2011). The SOT assesses the strengths and weaknesses of the somatosensory, visual, and vestibular cues that are used by a patient in order to maintain balance. The MCT assesses the timing of a patient's response to changes in balance that are necessary in order to maintain equilibrium. The ADT assesses the patient's ability to adapt to outside generated stimuli. Each test is explained in detail below.

**Sensory organization testing**. The SOT consists of six different conditions that work to assess each sensory system required in maintaining balance: somatosensory, visual, and vestibular inputs. Each condition is repeated three times, and the results are averaged for a combined equilibrium score (Myers, 2011). During the test, the patient is standing on a calibrated force plate that is enclosed on three sides. The patient is asked to stand as still as possible and maintain balance to the best of his/her ability while all six conditions are evaluated: condition one does not alter any of the three primary sensory systems required to maintain balance. The second condition measures center of gravity with eyes closed, meaning the patient is relying on vestibular and somatosensory input. Condition three distorts visual feedback by stabilizing the force plate while the walls of the enclosure move to postural changes. This means that the patient is relying on input from the three primary sensory systems; however, the visual input is misleading. The fourth condition distorts proprioceptive feedback, meaning the patient is relying on vestibular and vision inputs. Condition five distorts proprioceptive feedback and eliminates vision, meaning the patient is relying on vestibular input. The sixth and final

condition distorts visual and proprioceptive feedback by moving the force plate as well as the walls of the enclosure in response to the patient's movement. This condition forces the patient to rely on vestibular input while the visual inputs are misleading (Herdman & Clendaniel, 2014; Myers, 2011).

Throughout the SOT evaluation, the patient's center of gravity as well his/her ankle and hip movements are assessed during each condition. Patients should utilize adjustments around his/her ankles for small changes in posture while utilizing adjustments around his/her hips during large shifts in posture (Liaw, Chen, Pei, Leong, & Lau, 2009). The results of the SOT give the examiner information regarding the patient's risk for potential falling (Whitney, Marchetti, & Schade, 2006).

When assessing a patient using SOT, it is possible to discover that the patient is showing inconsistencies between the reported problem and the performance of the patient. This is referred to as malingering. A patient who is truly experiencing symptoms of vertigo will likely perform well on several of six positions being tested (Cevette, Puetz, Marion, Wertz, & Muenter, 1993). However, a patient who is exaggerating his/her symptoms, or malingering, will likely have a substandard performance on all six of the subtests (Mallinson & Longridge, 2005). The act of exaggerating symptoms may not be on purpose but may be the result of previous examiners' dismissive treatment of the patient's symptoms.

**Motor control testing.** Vestibulo-spinal reflexes connect the central vestibular system to various muscles in the body. Vestibulo-spinal reflexes allow the body to make postural changes in order to maintain balance and are engaged when a person is pushed forward or pulled backward (Myers, 2011). Motor control testing (MCT) measures the

latency of these reflexes in patients. There are three different responses that can be measured during a motor control test. These include: the myotic reflex, functional stretch response, and volitional movements (or learned responses). These three responses work together to ensure that the patient maintains balance throughout the external stimulus.

While conducting a MCT test, the patient is placed on the posturography platform while small, medium, and large backwards and forwards translations are presented sporadically. Each condition is presented three times while the time it takes the patient to sway and correct his/her balance is averaged for each condition. The larger the external stimulus is, the faster the response time will be (Myers, 2011). Responses are also quantified in terms of weight distribution, or how much weight is placed on the left leg versus the right leg. An abnormally slow response time may be due to a disorder that affects the vestibulo-spinal reflex, somatosensory, or proprioceptor systems. This test provides useful information regarding the patient's risk of falling in response to an unpredictable external disturbance (El-Kashlan & Handelsman, 2008).

**Adaptation testing.** The final test that is included in the posturography battery is the ADT, or adaptation test. This test assesses the patient's ability to adapt to an unexpected external stimulus. For example, some platforms may rotate the patient's toes up or down quickly a certain number of times. The reaction time of the patient and the time it takes the patient to adjust his/her posture to the stimulus should improve. If there is not improvement over time, the patient may be more at risk to experience falls or have difficulty maintaining balance (Myers, 2011).

## Vestibular Evoked Myogenic Potentials

The vestibular evoked myogenic potential (VEMP) is an ipsilateral response that evaluates the inferior portion of the vestibular nerve as well as the saccule (El-Kashlan & Handelsman, 2008). The VEMP is a short-latency vestibulo-spinal reflex response that occurs in reaction to intense acoustic stimuli and is recorded at the sternocleidomastoid (SCM) muscles. The ipsilateral response is taken from both the right and left SCM using surface electrodes and is elicited by presenting a loud tone burst or click while the SCM muscle is contracted and is referred to as the cervical VEMP (cVEMP) (Venhovens, Meulstee, & Verhagen, 2015). The amplitude of the cVEMP response is affected by the intensity of the stimulus as well as the amount of muscle activity (Myers, 2011). The ocular VEMP (oVEMP) is recorded extraocularly by placing surface electrodes near the eyes (Rosengren, Welgampola, & Colebatch, 2010). Ocular VEMP responses reflect the function of the utricle and superior vestibular nerve (Iwasaki & Yamasoba, 2014).

## Tasking

Mental alerting, also known as tasking, is important for the examiner to complete throughout the testing period. This applies to the nystagmus that is induced by positional testing, caloric or rotational chair tests (Desmond, 2011). Patients may have the ability to imagine a fixation point (even when the eyes are closed) that could enable suppression of the nystagmus (Desmond, 2011). This would affect the reliability and the sensitivity of the vestibular assessment. Mental alerting can be completed through the examiner asking the patient to perform tasks such as listing the states of the United States or listing all female names beginning with the letter “a.”

## Summary

The assessment of patients having complaints related to balance, dizziness, or vertigo has evolved into a more comprehensive evaluation that is able to test each of the sensory systems involved as well as the five vestibular end organs (McCaslin, 2015). Each of the tools discussed in this chapter, along with a thorough case history, are valuable in helping the examiner determine a diagnosis and may also help in the development of a management or rehabilitation plan.

## Screening Tests for Vestibular Dysfunction

Screening tests for vestibular dysfunction are important to utilize. Screening tests can give the examiner more information regarding a general overview of the vestibular system to help identify vestibular deficits. However, there are other screening tests available that assess for a specific pathology. It is important to keep in mind that screening tests should be used to complement a comprehensive vestibular assessment. A negative result on a screening test does not ensure a problem does not exist and further evaluations may be necessary. A description of several screening vestibular evaluations follows.

### Dynamic Visual Acuity Testing

The purpose of performing dynamic visual acuity testing is to assess the patient's visual capabilities during various speeds of head movement (Myers, 2011). If a patient complains of blurred vision throughout various head movements, it is necessary to assess the patient's visual capabilities, as this may be attributed to a defect in the vestibulo-ocular reflex. During head movements, the vestibular labyrinths produce an equal and opposite compensatory eye movement that keeps the eye steady (Jacobsen & Shepard,

2008). Dynamic visual acuity test protocols may include tests of static visual acuity, gaze stabilization, gaze perception time, and a patient's dynamic visual acuity (Myers, 2011).

Static visual acuity refers to the patient's ability to clearly see while his/her head is stable. This test can be completed by having the patient read a standard eye chart, or by having the patient describe the orientation of the letters "E" and "U" (Myers, 2011). Gaze stabilization is a measure of the fastest speed at which a patient can shake his/her head while being able to maintain clear vision with the stimulus target maintaining a set size. Dynamic visual acuity refers to how much larger the stimulus target had to be before the patient was able to appropriately identify it when shaking his/her head at a constant speed. These tests combined determine a patient's functional visual capabilities. While performing this test, it is important that an equal distance from the stimulus is maintained. Better measurements can also be obtained if the patient is able to ensure both short and equal head movements, not more than 20-30 degrees off center (Myers, 2011).

**Head-Impulse Test**

This test is also referred to as Halmalgyi head thrust (Halmagyi & Curthoys, 1988). This is an evaluation that tests the patient's functional VOR through fast, unexpected head turns (Myers, 2011). During this test, the patient is asked to keep his/her eyes on the examiner's forehead or nose. The examiner places his/her hands on the patient's head and unexpectedly and quickly turns the head in the planes of the semicircular canals. The examiner should ensure that the patient's head movements are no greater than 20 to 30 degrees in any direction. If the patient has an impaired VOR, the eyes will slip off the target when the head is rotated toward the affected ear (Myers,

2011). The examiner should see the patient's eyes perform correction saccades after the head is turned.

Because the examiner is using visual observation for a possible nystagmus, some nystagmus may be missed. A video-oculography system (v-HIT) was created to help measure eye velocity during head rotation (MacDougall, Weber, McGarvie, Halmagyi, & Curthoys, 2009). A camera is mounted on a lightweight frame and provides instant feedback to an automated analysis software. The examiner performs the HIT while the patient is wearing the frames. The v-HIT measurement provides the examiner with an objective measure of the VOR (MacDougall et al., 2009).

**Head-Shaking Nystagmus Test**

The head shake test is a VOR evaluation and may be performed actively or passively. The patient is fitted with Frenzel lenses or VNG goggles with the visor lowered. The examiner may also choose to observe the patient with no lenses or goggles; however, it may be difficult for the examiner to observe nystagmus if it is present. The patient is asked to shake his/her own head (active head shake) or the examiner may move the head (passive head shake). This should be completed at a rate of at least 1-2 Hz for 20 seconds (Myers, 2011). After 20 seconds has passed, the head stops moving and the patient is instructed to open his/her eyes. The examiner observes the patient to see if any nystagmus is present. If nystagmus is present then there is a strong indication that the patient's balance system is not dynamically compensated (Asawavichiangianda, Fujimoto, Mai, Desroches, & Rutka, 1999).

**Modified Clinical Test of Sensory Integration of Balance**

The modified clinical test of sensory integration of balance includes four different testing conditions. During the first condition, the patient is instructed to stand quietly with eyes open on a firm surface. For the second condition, the patient is instructed to stand quietly with eyes closed on a firm surface. The third condition includes the patient standing on foam or other compliant surface with eyes open. The final condition requires the patient to stand on a compliant surface with eyes closed. Each condition is held for at least 30 seconds or until the patient becomes unsteady. A result is considered to be abnormal if the patient exhibits excessive swaying, corrective steps, or imminent falls (Myers, 2011).

**Romberg/Tandem Romberg**

The Romberg or tandem Romberg is a vestibulo-spinal reflex evaluation that is used to assess the patient's ability to control his/her balance while standing still (Myers, 2011). The patient is instructed to stand with his/her feet shoulder width apart. First, the patient has the eyes open for 30 seconds. The examiner then instructs him/her to close the eyes for 30 seconds. The patient may not be able to keep the eyes closed for more than 30 seconds if he/she is excessively swaying or at risk of falling. The examiner may also perform this screening test by having the patient put his/her feet together or one foot in front of the other and having the eyes closed. The examiner should always be near the patient, but not touching the patient, in order to prevent falling if the patient were to lose balance. The examiner observes the patient on postural changes, if excessive sway is apparent, or if the patient favors one leg or one side.

### Fukuda Stepping Test

The Fukuda screening test may be performed with patients who are able to maintain balance during the eyes-closed Romberg testing and is also a vestibulo-spinal reflex evaluation (Honaker, Boismier, Shepard, N.P., & Shepart, N.T., 2009). The patient is asked to stand with the eyes closed and arms held out straight in front of the body. The patient then marches in place for 50 steps. The results of this test are considered abnormal if the patient's angle of rotation exceeds 45 degrees or if excessive sway or staggering is noted (Myers, 2011).

### Tandem Walk/Gait Assessment

The gait assessment is also a vestibulo-spinal reflex evaluation. During this assessment, the patient is asked to walk away from the examiner and then stop and turn around and walk back toward the examiner. The examiner observes the patient for veering to one side or the other, excessive swaying, widened stance, and cadence. During the tandem walk screening test, the patient is asked to walk heel to toe away from the examiner then turn around and walk heel to toe toward the examiner. Results are considered to be abnormal if the patient is excessively swaying, staggering, or is unable to walk heel to toe (Myers, 2011). This screening could be performed if the patient is able to complete the gait assessment with little difficulty.

## Vestibular Rehabilitation

Once the vestibular assessment is completed, there are multiple ways to treat patients with vestibular disorders. One option is the medical treatment of the symptoms and possible underlying pathologic conditions that may be occurring. The second option is reparative or ablative surgical techniques of the end organ or vestibular nerve, which

may be responsible for causing the patient to be dizzy. The third option is for the observation of symptoms and counseling to help the patient learn to cope with the dizziness. Treatment of vestibular disorders through exercises and repositioning techniques is referred to as vestibular rehabilitation therapy (VRT), and has been growing in popularity over the past two decades (Desmond, 2011).

The basic framework of current VRT programs is based on a series of exercises referred to as the Cawthorne-Cooksey exercises that were developed in the 1940s (Cawthorne, 1944; Cooksey, 1946). The group exercises include symptom-provoking maneuvers that were thought to promote central compensation and habituation to help persons with vestibular dysfunction caused by brain injury (Jacobsen & Shepard, 2008). Today, patients receive a customized exercise program that gradually increases in difficulty and speed as the patient improves (Jacobsen & Shepard, 2008).

It is essential for the clinician to complete an exhaustive evaluation that includes the chronology of symptoms, how the symptoms affect daily living, duration since the onset of the symptoms, and physical assessment of the vestibular system of the patients prior to starting the VRT to ensure the patient will receive benefit (Boyer et al., 2008). Vestibular rehabilitation has been found to be effective for the following vestibular complaints: bilateral and unilateral peripheral vestibular hypofunction (reduced vestibular function) associated with BPPV, vestibular neuritis, labyrinthitis, and Meniere's disease, and central vestibular disorders (Boyer et al., 2008; Deveze, Bernard-Demanze, Xavier, Lavieille, & Elziere, 2014; Sealy, 2014; & Sillier & McDonnell, 2011).

The goals of VRT are to desensitize the balance system to movements that provoke symptoms, coordinate and improve eye and head movements, improve static and

dynamic balance stability, and teach the patient how to become more active (Hillier & McDonnell, 2011; Toh, 2008).

Vestibular rehabilitation relies on the improvement of central compensation. This compensation depends on three main mechanisms: adaptation, substitution, and habituation (Deveze et al., 2014). Patients with vestibular symptoms may have significant activity and participation restrictions that affect the patient's daily life due to the patient's unwillingness to enter a position that causes dizziness (Hillier & McDonnell, 2011). Compensation may be delayed or disrupted if the patient decreases physical activity or has decreased somatosensory stimuli. This lack of stimuli and activity can lead to chronic dizziness and imbalance (Cowand, Wrisley, Walker, Strasnick, & Jacobson, 1998). Vestibular rehabilitation has been used to help reduce symptoms by utilizing maneuvers that aid in the habituation of unpleasant sensations, the substitution of strategies for the loss of vestibular function and that adaptation of residual vestibular function (Herdman & Whitney, 2014).

Habituation occurs through symptom reduction when the patient is exposed to provocative stimuli (Toh, 2008). Repeatedly performing maneuvers allows the brain to habituate or reduce the responsiveness of the vestibular system. If there are specific movements that cause dizziness, the patient is asked to provoke the dizziness by repeating this movement. Adaptation exercises are completed to improve visual-vestibular interaction and eye/hand coordination to reduce error of the VOR (Hillier & McDonnell, 2011). Vestibular dysfunction may cause asymmetrical eye rotation during head movement resulting in an inability to see clearly, reduction in VOR gain, or an inability to maintain balance during head movements (Herdman & Whitney, 2014).

Adaptation exercises may include gaze stabilization, which has the patient attempt to maintain fixation on a target while the head is moving. This can stimulate a retinal slip, which is an error signal sent to the brain when the target velocity does not match the eye velocity and causes the image to "slip" across the retina of the eye, resulting in adaptation of the VOR (Herdman & Whitney, 2014). Finally, substitution occurs by reducing reliance on other sensory systems (visual and somatosensory), which strengthens the vestibular system (Meringolda, 2013). Postural stability can be improved by having the patient perform exercises with and without vision and/or having the patient stand on foam. Removing or altering the visual and somatosensory system(s) results in the patient utilizing the remaining vestibular cues (Herdman & Whitney, 2014).

When the patient is affected by BPPV, canalith-repositioning procedures (CRP) may be appropriate to include in VRT. BPPV occurs as a result of displaced crystals of calcium carbonate referred to as otoconia. Otoconia are normally attached to the otolithic membrane in the utricle of the inner ear but can detach and collect in one of the semicircular canals or the cupula of the canal, which results in dizziness. Otoconia can detach for a variety of reasons, including aging, infection, or trauma (Jacobsen & Shepard, 2008). The goal for performing CRP is to move the otoconial debris from the affected semicircular canal back into the utricle through performing various maneuvers (Jacobsen & Shepard, 2008). The Epley maneuver is one example of a canalith repositioning procedure. During this exercise, the patient is positioned on the examination table facing the clinician. The patient is then brought to the offending ear Hallpike position (head hanging off the table). While the patient remains in the supine position, the patient's head is rotated to the shoulder on the opposite side (if the left ear

was the offending ear then the head would be rotated to the right shoulder). The orientation of the head stays the same (90 degrees) while the patient is rolled over onto the right shoulder and hip causing the patient to be looking down towards the floor. The head remains tilted down towards the shoulder while the patient is raised to the seated position. The head is then rotated forward with the chin tilted down. The patient is kept in each position until nystagmus has ceased (Desmond, 2011).

The original maneuver by Epley required five positional changes. There have been modifications to these positional changes such that only four positions have been performed, omitting the position in which the patient's nose is pointed down towards the floor. However, it is recommended that the maneuver be repeated multiple times if utilizing the four positional changes approach (Herdman & Hoder, 2014). Other modifications to the Epley maneuver include the timing between position changes while completing the maneuver. Moving through each position quickly is not necessary and longer wait times between switching positions may help reduce nausea (Herman & Hoder, 2014). Post-treatment instructions are other modifications that can occur while performing the Epley maneuver. The original Epley maneuver involves advising the patient to keep the head upright for 48 hours following the treatment, which includes sleeping with the head elevated 45 degrees (Epley, 1992). A follow-up visit would occur one week later and another maneuver would be performed if necessary. Modified instructions may have the patient stay upright for 24 hours or for as little as 20 minutes. Lynn, Pool, Rose, Brey, & Suman, (1995) suggested that a soft cervical collar may be beneficial for helping patients keep the head upright. Other post-treatment instructions include the patient sleeping upright for two to seven days or avoiding lying on the

affected ear side for a period of one to five days (Hunt, Zimmermann, & Hilton, 2012). A Cochrane Review regarding post-treatment instructions has been conducted and it was found that remission rates were significantly higher for patients who did not receive post-treatment instructions versus patients who did complete the post-treatment instructions and that inclusion of post-treatment instructions was more effective than the Epley maneuver alone (Hunt, Zimmermann, & Hilton, 2012). The original Epley maneuver included premedication of the patient using diazepam or scopolamine to help reduce nausea and vomiting (Epley, 1992) also included vibration to the mastoid of the affected side during the procedure to aid the movement of the otoconia through the canal (Epley, 1992). Recent studies conducted regarding the Epley maneuver do not involve premedication and have shown no additional benefit to using vibration during the procedure (Hunt, Zimmermann, & Hilton, 2012).

Another example of CRP is the Semont maneuver, also known as liberatory treatment or brisk treatment (Herdman & Whitney, 2014). Semont, Freyss, and Vitte described the Semont maneuver in detail in 1988. The maneuver begins by having the patient seated on the examination table facing the clinician. The patient is quickly moved toward the offending ear while the patient is looking toward the ceiling. After two to three minutes the patient is moved quickly to the opposite side maintaining the same head orientation, resulting in the patient looking toward the examination table. After approximately five minutes the patient is returned to the original seated position (Semont, Freyss, & Vitte, 1988).

The Gans repositioning maneuver (GRM) is another maneuver that could be conducted to help treat BPPV. The GRM is a hybrid repositioning treatment that

incorporates different aspects of the Semont maneuver and the Epley maneuver (Roberts & Gans, 2008b). The patient is instructed to move into a side-lying position towards the affected ear with the head turned 45 degrees away from the affected ear. This position is similar to the Semont maneuver. The second position has the patient roll from the affected side to the unaffected side, which is similar to the Epley maneuver. A liberal headshake is performed and then the patient is returned to a seated position. Roberts, Gans, and Montaudo (2006) found that 80% of 207 participants were clear of BPPV after one treatment with the GRM and another 15% were clear after a second treatment. All participants were clear of vertigo after 4 treatments. The clinician may also choose to have the patient participate in at-home exercises which may include the Brandt-Daroff exercises. This may be necessary because of recurring BPPV or unwillingness or inability of the patient to return for treatment. The Brandt-Daroff exercises are designed to provoke episodes of BPPV. The patient is instructed to move into the side-lying position on the involved side and then move back to the seated position and continue to the side-lying position on the uninvolved side. This is completed several times throughout the day for multiple days until the symptoms are no longer present (Roberts & Gans, 2008b).

Outcome measurements should be completed before and after rehabilitation. A patient can be discharged from VRT when the patient has reached all the goals set during the initial session and the patient self-reports the improvement of functional ability (Desmond, 2011). Examples of self-report measures include the DHI, VADL, and other dizziness questionnaires discussed earlier in the chapter.

Vestibular rehabilitation can help improve and manage dizziness symptoms as well as improve functional mobility. VRT is within the scope of practice for audiologists (AAA, 2004; ASHA, 1999). However, there are other medical professions that can provide VRT, including physical therapists, occupational therapists, chiropractors, otolaryngologists, and neurologists (Hain, 2013). Physical therapists with a specialty involving vestibular dysfunction are currently the healthcare professionals most commonly performing VRT (Herdman & Whitney, 2014).

## Vestibular Assessment in the Pediatric Patient

Vestibular dysfunction may also occur in children. However, it is not uncommon for vestibular dysfunction to go undiagnosed in many children simply because children do not have the capabilities or vocabulary to explain what they are feeling, making it difficult to recognize and diagnose appropriately. Children with vestibular dysfunction are initially thought to be clumsy and uncoordinated. Children may also be diagnosed with a behavior abnormality, have delayed motor development, or have learning disabilities due to poor dynamic visual acuity or deficiency of the VOR (Cushing, Levi, & O'Reilly, 2013). Prior to the start of vestibular assessment, vision testing as well as an age appropriate audiologic evaluation should be completed. When testing children, the examiner should prepare the family for what to expect during the assessment, have patience and creativity, as well as allow breaks in testing or several visits to the clinic. There are numerous factors that determine whether vestibular testing with children will be successful. Some factors depend on the child, such as age, size, cognitive ability, and limits of compliance. Other factors depend on the skill of the examiner. The examiner must be able to make the experience as nonthreatening and engaging as possible in order

to record valid information from the child (Zwicky, 2013). Similar to adults, children can be tested using ENG/VNG, rotational testing, CDP and VEMP as long as appropriate modifications are used.

Videonystagmography is preferred over ENG when testing children (Zwicky, 2013). However, ENG may be useful if the VNG goggles are unable to be worn due to poor fit related to small head size or craniofacial anomalies. Appointment times should also be longer for children than for adults. This is due to children requiring small breaks between each test to ensure compliance. When performing the caloric exam, the examiner should perform monothermal warm irrigations when necessary, reduce irrigation time when necessary, as well as make tasking fun and adjusted to the child's interests. However, children may be unable to complete an ENG/VNG assessment until five to seven years of age (Valente, 2007a). Rotary chair can easily be modified in order to test children, beginning with the child seated upon the parent's lap (Valente, 2011). The enclosure can be decorated in a child-friendly manner. Also during visual tests, the target can be a cartoon or related to the child's interests. Additionally, during tasking, the examiner could use children's songs or nursery rhymes. The examiner may also not be able to test every frequency that can be tested with adults due to a limited attention span. However, the examiner should observe and record eye movements through an infrared camera and test as many frequencies as possible in order to obtain thorough results concerning the ear's nonlinearity (Valente, 2007b). Most children over three years of age are able to participate in both subtests of rotary chair: sinusoidal harmonic acceleration and velocity step test (Fife et al., 2000). However, the child may be fearful of the

darkened enclosure causing the examiner to ensure continual interaction, reassurance and positive reinforcement throughout testing (Phillips, 2013; Valente, 2008).

The most widely used subtest of CDP performed on children is the sensory organization test (SOT) (Valente, 2007a). Modifications that should be taken into consideration by the examiner include using the smallest harness. The enclosure should be child-friendly. It is recommended that the examiner forgo the three trials of each condition if the child is unable to attend to the task; however, three trials would improve reliability of the test (Valente & McCaslin, 2011). The examiner should also ensure continual positive reinforcement as well as provide a reward following each trial. Rine et al., (2000) found that CDP testing can be completed on children as young as three years of age. Motor control testing (MCT) as well as adaptation subtests may also be performed with children (Valente, 2007b).

Due to the time-efficient, objective, and non-invasive nature of the test, vestibular evoked myogenic potentials (VEMP) are used with the pediatric population. VEMPs can be measured in children capable of supporting their head (as young as two to three months of age) (Wiener-Vacher, 2013). A possible modification that can be made when performing VEMPs on a pediatric patient is to use cartoon characters or other various child-friendly objects to ensure the child is positioned properly throughout the evaluation (Valente, 2011). Other modifications include having the child seated on the parent's lap to ensure comfort for the child as well as performing bilateral recordings to save time (Valente, 2008). For a more robust response, the examiner should consider using a 500 Hz tone burst rather than a click stimulus (Valente, 2007a).

Vestibular testing is most commonly performed on children with vertigo, recurrent unexplained falling, imbalance, or suspected malformations affecting the inner ear (Fife et al., 2000). Specifically, vestibular evoked myogenic potentials may also be performed on children in order to determine which ear should be implanted during consideration for cochlear implant candidacy to ensure that the least functional vestibular system is implanted (Jacot, Van Den Abbeele, Debre, & Wiener-Vacher, 2009). No matter what form of vestibular assessment test is selected, it is important that the examiner who is performing vestibular assessment with children obtain pediatric normative data so that diagnostic results are not compared to adult normative data (Valente, 2008).

A survey research design can be used to assess opinion and trends on various topics and consists of a predetermined set of questions given to a sample. There are also different modes of data collection for survey research. The most common modes include mail, telephone, web-based, and face-to-face survey. Some advantages to conducting survey research are that data can be obtained from a large geographic area, respondents can complete the survey at their leisure, there is a uniform question presentation that reduces the researcher's bias, and the data obtained are relatively easy to analyze (Valente et al., 2011). However, there are also disadvantages to conducting survey research, such as the possibility that only a small number of the sample will respond. Response rate is defined as the number of respondents divided by the number of eligible participants in the sample (Draugalis, Coons, & Plaza, 2008). Face-to-face surveys result in the highest response rate (Nulty, 2008). For online surveys, the response rate can vary considerably depending on methods used by the researcher to boost responses, such as

repeat e-mails or awarded incentives (Nulty, 2008). Other disadvantages to conducting survey research include not having the knowledge that the targeted respondent is actually the individual responding, and respondents may not share all information when asked in a survey format (Valente et al., 2011).

In the past, numerous survey-based studies have been completed in order to gain insight on general audiologic practices taking place in the United States (Finan, 2012; Martin, Armstrong, & Champlin, 1994; Martin, Champlin, & Chambers, 1998; Martin & Forbis, 1978; Martin & Morris, 1989; Martin & Pennington, 1971; Martin & Sides, 1985; Pennington & Martin, 1972). The first survey to include questions regarding vestibular testing was the survey conducted by Martin and Forbis in 1978.

Martin and Forbis (1978) sent questionnaires to 700 audiologists chosen at random from the ASHA membership directory. The researchers wanted to determine which audiometric procedures American audiologists most commonly used at that time. The questionnaire included questions that were broken up into ten groups: pure-tone audiometry, masking in pure-tone and speech audiometry, impedance measures, pediatric audiometry, Bekesy audiometry, Short Increment Sensitivity Index (SISI), recruitment tests, tone-decay tests, tests for central auditory disorders, and miscellaneous procedures. The researchers received 319 questionnaires in return. The questions pertaining to ENG were featured in the miscellaneous procedures section of the questionnaire. When the participants were asked which objective tests they administered, 134 of 319 reported performing objective vestibular tests of some kind. The most commonly administered objective test was the ENG. It was found that 93 of 134 (69.4%) audiologists who administered objective tests chose to administer the ENG. The questionnaire also

included questions regarding persons who should perform ENG testing and the audiologist's primary role in performing ENG. Martin and Forbis reported that 302 audiologists responded to the question regarding who should perform ENG testing. The most common response was that a technician under a physician's supervision should perform ENG (28.1%); this was followed closely by the response that an audiologist should perform ENG (22.9%). In nearly 20% of the surveys returned, participants responded that audiologists should have no role in ENG. However, 47.8% of the responding participants believed that audiologists should both administer and interpret ENG.

The Martin and Sides (1985) survey expanded on the previous survey of audiologic procedures conducted in 1978. This included adding sections in the questionnaire regarding hearing aids, counseling, tests for psuedohypacusis, and behavioral site-of-lesion tests. The researchers mailed out 750 questionnaires to audiologists chosen at random from the ASHA membership directory and received 230 questionnaires in return. Questions pertaining to ENG testing were included in the objective tests section of the questionnaire. Martin and Sides found that 74 of 219 participants that answered the question (33.8%) performed ENG testing.

In 1989, Martin and Morris conducted a survey study that included a detailed questionnaire regarding basic audiologic practices and procedures. The researchers mailed the questionnaire to 800 audiologists chosen at random from a list of members of the American Auditory Society, and received 468 responses. This questionnaire consisted of 100 questions that included topic areas discussed in earlier surveys as well as adding sections including the use of computers in audiologic practice. Electronystagmography

(ENG) continued to be one of the most widely used methods of electrophysiologic tests performed by audiologists. A total of 333 audiologists indicated using electrophysiologic tests and 233 of those respondents performed ENG testing. A new question was added to this survey compared to the previous surveys regarding the percentage of time performing ENG testing. A total of 457 audiologists responded to the question. Nearly 50% of the respondents did not perform ENG while approximately 45% performed ENG 1%-25% of the time. When asked if audiologists should be performing ENG testing, approximately 45% of respondents felt that an audiologist should perform ENG while nearly 28% believed a technician under the audiologist's supervision should perform ENG testing. Finally, 60% of respondents believed that audiologist's primary role in ENG should be to both administer and interpret the test.

Martin, Armstrong, and Champlin (1994) conducted a study that surveyed audiologists' testing procedures that were currently used compared to those recommended by ASHA. The researchers mailed the questionnaire to 500 audiologists throughout the United States who were chosen at random from a list of members of the American Auditory Society. A total of 258 questionnaires were returned to the researchers. The researchers reported that audiologists who performed ENG testing spent less than 25% of their time in this practice. No other questions regarding ENG were included in this survey.

By 1998, Martin, Champlin, and Chambers were conducting the seventh survey of audiometric practices in the United States. A ten-page, 98-item questionnaire was mailed to 500 audiologists randomly selected from the AAA membership directory. A total of 218 questionnaires were returned. Approximately 47% of responding clinicians were

administering ENG testing and 68% believed that an audiologist should perform ENG testing while 18% believed a technician should perform ENG testing. The researchers also found that 80% of the participants responded that audiologists should be both administrator and interpreter. The researchers also reported that only 5% responded that audiologists should have no role in ENG testing. Refer to table 1 for an overview of the surveys completed by Martin and colleagues.

*Table 1. Overview of Martin et al. (1978, 1985, 1988, 1994, 1998) surveys*

| | Martin & Forbis | Martin & Sides | Martin & Morris | Martin, Armstrong, & Champlin | Martin, Champlin, & Chambers |
|---|---|---|---|---|---|
| Year Published | 1978 | 1985 | 1988 | 1994 | 1998 |
| Number of Participants | 319 | 230 | 468 | 258 | 218 |
| Number of Audiologists Performing Objective/ Electrophysiologic Tests | 134 | 219 | 333 | N/A | 212 |
| Number of Audiologists Performing ENG | 93 (69%) | 74 (34%) | 233 (70%) | N/A | 100 (47%) |
| Audiologists should both administer and interpret ENG | 47.80% | N/A | 60% | N/A | 80% |
| What percentage of time is spent performing ENG (Most common answer) | N/A | N/A | <25% of practice time | <25% of practice time | N/A |

In addition to the surveys conducted by Martin and colleagues, Finan conducted a survey in 2012. The purpose of the study was to collect updated information regarding audiometric practices in the United States. A total of 1,057 surveys were emailed to audiologists at random from the AAA membership directory. The survey included questions regarding demographics, otoscopy, audiometric evaluations, auditory

processing disorders, electrophysiologic tests, vestibular testing, and hearing aids. The researcher also wanted to determine if techniques and procedures were dependent on the type of practice the audiologist was working in. A total of 172 surveys were included in the results for this study.

Finan (2012) reported that 65% of respondents were performing vestibular testing. The most commonly used vestibular testing method was VNG with air calorics (65%). The researchers also found that 82% of respondents did not perform vestibular rehabilitation with patients. The most common practice location for those respondents who performed vestibular testing was an ENT (Ear Nose and Throat) office, followed by a hospital, while audiologists who worked in a university, school, or private practice setting were less likely to perform vestibular testing.

There is also precedence for conducting survey studies that examine narrowly focused areas of practice such as diagnosis and management of auditory processing disorder and audiological immittance practices. Emanuel, Ficca, and Korczak (2011) completed a study to survey diagnostic and intervention protocols for those audiologists conducting auditory processing disorder testing. The researchers completed this survey in order to gain knowledge regarding tests that should be included as part of a basic auditory processing test battery. Emanuel, Henson, and Knapp (2012) completed a survey study regarding audiological immittance practices. They wanted to determine the number of audiologists practicing tympanometry and acoustic reflex testing as well as identify the specific practices being performed.

Although the Martin and colleagues studies and the Finan (2012) study included a section of questions regarding vestibular testing, there are no studies specifically targeting vestibular clinical practices of audiologists.

## Summary

In 1999, ASHA published guidelines regarding the role of audiologists in vestibular and balance rehabilitation, and in 2004, AAA published a position statement regarding audiologist's role in the diagnosis and treatment of vestibular disorders; however, these publications are not official standards that audiologists are required to abide by. It is appropriate to conduct surveys of audiological practices in specific areas of audiology in order to examine if the practice patterns of clinicians are aligned with current research. General audiological practices surveys provide an acceptable overview, however, not as much detail is provided compared to a survey that primarily focuses on one topic area. Currently, there are no studies of U.S. audiologists that have specifically focused on vestibular practices.

# CHAPTER III

# METHODOLOGY

## Participants

Participants surveyed were active members of the American Academy of Audiology (AAA). The participants were recruited from an electronic member directory available on the AAA website and were self-identified as having a specialty in vestibular testing. Potential participants were identified by using the "Find an Audiologist" function on the website. Different specialty areas are available to choose from under "Search by Specialty," including tinnitus, diagnostics, hearing conservation, vestibular testing, and more. This "Search by Specialty" was completed for all fifty states and the District of Columbia. In an effort to achieve a national representation, fifty percent of the vestibular audiologists from each state were chosen by selecting every other name from the alphabetically ordered list for each state.

## Instrumentation

Research was conducted using an electronic survey through the web-based survey company, Qualtrics. Qualtrics was founded in 2002 and allows researchers to collect and analyze data based on their own survey design (Qualtrics, 2015). Internet-based surveys are advantageous compared to mail-based surveys due to the ability to reach difficult to contact participants as well as the convenience of having automated data collection (Wright, 2006). This ultimately reduces researcher time and decreases the cost of

mailing out surveys. Internet-based survey companies, such as Qualtrics, are able to analyze the information collected while maintaining the anonymity of the participant.

The survey questions were based on the review of the literature involving vestibular assessment practices, vestibular rehabilitation practices, and outcome measurements used, if any. The survey consisted of 45 questions that were primarily multiple-choice in nature and were organized into six sections: General/Demographics, Training, Screening, Assessment, Rehabilitation and finally Vestibular Testing in Children (see Appendix C). The survey also included a subjective format, which included a text box feature in the survey to allow the participants to further explain answers pertaining to specific instructions utilized, specific vestibular testing completed with children, as well as specific reimbursement codes used. Qualtrics also includes a feature, called Skip Logic, which allows the participant to skip or answer questions based on answers to previous questions. For example, if the participants did not perform vestibular rehabilitation, then they were able to skip questions pertaining to that area.

## Data Collection

A pilot study was conducted to ensure an accurate time to complete the survey was listed as well as to gain additional feedback regarding the completeness of the survey and/or if any questions resulted in confusion. Three audiologists received the survey and changes were made based on their suggestions. Upon approval from the University of Northern Colorado Institutional Review Board (see Appendix A), an email, which included a link to the survey, was sent to potential participants explaining the purpose of the survey (see Appendix B). The email also stated that the survey would take an estimated five to ten minutes to complete (depending on the amount of detail given for

each written answer). The decision to complete the survey served as informed consent. Participants were given a three-week window to complete the survey. Once the three weeks' time elapsed, a reminder email was sent to participants extending the survey deadline an additional two weeks. Following the final week of the survey, the researcher obtained analyzed data from Qualtrics.

## Data Analysis

Survey data were analyzed using Qualtrics data analysis. Upon collection of the surveys, the data gathered from participants were descriptively analyzed if a written answer was given. Data collected were displayed in table and figure format. The survey was not included in the analysis if the participant responded "no" when asked if they perform vestibular testing. For participants who did not complete every question on the survey, responses were included in the data analysis for the questions answered. When applicable, the information was separated into three groups: years of experience, type of clinical setting, and regional location. Questions involving practices and procedures were compared between each group in order to identify possible differences in demographic variables.

# CHAPTER IV

## RESULTS

A total of 825 surveys were distributed via e-mail to members of the American Academy of Audiology (AAA) who self-identified as vestibular audiologists when giving their information to the organization. Fifty percent of the vestibular audiologists from the United States, including the District of Columbia were asked to participate in the study. The audiologists were given three weeks from the initial e-mail to participate in the survey. At this point, a total of 98 responses were collected. Invalid e-mail addresses were immediately filtered out following the initial e-mail. If an email was identified as undeliverable, an additional e-mail was then sent to an audiologist in that state randomly selected as a replacement to ensure e-mails were sent to 50% of audiologists from each state. A reminder email was distributed to 825 audiologists three weeks after the initial e-mail and extended the survey deadline by an additional two weeks. Another 46 surveys were collected for a final count of 144 responses. A response rate of 17.45% was calculated. A comprehensive summary of the survey data can be found in Appendix D.

The survey data were organized using an analysis report from Qualtrics. It separated each question into a respondent total (how many audiologists responded to the question), response total (total number of responses to the question) and a percentage (percentage of the total results for that question). If multiple answers could be reported, then the percentage was taken by dividing the response for that answer by the total number of respondents for that question. The survey questions were organized into six

sections: General/Demographics, Training, Screening, Assessment, Rehabilitation, and Vestibular Testing with Children. The results for each section of the survey are reported in this chapter. Percentages reported throughout this chapter have been rounded to the nearest whole number.

## Survey

### General/Demographics

The first question of the survey asked the participants to report if they performed vestibular testing. If the response recorded was "yes," then the participant would advance to the next question of the survey. If the response recorded was "no," then the survey would immediately end for that participant. Of the 144 respondents, 4% (n=6) reported that they did not complete vestibular testing and, therefore, did not advance to the remaining survey questions.

The second question of the survey asked respondents to report their current clinical setting. Of the 137 respondents, 37% reported working in an otolaryngology/otology office. Twenty-nine percent of respondents reported working in a hospital setting followed by 23% who reported working in a private practice setting. The most common clinical setting for the 7% of participants who responded "other" was working in a "clinic." An outpatient clinic or multi-specialty clinic was also reported by those participants who responded "other" to the survey question. Figure 1 displays a breakdown of reported clinical settings.

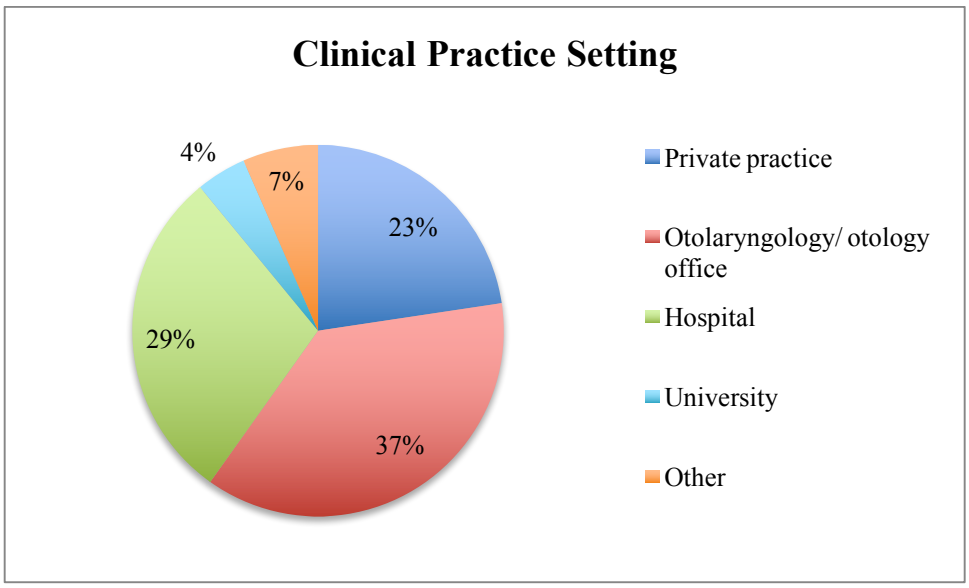



*Figure 1*. Percentage of respondents in various clinical practice settings

Respondents also reported on their demographic location in the United States, highest degree held, as well as years of practice in audiology. Fifty percent of audiologists in each state and the District of Columbia were asked to take the survey; however, only 40 states and the District of Columbia were represented in the results of the survey. States that are not represented include Alabama, Arkansas, Delaware, Hawaii, Idaho, Maine, North Dakota, South Carolina, Vermont, and Wyoming. The highest degree currently held by respondents was a doctor of audiology (AuD) at 84%, followed by a master's degree for 10% of respondents, and a doctor of philosophy (PhD) degree for 6% of 135 respondents. Approximately 35% of respondents reported having over 21 years of practice, followed by reports of 1 to 5 years of practice (33%), 6 to 10 years of practice (18%), and 11 to 20 years of practice (14%) (n=135). Figure 2 displays years of experience in practicing audiology.

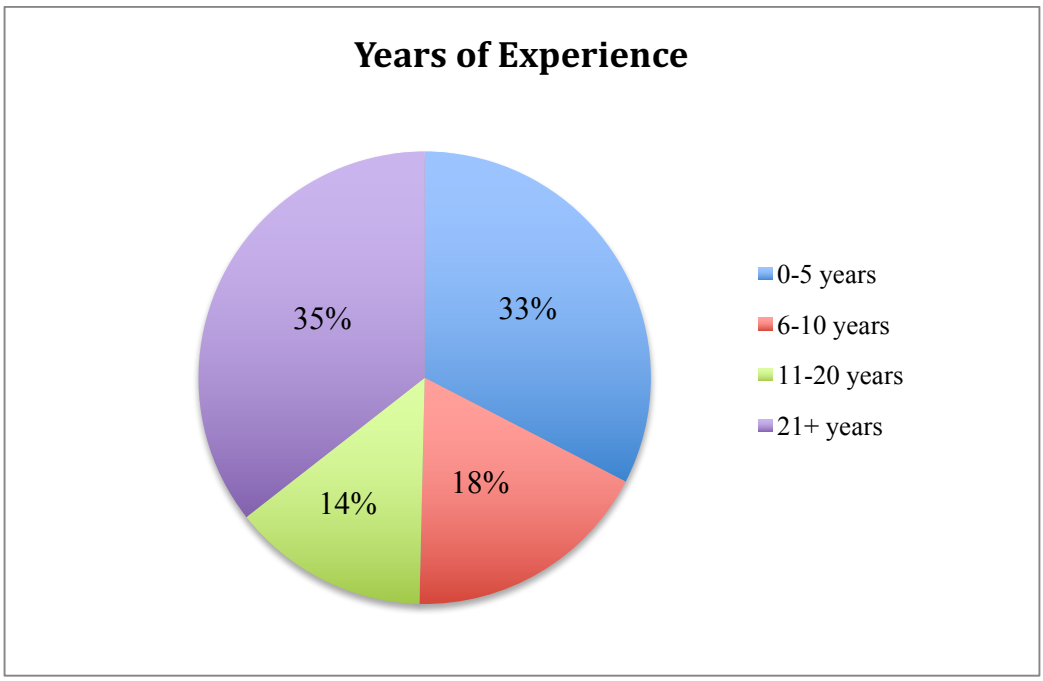



*Figure 2*. Percentage of respondents and their years of experience practicing audiology

In addition, respondents were asked how many hours per week were spent providing audiology services as well as what percentage of their practice time they perform vestibular testing. Forty-five percent of 134 respondents reported working 31 to 40 hours and 40% reported working over 41 hours per week. The remaining respondents reported working 21 to 30 hours (8%), 11 to 20 hours (6%), or 1 to 10 hours (2%). The most common response reported for percentage of practice time performing vestibular testing was "≤25% of my practice time" (39% of respondents), followed by "approximately 25% of my practice time" (34% of respondents), and finally, 13% of respondents reported for both "approximately 50% of my practice time" and "≥75% of my practice time" (n=135). Figure 3 displays the percentage of practice time spent performing vestibular testing.

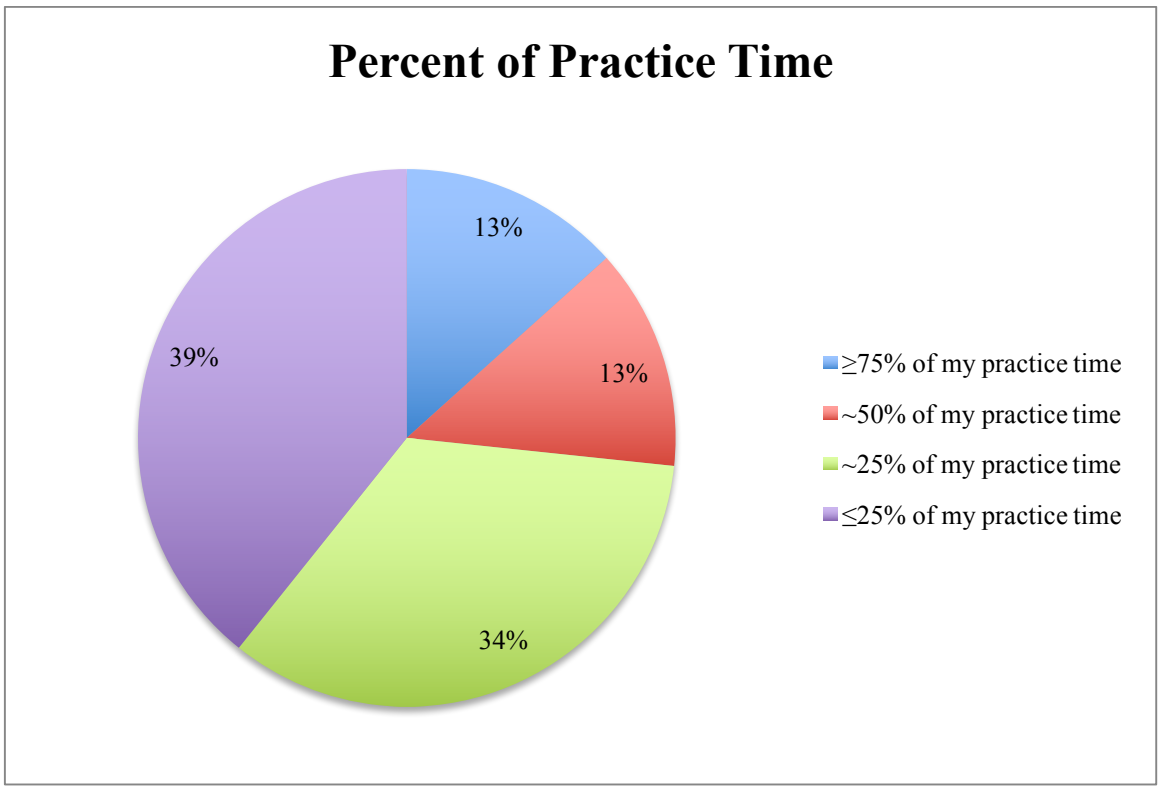



*Figure 3*. Percentage of practice time dedicated to vestibular testing

**Training**

ASHA provides a position statement as well as practice guidelines for vestibular rehabilitation, and AAA provides a position statement for the role of audiologists in the diagnosis and treatment of vestibular dysfunction. Each of these documents includes guidelines for training and education that should occur prior to audiologists performing vestibular assessment and rehabilitation. Two questions were related to training and education for audiologists who perform vestibular screening, assessment, and rehabilitation. The first question addressed where the respondent received training for vestibular assessment. A total of 135 participants responded to this question and multiple answers could be chosen for a total of 319 responses. The highest response was "graduate educational institution" with 113 responses (84%). This was followed by "special workshops" with 81 responses (60%), "seminars" with 63 responses (47%),

"self-taught" with 40 responses (30%), and "other" with 21 responses (16%). Only 1 response was reported for "no training" received (.7%). The 21 responses from participants who reported "other" training indicated that training was most commonly obtained through their internship/externship experiences (38%). This was followed by on-the-job training (24%), doctoral or Ph.D. programs (19%), other balance specialty institutions such as Salus University Advanced Vestibular Program and the American Institute of Balance in Florida (10%), basic research throughout career (5%), and continuing education with seminars and lectures (5%). Figure 4 displays an overview of where training was received for vestibular assessment.

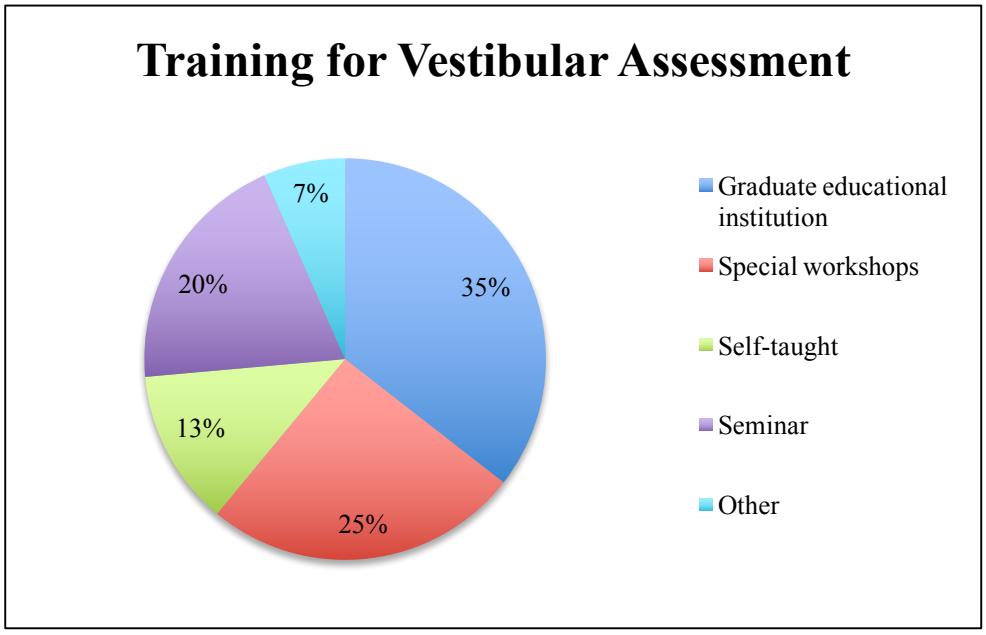



*Figure 4.* Training for vestibular assessment

The second question addressed where training was received for vestibular rehabilitation. A total of 27 participants responded to the question. This question was only available to be answered by those respondents who answered "yes" to performing vestibular rehabilitation. Multiple answers could be chosen for a total of 59

responses. The most common response to where audiologists were trained for vestibular rehabilitation was "special workshops" with 19 responses (70%). This was closely followed by "seminar" with 18 responses (67%), and "graduate education institution" with 11 responses (41%). Additional reported responses included "self-taught" with six responses (22%) and "other" training with five responses (19%). For those audiologists who answered "other" training, the most common responses indicated that they received training at an internship/externship site (60%), on-the-job training (20%) and through continuing education seminars and lectures (20%).

**Screening**

There were two questions on the survey dedicated to screening for vestibular dysfunction. The first question addressed which assessments are used for screening. A total of 131 audiologists answered this question, which could have multiple answers, for an overall total of 268 responses. The most common response was "I do not perform screening assessments for vestibular disorders" (47%). The most commonly used screening assessments were the Fukuda test (31%) and the Romberg/Tandem Romberg test (27%). For the respondents who answered "other," the most common response was "performing Dix-Hallpike" (27%). Additional popular responses included "head thrust" (15%), "having screening for vestibular dysfunction being performed beforehand by another professional" (15%), and "eye movement testing" (8%). Figure 5 displays an overview of vestibular assessments used for screening.

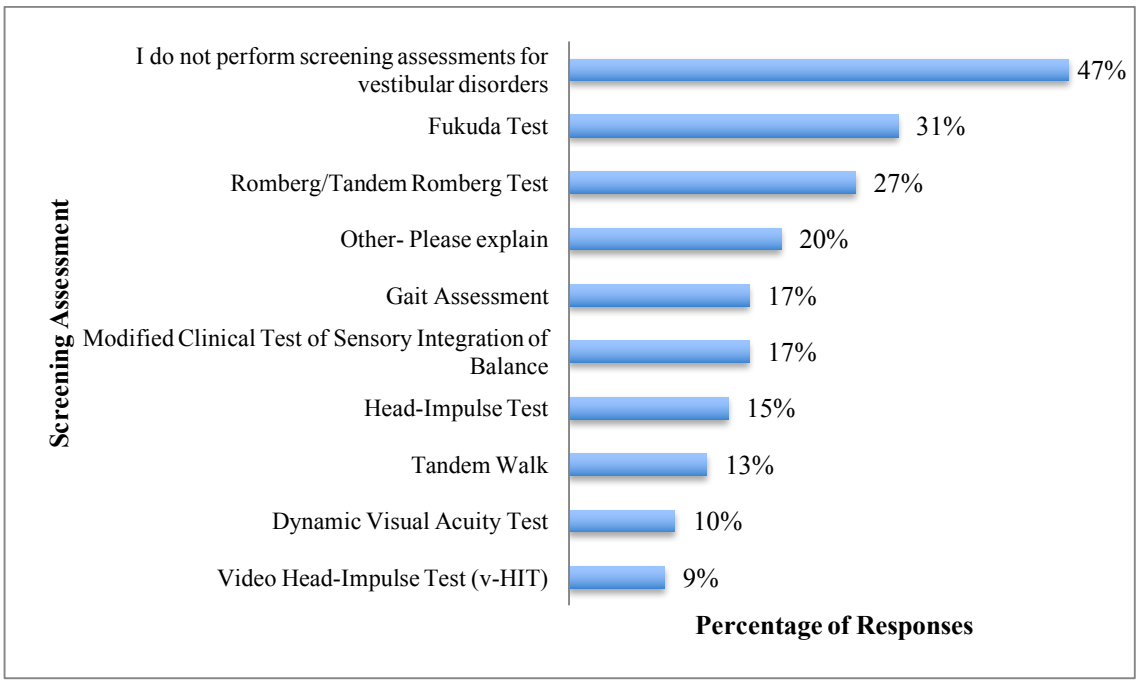



*Figure 5*. Vestibular assessments used for screening

Furthermore, 131 audiologists also reported use of subjective questionnaire(s) for vestibular patients. More than one response could be chosen for a total of 146 responses. The most common responses were use of the Dizziness Handicap Inventory (45%) and "I do not use subjective questionnaires" (45%). There were 19 respondents (15%) who reported using "other" subjective questionnaires. A majority of these respondents (84%) use a questionnaire created or modified by their clinic.

**Assessment**

Current Procedural Terminology (CPT) coding describes how to report procedures or services and is maintained by the American Medical Association (American Medical Association, n.d.). Vestibular assessment tests are included in Current Procedural Terminology coding for billing purposes. However, Current Procedural Terminology coding does not encompass every test and procedure that an audiologist may choose to perform for vestibular assessment. A total of 652 responses

(n=134) were reported. The most commonly used Current Procedural Terminology code when performing vestibular assessment was “CPT 92450” (96%). This CPT code is used for a basic vestibular evaluation and includes spontaneous nystagmus test with eccentric gaze fixation nystagmus, with recording; positional nystagmus test, minimum of 4 positions, with recording; optokinetic nystagmus test, bidirectional foveal and peripheral stimulation, with recording; and oscillating tracking test, with recording. Another commonly reported code was “CPT 92543” (94%), which is for caloric vestibular testing. This was followed by “CPT 95992” (52%), which is the CPT code for canalith repositioning procedures.

Prior to the start of vestibular testing, 62% of respondents reported that they tell their patients to “abstain from medications that suppress vertigo and dizziness.” More than one response could be chosen; therefore, a total of 406 responses were reported (n=132). In addition to abstaining from medications, respondents instruct their patients to “abstain from alcohol” (60%) and “limit food intake” (56%). Fifty-five percent of responses reported requiring “all of the above,” which included abstaining from tobacco use, alcohol use, caffeine, medications that suppress vertigo, and limiting food intake. Fifteen respondents (11%) chose “other” instructions. The most common “other” response included instructing patients to abstain from wearing eye makeup (33%). Figure 6 displays an overview of the various instructions used by respondents.

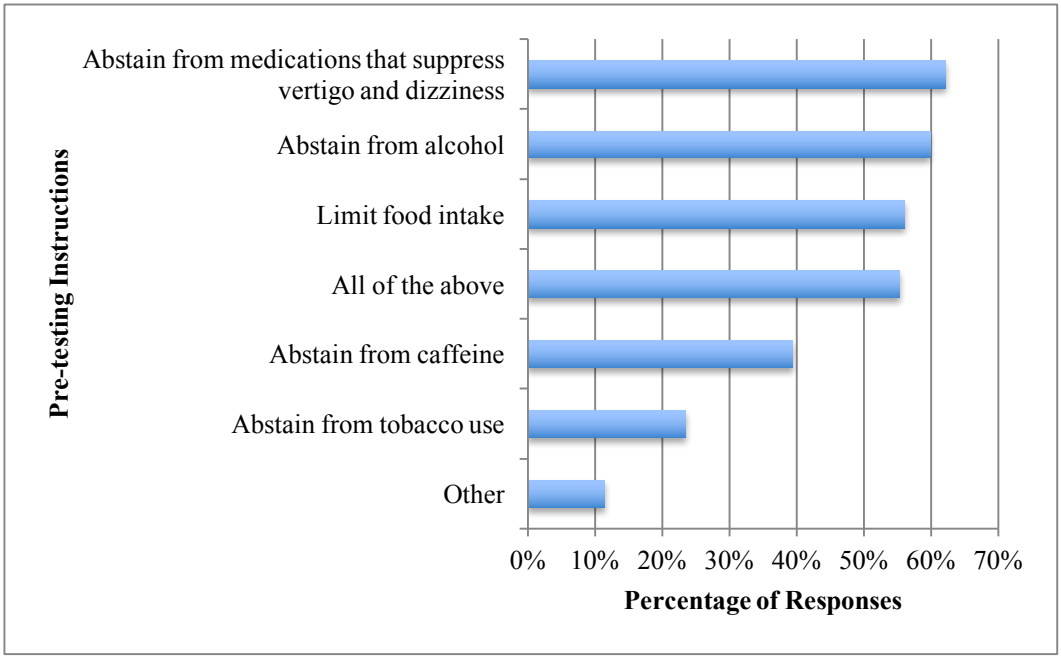



*Figure 6*. Pre-testing instructions

In addition, 41% of respondents reported that they "sometimes" perform the vertebral artery screening test (VAST) or a similar test prior to the evaluation of vestibular function, and 33% reported that they "never" performed the vertebral artery screen test (VAST) or similar test. Of the 5% of respondents who reported "other," the most commonly reported response was performing the vertebral artery screen test (VAST) or similar test prior to vestibular testing only if it was medically necessary or based on case history (50%).

Occasionally, patients show inconsistencies between the reported problem and their performance on vestibular tests. This may be referred to as malingering. Computerized Dynamic Posturography (CDP) is able to assess postural responses, document changes in responses, and identify inconsistencies. A question was included in the survey regarding how many malingerers have been identified using vestibular function tests. Forty-five percent of the 130 respondents reported identifying "1 to 5

malingerers," 28% reported identifying "0 malingerers," and 18% of respondents reported identifying ">5 malingerers" since they began practicing audiology.

When asked which tests they utilize when evaluating vestibular function, the most common response reported was "videonystagmography (VNG) with air calorics" (80%). More than one answer could be chosen for a total of 369 responses (n=132). Additionally, 47% reported utilizing "cVEMP" to assess vestibular function, followed by "VNG with water calorics" (28%) and "computerized dynamic posturography" (28%). There were 17 responses indicating use of "other" forms of testing. The most common "other" response was use of electrocochleography (ECoG) (41%). Figure 7 displays a breakdown of vestibular tests utilized by respondents.

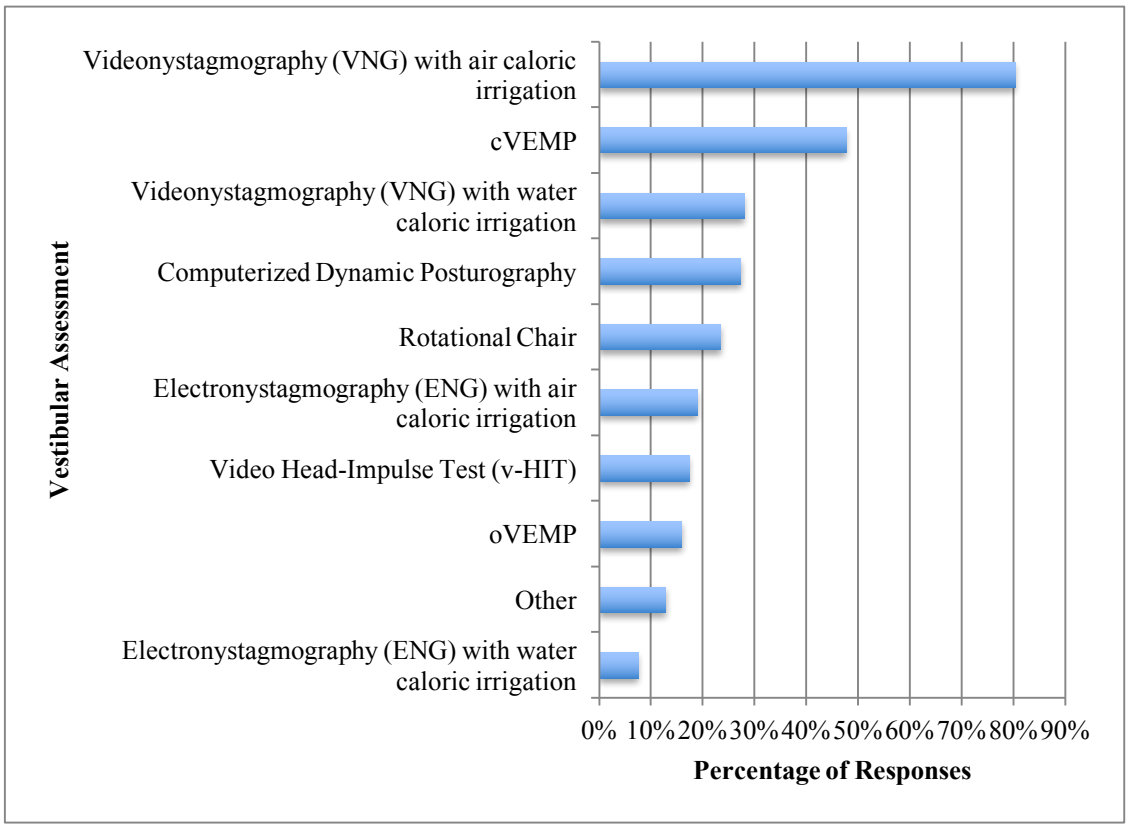



*Figure 7.* Vestibular assessments used when evaluating vestibular function

**Videonystagmography/electronystagmography**. When asked about the percentage of patients evaluated with videonystagmography the most common response was ">75%" (78%). Only the 129 respondents who reported performing VNG testing with either air calorics or water calorics to assess vestibular function could respond to this question. When questioned about the percentage of patients evaluated with electronystagmography (ENG), the most common responses were "<25%" of patients (78%) and ">75%" of patients (19%). This question was only available to the 27 respondents who reported performing ENG on patients to assess vestibular function.

Other questions addressed the recording duration most commonly used while testing oculomotor function as well as what instructions are used when performing optokinetic (OPK) testing. Respondents were only allowed to answer these questions if they reported performing VNG or ENG to assess vestibular function (Q14). A total of 132 responses were reported. The most commonly used recording duration was "approximately 20 seconds" (43%) when testing oculomotor function. In addition, 27% of respondents also reported using a recording duration of "approximately 30 seconds." There was a small number of respondents (5%) who reported "other" as a response. These individuals broke up each oculomotor test as having a different recording duration. For gaze testing, the responses ranged from 15 to 30 seconds; for smooth pursuit, 30 to 90 seconds; and for saccade testing, 60 to 90 seconds. Other responses included having a shorter recording duration for a "clean recording" than when a pathologic nystagmus was present. Figure 8 displays a breakdown of the recording duration utilized when evaluating oculomotor function.

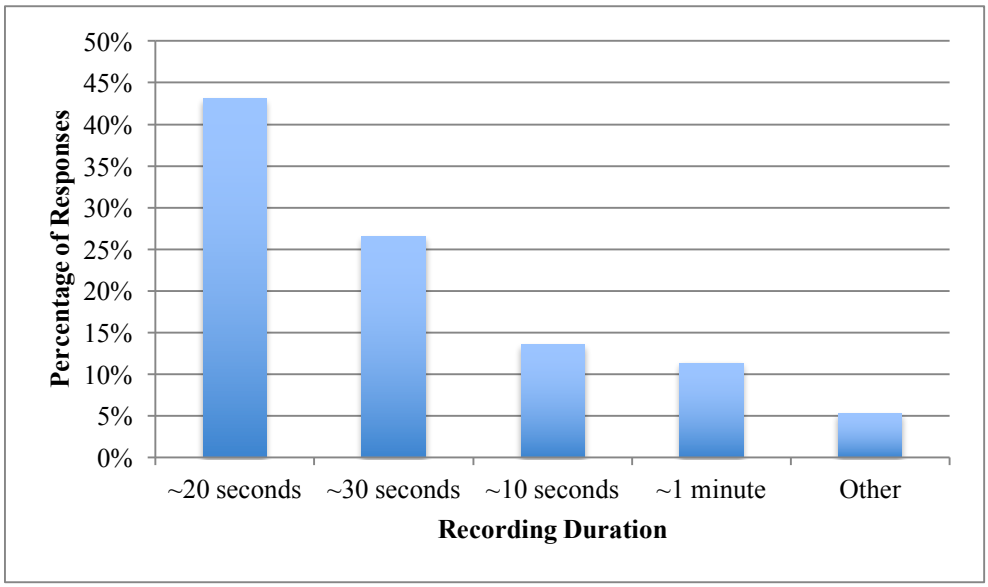



*Figure 8*. Recording duration used for oculomotor function tests

While performing optokinetic (OPK) testing, the amplitude of the patient's eye movements can change depending on the directions given to the patient by the examiner. If the examiner asks the patient to actively follow the moving target by asking them to "pick a dot and follow it across the bar, then go back and pick up another dot and repeat," the amplitude will be larger than if the examiner simply asked the patient to look passively in the direction of the stimulus (Desmond, 2011). "Stare" optokinetic responses can also be referred to as the passive instruction given to the patient, while "look" involves the patient actively counting or following the stimuli (Kashou et al., 2010). When asked which instructions they utilized, almost half (49%) of the 132 respondents use "look" instructions when performing OPK testing, which involve asking the patient to actively count the stimuli. "Other" instructions were reported by 23% of the respondents. The most common "other" instruction given to patients includes giving them "stare" instructions and switching to "look" if there is not an appropriate response

as well as having the patient "watch them as they go by." Other respondents reported giving their patients "no instructions at all."

Electronystagmography was reportedly used less often than VNG. However, it is important to note that over half of the 28 respondents (54%) who use ENG reported "never" recalibrating equipment prior to each caloric irrigation. In addition, 11% of respondents reported "other" when asked if they re-calibrate prior to caloric irrigations. One respondent who reported "other" indicated calibrating after two irrigations and another reported recalibrating after performing the Dix-Hallpike. Figure 9 displays a breakdown of responses regarding re-calibration prior to the start of each caloric irrigation performed.

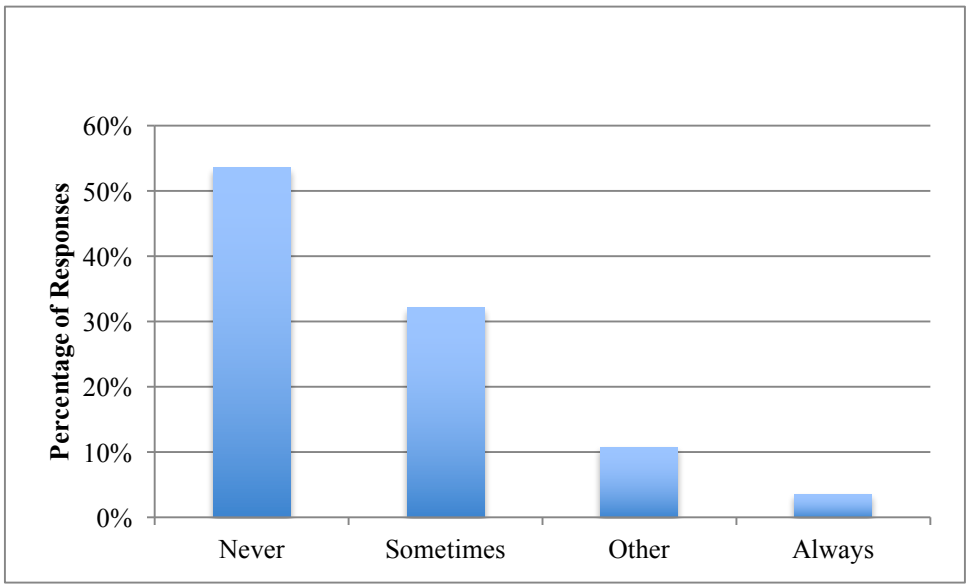



*Figure 9*. Frequency of re-calibration performed prior to each caloric irrigation during ENG testing

Results regarding both ENG and VNG caloric testing involved questions that examine which caloric order is used, what cutoff is used for considering results to have a unilateral weakness, as well as when it is necessary to perform ice water calorics. The two most common orders of caloric examination both include starting with the right ear

first. Consequently, the most common order reported was “RC, LC, RW, LW” (30%), with “RW, LW, RC, LC” (25%) also frequently reported (n=131). Nearly 5% of respondents reported “other” as a response. The most common order reported by these respondents was performing “warm calorics first and starting with the worse ear.” Figure 10 displays an overview of the various orders in which caloric irrigations can be performed.

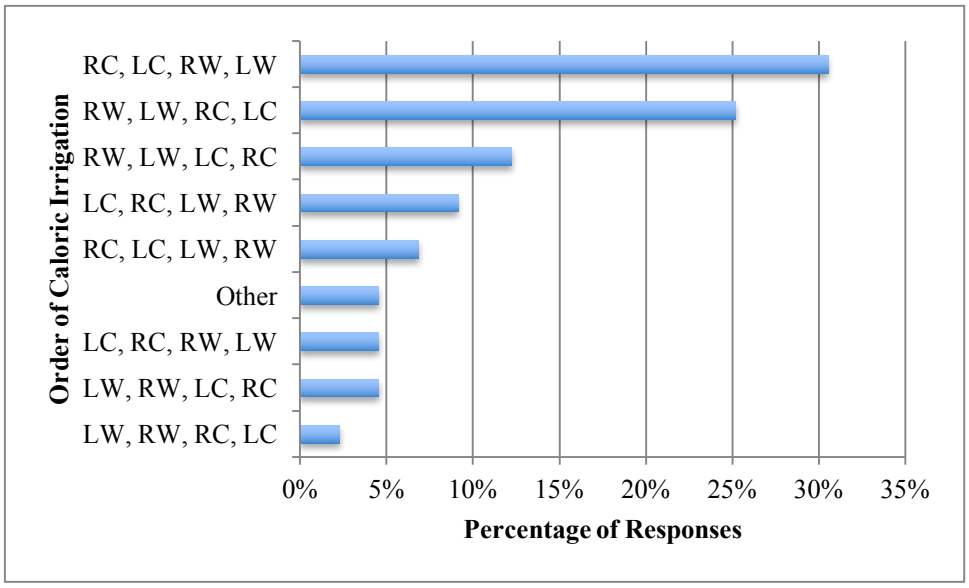



*Figure 10*. Order of caloric irrigations

The most commonly reported cutoff for considering a response to have unilateral weakness was “>25%” (62%) (n=130). For those respondents who reported “other” (12%), the most common responses were “>22%” (33%), “>23%” (27%), and “>30%” (13%). In addition, 27% of respondents reported using “>20%” as the cutoff for unilateral weakness. When asked when they use ice water calorics, over half of the 130 respondents (53%) reported using ice water calorics “when conventional calorics did not produce a measurable response.” Another 38% of respondents reported they “do not use ice water calorics.” Only 9% of respondents reported “other.” Of these respondents, ice water

caloric testing was used if there was “no response” with conventional calorics or the respondent indicated “will refer for rotary chair testing rather than perform ice water calorics.”

**Rotational chair/computerized dynamic posturography/video head impulse test.** There were 31 respondents who reported using rotational chair when asked which tests were utilized to assess vestibular function. When asked what percentage of patients are evaluated with rotational chair, the most common response was “>75%” of patients (55%). This question was only presented to the 31 respondents who reported performing rotational chair to assess vestibular function (Q14). Of the 36 respondents who reported using Computerized Dynamic Posturography (CDP), 31% reported utilizing this test for “>75%” of their patients, followed by “25%-49%” (25%), and finally “<25%” and “50%-75%” (both at 23%). Twenty-two respondents reported using the Video Head Impulse Test (v-HIT) when assessing vestibular function. Of these respondents, 32% reported using this test for “>75%” of patients. In addition, this was followed by 28% who reported using this test for “25%-49%” of their patients, 23% who reported “50%-74%,” and finally 18% who reported utilizing this test for “<25%” of patients.

**Vestibular evoked myogenic potential.** Twenty-one respondents reported using oVEMP when assessing vestibular function. Nearly half of these (48%) reported utilizing this test for less than 25% of patients. Twenty-one respondents (100%) reported using unilateral stimulation (recording from one side at a time). There were 62 respondents who reported using cVEMP to assess vestibular function, and 40% of these reported using this test for less than 25% of patients.

It was also reported by 95% of respondents who use the cVEMP test that they use unilateral stimulation, while 5% perform bilateral stimulation (record from both sides simultaneously).

When asked about methods to ensure muscle contraction while performing cVEMP, 40% of the 62 respondents reported using a method other than those listed on the survey. Of those respondents who reported "other," the most common responses for which method was used to ensure muscle contraction were "none" (36%), "have patients raise head from supine position" (20%) and "observe for muscle contraction" (12%). Figure 11 displays a breakdown of methods reported by respondents.

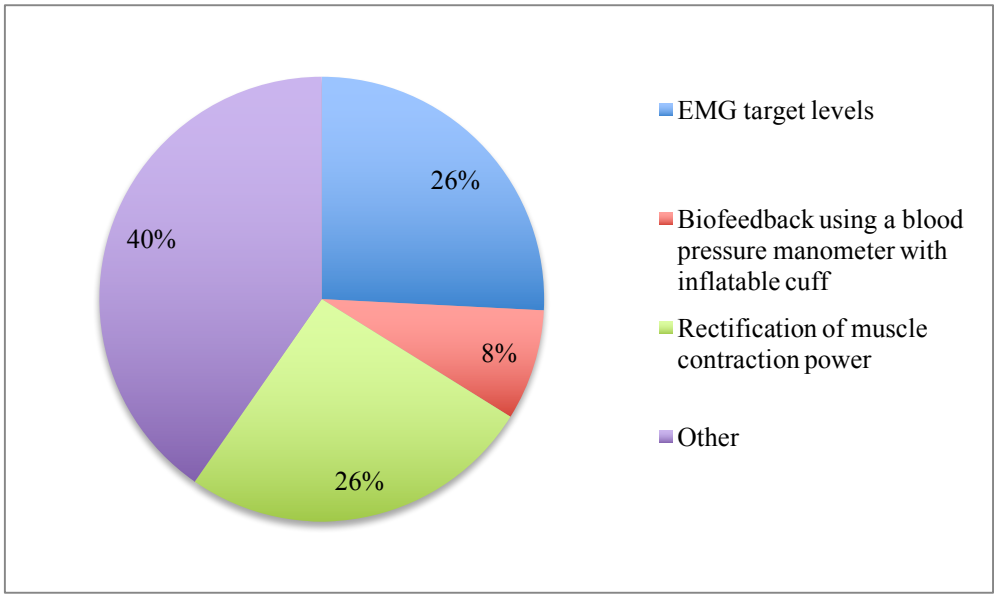



*Figure 11*. Methods used to ensure muscle contraction during cVEMPs

**Tasking**. Mental alerting, also known as tasking, is important for the examiner to utilize throughout the testing period. Patients may have the ability to imagine a fixation point (even when the eyes are closed) that could enable suppression of the nystagmus (Desmond, 2011). This affects the reliability and the sensitivity of the vestibular

assessment. The most common tasking methods utilized by respondents (n=122) included listing names, counting, listing states, going through each letter of the alphabet to list varying items or names, and listing items found in different environments, such as a farm or classroom. One respondent reported "tap[ping] the patient's shoulder while talking normally." Another respondent reported having the patient "describe their house" as well as "describe the route taken to the test site."

When asked which vestibular tests are done with patient tasking, 128 respondents responded to this question with a total of 294 responses. The most common vestibular test performed with tasking was caloric irrigation testing (95%). Other common responses included "positional testing/static position testing" (62%) and "rotational chair-sinusoidal harmonic acceleration" (27%). One respondent reported, "I don't task while irrigating, only immediately after." Another common response for tasking was during "gaze testing without visual fixation" (25%). Figure 12 displays a breakdown of the responses.

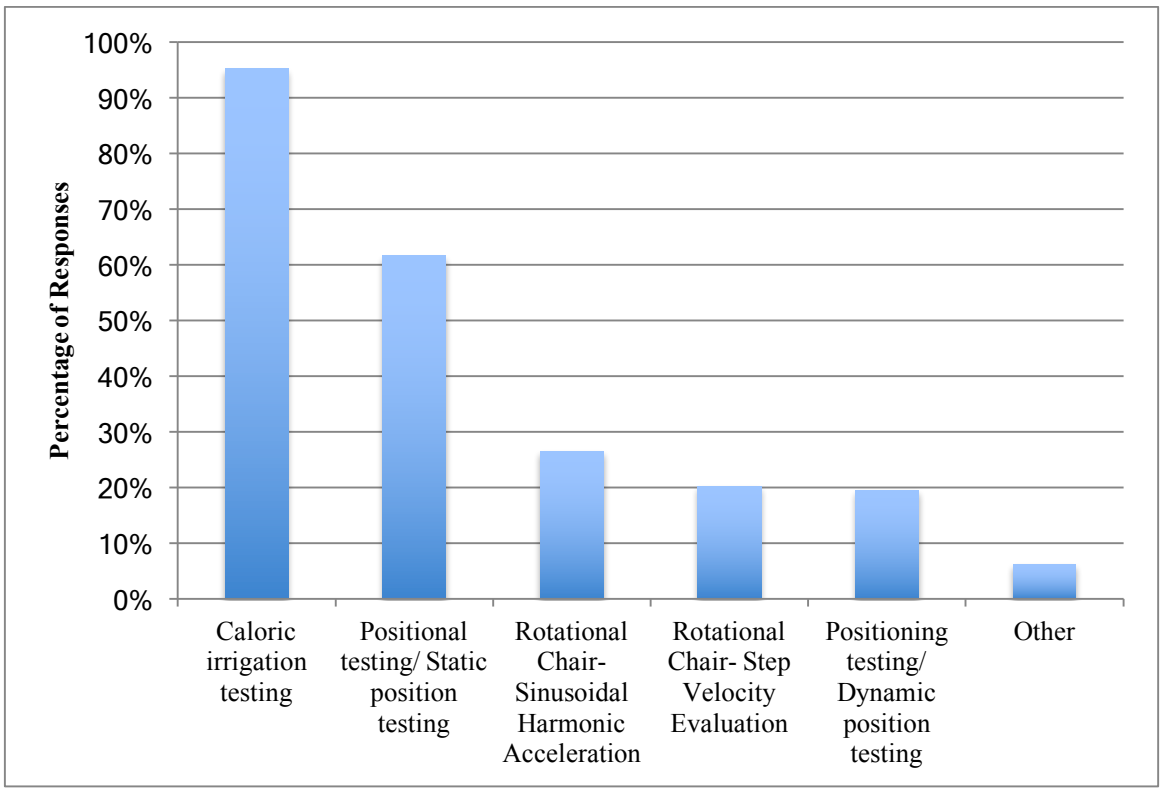



*Figure 12*. Vestibular assessments with patient tasking

**Rehabilitation**

Only 21% (n = 27) of respondents reported performing vestibular rehabilitation therapy (VRT). If they reported performing VRT, additional questions were included in the survey. When asked which rehabilitation procedures were used, 100% of respondents reported using "canalith repositioning procedures (CRP)." Respondents were able to provide multiple answers; therefore, a total of 55 responses were obtained for this question. Forty percent of responses indicated using "gazing stabilization exercises" as well as "adaptation, habituation, and substitution protocols" (19%). Those respondents who responded "other" indicated that they complete "counseling" for VRT. One respondent reported "perform[ing] CRP while other aspects of VRT are performed by a physical therapist."

Respondents were also asked to report if they work closely with another medical professional, which reimbursement codes they use, and what post-treatment instructions they give their patients following therapy. When it comes to performing vestibular rehabilitation, some audiologists opt to work closely with another medical professional for assistance. There were 27 audiologists who responded to the question. Fifty-nine percent of the answers indicated that audiologists frequently work with physical therapists. Respondents could choose multiple responses; therefore, 45 responses were reported. In addition, 56% of responses indicated that audiologists also commonly work with otolaryngologists/otologist. Fifteen percent of respondents reported they "did not work closely with another medical professional." One respondent reported "other" and stated that they "work closely with a physical therapist on occasion."

There were 24 respondents who reported which post-treatment instructions they give their patients. The most common post-treatment instructions following CRP included "keep head straight for the rest of day (do not look up or down)" and "sleep slightly elevated for one night." Other instructions reported included "not sleeping on affected side," "repeat the CRP once a day for two weeks," "limited activity for 24-48 hours," or "keep head upright for the next 3-4 hours." Five respondents reported that they "do not give post-treatment instructions." In addition, three respondents stated that they have their patients "wear a soft neck collar for 48 hours while making sure to keep head in one position looking straight ahead, and sleep in a recliner for 48-72 hours."

At present, there is no CPT code for vestibular rehabilitation therapy (VRT), and the federal Medicare program does not reimburse for vestibular treatment provided by audiologists (AAA, 2005). Therefore, when asked which CPT code they utilize for VRT,

20 audiologists responded. Forty-percent of respondents reported that they "do not bill for VRT." For those respondents that do bill for VRT, the most commonly used reimbursement code is "CPT 95992 (Canalith repositioning procedure(s) [Epley maneuver, Semont maneuver] per day)." Other reimbursement codes used include "CPT 92541 (spontaneous nystagmus test)" and "CPT 92542 (positional nystagmus test)."

The original maneuver by Epley required five positional changes. There have been modifications to these positional changes to include only four positions, omitting the position with the patient's nose pointed down towards the floor. However, it is recommended that the maneuver be repeated multiple times if utilizing the four positional changes approach (Herdman & Hoder, 2014). Included in the survey was a question regarding modifications to the Epley maneuver. There were 27 respondents with a total of 28 responses. When completing the Epley maneuver, 48% of respondents perform "four positional changes and repeat the maneuver multiple times," while 30% of respondents reported performing "four positional changes and DO NOT repeat the maneuver multiple times." In addition, 19% of respondents perform "all five positional changes of the Epley" and 7% of respondents "do not perform the Epley maneuver" for VRT. Figure 13 displays an overview of positional modifications made while performing the Epley maneuver.

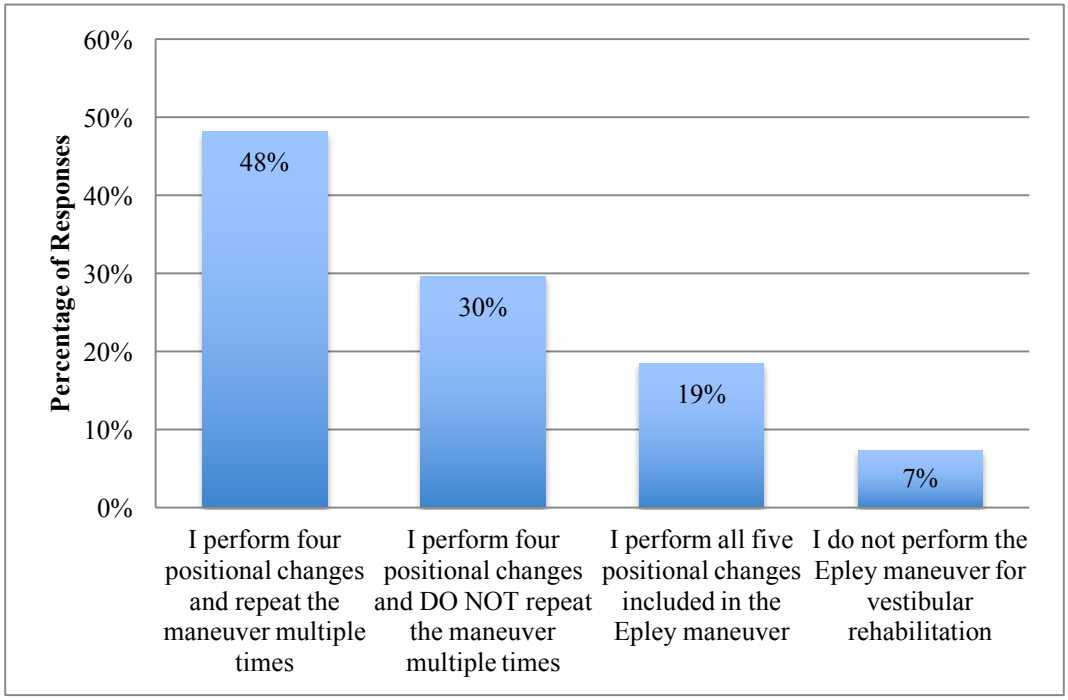



*Figure 13*. Positional modifications of the Epley maneuver

Seventy-eight percent of the 27 respondents who complete VRT reported that they recommend home exercises for their patients. Respondents who reported that they recommend home exercises to their patients were asked to explain what home exercises were recommended. Responses were varied and included having the patient perform the 'Brandt-Daroff," the "Epley maneuver as needed" or the "Cawthorne-Cooksey if the patient has not compensated." Other respondents reported that they have their patients "perform balance and gaze stabilization exercises." One respondent recommended home exercises that are "based on the patient" while another respondent reported they "have their patients perform the Lempert Roll if the dysfunction is occurring in the horizontal canal."

Respondents who reported they did not perform VRT (101 respondents) were automatically advanced to questions to further understand why they did not perform VRT and what the next step would be if the patient was diagnosed with having vestibular

dysfunction and the audiologist was not able to perform VRT. More than one response could be chosen; 214 responses were reported. Over half of the responses (52%) indicated that "billing/reimbursement issues" prevent them from performing vestibular rehabilitation. Other common responses revealed that a "lack of training" (46%) and "lack of time" (42%) were reasons why VRT could not be performed. There were 33 responses that indicated "other" as the reason why VRT was not performed. A majority of respondents reported that they "refer patients to a physical therapist for VRT." There were 100 respondents who reported which procedure they use if they do not perform vestibular rehabilitation. More than one answer could be chose for a total of 173 responses. "Referral for vestibular rehabilitation" was reported as the next step for patients who were diagnosed with a vestibular dysfunction in 84% of responses. "Referral to other professionals" was reported in another 57% of responses and those respondents who reported "other" indicated an "ENT referral" or a "physical therapist referral" as the most common procedure for patients.

**Vestibular Testing with Children**

When asked if they perform vestibular testing on children, 56% of respondents reported "yes," while 44% reported they "do not perform vestibular testing on children" (n=128). If respondents reported "yes," they were asked to answer an additional question about which testing they complete with children. If respondents reported "no" to the question, then they were advanced to the end of the survey and thanked for their participation. The most common testing reported for children was a "VNG test battery." Other common testing reported was "rotary chair," and "CDP." Ten responses included

statements that they "use the same test battery for children and adults if it can be tolerated."

## Research Question 3

Data from this survey were also organized to assess Research Question 3: Are techniques and procedures dependent on demographic factors (e.g., type of practice, years of experience, or regional location)?

### Years of Experience

Respondents were sorted into the following categories: 1-5 years (n=44), 6-10 years (n=24), 11-20 years (n=19), and 21+ years (n=48). Answers to various questions regarding techniques and procedures were tallied and converted to percentages and rounded to the nearest whole number. Respondents' answers are displayed in data tables and split into four sections: screening, assessment, rehabilitation, and vestibular testing with children.

**Screening**. A majority of respondents reported they do not perform screening assessments for vestibular disorders. Figure 14 displays a breakdown of the top three responses reported for screening assessments utilized while Figure 15 displays a breakdown of screening questionnaires utilized. The Dizziness Handicap Inventory was the most commonly used questionnaire across all years of experience groups. However, the 21+ years group reported using a wider variety of screening questionnaires when compared to the other groups. In the 1-5 years of experience group, 57% of respondents did not utilize vestibular questionnaires. This was the also the case for 45% of the 6-10 years group, 32% of the 11-20 years group, and 39% with 21+ years of experience.

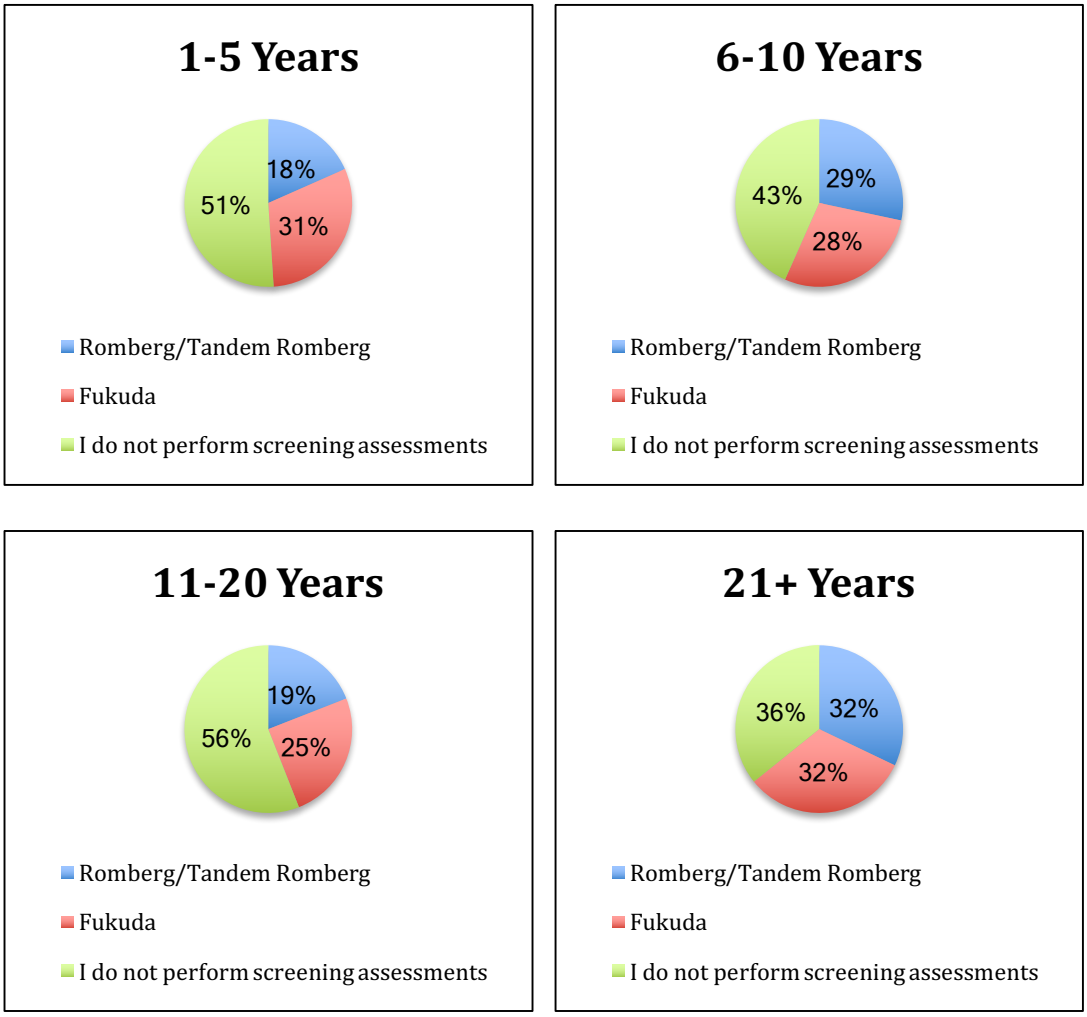



*Figure 14*. Screening assessments

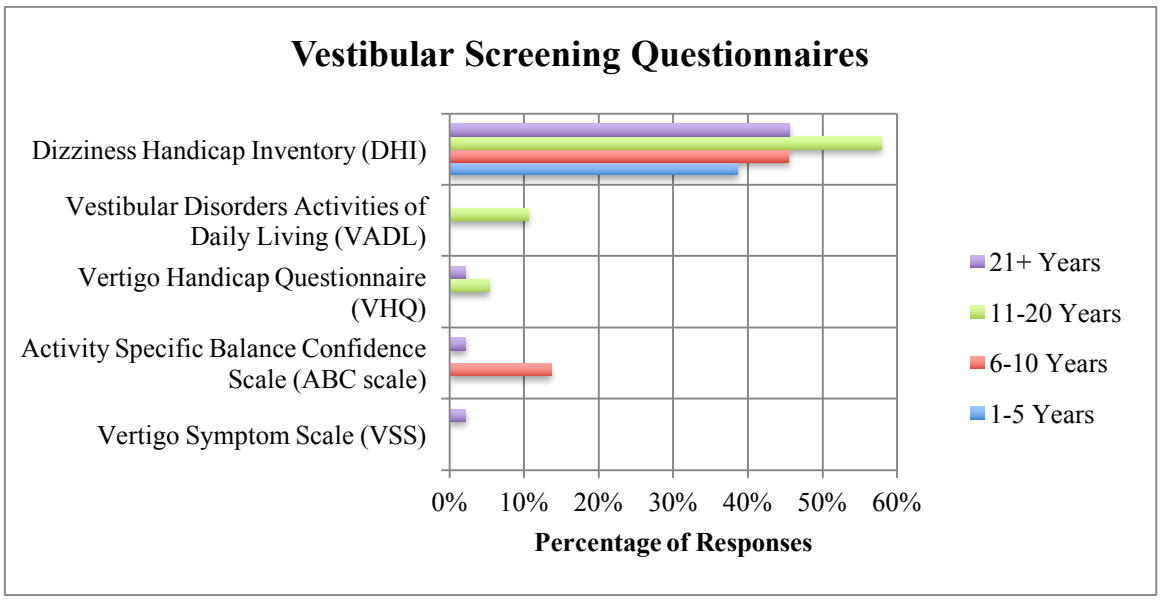
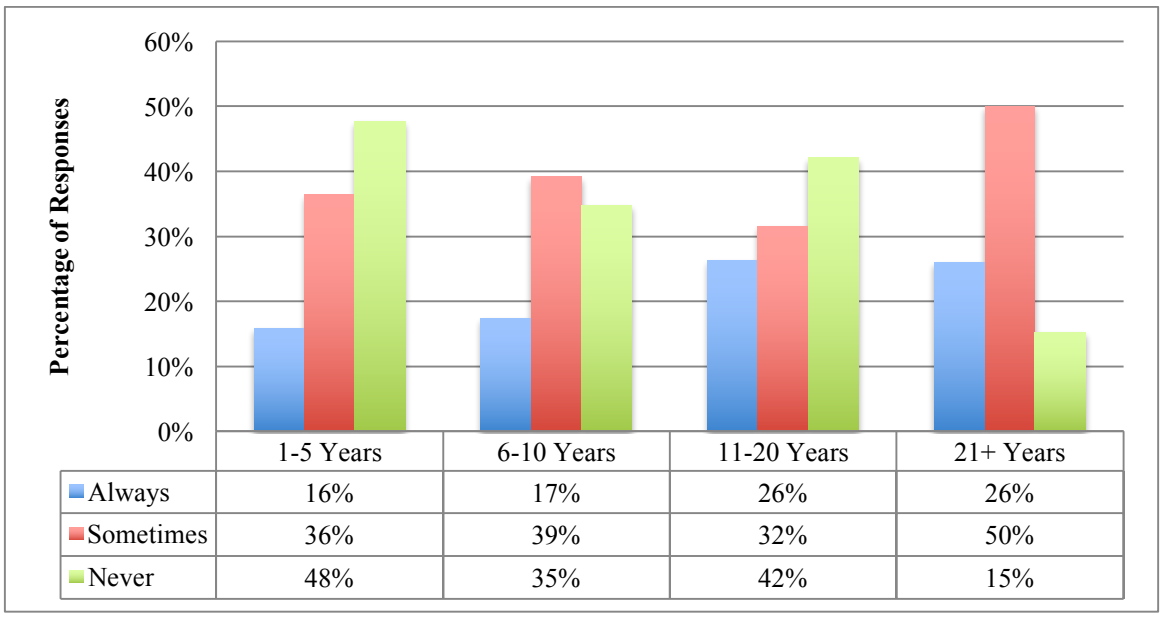



*Figure 15*. Screening Questionnaires

**Assessment.** The group with 21+ years of experience reported that they were more likely to perform the vertebral artery screen test (VAST) "always" or "sometimes" prior to starting vestibular assessment compared to the other groups of respondents. The group with 1-5 years of experience was found to be least likely to perform the vertebral artery screen test (VAST) prior to a vestibular assessment. Figure 16 displays the responses reported for each group.




| | 1-5 Years | 6-10 Years | 11-20 Years | 21+ Years |
|---|---|---|---|---|
| Always | 16% | 17% | 26% | 26% |
| Sometimes | 36% | 39% | 32% | 50% |
| Never | 48% | 35% | 42% | 15% |

*Figure 16*. Performance of the vertebral artery screen test (VAST) or similar test prior to starting vestibular assessment

The trend for most common vestibular assessment performed was consistent among groups. Performing "VNG with air calorics" remained the most prevalent response reported. Figure 17 displays the varying vestibular assessments performed by each group.

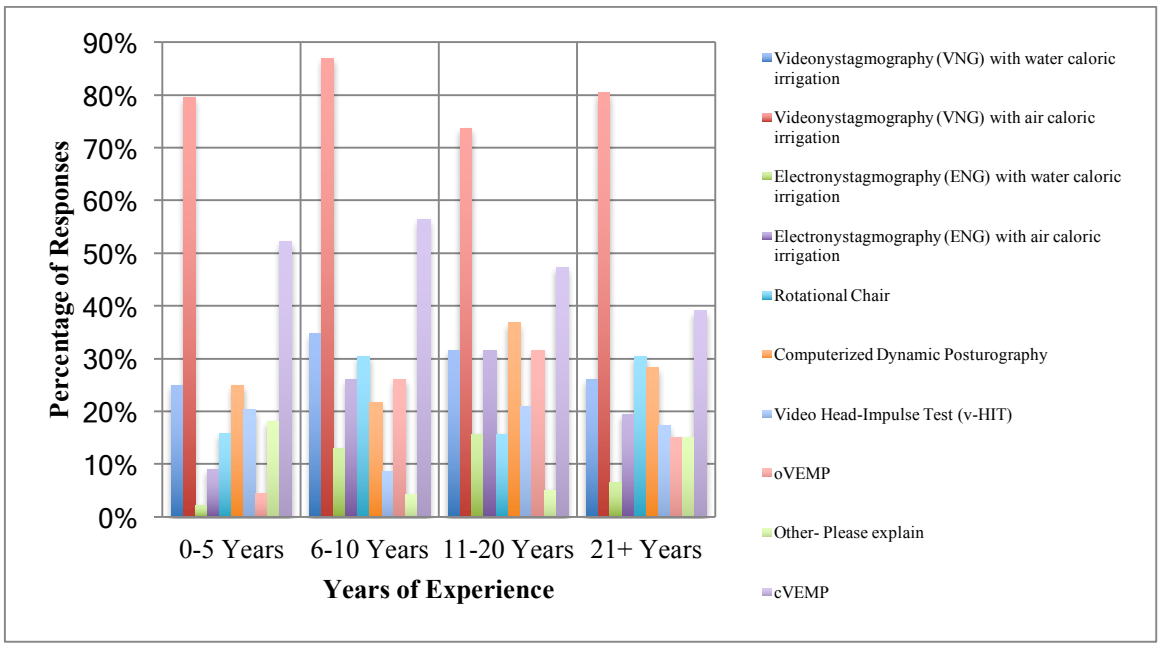



*Figure 17*. Vestibular assessments utilized

During the assessment of oculomotor function while performing an ENG or VNG, it was reported that the most common duration of recording is "approximately 20 seconds." This trend was consistent across all groups. Figure 18 displays the responses of duration times for each group.

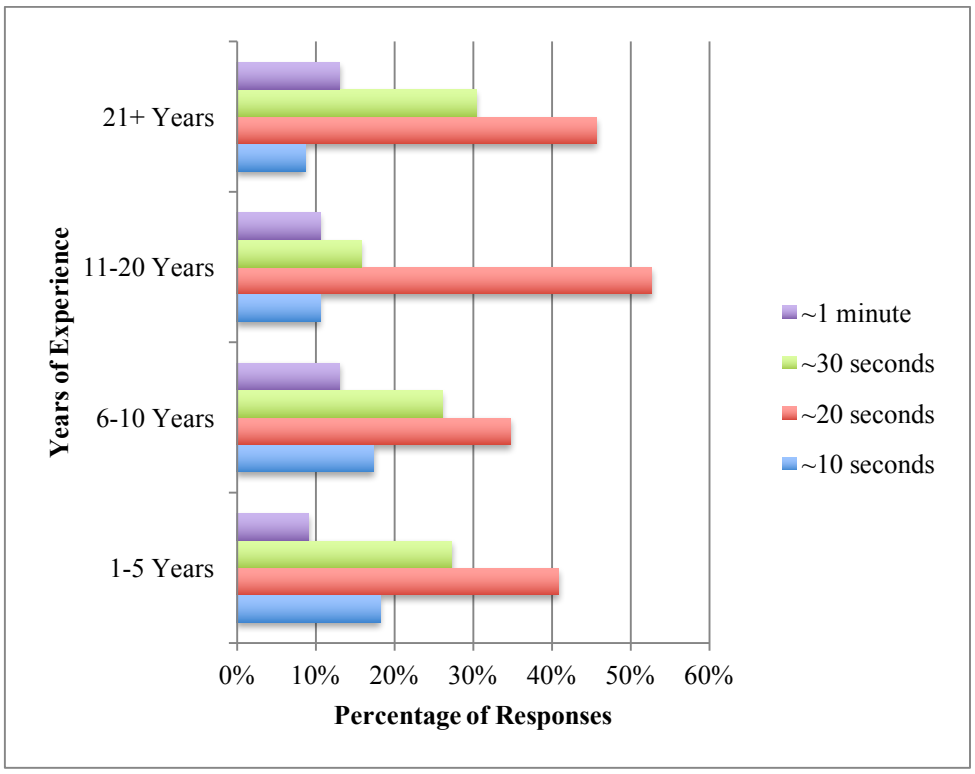



*Figure 18*. Percent of responses for the duration of time utilized for oculomotor function testing

It was also reported that the most popular instructions for optokinetic (OPK) testing included the "look" instructions asking patients to actively count the stimuli. These instructions were reportedly the most commonly utilized instructions for the groups: 1-5 years (52%), 6-10 years (52%), 11-20 years (42%), and 21+ years (46%). Figure 19 shows that during ENG testing, re-calibration is most commonly "never" performed between caloric irrigations by every group. The 1-5 years group reported 60% of respondents do not re-calibrate between caloric irrigations, while the 6-10 years group reported 50%, the 11- 20 years group reported 57%, and the 21+ years group reported that 50% do not re-calibrate.

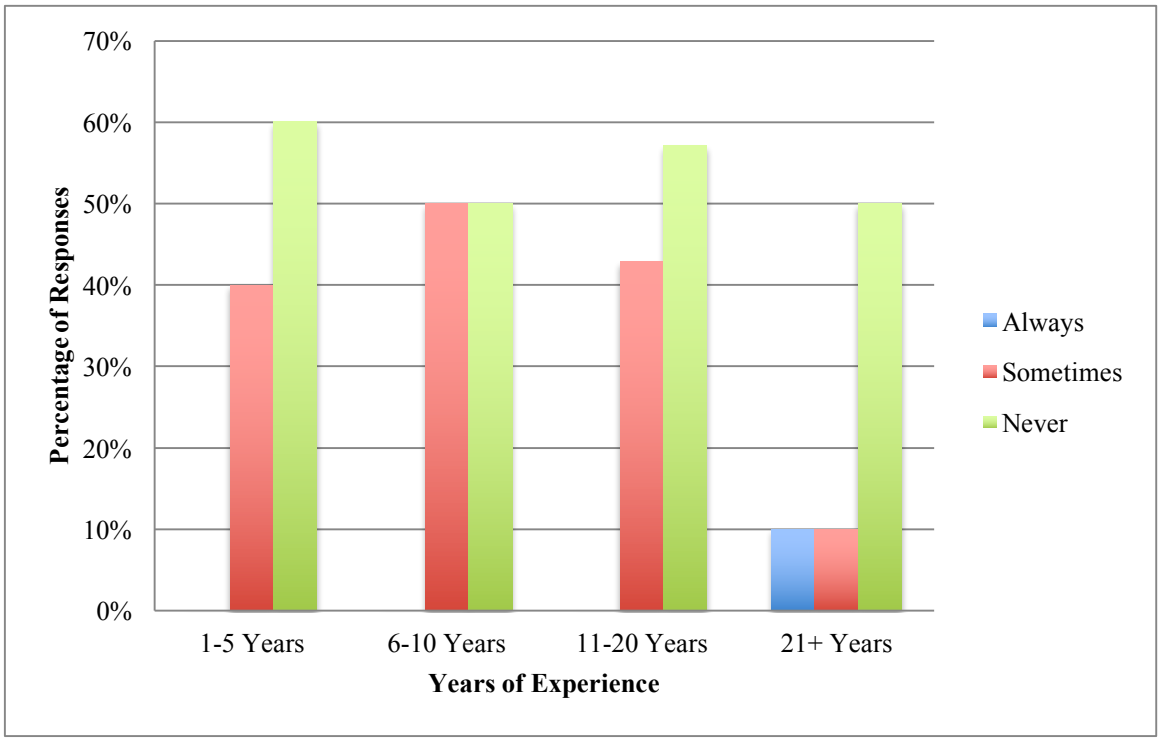



*Figure 19*. Re-calibration performed between caloric irrigations

While performing caloric irrigations, the order of irrigations of "RC, LC, RW, LW" is most commonly performed in the 1-5 years group (33%) and the 6-10 years group (30%). However, the most commonly used order of irrigations for 11-20 years was evenly distributed between "RC, LC, RW, LW" and "RW, LW, RC, LC," which were reported at 37%. The 21+ years group reported utilizing "RW, LW, RC, LC" most often (33%). Figure 20 displays the responses for each group regarding caloric irrigation testing order.

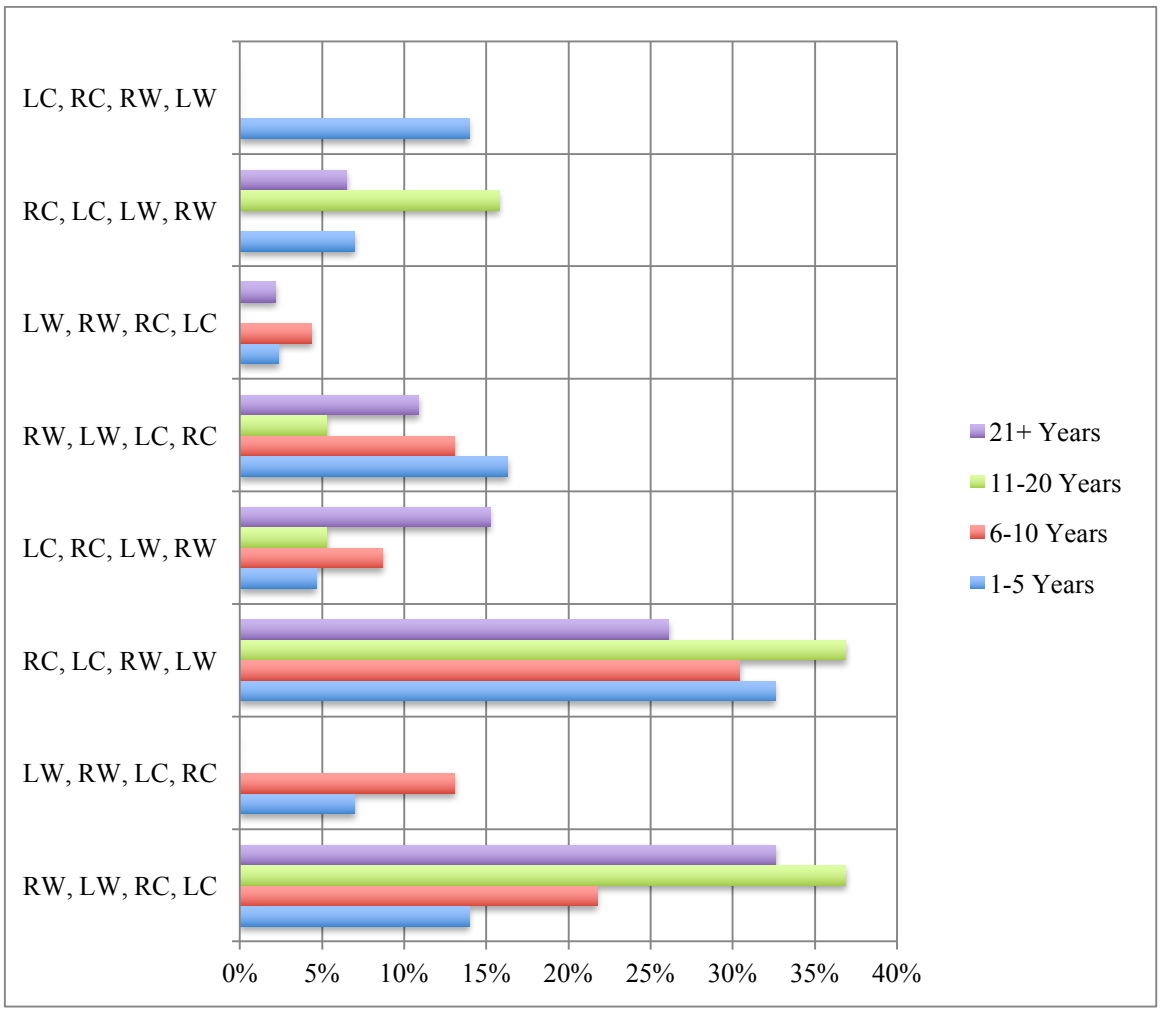



*Figure 20*. Order of caloric irrigations

The most commonly used cutoff for unilateral weakness was found to be ">25%" in every group. For 1-5 years, 61% of respondents reported using ">25%" for the cutoff followed by respondents with 6-10 years of experience (78%), 11-20 years (63%) and 21+ years (53%).

While performing oVEMPs, every respondent in each group performs the test with "unilateral stimulation." This was also the case for cVEMPs, with the exception of one respondent in the 0-5 years of experience group who reported recording "bilateral stimulation."

The most common testing where tasking methods were reportedly utilized was "caloric irrigation testing" for each group. For every group, utilizing tasking methods while performing "caloric irrigation testing" was reported for 95% of responses for each group. Figure 21 displays a breakdown of the use of tasking methods for each group.

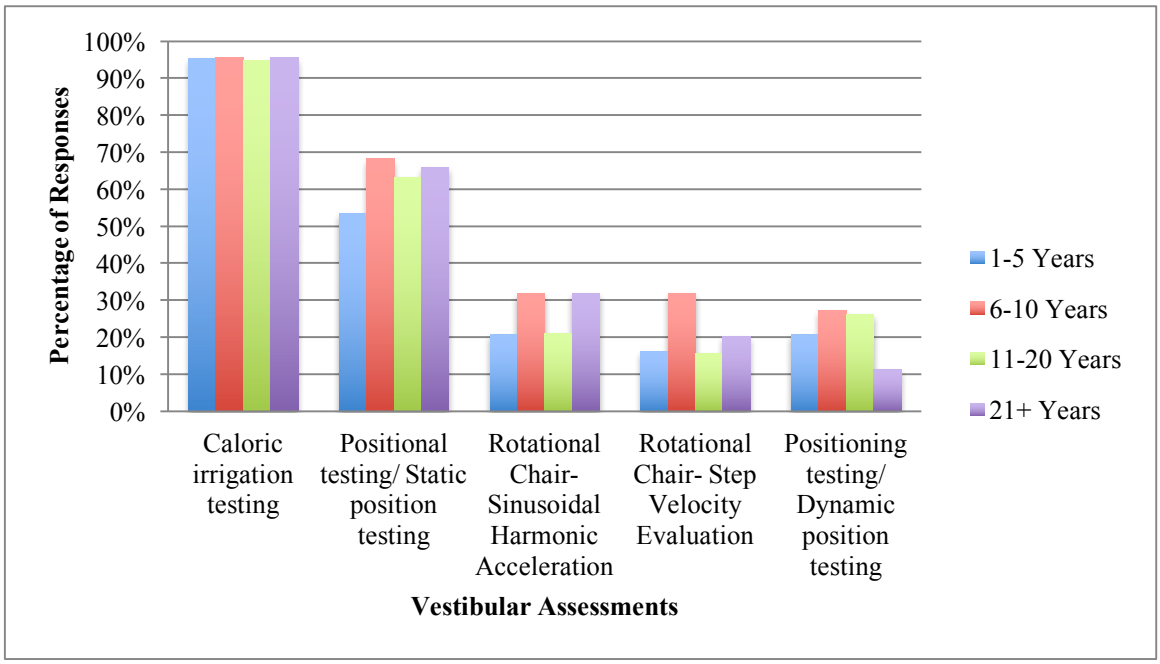



*Figure 21*. Vestibular assessments that utilize tasking methods

**Rehabilitation.** "Canalith repositioning procedures" were reported as the most commonly used rehabilitation method for VRT. It was reported that 100% of responses in every group perform CRP if they complete VRT. When performing the Epley maneuver, only the group with 21+ years of experience perform "four positional changes and DO NOT repeat the maneuver multiple times" (44% of responses). There were also only two respondents in the 21+ years group who reported they "do not perform the Epley maneuver." Figure 22 displays a breakdown of positional modifications made to the Epley maneuver.

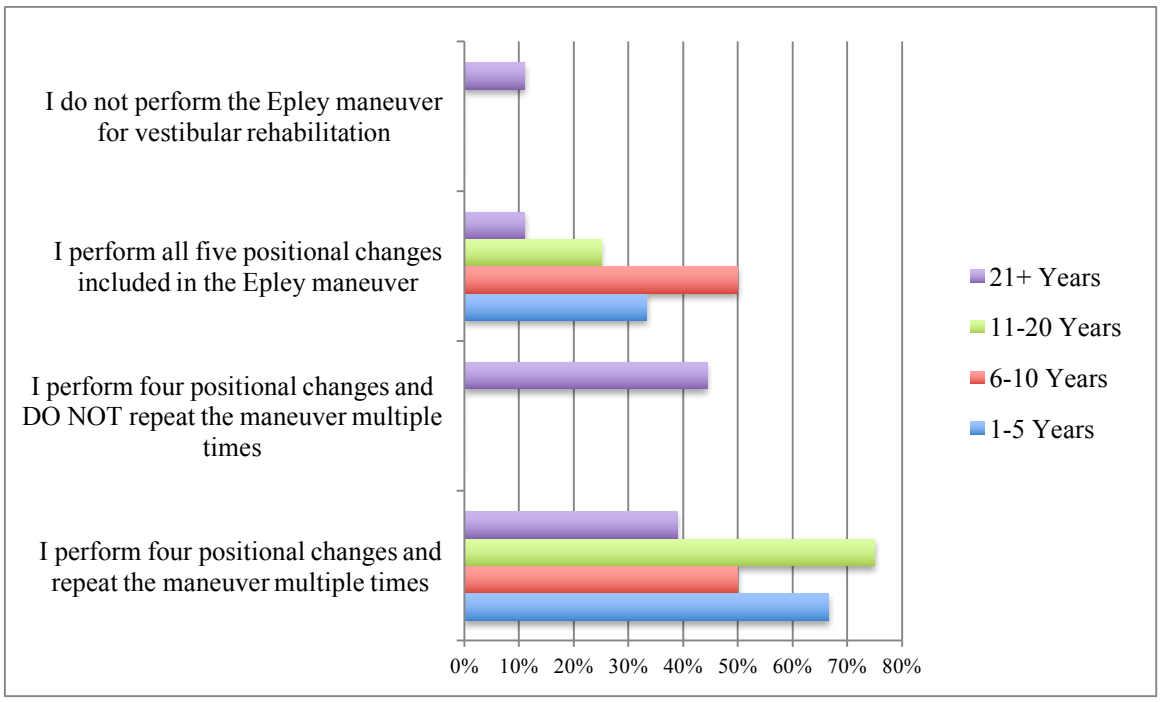



*Figure 22*. Positional modifications while performing the Epley maneuver

**Vestibular testing with children.** Finally, Figure 23 shows that a majority of respondents in the 6-10 and the 11-20 years of experience groups perform vestibular testing on pediatric patients.

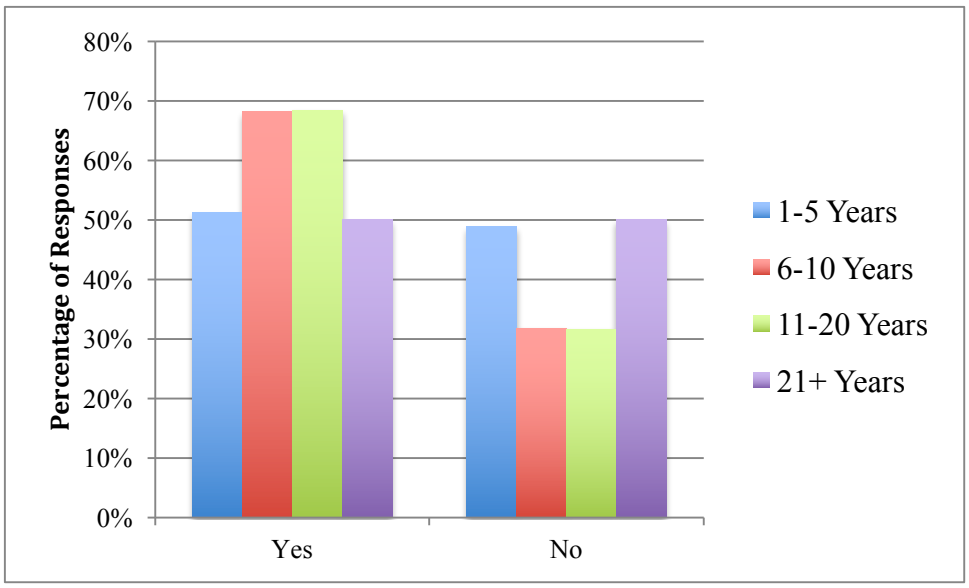



*Figure 23*. Vestibular testing with pediatric patients

**Type of Clinical Practice**

Data were also organized by type of clinical practice settings. Respondents were sorted into the following categories: private practice (n=31), otolaryngology/otology clinic (n= 51), hospital (n=40), and university (n=6). Respondents were not included if they listed their clinical setting as "other." A total number of 128 respondents' answers to various questions regarding techniques and procedures were tallied and converted to percentages that were rounded to the nearest whole number. Respondents' answers are displayed in data tables and split into four different sections: screening, assessment, rehabilitation, and vestibular testing with children.

**Screening.** When screening, there are many different screening assessments that can be utilized. Figure 24 displays a breakdown of the most popular screening assessment utilized by each type of practice group.

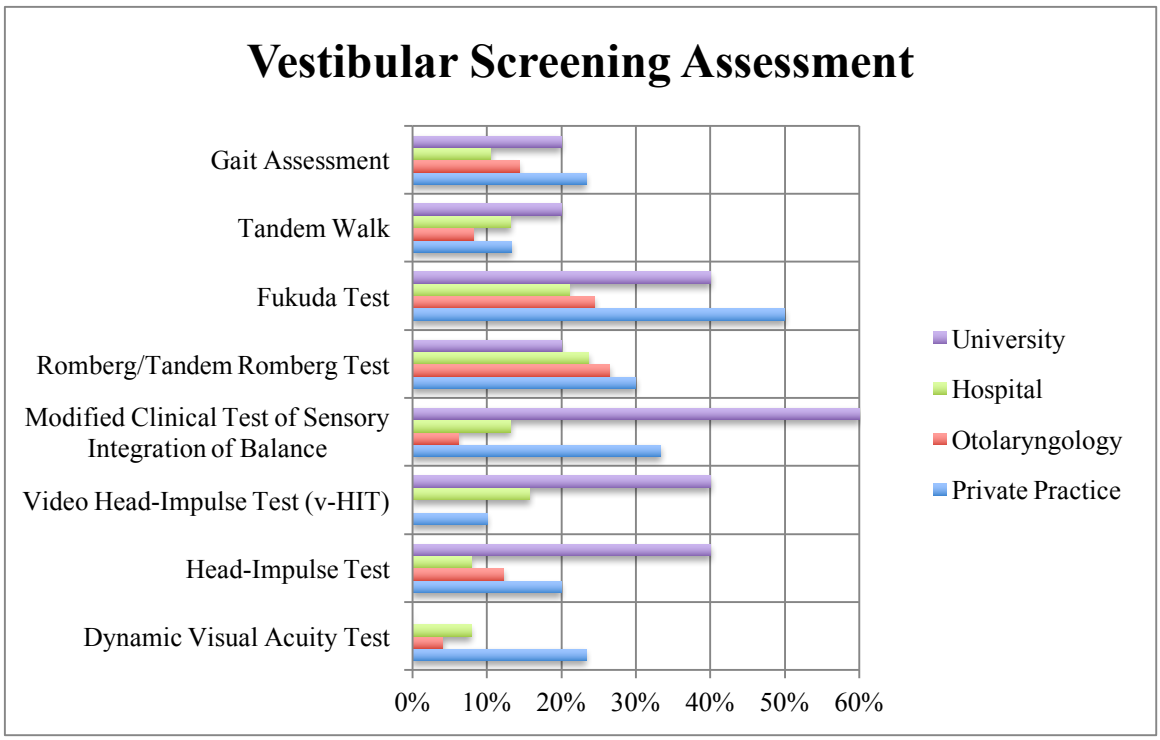



*Figure 24*. Screening assessments used in each clinical setting

Screening questionnaires also seemed to vary depending on the type of practice. The Dizziness Handicap Inventory was the most commonly reported questionnaire, as displayed in Figure 25.

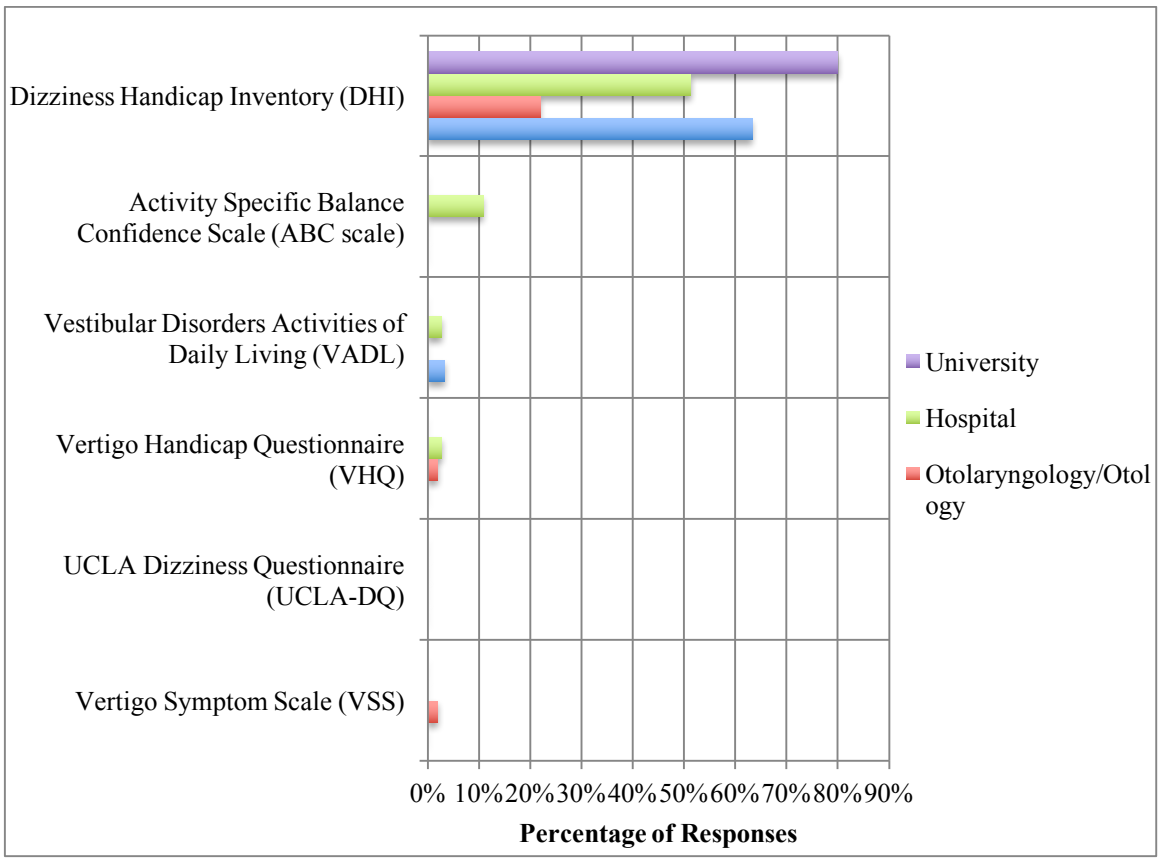



*Figure 25*. Vestibular questionnaires

**Assessment.** The private practice group reported that 90% of respondents perform the vertebral artery screen test (VAST) or similar test "sometimes" or "always." Of the otolaryngology/otology group, 56% of respondents reported that they "never" perform the vertebral artery screen test (VAST) while 47% of the hospital group reported they "sometimes" perform the vertebral artery screen test (VAST). Of the university group, 80% of respondents perform the vertebral artery screen test (VAST) or similar test "sometimes" or "always."

When performing ENG or VNG, the most commonly used duration for oculomotor testing varied among practice groups. This is displayed in Figure 26. The most common recording duration for private practice was "approximately 20 seconds"

(40%) while the otolaryngology/otology group reported the most common recording duration to be “approximately 30 seconds” (34%). The hospital group reported the most common recording duration was “approximately 20 seconds” (61%) and finally, the university group reported “approximately 20 seconds” as the most popular recording duration (40%).

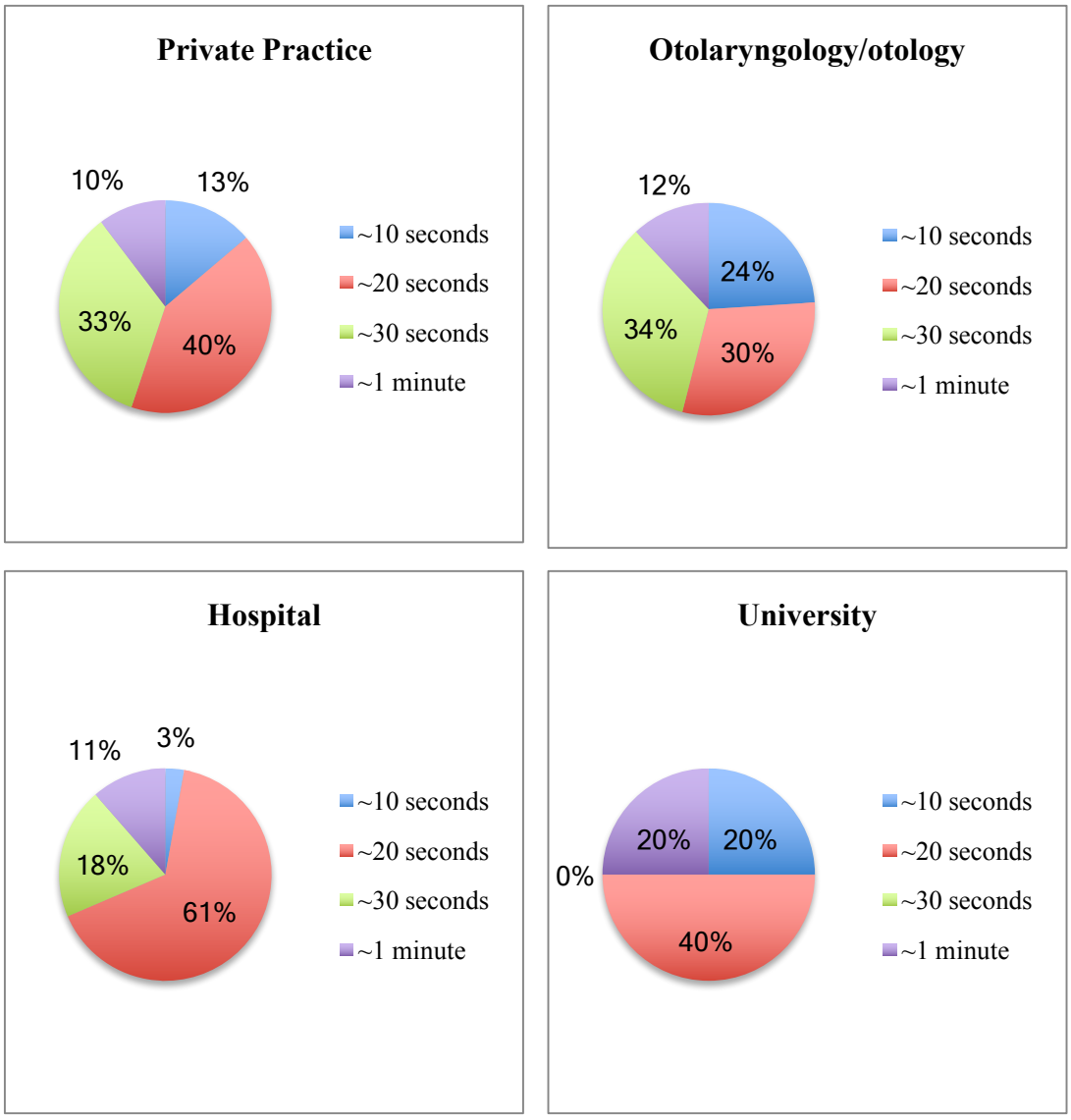



*Figure 26*. Duration of recording for oculomotor testing

It was also reported that the most popular instructions used for OPK testing included the "look" instructions requesting that patients actively count the stimuli. These instructions were reportedly the most commonly used instructions by individuals in the private practice (40%), otolaryngology/otology (52%), hospital (47%), and university (60%) types of clinical practices.

When performing caloric irrigation, the order of irrigation most commonly began in the right ear. Figure 27 displays an overview of the different orders of irrigation used by each practice setting. The private practice (41%), otolaryngology/otology (30%), and hospital (29%) setting groups most commonly reported using the "RC, LC, RW, LW" order of irrigations. The university (80%) setting group indicated they most commonly use the "RW, LW, RC, LC" caloric irrigation order.

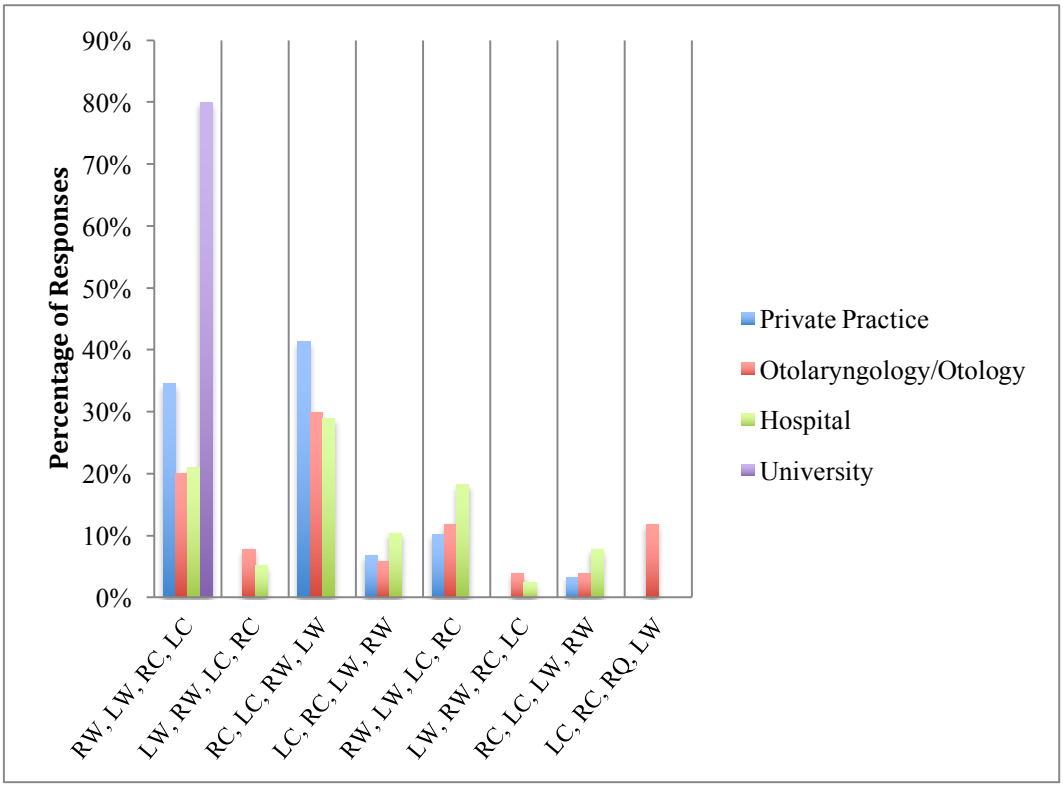



*Figure 27*. Order of caloric irrigations

The most commonly reported cutoff for unilateral weakness was “>25%” for the private practice (48%), otolaryngology/otology (73%), and hospital (68%) groups. The most commonly reported cutoff for the university setting group was “>20%” (40%).

While performing oVEMPs, it was reported that every respondent in each group performs the test with “unilateral stimulation.” This was also reported while performing cVEMPs with the exception of one respondent in the private practice setting group and two respondents from the hospital group that reported recording from “both side simultaneously.”

**Rehabilitation.** “Canalith repositioning procedures” were reported as the most commonly used rehabilitation method for VRT. It was reported that 100% of responses in every group perform CRP if they complete VRT. When performing the Epley maneuver for VRT, a majority of the respondents in each group reported that they “perform four positional changes and repeat the maneuver multiple times.” Of the private practice group, 42% of respondents perform “four positional changes and repeat the maneuver multiple times,” and 43% of the otolaryngology/otology respondents reported performing the “four positional changes and repeat the maneuver multiple times.” Half of the hospital group respondents reported performing the Epley maneuver this way as well as 100% of the university group respondents. Only two respondents from the private practice group reported that they “did not perform the Epley maneuver,” as shown in Figure 28.

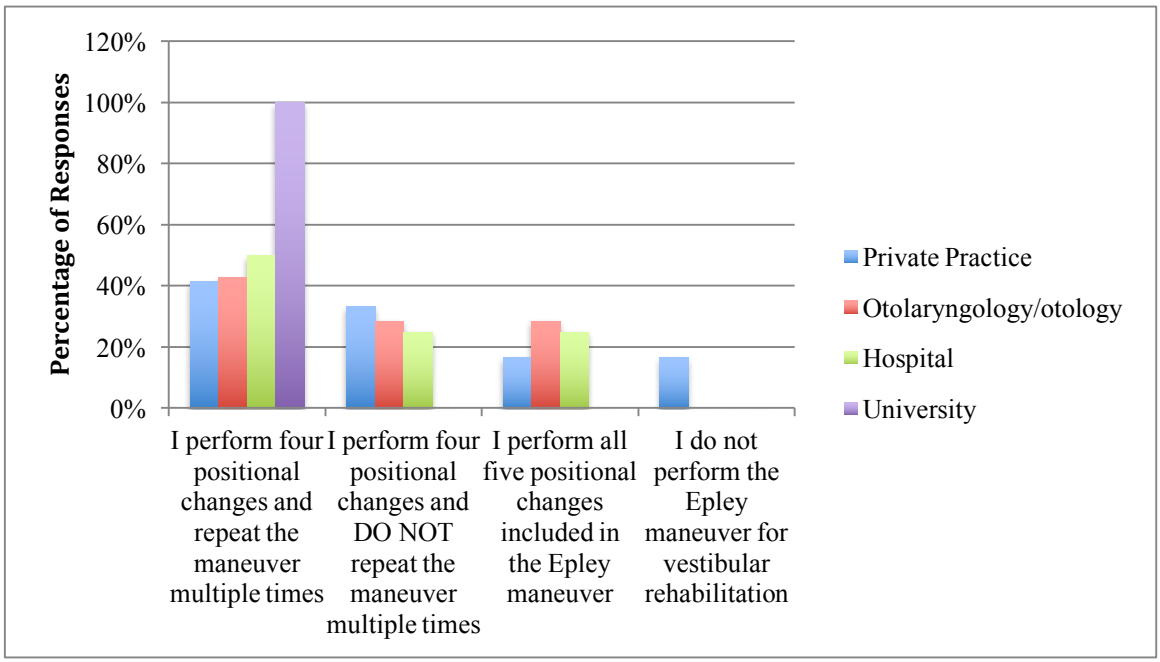



*Figure 28*. Epley maneuver positional modifications

**Vestibular testing with children.** Figure 29 displays the trends in performing vestibular testing with children between each group. The private practice group is split with 50% performing vestibular testing on children and 50% that do not. The otolaryngology/otology group reported that 54% of respondents perform vestibular testing on children. This was followed by the hospital group (55%), and finally the university group (60%).

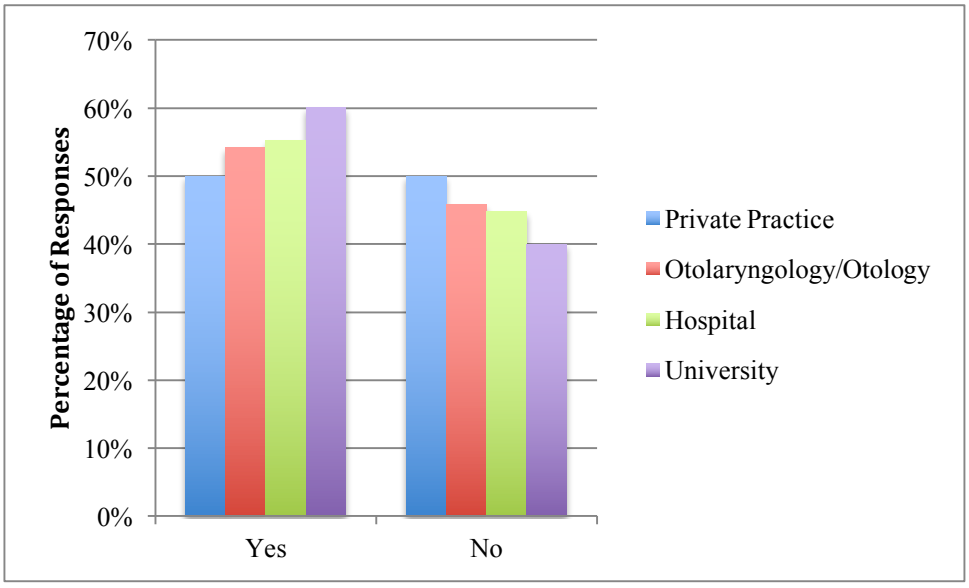



*Figure 29.* Do you perform vestibular testing on pediatric patients?

**Regional Location**

Finally, respondents were sorted into the following regions of the United States for comparison purposes: Midwest (n=35), Northeast (n=35), Southwest (n=16), Southeast (n=33), and West (n=20) (National Geographic Society, 2012). There were seven respondents who practice in multiple states. If both states were in the same region, for example, a respondent practices in both Minnesota and Wisconsin, then the survey was only counted once. If the respondent practices in multiple regions, for example, Kentucky and Ohio, then the survey was counted as one for the Midwest group and one for the Southeast group. Figures 30-34 display participation from each of the states included in each region.

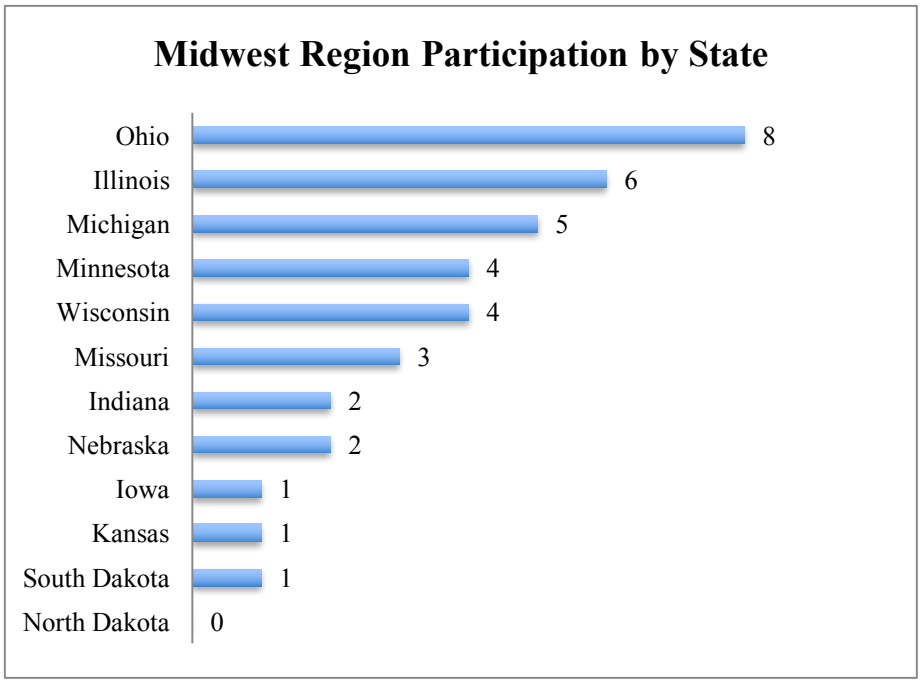



*Figure 30*. Respondent participation by state in the Midwest

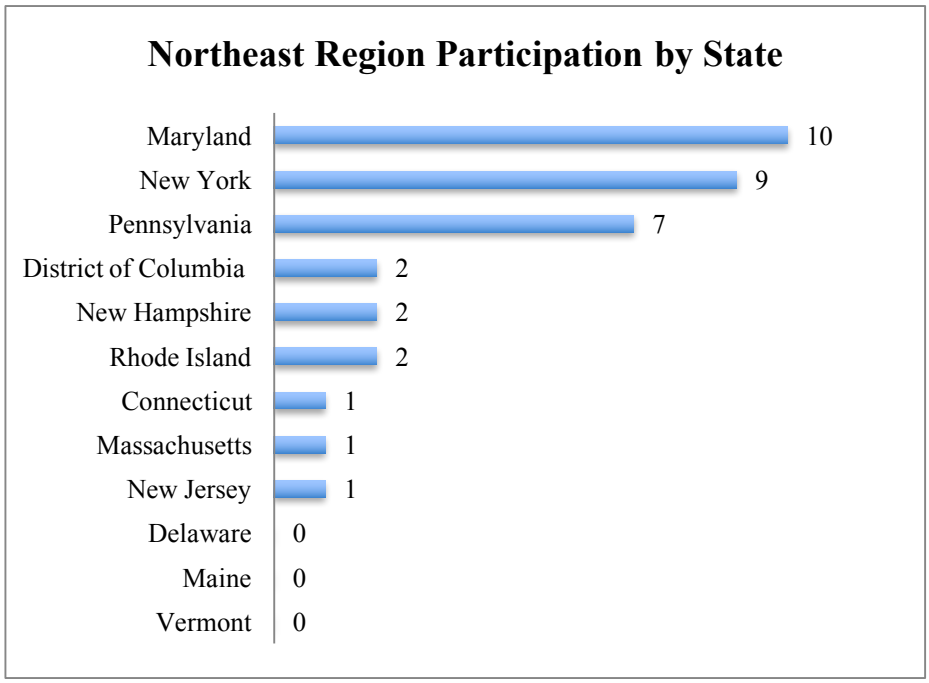



*Figure 31*. Respondent participation by state in the Northeast

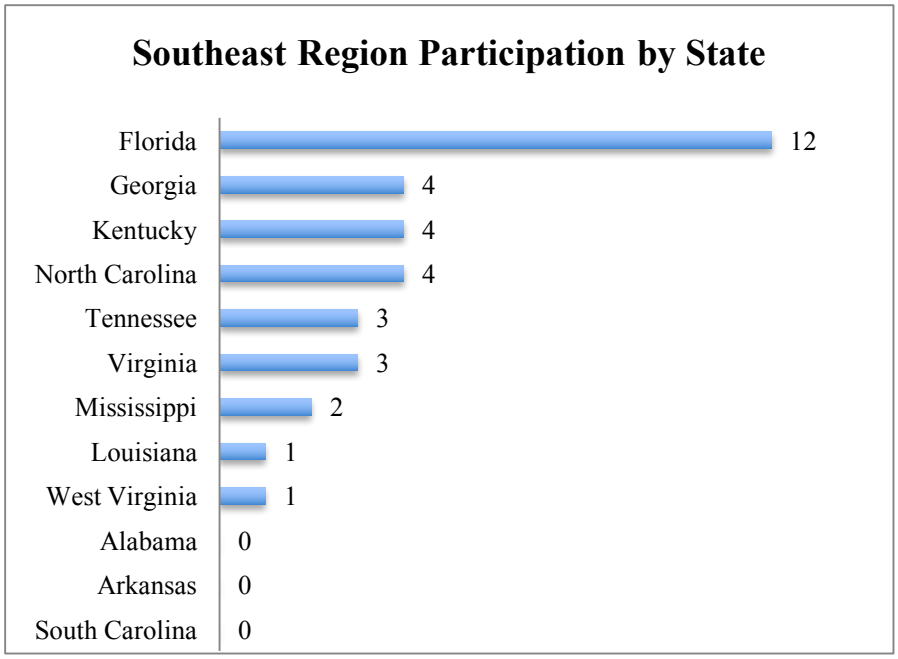



*Figure 32*. Respondent participation by state in the Southeast

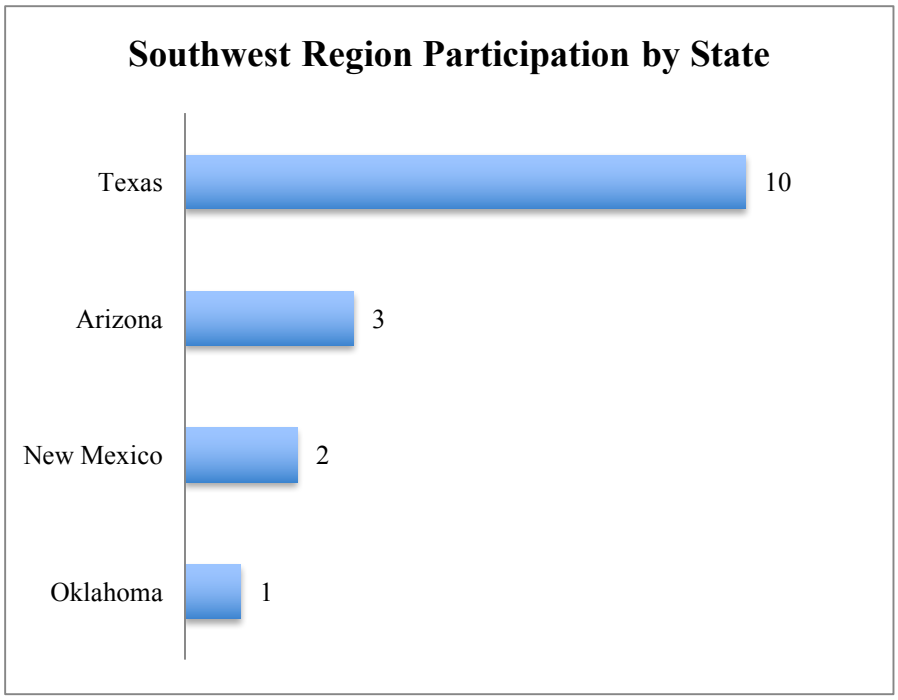



*Figure 33*. Respondent participation by state in the Southwest

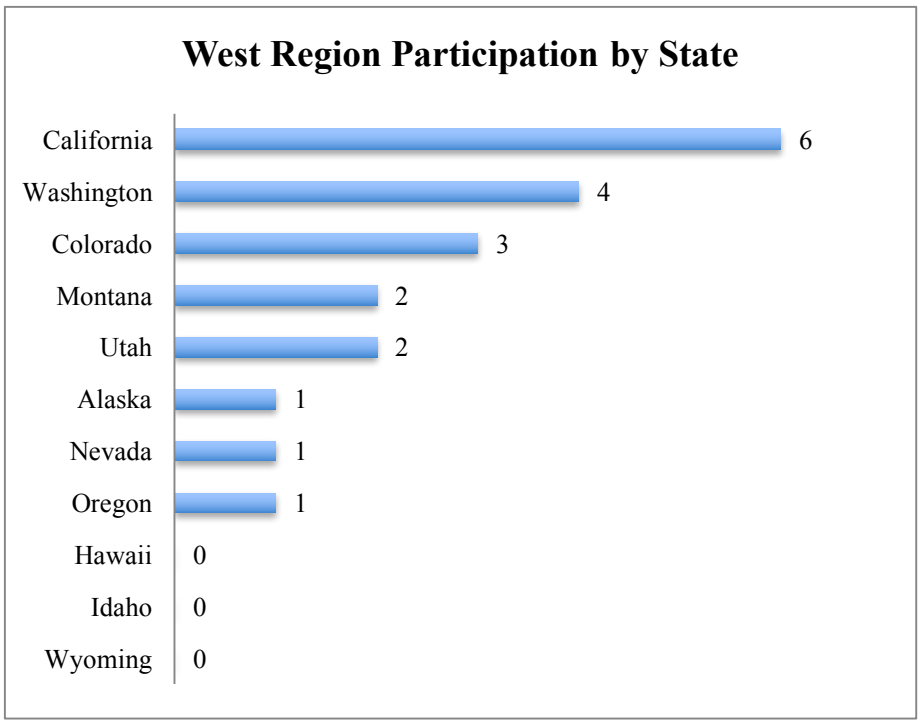



*Figure 34*. Respondent participation by state in the West

A total of 135 respondents' answers to questions regarding techniques and procedures were tallied and converted to percentages that were rounded to the nearest whole number. Respondents' answers are displayed in data tables and split into four different sections: screening, assessment, rehabilitation, and vestibular testing with children.

**Screening.** If respondents perform screening assessments, the Fukuda and Romberg are the most widely used. In the Midwest region group, 46% of respondents did not utilize vestibular assessments. This was the also the case for 50% of the Northeast region group, 34% of the Southeast region group, 57% of the Southwest region group, and 50% of the West region group. Figure 35 displays a breakdown of which screening assessments are being utilized by region.

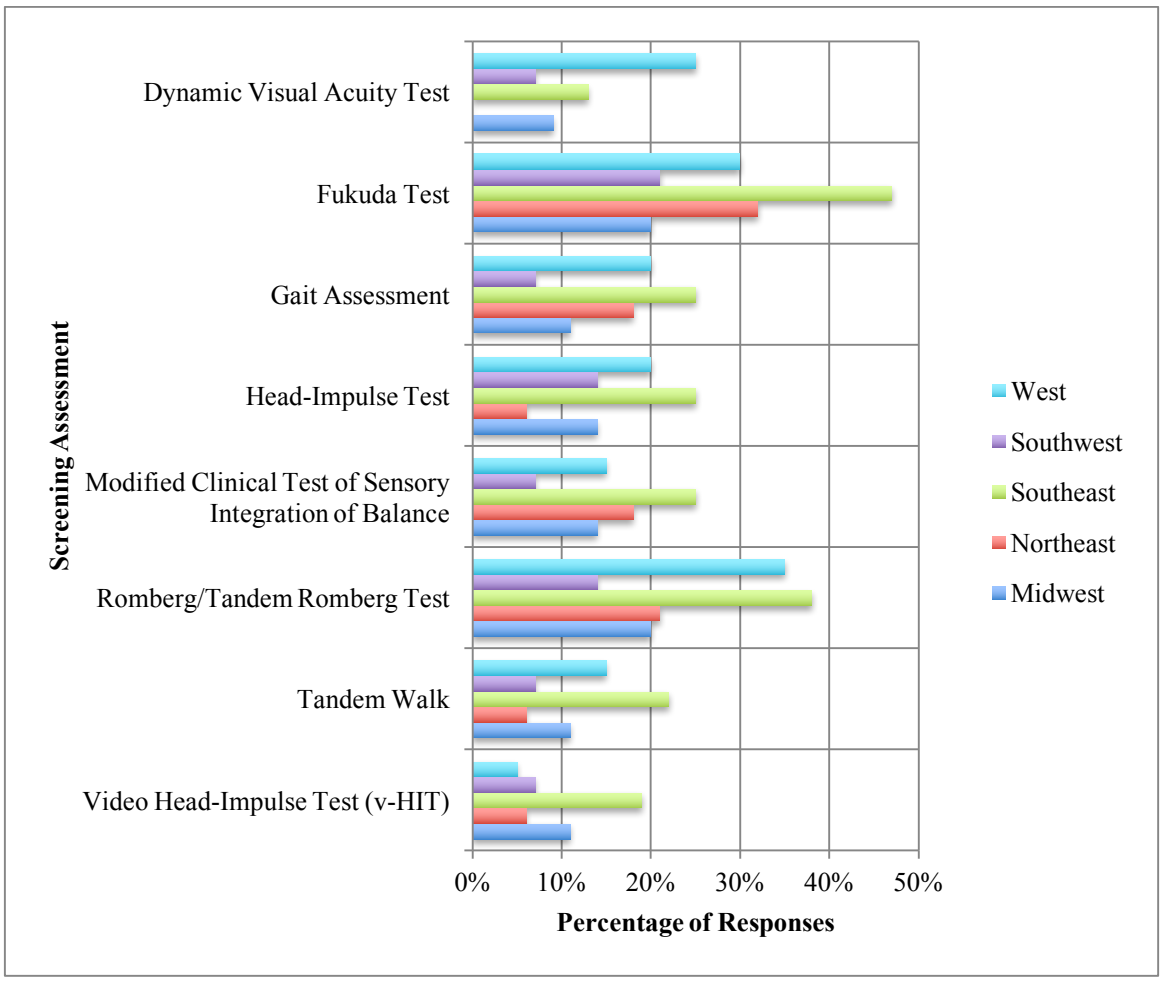



*Figure 35*. Vestibular screening assessments by region

The Dizziness Handicap Inventory (DHI) is the most utilized screening questionnaire. Forty-seven percent of the Midwest group, 43% of the Northeast group, 59% of the Southeast group, 14% of the Southwest group and 45% of the West group most commonly utilize the Dizziness Handicap Inventory. Figure 36 displays a breakdown of screening questionnaires utilized by the different regions.

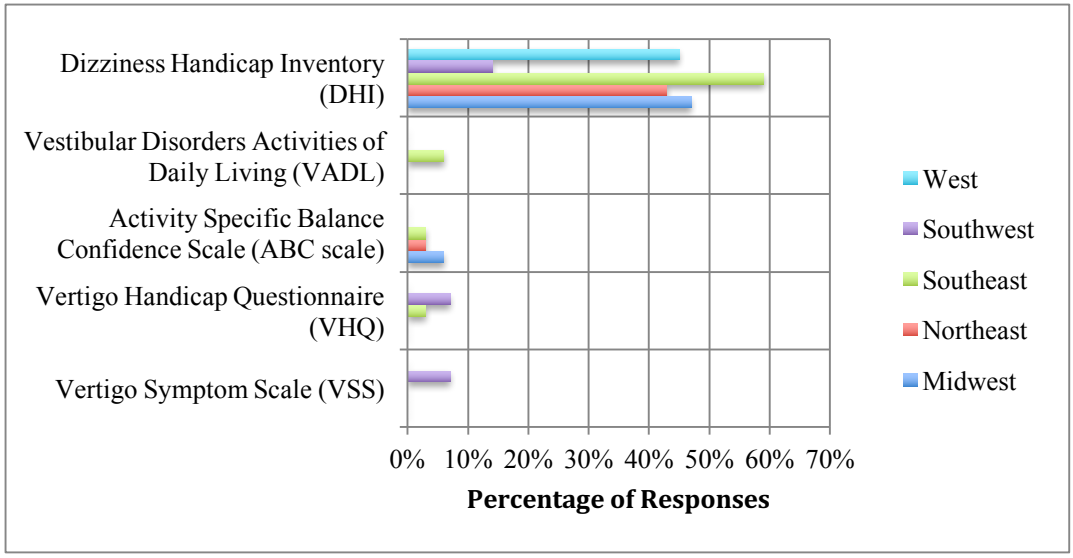



*Figure 36*. Screening Questionnaires

**Assessment.** The Southwest group reported they were least likely to perform the vertebral artery screen test (VAST) prior to vestibular assessment (64%) while the Southeast group was more likely to "sometimes" perform the vertebral artery screen test (VAST). Figure 37 displays the responses reported for each group.

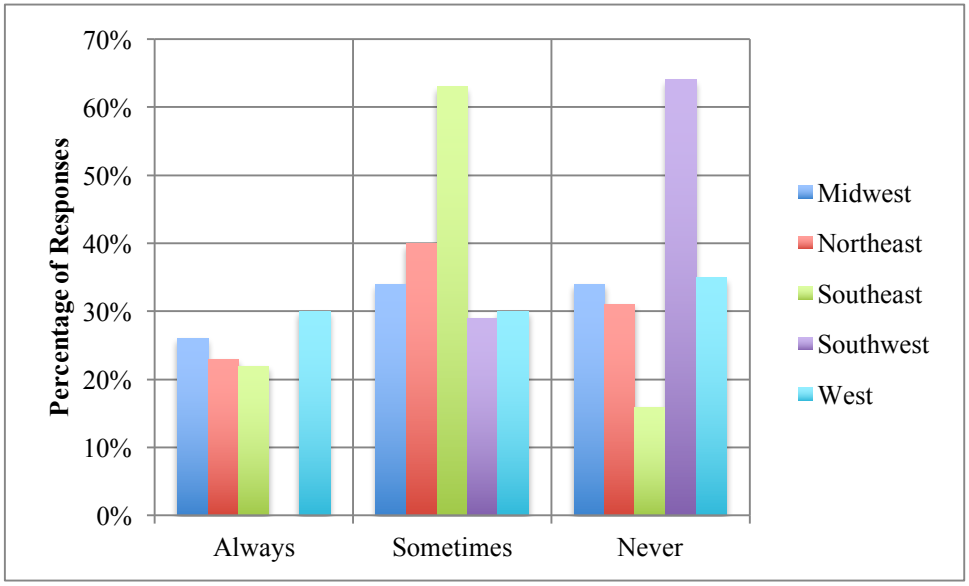



*Figure 37*. Performance of the vertebral artery screen test (VAST) or similar test prior to starting vestibular assessment

The most common vestibular assessment utilized in each region was "VNG with air calorics" with 71% of responses in the Midwest, 89% of responses in the Northeast, 84% of responses in the Southeast, 79% of responses in the Southwest, and 75% of responses in the West group. Cervical vestibular evoked myogenic potential (cVEMP) testing was the next most widely used assessment. A large percentage (43%) of the

Midwest group also utilized Computerized Dynamic Posturography. Figure 38 displays a breakdown of the different vestibular assessments utilized in each region.

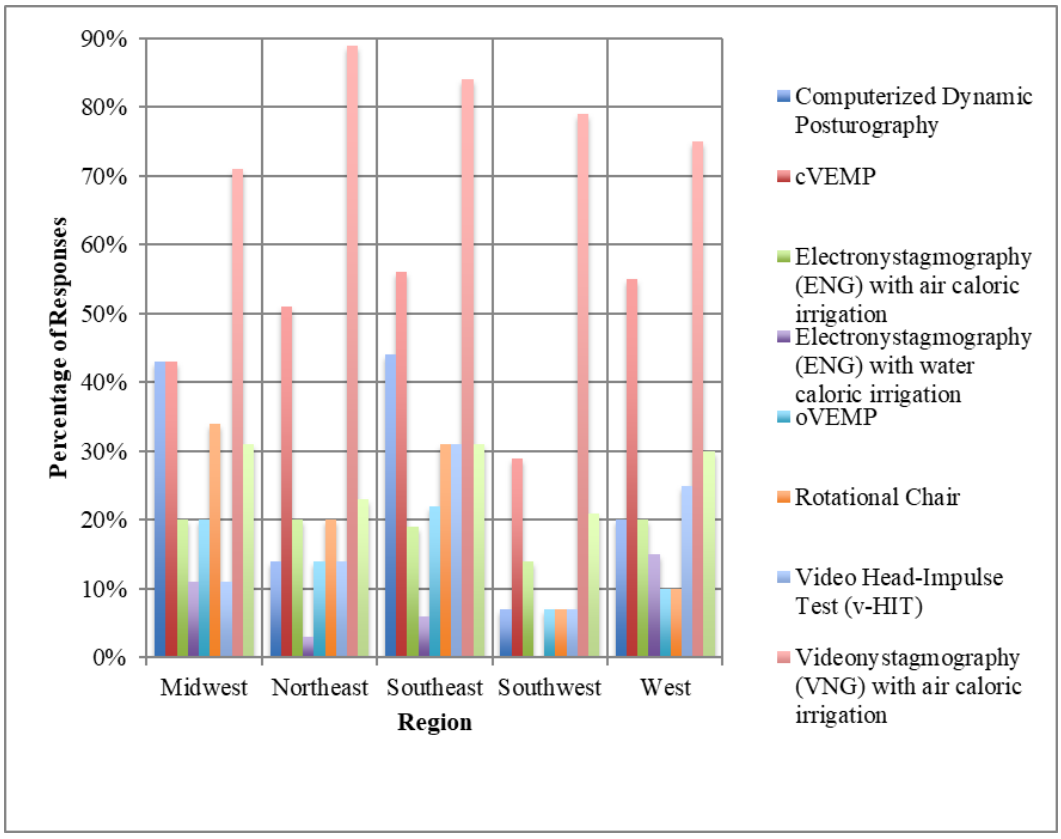



*Figure 38*. Vestibular assessments utilized in each region

While performing ENG or VNG, oculomotor function testing could have a different duration of recording that is dependent on the audiologist performing the test. The most common recording duration for the Midwest, Southeast, and West groups was "approximately 20 seconds." However, the most common recording duration for the Northeast and the Southwest was "approximately 30 seconds." Figure 39 displays a breakdown of recording duration utilized for each region.

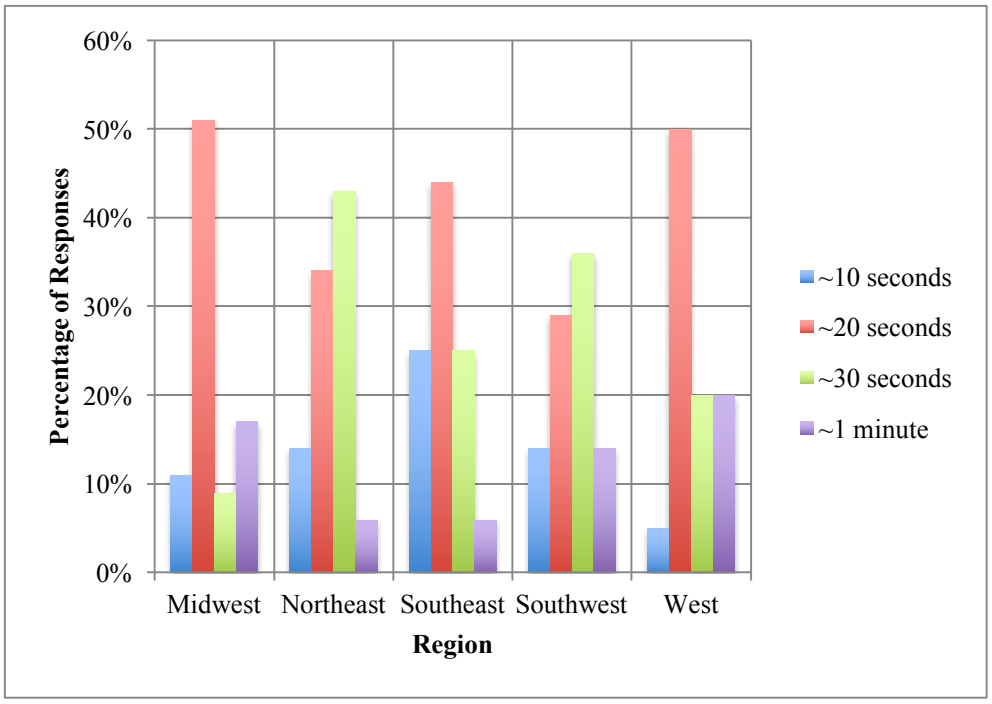



*Figure 39*. Percent of responses for the duration of recording for oculomotor testing for each region

The most commonly used instructions when performing optokinetic testing (OPK) included the "look" instructions, which asks patients to actively count the stimuli as it passes by. Forty-nine percent of the Midwest group, 46% of the Northeast group, and 50% of the Southeast, Southwest, and West groups most commonly utilized the "look" instructions. While performing electronystagmography (ENG), a large percentage of respondents reported they do not perform re-calibration before each caloric irrigation. This was the case for 67% of the Midwest group, 71% of the Northeast group, and 50% of the Southeast and Southwest groups respectively. The West group had 60% of respondents report they "sometimes" performed re-calibration prior to each caloric irrigation, while 50% of the Southeast and Southwest groups also reported they "sometimes" re-calibrate. Figure 40 displays a breakdown of whether or not re-calibration is performed in each region.

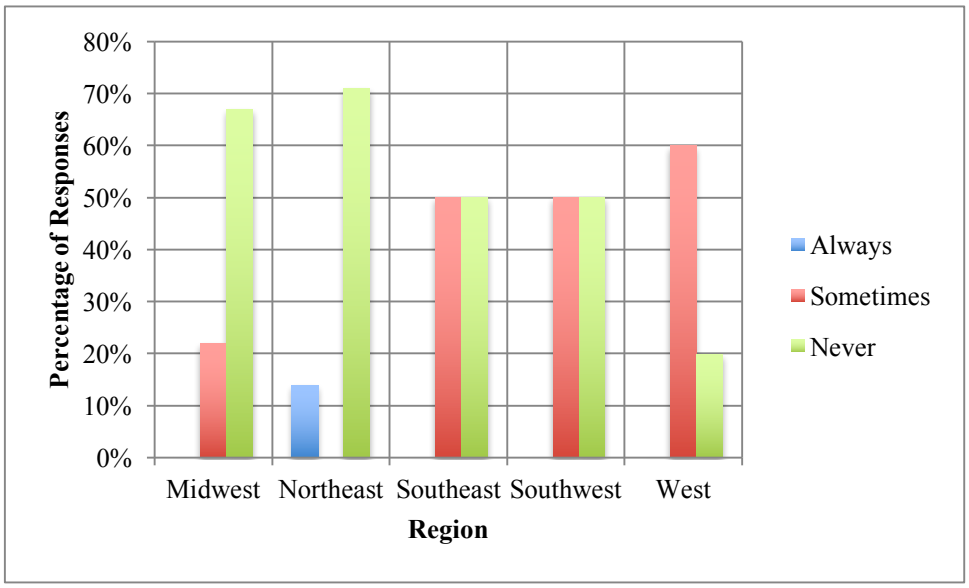



*Figure 40*. Re-calibration performed between caloric irrigations with ENG

While performing caloric irrigations, the most commonly used order of irrigations for 26% of the Midwest group, 41% of the Northeast group, 29% of the Southwest group, and 30% of the West group was "RC, LC, RW, LW." The most commonly used order of caloric irrigations for the Southeast group was "RW, LW, RC, LC" with 41% of responses. Figure 41 displays a breakdown of the responses for each group regarding the order of caloric irrigation testing.

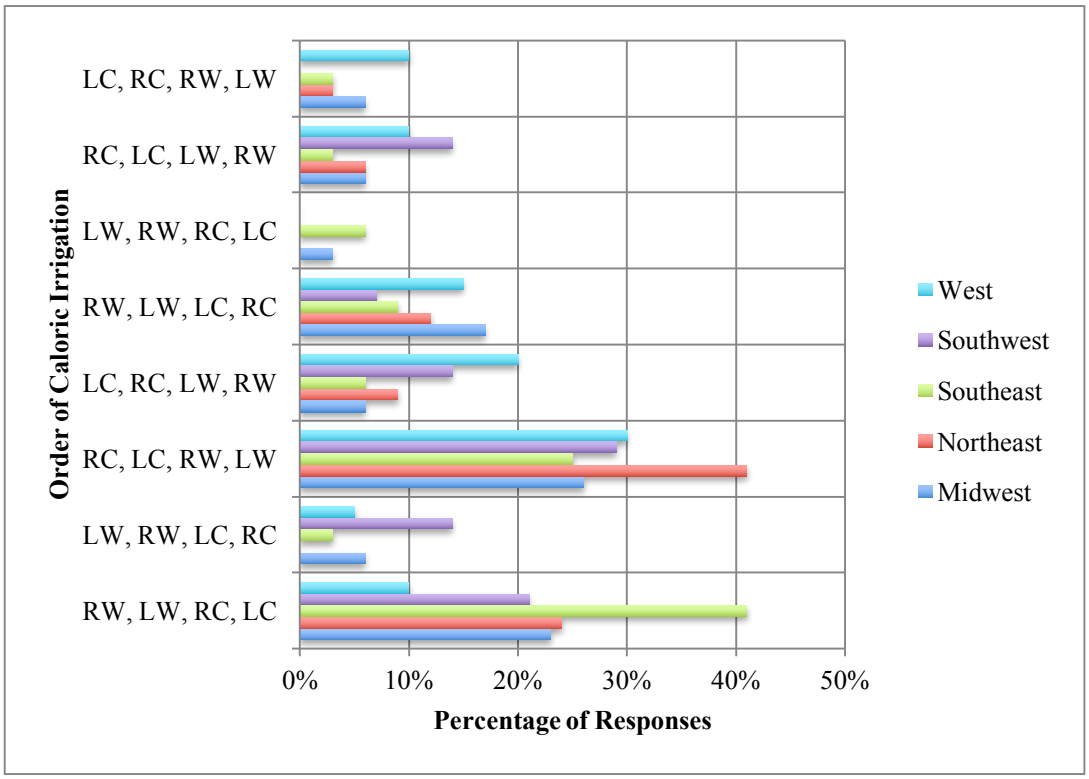



*Figure 41*. Order of caloric irrigation

The most commonly used cutoff for considering a caloric irrigation to have a unilateral weakness for four of the groups was "<25%." This was the case for Southwest group (77%), Northeast group (74%), Southeast group (59%), and the Midwest group (57%). The most commonly used percentage for the cutoff for unilateral weakness for the West group was ">20%" (50%).

One-hundred percent of respondents in each group reported using "unilateral stimulation" when performing ocular vestibular evoked myogenic potentials (oVEMP). This was also the case while performing cervical vestibular evoked myogenic potentials (cVEMP) with the exception of one respondent in Midwest group and two respondents in the Northeast group who reported utilizing "bilateral stimulation" while testing.

**Rehabilitation**. “Canalith repositioning procedures” were reported as the most commonly used rehabilitation method for vestibular rehabilitation therapy (VRT). It was reported that 100% of responses in every group perform canalith repositioning procedures (CRP) if they complete vestibular rehabilitation therapy. When performing the Epley maneuver, it was reported that one respondent in the Northeast group and one respondent in the Southeast group do not perform the Epley maneuver. One-hundred percent of responses for the West group reported performing four positional changes and DO NOT repeat the maneuver multiple times. In the Southeast group, 70% of responses reported performing four positional changes and repeating the maneuver multiple times. An equal number of responses in the Midwest group (43%) reported performing four positional changes and repeating the maneuver or they perform all five positional changes included in the Epley maneuver. Figure 42 displays a breakdown for each group.

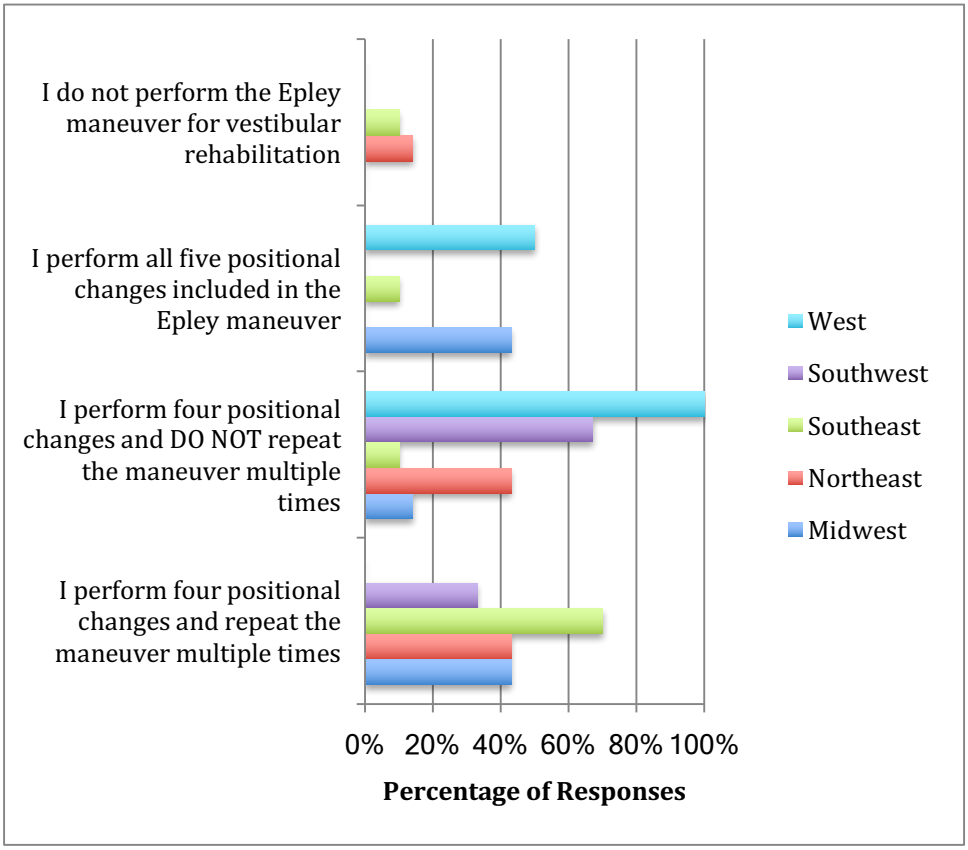



*Figure 42*. Positional modifications while performing the Epley maneuver

**Vestibular testing with children.** Figure 43 displays the percentages of respondents who perform vestibular testing on children. The Southwest and West groups have the highest percentage of respondents performing vestibular testing on children with 62% and 65% respectively.

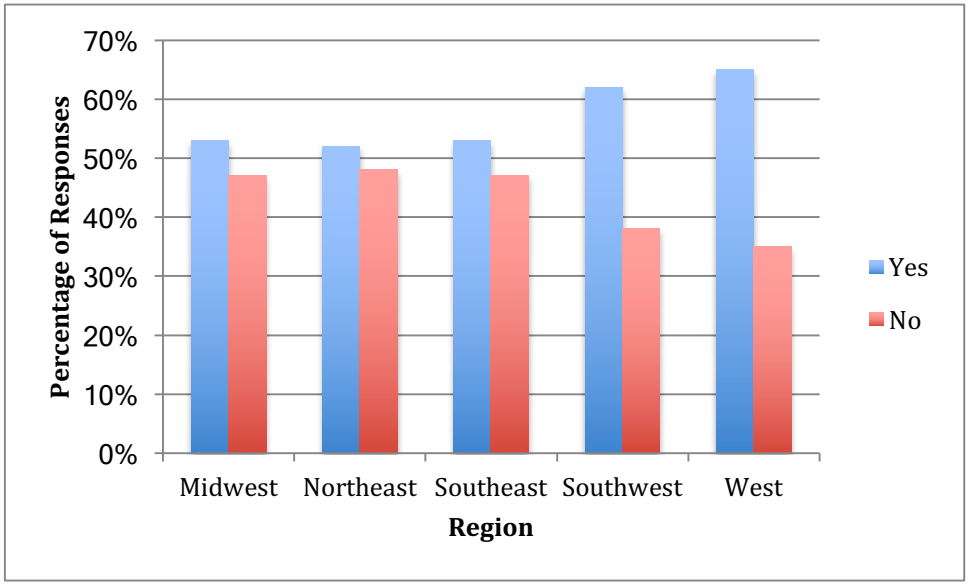



*Figure 43*. Vestibular testing with pediatric patients per region

# CHAPTER V

# DISCUSSION AND CONCLUSIONS

The purpose of this capstone research project was to gain a better understanding of audiologists' practices and procedures related to vestibular assessment. Secondarily, it was of interest to determine what training and education is received by audiologists who perform vestibular testing. Approximately 35% of individuals over the age of 40 (an estimated 69 million Americans) have experienced some form of vestibular dysfunction (Agrawal, Carey, Santina, Schubert, & Minor, 2009). The scope of practice of audiology encompasses the evaluation of vestibular function and the ability to conduct vestibular rehabilitation (ASHA, 2003). Consequently, the role of the audiologist has become increasingly important for the evaluation of these patients as well as for provision of the appropriate intervention or rehabilitation.

The American Academy of Audiology (AAA) and the American Speech-Language-Hearing Association (ASHA) have published position statements regarding the audiologist's role in vestibular assessment; however, specific vestibular assessment techniques are not incorporated. The result is that one practicing audiologist may be performing different techniques when compared to another practicing audiologist.

Therefore, this survey focused on vestibular clinical practices to determine current procedures across the profession as well as current procedures compared to years of experience, different clinical settings, and different regional locations. Three research questions were addressed by this study:

Q1 What are the common techniques and procedures related to screening, assessment, and intervention of vestibular disorders used by practicing audiologists in the United States?

Q2 What training and education do audiologists who perform screening, assessment, and intervention of vestibular disorders receive?

Q3 Are techniques and procedures dependent on demographic factors (e.g., type of practice, years of experience, or regional location)?

In an effort to achieve national representation, this survey was sent to 50% of audiologists in each state who self-identified as being vestibular audiologists. Of 825 audiologists polled, 144 responded. This was a response rate of 17.5%. Adequate response rate is important in order to ensure that nonresponse bias is minimal. Nonresponse bias occurs if the answers of respondents vary from the potential answers of those who decided not to participate or answer (Deming, 1990). Past surveys conducted by Martin and colleagues reported response rates ranging from 30%-76% (Martin, et al., 1994; Martin, et al., 1998; Martin & Forbis, 1978; Martin & Morris, 1989; Martin & Sides, 1985). A survey conducted by Emanuel, Ficca, and Korczak (2011) regarding auditory processing disorder (APD) had a response rate that was estimated to be between 27% and 38%. Emanuel, Henson, and Knapp (2012) conducted two separate surveys regarding tympanometry and acoustic reflex threshold (ART). The response rate for the tympanometry survey was 30% while the response rate for the ART survey was 23%. The current study had a poorer response rate than past survey research regarding audiology practices and procedures. This may be due to the use of an online survey as opposed to a mailed version or because individuals were disinclined to respond to a survey in general due do time constraints or lack of interest. A low response rate may also be due to a lack of compensation to respondents for participating in the survey.

## Training for Audiologists

To perform balance system assessment, ASHA recommends that the audiologist receive the appropriate education through a program that covers all aspects of balance assessment (American Speech-Language-Hearing Association, 1999). Training should take place in a clinical setting affiliated with medical personnel.

A number of respondents to this survey (37%) reported working in an otolaryngology/otology office. A Doctor of Audiology degree was held by the majority of respondents (84%). Beginning in 2007, new applicants for American Board of Audiology certification must have a doctoral degree from an accredited university program while new applicants for CCC-A certification from the American Speech-Language-Hearing Association must have a doctoral degree from an accredited university program as of 2012 (Academy of Doctors of Audiology, nd; American Speech-Language-Hearing Association, 1999). There were many respondents (36%) that had 21+ years of experience practicing audiology and 45% reported practicing 31 to 40 hours a week. Numerous respondents (45%) reported practicing audiology full-time; however, 39% of respondents reported that ≤25% of practice time is dedicated to vestibular testing.

According to the ASHA guidelines regarding vestibular rehabilitation, specific knowledge is necessary to successfully assess various vestibular disorders. Additional and appropriate education and training be acquired beyond graduate level coursework in order to successfully perform vestibular rehabilitation because only a portion of the indicated knowledge and skills can be acquired through graduate level education. However, these guidelines listed above were published prior to implementation of the Doctor of Audiology degree as the entry-level degree for practicing audiology. Prior to

this degree requirement, the minimum educational requirement was a master's degree in audiology. With respect to vestibular rehabilitation, a majority of respondents (70%) indicated that training or education for vestibular rehabilitation was received from special workshops. An additional finding of note is that 41% of respondents indicated that they received education and training for vestibular rehabilitation (separate from training for vestibular assessment) from a graduate education institution. The respondents could choose more than one answer to this question on the survey, which means they could have received training and education from more than one source.

## Trends in Practice

Screening tests can give the examiner more information regarding a general overview of the vestibular system to help identify vestibular deficits. However, it was noted that a number of respondents (47%) in this study indicated that they do not perform screening assessments.

Dizziness questionnaires also allow the examiner to have greater insight prior to vestibular assessment. Nevertheless, 45% of respondents' responses to the question about use of questionnaires indicated that no subjective questionnaires were administered to vestibular patients. Another 45% of responses suggested that the Dizziness Handicap Inventory (DHI) is the most commonly used dizziness questionnaire to evaluate the frequency and intensity of symptoms, movements that trigger symptoms, and possible emotional problems associated with vestibular disorders. This finding is in agreement with the conclusion by Herdman and Clendaniel (2014) that the Dizziness Handicap Inventory is the oldest and most widely used self-assessment available for patients with balance and dizziness complaints.

The most commonly used Current Procedural Terminology (CPT) coding for vestibular assessment reported by respondents was CPT 92450, basic vestibular evaluation, which includes the spontaneous nystagmus test with eccentric gaze fixation nystagmus, with recording; positional nystagmus test, minimum of 4 positions, with recording; optokinetic nystagmus test, bidirectional foveal and peripheral (96%). More than one Current Procedural Terminology (CPT) code could have been chosen on the survey. However, Current Procedural Terminology (CPT) coding does not encompass every test and procedure that an audiologist may choose to perform. This may prevent some audiologists from performing certain assessments that are not covered with a Current Procedural Terminology (CPT) code and for which they will consequently not receive reimbursement for services.

Another interesting finding was that 40% of respondents sometimes perform the vertebral artery screening test (VAST) or a similar test and 33% never perform the VAST. The number of respondents using this type of testing on vestibular patients may be low because of enhanced case history protocols. However, it is important to note that if the VAST is not performed, the patient may be at risk of decreased blood flow to the brain while performing positional and positioning tests, and stroke-like symptoms may occur (McCaslin, 2013).

The most commonly used test for performing vestibular assessment was found to be VNG with air calorics (80%). This finding is in agreement with the 2012 study conducted by Finan, which showed that a majority of respondents (65%) performed VNG with air calorics. The trend toward the use of air for caloric testing, may be due to its easier cleanup and less preparation required when compared to caloric testing using water

(28%). The most commonly used order for caloric irrigation was right-ear cool stimulus, left-ear cool stimulus, right-ear warm stimulus, and left-ear warm stimulus. The Committee on Hearing, Bioacoustics, and Biomechanics (CHABA, 1992) as well as the American National Standards Institute (ANSI, 2009) have recommended that caloric irrigation be performed in a specific order: right-ear warm stimulus, left-ear warm stimulus, right-ear cool stimulus, and left-ear cool stimulus. While this order did not match what the majority of audiologists reported on this survey, Lightfoot (2004) conducted a study that revealed that test order had no physiological effect on the caloric response.

In this study, 21% of respondents reported performing vestibular rehabilitation therapy (VRT). Interestingly, for those respondents who do not perform vestibular rehabilitation therapy, over half of the respondents (52%) indicated that "billing/reimbursement issues" prevent them from performing vestibular rehabilitation. Another factor that could deter respondents from performing vestibular rehabilitation therapy is that it also falls under the scope of practice for physical therapists and these professionals can receive reimbursement for services. For respondents who do perform vestibular rehabilitation therapy, 48% reported that they perform the Epley maneuver with four positional changes and repeat the maneuver multiple times. This finding is in agreement with Herdman and Hoder (2014) who recommended that the maneuver be repeated multiple times if utilizing only four positional changes as opposed to the five positional changes completed for the original Epley maneuver.

Post-treatment instructions were found to be variable. Epley recommended advising the patient to keep the head upright for 48 hours following treatment, which

includes sleeping with the head elevated 45 degrees (Epley, 1992). A follow-up visit would occur one week later and another maneuver would be performed if necessary. Respondents to the current survey indicated that the most common post-treatment instructions following CRP included "keep head straight for the rest of day (do not look up or down)" and "sleep slightly elevated for one night." Other instructions that were reported included "not sleeping on affected side," "repeat the CRP once a day for two weeks," "limited activity for 24-48 hours," or "keep head upright for the next 3-4 hours." Additionally, five respondents (21%) reported that they "do not give post-treatment instructions." A Cochrane Review regarding post-treatment instructions was conducted and it was found that remission rates were significantly higher for patients who did not receive post-treatment instructions (Hunt, Zimmermann, & Hilton, 2012). There were also three respondents who stated they have their patients "wear a soft neck collar for 48 hours while making sure to keep head in one position looking straight ahead, and sleep in a recliner for 48-72 hours." There are numerous post-treatment instructions suggested in the research literature. The findings of this study indicate that varying post-treatment instructions are given by audiologists.

An interesting finding to note is that over half of the respondents (56%) reported performing vestibular testing with children. Diagnosis of a vestibular dysfunction may be difficult with children because they may not have the ability to accurately express or explain what they are feeling or experiencing. The most common test utilized is videonystagmography (VNG). However, it was noted that some modifications might need to be made when testing children. Some of these modifications may include

reducing irrigation time when necessary, allowing small breaks between each test, or performing only monothermal warm irrigations (Valente, 2007a).

## Demographics

Research question 3 was included to determine if vestibular assessment and rehabilitation techniques and procedures were dependent on demographic factors, such as years of experience, type of practice, or regional location.

### Years of Experience

Respondents reported that they had 1-5 years, 6-10, 11-20 or 21+ years of experience. The most common responses were 21+ years of experience (36%) and 1-5 years of experience (33%). A lack of responses from individuals with6-10 years of experience as well as those with 11-20 years of experience may be due to busy work and family schedules for these groups. Notable differences associated with years of experience were rates of screening and vestibular assessments such as the vertebral artery screen test (VAST), order of caloric irrigation, re-calibration during ENG testing, and modifications to the Epley maneuver.

Respondents with 1-5 years and 11-20 years of experience most commonly used the Fukuda screening test. Respondents with 6-10 years and 21+ years of experience reported using the Fukuda test as well as the Romberg test for screening prior to vestibular assessment. With regard to the vertebral artery screen test (VAST), respondents with 21+ years of experience are more likely to “sometimes” conduct the testing while respondents with 1-5 years of experienceare more likely to “never” conduct the VAST. This may be because individuals practicing for 1-5 years have less experience with patients who may experience decreased blood flow to the brain while performing

positional and positioning tests. The results of this survey may also be due to the group with 1-5 years experience utilizing different case history procedures than the 21+ years group.

When performing electronystagmography (ENG), Barin (2006) recommended recalibrating approximately every 10 minutes due to changes in the corneo-retinal potential (CRP). Respondents in the 1-5 years, 11-20 years, and 21+ years commonly reported that they "never" re-calibrate between caloric irrigations. The only respondents who reported they "always" re-calibrate between caloric irrigations occurred in the 21+ years of experience group. This may be due to the habit of always recalibrating or because older test equipment may require this re-calibration.

A majority of respondents in every experience group began with the right ear when performing caloric irrigations. Those in the 1-5 years and 6-10 years groups perform "RC, LC, RW, LW" most commonly. Respondents with 21+ years of experience perform "RW, LW, RC, LC" most commonly and those with 11-20 years of experience perform both orders of caloric irrigation equally. This variability may be because of the introduction in 2009 of standards set by the American National Standards Institute (ANSI), specifying that the right ear irrigation with warm water should be performed first. In the past, it was thought that irrigating with cold water first might hinder the response to warm water by diminishing the difference in temperature. However, this has been shown to have only marginal clinical implications (Lightfoot, 2004).

While performing vestibular rehabilitation therapy (VRT), the Epley maneuver is a common treatment. Respondents with 1-5 years and 11-20 years of experience reported performing four positional changes and repeating the maneuver. Respondents with 6-10

years of experience either perform all five positional changes or perform four positional changes and repeat the maneuver. Those with 21+ years of experience also performs four positional changes but a large number of respondents do not repeat the maneuver multiple times. This may be due to their enhanced experience with performing the procedure. Those with 6-10 years of experience as well as 11-20 years of experience tend to perform vestibular testing on pediatric patients more commonly than the other two groups. One reason for this may be that audiologists practicing for 1-5 years may not have the experience necessary to test children.

**Work Setting**

Respondents reported that they worked in a private practice, otolaryngology/otology office, hospital, university, or school district. The most popular work setting was an otolaryngology/otology office. Notable differences were seen for respondents in various practice settings with respect to screening assessments, duration of ENG/VNG recording and order of caloric irrigation testing.

For screening assessments, the Fukuda test is the assessment most commonly conducted in audiology private practices, the Modified Clinical Test of Sensory Integration of Balance is most commonly used in university settings, and the Romberg test is most commonly used in hospitals and otolaryngology/otology offices. When conducting oculomotor testing, approximately 20 seconds is the most commonly used recording duration in the private practice, hospital, and university settings. Thirty seconds is the most commonly used recording duration by those working in otolaryngology/otology offices. When performing caloric irrigations, the most commonly used order for those respondents working in private practices, otolaryngology/otology

offices, and hospitals was “RC, LW, RW, LW.” The most commonly used irrigation order for those working in university settings was “RW, LW, RC, LC.” This finding may be due to the respondents in the university setting preferring to teach students to perform irrigations according to the standards set by the American National Standards Institute (ANSI, 2009).

Respondents working in university, hospital, and otolaryngology/otology settings are more likely to perform vestibular testing on pediatric patients than those working in other settings. This finding may be because children are simply more likely to be seen in hospital or otolaryngology/otology settings versus private practice settings. In addition, pediatric testing may occur more frequently in a university setting to provide experiences to audiology graduate students in a supervised setting.

**Geographic Region**

Respondents also reported which state(s) they practice in. This information was used to group respondents based on regional location: Midwest, Northeast, Southeast, Southwest, and West. Notable differences were seen from respondents from different regions with regard to screening assessments utilized, performance of the vertebral artery screen test (VAST), duration of recording for oculomotor testing, and order of caloric irrigation testing.

The Fukuda and Romberg tests were the most commonly used screening test by all respondents. Respondents from the West region more commonly reported utilizing the Romberg, while respondents from the Southeast, Northeast, and Southwest more commonly reported utilizing the Fukuda. Respondents from the Midwest region more commonly utilize both tests. Respondents in the Southwest regional group were more

likely to "never" perform the vertebral artery screen test (VAST), while individuals in the Southeast regional group were more likely to "sometimes" perform the vertebral artery screen test (VAST).

Respondents from the Northeast region were more likely to use a recording duration of "approximately 30 seconds" while conducting oculomotor testing. The other regional groups were more likely to utilize a recording duration of "approximately 20 seconds." When performing caloric irrigations, the most common order of caloric irrigations used by the West, Southwest, Northeast, and Midwest regional groups was "RC, LC, RW, LW," while the most common order used by respondents in the Southeast group was "RW, LW, RC, LC." Respondents from the West and Southwest groups are also more likely to perform four positional changes of the Epley maneuver and do not repeat the maneuver multiple times. Respondents from the Southeast were more likely to perform four positional changes and repeat the maneuver multiple times.

## Study Limitations

Fifty percent of audiologists who chose to be members of the American Academy of Audiology, and who self-reported vestibular audiology as a specialty area, were asked to participate in an online survey. This consequently led to a small population size because the survey was designed specifically for a small subset of practicing audiologists. If audiologists did not indicate that they practice vestibular audiology in the information provided to AAA, or if they were not active members of AAA, they were not included in this study. In addition, some potential participants were lost who had self-identified as vestibular audiologists, but when answering Question 1 of the survey, they reported that they did not perform vestibular audiology. These individuals were consequently not

included in the study. Also, some states were not represented in this study, specifically Alabama, Arkansas, Delaware, Hawaii, Idaho, Maine, North Dakota, South Carolina, Vermont, and Wyoming, because no audiologists from these states responded to the survey. It is possible that this study could have had more participants if audiologists had been recruited from more than one national professional organization or if other means of contacting participants had been used, such as social media.

Of 825 audiologists polled, 144 responded. This was a response rate of 17.5%. Adequate response rate is important in order to ensure that nonresponse bias is minimal. Nonresponse bias occurs if the answers of respondents vary from the potential answers of those who decided not to participate or answer (Deming, 1990). The current study had a poorer response rate than past survey research regarding audiology practices and procedures. This may be due to the use of an online survey as opposed to a mailed version or because individuals were disinclined to respond to a survey in general due do time constraints or lack of interest. A low response rate may also be due to a lack of compensation to respondents for participating in the survey.

Some respondents noted limitations to some of the questions of the survey. Question 17 addressed recording duration for gaze testing and grouped all the oculomotor tests together. However, some respondents indicated that these oculomotor tests should have been separated because they used differing duration times for each test. Another question that could have been expanded was Question 45 which asked about vestibular tests for children. An additional question about modifications to adult vestibular assessment protocols should have been included. There were also 12 questions included in the survey that offered the respondent the option to choose more than one response. It

was found that offering more than one response made it difficult to develop conclusions and analyze the data related to these questions because it was difficult to know how many answers each respondent provided.

## Conclusions

The aim of this study was to identify current practices and procedures in vestibular assessment and rehabilitation employed by vestibular audiologists. Multiple surveys of audiologists' general practices have been completed (Martin, Armstrong, & Champlin, 1994; Martin, Champlin, & Chambers, 1998; Martin & Forbis, 1978; Martin & Morris, 1989; Martin & Sides, 1985); however, previous surveys were not designed to gain information about vestibular assessment and treatment methods of practicing audiologists.

Guidelines from the American Academy of Audiology (AAA) and the American Speech-Language-Hearing Association (ASHA) provide recommendations regarding vestibular assessment as well as education and training for audiologists, but no standards currently exist for this area of audiology. With the exception of textbooks, there is scarcity of information about recommended techniques for vestibular assessment and treatment.

Descriptive analyses of the survey results revealed variability in vestibular practices among audiologists. Specifically, responses to questions regarding assessment protocols and rehabilitation methods were quite variable with respect to vascular screening prior to testing, order of testing, re-calibration during testing, and modifications to the physical maneuvers for vestibular rehabilitation. This study also provided information regarding where and how audiologists receive training in vestibular

assessment and treatment, and the level and type of training is also quite variable. In the absence of universal guidelines and standards, students, educators, and professionals may utilize these survey results as an informative tool regarding current practices in vestibular audiology.

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# APPENDIX A
# INSTITUTIONAL REVIEW BOARD

UNIVERSITY OF
NORTHERN COLORADO

*Institutional Review Board*

| | |
|---|---|
| DATE: | November 2, 2015 |
| TO: | Kelli Lingen |
| FROM: | University of Northern Colorado (UNCO) IRB |
| PROJECT TITLE: | [823090-2] SURVEY OF THE CURRENT STATUS OF VESTIBULAR CLINICAL PRACTICES IN THE UNITED STATES |
| SUBMISSION TYPE: | New Project |
| ACTION: | APPROVAL/VERIFICATION OF EXEMPT STATUS DECISION |
| DATE: | November 2, 2015 |

Thank you for your submission of New Project materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

**Thank you for your patience with the UNC IRB process. Your IRB application is clear and thorough. There are no requests for modifications or additional materials.**

**Best wishes with your research and please don't hesitate to contact me with any IRB-related questions or concerns.**

**Sincerely,**

**Dr. Megan Stellino, UNC IRB Co-Chair**

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

# APPENDIX B

# E-MAIL TO PARTICIPANTS

Dear Audiologist,

You are invited to participate in a research study surveying the current clinical vestibular techniques and procedures related to screening, assessment, and intervention of vestibular disorders as well as what training and education audiologists who perform vestibular testing receive.

This project is being conducted to fulfill my capstone research requirement in the Doctor of Audiology degree program at the University of Northern Colorado. This is a web-based survey hosted by Qualtrics.com, which insures your anonymity. Your participation in this research study poses no known risks.

Your participation is completely voluntary and your responses will be kept confidential. It is anticipated that this survey will take approximately 5-10 minutes to complete. The time length may vary depending on your answers to the questions. Your participation is greatly appreciated and will provide information for audiologists, students, and other professionals about current common practices in vestibular testing and management. The decision to complete the survey will serve as informed consent to have your responses included in the study.

If you have any concerns about your treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

To begin the survey, please click on the link below:

https://unco.co1.qualtrics.com/SE/?SID=SV_8ek0tTtg2y2Ok4Z

The survey will be open through December 8th, 2015. Three weeks following this mailing, a follow-up reminder will be sent out inviting you again to participate if you have not already completed the survey. You may contact the research investigators with questions pertaining to your participation at any time.

Thank you for your time and consideration.

Sincerely,
Kelli Lingen, B.S.
Doctor of Audiology Student
University of Northern Colorado
Ling1201@bears.unco.edu

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Tina M. Stoody, Ph.D.
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Audiology Graduate Coordinator
Director, FETCH~LAB UNC
Audiology and Speech Language Sciences
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# APPENDIX C

# SURVEY

Survey Questions

1. Do you perform vestibular testing?
    a. Yes
    b. No- no other participation is required

2. What is your current clinical setting?
    a. Private practice
    b. Otolaryngology/otology office
    c. Hospital
    d. School district
    e. University
    f. Other –Please explain

3. In which state(s) do you currently practice?

4. What is the highest degree you currently hold?
    a. Doctor of Audiology (Au.D.)
    b. Doctor of Philosophy (Ph.D.)
    c. Doctor of Education (Ed.D.)
    d. Master'sdegree
    e. Other—please explain

5. How many years have you practiced audiology?
    a. 0-5 years
    b. 6-10 years
    c. 11-20 years
    d. 21+ years

6. How many hours per week do you provide clinical audiology services?
    a. 1-10 hours
    b. 11-20 hours
    c. 21-30 hours
    d. 31-40 hours
    e. 40+ hours

7. How often do you perform vestibular testing? (Please choose the answer that best fits)
    a. >75% of my practice time
    b. ~50% of my practice time
    c. ~25% of my practice time
    d. ≤25% of my practice time

8. Where did you receive training for vestibular assessment?
    a. Graduate educational institution
    b. Special workshops
    c. Self-taught
    d. Seminar
    e. No training
    f. Other- Please explain

9. When performing vestibular assessment, which reimbursement code(s) do you utilize? (Please select all that apply)
    a. CPT 92540 Basic vestibular evaluation, includes spontaneous nystagmus test with eccentric gaze fixation nystagmus, with recording, positional nystagmus test, minimum of 4 positions, with recording, optokinetic nystagmus test, bidirectional foveal and peripheral stimulation, with recording, and oscillating tracking test, with recording
    b. CPT 92541 Spontaneous nystagmus test, including gaze and fixation nystagmus, with recording
    c. CPT 92542 Positional nystagmus test, minimum of four positions, with recording
    d. CPT 92543 Caloric vestibular test, each irrigation, with recording
    e. CPT 92544 Optokinetic nystagmus test, with recording
    f. CPT 92545 Oscillating tracking test, with recording
    g. CPT 92546 Sinusoidal vertical axis rotational testing
    h. CPT 92547 Use of vertical electrodes in an or all of the above tests counts as one additional test
    i. CPT 92548 Computerized dynamic posturography
    j. CPT 95992 Canalith repositioning procedure(s) (Epley maneuver, Semont maneuver) per day
    k. CPT 97112 Neuromuscular re-education of movement, balance, coordination, kinesthetic sense, posture, and proprioception

10. Which of the following assessments do you use during <u>screening</u> for vestibular dysfunction? (Please choose all that apply; you will be asked about vestibular assessment later)
    a. Dynamic Visual Acuity Test
    b. Head-Impulse Test
    c. Video Head-Impulse Test (v-HIT)
    d. Head-Shaking Nystagmus Test
    e. Modified Clinical Test of Sensory Integration of Balance
    f. Romberg/Tandem Romberg Test
    g. Fukuda Test
    h. Tandem Walk
    i. Gait Assessment
    j. Other—please explain
    k. I do not perform screening assessments for vestibular disorders

11. What subjective questionnaire(s) do you use with vestibular patients? (Please select all that apply)
    a. Dizziness Handicap Inventory (DHI)
    b. Vertigo Handicap Questionnaire (VHQ)
    c. Vertigo Symptom Scale (VSS)
    d. Activity Specific Balance Confidence Scale (ABC scale)
    e. UCLA Dizziness Questionnaire (UCLA-DQ)
    f. Vestibular Disorders Activities of Daily Living (VADL)
    g. Other—please explain
    h. I do not use subjective questionnaires

12. Prior to evaluating vestibular function, what pre-testing instructions do you ask patients to follow? (Please select all that apply)
    a. Abstain from caffeine
    b. Abstain from alcohol
    c. Abstain from tobacco use
    d. Abstain from medications that suppress vertigo and dizziness
    e. Limit food intake
    f. Other—please explain

13. Prior to evaluating vestibular function, do you perform the VAST?
    a. Always
    b. Sometimes
    c. Never
    d. Other—please explain

14. When evaluating vestibular function, which tests do you utilize? (Please select all that apply)
    a. Videonystagmography (VNG) with water caloric irrigation
    b. Videonystagmography (VNG) with air caloric irrigation
    c. Electronystagmography (ENG) with water caloric irrigation
    d. Electronystagmography (ENG) with air caloric irrigation
    e. Rotational Chair
    f. Computerized Dynamic Posturography
    g. Video Head-Impulse Test (v-HIT)
    h. oVEMP
    i. cVEMP
    j. Other—please explain

15. When evaluating vestibular function, on what percent of your patients do you perform VNG? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%

16. When evaluating vestibular function, on what percent of your patients do you perform ENG? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%

17. When performing ENG/VNG testing, what recording duration do you utilize while testing ocular motor testing?
    a. ~10 seconds
    b. ~20 seconds
    c. ~30 seconds
    d. ~1 minute
    e. Other- Please explain

18. When performing OPK testing, which patient instruction do you utilize?
    a. "Look" instructions- actively count the stimuli
    b. "Look" instructions- actively follow the stimuli to the end then repeat
    c. "Stare" instructions- passively stare at the stimuli
    d. Other- Please explain

19. When performing ENG testing, do you re-calibrate before each caloric irrigation?
    a. Always
    b. Sometimes
    c. Never
    d. Other—please explain

20. When performing caloric irrigation, which order of caloric stimulation do you utilize?
    a. RW, LW, RC, LC
    b. LW, RW, LC, RC
    c. RC, LC, RW, LW
    d. LC, RC, LW, RW
    e. RW, LW, LC, RC
    f. LW, RW, RC, LC
    g. RC, LC, LW, RW
    h. LC, RC, RW, LW
    i. Other—please explain

21. When performing caloric irrigation, what do you consider the cutoff for a unilateral weakness?
    a. ≥ 20%
    b. ≥ 25%
    c. Other, please explain

22. Under what circumstances do you typically perform ice water caloric irrigation?
    a. When conventional caloric irrigation does not produce a measurable response
    b. Other—Please explain
    c. I do not perform ice water caloric irrigation

23. When evaluating vestibular function, on what percent of your patients do you perform Rotational Chair? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%

24. When evaluating vestibular function, on what percent of your patients do you perform Computerized Dynamic Posturography? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%

25. When evaluating vestibular function, on what percent of your patients do you perform v-HIT? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%

26. When evaluating vestibular function, on what percent of your patients do you perform oVEMP? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%
27. When evaluating vestibular function, on what percent of your patients do you perform cVEMP? (Please choose the answer that best fits)
    a. >75%
    b. 50% -74%
    c. 25% - 49%
    d. <25%

28. When performing oVEMPs, which position protocol do you utilize?
    a. I record from one side at a time (unilateral stimulation)
    b. I record from both sides simultaneous (bilateral stimulation)
    c. Other- Please explain

29. When performing cVEMPs, which position protocol do you utilize?
    a. I record from one side at a time (unilateral stimulation)
    b. I record from both sides simultaneous (bilateral stimulation)
    c. Other- Please explain

30. When performing cVEMPs, which method do you utilize to ensure muscle contraction?
    a. EMG target levels
    b. Biofeedback using a blood pressure manometer with inflatable cuff
    c. Rectification of muscle contraction power
    d. Other—please explain

31. Since you have been practicing audiology, how many malingerers have you identified while utilizing vestibular function tests?
    a. 0
    b. 1-5
    c. >5
    d. Other—please explain

32. When evaluating vestibular function, please list which tasking methods you utilize.

33. When evaluating vestibular function, for which tests do you utilize tasking methods? (Please select all that apply)
    a. Positioning testing/Dynamic position
    b. Positional testing/Static position
    c. Caloric irrigation testing
    d. Rotational Chair—Sinusoidal Harmonic Acceleration
    e. Rotational Chair—Step Velocity Evaluation
    f. Other—please explain

34. Do you perform vestibular rehabilitation therapy (VRT)?
    a. Yes
    b. No

35. When performing vestibular rehabilitation, which testing do you utilize? (Please select all that apply)
    a. Adaptation, habituation, and substitution protocols
    b. Gaze stabilization exercises
    c. Static and dynamic balance activities
    d. Canalith Repositioning Procedures (CRP)—Epley maneuver, Semont maneuver, or Dix Hallpike
    e. Other, please explain

36. Do you work closely with another medical professional(s) to assist in vestibular rehabilitation? (Please select all that apply)
    a. Yes- physical therapist
    b. Yes-occupational therapist
    c. Yes- otolaryngologist/otologist
    d. Yes-neurologist
    e. Other—please explain
    f. I do not work closely with another medical professional

37. Where did you receive training on vestibular rehabilitation? (Select all that apply)
    a. Graduate educational institution
    b. Special workshop
    c. Seminar
    d. Self-taught
    e. No training
    f. Other—please explain

38. When performing vestibular rehabilitation, which reimbursement code(s) do you utilize? (Please list all that apply)

39. When performing vestibular rehabilitation, which positional modifications do you make to the Epley maneuver? (Please select all that apply)
    a. I perform four positional changes and repeat the maneuver multiple times
    b. I perform four positional changes and DO NOT repeat the maneuver multiple times
    c. I perform all five positional changes included in the Epley maneuver
    d. I do not perform the Epley maneuver for vestibular rehabilitation

40. Please describe the post-treatment instructions you give to patients following canalith-repositioning procedures (CRP).

41. When performing vestibular rehabilitation, do you recommend home exercises to your patients?
    a. Yes- please explain
    b. No

42. Please indicate the reason(s) for not performing vestibular rehabilitation. (Please select all that apply)
    a. Lack of equipment
    b. Equipment cost issues
    c. Billing/Reimbursement issues
    d. Lack of time
    e. Lack of training
    f. Other—please explain

43. If you do not perform vestibular rehabilitation, please indicate your procedure for the vestibular rehabilitation patient. (Please select all that apply)
    a. Discharge the patient and/or recommendations for routine follow-up
    b. Referral for vestibular rehabilitation
    c. Referral to other professionals
    d. Other—please explain

44. Do you perform vestibular testing on pediatric patients?
    a. Yes
    b. No

45. When evaluating vestibular function on children, which tests do you utilize? (Please list all that apply)

# APPENDIX D

# SURVEY RESPONSES

### 1. Do you perform vestibular testing?

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Yes | | 138 | 96% |
| 2 | No | | 6 | 4% |
| | Total | | 144 | 100% |

### 2. What is your current clinical setting?

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Private practice | | 31 | 23% |
| 2 | Otolaryngology/ otology office | | 51 | 37% |
| 3 | Hospital | | 40 | 29% |
| 4 | School district | | 0 | 0% |
| 5 | University | | 6 | 4% |
| 6 | Other- Please explain | | 9 | 7% |
| | Total | | 137 | 100% |

| Other- Please explain |
|---|
| Outpatient clinics connected to a University Hospital Medical Center |
| Clinic |
| clinic |
| Free standing clinic, not overseen by ENT, but associated with large medical facilities. |
| hospital outpt rehab |
| Hospital based university clinic |
| multi-specialty clinic |
| Clinic |
| I'm retired from a multi specialty clinic.  I'll answer questions form when I did work. |

**3. In which state(s) do you currently practice?**

| | | |
|---|---|---|
| Texas | Virginia, DC | Indiana |
| Texas | Iowa | Washington |
| New Jersey | Texas | Michigan |
| New Mexico | Missouri | Minnesota |
| Pennsylvania | Illinois | Illinois |
| South Dakota | Maryland | Florida |
| Illinois | Ohio | California |
| Oklahoma | Maryland | Ohio |
| Pennsylvania | Wisconsin | Nebraska |
| Colorado | California | Washington |
| Pennsylvania | Florida | Ohio |
| Florida | Minnesota, Wisconsin | DC |
| Montana | Florida | Tennessee |
| New York | Montana | Arizona |
| Michigan | North Carolina | Florida |
| Texas | Louisiana, Texas | Texas |
| Wisconsin | Ohio | Georgia |
| New Mexico | Florida | New York |
| Oregon | Florida | Tennessee |

| | | |
|---|---|---|
| New York | New York | Texas |
| Arizona | Alaska | Ohio |
| ohio | Texas | NEVADA |
| Virginia | MInnesota | Rhode Island |
| New york | Mississippi | Washington |
| Florida | Washington | Kentucky |
| Colorado | New York | North Carolina |
| Kentucky | Maryland | Florida |
| Utah | California | New Hampshire |
| Massachusetts | Colorado | Kentucky, Ohio |
| Pennsylvania | West Virginia | Illinois |
| Illinois | Texas | Georgia |
| Maryland | Texas | Michigan |
| Maryland | North Carolina | Maryland |
| MIchigan | California | Nebraska |
| Georgia | Georgia | Arizona |
| New York | Kansas and Missouri | |
| Pennsylvania | california | |
| Wisconsin | New York | |
| Connecticut | Missouri | |
| Tennessee and Mississippi | New Hampshire | |
| Rhode Island | Illinois | |
| Maryland | Pennsylvania | |

| | |
|---|---|
| Florida | Florida |
| New York | Maryland |
| Utah | Maryland |
| Virginia | Indiana, Kentucky |
| North Carolina | California |
| Maryland | Florida |
| Michigan | Ohio |
| Pennsylvania | Minnesota |

**4. What is the highest degree you currently hold?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Doctor of Audiology (Au.D.) | | 113 | 84% |
| 2 | Doctor of Philosophy (Ph.D.) | | 8 | 6% |
| 3 | Doctor of Education (Ed.D.) | | 0 | 0% |
| 4 | Master's Degree | | 14 | 10% |
| 5 | Other- Please explain | | 0 | 0% |
| | Total | | 135 | 100% |

**5. How many years have you practiced audiology?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | 0-5 years | | 44 | 33% |
| 2 | 6-10 years | | 24 | 18% |
| 3 | 11-20 years | | 19 | 14% |
| 4 | 21+ years | | 48 | 36% |
| | Total | | 135 | 100% |

**6. How many hours per week do you provide clinical audiology services?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | 1-10 hours | | 2 | 1% |
| 2 | 11-20 hours | | 8 | 6% |
| 3 | 21-30 hours | | 10 | 7% |
| 4 | 31-40 hours | | 60 | 45% |
| 5 | 40+ hours | | 54 | 40% |
| | Total | | 134 | 100% |

**7. How often do you perform vestibular testing? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | ≥75% of my practice time | | 18 | 13% |
| 2 | ~50% of my practice time | | 18 | 13% |
| 3 | ~25% of my practice time | | 46 | 34% |
| 4 | ≤25% of my practice time | | 53 | 39% |
| | Total | | 135 | 100% |

## 8. Where did you receive training for vestibular assessment?

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Graduate educational institution | | 113 | 84% |
| 2 | Special workshops | | 81 | 60% |
| 3 | Self-taught | | 40 | 30% |
| 4 | Seminar | | 63 | 47% |
| 5 | No training | | 1 | 1% |
| 6 | Other- Please explain | | 21 | 16% |
| | Total | | 319 | 100% |

| Other- Please explain |
|---|
| CFY |
| SALUS UNIVERSITY ADVANCED VESTIBULAR PROGRAM, RECENTLY COMPLETED THE 52 WEEK COURSE |
| The American Institute of Balance Florida |
| Had one class in grad school but learned at ENT setting during my 4th year placement |
| Audiologist co-workers |
| Doctoral Program |
| Externship |
| Residency |
| 4th year residency |
| UFL Distance Learning |
| clinical rotations |
| Mentored, on-the-job training. |
| in office training as well from fellow audiologists |
| shadowing |
| Basic research beginning 40 years ago |
| Continuing education through seminars and lectures |
| internship |
| collateral areas of Ph.D. program (neuroscience, neuropsych, medical neurology course work) |
| Clinical Internships |
| on-the-job training |
| I was taught to do ENGs in grad school in 1970. Of course, took classes through the years and also in my AuD program. |

**9. When performing vestibular assessment, which reimbursement code(s) do you utilize? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | CPT 92541 Spontaneous nystagmus test, including gaze and fixation nystagmus, with recording | | 52 | 39% |
| 2 | CPT 92542 Positional nystagmus test, minimum of four positions, with recording | | 58 | 43% |
| 3 | CPT 92543 Caloric vestibular test, each irrigation, with recording | | 126 | 94% |
| 4 | CPT 92544 Optokinetic nystagmus test, with recording | | 46 | 34% |
| 5 | CPT 92545 Oscillating tracking test, with recording | | 45 | 34% |
| 6 | CPT 92546 Sinusoidal vertical axis rotational testing | | 40 | 30% |
| 7 | CPT 92547 Use of vertical electrodes in an or all of the above tests counts as one additional test | | 32 | 24% |
| 8 | CPT 92548 Computerized dynamic posturography | | 34 | 25% |
| 9 | CPT 95992 Canalith repositioning procedure(s) (Epley maneuver, Semont maneuver) per day | | 70 | 52% |
| 10 | CPT 97112 Neuromuscular re-education of movement, balance, coordination, kinesthetic sense, posture, and proprioception | | 1 | 0.75% |
| 13 | CPT 92540 Basic vestibular evaluation, includes spontaneous nystagmus test with eccentric gaze fixation nystagmus, with recording, positional nystagmus test, minimum of 4 positions, with recording, optokinetic nystagmus test, bidirectional foveal and peripheral stimulation, with recording, and oscillating tracking test, with recording | | 129 | 96% |

| Other- Please explain |
| --- |
| 92700, unspecified |
| Stopping here. Getting to be too long. |
| 92700 for VEMP and vHIT |
| Only use non bundled codes if entire test was not performed |
| Also bill for tympanometry which we perform prior to each test |
| Rotary Chair |
| will use other codes if only parts of VNG battery performed |
| Depends on the patient and what is ordered on referral |
| Codes for Electrocochleography, Evoked Potentiials, miscellaneous codes for vHIT and cVEMP, also audiometry, tympanometry, acoustic reflexes |
| 95992 used if done on different day than 92540/92543 |
| 92585 VEMP 92584 EcoG- differentiating between migraine related vertigo vs menieres disease |
| some can only be used independently if full tesing 92540 not used- Also use some PT assessment codes for gait |
| 92700 - VEMP 92584 - ECochG |
| However not all patients receive all tests |
| 92557 - Rule out disorder affecting inner ear; 92567 - abnormal ME can affect caloric response; 92700 - VEMP testing as ordered; 92584 - ECoG as ordered |
| 92550 Tympanometry |
| ABN for Epley Chair, BPPV evaluation and treatment |
| Canalith repositioning infrequently--typically they see our vestibular physical therapist--better reimbursement. I see them when she is not available. |
| Performed VNGs, so horizontal and vertical and rotary nystagmus was tested. Also did VRT |

**10. Which of the following assessments do you use during <u>screening</u> for vestibular dysfunction? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Dynamic Visual Acuity Test | | 13 | 10% |
| 2 | Head-Impulse Test | | 19 | 15% |
| 3 | Video Head-Impulse Test (v-HIT) | | 12 | 9% |
| 4 | Modified Clinical Test of Sensory Integration of Balance | | 22 | 17% |
| 5 | Romberg/Tandem Romberg Test | | 35 | 27% |
| 6 | Fukuda Test | | 41 | 31% |
| 7 | Tandem Walk | | 17 | 13% |
| 8 | Gait Assessment | | 22 | 17% |
| 9 | Other- Please explain | | 26 | 20% |
| 10 | I do not perform screening assessments for vestibular disorders | | 61 | 47% |
| | Total | | 268 | 100% |

| Other- Please explain |
| --- |
| Dix Hallpike |
| Medical History and Patient History |
| Eye movement test |
| No screening |
| Hallpike |
| After headshake nystagmus, hyperventilation-induced nysdtagmus, Valsalva-induced nystagmus, Rapid Positioning Maneuvers |
| DHI |
| Romberg and Fukuda are performed by our physicians |
| orthostatic screening |
| Gans Sensory Organization Performance Test |
| Eye- Movement Test |
| We will be getting vHIT within a few months |
| DHI, Dix-Hallpike screening |
| ENT |
| Past pointing and Hallpike |
| ENT I work with does screening |
| Vertebral Artery Test |
| Dix-Hallpike |
| Head thrust |
| Head thrust, ocular range of motion, GANS, |
| Dix-Hallpike - most patients may not describe their dizziness well so this can help rule out BPPV even though not technically screener. |
| Bedside Exam and Dix Hallpike |
| Case History Dix-Hallpike |
| Bedside exam (neurotologic) and vHIT when evaluating patients from Emergency |
| Head shaking |
| Otologist I worked closely with did these prior to VNG. |

**11. What subjective questionnaire(s) do you use with vestibular patients? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Dizziness Handicap Inventory (DHI) | | 59 | 45% |
| 2 | Vertigo Handicap Questionnaire | | 2 | 2% |
| 3 | Vertigo Symptom Scale (VSS) | | 1 | 1% |
| 4 | Activity Specific Balance Confidence Scale (ABC scale) | | 4 | 3% |
| 5 | UCLA Dizziness Questionnaire (UCLA-DQ) | | 0 | 0% |
| 6 | Vestibular Disorders Activities of Daily Living (VADL) | | 2 | 2% |
| 7 | Other- Please explain | | 19 | 15% |
| 8 | I do no use subjective questionnaires | | 59 | 45% |
| | Total | | 146 | 100% |

| Other- Please explain |
|---|
| WE HAVE A CUSTOM CASE HISTORY FORM FOR BALANCE PATIENTS |
| physician created |
| Clinic case history |
| Penn Acoustic Neuroma Quality of Life Scale |
| This clinic's dizziness questionnaire |
| We developed our own questionnaire |
| Clinic-designed questiionnaire |
| Dizziness questionnaire which is a mixture of several others |
| our own questionnaire designed by our ENTs and audiologists |
| Our neuropathologist  shave their own form |
| Custom questionnaire |
| modified clinic-specific questionnaire |
| Modified questionnaire |
| Made my own with questions pulled from DHI and VHQ |
| GAD-7, PHQ-9 |
| Our own hx form that we developed |
| Vestibular Questionnaire - Created by the office |
| we have a 5-page questionnaire we developed for our lab |
| I used a combo of some of the above that I developed to assess info to complete reports. |

**12. Prior to evaluating vestibular function, what pre-testing instructions do you ask patients to follow? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Abstain from caffeine |  | 52 | 39% |
| 2 | Abstain from alcohol |  | 79 | 60% |
| 3 | Abstain from tobacco use |  | 31 | 23% |
| 4 | Abstain from medications that suppress vertigo and dizziness |  | 82 | 62% |
| 5 | Limit food intake |  | 74 | 56% |
| 6 | All of the above |  | 73 | 55% |
| 7 | Other- Please explain |  | 15 | 11% |
|  | Total |  | 406 | 100% |

| Other- Please explain |
|---|
| none |
| No Cannibus |
| I ask them to avoid caffeine only if they drink it occasionally. Abstaining if regular user can cause withdrawal which can affect performance /results |
| no make up |
| No eye makeup |
| comfortable attire, no dresses, no eye makeup |
| no make up |
| No eye makeup and have a driver. |
| Wear comfortable clothing; no eye make-up and limited product on face and neck. |
| Do not wear eye make-up |
| No makeup, comfortable clothes, someone else to drive them after test |
| Not sure all of these are needed. |
| we ask that they limits meds as much as possible but some are simply too sick to tolerate a cold-turkey stoppage. We stopped asking them to discontinue coffee--all it does is trigger headaches and migraines which interfere with testing far more than the caffeine does. |
| Carefully quizzed each pt about meds. Many have possible dizzy side effects, but can't be taken off. |

**13. Prior to the evaluation of vestibular function, do you perform the Vertebral Artery Screening Test (VAST) or a similar test?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Always | | 28 | 21% |
| 2 | Sometimes | | 54 | 41% |
| 3 | Never | | 44 | 33% |
| 4 | Other- Please explain | | 6 | 5% |
| | Total | | 132 | 100% |

| Other- Please explain |
|---|
| My patients always see the ENT first |
| Once or twice when case hx suggested it may be an issue. |
| if medically necessary |
| Drs in neurology and vascular surgery do not think this measure is valid |
| based on medical history |
| Yes, prior to performing Dix-Hallpike maneuver |

**14. When evaluating vestibular function, which tests do you utilize? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Videonystagmography (VNG) with water caloric irrigation | | 37 | 28% |
| 2 | Videonystagmography (VNG) with air caloric irrigation | | 106 | 80% |
| 3 | Electronystagmography (ENG) with water caloric irrigation | | 10 | 8% |
| 4 | Electronystagmography (ENG) with air caloric irrigation | | 25 | 19% |
| 5 | Rotational Chair | | 31 | 23% |
| 6 | Computerized Dynamic Posturography | | 36 | 27% |
| 7 | Video Head-Impulse Test (v-HIT) | | 23 | 17% |
| 8 | oVEMP | | 21 | 16% |
| 9 | Other- Please explain | | 17 | 13% |
| 10 | cVEMP | | 63 | 48% |
| | Total | | 369 | 100% |

| Other- Please explain |
|---|
| ALSO USE VNG FOR OCULOMOTOR TEST BATTERY WITH ENG FOR CALORICS |
| Gans SOP test |
| ECOG |
| VORTEQ |
| When requested we will do cVEMP |
| ECOG |
| Posturography EcoG |
| Use ENG on patients who cannot wear goggles |
| ECOG |
| Ecog |
| we just obtained vHIT and will use that in the future |
| Not all tests are used for all patients |
| Electrocochleography - as ordered by ENT; ABR - as ordered by ENT; Dix-Hallpike & Roll test to rule out BPPV |
| Ecog |
| VAT |
| Dynamic Visual Acuity Test |
| we have ENG capability when necessary as well as air caloric if they have a TM perforation. we also do VNG Pressure testing for perilymph fistula and electrocochleography, OAE, and ABR. |

**15. When evaluating vestibular function, on what percent of your patients do you perform VNG? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | >75% | | 100 | 78% |
| 2 | 50%-74% | | 15 | 12% |
| 3 | 25%-49% | | 7 | 5% |
| 4 | <25% | | 7 | 5% |
| | Total | | 129 | 100% |

**16. When evaluating vestibular function, on what percent of your patients do you perform ENG? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | >75% |  | 5 | 19% |
| 2 | 50%-74% | | 0 | 0% |
| 3 | 25%-49% |  | 1 | 4% |
| 4 | <25% |  | 21 | 78% |
| | Total | | 27 | 100% |

**17. When performing ENG/VNG testing, what recording duration do you utilize while testing ocular motor function, such as gaze testing?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | ~10 seconds | | 18 | 14% |
| 2 | ~20 seconds | | 57 | 43% |
| 3 | ~30 seconds | | 35 | 27% |
| 4 | ~1 minute | | 15 | 11% |
| 5 | Other- Please explain | | 7 | 5% |
| | Total | | 132 | 100% |

| Other- Please explain |
|---|
| 15 seconds |
| Gaze - 15 sec Pursuit - 30 sec Saccades - 60 sec |
| 20 seconds for gaze testing, longer if nystagmus is present. 1.5 minutes for tracking and saccades |
| Smooth pursuit can last from 48 seconds to 2 minutes. Saccades from 60 seconds to 90 seconds, gaze usually from 20-30 seconds, depending on what I'm seeing or expect to see. |
| 10 seconds of clean recording, if pathologic nystagmus longer to determine fatigability, ability to fixate |
| Ocular motor function testing may include OPKs, saccades, and smooth pursuit. Gaze testing could also be included within this category. If so, I would spend 3-5 minutes. |
| typically 10-20 seconds, unless something unusual is happening |

**18. When performing OPK testing, which patient instruction do you utilize?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | "Look" instructions- actively count the stimuli |  | 64 | 48% |
| 2 | "Look" instructions- actively follow the stimuli to the end then repeat |  | 20 | 15% |
| 3 | "Stare" instructions- passively stare at the stimuli |  | 18 | 14% |
| 4 | Other- Please explain |  | 30 | 23% |
| | Total | | 132 | 100% |

| Other- Please explain |
|---|
| look in center and ignore stimuli |
| 1) stare straight ahead 2) count dots if “stare” returns low gains |
| Initial instruction is just to look at what presents in front of the patient with no additional instruction. If I am not getting the results I want I give “Look” instructions both kinds, whatever works best with the patient to get the best results. |
| depends on ability to do stare |
| Watch as they go by |
| Actively watch the lights moving across the screen |
| “Watch” the lights as they pass by, or, “count” the lights if the pt is having difficulty performing the test task. Pts frequently need no instructions and perform the task automatically; I merely have to encourage them to keep watching. |
| Pick a line and tell me when you see a green box...however field of vision is black and white checker board...if VNG only. If rotary chair used...then look and count instructions |
| “Scan” or “search through”-- also, “look for one that is different from the others.” |
| Relax and let your eyes do what they naturally want to do |
| Both 1 and 2. I start with #1, but if they can't do that I switch to #2 |
| Look at the stimuli like you are watching a train pass by |
| Do not test |
| Depends on stimuli if using “bar” may add watch for a colored light to come by if using full stripes(rotary chair enclosure)follow enough |
| “Let your eyes follow” |
| Both look and stare |
| I ask them to first stare and then look |
| depends on the patient and the data |
| Look similarly to sitting at the train tracks and watching the train cars go by |
| Initially I don't give instructions. If they don't/can't I instruct them to count; actively follow or look for their friend in the windows of the train. |
| All of the above as is needed on individual basis to get the best reading. |
| “watch the squares/balls/etc as they pass by” |
| Look at the screen |
| follow |
| I don't direct patient unless there is no response |
| “watch” them passing by without blurring the vision, keeping the lights separate. |
| Watch them as they go by |
| Stare right in the center and ignore what you see |
| OPK is typically automatic and performed best with no instructions. Only gave instructions, if pt had problems. |
| I don't run OPKs because they are more of a tracking test and not true OPK when using the bar, which is what we have. |

**19. When performing ENG testing, do you re-calibrate before each caloric irrigation?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Always |  | 1 | 4% |
| 2 | Sometimes |  | 9 | 32% |
| 3 | Never |  | 15 | 54% |
| 4 | Other- Please explain |  | 3 | 11% |
| | Total | | 28 | 100% |

| Other- Please explain |
|---|
| AFTER TWO IRRIGATIONS |
| ENG before calorics but not inbetween use low light source and CRP has stabilized- rarely with VNG as is extremely stable- will add more variation with insesive re-calibrations |
| Re-calibrate after Hallpike only. |

**20.When performing caloric irrigation, which order of caloric stimulation do you utilize?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | RW, LW, RC LC | | 33 | 25% |
| 2 | LW, RW, LC, RC | | 6 | 5% |
| 3 | RC, LC, RW, LW | | 40 | 31% |
| 4 | LC, RC, LW, RW | | 12 | 9% |
| 5 | RW, LW, LC, RC | | 16 | 12% |
| 6 | LW, RW, RC, LC | | 3 | 2% |
| 7 | RC, LC, LW, RW | | 9 | 7% |
| 8 | LC, RC, RW, LW | | 6 | 5% |
| 9 | Other-Please explain | | 6 | 5% |
| | Total | | 131 | 100% |

| Other-Please explain |
|---|
| If the person has a significantly asymmetrical hearing loss I begin in the ear with more hearing loss so I can talk then through the first irrigation but all else equal I do LW, RW, RC, LC |
| ear order depends, but usually four irrigations, warm first |
| LC, RC, RW, LW |
| perform 1st caloric on ear that I think may be affected with WC |
| Order does not matter, so it is patient specific. I would start with the ear in question and progress from there. I typically start with warm calorics first, as the response is larger and more representative of overall function. |
| warm first, worse side first |

**21. When performing caloric irrigation, what do you consider the cutoff for a unilateral weakness?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | > 20% |  | 35 | 27% |
| 2 | > 25% |  | 80 | 62% |
| 3 | Other- Please explain |  | 15 | 12% |
| | Total | | 130 | 100% |

| Other- Please explain |
|---|
| >22% |
| >/=22% |
| Greater than 22% |
| 23% or greater |
| 25 to 29% is deemed “borderline”. 30% or more is criteria for significant UW. |
| >23% |
| 23% |
| For a long time we used 20%, we now generally use 25. However, I still sometimes call it in that “gray area” between 20-25, and even sometimes on the border, say 19%, if other findings corroborate a unilateral issue. |
| 23 |
| depends on other info |
| >22% |
| 20 if total SPEV is greater than 80. 25 if below. |
| 22% or greater |
| If the difference is 15-19%, I will report as a possible significant difference in view the patients complaints of vertigo and correlation with other test results such as the abnormal VAT. |
| 20-25% caloric weakness is borderline normal and >30% caloric weakness is abnormal). |

**22. Under what circumstances do you typically perform ice water caloric irrigation?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | When conventional caloric irrigation does not produce a measurable response | | 69 | 53% |
| 2 | Other- Please explain | | 12 | 9% |
| 3 | I do not perform ice water caloric irrigation | | 49 | 38% |
| | Total | | 130 | 100% |

| Other- Please explain |
|---|
| IN BILATERAL TOTAL LOSS |
| rarely do ice water refer for rotational testing |
| SPV < 4 deg/sec per irrigation or if the total response is less than 22 deg/sec |
| If sum of all irritations is less than 20 deg/sec |
| If warm and cool do not produce response or if patient received gentamycin or has very narrow canals |
| after intratympanic gentamicin treatment |
| when needed to establish absence of function like post vestibular nerve section; labrynthectomy etc |
| When I have no measurable caloric reactivity and absent VOR responses during rotary chair. |
| When there is a question of any residual function in the ear in question prior to surgery |
| On rare instances only will we do ice water. Only if we get no response at all. |
| I don't perform them as I have Rotary chair testing. |
| Some pts may respond outside the bell curve and require ice water. Would not want to report no response, if I can get one with ice water. |

**23. When evaluating vestibular function, on what percent of your patients do you perform Rotational Chair? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | >75% |  | 17 | 55% |
| 2 | 50%-74% |  | 5 | 16% |
| 3 | 25%-49% |  | 5 | 16% |
| 4 | <25% |  | 4 | 13% |
| | Total | | 31 | 100% |

**24. When evaluating vestibular function, on what percent of your patients do you perform Computerized Dynamic Posturography? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | >75% |  | 11 | 31% |
| 2 | 50%-74% |  | 8 | 22% |
| 3 | 25%-49% |  | 9 | 25% |
| 4 | <25% |  | 8 | 22% |
| | Total | | 36 | 100% |

**25. When evaluating vestibular function, on what percent of your patients do you perform v-HIT? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | >75% | | 7 | 32% |
| 2 | 50%-74% | | 5 | 23% |
| 3 | 25%-49% | | 6 | 27% |
| 4 | <25% | | 4 | 18% |
| | Total | | 22 | 100% |

**26. When evaluating vestibular function, on what percent of your patients do you perform oVEMP? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | >75% | | 3 | 14% |
| 2 | 50%-74% | | 4 | 19% |
| 3 | 25%-49% | | 4 | 19% |
| 4 | <25% | | 10 | 48% |
| | Total | | 21 | 100% |

**27. When evaluating vestibular function, on what percent of your patients do you perform cVEMP? (Please choose the answer that best fits)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 4 | >75% |  | 11 | 18% |
| 5 | 50%-74% |  | 12 | 19% |
| 6 | 25%-49% |  | 14 | 23% |
| 7 | <25% |  | 25 | 40% |
| | Total | | 62 | 100% |

**28. When performing oVEMPs, do you perform unilateral or bilateral VEMPs?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 3 | Other- Please explain | | 0 | 0% |
| 4 | I record from one side at a time (unilateral stimulation) | | 21 | 100% |
| 5 | I record from both sides simultaneous (bilateral stimulation) | | 0 | 0% |
| | Total | | 21 | 100% |

**29. When performing cVEMPs, do you perform unilateral or bilateral VEMPs?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | I record from one side at a time (unilateral stimulation) | | 59 | 95% |
| 2 | I record from both sides simultaneous (bilateral stimulation) | | 3 | 5% |
| 3 | Other- Please explain | | 0 | 0% |
| | Total | | 62 | 100% |

**30. When performing cVEMPs, which method do you utilize to ensure muscle contraction?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | EMG target levels | | 16 | 26% |
| 2 | Biofeedback using a blood pressure manometer with inflatable cuff | | 5 | 8% |
| 3 | Rectification of muscle contraction power | | 16 | 26% |
| 4 | Other- Please explain | | 25 | 40% |
| | Total | | 62 | 100% |

| Other- Please explain |
|---|
| EXPERIMENTING STILL WITH PROTOCOL |
| none |
| observation |
| NONE |
| None of the above. This has not been supported in the most current scientific literature. I watch and make sure head position is identical between sides. |
| Lay supine and raise your head to a pre-determined target consistently; stimulates both sides equally |
| lay supine, turn head and lift |
| None |
| self-monitoring |
| head raise only |
| Observation, activity |
| N/a |
| nothing |
| None |
| Patient instructions |
| None at this time due to limitation of current equipment. Therefore, do not put as much weight on asymmetry as do absence of response. |
| I don't |
| head lift from a fixed upper torso angle |
| use same method for both sides and have had no issues |
| Patient is reclined to 30 degrees supine, turn head 45 degrees to right or left and lift head a 1/2 inch off the back of the recliner and hold for the roughly 20 secs it takes to reach a count of 100 stimulus tone bursts. Rest a few seconds and repeat. |
| Most often none |

**31. Since you have been practicing audiology, how many malingerers have you identified while utilizing vestibular function tests?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | 0 | | 36 | 28% |
| 2 | 1-5 | | 59 | 45% |
| 3 | >5 | | 24 | 18% |
| 4 | Other- Please explain | | 11 | 8% |
| | Total | | 130 | 100% |

| Other- Please explain |
|---|
| VERY DIFFICULT TO ANSWER BECAUSE OUR TEST BATTERY AS AUDIOLOGISTS IS NOT POWERFULL ENOUGH TO POSITIVELY ID MALINGERERS |
| I have many that testing is normal, but none that I can think are malingering. Many with anxiety or psychological issues, yes. |
| don't feel you can prove malingerers with balance tests |
| I am going to say greater than 5, but for 2 reasons. 1- I have been practicing for a long time and 2- we are a site for independent medical evaluations and many of these patients are trying to win court cases so many of them malinger. Still the number is very low when taking into consideration the years of practice I've had. |
| not possible to identify only with VNG |
| Not understanding this question. I would have to say 0. |
| Identified patterns of malingering, not for legal purposes. |
| Don't know |
| such a low target probably near 50 out of several thousand patients - |
| True malingering - twice. Exaggerated symptoms - frequently and many have normal vestibular function with valid complaints of dizziness caused by other issues (neurological, migraine, etc) |
| Not sure what you are asking here. Certainly can get normal VNG and pt has legit vestibular problems. We are not testing the complete system. |

**32. When evaluating vestibular function, please list which tasking methods you utilize.**

| |
|---|
| Boys/Girls names with alphabet |
| organized tasking for each letter of alphabet, eg. names, places, animals, etc. |
| Female names in alphabetic order. Then male names in alphabetic order. Animals in alphabetic order. Places in alphabetic order. If I need more I start asking the patient where they work, list their coworkers. How many children do they have, names, etc. |
| Tell me a name that begins with the letter... List states/state capitals that begin with the letter... Name me all of the fruits/vegetables you can think of... Name objects you might find in a kitchen/garage/living room, etc. Counting backwards by a set interval |
| names in alphabetical order, states, sports teams, food items, description of house, route taken to test site, work, counting, hobbies, etc. highly depends on response seen and patient's interest |
| Tasking is performed in all vision denied conditions. Will verify exact tasking method used based on pt. sometimes I just make conversation with the pt, sometimes I will ask them to list things, spell things, or perform simple math. Pts who don't speak English, I will just ask them to repeat words in English |
| Name a girl's name that starts with... Name a food... Name an animal... Name a state... Tell me some things you might see in a kitchen, or bedroom, or car, or park, etc Count backwards by 3's Just carry on a conversation for those who cannot follow the above |
| Repetition, identification of every day items |
| Tapping shoulder and talking normally |
| Different categories going through the alaphabet (i.e. 2 girls names with letter A, B, C,...., boys names, animals, foods, etc.) Count backwards from 100 by 3s Tell me about you grandchildren Tell me anything you find in a house, kitchen, bathroom, outside, etc. Name as many fruits, veggies, cars, colors, school subjects, etc |
| Name girls name alphabetically, States, Fruits and Veggies..etc |
| Inconsistent findings between tests and poorer performance for less difficult SOT |
| Conversational (e.g. ask about children, favorite hobbies), list items (e.g. states, favorite ice cream flavors), and naming fruits and veggies while going through the alphabet (e.g. a = apple) |
| Anything and everything- what works for a particular patient- if to difficult patient can't task and suppresses if too easy supresses so varialbe tasking - counting back- 2's or naming names- it is the level for the patient and the variability |
| Girl names, boy names, locations/places, food, animals in alpha order. Counting by 2 or 3's, counting backwards, etc. |
| Listing things such as girls names, cities, states, etc. May also use counting backwards from100 by certain amounts |
| Count backward from 100 by 3's, 5's, etc., list items you'd find in a garage/picnic basket/etc., list girl/boy/car manufacturers/car make names alphabetically starting with A, B, C..., |

| |
|---|
| Alphabetical lists, listing favorite desserts or vacation destinations, colors, cars-- endless possibilities. I tailor it to the patient and what provides best quality data. For some patients, tasking itself is disruptive to the data in which case I don't use it at all. |
| Names by letter of alphabet Cities, states, and countrie Fruits and vegetables Family members and ages |
| Girls/boys names; city, states, towns; animals. foods. All in alphabetical order. During positional tests if the need alerting then I have them count backwards from 100 by 2s |
| count back by 3 from 50 spell... states list categories (flowers, veggies, dog breeds, etc) boys/girlsnames that start w/ A, B, C... cities in Pa, Fla, MI suburbs of Clevleand |
| - name or list things such as boys/girls names, US States, Countries, vegetables/fruit, animals, etc. - describe things would find in a bedroom/kitchen/bathroom/garage, etc. - general conversation; tell me about your kids/family/ work, etc. |
| Alphabetical lists and counting backwards. |
| naming girls, boys, ect starting with A-Z |
| counting answering questions, |
| Conversation, naming things, counting by 3s or 4s. |
| Boys/Girls names, foods, animals, states, taking about what they will do that day, general conversation |
| Naming fruits, vegetables, names, and animals. |
| Listing items (fruits, vegetables, animals etc) Listing names in alphabetical order Simple math (2+2, 4+3 etc) |
| I ask the pt a series of questions depending on the pts age, lifestyle, etc |
| Names |
| Math, Names of girls/boys beginning with a particular letter, Counting backwards or backwards by two's from a certain number, States starting with a particular letter, what is the 5th month of the year etc, favorite season,favorite flower. I use multiple tasking on a patient dependent on the clarity of my findings and ease of patient response. I want to stress the patient a bit to get the clearest tracings. Just as additional information, people respond with body language differently. Some patients may close their eyes to seek out an answer, make sure you tell patients the importance of keeping |
| Answering questions like “Tell me about your hobbies” and listing a category alphabetically e.g. Girl's Names |
| Naming colors, animals, counting, girls names with a certain letter, states, etc. |
| counting, listing topics down the alphabet, normal converstation |
| Counting, Naming family members, Girls/ Boys names, |
| Girls names that begin with A, B, C, etc. Boys names that begin with A, B, C etc. Name places that begin with A, B, C etc. Name grocery store items |
| counting by 2,3, and/or 4, counting backwards, listing names/things/places beginning w/ specific letters, ingredients in a salad, sports, colors, animals, fruits/vegetables |
| To many to list. |
| Asking questions about family/work, listing names beginning with different letters of the alphabet, listing sports teams, discussing hobbies |

| |
|---|
| Counting (by ones, twos, backward, forward); multiplication tables; lists (Presidents, months, occupations, Indian tribes, animals, states, cities in Utah, etc., -- by alphabet or by category); naming (children, grandchildren, neighbors, best friends, high school teachers,etc.); descriptions (game of golf, layout of house, current novel, latest movie, favorite vacation), and by conversational tasking. Tasking style is dictated by what they're at ease with, how responsive they are, the level to which they initiate topics, their apparent degree of suppression, and their comfort level (progressing nausea) with the testing. |
| If general conversation is not tasking enough then patients are asked to list names of people or states or cities (alphabet backwards or skipping), take me on a tour of their house (when they have to visuallize it is impossible for them to supress), or math |
| states and cities |
| Listing, naming, counting, general conversation, description of symptoms, past medical history |
| Names, things you do in your free time, items you find at a grocery store, states, places you've visited, favorite vacation spot |
| Girls names beginning with A...B...C...etc Boys names beginning with A...B...C...etc Something you buy in the grocery store beginning with A...B...C...etc Place name (city/state/country) that begins with A...B...C...etc or if too difficult linguistically - count aloud by 3s or 4s or backwards from 100 by 3s or 4s etc Sometimes we can just chat about family as well if this distracts the patient sufficiently |
| naming tasks (name a city/person/object starting with the letter a/b/c...), simple math (count backwards from 100 by 7s), discussion with patient (telling me about themselves or their upcoming appointments). |
| months of the year backwards, animals in the zoo, states in the U.S., countries, items in a hardware store |
| Name fruits, vegetables, animals, names beginning with __, ice cream flavors, general conversation if the patient won't cooperate |
| We typically have them give me boys/girls names alphabetically and states, cities countries by alphabet. Occasionally we will use counting backwards, etc. Other times, depending on what is happening with the test results, we will just ask questions about |
| Alphabetical order- states, names, simple addition, items found on a desk, Occupations, items found in each dept at a grocery store |
| Name City, States, Countries List girl/boy names (go through alphabet) Name different restaurants Name different stores found in mall Name different sports in Olympics Name all NFL teams |
| Female names A-Z at least 2 names per letter, Male names A-Z at least 2 names per letter, Foods A-Z at least 2 foods per letter |
| I administer simple math problems; list states/capitals |
| Counting, naming, general discussion, calculation |
| Patient interview |
| to many to list |
| Visualizations - how many upper cupboards do you have in your kitchen, etc? Name boy/girl names starting with A, B, C... Where are you from? Do you have children? |

| |
|---|
| namimg objects, people, states...counting schemes Whatever seems to work best for the individual |
| naming objects, regular conversation (usually about family i.e how many kids-name them in order by age or alphabet. ETC |
| Spelling. Interests tv show books music family |
| go through alphabet naming names, places, etc ask patient about their family and likes, travels, interests, etc |
| Tasks that involve spatial descriptions - ex: “what is the color of the countertop in your kitchen”, “How many windows are in your living room?” |
| Counting up and down by different intervals Name Countries, towns, states, continents Name men's/women's names beginning with the letter A...Z Name things that are the color (blue, red, etc.) Name books, movies, TV shows, foods, things found in bathroom/kitchen/bedroom List words that begin with the letter A...Z |
| states, cities, animals, boy names, girl names |
| verbally answer questions or name requested items |
| Names of boys, girls, states, etc,.A to Z |
| counting backwards, names of states, etc |
| Listing of random objects or titles or names. |
| Arithmetic, name recall, naming states in alphabetical order, |
| Counting, naming boys and girls names, cities, states, and countries of the alphabet, food, items in each room of the house |
| Name sports, fruits/vegetables, makes/models of cars, types of flowers. Boy's/girl's names, animals, states or countries starting with a particular letter. Sometimes simple arithmetic probs. Name and age of children or grandchildren. Sometimes |
| none |
| Give a state, city, or country that begins with the letter I give you. Give a women's name that begins with the letter I give you. Give a man's name that begins with the letter I give you. Name something you would find in a grocery store that begins with the letter I give you. For elderly patients that have extreme difficulty tasking: Repeat the following states after me. |
| Counting, repeating recipes, naming states and/or capitals, girls and boys names |
| tasking during calorics - mental tasking such as counting backwards, listing, etc. |
| General talking/discussion; giving male/female names; giving states for every alphabet letter; counting; etc. |
| counting backwards, naming states, cities, food etc |
| Arithmetic, alphabet naming, naming as many things in a category as possible , etc. |
| object identification in particular environments (tell me some things in your kitchen, forest, farm, etc), state identification (tell me states that begin with the letter c), group naming (tell me some vegetables, fruits, etc) |
| Addition Naming states Boys and girls names by alphabet |
| states, names, directions, recipe ingredients, capitols |
| Go through alphabet naming places and names |

| |
|---|
| counting, naming, conversing |
| Listing states, ice cream toppings, men's names, women's names, address, phone numbers, pizza toppings. |
| I ask the patient to tell me about their family, job, hobbies etc. |
| Counting backward; alphabet of names, places, animals, & things at store; naming things in category; encouragement/reminder about eye placement or openness. |
| Name states that begin with a specic letter Name family members Count by 3s or 7s etc Names baby names that start with A then B etc |
| Listing names, cities, foods etc. |
| Naming things such as: animals, things in a kitchen, boys/girls names, etc, sometimes have them count backwards from 100 in 3's, etc. |
| going through the alphabet (ex. Give me a state that starts with an “A”). Name states name foods Girl/boy names |
| Have tried all of the options. I prefer to carry on a conversation. Tell me about your grandkids or a vacation you enjoyed. This way you are not over tasking by requiring too high level math tasks. Relaxes the pt and makes it fun while taking their mind off of my induced dizziness. |
| Men/women names, city/states, street names, what's in a classroom, items in a kitchen, ice cream flavors, items on a pizza or salad, favorite musicians, favorite actors/actresses, counting back, etc. |
| A girls/boys name that begins with A, B, C .... A state that begins with A, B, C .... Name three fruits, name three colors, etc |
| Names/countries/places/foods/animals starting with each letter of the alphabet etc Count up/back to/from 100 in 2/3/4/5/6 etc Tell me the names of your children/grandchildre/friends Describe your bedroom/kitchen/foods you buy at the store |
| Girl/boy names from A to Z List items in grocery stores List stores in the mall List model and make of cars List states alphabetically List countries in certain continent Count backwards from 100 in different multipliers |
| Counting, listing, naming |
| Girls names, boys names, grocery store items, places - alphabetically |
| List names, foods, cities, states, countries, animals with each letter of the alphabet List pizza toppings, ice cream flavors, dog breeds, vacation sites, items in a classroom, playground etc. Just make conversation |
| Addition, naming states cities starting with A in the alphabet, girls/boys names, school subjects, items on a desk, etc |
| varies depending on intellect of patient usually states alphabetically |
| Alphabet of names, cities, etc |
| Naming states that start with the letter ___ Person, place, or thing that starts with the letter ___ Multiplication tasks (i.e., 14x3, 17X2, 18X4, etc. Counting tasks (i.e., “Count backwards from 100 by ___ Girl's name/Boy's name that starts with the letter ___ If tasking produces too much random eye movement, I will sometimes count aloud from 1-5 or 1-10 and ask pt to concentrate on that for a few seconds to get a cleaner tracing. My favorite is to ask them to go into their favorite grocery store and tell me |
| Conversation or women's/men's names, states, animals that start with alphabet |

| |
|---|
| general conversation, listing of items i.e 5 animals that start with W |
| ask them to name boys names with different letters (i.e., tell me a boys name that starts with the letter a, boys name that starts with the letter s) “ “ with girls names “ “ with states “ “ with colors Sometimes have them count backwards from 100 by 3's |
| Questioning: female names male names foods city, state country animals |
| NAMING STATES, BOYS NAMES, GIRLS NAMES, COUNTING BACKWARDS, CONVERSATION |
| counting by 2, 3, 4, and backwards by 2 starting at 100, female/male names, places, |
| names, places, animals, counting, places |
| counting, alphabet recall, names, |
| The following are A-Z: men names, women names, states, cities, countries, animals, foods Also, directions from A to B, favorite recipe, talk about hobby, talk about work, name co-workers, name family members, DHI, counting, colors, TV show description, movie desciption, favorite book description, etc. All depending on patient's level or awareness, education level, cognitive ability, etc |
| None for the most part. It's not needed. If tasking, addition/subtraction or naming random items is used |
| Names that begin with the letter... Fruits/vegetables that begin with the letter... States that begin with the letter... Count backwards from 20 by 2s, 30 by 3s, etc |
| naming things; conversation |
| name boys/girls names, cities in IL, cities around country, states in US, items in hardware/department/furniture/electronic store, animals in zoo, models of cars, sports teams, items used in job, vacation places, others based on pt interests |
| I will give the patient a topic such as “Things found in the kitchen” and have the patient state different items out loud. When the patient can no longer think of items, I will give them a new topic immediately to keep them tasking. |
| count backwards from 25 |
| Names that start with A, B, etc Veggies, fruit, nfl teams, states, etc |
| Naming boys names, girls names, places, foods, or animals. For each category I have the patient start with the letter A, then letter B, etc. For younger children I will have them sing songs or do simple math problems. |
| Naming names (going through the alphabet), states in the USA, vegetables, fruits, colors, animals at the zoo, etc. |

**33. When evaluating vestibular function, for which tests do you utilize tasking methods? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Positioning testing/ Dynamic position testing | | 25 | 20% |
| 2 | Positional testing/ Static position testing | | 79 | 62% |
| 3 | Caloric irrigation testing | | 122 | 95% |
| 4 | Rotational Chair- Sinusoidal Harmonic Acceleration | | 34 | 27% |
| 5 | Rotational Chair- Step Velocity Evaluation | | 26 | 20% |
| 6 | Other- Please explain | | 8 | 6% |
| | Total | | 294 | 100% |

| Other- Please explain |
|---|
| GAZE TEST WITH EYES CLOSED |
| I don't task while irrigating, only immediately after. |
| I task with all non fixation testing. |
| none |
| Spontaneous testing ; usually dont for gazes |
| Gaze w/ o visual fixation |
| Only use with static position testing |
| Typically none. Only rotary chair and calorics really would need it if it is used |

**34. Do you perform vestibular rehabilitation (VRT)?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Yes |  | 27 | 21% |
| 2 | No |  | 101 | 79% |
| | Total | | 128 | 100% |

**35. When performing vestibular rehabilitation, which testing do you utilize? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Adaptation, habituation, and substitution protocols |  | 5 | 19% |
| 2 | Gaze stabilization exercises |  | 11 | 41% |
| 3 | Static and dynamic balance activities |  | 9 | 33% |
| 4 | Canalith Repositioning Procedures (CRP)- Epley maneuver, Semont maneuver, or Dix Hallpike |  | 27 | 100% |
| 5 | Other- Please explain |  | 3 | 11% |
| | Total | | 55 | 100% |

| Other- Please explain |
|---|
| These are not “tests,” so I think you made a typo... |
| We have a physical therapist who completes all vestibular rehabilitation other than CRP counseling |

**36. Do you work closely with another medical professional(s) to assist in vestibular rehabilitation? (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Yes- physical therapist |  | 16 | 59% |
| 2 | Yes- occupational therapist |  | 2 | 7% |
| 3 | Yes- otolaryngologist/otologist |  | 15 | 56% |
| 4 | Yes- neurologist |  | 7 | 26% |
| 5 | Other- Please explain |  | 1 | 4% |
| 6 | I do not work closely with another medical professional |  | 4 | 15% |
| | Total | | 45 | 100% |

| Other- Please explain |
|---|
| PT on occasion |

**37. Where did you receive training for vestibular rehabilitation?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Graduate educational institution | | 11 | 41% |
| 2 | Special workshops | | 19 | 70% |
| 3 | Seminar | | 18 | 67% |
| 4 | Self-taught | | 6 | 22% |
| 5 | No training | | 0 | 0% |
| 6 | Other- Please explain | | 5 | 19% |
| | Total | | 59 | 100% |

| Other- Please explain |
|---|
| Continuing education through lectures and seminars |
| on the job |
| internship |
| externship |
| 4th Year residency |

**38. When performing vestibular rehabilitation, which reimbursement code(s) do you utilize? (Please list all that apply)**

| Text Entry |
| --- |
| It depends on what I am doing. With some carriers, I use an E&M code. I may also use the canalith repositioning code. For Medicare, I use 92700 (unlisted) and the patient self pays. |
| Self pay |
| Canalith repositioning |
| 92541, 92542, 95992 |
| 92542 |
| 92591, 92592(59-modifier)...testing 95992..treatment with CRP |
| None |
| none- except non medicare CRP |
| Do not bill for rehab |
| Don't do on ongoing basis |
| CRP - 95992 |
| none |
| We do not bill for CRT |
| I don't bill for VR. |
| I don't bill for VRT. |
| 95992 |
| 95992D |
| ABN only |
| We don't.  Nothing pays.  It is done private pay. |
| I'm unsure; my biller will have the code (Epley maneuver billed through the physician). |

**39. When performing vestibular rehabilitation, which positional modifications do you make to the Epley maneuver (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | I perform four positional changes and repeat the maneuver multiple times | | 13 | 48% |
| 2 | I perform four positional changes and DO NOT repeat the maneuver multiple times | | 8 | 30% |
| 3 | I perform all five positional changes included in the Epley maneuver | | 5 | 19% |
| 4 | I do not perform the Epley maneuver for vestibular rehabilitation | | 2 | 7% |
| | Total | | 28 | 100% |

**40. Please describe the post-treatment instructions you give to patients following canalith repositioning procedures (CRP).**

| |
|---|
| Keep head upright for the remainder of the treatment day- no restrictions longer than day of |
| None. Research has shown for almost 10 years that post maneuver restrictions are not |
| For first time patients, I do not provide post-treatment instructions other than to call the office if the symptoms return. The otoconia should resorb once back in the correct place, so after-care instructions are not necessarily needed. However, for patients with recurrent BPPV, I advise theem to avoid doing things that usually make them dizzy for the rest of the day and to sleep with an extra pillow or 2 that night. |
| Wear a soft neck collar for 48 hours, do not bend over or lie down flat...sleep in a recliner for two nights. |
| Keep head vertical and sleep 30 degree angle, just day and night of manuever |
| Move gently and squat down instead of bending over for a couple days and then move normally to see if symptoms recur |
| Do not move head x 48 hrs, sleep in recliner at <45* x 48 hr. Pt have option of neck collar to help restrict head movement. |
| Avoid looking up or down for the remaining of the day, and do not sleep on the affected side one night. |
| Limited activity for 24-48 hrs. |
| Varies...typically keep head vertical for the remainder of the day, first night sleep slightly elevated. Next day resume normal activities. Return in one week for a recheck. |
| Try and keep your head 'straight' for the rest of today, i.e. do not look up, down or lie down. |
| don't lay flat for the rest of the day |
| Repeat the CRP once a day for two weeks |
| don't bend over and pick up things today; don't shake head yes or no today; sleep sitting or elevated 24-48 hours; do not lay on side of treatment for 7-10 days; don't worry if forget some of these things- after period try laying on treatment side; if still dizzy - go to Brandt-Daroff routine until reevaluate |
| We do no give post-treatment instructions unless its a patient that has had recurrent BPPV. Then we recommend sleeping in a reclined position and limiting movements that would typically provoke symptoms for the next couple of days. |
| Don't sleep flat or on the affected side. Sleep propped up 30degrees and on back. Avoid excess head movements. |
| The patient is sent home with an information sheet outlining the procedure and what BPPV is. The post instructions encourage sleeping elevated for 2 nights and cautious head movements for 48 hours. No quick head turns. I may also recommended a particular sleeping position depending on canal/side affected. |
| I do not give post treatment instructions for CRP. |
| Try to keep head upright and sleep in a recliner that night, then try to avoid sleeping on the affected side for 2 days. I suggest sleeping in comfortable pants with a pocket and to put a tennis ball in the pocket so they won't lie on that side. |
| Do not move your head when looking down for 48 hours Sleep with held elevated for 2 |

| |
|---|
| Check with patient in a week via phone or secure messaging to see if the pt has to return for repeat repositioning. |
| Typically: Keep head upright for the next 3-4 hours. |
| Don't stand on your head for 24 hours! Seriously, studies have shown that no post-treatment instructions are necessary other than doing something like standing on your head! |
| For the next 48-72 hours I want you to sleep in either a recliner on your back (don't turn over on your sides) or with 3-4 pillows propped up behind you so you're sleeping at a 45 degree angle. (About 90% of our CRP patients get a collar). Wear this collar around your neck, which helps remind you not to look up or look down. Also, don't bend down at the waist. Keep your head in one position looking straight ahead; allow your spouse to pick up any objects that you want from a low position. It is common to feel dizzy after a CRP, but if it persists or if you have worse spinning, please call our office. Don't do the balance exercises at home for the next 2-3 days. (We have balance exercises and directions we give to them on paper). |

**41. When performing vestibular rehabilitation, do you recommend home exercises to your patients?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Yes- Please explain |  | 21 | 78% |
| 2 | No |  | 6 | 22% |
| | Total | | 27 | 100% |

| Yes- Please explain |
|---|
| The more VRT they get, the faster they will improve and get better |
| Every day - specific for each patient. |
| Once recurrent BPPV has been documented, I will tech patients to do the Epley at home |
| sometimes |
| Depends. Some HCBPPV patients I have roll at home, once a day and return in one week. Some patients with post-vertiginous syndrome following resolution of BPPV, I have do Headshakes for one week and return if mild symptoms of lightheadedness do not resolve |
| Rarely. |
| I have a self directed program I give my patients |
| Several standard exercises and Tia Chi if avaialble in area |
| As needed if BPPV returns. Or to complete the Lempert Roll for 7 days if horizontal canal |
| sometimes |
| For patients that feel comfortable completing the CRP at home we will give the exercise to them in case symptoms occur again. Our PT also provides exercises to do at home for other types of vestib rehab |
| balance and gaze stabilization exercises |
| BBPV: Epely maneuver if pt lives far away and cannot come in to clinic Peripheral vestibular involvement: pt sent to Physical Therapy or pt does Cawthorne-Cooksey exercises if pt has not compensated |
| Standard Brandt Darroff,eys x1 Head x1 X2 etc. |
| Brandt-daroff that can be done 48-72 hours after CRP. |

**42. Please indicate the reason(s) for not performing vestibular rehabilitation. (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Lack of equipment | | 29 | 29% |
| 2 | Equipment cost issues | | 11 | 11% |
| 3 | Billing/Reimbursement issues | | 53 | 52% |
| 4 | Lack of time | | 42 | 42% |
| 5 | Lack of training | | 46 | 46% |
| 6 | Other- Please explain | | 33 | 33% |
| | Total | | 214 | 100% |

| Other- Please explain |
|---|
| conflict with OT/PT scope of practice |
| We have a PT department |
| We have a PT clinic nearby with 2 vestibular certified therapists. I consult with them often. |
| VRT is provided by PTs within the hospital. |
| We have a vestibular rehab specialist in-house |
| Our Facilty has physical therapists trained & the policy is to refer to them for VR |
| Work with PT, let them perform tx. |
| Our institution's PT office is a few doors down. And they are trained in VRT. There's no need for us to compete with them |
| We refer out of office. |
| We have a great local facility that does this. We refer out. |
| PT dept performs |
| We have a physical therapist in the office that does rehab for our patients |
| I work with 2 vestibular certified physical therapists. |
| We have 3 vestibular rehabilitation PTs |
| Have to refer to physical therapist trained in VR at my facility |
| we have an excellent vestibular physical therapist |
| Physical Therapists do it. We do some canalith repositioning. |
| WILL BEGIN NEXT YEAR DOING SOME VESTIBULAR REHABILITATION |
| Patients are referred to Physical Therapy |
| PT does VR in this rehab facility |
| I do repositioning maneuvers only refer to PT for other issues |
| I work for an HMO. Our PT department does vestibular rehab, so I refer to them. |
| I refer to an excellent PT for vestibular rehabilitation and I have no training on this |
| Multidisciplinary team. VR with PT/OT |
| We refer out to a specialized vestibular physical therapist. In a busy ENT clinic, there is only so much you can do in house. |
| refer to PT colleagues |
| I do repositioniong maneuvers but refer to PT for further rehab |
| Physical therapy assistants in office perform |
| Refer to pt department |
| Physical therapists usually perform this |
| Have worked in the past with a PT who performed VRT |
| Work directly with a vestibular therapist who does this and much more. |

**43. If you do not perform vestibular rehabilitation, please indicate your procedure for the patient. (Please select all that apply)**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Discharge the patient and/or recommendations for routine follow-up | | 15 | 15% |
| 2 | Referral for vestibular rehabilitation | | 84 | 84% |
| 3 | Referral to other professionals | | 57 | 57% |
| 4 | Other- Please explain | | 17 | 17% |
| | Total | | 173 | 100% |

| Other- Please explain |
|---|
| refer back to physician for recommendations |
| Dependent on patient history and results of VNG testing, referral may be to neurologist or vestibular rehabilitation or both |
| will do BPPV treatment; all other vestibular rehab is referred to a PT |
| send back to referring MD with RX |
| ENT makes referral |
| I recommend the patient be referred to vestibular rehab. Technically, I'm not making that referral. |
| We typically recommend PT if indicated and forward our report to the referring MD. Most of our pts are doctor-referred so we are not directly referring to PT |
| I actually do perform BPPV treatment, which is a form of VRT, but nothing else -- our patients are served by our own staff of PTs. |
| to PT |
| PRN per each physician |
| Patients are always sent back to referring ENT - recommend referral via ENT for vestibular rehab |
| Send patient back to their ENT with recommendations for vestibular rehab and their ENT will refer them for therapy. |
| If already indicated on referral will refer for VR; otherwise, will suggest a specific referral to neurology, VR and/ or further testing such as imaging. |
| I'm lucky to have an awesome vestibular therapist who has worked miracles. |
| Return to referral source for referral for treatment |
| The ENT would be the one to refer for vestibular rehab. |

**44. Do you perform vestibular testing on pediatric patients?**

| # | Answer | Bar | Response | % |
|---|---|---|---|---|
| 1 | Yes |  | 72 | 56% |
| 2 | No |  | 56 | 44% |
| | Total | | 128 | 100% |

**45. When evaluating vestibular function in children, which tests do you utilize? (Please list all that apply)**

| |
|---|
| I rarely do children but I will on occasion. I will do functional and then VNG |
| Vng |
| Don't perform on children less than 10 years, but perform all testing the child will tolerate. Occulomotors using child friendly stimuli (smiley face instead of dot, moving train for OPK). |
| The same as adults. The youngest I have tested is 16 years old. |
| Questionnaires, VNG, posturography, gait assessment |
| VNG battery, ABR, audiological testing |
| Rarely see kiddos. I do whatever they can tolerate to get the maximum information. |
| VNG, ENG, oVemp, cVemp and the fukuda and rhomberg screening tests; sometimes a fistula test as well. |
| all the same as for adults. Youngest child seen was 8 years old |
| Usually I will test 10 year olds and older. I did test a mature 7 year old. Same work up as an adult. |
| OPK, gaze, saccades, tracking, positional/positioning, Calorics. Only test children 5+ yrs |
| We typically will work with teenagers and complete the same protocol as adults |
| Full basic VNG battery if old enough (5 years), RVT if old enough (5 years), cVemp on all pedi |
| VNG battery |
| All of the same evaluations we perform on adults oVEMP, cVEMP, vHIT, VNG, rotary chair, CDP for children above 5. For children less than 5, we typically do rotary chair and cVEMP. |
| standard VNG test battery |
| VNG |
| cVEMP, VORTEQ, OPKs, Gaze, Head shake |
| Most of our pediatric pts to date have been over age 10 and capable of performing the same tests as our adults. We have yet to get a referral on very young pts. |
| cVEMP, VNG (with or without calorics depending on age), Gan's SOP test |
| Any they will tolerate |
| Primarily rotary chair, but depending on age I have also successfully completed VNG, vHIT, VEMP, CDP. When unable to get any objective information, I utilize gross tests of VOR function (i.e., spinning on an office chair while held on mommy's lap.) |
| Same tests but only if child is at least 12 years old. Director does not accept pediatric patients under 12. |
| VNG, ECOG, VEMP, Audiogram |
| RC mostly |
| Full test battery: Oculomotor, positional, positioning, and caloric testi |
| CDP, VNG, calorics, rotary chair |
| Depending on age, we might do a full VNG (gaze, positional, and calorics). If they are very young, typically we just use bedside evals (Dix-Hallpike, Fukuda, Romberg, etc). |

| |
|---|
| VNG, we just got our VHIT's, so we have just started using it. Sensory Organization Performance Test, exercise ball. |
| audio, VNG |
| CDP, VNG |
| functional assessment and VNG if needed |
| Saccade, gaze, tracking OPKs, Hallpike, Positionals, & Calorics |
| VNG, gait, SOP, VOR - I have tested pediatrics for vestibular but have not yet been asked to test a child under 13. |
| Anything and everything already mentioned, depending on the patient's attention level and degree of mobility. |
| Depends on the child's age and needs. Behavioral and electrophysiology definitely. cVEMP, rotary chair, positionals if necessary, immittance, Sensory Organization Performance tests include CTSIB. |
| Rotary Chair, Occulomotor, Positional static/dynamic, VEMP, ABR |
| Same as adults... “bedside testing”/screening Basic VNG + calorics.. |
| Same as for adult, including calorics. |
| v-hit cVEMP rotary chair bed side eval OPKs writing reflex dynamic surface testing full VNG depending on age |
| We do as much of the traditional VNG as possible. We often use electrodes instead of goggles if the child seems afraid of the goggles or if they are too big on the child's head. We try to perform cVEMPs on these kids, but are not always able to complete. |
| History is the most important. I will do Hallpike, SOP, look for spontaneous, gaze, head shake and positional nystagmus |
| Under age 2-3: Bedside Exam and Rotary Chair Once they are able to participate we add in: vHIT, VEMPS, and cool water calorics (typically in that order. Once patients are about 8-9 years old they can participate in all of those tests) |
| VNG/ENG (as much as possible), let physician decipher/interpret results for treatment options, refer to other offices if limited results |