

# VESTIBULAR REHABILITATION SIG

## APTA & Academy of Neurologic Physical Therapy

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## Message from the Chair

Anne K. Galgon, PT, PhD, NCS

Vestibular Rehab SIG Chair

Hello Vestibular Rehabilitation Special Interest Group (VR SIG) Members,

### VR SIG at CSM 2019

This issue of the VR SIG newsletter presents articles covering presentations at CSM that took place in Washington DC in January of 2019. Once again CSM provided a great opportunity for education on vestibular related issues and for networking between therapists who provide specialized care in vestibular rehabilitation. I want to thank everyone who presented at CSM and supported the VR SIG activities. It was evident, by the number of therapists in program sessions, that information on vestibular rehabilitation and concussion management is highly sought after. Members of the VR SIG are at the cutting edge of physical therapy practice, which was exemplified in the excellent presentation on Telehealth and Vestibular Rehabilitation presented by Sara Gallagher, Sara Oxborough, Linda D'Silva, Karen Skop, (from the VR SIG), and Alan Lee (from APTA). We also had a large number of individuals who came to our business meeting on Saturday at 6:45 am where we discussed our accomplishments, goals for the next year, and recognized the individuals who have served the VR SIG. This year we recognized our outgoing officers, Lexi Miles who has been my right-hand woman over the past 6 years, and Kurt van der Schalie our nominating committee chair. Courtney Hall was recognized for best article in our Newsletter for her 2017 article on the vestibular hypofunction CPG.

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## Message from the Chair cont.

Sara Oxborough received the VR SIG Service Award. Please read the description of her service record presented in this newsletter. I cannot thank her enough for the countless hours she has given to the Abstract of the Week during the last 6 years. She constantly steps up to the plate to participate in many of the SIG initiatives. Sara truly represents all of the wonderful clinicians that support the advancement of vestibular rehabilitation practice.

### **International Conference of Vestibular Rehabilitation (ICVR) proceeding published in Journal of Neurological Physical Therapy (JNPT).**

I also want to give another shout out to the Program Committee of the ICVR, Susan Whitney, Janet Helminski and Michael Shubert, who are the editors of the supplement of the April volume of JNPT. Highlighted in the supplement are articles covering key presentations. Congratulations for your work writing, soliciting and compiling articles, and creating this excellent addition to JNPT. I urge all members, whether you attended the ICVR or not, to read this supplement featuring advances in research and clinical practices in vestibular rehabilitation. The members should be aware that Susan, Michael, and Janet have all been recipients of the VR SIG service award. They continue to contribute over and over again to the advancement of vestibular rehabilitation practice.

Mostly due to Michael, Sue, and Janet's successful programming, I am happy to announce that the ANPT has authorized a second ICVR in 2021 and future conferences in the years to follow. Currently, the conference planning committee is working with the ANPT to determine a date and location for the next Conference. Keep your eyes and ears open for announcements which should be coming soon.

### **Vestibular Rehabilitation Specialization**

If you have read my messages in the past newsletters you may understand how strongly I feel about recognizing all the physical therapists who have committed themselves to the practice of vestibular rehabilitation. This commitment is exemplified by every person I have highlighted in this message. They have worked to advance their personal knowledge and skill, but are also committed to educating and mentoring others in managing individuals with vestibular disorders. Several of my previous messages detail the history and rationale for specialty certification and describe the characteristics of a clinical specialist in vestibular rehabilitations.

However, recently a panel appointed by the APTA upheld the ABSPT decision to deny board certification of a speciality in Vestibular Rehabilitation. With this denial there continues to be no process or forum to recognize the thousands of therapists across this country who have strived and attained advanced practice in vestibular rehabilitation. Although this is very discouraging, I want to personally thank the Vestibular Specialization Task Force members, Dennis Fell, Rob Landel, Michael Schubert, Janet Helminski, Joe Krazak, Susan Herdman, Janene Holmberg, Rebecca English, Becky Olson-Kellogg, and Kim Gottschall, for their tremendous work in developing the petition and appeals for specialization to the ABPTS.



## Message from the Chair cont.

The Vestibular Specialization Task Force has also attained important data from a practice analysis survey that could describe advanced practice and entry level practice of vestibular rehabilitation. The VR SIG will be proposing to the ANPT Board a plan to create a description of advanced practice in vestibular rehabilitation and in recommendations for entry-level education in vestibular rehabilitation. The dissemination of this information will go a long way in recognizing specialization in the future and pave the way for improved avenues for training vestibular rehabilitation therapists.

The VR SIG would like to thank the ANPT Board for their continued support of Vestibular Specialization during this process.

Below I have included the ANPT official notification on the denial:

### **ABPTS Denial of Vestibular Specialization Upheld by APTA Appeal Panel**

*The Academy of Neurologic Physical Therapy regrettably informs everyone that an appeal was filed regarding the ABPTS decision to deny the proposal for a Vestibular Clinical Specialist certification. An Appeal Panel was appointed by the APTA Board and conducted an appeal hearing in January. ANPT has been informed of the decision of the Appeal Panel to uphold the decision and deny formation of a VCS certification through ABPTS. ABPTS has stated the opinion that vestibular practice is a sub-specialty and not a specialty. But there is currently no process for approval of a sub-specialty.*

*While it's not the outcome we were hoping for, we believe the Appeal Panel conducted a thorough hearing. The Vestibular SIG will be discussing next steps, and future proposals for action will be presented to the ANPT Board of Directors.*

*This petition and appeals process has served to identify places where the the ABPTS could better guide groups petitioning for specialization. The APTA Panel made several recommendations to the ABPTS for change in the summary report.*

*The Board offers very sincere thanks to each Vestibular Task Force member for their years of effort toward this project!*

### **Moving forward!**

Despite this set back, I continue to be excited about being a vestibular rehabilitation therapist and a proud member of the VR SIG. Our resources and services are in high demand. Serving members and new volunteers bring new ideas and initiatives that makes our work important to the future of physical therapy practice. Look for notifications in the Abstract of the Week, Facebook and Twitter for new podcasts, updated factsheets, online educational offerings, and an updated easier to use provider map.

My thanks to all the members of our leadership group who are making these all happen. I am always happy to talk to anyone interested in promoting vestibular rehabilitation.

# Telehealth in Vestibular Rehab

**By: Linda D'Silva, PT, PhD, NCS, Sarah Gallagher, PT, DPT, NCS, Alan Chong W. Lee, PT, PhD, DPT, CWS, GCS, Sara Oxborough, PT, and Karen Skop, PT, DPT, MS**

Contributed by: Lisa Farrell, PT, PhD, ATC

“Telehealth in Vestibular Rehabilitation: Are you ready? Or, Are You Spinning?” was presented to a packed ballroom of interested attendees.

Dr. Lee began the presentation with a brief history of how telehealth developed, with foreshadowing of today's technology being advertised as early as 1924. He defined telehealth as a “collection of means or methods for enhancing health care, public health, and health education delivery and support using telecommunication technologies” to allow communication between the patient and healthcare practitioner who is at a distant site. Telehealth is the umbrella term that includes telemedicine, telehealth nursing, telemental health, telerehabilitation, telepractice, and home telehealth. Telerehabilitation is the telehealth term that is specific to physical therapy being that “rehabilitation services [are provided] at a distance using telecommunication technology”.

Dr. Lee discussed the available delivery models of telehealth from a synchronous method: live audio video, where services are provided in a two-way interaction between patients, caregivers, and the medical practitioner(s) via audiovisual technology, to asynchronous methods: store-and-forward as well as remote patient monitoring, where clinical information like data, images, sound, and/or video is recorded and then transmitted to the practitioner. According to the definitions and guidelines from the APTA board of directors (G03-06-09-19), telehealth is an appropriate model of service delivery for physical therapy and “includes, but [is] not limited to, education, advice, reminders, interventions, and monitoring of interventions”. Dr. Lee finished by sharing emerging evidence of successful use of telerehabilitation with patients following total knee arthroplasty and with patients in a skilled nursing facility. He also briefly discussed how telerehabilitation has been incorporated into the curriculum of several physical therapy programs and informed us of its use in a variety of physical therapy clinic settings where musculoskeletal, integumentary, pediatric, and cardiac rehab services are provided.

Dr. Skop added to the discussion by educating us about the federal government's involvement in telehealth. She shared that since 2017, telehealth has been a national mandate for all Armed Services and has been done so to lower healthcare costs, improve medical access, and improve patient satisfaction. As of 2018 it was reported by the Office of Telehealth Services, plus the Office of Connected Care, that there have been over one million telehealth visits. Additionally, Dr. Skop reported that as of June 2018, providers can cross state lines to deliver care for veterans and that they will be protected by the federal government, if needed. The scope of physical therapy related services requested by the Veteran's Administration (VA) ranges from follow up care for spasticity, mild concussion, stroke, and amputation/prosthetics to home evaluations to musculoskeletal complaints and chronic pain management.

Dr. Skop detailed the VA's process to provide telerehabilitation which starts from the patient and provider agreeing on the service and using an app-based service request on a patient secured link. Before care is provided the following must be in place: assurance that all equipment is working and there is proper documentation of a safety checklist (i.e. patient advised of suicide hotline and patient makes known that they are safe and in a private place), emergency contact information and procedures, and appropriate privacy and security. From this point care is administered via “virtual rehab”. The care can occur one-on-one, in a group setting (i.e. support groups), or can be administered in a multi-disciplinary manner. Dr. Skop described the telehealth service used specifically for those that require vestibular rehabilitation as including an initial face-to-face in the clinic visit, which allows for hands-on assessment, differential diagnosis, and development of rapport, which promotes better compliance. She stated that Ashburner, et al (2016) found that the development of rapport is key to telerehabilitation success. After the initial face-to-face visit, “virtual rehab” is used for follow up visits and often only requires one or two visits total for vestibular rehabilitation.

# Telehealth in Vestibular Rehab cont.

By: **Linda D'Silva, PT, PhD, NCS, Sarah Gallagher, PT, DPT, NCS, Alan Chong W. Lee, PT, PhD, DPT, CWS, GCS, Sara Oxborough, PT, and Karen Skop, PT, DPT, MS**

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Dr. Skop finished by providing a case study of a veteran with a unilateral vestibular hypofunction who initially had face-to-face visits at the VA in Tampa, but then left Florida for the summer and was requiring daily phone calls regarding his home exercises. He was offered “virtual rehab” and had three telehealth visits before returning to Tampa. Due to multiple barriers with the telehealth, the patient reported preferring “in-person” visits. These barriers included the patient not being tech savvy and needing over 60 minutes to problem solve use of the equipment, the patient was hearing impaired and required specialized equipment or use of a caregiver to assist with instructions, and lastly, with the intervention there was sometimes difficulty observing the patient perform the exercise due to poor lighting. However he did provide some positive feedback regarding the telehealth visits by stating it gave him feedback and helped progress his exercises.

Dr. Gallagher covered a spectrum of topics from governmental regulations to implementation of services when considering use of telerehabilitation as a method of delivering physical therapy care. She then discussed in more detail the process that lead to her being able to provide telerehabilitation. Since governmental laws and regulations vary by state, she explained how she began the process by utilizing the sites that are found in Figure 1. These resources aided her in finding out the telerehabilitation guidelines for her state. For example, in

Colorado where she works, to practice telerehabilitation she must hold a Colorado license and any patient she treats via

telerehabilitation must be in the state when she provides care for them. She recommended that physical therapists wanting to offer telerehabilitation first look into their state’s PT Practice Act for telehealth legislation regarding the ability to practice using this form of care, as well as finding out how to comply with HIPAA.

Additionally, she discussed the term parity, which deals with state statutes regarding payment coverage of telehealth. In Colorado, coverage of telehealth-based services is required to have equal access to the same extent that service is covered when provided in person, but it does not require plans to cover telehealth. Under the parity laws for Colorado, telehealth does not include delivery of services via voice only telephone communication or text messaging, fax or email. Lastly, regarding laws and regulations, Dr. Gallagher discussed patient consent and provided mandated language that is used in Colorado about patients’ rights to refuse telemedicine services and that they shall have access to all medical information.

Per Ms. Oxborough and Dr. Gallagher, the logistics of implementing telerehabilitation services requires the following:

- Choose technology that is HIPAA compliant with secure networks and devices, updated software and firewalls, no storage of video transmissions, and fully encrypted data.
- Platform type examples: Anywhere Healthcare, Blue Jay Mobile Health, Clocktee, Coviui, Cyno, Doxy.me, Google Hangouts, Neorehab, PHZIO, Thera-Link, Videotherapy, Vsee, and Zoom.
- Have policies and procedures in place for patient selection, consent/disclosures, technology failure, and emergency plan at patient’s site.
- Have physical therapy staff training that includes orienting to video platform, confirming patient identity and location, eye contact to camera, appropriate lighting set up, adaptation of examination/treatment, over-explaining instructions, space selection for video sessions, and documentation.
- Understand your state’s statutes regarding insurance coverage and what services are covered by insurances that are accepted. Keep in mind, currently, Medicare does not reimburse for telehealth with physical therapy.

Figure 1: Helpful sites

- [www.apta.org/Licensure/StatePracticeActs/](http://www.apta.org/Licensure/StatePracticeActs/)  
Center for Connected Health Policy
- [www.cchpaca.org](http://www.cchpaca.org)
- <https://www.fsbpt.org/FreeResources/RegulatoryResources/TelehealthinPhysicalTherapy.aspx>  
The Federation of State Boards of Physical Therapy Telehealth Guidelines

# Telehealth in Vestibular Rehab cont.

By: **Linda D'Silva, PT, PhD, NCS, Sarah Gallagher, PT, DPT, NCS, Alan Chong W. Lee, PT, PhD, DPT, CWS, GCS, Sara Oxborough, PT, and Karen Skop, PT, DPT, MS**

Contributed by: Lisa Farrell, PT, PhD, ATC

Ms. Oxborough highlighted the benefits of using telerehabilitation as a method of providing care by reminding us of the barriers that make access to vestibular therapy difficult, such as when patients live in rural areas and/or there is a difficulty getting to the clinic during operating hours. Additionally, she identified that telerehabilitation could be helpful due to a shortage of competent physical therapists trained in vestibular rehabilitation to provide care. When selecting patients to participate in telerehabilitation, Ms. Oxborough recommended that patients should not be a fall risk, not have high subjective symptom scores, and not need any hands-on treatment, such as for BPPV. Also, she recommended that patients ideally should have their initial visit face-to-face in the clinic to determine if they are good candidates for telehealth, gain consent, and provide a comprehensive examination. She also recommends that patients return for reassessment. She provided a patient case example of a man who had persistent dizziness that demonstrated successful outcomes with telerehabilitation, including reduced impairments and improved function. The patient attended all telerehabilitation visits which were paid for by private insurance and the patient reported satisfaction with treatment.

Dr. D'Silva ended the presentation by informing us about the use of mobile apps to improve home exercise compliance. Depending on the app, different features can be available including:

- enabling two-way communication between patients and practitioner along with tracking
- creating exercises specific to patients
- providing patient education resources

She emphasized how these apps supplement therapy and are easy to use with “just a click of a button”. She showed an example of how a mobile app can store video of the exercises, reminders to the patients, and then provide stats of exercise compliance for the practitioner. Lastly, she provided lessons learned about the disadvantage of using mobile apps. She acknowledged that practitioners have to see the value of the app, that dealing with patient data can be time consuming since it does not upload to electronic medical records, apps have to be paid for, and there needs to be settings in place that limit when practitioners are available to patients.

Although some level of telehealth has been in existence for several medical disciplines since the early 20th century, it's use within rehabilitation is only in the developmental stage and the potential for use is yet to be realized. In this growing area of practice, the presenters ask, “Are you ready? Or, are you spinning?” when it comes to telerehabilitation.

## Presenters' Recommendations

- Know your state's PT Practice Act and telehealth legislation
- Find out about your state's Parity Laws and insurances that accept this form of care
- Choose technology that is HIPAA compliant
- Be sure to have policies and procedures in place
- Provide training to physical therapy staff

# PPPD: Early Detection and Integrative Rehabilitation Therapy Improves Outcomes

**By: Tara Denham PT, MA; Jennifer Fay PT, DPT, NCS; Eva Mihovich PhD; and Artmis Youssefnia**  
 Contributed by: Jennifer Fay, PT, DPT Board-Certified Clinical Specialist in Neurologic Physical Therapy (NCS)

Persistent Postural Perceptual Dizziness (PPPD) is a common chronic dysfunction of the vestibular system and brain that produces persistent non-vertiginous dizziness, unsteadiness, and non-spinning vertigo. Therapists need to be aware of this condition and how to properly manage it using a multi-disciplinary approach in order to maximize outcomes. This diagnosis has been in the medical literature for centuries under various names, however in 2006, the Barany Society formed a committee to standardize the definition and to create diagnostic criteria which were published in the Journal of Vestibular Research in 2017 (1). PPPD manifests with one or more symptoms of dizziness, unsteadiness or non-spinning vertigo, that are present on most days for three months or more and are exacerbated by upright posture, active or passive movement, and exposure to moving or complex visual stimuli. Patients with this condition will often go to several health care providers over the course of months to years before they are referred to vestibular rehabilitation. Nada et al demonstrated that patients whose symptom duration was significantly longer did not benefit from vestibular therapy compared to patients whose symptoms were of shorter duration (2). This suggests that early intervention is more effective than delayed treatment. Occasionally they have already gone through a course of traditional vestibular rehabilitation with little to no effect on their symptoms. The purpose of this article is to educate therapists on how to recognize a patient presenting with signs of PPPD and some effective treatment strategies with this population.

The pathophysiology of PPPD indicates that the central nervous system gets caught in a cycle of maladaptation after an acute trigger of vertigo or unsteadiness of vestibular, neurological, or psychiatric origin. It is thought to arise from the 'mismatch' between 'bottom-up' inputs (ie, vestibular and/or proprioceptive) and maladaptive signals from 'top-down' attentional control systems (ie, anxiety-driven hypervigilance). Patients with this disorder demonstrate stiffened postural control and favor visual information over vestibular for postural control. They fail to adapt to normal relaxed posture after threat perception and can develop secondary gait abnormalities, neck stiffness, and increased perception of dizziness/unsteadiness and high anxiety. Symptoms of PPPD are exacerbated by postural challenges and perceptual sensitivity to space-motion stimuli.

Yellow flags are psychosocial indicators suggesting an increased risk of progression to long-term distress and disability. They include the patient's attitudes and beliefs, emotions, behaviors, and family and workplace factors. Some yellow flags to consider include duration of symptoms greater than 3 months, history of anxiety, depression, panic attacks, trauma, non-otogenic trigger, history of exhausting the medical system, and unsuccessful traditional vestibular therapy course(s). Once these yellow flags are identified it might direct the clinical decision making to a Physical Therapy treatment diagnosis of PPPD.

Frequently the therapists at Rusk encounter patients who have gone through multiple rounds of vestibular therapy with no success, because the focus was on treating a unilateral vestibular hypofunction, which is not the cause of their symptoms. Patient's with PPPD need a new approach for treatment as this is such a multi-faceted condition including autonomic dysregulation, visual vertigo, and motion intolerance. Treatment should start with educating the patient on what is PPPD and how it is treated by physical therapy.

Photo from game played during presentation.



# PPPD: Early Detection and Integrative Rehabilitation Therapy Improves Outcomes cont.

By: Tara Denham PT, MA; Jennifer Fay PT, DPT, NCS; Eva Mihovich PhD; and Artmis Youssefnia

Contributed by: Jennifer Fay, PT, DPT Board-Certified Clinical Specialist in Neurologic Physical Therapy (NCS)

Labeling a condition is a huge stress relief for patients who have gone through many months if not years of medical tests to no result. Patients need to be educated that their condition includes a strong association with anxiety but is not a psychiatric disorder. They need validation that their symptoms are real and that there is a functional reason for why they feel dizzy. Therapists need to stress that the patients will recover and the original trigger of their symptoms (eg vestibular neuritis, concussion) has healed. The problem is with the function of the CNS, not the structure, and that the brain needs to be reeducated that what it is perceiving as a threat is not dangerous.

Medical tests are likely to be negative and therefore over-referring patients to other specialists for more medical tests is something that should be avoided as this can drive up a patient's anxiety. Therapists should incorporate treatments including meditation and deep breathing exercises for autonomic dysregulation, aerobic exercise to treat fatigue, and optokinetic videos/virtual reality to address visual vertigo. Patients should be educated that symptom provocation does not indicate tissue damage, however, therapists should be aware that frequent discussion of symptom intensity can contribute to the hypervigilance that these patients experience.

## 4 Main Areas for Focus

- Autonomic dysregulation
- Motion intolerance
- Visual vertigo
- Fatigue

Psychological processes in PPPD share some similarities to cognitive models of health anxiety and panic disorder. Dizziness becomes persistent when it is processed as a threat, and that is maintained by unhelpful appraisals, avoidance and safety behaviors, and selective attention to body sensations associated with dizziness. In many PPPD patients there is a vicious cycle of anxiety and dizziness where symptoms of dizziness, vertigo, and imbalance contribute to increased anxiety, hypervigilance and panic, as well as increased stress/perception of danger (3). According to Staab the predominant diagnostic categories are Panic attacks (15%) and Anxiety (15%) (1). At Rusk we are fortunate to have a vestibular psychologist to help treat these patients with various cognitive behavioral therapy treatment strategies include psychoeducation, mindfulness, anxiety management, and reinforcement of self esteem and self efficacy. Psychoeducation about the cognitive behavioral model – the links between thoughts (appraisals) and emotion, how emotions guide behavior, and how actions sometimes have unintended consequences (4). Mindfulness is the act of paying attention without judgment. It can be helpful for emotional regulation and enhancing the skill of mindfully observing unpleasant emotions and sensations (anxiety and dizziness) without overreacting. Mindfulness can be useful in helping the vestibular patient “radically accept” that they may have a recurrent or permanent disorder that will necessitate the need to utilize the skills learned in vestibular rehabilitation and psychotherapy throughout their life. Anxiety management strategies include deep breathing and grounding breathing techniques which employs mindful awareness of feet on the ground to counterbalance lightheadedness, dizziness, etc., as well as meditation. Therapists and patients create manageable and achievable goals to promote a return to function (walk your child to school by yourself). Upon completion of these goals therapists give high praise to the patients for challenging themselves and successful achievement.

Therapists need to be aware of PPPD when evaluating patients who have complaints of chronic dizziness. Treatment approach should be on an individualized basis incorporating knowledge of the pathophysiology and the patients self-identified triggers into the treatment plan. Therapists need to incorporate other treatment strategies to successfully treat this population as a traditional vestibular rehabilitation program does not always address all of the activity and participation limitations in these individuals. Additionally providing the patient with ownership of their condition through education and empowering them to return to function is a key to success.

## References

1. Staab JP, Eckhardt-Henn A, Horii A, et al. Diagnostic criteria for persistent postural-perceptual dizziness (PPPD): Consensus document of the committee for the Classification of Vestibular Disorders of the Barany Society. *Journal of vestibular research: equilibrium & orientation*. 2017;27(4):191-208.
2. Nada EH, Ibraheem OA, Hassaan MR. Vestibular Rehabilitation Therapy Outcomes in Patients With Persistent Postural-Perceptual Dizziness. *Ann Otol Rhinol Laryngol*. 2019;3489418823017.
3. Staab JP, Balaban CD, Furman JM. Threat assessment and locomotion: clinical applications of an integrated model of anxiety and postural control. *Seminars in neurology*. 2013;33(3):297-306.
4. Yu YC, Xue H, Zhang YX, Zhou J. Cognitive Behavior Therapy as Augmentation for Sertraline in Treating Patients with Persistent Postural-Perceptual Dizziness. *BioMed research international*. 2018;2018:8518631.

# “Is the Proof in the Pudding? A literature review of the Psychometric Properties of Concussion”

By: Rebecca Bliss, PT, DPT; Karen Skop, PT, DPT, MS; Diane Wrisley, PT, PhD, NCS

Contributed by: Karen M. Skop, PT, DPT, MS

ANPT Vestibular SIG hosted “Is the Proof in the Pudding? A literature review of the Psychometric Properties of Concussion” on Saturday morning. Drs. Bliss, Skop and Wrisley applied the tests and measures we all tend to lean toward in the management of concussion, but sought to answer the questions “Are these the best test we have?”, “Are the tests we use every day applicable to the concussion world?”, and “What are the clinical gaps that we should consider?”. Research has exploded in concussion literature over the past decade, so as Physical Therapists, we continue to advance our knowledge and skills in the management of this population, and also provide our clientele with the best “evidence-based medicine”.

Translation of knowledge from the research world to the clinical realm is slow. It takes an average of 14-17 YEARS for research to get into the hands of those who are actually practicing and implementing the research on real patients. The questions this presentation sought to answer were: What is out there?, How can we apply it?, and What do we do with our patients?

Since concussions are a heterogeneous injury, expert recommendations suggest that concussion management should correlate with symptom management. This approach is not new to Physical Therapy; Physical Therapists consider the patients’ symptoms and functional deficits in order to prescribe the most appropriate intervention. The 2016 Concussion Statement of Concussion in Sport was the first year that concussion was mentioned as a rehabilitative injury (1). This Berlin statement addressed the need for Physical Therapy and vestibular rehabilitation directly.

The University of Pittsburgh Medical Center (UPMC) and University at Buffalo has coined two clinical trajectories, or pathways, to concussion recovery to aid clinicians in providing systematic care (2). Clinicians might follow the UPMC 6 clinical trajectories: cervical, ocular, vestibular, cervical, post-traumatic migraine and cognitive/neuro-fatigue, or the Ellis model: physiological, cervical and vestibular ocular, both with overlapping clinical differences. To explore the humdrum topic of psychometrics (sorry to those who love interclass coefficients and statistical regression models....), we used a case based, clinical trajectory model. The age spectrum of the cases ranged from young adolescent to geriatric patients. Each case was discussed to highlight the tests and measures, clinical considerations, and to answer the question, can we apply these measures to this case example. We also had a little Destiny’s Child, Little Wayne, and Carly Rae Jepson to entertain the audience!

The sport concussion case was “up to bat” first. Dr. Bliss discussed an adolescent baseball player, with chronic (>4 month history) of symptoms (3). The clinical trajectories of vestibular and physiological/neuro-fatigue were addressed. This 15-year-old athlete had been experiencing symptoms, beyond the expected recovery period, of continued dizziness and persistent symptom aggravation while he tried to balance his home and school life.

Test / Outcome Measure	Can we apply to this case? 15 yo chronic symptoms	Considerations
Dizziness Handicap Inventory (DHI) <sup>4,5</sup>	Maybe	Some of the questions may not be age appropriate; Criterion validity mTBI, DVAT & DHI. (mean age 22)
Vestibular Ocular Motor Screening (VOMS) <sup>6a</sup>	Yes	
Head Thrust Test <sup>6b</sup>	Yes	
Dynamic Visual Acuity Test (DVAT) (instrumented) <sup>10,14</sup>	Yes	
Limits of Stability (LOS) <sup>15</sup>	Maybe	
Functional Gait Assessment (FGA) <sup>16</sup>	Maybe	Not validated for concussion; not validated in this age group; may not be sensitive enough to measure change in this population
Buffalo Concussion Treadmill Test <sup>17-19</sup>	Yes	

# “Is the Proof in the Pudding? A literature review of the Psychometric Properties of Concussion” cont.

By: Rebecca Bliss, PT, DPT; Karen Skop, PT, DPT, MS; Diane Wrisley, PT, PhD, NCS

Contributed by: Karen M. Skop, PT, DPT, MS

Concussion in the military is a huge problem affecting over 300K veterans and active duty service members, with those estimates most likely being low considering the exposure of our armed forces both in training and deployments (20,21). Dr. Skop discussed a Colonel in the US Army SOF who was exposed to countless concussive events, both from hard hits in combative and parachute jumps, to explosions from roadside bombs, controlled explosions or “breeches”, and MVAs. The case unfolded discussing good subjective questionnaires to aid in clinicians’ differential diagnostic pathway. The primary clinical trajectories discussed included cervical and visual, while weaving in orthopedic clinical practice guidelines for neck pain to apply knowledge translation.

Geriatric concussion is a huge problem (38-41). Concussion in the older adult is more common than in the younger adult, with more serious consequences, and presents with a decline in function and cognitive deficits that may be attributed to dementia. Dr. Wrisley presented on a 74-year-old female, Iva Fallen, who was admitted to an acute care hospital based setting after sustaining a fall. Iva Fallen had dizziness and true vertigo which developed acutely. As the case continued, she developed cognitive, mood, and behavioral changes. Clinical assessment tools were discussed to address these changes.

Overall, there are many good tests and measures available to use for the concussed population. Decisions on treatment, progression, and return to activity should be carefully considered until more research is done on this specific patient population.

References can be found on page 16.

Test / Outcome Measure	Can we apply to this case? Military >40 yo	Considerations
HIT-6 <sup>22</sup>	Yes	Good for global headache reporting across many populations
2017 Neck CPG <sup>23</sup>	Yes	See CPG 2017 revision for complete list of test/measures recommended
Convergence Insufficiency Symptom Survey <sup>24,25</sup>	Yes	Children & adults
Cranio-Flexion Rotation Test <sup>26,26</sup>	Yes	100/94% Se/Sp to differentiate cervicogenic headache vs. migraine
Neck flexor endurance test <sup>27,28</sup>	Yes	
Head-neck-differentiation <sup>29,30</sup>	Maybe	No psychometric properties available
Joint-Position Error <sup>31</sup>	Maybe	Sp 82% / Se 92%
Smooth Pursuit Neck Torsion Test <sup>32,33</sup>	Yes	Sp 91 / Se 72%
Near Point of Convergence <sup>34,34,35</sup>	Yes	
King-Devick <sup>36,37</sup>	No	Evidence is mounting; but studies found little evidence in chronic military populations

Test / Outcome Measure	Can we apply to this case? Elderly >70 yo	Considerations
Hallpike -Dix	Yes	
Positive and Negative Affect Schedule (PANAS) <sup>42,43</sup>	Maybe	Good reliability & validity in older adults; NOT specific to concussion
Montreal Cognitive Assessment (MoCA) <sup>44</sup>	Maybe	Good reliability & validity in older adults; NOT specific to concussion
Geriatric Anxiety Scale <sup>45</sup>	Maybe	Good reliability & validity in older adults; NOT specific to concussion
Dizziness Handicap Inventory (DHI) <sup>46</sup>	Yes	Good psychometric properties for this age group, not specific to concussion; specific to BPPV
Balance tests (BERG <sup>47</sup> / FGA <sup>48,49</sup> / SOT <sup>50</sup> / miniBEST <sup>51</sup> )	Yes	Good measures of fall risk in elderly; few are specific to post-concussion, but some of these test measure important aspects of balance post-concussion

## **CSM Platform Highlight: Ambulatory Care Visits for Benign Paroxysmal Positional Vertigo in the United States: Prevalence and Physician Treatment Recommendations**

**By: Pamela M. Dunlap, DPT, Samannaaz S. Khoja, PT, PhD, Susan L. Whitney, DPT, PhD, FAPTA, Janet K. Freburger, PT, PhD**

Contributed by: Pamela M. Dunlap, DPT

This platform presentation detailed the rate of visits to ambulatory care physicians for benign paroxysmal positional vertigo (BPPV) and physician treatment recommendations. Here, we will also summarize ambulatory care physicians' adherence to clinical practice guidelines for BPPV (1). Clinical practice guidelines published by the American Academy of Otolaryngology - Head and Neck Surgery (AAO-HNS) recommend that patients with BPPV are diagnosed using the Dix-Hallpike or Roll test and then treated with the appropriate canalith repositioning maneuver. They also recommend against diagnostic imaging such as computed tomography (CT) scan or magnetic resonance imaging (MRI) and the prescription of anti-vertigo medications such as Meclizine for the treatment of BPPV (2,3). However, evidence suggests that medications are the mostly commonly recommended treatment for vestibular disorders (4). Recent research from Europe and Australia highlight the underutilization of canalith repositioning maneuvers and PT referral for persons with BPPV (4,5). However, there is little current evidence regarding current practice for BPPV in ambulatory care settings in the US. Thus, the purpose of our study was to 1) examine the rate of BPPV visits and physician treatment recommendations for BPPV over time, and 2) identify physician adherence to clinical practice guidelines for BPPV.

We examined data from the National Ambulatory Medical Care Survey (NAMCS) from 2004-15 including 5.6 million estimated weighted visits in total. This is a national probability sample survey of office-based physicians with data collected through interviews and electronic medical records. Through sample weighting strategies, we are able to estimate visits for the US population. We limited our analysis to patient visits by individuals 18 years of age or older with a diagnosis of BPPV (ICD-9-CM: 386.11). We extracted patient demographic and insurance information, clinical characteristics such as reason for visit and comorbidities, and physician characteristics such as physician specialty and office location that were associated with the visits. We were interested in examining the following physician treatment recommendations: diagnostic imaging (CT/MRI) and anti-vertigo medication prescription. We categorized visits as guideline adherent if imaging and anti-vertigo medications were not recommended at the visit. Analyses accounted for the complex survey design and were weighted to the population of the US (6).

We found that the number and rate of BPPV visits increased over time from 846,860 visits (0.04% of all visits) in 2004-06 to 1.9 million visits (0.08% of all visits) in 2013-15 (1). This increase in the rate of visits to ambulatory care physicians for BPPV could be due to increased physician awareness of the diagnosis. The mean age of the sample increased over time from 56 years in 2004-06 to 67 years in 2013-2015 as did the percentage of visits covered by Medicare insurance (1). The majority of the visits to ambulatory care physicians for BPPV were made by females, whites, and were covered by private insurance. Most of the visits were made for an acute problem (defined as being present for less than 3 months). The percentage of visits made by individuals with no comorbidities decreased over time while the percentage of visits with 3 or more comorbidities increased. Most visits for BPPV in ambulatory care settings are made to primary care physicians, followed by otolaryngologists, neurologists, and other specialists (1). There were more visits made to physician offices in the south and in metropolitan areas in this sample.

## CSM Platform Highlight: Ambulatory Care Visits for Benign Paroxysmal Positional Vertigo in the United States: Prevalence and Physician Treatment Recommendations cont.

**By: Pamela M. Dunlap, DPT, Samannaaz S. Khoja, PT, PhD, Susan L. Whitney, DPT, PhD, FAPTA, Janet K. Freburger, PT, PhD**

Contributed by: Pamela M. Dunlap, DPT

The rates of physician recommendations for diagnostic imaging for BPPV were low over time (1-6%). The rate of antivertigo medication prescription decreased from 50% in 2007-09 to 16% in 2013-15. This decrease may be due to the publication of the AAO-HNS clinical practice guidelines recommending against anti-vertigo medication prescription in 2008. Otolaryngologists and neurologists were adherent to clinical practice guidelines (defined as not prescribing anti-vertigo medication and not recommending imaging) for BPPV in approximately 80% of visits over years 2004-2015. Primary care physicians have improved with rate of guideline adherence around 43% in 2007-2009 to approximately 79% in 2013-2015 (1). Again, this overall improvement in guideline adherence by primary care physicians may have been in response to the publication of the clinical practice guidelines.

A limitation to this analysis was that we were unable to determine if the physician provided a canalith repositioning maneuver at the visit. Also, because the diagnosis of BPPV could have been a secondary diagnosis for the visit, the treatment recommendations made at some visits could have been for other conditions. However, this analysis provides important information describing the population of patients accessing ambulatory care for BPPV. While this has been studied in other countries, there is a lack of recent epidemiologic literature for patients with vestibular disorders in ambulatory care settings in the US.

In summary, ambulatory care visits for BPPV have increased over time. Primary care physicians are improving with adherence to clinical practice guidelines for BPPV over time while specialists remained adherent to guidelines in approximately 80% of visits over years 2004-2015.

We would like to acknowledge the following sources of funding for this research: Vestibular Disorders Association (VeDA) Travel Grant for Vestibular Research Program and Health Resources and Services Administration of the US Department of Health and Human Services under Cooperative Agreement U81HP2649504-00, Health Workforce Research Centers Program.

### References

1. Dunlap PM, Khoja SS, Whitney SL, Freburger JK. Assessment of Physician Adherence to Guidelines for the Diagnosis and Treatment of Benign Paroxysmal Positional Vertigo in Ambulatory Care Settings. *JAMA Otolaryngol Head Neck Surg* 2018;144:845-6.
2. Bhattacharyya N, Baugh RF, Orvidas L, et al. Clinical practice guideline: Benign paroxysmal positional vertigo. *Otolaryngology - Head and Neck Surgery* 2008;139:S47-S81.
3. Bhattacharyya N, Gubbels SP, Schwartz SR, et al. Clinical Practice Guideline: Benign Paroxysmal Positional Vertigo (Update). *Otolaryngol Head Neck Surg* 2017;156:S1-S47.
4. Grill E, Penger M, Kentala E. Health care utilization, prognosis and outcomes of vestibular disease in primary care settings: systematic review. *J Neurol* 2016;263 Suppl 1:S36-44.
5. Lloyd M, Mackintosh A, Grant C, et al. Evidence-based management of patients with vertigo, dizziness, and imbalance at an Australian metropolitan health service: an observational study of clinical practice. *Physiotherapy theory and practice* 2018:1-8.
6. National Center for Health Statistics AHCD. 2015 NAMCS Micro-Data File Documentation [PDF Document]. 2015:Available from: [ftp://ftp.cdc.gov/pub/Health\\_Statistics/NCHS/Dataset\\_Documentation/NAMCS/doc2015.pdf](ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NAMCS/doc2015.pdf).

## Newsletter Article of the Year: Clinical Practice Guidelines for Peripheral Vestibular Hypofunction Courtney Hall, PT, PhD



The Co-Editors of the VRSIG Newsletter would like to Congratulate Courtney Hall PT, PhD for authoring the newsletter article of the year entitled “Clinical Practice Guidelines for Peripheral Vestibular Hypofunction.” This award is decided by a panel of reviewers from the SIG leadership team, which evaluates articles on the following criteria:

- The article is written clearly and concisely
- There is a clear theoretical basis for the article
- The review of literature and introductory statements provide evidence for the importance of the article to physical therapy and it makes an important contribution to the understanding of clinical practice and patient care
- The article provides information that can assist others in the delivery of physical therapy services.
- The article contains clear descriptions of clinical procedures or describes approaches that can be understood by others and contains supportive rationales for the approaches used and elements of the article with enough clarity to permit replication.

At the Business Meeting in Washington DC, the VRSIG had an opportunity to acknowledge Dr. Hall for her hard work and willingness to support the SIG in providing information on the action statements of the CPG.

Thank you Dr. Hall!



## 2019 Service Award Winner

### Sara Oxborough, MS, PT

Contributed by: Becky Olson-Kellogg, PT, DPT



The VR SIG was proud to award the 2019 Service Award to Sara Oxborough. Sara is the Director of Rehabilitation at the National Dizzy & Balance Center in the Minneapolis/St. Paul area. She has served the VR SIG in multiple avenues, including:

- Chairing the Abstract of the Week Committee since 2012
- Participating in developing & presenting the CE course "Expanding Neurologic Expertise: Introduction to Vestibular Rehabilitation"
- Member of the VR SIG Telehealth Committee
- Speaker at CSM in 2017 and 2019 on vestibular rehabilitation topics
- Member of the Marketing Committee for the inaugural International Conference for Vestibular Rehabilitation

She also willingly volunteers for a variety of other tasks to support the VR SIG and our Chair Anne Galgon. We all join in thanking Sara Oxborough for all she has contributed to help our VR SIG, and to promote and progress vestibular rehabilitation!

## Academy of Neurologic PT Nominations

Each year the Academy of Neurologic Physical Therapy recognizes its members for their outstanding work. Now is the time to submit a nomination for these awards by clicking here <http://neuropt.org/about-us/awards-and-accolades/nomination-forms>

Awards:

- Service to the Academy
- Early Career Professional Award
- Excellence in Neurologic Education Award
- PT Clinical Excellence in Neuro Physical Therapy
- PTA Clinical Excellence in Neuro Physical Therapy
- Excellence in Neurologic Research
- Outstanding Clinical Innovator in Neuro Physical Therapy
- Outstanding Advocacy Neuro Physical Therapy

Those selected will be recognized at the CSM ANPT Membership Meeting in Denver, CO February 14, 2020.

### CALL FOR NEWSLETTER CONTRIBUTORS!!!!

Have you presented a poster at CSM?

OR

Do you wish you had more information about that poster you saw at CSM?

Consider contributing to the newsletter!!

Submit your poster presentation for a chance to be featured in the next newsletter. If you are interested in submitting your poster please contact Jasmine Edwards, PT, DPT, NCS at [jjacksonpt@gmail.com](mailto:jjacksonpt@gmail.com) or Debbie Struikma, PT, NCS at [dstruikma77@aol.com](mailto:dstruikma77@aol.com).

## Post-doctoral fellowship in Vestibular Rehabilitation: Center for Hearing and Balance, Johns Hopkins University

We are recruiting a post-doctoral fellow to develop and test a novel kinematics-based approach to inform vestibular rehabilitation. Our work aims to:

- 1) determine the kinematic differences between healthy controls and patients with unilateral vestibular deafferentation during gait and gaze stability exercises
- 2) compare recovery outcomes of patients following prescriptions aided by on-line kinematic data to those of patients receiving traditional vestibular rehabilitation based on clinician assessment only
- 3) compare recovery outcomes of patients given additional kinematic feedback at home via mobile app to i) patients treated using traditional vestibular rehabilitation and ii) patients provided kinematic feedback only during outpatient visits.

### Required Skills

Eligible applicants should have earned a PhD or ScD in Movement Science, Kinesiology, Neuroscience or Psychology. We seek applicants with strong organizational, written, and verbal communication skills. Applicants should have a desire to work as a team member. Prior experience measuring walking kinematics (e.g., gait analysis, body worn sensors, etc.) is desirable. During their training, the post-doctoral fellow will be provided with opportunities to continue to develop professional development skills via publishing manuscripts, developing grant proposals, and mentoring graduate and undergraduate students. The fellow will have a strong multidisciplinary training experience through interactions with multiple laboratories in the Center for Hearing and Balance at Johns Hopkins University, which holds weekly joint seminars and spans the Depts. of Otolaryngology, Neuroscience, and Biomedical Engineering. Technical and programming support is also available through the associated Department of Biomedical Engineering.

If interested, please email a letter of interest, CV, and names of three references to: **Kathleen Cullen (kathleen.cullen@jhu.edu) or Michael Schubert (mschube1@jhmi.edu).**

We are an equal opportunity employer and all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability status, protected veteran status, or any other characteristic protected by law.

# “Is the Proof in the Pudding? A literature review of the Psychometric Properties of Concussion”

## References

By: Rebecca Bliss, PT, DPT; Karen Skop, PT, DPT, MS; Diane Wrisley, PT, PhD, NCS

Contributed by: Karen M. Skop, PT, DPT, MS

1. McCrory, P., Meeuwisse, W., Dvorak, J., Aubry, M., Bailes, J., Broglio, S., ... Vos, P. E. (2017). Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016. *British Journal of Sports Medicine*, *bjsports-2017-097699*.
2. Ellis, M. J., Leddy, J. J., & Willer, B. (2015). Physiological, vestibulo-ocular and cervicogenic post-concussion disorders: an evidence-based classification system with directions for treatment. *Brain injury*, *29*(2), 238-248.
3. Li, C., Beaumont, J. L., Rine, R. M., Slotkin, J., & Schubert, M. C. (2014). Normative Scores for the NIH Toolbox Dynamic Visual Acuity Test from 3 to 85 Years. *Frontiers in Neurology*, *5*, 223. <https://doi.org/10.3389/fneur.2014.00223>
4. Kontos, A. P., Deitrick, J. M., Collins, M. W., & Mucha, A. (2017). Review of Vestibular and Oculomotor Screening and Concussion Rehabilitation. *Journal of Athletic Training*, *52*(3), 256-261. <https://doi.org/10.4085/1062-6050-51.11.05>
5. Klefffelgaard, I., Soberg, H. L., Tamber, A.-L., Bruusgaard, K. A., Pripp, A. H., Sandhaug, M., & Langhammer, B. (2019). The effects of vestibular rehabilitation on dizziness and balance problems in patients after traumatic brain injury: a randomized controlled trial. *Clinical Rehabilitation*, *33*(1), 74-84.
6. Mucha, A., Collins, M. W., Elbin, R. J., Furman, J. M., Troutman-Enseki, C., DeWolf, R. M., Kontos, A. P. (2014). A Brief Vestibular/Ocular Motor Screening (VOMS) assessment to evaluate concussions: preliminary findings. *The American Journal of Sports Medicine*, *42*(10), 2479-2486.
7. Yorke, A. M., Babcock, M., & Alsalaheen, B. (n.d.). Validity and Reliability of the Vestibular/Ocular Motor Screening and Associations With Common Concussion Screening Tools.
8. Worts, P. R., Schatz, P., & Burkhardt, S. O. (2018). Test Performance and Test-Retest Reliability of the Vestibular/Ocular Motor Screening and King-Devick Test in Adolescent Athletes During a Competitive Sport Season. *The American Journal of Sports Medicine*, *46*(8), 2004-2010. <https://doi.org/10.1177/0363546518768750>
9. McDevitt, J., Appiah-Kubi, K. O., Tierney, R., & Wright, W. G. (2016). Vestibular and Oculomotor Assessments May Increase Accuracy of Subacute Concussion Assessment. *International Journal of Sports Medicine*. <https://doi.org/10.1055/s-0042-100470>
10. Alahmari, K., Reddy, R. S., Silvian, P., Ahmad, I., Nagaraj, V., & Mahtab, M. (2017). Intra- and inter-rater reliability of neutral head position and target head position tests in patients with and without neck pain. *Brazilian Journal of Physical Therapy*, *21*(4), 259-267. <https://doi.org/10.1016/j.bjpt.2017.05.003>
11. Dunlap, P. M., Mucha, A., Smithnosky, D., Whitney, S. L., Furman, J. M., Collins, M. W., Sparto, P. J. (2018). The Gaze Stabilization Test Following Concussion. *Journal of the American Academy of Audiology*. <https://doi.org/10.3766/jaaa.18015>
12. Honaker, J. A., Criter, R. E., Patterson, J. N., & Jones, S. M. (2015). Gaze Stabilization Test Asymmetry Score as an Indicator of Previous Concussion in a Cohort of Collegiate Football Players. *Clinical Journal of Sport Medicine: Official Journal of the Canadian Academy of Sport Medicine*, *25*(4), 361-366.
13. Kaufman, Dr; Puckett, M.J; Smith, M.J; Wilson, K.S; Cheema, R; Landers, M. (2014). Test-retest Reliability and Responsiveness of Gaze Stability and Dynamic Visual Acuity in High School and College Football Players. *Physical Therapy Sport*, *15*(3), 181-188. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24295546>
14. Kaufman, D. R., Puckett, M. J., Smith, M. J., Wilson, K. S., Cheema, R., & Landers, M. R. (2014). Test-retest reliability and responsiveness of gaze stability and dynamic visual acuity in high school and college football players. *Physical Therapy in Sport*, *15*(3), 181-188. <https://doi.org/10.1016/j.ptsp.2013.10.002>
15. Pickerill, M. L., & Harter, R. A. (2011). Validity and reliability of limits-of-stability testing: a comparison of 2 postural stability evaluation devices. *Journal of Athletic Training*, *46*(6), 600-606. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22488184>
16. Wrisley, D. M., Marchetti, G. F., Kuharsky, D. K., & Whitney, S. L. (2004). Reliability, Internal Consistency, and Validity of Data Obtained With the Functional Gait Assessment. *906 Physical Therapy*, *84*(10).
17. Leddy, J. J., Haider, M. N., Ellis, M., & Willer, B. S. (2018). Exercise is medicine for concussion. *Current Sports Medicine Reports*, *17*(8), 262-270.
18. Leddy, J. J., Hinds, A. L., Miecznikowski, J., Darling, S., Matuszak, J., Baker, J. G., ... Willer, B. (2018). Safety and Prognostic Utility of Provocative Exercise Testing in Acutely Concussed Adolescents. *Clinical Journal of Sport Medicine*, *28*(1), 13-20. <https://doi.org/10.1097/USM.0000000000000431>
19. Ellis, M. J., Cordingley, D. M., Vis, S., Reimer, K. M., Leiter, J., & Russell, K. (2017). Clinical predictors of vestibulo-ocular dysfunction in pediatric sports-related concussion. *Journal of Neurosurgery: Pediatrics*, *19*(1), 38-45.
20. Kelley, A., Estrada, A., King, M., Erickson, B., Hayes, A., & Basso, J. (2017). Research Program Return to Duty (RTD) Toolkit Expert Panel Workshop, 16-17 February 2017.
21. Capó-Aponte, J. E., Urosevich, T. G., Temme, L. A., Tarbett, A. K., & Sanghera, N. K. (2012). Visual dysfunctions and symptoms during the subacute stage of blast-induced mild traumatic brain injury. *Military medicine*, *177*(7), 804-813.
22. Yang, M., Rendas-Baum, R., Varon, S. F., & Kosinski, M. (2011). Validation of the Headache Impact Test (HIT-6™) across episodic and chronic migraine. *Cephalalgia*, *31*(3), 357-367.
23. Blanpied, P. R., Gross, A. R., Elliott, J. M., Devaney, L. L., Clewley, D., Walton, D. M., ... & Boeglin, E. (2017). Neck pain: revision 2017: clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy*, *47*(7), A1-A83.
24. McGregor, M. L. (2014). Convergence insufficiency and vision therapy. *Pediatric Clinics*, *61*(3), 621-630.
25. Abraham, N. G., Srinivasan, K., & Thomas, J. (2015). Normative data for near point of convergence, accommodation, and phoria. *Oman journal of ophthalmology*, *8*(1), 14.
26. Tabet P, Saliba I. Meniere's Disease and Vestibular Migraine: Updates and Review of the Literature. *Journal of Clinical Medicine Research*. 2017;9(9):733-744. doi:10.14740/jocmr3126w.
27. Edmondston, S., Björnsdóttir, G., Pálsson, T., Sölgård, H., Ussing, K., & Allison, G. (2011). Endurance and fatigue characteristics of the neck flexor and extensor muscles during isometric tests in patients with postural neck pain. *Manual therapy*, *16*(4), 332-338.
28. Harris, K. D., Heer, D. M., Roy, T. C., Santos, D. M., Whitman, J. M., & Wainner, R. S. (2005). Reliability of a measurement of neck flexor muscle endurance. *Physical therapy*, *85*(12), 1349-1355.
29. Reiley, A. S., Vickory, F. M., Funderburg, S. E., Cesario, R. A., & Clendaniel, R. A. (2017). How to diagnose cervicogenic dizziness. *Archives of physiotherapy*, *7*(1), 12.
30. Cheever, K., Kawata, K., Tierney, R., & Galgon, A. (2016). Cervical injury assessments for concussion evaluation: A review. *Journal of athletic training*, *51*(12), 1037-1044.
31. De Vries, J., Ischebeck, B. K., Voogt, L. P., Van Der Geest, J. N., Janssen, M., Frens, M. A., & Kleinsrensink, G. J. (2015). Joint position sense error in people with neck pain: a systematic review. *Manual therapy*, *20*(6), 736-744.
32. Jørgensen, R., Ris, I., Falla, D., & Juul-Kristensen, B. (2014). Reliability, construct and discriminative validity of clinical testing in subjects with and without chronic neck pain. *BMC musculoskeletal disorders*, *15*(1), 408.
33. L'Heureux-Lebeau, B., Goudout, A., Berbiche, D., & Saliba, I. (2014). Evaluation of paraclinical tests in the diagnosis of cervicogenic dizziness. *Otology & Neurology*, *35*(10), 1858-1865.
34. Scheiman, M., Galloway, M., Frantz, K. A., Peters, R. J., Hatch, S., Cuff, M., & Mitchell, G. L. (2003). Nearpoint of convergence: test procedure, target selection, and normative data. *Optometry and Vision Science*, *80*(3), 214-225.
35. Pearce, K. L., Sufinko, A., Lau, B. C., Henry, L., Collins, M. W., & Kontos, A. P. (2015). Near point of convergence after a sport-related concussion: measurement reliability and relationship to neurocognitive impairment and symptoms. *The American journal of sports medicine*, *43*(12), 3055-3061.
36. Walsh, D. V., Capó-Aponte, J. E., Beltran, T., Cole, W. R., Ballard, A., & Dumayas, J. Y. (2016). Assessment of the King-Devick®(KD) test for screening acute mTBI/concussion in firefighters. *Journal of the neurological sciences*, *370*, 305-309.
37. Galetta, K. M., Liu, M., Leong, D. F., Ventura, R. E., Galetta, S. L., & Balcer, L. J. (2016). The King-Devick test of rapid number naming for concussion detection: meta-analysis and systematic review of the literature. *Concussion*, *1*(2).
38. Albrecht JS, Hirshon JM, McCunn M, et al. Increased Rates of Mild Traumatic Brain Injury Among Older Adults in US Emergency Departments, 2009-2010. *J Head Trauma Rehabil*. 2016;31(5):E1-7
39. Mercier E, Mitra B, Cameron PA. Challenges in assessment of the mild traumatic brain injured geriatric patient. *Injury*. 2016;47(5):985-987.
40. Gardner RC, Dams-O'Connor K, Morrissey MR, Manley GT. Geriatric Traumatic Brain Injury: Epidemiology, Outcomes, Knowledge Gaps, and Future Directions. *J Neurotrauma*. 2018.
41. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *J Pers Soc Psychol*. 1988;54(6):1063-1070.
42. Therrien Z, Hunsley J. Assessment of anxiety in older adults: a systematic review of commonly used measures. *Aging Ment Health*. 2012;16(1):1-16.
43. Nasreddine ZS, Phillips NA, Bedirian V, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. *J Am Geriatr Soc*. 2005;53(4):695-699.
44. Segal DL, June A, Payne M, Coolidge FL, Yochim B. Development and initial validation of a self-report assessment tool for anxiety among older adults: the Geriatric Anxiety Scale. *J Anxiety Disord*. 2010;24(7):709-714.
45. Jacobson GP, Newman CW. The development of the Dizziness Handicap Inventory. *Arch Otolaryngol Head Neck Surg*. 1990;116(4):424-427.
46. Berg KO, Wood-Dauphinee SL, Williams JL, Maki B. Measuring balance in the elderly: validation of an instrument. *Can J Public Health*. 1992;83 Suppl 2:S7-11.
47. Wrisley DM, Marchetti GF, Kuharsky DK, Whitney SL. Reliability, internal consistency, and validity of data obtained with the functional gait assessment. *Phys Ther*. 2004;84(10):906-918.
48. Wrisley DM, Kumar NA. Functional gait assessment: concurrent, discriminative, and predictive validity in community-dwelling older adults. *Phys Ther*. 2010;90(5):761-773.
49. Ford-Smith CD, Wyman JF, Elswick RK, Fernandez T, Newton RA. Test-retest reliability of the sensory organization test in noninstitutionalized older adults. *Arch Phys Med Rehabil*. 1995;76(1):77-81.
50. Franchignoni F, Horak F, Godi M, Nardone A, Giordano A. Using psychometric techniques to improve the Balance Evaluation Systems Test: the mini-BESTest. *J Rehabil Med*. 2010;42(4):323-331
51. Godi M, Franchignoni F, Caligari M, Giordano A, Turcato AM, Nardone A. Comparison of reliability, validity, and responsiveness of the mini-BESTest and Berg Balance Scale in patients with balance disorders. *Phys Ther*. 2013;93(2):158-167.