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Overview of Vestibular Education and Incorporating
Fundamentals of Vestibular Evaluations in the General
Audiology Population,

presented in partnership with Salus University

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- [Dr. Smaka] It's my pleasure at this time to introduce our presenter, Dr. Bre Myers. Dr. Myers completed her Master's degree in audiology at Bloomsburg University, her clinical doctorate in audiology, and her PhD in biomedicine from Salus University. In 2006, she opened and co-owned Berks Hearing Professionals for 10 years. She is currently assistant professor in the Osborne College of Audiology at Salus University. Her book, "The Vestibular Lab Manual", is currently in its second edition. She serves as an assistant editor for "Audiology Today" and Plural Publishing, her areas of teaching and research include vestibular diagnostics, best clinical practices, and interprofessional education. Dr. Myers, it is great having you with us today, and I'll turn the microphone over to you.

- [Dr. Myers] Excellent, thank you Carolyn. It's a pleasure to be here, and hello and welcome to everyone to today's session. As Dr. Smaka has said that I've spent the last basically 12 years of my career educating both residential and online distance education students over all the aspects of vestibular science. And it's been my personal goal to make sure that even those with no apparent interest in performing vestibular assessments daily in their careers still leave the university with a working knowledge so that they're able to properly counsel and also make recommendations to their patients. So, as this title suggests, today's session has two distinct portions. The first section will review how vestibular education is being delivered in the US, and within this section we will focus on the first learning objective, which is to identify the inconsistencies that currently exist. Specifically, we'll be looking at the inconsistencies in curriculum, and also the overall expectations of abilities once a student has completed said curriculum. We will also briefly end this section by addressing the second outcome, which is identifying some methodological approaches to improve delivery. Also at this time, I will open up the session for those who may be teaching to share some approaches that you've found successful. We'll then switch gears a bit and discuss ways in which we can incorporate some vestibular assessments into the general hearing-centered audiology practices without increasing cost or spending a lot of time, precious time, in these evaluations. Finally, we'll end today's sessions by

covering the fourth outcome, where I've prepared a few videos showing bedside technique suitable for screening the vestibular ocular and vestibular spinal reflexes in practice. Okay, so what exactly are we teaching? This past spring and summer, I was involved in some survey research with Doctors Anne Hogan at Pacific University and also Dr. Robin Criter at Western Michigan University. We created an electronic smart logic survey and distributed it to the current Au.D. faculty and also recent residential Au.D. graduates to gauge how vestibular science was being delivered in residential AD programs. A portion of the study's results were then presented at the 2019 University of Pittsburgh's Audiology Teaching Conference. To date, we've had 38 respondents, 33 of which were totally completed but unfortunately of those 33, two neglected to indicate whether they were faculty or a recent grad, so the number that I'm showing you will be representative of a grand total of 31 surveys. It was a very even split between the groups. We had 15 faculty respondents and 16 graduate respondents. And while these numbers are admittedly small, we feel that their responses are fairly representative of what is happening in the programs.

We felt that a closer look at this topic was warranted because diagnosing and treating balance disorders has been an audiology scope of practice since the 1990s. This actually predates the transition from the Master's to the Doctorate of Audiology as a terminal degree, yet there does remain an inequality in the amount of time spent covering topics, specifically vestibular topics, in most programs. So the first question was how many courses are taught in your Au.D. program with the main focus on the vestibular system? The answers that we received ranged from zero to three courses, with a credit range of zero to nine credits. The average number of credits was three credits, actually. The most reported number of courses was two, so 17 respondents reported that they had two distinct courses specifically for the vestibular sciences. Eight respondents reported having only one course, only five respondents reported having three courses, and one respondent reported having no specific course for vestibular science. And when we compare this to the total number of credits reported for the entire curriculum, we found that vestibular studies accounted for between zero

and 8% of what is being taught, with an average percentage of 5%. The next line of questions asked respondents to rate the importance of topics as either critically important, moderately important, slightly important, not important, or not sure. Those that were ranked as either critically or moderately important were further defined as must or should be included in the curriculum respectively. The results of the questions are as follows. So, both groups were in agreement that vestibular anatomy, physiology, case history, VNG and ENG, VEMP, vestibular pathologies, and Epley and canalith repositioning maneuver be in the curriculum. Video head impulse or vHIT testing, rotary chair, falls risk, bedside evaluations, and case studies were also highly rated with at least one group in the 100% consensus of its inclusion. It was interesting and a little disheartening to see such low percentages for the history of vestibular sciences. Being a history buff myself, I took a little sigh when I saw those numbers because to me, it would be very hard to imagine teaching pure-tone testing without mentioning Bekesy or Carhart, or OAEs without talking about Kemp.

But perhaps the lack of appreciation is simply a lack of knowing that the vestibular science has been derived from a number of scientific fields, including otology, neurology, and even just general physics. And aside from clinical researchers like Epley, Dickson, Hall, Pike, and Barany, few others are known to the average clinician. Okay. Okay, so next we asked how content was being delivered. Respondents were asked for each topic to choose all that apply within the following categories: general vestibular course, advanced vestibular course, hands-on lab, other course, another course that's not vestib focused or not covered. Fortunately, only one or two of the respondents reported not covering history of vestibular science, bedside evaluations, vestibular case studies vestibular report writing, and vestibular rehabilitation. All other topics were reported as being covered in at least one, if not more, than the above-mentioned courses. And for the sake of time, I would like to focus on how much hands-on learning is being reported per topic. Okay, so hands-on learning is a meaningful experience, particularly when training future clinicians. The table indicates each topic, and those with the asterisk were previously identified as being either

critically or moderately important and are an essential clinical skill. As you can see, only 84% of respondents are reporting hands-on learning opportunities for VNG and ENG, and keeping this in mind for further on in the evaluation, get my little arrow here, only 45% are reporting hands-on training with bedside evaluations. Would we accept this percentage of hands-on training when learning basic pure-tone testing? I don't think we would, and I wouldn't think we would expect a student to perform a task if they haven't been given an opportunity to practice it, which leads me into our next topic. What are our expectations of newly minted clinicians? So we asked both groups to gauge their expectations and then compared the two group responses using a Chi-Square analysis with a P value set to about 0.05. We asked the recent graduates what level was reasonable to be expected of them following the completion of their coursework, and we asked the faculty what level they felt their students should be able to perform a list of tasks. So this would equate to either like a late-stage fourth-year student or a third-year if they're in the three-year program, or also a newly minted Au.D. graduate. The ratings scale was a five-point categorical scale, which included consistent, so with minimal assistance, adequate, needing some assistance, present, with moderate assistance, emerging, with constant assistance, or could not perform. And the following slides highlight the topics where recent graduates and faculty expectations were significantly different.

So the first significantly different expectation was the difference in the performance of calorics. As you can see, 60% of the faculty respondents thought that recent graduates should be able to perform calorics with very minimal assistance, and this is compared to Au.D. graduates ranking themselves as about 20%. So we have the 60% for faculty compared to the 20% for calorics. This, added to the some assistance, would actually equal the minimal assistance needed at the faculty performance. So we see the P value of about 0.0006, so very different expectations with calorics. Another task with significantly different expectations were the ability to perform VEMPs. Again, we see faculty reporting a higher degree of expected performance compared to recent graduates. As you can see, they are at least expecting, they have 27% expected

students or recent graduates to perform with minimal assistance, and we don't see that part of the graph at all over in the Au.D. grad expectation. They're thinking they will need at least moderate or constant assistance on this particular task. The same disparity is found in performing the vHIT, with 20% of recent grads even reporting that they would not be able to perform vHIT at all. They would not be expected to perform that. Whereas here we see a disparity where faculty would expect them to be able to perform it as well as the vast majority, well, 53%, excuse me, with either minimal or some assistance. Another significantly different expectation in performance ability is performing of rotary chair. You see 54% of recent graduates stating that they would not be able to perform rotary chair if asked. This is compared to only 7% of faculty expectations that they would not be able to perform it. The final significantly different expectation is within the performance of a falls risk assessment. Not surprisingly, recently Au.D. graduates were more conservative with generally expecting that they will need more assistance in most things.

However, again, not surprisingly. And it's probably not a bad thing that we want them to feel like they need a little bit more assistance because although we want them to be confident, we don't want them to be overly confident thinking that they need less assistance than they actually do. However, when we see such significant disparities between what the expectations are, this really is concerning for us. So, this is where things differed. Let's look at where things were rated not as significantly different, but the data's still pretty interesting here. So, not surprisingly, most agree that performing of at least a case history should be a very consistent skill with 73% expecting that this should be able to do. And also, since both groups weren't significantly different, I'm just showing the faculty expectations on this. Just bear in mind that the recent Au.D. graduates are slightly less than this, but still very similar in numbers there. So, while we can do case history, unfortunately, only about 47% felt that they would be able to perform bedside vestibular evaluations with minimal assistance. Much more, the larger piece of the pie, by 3% is that they would need at least some or sometimes constant assistance. So let's break down the VNG into its component parts because this is

realistically what a new graduate or fourth year would probably be expected to perform, and this is in line with, in my opinion, being able to perform a pure tone evaluation. At our university, we actually credential our students on this, so we have them perform and have them demonstrate that they are able to perform a VNG on a partner with no assistance from the instructor, and they're graded on a pass, no pass criteria. So we see the majority, about 67% to 60%, that they're able to perform ocular motor assessments, positional and also positioning assessments, and calorics. And then the next largest piece of the pie would be of some assistance, so that equals roughly about 80 to 87% that they would be able to do this fairly independently. With only that small 13% needing some moderate or even, for calorics, having that, again, 7% constant assistance. So that's good. However, when we move into more advanced vestibular assessments like computerized dynamic posturography, VEMP, vHIT, and rotary chair, we see just a spread of data, and in some instances there's very little percentage difference between an expectation of minimal assistance and one of constant assistance.

So for example, performing computerized dynamic posturography. 13% said they would need minimal assistance while another 13% say they would not be able to perform it. So, the larger these chunks or these pieces of the pie are, the more equally dispersed our expectations are, which doesn't lead to consistency, I think. So, clearly there's really no set expectations in these areas and I really guess it begs the question, should there be consensus as to what we expect our recent graduates and, as I said, perhaps fourth-year students' skillsets should be in the context of vestibular assessment? Let me get rid of that one. Okay, so wrapping up this topic, we see a very small percentage of courses and credits focused on vestibular science. And we also see a lack of consistency across survey respondents in terms of importance of topics and how clinical skills are being taught. We also see a lack of agreement in many areas regarding expectations between groups, but also within a given clinical skill. Which leads to our next learning outcome. What are some methodological approaches to improve technical delivery of vestibular skill? And I think that we must first provide

more hands-on learning opportunities, much like we do for our audiological assessments and hearing aids. There's many different ways we can increase hands-on learning. One is by using lab time and lab stations, having them practice on peers is fine. And it also gives them a chance to experience certain aspects, particularly of the VNG. What the goggles feel like, what it's like to place them on another person, and having them placed on you. And we certainly want to honor any student limitations, too. This is a learning experience, however. We wouldn't want to put a student in any harm's way, which we're testing them on our patients but they should certainly know what that feels like. There's also a potential opportunity for incorporating simulations into the curriculum. So, if you're not comfortable with delivering calorics on a student or a peer, we might be able to get a dummy head with a fake ear in it, and just practice inserting the caloric, whether it be air or water, into the ear. The same ears that you can use to practice ear mold impressions can work that way, that way the student gets an idea of what the depth is and how to just even hold the caloric irrigator and that sort of thing.

So, in order to address the disparities in expectations of programs or classes, could develop a skills assessment checklist. This we found to be important as well. That way the students understand what their expectations are and what my expectations are, so there shouldn't be any disparities between that. And as I said before, at our university our students are checked and verified that they can perform a basic VNG evaluation. And it's not all done at once. It's actually done, we do a midterm evaluation where we assess their ability to navigate the computer equipment, properly place the goggles, calibrate according to manufacturer specifications, give proper ocular motor instruction, and then maybe have them perform a positional testing with recording. And then the final then focuses on the more dynamic positioning maneuvers, and then caloric stimulation, and then some of the interpretation of the data as well, too. They're given these tasks at the beginning of the semester and then we work towards them with lab time so that they know exactly what is to be expected of them. So I wanna talk a little bit about vestibular specialty tracks. Only 3% of respondents, that would be one

of the respondents from our survey, reported that their program currently offered a type of vestibular specialty track. And believe me, teaching in the setting, I'm very aware that time within the curriculum is a commodity, and so perhaps having post-graduate certificate programs as a way in which we can mitigate this so that if the student is really interested in learning more of the advanced techniques, there'd be time afterwards. However, at least the general knowledge base of the existence of these tests, I feel should be within the curriculum itself. Then of course any continuing education opportunities, which is probably the current mode to fill any of the knowledge and skill gaps that exist. So, at this point I wanted to open this topic up to the audience. And if there's any points that you needed clarification of or wanted me to discuss further, I can go back in the slides before we close on and move on to some bedside evaluations. Nothing, you guys are all good? You're all asleep? I'm sorry. I have a question here. "Do we have data that indicates "how many of the programs in the country "do have all of the equipment "for a complete vestibular testing?" That's a really great question. No, and that's an honest question, too. Unfortunately the survey that we presented did not ask if equipment was available. That's a valid point. How can a program that doesn't have the equipment available to practice properly teach these skills, or what are they doing?

So, are they relying upon external placements for their students to learn the necessary techniques? I think it speaks to the size of programs, too. So, those that are maybe housed within and maybe only have six to 10 students or 12 students, they just may not have that ability to get the equipment needed in order to train because vestibular equipment is not cheap. That's a very, very big concern. So, I think, yes, knowing who has the testing equipment and whether they should or if it's available in a clinical program. I do know that some people don't have lab space in order to practice, but they might have a very well-equipped ear institute or an on-campus clinic where that's where their students are getting their on-campus training, too. That's a really good question, so that's maybe part two of the survey that we'll be focusing on, too. Are there any other questions? Okay. All right, so let's move on to the third outcome here

that we wanna look on, is to identify and describe when bedside vestibular evaluations are warranted in the general audiological population. So, even if you do not have expensive equipment, you can still incorporate simple screening evaluations in your daily practice, and in my opinion you probably should. If you're seeing one of these groups of patients, there is an opportunity for balance and vestibular education. So, if you're seeing pediatric, adult, or geriatric, we're gonna focus on some bedside evaluations that are appropriate for each one of these age groups. And I hope at least you're seeing one of those age groups, or I'm not quite sure who you're seeing. In terms of pediatric vestibular screenings, we often talk about delayed speech milestones in children as being an indicator for hearing screening. What we don't often talk about is if the child has delays in fine or gross motor skills as needing a vestibular evaluation. These are questions, however, that we do already ask in a pediatric case history or probably should, so, example, when did your child sit unsupported, or walk? In addition to saying the first word, these are all important gross motor milestones that show up on pediatric case histories.

But what do we do with that information? We're already asking it, but what are we exactly doing? Do we just put it in the back of our mind for later? Or better yet, here's a question: what should we be doing with that information? Are we probing any further, or are we just, like I said, putting it in the back and really not doing anything with it? As audiologists, we know what the educational consequences of untreated hearing loss can be. But what are the compounded educational barriers in a child with an undiagnosed or untreated deficit in the vestibular system that's affecting their visual acuity, specifically when their head's moving? Are there reading implications due to unilateral or bilateral vestibular dysfunction? And I just think we just don't know enough and we're not using enough of what information is out there. So, getting into the epidemiology, how prevalent is it and the precise prevalence is really difficult to identify, primarily because pediatrics may have a real difficulty, a difficult time describing vestibular symptoms. Sometimes acute or severe vestibular impairments can be mistaken for a gastrointestinal problem, primarily because nausea and vomiting

are often seen with vestibular impairments but also we know kids get the flu, they get the stomach bug, so it's trying to tease out which is what. Also, congenital vestibular impairments may be misclassified as more neurologic when it could just be a deficit in the peripheral vestibular system. Depending upon kind of searching through the literature, we see ranges from about 5.7 to 17% as having some type of vestibular disorder, and that's just within the general pediatric population ranging in age from three years to early adolescence. So this isn't even kids with hearing loss. This is just the general pediatric population with numbers this high. So, when we look at the prevalence of vestibular problems and balance disorders in pediatrics with hearing disorders, the prevalence becomes even greater. Not surprisingly, but in one study, which looked at the prevalence of pediatric vestibular disorders, 54.5% of children initially referred for hearing loss had some type of vestibular impairment as well. And most often found were children who had CMV, so cytomegalovirus, inner ear malformations, and other genetic syndromes. So, interestingly if we look at this, they looked at over 2500 children, 1,037 were referred for balance disorders. So we're not talking about those that were referred for balance disorders, we're talking within the hearing loss, that will be referred strictly for hearing loss.

This is where we see that 54% of those children presented with a vestibular impairment. You can see that in this particular study, too, about 68% were tested without cochlear implantation. So, the majority had that mild, moderate hearing loss and were not cochlear implant candidates. But there was about a little bit more than 400 who had severe to profound enough to be CI warranted who were included in this hearing loss population. So the same study took a closer look into children with profound hearing loss, and what they found was it's really a mixed bag. 40% had absolutely normal vestibular function, 20% had complete bilateral vestibular loss, and 40% had either partial, bilateral, or some type of asymmetric vestibular loss. So, 60% had something and 40% had nothing. I think this is something to consider. There's no set rules in profound hearing loss. I think it's really dependent upon the cause. If we can find what the cause of the hearing loss is, then we might be able to better guess.

But so if the cause is unknown, then further vestibular testing is warranted because there's a higher chance that they have something wrong than not. It is becoming routine to assess a child's vestibular system before and after cochlear implantation. So that same study found that 50% of patients post-cochlear implantation did demonstrate some type of vestibular impairment on the implanted side. So 41% had a partial vestibular loss and 9% had a complete loss on the side of implantation. Okay. Is everyone still hearing me okay? Okay. Okay, thank you, thank you guys for saying yes. Okay, so perhaps one of the most unexpected findings was that there were more children identified with vestibular impairment in the hearing impaired population compared to those who were initially referred for balance disorders. So as I said before, 54% of those with a hearing impairment were found to have a vestibular impairment, but that same study where we had all those patients referred for balance disorders, vestibular impairment was only present in 36% of those children. So what does that mean? So, I think this is mostly likely due to the complexity of balance and postural control and the involvement of the central nervous system and other systems in the body.

So these kids who are coming in with postural control, they very well may have some issues within their inner ear and their vestibular system itself, but it may be something else entirely. So we really don't know until we do some investigation and get some good diagnostic testing done. So another study looked at the causes of pediatric vestibular disorders by reviewing 2,000 charts. The most common diagnosis that they found here was something called migrainous equivalent, which comprised 25% of the diagnoses. 20% reported paroxysmal benign vertigo in children, in childhood, so this is not to be confused with benign paroxysmal positional vertigo, which is caused by displaced otoconia in the semi-circular canals. This is something entirely different, but paroxysmal benign vertigo in childhood is really identified through case history. Children will have just transient, very brief episodes of true rotational spinning, they might have nausea and vomiting, and then as quickly as it comes, it kinda goes away, and this can be a recurrent problem in some kids. So 10% of the study, the Pediatric

Chart Review study, had cranial trauma or traumatic brain injury, 10% had ophthalmic disorders, and 5% had vestibular neuritis, which is a more common occurrence as you get older where we see the unilateral shutdown of one of the peripheral systems. In other charts in this group we saw malformations, chronic otitis media, some psychiatric issues as well, too, orthostatic hypotension was a little bit less common. We did see incidents of BPPV and also some were classified as having Meniere's, though in children that's a very rare finding. Okay, so hopefully these numbers have convinced you that it is within your patient's and your best interest to start screening for vestibular imbalance problems within the pediatric population. So what would you observe clinically in this population? So, in infancy it is normal to see occasional bursts of nystagmus, but these are usually very brief as the child's vestibular ocular reflexes are kind of growing and figuring things out. But anything that's persistent should definitely be further investigated.

So, asking the parents or caregivers if they're noticing fast eye movements in their child, or if their child is unable to focus on their finger. Also, you want observe overall muscle tone and determine if it's lacking or not. Now this can be kind of hard unless you've been around pediatrics for a while, but you can kinda tell. In newborn babies, they have virtually no muscle tone. They're not moving around, they're just trying to figure out their own bodies at this point. But as the child starts to grow in its second and third month, and starts showing a little bit of coordination of movement. Are they able to hold their bottle a little bit? Or are they able to grasp at toys, those sorts of things? Or is the baby just kinda laying there and really not initiating any of those overall movements? That might be a cause for concern. And once the infant has developed neck strength to hold their head upright, then you wanna observe or inquire about some head-righting reflexes. That becomes the next area to ask about. So, once the baby's able to sit kind of on a caregiver's lap, having the baby face you and just having the mom kind of bounce on the lap or pat the back, seeing if the child's able to maintain their head over the center of their body or if it's flopping around. Of course you don't wanna do that until the child has the neck strength, but if the child doesn't

have the neck strength and it's about that time where they should, then that might, again, be a red flag for you. So asking the parents if they're able to lift their head up against gravity, for example during tummy time. Are they able to prop themselves up and turn their head over? Or is that something that they're struggling with? Another type of problem to ask about is something called torticollis, and this happens when there is a persistent contraction on one side of the neck and it almost looks like their head is pinned to one of their shoulders. And so this requires some physical therapy, and that has been found in some children with vestibular issues as well. So as I stated before, we are already asking about gross motor skills during our case history, so if the caregiver is reporting some delays it really can't hurt to follow up and ask more about what's going on.

Okay, moving on to toddlers and later childhood, it is absolutely normal for a toddler to fall down. I mean, the term toddle which literally means to walk with short steps. However, toddlers generally wanna explore their environment, so if you have a child who is light or motion sensitive and wants to sit still, that could be a red flag. I know having raised, my daughter's nine year old now, once she started walking, I couldn't stop her from going places that she probably shouldn't have. But seeing a child who's sitting down and not wanting to explore, not moving, that could be definitely something to raise a little bit of concern. Also if you're seeing nystagmus or if the caregiver is noting fast eye movements, then referral to neuro-ophthalmology is definitely recommended. And if the caregiver reports that the child is clumsier than their peers or has delayed motor development, that's another reason for referral for perhaps vestibular testing. If the child has periods of vomiting, if they're actually able to say that they feel like they're spinning, or they're wanting to lay still, all these things might be evidence for you to kinda further investigate or refer to someone who's well-versed in pediatric assessment. So let's talk about some of the symptoms and whether they would be classified as either peripheral or central. But first let me define peripheral. So, the word peripheral indicates that there is a problem within the inner ear. So, either the semi-circular canals, or the otolith organs, or both, could be the source. And the term

central implies involvement of more of the central nervous system, so from the eighth cranial nerve through the various pathways that comprise the integration and processing of all that vestibular, and somatosensory, and visual information. So, generally be suspicious of peripheral issues if there is nystagmus with head movement, if their vision is blurry with head movement, if they're below age levels in balance tasks, if they complain of a true spinning sensation, if they have hearing loss, or tinnitus, or some other coordination issues. More centrally located disorders tend to be more severe or widespread and they'll have delayed motor tasks and issues with visuo-motor coordination. They might also have those persistent reflexes like torticollis and they may have some other sensory integration difficulties. Turning to the next population that we probably see in our audio booth, let's talk about what's appropriate for adult vestibular screenings and why we should be doing them for just our average adult.

So, vestibular screenings. Using the NHANES data, a study found that 35% of US adults aged 40 and older had evidence of postural issues and the odds of having these postural issues increased with age. Okay, so, 40 years old is not old at all. This is your average adult patient. This is probably a lot younger than what our typical adult patients come by. But we just see this ever increasing with age. Very importantly, the odds of a balance dysfunction was 70% higher in those with diabetes mellitus, so type 2 diabetes. I know there's been a lot of talk. Diabetes is a hot topic within audiology itself. And there's justification for it. So not only in the hearing, the known effects involved in the auditory section of this, problems with balance doesn't just arrive from the vestibular system, it involves the peripheral somatosensory information feeding in, it's a combination of eye integration. And what does diabetes affect? But it can cause peripheral neuropathies in the feet, so dulling our senses down there. It can cause visual problems, so decreasing the amount of visual input in here in addition to its potential dysfunction or its potential effects on the inner ear itself. So it's not surprisingly that those with diabetes walking into our clinics might be suffering some type of a balance dysfunction. So when we do take hearing loss into consideration, we

see a 1.4-fold increase in the odds of reporting a fall for every 10dB of hearing loss over 25dB in adults aged 40 to 69. So again, we see this was based on the Lin and Ferrucci findings that were reported a little bit earlier, I think in 2012. So again, we see a younger cohort, adults aged 40-69, so these are still working adults reporting falls if they have hearing loss. So moving up a little bit in age, when we talk about geriatric vestibular screenings using the same NHANES data, a different study revealed 85% of those over the age of 80 exhibited balance dysfunction. And now both the American and British Geriatric Societies recommend annual screenings of adults 65 years and older, balance screening adults, okay? And as audiologists, I think we're in a perfect position to perform these screenings and of its potentially great benefit to our patients. I say this because a 2012 Cochrane Review found that there was a 24% reduction in falls in the elderly if healthcare providers performed clinical balance assessments, identified risk factors, and had referral and follow-up care strategies in place.

So, think about this in an age of showing improved outcomes in our patients, this can become crucial for our profession to really own vestibular imbalance screenings. We can really, truly serve as a gatekeeper and keep our older population safe in the meantime. Okay, so wrapping up learning outcome three we see that regardless of age, a significant number of our patients have some type or at risk for vestibular and, or balance dysfunction. And by implementing quick and simple screenings in an otherwise hearing-centric practice, we are realizing a fuller scope of practice and are adding value to our services. We also need to know where our referral sources are and build relationships with them. So we can't just screen and then say, "Good luck with that." We need to have a plan of action, like who are we aligning ourselves with? And there's a number of different people that we can talk about at the conclusion of this presentation. Okay, so now let's focus on some basic screening techniques for each population we've just finished discussing. Are there any questions so far before I move on? Anything that I've gone over with the rationale? If you do, feel free to type and I'll get to it, okay? Okay. Let me see where I'm at. So these bedside assessments that we're gonna show you do not require special equipment and can be performed in just

a few minutes. Let me get on the right one, there we go. So for pediatrics, we have the one-leg stance and questioning the caregiver as primary ones. For adults, we have the Halmagyi head thrust and Fukuda steps that I'll go over. And one thing that I wanted to add is the dizziness handicap inventory, which is a functional assessment, so it's a questionnaire that you can hand your patients. That can also be an easy ad for vestibular assessments for adults and geriatrics alike, particularly if they can't perform any of the tests that we have listed up here. So there will be some people where we cannot perform some of the actual screening tests but, again, something like the dizziness handicap inventory can give us some information and properly lead to appropriate referrals.

So, finally for the geriatric we have falls risk assessment, including the Timed Up and Go, and some quick screening questions. So let's go to pediatric screening procedures. So a study by Castiglione and Lavender found that the single-leg stance subtest of the Bruininks Oseretsky Test of Motor Proficiency II, or the BOT-2, I've been really trying to practice pronouncing that test name. But that was the most sensitive in identifying children with vestibular disorders. It's appropriate for children who are about four years or older, and it's very simple. You ask the child to stand on one leg and then have them close their eyes. And if they're unable to hold that position for less than four seconds, it's considered a fail and the child should probably be referred for further testing. So you wanna be sure that you keep the child's safety a number one priority during this test. So consider performing the test with you in a kind of a catch position or standing near a wall or the corner so that if the child does lose their balance, you're there to support them and you're not just letting them fall into something where they could, excuse me, potentially hurt themselves. Another very simple screening question that we can do in this population is asking if the child sat unassisted later than 7.5 months, if they began walking after 14.5 months, or generally, it sounds silly, but if the caregiver has any concerns for motor delays. That can actually serve as a very sensitive screening tool. And if they answer yes to any of those three, age of sitting, age of walking, or parental concerns, then you should really encourage them to reach

out for further information. Okay. All right, for adults who have reported some episodes of spinning or vertigo or blurry vision, a simple head movement can reveal vestibular deficit. So this test in and of itself has some contrary indications. It involves sitting eye-to-eye with the patient and asking them to focus on your nose while you move their head quickly and unexpectedly left and right. So, I have a video that will start here in a few seconds. But you're gonna see you only wanna move the head about 20 degrees from the center. It needs to be done quickly, and I guess we'll start the video now so you can see what I'm talking about. Oh, I guess I can start the video now. Oh, thank you. So I'm putting my hands on her head and I'm bringing them forward. I'm kind of having her to look at my nose. I kind of tilt it down a little bit so that her horizontal semi-circular canals are in line, and we shake, and we quickly turn, quickly turn. So I'm not going far, but I'm going randomly and I'm kinda giving her a little jiggle in between so she doesn't know when, exactly, I'm going to be doing that. So let's watch that again.

So again, always ask permission, too, to touch your patient's head. So tilt their head down, have them stare at your nose, and just go left and right. And so what I'm doing is I'm thrusting outward. You can actually turn their head outward and thrust inward if you're a little bit cautious. It's the direction of the head turn, not the end point. So if I were to turn the head slowly to the right and then thrust towards the center which would be a leftward thrust, we'd actually be activating that left horizontal canal there. So that's good. I think we wanna move on to the next slide. So, what's a fail on this one? Well, if you're looking at their eyes and their eyes move with their head and then they have to make a corrective move back to refocus on your nose, that's a fail, okay? What they should be able to do is no matter how fast or what direction you turn their head, they should be able to stay focused on your nose. So, what this implies is that, so when you thrust your head to the left, if their eyes move with their head, that means that that left vestibular system isn't activating the vestibular ocular reflex. So that may indicate a little bit of a hypofunction on the side towards the thrust. So you wanna do it multiple times, too, just to be sure that we have a consistent response. You can see it

doesn't take any extra equipment and it really only takes about 30 seconds to a minute to administer on most patients. So yeah, a normal response or a non-fail would be them keeping their eyes focused on you, and an abnormal response would be the eyes are moving with the head and then moving back to your nose to refocus. So another easy screening test do do looks at the vestibular spinal reflexes. So this is a little bit different. You wanna, of course, ensure your patient's safety so if they cannot stand or walk unassisted then they really should not perform this test. But what you do is you ask the patient to close their eyes and march in place for 50 steps. This is called the Fukuda step test. So they march in place for 50 steps and if their vestibular system is normal, they may drift forward and backward, but generally they stay close to the same place. And if they have a deficit on one side, the patient may turn towards the impaired side. So now the sensitivity and specificity on this aren't the best, but this can give you a general way for, again, that average adult population to screen it properly.

So let's take a look at the first video. This is the normal one as you'll see. Play, there we go. So he was just asked to march. Clinician is right there to make sure that he's being safe. You see he's moving forward a little bit and that's fine. A little bit of forward and backward is to be expected. But he's generally keeping pretty oriented. The students have a good time practicing these in the clinic. Okay, so let's take a look, then, at the second video. And this time what you're gonna see is I've instructed the patient to turn toward the right, but this does actually happen in people with vestibular hypofunction. You see just this little drift to one side. And the thing is when they're doing this, they really don't have any awareness that they're turning to one side. So what this is indicating, so when they turn, that indicates that the vestibular spinal reflex, that it's pushing against the weaker side. So if you think about using maybe let's say football, American football, as an analogy, or even rugby, where you have two forces that are pushing against each other, and the stronger one is gonna push the weaker one backwards, so this is why when turning to the right we indicate that the right side is weaker than the other. These are very easy to test, and bringing it back to vestibular education and the question about equipment, bedside screening evaluations don't

require any special equipment. This is something that we can and probably should be teaching all of our students so that they're comfortable with it and administering it so that we don't have to use equipment costs as a barrier for proper vestibular education and an assessment of our patients. Okay. So for our older adults, and sometimes even for the regular adult population, a falls risk assessment may be warranted. One telling screening is called the Timed Up and Go test, or the TUG test, and this assesses a patient's functional mobility. And again, it's a very easy test to perform. The patient is basically timed. You ask them to stand up from a chair that has arm rests, so they are allowed to use the arm rest to help them up. They're instructed to walk 10 feet at their normal pace, turn and return to the chair, and sit down. And if their time is greater than 12 seconds, it suggests a high falls risk level. I do this with every patient that I have regardless of age.

Generally, it becomes more adult-like for reasons but some kids, too, it's good. The way our waiting room is set up, we can actually call the patients and they're not looking at the door, they have their back towards me. So when I call their names, for example Mrs Jones, number one I say it as a hearing screening. If they don't hear me I know that, oh, we might be dealing with a hearing impairment in the VNG room, so we'll be sure to monitor how I'm delivering instructions. Or if they do hear me and turn, how are they just getting up out of that chair? Are they popping up and coming back really quick? Then I'm thinking, okay, we're probably fine. Maybe my radar isn't up for falls risk or talking about having that conversation with them. But if they're the type of adult who, I call their name, they say "Yes" and then they attempt to start to stand up, and they're doing the back-and-forth one, two, three, and kind of really creaky getting up, and then because they're not facing me, they do actually have to turn and start walking back towards the exam rooms, I can take a quick assessment of their gait. And I'm sure you guys have all done this subconsciously too when you call your patients back. Just seeing how they're rising to come back with you, even if you're not doing any vestibular testing at all. You know, is this person gonna be able to step up into the booth? Or am I gonna have to assist them? Or are we gonna have to find the flat

booth? How far can they walk? Do we need a wheelchair? Those sorts of things. So, again, you can do this formally or informally and when you notice this now, now this should really spark the requirement for you to have that conversation about falls, about the vestibular system. And maybe having some handouts available in your waiting room or back in the clinic room. Like hey, I noticed you were having some difficulty with mobility, here are some things to keep in mind at home. The last thing we want to happen is have you sustain a potentially life-threatening fall with this. So the other falls risk questions can, again, easily be added to your regular case history if they're not already in there. I mean, they very well could be in there already. But asking about the number of falls in the past year is very important. If they've had two or more, that alone warrants further investigation, okay? So, if they said, "Yeah, I fell twice", you wanna ask about that. If they report one fall without an injury, do a Timed Up and Go test and perhaps if that's okay, and they seem to be walking pretty normally, no further assessment is really required. But if they report a fall and you notice their TUG test is longer than it should be, or if they're weaving back and forth, or they're complaining of dizziness as well, then you should really consider trying an assessment or recommending further assessment.

Also important is reviewing their medications. This population tends to be polypharm-heavy, meaning multiple medications, and a lot have dizziness as a side effect. I forget the exact number but I know it's in the thousands at this point. Particularly be aware of psychoactive such as antidepressants, antipsychotics, also benzodiazepines, antihypertensives, any nonsteroidal anti-inflammatory drugs or diuretics. All of these are known to increase the odds of incurring a fall. And also as I said with polypharmacy, just taking four or more medications has been shown to increase the risk of falls at that alone, regardless of medications. So I have a question. So if a high falls risk is determined through a screening during a hearing test, what would be the safest next steps to protect that patient, especially if the elderly? Great question. And I think as I said before, having that conversation with them, giving them literature. And the Vestibular Disorders Association has a good amount of information on their

website. Also the AGA, the American Geriatric Association and ABA also has falls risk information and things you can do to keep yourself safer. Home checklist, those sorts of things, can all be very valuable for the patient or the patient's caregiver to have, and really educating them on the severity of a fall in this population can be enough to make sure that they're taking all the precautions they can. We can't prevent every fall, and I wish we could, but, again, as audiologists, I think we're in this population, we need to be more adamant that we care and that we're trying to keep our patients safe. I mean, I don't know about you but I get heartbroken when I hear of a patient of mine who's had a fall, whether it be one in for vestibular testing, but more often than not it's my hearing aid patients, it's my patients who I'm seeing, and maybe we didn't even have that conversation years ago and now we find out that they, again, have incurred a fall with that. Okay.

So Carolyn, forgive me, I'm ending a little bit early here. I didn't time it right, my apologies, but I wanna bring everything to a close. Hopefully we can have some more great discussions that'll fill out the last part of this last 10 minutes. But so regarding vestibular education, sincerely believe that there's a need for increased consistency between the programs, particularly in the areas of bedside evaluations being taught, given that's something that doesn't need heavy equipment costs. But if we can teach the students the value of these types of assessments, and I don't pretend to think that all of my students fell in love with the vestibular system. In fact, I am very sure that many of them do not like talking about the vestibular system for as long as they have to. We are one of the few programs that have three courses in there. So I know my students who never really want to incorporate that into their practice heavily, but all of them leave knowing the importance of the screening questions that need to be asked and the importance of reducing falls risks for the elderly and the importance of identifying barriers to education other than hearing loss in the children if they decide to do pediatrics. So, giving our up and coming students that these tools are important. And we also need to, outside of school there are many practicing clinicians that don't have this awareness of the importance of bedside evaluations and how to incorporate

them into their more hearing-centered clinical practice. And this has, again, intrinsic value to our patients but also to our profession. If we come at it with the light of protecting our patients but also practicing to our fullest scope can be huge, and maybe that's the draw, that's the differentiator between us and other places where they could get their hearing assessed or get their hearing aids. And finally, in terms of application to your clinical practice, I hope that you see the value in vestibular screenings regardless of the population that you serve. And my hope is that in the future, we see a reduction of falls and an increased quality of life measures in all of our patients. So, I'd like to thank you for your time and attention. These are just several of the references that we've listed in terms of getting this presentation up and ready for you. And I will entertain questions now. Or any other discussions.

- [Dr. Smaka] Thank you so much Dr. Myers. Kimberly is pulling up some polls for our attendees while we wait for questions. I actually had a question for you. Did you set up the Salus Vestibular Clinic, or was that there before your time?

- [Dr. Myers] Well, that's a good question. It was partially done. We did have a rotary chair, and we did have a computerize dynamic posturography, but then as our class sizes grew, we added different stations. And we just recently, our old rotary chair died so we did just get a brand new rotary chair to replace it. So yes, we do have a dedicated lab. We have four VNG stations in addition to the clinic where we have an additional VNG and vHIT in the clinic. Now, the clinic shares our rotary chair and computerized dynamic posturography, so we are fortunate that we have a small campus so that we can transfer the advanced vestib patients over to the lab when we need to borrow the rotary chair for them.

- [Dr. Smaka] And do you see children and adults?

- [Dr. Myers] We do.

- Oh, awesome.

- We do. Yeah, and I've taught my pediatric hearing clinician counterparts to do the one-legged stance for all their pediatric patients and they really have a good time doing it. I mean, kids, they're probably fearful, we know how challenging, sometimes, pediatrics can be, but kids tend to love balance questions because it's just like playing with them on a playground. So I've really not run into a lot of pushback for having kids do basic postural tests. I mean we have foam that they can stand on so it's kind of like squishy like the foam pits that they play in in the SkyZone and jump boxes, so we have a good time.

- [Dr. Smaka] Oh, that's great. We have a couple polls and then after the polls, we do have questions that have come into the Q&A. So we'll start with the first poll for the attendees. I'm just curious of the folks logged in today, it looks like we have about 60 people, do you currently do vestibular testing in your practice? And if you answer yes to poll number one, let us know on poll number two what your patient caseload is. So we'll give those a minute to come through. Again, we have almost 60 people in the classroom so I'm hoping most everyone can click on these polls. Just click on the radio dials right in front of your screen there. Thanks for those of you who are. And then in the meantime, we'll go to some of these questions. Ingrid asked, "I have added the Romberg test "to my ENG battery, I'll add the bedside test "discussed here as well."

- [Dr. Myers] Aw, thank you, good.

- [Dr. Smaka] Yeah, that's great. Thanks for sharing that, Ingrid. Megan asked, "Can you please describe again "what an abnormal Halmagyi head thrust indicates?"

- [Dr. Myers] Sure. So, an abnormal Halmagyi head thrust indicates that there could be a peripheral weakness to the side of the thrust. So if you're holding the person's head

and you thrust their head towards the right and their eyes travel with their head instead of staying focused on your nose, that indicates that potentially, that right peripheral balance system, specifically the horizontal canals, might be reduced in function.

- [Dr. Smaka] Thank you, and if my memory serves me right, Megan, I think we have a head thrust, a whole course on that by Devin McCaslin I think in our course library, if you just wanted to look more into the background and how to exactly perform and all that. So, I'm pretty sure we have a course like that. Our next question from Ingrid, or comment, she said, "In California, vestibular rehab", I think she means is provided by physical therapists. She says it's not but I think she means it's provided by physical therapists. "I lost reimbursement so I had to end "that aspect of my practice."

- [Dr. Myers] Yeah, unfortunately the way things are currently, but maybe not in the future, reimbursement through Medicare for vestibular rehabilitation, like any aural rehabilitation, those rehab codes aren't in our wheelhouse yet. I've had patients pay out of pocket and I've also aligned myself with several local physical therapists that we work with and they take the results of our testing to heart when they're designing exercises, too. So, yeah, it's a shame because I think I'd really enjoy incorporating a vestib rehab practice in there, but you could get those referral sources, too, to the local physical therapists if you're additionally doing the fall screening. And again, we're not talking an investment in equipment and not a lot of time to just incorporate these. We're just pretty much adding value to them coming to see you in the first place.

- [Dr. Smaka] Right. Just to go back for the polls for a minute there, I think everyone can see the results here. We have about a 50-50 split on people doing vestibular in their practice, maybe a little leaning more toward people that are not today. And then of the people that are, we're seeing more doing adults. That's not surprising, but it is nice, actually, for me to see that a few people in the classroom today are seeing children. So we have a comment from Michael. "Is the head thrust test the most "appropriate for VOR screening?"

- [Dr. Myers] It is for patients who have the ability to move their neck like that, yes. VOR screening, this is very sensitive to unilateral vestibular losses, and because you're moving it at such a fast rate, that's how we get this kind of nice sensitivity and specificity. And actually the head thrust, it was the original design for what we call the vHIT now, it's the video head impulse test. So the video head impulse test requires an expensive piece of equipment to actually video record these eye movements, but that entire test was based upon this head thrust ability to really detect abnormal eye movements at a very fast rate. So, another screening test that we didn't get a chance to talk about would be something like the Snellen test where you use an eye chart and you gently shake their head back and forth and you look for a change in visual acuity while their head is moving. That's a little bit less sensitive, and it generally, if we're suspecting more of a bilateral or more involved problems, those people, their vision will actually get significantly worse with that. But no, for the sake of VOR screening a head thrust if, again, they don't have any neck or back contrary indications, that's a really good screening tool.

- [Dr. Smaka] Thank you, we have two more here in the queue. Ina has asked, "In patients with disconjugate eye movements, "can we do head thrust tests?"

- [Dr. Myers] Oh, that's a good question. It depends what the disconjugant eye movements are from. So if it's like a lazy eye or amblyopia, you're gonna be looking more at their stronger eye, that's probably the one that's going to be focused on you anyway. So I would look at that eye independently and for the lazy eye, the eye that's maybe turned out, then it would be harder to see any type of true movement in that eye. That's a really good question. Certainly, if they don't know why they have disconjugant eye movements, if they don't have a relationship with a neuro-ophthalmologist, then that would be an excellent conversation to have and just say, "Hey, is this something "that you've had since childhood? "Or is this something that's recently occurred?" So that they can get the proper treatment that they need.

- [Dr. Smaka] Thank you, and she comments that she is a previous student of yours at Salus. So, welcome, welcome previous and current Salus students. We'll give it another minute. I don't see any other questions in the queue right now, but I know sometimes things come up. So we'll give it another minute. While you guys are thinking or typing, I'll just remind you that next week's webinar on Audiology Online, same time, noon eastern on Wednesday, from noon to 1:30, we'll have with us Dr. Anne Hogan speaking about vestibular rehab. So I think even if you're not doing rehab, reimbursement issues or whatnot, I think it's still always great information to have, especially if you're thinking of getting into testing, or even for referrals if you're not doing any vestibular in your practice at all or counseling. So I know it's going to be a great webinar. I got a sneak peak on the PowerPoint. I think you'll really enjoy it if you can attend. Any comments on that, Dr. Myers? I know you work with.

- [Dr. Myers] I wish I could see it. Unfortunately, I am busy that day, but no, Dr. Hogan is a great presenter, she's dynamic, and this particular topic of hers is well-versed on. So yeah, this is a non-miss type event.

- [Dr. Smaka] And the good news is it, just like today's webinar, it will be recorded and available on-demand, so anybody who can't attend the live webinar, I love the live webinars with the interactivity, hearing from you guys, questions and comments, but if you can't attend, it will be available in our course library as an on-demand course a few minutes afterward. Well, I don't see any other questions coming into the Q&A today, so Dr. Myers I just wanna thank you so much for all your time and expertise. It's been great working with you and Salus University.

- [Dr. Myers] Great, thank you so much Carolyn. Have a great day.

- [Dr. Smaka] Have a great day, everybody. Thanks for attending today, hope to see you next week. Bye now.