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Vanderbilt Audiology Journal Club:  
Cognition and Self-Efficacy  
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- [Carolyn] It's my pleasure to welcome back to Audiology Online Drs. Erin Picou and Todd Ricketts. Dr. Ricketts is Professor and Vice Chair, Department of Hearing and Speech Sciences at Vanderbilt University and Medical Center. He is the Director of the Dan Maddox Memorial Hearing Aid Research Laboratory. Dr. Erin Picou is a Research Assistant Professor in the Department of Hearing and Speech Sciences at Vanderbilt University Medical Center. She currently directs the Hearing and Effect Perception Interest Laboratory, which is funded through a variety of industry and federal funding sources. Both Dr. Ricketts and Dr. Picou are involved with the teaching and mentoring AUD students at Vanderbilt, and you can read a longer bio for each presenter on our course registration page, or by visiting [medschool.vanderbilt.edu](http://medschool.vanderbilt.edu). At this time, I'll turn the microphone over to Dr. Picou.

- [Erin] All right, thank you Carolyn for that introduction, and for the opportunity to be here today. Dr. Ricketts and I are both really excited and really appreciate the opportunity to review all of the hearing aid research articles that have been published in the last year, and then explore some of those in more detail, especially looking for those that might have some key clinical takeaway points. So that's what we've done. And I also want to thank all of you for taking the time to tune in and explore those hearing aid research articles in more detail with us. So these are our disclosures, they are listed here for your information. The one I do wanna say is that we are receiving an honorarium for today's talk, which we are donating back to our home department, which is the department of hearing and speech sciences at Vanderbilt University, and we're not gonna talk about any specific feature or product today. Because it is a journal club, our learner outcomes are focused really on those research articles that we're gonna talk about and explore together. So by the end of today's webinar, I hope that you will be able to list the key journal articles that we talk about. For each of those journal articles, I hope that you will be able to describe, very briefly, the purpose, method, and results/conclusions for each of those articles. And finally, I hope that you'll come away with some clinical key takeaways from each article because we really

selected articles that we thought had some clinical implications. So as I mentioned, we went back and we read the hearing aid related papers in the last year. So we went from about March of 2019 to February of 2020. We read them all, and we came up with some that we thought grouped together nicely around two separate, but related, themes of self-efficacy and cognition. So I'm gonna talk about three hearing aid related articles that focus on self-efficacy, and then I'm gonna turn it over to Dr. Ricketts who's gonna talk about a couple of hearing aid related articles that focus on cognition. So the first one I'm gonna talk about is from a group out of Australia, and it's called The relationship between hearing loss self management and hearing aid benefit and satisfaction, and it was published in 2019 in the "American Journal of Audiology." So their question was, "Is there a relationship "between self-reported hearing loss self-management "and self-reported hearing aid benefit and satisfaction "when we look at a group of experienced bilateral "hearing aid users?" Well what is this and what does that even mean?

So to back up a little bit, we know that the ability to self-manage a chronic condition, like hearing loss, is a factor that influences a person's experience with that condition. So self management is, by definition that I've got listed here, "The knowledge and skills "that are used to manage the effects of a chronic condition "on all aspects of daily life." So this includes skills like the ability to use and manage a prescribed intervention, maintaining physical and emotional wellbeing, making sure that a person is monitoring and responding to changes in that chronic condition, seeking out, knowing where resources are, and using resources and support related to that condition, and really taking an active role in a clinical decision making surrounding chronic condition. So when we think about hearing hearing healthcare, some of those things apply and some of them don't, but self-management in hearing healthcare can really be these three things. So knowing about one's own condition, so the factors that caused the hearing loss in the first place, knowing about treatment options and management strategies, so both what options are available for my particular degree, type, and configuration of hearing loss, as well as how do I interact with my environment to optimize my hearing

abilities as they are? And then finally, managing the social and emotional effects of the condition on everyday life, so how well is somebody coping with their hearing loss on an emotional and social level? More generally, outside of hearing loss, we know that self-management is linked to treatment outcomes, so people who are better at self-managing things like diabetes have documented better glycemic control and better blood pressure. We know that self-management is related to better handling of the day-to-day demands of the chronic condition, more feelings of empowerment, and also better self-reported general health. So if all of these things are true for self-management of other chronic conditions, the authors of this paper wanted to know if self-management of hearing loss is related to outcomes with hearing aids. So the authors evaluated the relationship between self-management and hearing aid benefit and satisfaction using questionnaires. To measure hearing aid benefit they used the abbreviated profile of hearing aid benefit. If you're not familiar with it, that's a 24 item questionnaire where a respondent rates the degree of difficulty they have in their everyday listening situations. And there are four sub-scales of that questionnaire.

So these are questions related to ease of communication, difficulty listening in background noise, in reverberation, and then the degree to which sounds are aversive. To measure hearing aid satisfaction, the authors used the satisfaction with amplification in daily life, this is a 15 item questionnaire, it also has four sub-scales. And those are related to positive effect of the hearing aid, service and cost, negative features, and personal image. To evaluate self-management, they also used a questionnaire paired with an interview. So they used the Partners in Health Scale, which is a 10 item questionnaire where the respondent rates their own ability to self-manage their hearing loss, and then following those ratings, an interviewer follows up each of those 10 items with some questions, and then the interviewer also rates the respondent's ability to self-manage. So they used the Partners in Health Scale plus the Cue and Response questionnaire for that. Let me just go into a little bit more detail about that. So the Partners in Health Scale, when the authors did some factor analysis, they found that the questions lumped into three main domains. Self-management

about knowledge, so how well somebody knows about their hearing loss and what appropriate treatments and management there is for that hearing loss. So for example, a person would rate how much they know about their hearing loss, and in an interview follow up question in the Cue and Response, would be, "What do you know about your hearing loss?" In the actions domain this is things like attending appointments, adhering to recommendations and treatments, self-management in the active shared decision making process with the clinician, and monitoring changes and addressing those changes. So for example, a rating here would be, I attend appointments as asked by my hearing healthcare professional, and then an interview cue would be, "Is there anything "that prevents you from attending appointments?" And then finally, the third domain is psychosocial behaviors, so this is how well somebody is coping with the emotional wellbeing and social participation. So on the Partners in Health scale, an example is I manage the effect of my hearing loss and how I feel, and then the interviewer would follow that up with, "Does your hearing loss "ever get you down?"

So as you can see, higher scores would be indicative of better coping and more self-management of hearing loss. So these authors recruited 37 adults who were 52 to 83 years old and they have bilateral hearing loss, longstanding, and they're all existing BTE hearing aid users. All of them wore their hearing aids for more than four hours a day, and most of them wore it for more than eight hours a day. So what they found is no relationship between the knowledge domain of self-management and hearing aid benefiter satisfaction. So it really didn't matter if somebody knew more about their hearing loss, they weren't able to apply that to get more benefit or satisfaction from their aids. Although there was a relationship between age and knowledge. So people who were older tended to demonstrate lower self-management in that knowledge domain. In the action domain, they found that self-management scores were positively correlated with satisfaction on the positive effect scale of the satisfaction questionnaire. So that means that people who had higher self-management abilities had greater satisfaction with the extent to which the hearing aids improved their speech understanding, reduced the need for repetition, and produced a natural sound

quality. So being able to take action, and attend appointments, and get those follow up visits, make the most out of those follow up visits led to better satisfaction with the hearing aids. And then finally in the third domain, psychosocial wellbeing, was related to both hearing aid benefit and hearing aid satisfaction, accounting for a pretty big chunk of the variants in both of these domains. So people who demonstrated better psychosocial wellbeing self-management reported less difficulty in background noise and reverberant situations. So when they are better at coping and managing the psychosocial effects of their hearing loss, they can understand more in background noise and reverberation, which are pretty difficult listening situations. And then also when they demonstrate better psychosocial wellbeing self-management, they also are more satisfied with the appearance of the aid, and the extent to which other people perceived them as capable.

So this is just a direct quote from this article, and they say that, "self management statistically accounted "for 18 to 26% of the variance in particular aspects "of hearing aid benefit and satisfaction, "suggesting that self-management is one of the important "components of hearing rehabilitation." So they're related, and they're strongly related. So this suggests that people who are better able to manage their situations and have better coping skills are likely to do better in difficult listening situations. So it's not just the hearing aid that's doing it, it's also the psychosocial self-management. So the authors argue that this calls for greater focus of the psychosocial aspects of hearing loss in patient-centered care. So by incorporating patient-centered care, we could lead to lead to better hearing aid satisfaction and benefit. So does it matter clinically? I would say yes. So we know that hearing aid satisfaction rates are generally pretty high, and we've identified a whole host of factors that can lead to hearing aid satisfaction. So people who report more unaided hearing, more difficulties hearing unaided are more likely to be satisfied, people are more likely to be more satisfied with newer hearing aids, when the hearing aid sounds good. But this study suggests that self-management is a big piece of that hearing aid satisfaction, a big piece of hearing aid satisfaction. So that is the first article I wanted to talk about, which demonstrated self-

management is related to hearing aid satisfaction. The next one asks, well how do hearing aid owners acquire hearing aid management skills? So we're shifting a little bit from hearing loss management to hearing aid management, but we're still in that self-efficacy domain. So this article was published in 2019 in the "Journal of the American Academy of Audiology," also from a group out of Australia. And I think it's pretty clear what they asked. How do hearing aid owners acquire hearing aid management skills? So we know that as hearing healthcare providers, we train hearing aid users how to handle and maintain their hearing aids. But we also know that hearing aid users have difficulty with this. So upwards of as high as 90% of people have some trouble managing some aspect of their hearing aids, and we also know that there are some factors associated with hearing aid handling skills. So ITEs are easier to manipulate than BTEs, females are more likely to have difficulty.

Also apparently, stock photo audiologist models have some hearing aid handling skills difficulty, so in this figure, you probably can't see it, 'cause it's too small, but that is a left hearing aid going onto a right ear. It's not just that one. This stock photo audiologist is also having some trouble, not really sure what the plan here was, but if you follow that movement all the way through, the hearing aid's gonna not be managed well. So those are some things that can affect hearing aid handling skills. Common clinical practice, so this might not apply to you, this might not be how you're doing it, but this is a pretty common way to train people on hearing handling skills. It would be about 45 minutes of training averaged across two to five appointments over the first 30 to 45 days of the oral rehabilitation program. So often this is in face-to-face appointments, and it might be supplemented with written or digital materials such as handouts from the manufacturer or clinic-specific handouts that you might have developed. So there's some limitations to this approach. You might have experienced some limitations on your own, this is a list that the authors came up with. Excuse me. So for example, it could be perceived as information dumping, so audiologist is just pouring information into the patient. We know that owners are unable to recall 25 to 65% of information, only four weeks after they've been fit. So they're losing a lot of

what we're dumping into their brains. And, at least in 2010, there was some evidence to suggest that clinicians had a limited understanding of health literacy and how that might affect hearing aid handling skills and uptake. But we know that hearing aid handling skills are important for success. So if you have trouble managing your hearing aids, you're gonna be less likely to use them, less likely to benefit from them, and less likely to be satisfied with them. So we need to help support our patients acquire these hearing aid handling skills. So that was the focus of this article, how do hearing aid owners acquire hearing aid handling skills? So these authors used concept mapping to identify key themes. So in a concept mapping study, participants first generate, sort and rate the importance of the statements, and then the data analysis pulls out some key themes.

So the question was posed to two different groups of participants, hearing aid owners and clinicians, and they were asked to generate statements around the question "How do hearing aid owners learn skills required to use, handle, manage, maintain, and care for their hearing aids?" So they come up with, separately, the hearing aid owners and the clinicians come up with statements to answer that question, and then they were rated, sorted, and themes are identified. So they did this in two sessions. So in the first session it was just brainstorming, so that's the statement generation. So people are putting out ideas, all the statements get written down, they're all visible for other people to see, and then other participants in the group could expand on the statements, and generate their own statements. So the clinicians and the hearing aid owners didn't see each other's statements, but they saw the statements in their own group. The hearing aid owners did this in an in-person meeting and the clinicians did it remotely. And then the second session, the participants come back and they sort and rate those statements, and come up with a theme. And so rating them, they rated how often they used that mode of learning, and then how beneficial that mode of learning was. So these authors found six main concepts related to how hearing aid owners acquire hearing aid handling skills, and these are relationship with the clinician, clinician as a source of knowledge and support, hands-on experience, seeking

additional information, asking for support, and external resources. So let's go back to the top. When we think about relationship with the clinician, an example statement of something in that theme would be, "Having a good relationship with the clinician, especially open lines of communication to be able to ask for support." So it's really about the therapeutic relationship. The next one down is really about the clinician as a source of knowledge, a source of knowledge, I don't know. A source of knowledge. So asking the clinician to summarize the important tasks on a cheat sheet, a simple overview of common hearing aid instructions would be an example statement from that domain. Hands-on experience, for example, trying new things if they can't do things the clinician has instructed, showing different ways to insert the hearing aid. Seeking out additional information, so this is repeatedly asking questions until they get an answer that makes sense to them. The fifth, asking support for other people, so asking partners and or family members to attend appointments, or to do it for them. And then finally, external resources is accessing information through mediums other than the clinician.

So through newsletters, going to the library, or borrowing books. So both groups of participants rated how often they did these things, and how useful they were. So of the six concepts, hearing aid owners and clinicians said that the hearing aid owners used them similarly often except that hearing aid owners reported using their relationship with their clinician less than the clinicians rated it. And then this is, as you might imagine, not all of those modes of learning were equally useful. So this figure is showing, in those six domains, how useful clinicians and hearing aid owners rated each of those statements. So higher means that the mode is more useful and lower means that it's less useful. You can see that generally, hearing aid owners and clinicians agreed about the relative utility of each of these domains. Whereas hearing aid owners generally also felt that a particular thing was less useful than the clinicians. So those differences were statistically significant where those red arrows show up. So you can see that they're rank ordered, so the most helpful thing, rated by both groups of participants was that relationship with the clinician. So that therapeutic relationship

and also using the clinician as a source of knowledge were the most useful ways that hearing aid owners acquired hearing aid handling skills. And in general, these four, relationship with the clinician, clinician as a source of knowledge, seeking additional information, and hands-on experience or practice were generally deemed useful. Whereas asking support from other people and using external resources were rated as less useful by both groups. So this means that those trial-and-error techniques were rated not so useful, and the authors thought that that might be because the hearing aid owners' baseline skills are too low. So if you just don't have very many skills in the first place, trial-and-error isn't gonna help. We might be able to help increase those trial-and-error techniques and increase their utility by empowering the patients and helping them get some good, solid baseline skills before we turn them over to trial-and-error. And then another one that came up as not very useful was reading pamphlets.

So I forgot to mention that this study was actually conducted in 2015, and around that same time in 2015, there were a couple of other studies that documented the readability of the hearing aid manufacturer and clinic-specific pamphlets, and it turns out that around that time, and probably before that, those pamphlets weren't very readable. So they were written at really high grade levels. So it might be that those pamphlets are more useful now than they were in 2015. But the authors think that the readability of the pamphlets contributed to the low benefits of the external resources. So why is this important? Well, it gives us insight into how we can help support our patients learning hearing aid handling skills. So we know it's our job to help them do that, to support them, and we can see that we play a pretty key role. It's also clear that we are not the only role, and currently, at least in 2015, the role of family, friends, and external others was kind of low. So another way we could improve that would be to include spouses or friends in the training, or maybe even put out general trainings to the world at large so that there's a bigger resource network to help our patients acquire these hearing aid handling skills. So does it matter clinically? Yeah, so the authors suggest that we can enhance our hearing aid owners acquisition skills by using more diverse methods. So instead of just doing a face-to-face training and maybe sending

them home with a brochure, we could develop personalized training programs, give them the opportunity to learn, demonstrate practice during those appointments, also give support materials that are written at an appropriate grade reading level so they're understandable and digestible, and then empower the client throughout the hearing aid fitting process. So specific recommendations from the authors would be increase the use of tactile training methods. So have the patients demonstrate for you in the office, or remotely, that they can do these tasks. Tailor those training goals, so focus on specific tasks in the first few weeks, and then broaden to the more difficult ones after they've developed that baseline level of hearing aid handling skills. Supplement the training with these digital and written materials that are, again, using easily read materials, and maybe even targeting them towards the caretaker or significant other. Develop a strong therapeutic relationship, and then the authors recommend unbundling price structures to put a value on the services provided so we don't just put hearing aids on and send them out the door.

Okay, and then the last article that I wanna talk about is the factors associated with successful setup of self-fitting hearing aid and the need for personalized support. So this, again, is thinking about self-efficacy, and when we think about how our service delivery models are changing, this article really addresses the factors that are related to having somebody be self-efficacious during the whole hearing-aid fitting process. So the authors wanted to know if there were personal factors that would help predict whether or not somebody could self-fit a hearing aid. So if we could identify personal factors that would predict who would be better at self-fitting a hearing aid, or who would need more support, we could then tailor our services based on the individual patient. The authors were interested in a couple of factors of interest, cognitive status, locus of control, hearing aid self-efficacy, and problem solving skills. So we know that changes in our hearing healthcare system are here, so over-the-counter hearing aids are what they are. Clinics are looking into and maybe even implementing limited service delivery models, we are in the middle of a global pandemic, which has changed a lot of the ways that we can deliver our services, and so a self-fitting hearing aid, or

identifying the factors that are related to needing a lower hands-on, lower face-to-face service delivery model can really help us, again, tailor those services to best meet the needs of our patient in the current environment. So a self-fitting hearing aid is a specific way to look at this, but this is a hearing aid, or a personal amplification device that's designed to be set up and managed by the user. So a hearing aid user would need to select, connect, and adjust the components. So example, the tubing, and the domes, they would do audiometry through the hearing aid, then the hearing aid would apply a prescriptive fitting rationale to the measured threshold, and then the user can fine-tune or train the settings. So I've put a green box here around the things that are different about a self-fitting hearing aid than a traditional hearing aid. So in a traditional hearing aid, the user could have fine control, and as an audiologist, you could prescribe and fit the hearing aid and send them out the door, but the user now is involved in the selection, and the setup, and the audiometry. So this is what's really different.

So we know, the reasons that the authors were interested in that list of personal factors is because we know that an intact cognitive status, higher self-efficacy, and internal locus of control are associated with successful hearing aid use. So locus of control is the extent to which an individual believes that they can influence the events in their own lives, or the events in their lives are left up to something else, powerful other, or not-so-powerful others. We also know that manual dexterity and health literacy are associated with day-to-day hearing aid management tasks. So why does it matter? Again, I think I've already said this, but establishing those factors that can facilitate limited service delivery options can really help us expand our clinical practices, so meet a larger need of people who have hearing loss and have more hands-on time for people who need more hands-on time. And that's really gonna help us individualize our hearing healthcare, and broaden our clinical practice, and reach a broad spectrum of patients. So these authors measured patient factors. So they measured health locus of control using the Multidimensional Health Locus of Control Scale, which looks at, like I said, the extent to which somebody believes that the

events in their life are the result of a powerful other or chance. They measured hearing aid self-efficacy using the Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids, which is easier to read than to say. But it measures basic handling skills, advanced hearing aid handling skills, adjustment hearing aid related skills. They also did a problem solving skill test, which sounds kind of fun, which is the Twenty Questions subtest of this executive function system test. So the participant asks the examiner a series of questions and tries to guess what the answer is based on those 20 questions. They measured the cognitive status using the MoCA, or the Montreal Cognitive Assessment test. They also measured demographic data and hearing thresholds. Then they sent the patients home, and brought them back, put them in a room and said, "Okay, here's your PowerPoint slide, here's the tools you need, "and here's a telephone. "I want you to self-fit this hearing aid. "If you need help, call, and we'll have somebody "who will answer the phone." So they were instructed to complete a nine-step process, which was to pair the hearing aids to a mobile device, identify which hearing aid was left and right, select the correct ear size, adjust the length of the tubing, insert the hearing aids into their ear, ensure the fitting app had identified the correct hearing aids, test their hearing, adjust the settings, and then learn how to care for the hearing aids.

So the authors judged the degree to which people could do each of these steps. To provide support for the patients, the authors were trying to do all of the best practices, so the instructions and the PowerPoint slide were written at a 5.8 grade level, they had videos of what they thought would be the hardest steps, and the videos were captioned, they had that telephone available for the clinical assistant, and then the assistant monitored the participant's progress through webcam and headphones, and then the assistant judged whether or not they successfully completed those tasks, so whether they got it right and whether they did it independently. So if they called that clinical assistant, then they weren't independent. So the successful self-fitter accurately completed all steps independently with or without help from that clinical assistant. And an unsuccessful self-fitter had unresolved errors and the hearing aid

was never successfully fit, they weren't ready to go out in the world with it. So the participants were 60 adults, aged 50 to 85 who has pure tone averages between 25 and 65 dB. 30 of them were experienced hearing aid users, and 30 of them had no hearing aid experience. And the hearing aid was the Sound World Solutions Companion self-fitting hearing aid, a 16 channel instrument with noise reduction, directional microphones, rechargeable, and feedback cancellation. They found that 2/3 of participants were successful. So 41 out of 60 participants successfully self-fit, and 1/3 didn't. The people who were successful were more likely to have hearing aid experience, and to own a mobile device. Of the successful self-fitters, 63%, more than half, sought help from the assistant, and only 15 out of 60 were able to self-fit the hearing aids without any help from anybody else. The people who were more likely to seek help also were more likely to have an external locus of control. So that makes sense, because an external locus of control generally means that they think that the events that happen to them are the result of outside, so they're more likely to reach outside to get help.

They also found that there was no one single step where people really got hung up. The errors and the unsuccess were pretty much evenly distributed across those nine steps, although one participant couldn't do anything. Well not that they couldn't do anything, they couldn't successfully complete any of those nine tasks. In terms of where and when people needed help, they were more often things related to the Bluetooth, so pairing the hearing aids, adjusting the settings, and doing the hearing test with the Bluetooth. So why is this important? Well it means that a large population might not be able to independently successfully self-fit a hearing aid. So there are a large part of the population who's going to need help, and might not be able to do it in this remote, low service delivery context. These limited service delivery models, then, would be better suited to people who already have hearing aids, and who own mobile phones. Does it matter clinically? Absolutely, I will say that the participants, as with many of our research laboratory studies, represent a biased sample of the population, so these are people who were willing to come in and who were engaged, and aware,

and all of those things. So the percentage of successful hearing-aid fitters out in the world might be lower. The study also really provides, I think, some evidence, some strong evidence, that we need trained support personnel, even in a limited service delivery model because so few of those participants were able to do it independently successfully. And then just a note from those clinical assistants, so they weren't audiologists, some of them were entering audiology degree programs, and some of them were just, not just, but were people who were involved but they weren't audiologists. And they commented that the telephone support aspect of this was challenging, because it was tough for them to troubleshoot the problem because they couldn't see it. Participants couldn't always describe what the problem was, and many of the participants had difficulty hearing because they had hearing loss. So the advice from the clinical assistants was to do this with a webcam, which might help them better troubleshoot without having to make an in-person visit. And with that, I will switch gears a little bit and turn it over to Dr. Ricketts who's gonna talk about cognition and hearing aids.

- Well thank you very much Dr. Picou for that really interesting review of recent articles on self-efficacy. Yeah, I'm gonna go to one of the current hot topics, the relationship between hearing loss, hearing aid use, and cognition has been of great interest over the last couple of years. Of course that's one of the challenges of research is coming up with definitive answers to our questions around a topic just takes a long time. And what I wanna do is review two studies that take a stab at addressing some important topics around cognition, and hearing loss, and hearing aids. The first study, completed by Julia Sarant and colleagues in Australia, really was interested in this idea of how hearing aids might interact with cognition, and how hearing loss might interact with cognition as well. So really this study asked two different types of questions. First they were interested in what about potential hearing aid users? So what about people when they have not yet received a hearing aid, is, in those individuals, hearing loss related to cognitive impairment? And so can we test and find that hearing loss and cognitive impairment might actually be related? Then they went ahead and had people use

hearing aids and pose the question, over 18 months of hearing aid use, are there changes in cognition in older adults? And does that affect quality of life? So a little background. One of the reasons that this topic has been of such great interest recently is we really think that there is going to be a large increase in the prevalence of dementia with over 131 million individuals experiencing cognitive impairment within 30 years or so. What really got people excited about hearing aids relative to the topic of cognitive impairment though, is that we know that a lot of dementia risk is genetic, about 2/3 of that risk is genetic. But more recent studies have shown that approximately 1/3 of the remaining cases may be preventable or, I think, more appropriately, may be delayed through modifying some of those risk factors. If we improve education, if we reduce smoking, if we manage hearing loss, manage diabetes, manage obesity, all of those have been identified as potential risk factors associated with the beginning of cognitive decline. In particular, hearing loss has been identified as a modifiable risk factor for dementia in older adults, and it may account for up to almost 10% of the modifiable risk.

One of the studies that I am not reviewing, but I think is pretty interesting is the relationship between hearing loss and cognition, in particular mild cognitive impairments and dementia seems to be strongest kind of in the young older adults, those that are 45 to 64. The reason this is important is that really very few older adults use hearing aids that have hearing loss, so we've heard the data that somewhere in the neighborhood of 20% or so of adults with hearing loss use hearing aids. And we know that that hearing aid use is at the lowest level in adults with more mild hearing loss, and older adults who are a little younger. So this very range, where there seems to be the strongest association between dementia and hearing loss. Other research, doing meta-analysis of existing data suggests those who use hearing aids have better cognition than those who remain untreated, even though that suggests that there may be a relationship, there is no evidence yet that this relationship is causal. What do we mean by that? What do we mean not causal? If we see a relationship, why wouldn't we think that one causes the other? Why doesn't increased hearing loss increase the risk for

cognitive decline? Well related to that issue of hearing aid use, we know those with better cognition are more likely to seek hearing treatment, therefore there's a little bias in those meta-analysis type studies because those that use hearing aids are likely to have higher cognition to begin with, rather than the hearing aid use necessarily resulting in better cognition. When we consider just hearing loss and cognition, there is this issue of an underlying causality related to aging. We know that neuropathic and microvascular changes that we see associated with aging increase the risk of both hearing loss and cognitive decline, so there may be underlying factors that are increasing risk for both. So why does this matter? We know that cognitive decline has some pretty devastating outcomes. It has a tremendous cost associated with it, there is increased caregiver burden, those with cognitive decline experience a large range of negative consequences including reduced quality of life. So if we could delay cognitive decline, the onset of it, even slightly, we would have a tremendous positive impact on individuals, as well as healthcare systems worldwide. So in this study, they looked at 99 participants aged 60 to 84 years old. They identified people that had no past history or previous diagnosis of cognitive impairment. And so they're looking at older adults who are cognitively in a normal range. 71% of the participants were retired and 67% had postgraduate tertiary education.

So that is an important point for this study comparatively to the population at large is this is a particularly well educated group of individuals. All the clients were clients of the University of Melbourne Academic Hearing Aid Clinic. So all of the participants completed a preoperative assessment battery that included audiometry, some speech perception testing, and then a variety of cognitive testing, health questionnaires, quality of life questionnaires, life and ease of listening questionnaires. So that includes all 99 people. Hearing aids were chosen through a needs discussion with the participants and all were fit with the NAL-NL2 prescription, and then there was a follow up 18 months after hearing aid use began with 37 participants, using an identical battery that also included reported hearing aid use and hearing aid usage logs. So let's start by considering those 99 original patients. What did they find at baseline? Well they did

determine that increased age, less education, and greater hearing loss were all significantly correlated with poorer executive function. Specifically, 10 dB of hearing loss was associated with a decrease of about 7.5% of executive function relative to the mean score. And that's actually after controlling for all other explanatory variables, including age. When you look at just age, every 10 years of increasing age was associated with a decrease of executive function of about 14%. And of course, as you might expect, having a lot of education was associated with an increase of executive function. But if we take our first two sub-bullets and kind of do a little bit of a squint, what this suggests is that 10 db of hearing loss, in terms of its negative impact on executive function is approximately equivalent to five years of aging, because the effect on executive function was about half as large. So in terms of follow up, if we really wanna know the impact of hearing aid use on cognition, we're gonna have to know whether the patients actually use the hearing aids.

And so this is hearing aid use, and this is the data that they reported in tabular form from the hearing aids themselves. And we can see that if we add the first two columns together, almost 77% of individuals used the hearing aids for at least 60% of waking hours. Given that there are 37 people, if we look at the column on the right, basically we have one individual out of the group that uses the hearing aid less than 30% of waking hours. Did these individuals find benefit from the hearing aids? What we see in the red bars here is individuals that got at least 5% benefit in the ease of cognition, reverberation, or background noise sub-scales of the APHAB. The pink bars are those individuals that got at least a 10% benefit in at least one of those subcategories. And so you can see, the vast majority of individuals received at least 5% benefit in some of the subcategories, and the majority actually received at least 10% benefit. The other thing that I wanna draw your attention to is what's happening with males versus females. The relatively higher pink bars with the females suggests that more females in this study were receiving more benefit, or larger benefits on the APHAB sub-scales, that is the greater than 10% benefits. So one of the most compelling results of this study relates to executive function as a subset of cognition. And so this is executive

function as measured by the cog state battery, looking at decrease in total errors. And what you can see is that there was a significant decrease in errors, and significant increase in executive function when all individuals were considered together. This is the first study that I'm aware of that shows that hearing aid use can significantly increase executive function for all. Even though this is a pretty small group, another interesting finding, we'd have to take a little more research, is the male female difference. Because it looks like that benefit in executive function is clearly larger for the females studied in this study comparatively to the males. Applying a different statistical analysis, something called the reliable change index, they went through and tried to determine who really had clinical improvement, versus no change, versus a decline in executive function. And overall, considering both males and females, about 30% of individuals showed clinical improvement, and 67.6% showed no change. All-in-all, out of the entire group, only one male showed a decrease in executive function over the 18 months of hearing aid use. In addition, women also showed clinically significant improvements in working memory, but those were not seen in men. So what do these results tell us?

In this relatively small group of 37 participants, there was a significant improvement in executive function associated with 18 months of hearing aid use. And I think even more importantly, all but one male showed stable or improved cognitive function. Stable or improved psychomotor function, working memory, visual attention, and visual learning was observed in 73 to 81% of participants. And again, in this particular population group, it was particularly large in women. So why is this important? Well I think it's another piece that suggests treating hearing loss with hearing aids may delay cognitive decline. But of course, this study is still limited. If that is found to be definitively true, I think the impact clinically is huge. But we have to recognize that this is, as the authors point out, a relatively small sample size. It's not actually definitive evidence that hearing aids actually slow cognitive decline because there's not a control group to see what happens without 18 months of hearing aid use. But it is the first evidence that hearing aid use can significantly improve executive function in some older adults. One of the

things about this study is it really focused on older adults with no history of cognitive decline. I think, for many of us, we also have interests in whether those with cognitive decline, mild cognitive impairments, mild Alzheimer's disease also might show some of these same benefits. Can we not only delay the onset of cognitive decline, can we slow the progress of cognitive decline once it begins? And that's something that also is of considerable interest. But before we get there, we want to know whether those with cognitive decline use hearing aids and have challenges relative to their use. And that's where this second study that I'm gonna review comes in. In this study, they were really interested in experiences of hearing aid use among patients with mild cognitive impairment and Alzheimer's disease and dementia. This is a really small, qualitative study. But I think it's pretty interesting. The authors note that those with dementia are really at elevated risk for experiencing reduced quality of life, increased social isolation, and depression. And we have existing data that adults with normal cognition, hearing aids can improve those factors.

So there is a potential for benefit from hearing aids in individuals with dementia that are sort of unrelated to cognitive decline. But they really wanted to know, what are the barriers to hearing aid use in these individuals with mild cognitive impairment? So we know that over half of 85-year olds using hearing aids report that their quality of life is either quite a lot or very much better because of their hearing aid use. We know that hearing loss is more common in people with dementia. And as we talked about in the last study, it's been identified as a risk factor for dementia development. We know that perceived hearing handicap, comfort, limited perceived benefit, high cost, perceived difficulty with hearing aid use, all of those had been identified previously as barriers to hearing aid use in cognitively healthy older adults. But as the authors point out, cognitive ability has rarely been studied as a potential barrier. The other factor that we know from previous research is cognitive status at the time of hearing aid use is associated with hearing aid use. Specifically, those with more cognitive decline are more likely to stop using their hearing aids. This matters because individuals with mild cognitive impairment and their caregivers have the potential for multiple benefits if

cognitive decline can be delayed. And certainly identifying and eliminating any potential barriers may help increase hearing aid use with those with mild cognitive impairment. So in this study, there were 10 adults recruited from four memory clinics within one mental healthcare system in the UK. This was a qualitative research design that included semi-structured interviews. Participants were interviewed either in the research facility or in their own homes. Family members were sometimes present at these interviews, but they did not contribute. As I mentioned, this was a semi-structured interview related to hearing aid use, and when they helped, and when they didn't. The authors identified four themes. The first theme, which I think is the most compelling, is there were in fact memory and cognitive barriers to hearing aid use, misplacing their hearing aids, forgetting to use them were a problem for these individuals. The remaining themes are themes that we see in older adults without cognitive impairments. They are there are device use barriers, they need help with insertion, batteries, they're too loud, they interfere with glasses. There are barriers related to hearing aid benefits, but most individuals noted that the hearing aids did provide benefits.

And so in this population, they got benefits even though there were barriers. And finally, there were the previously reported barriers related to ambivalence and stigma. I'm not sure they help, people view me as disabled, and people really felt like they were judged when they were wearing their hearing aids. So in conclusion, many of the barriers associated with hearing aid non-use in those with normal cognition were also identified in this study. However, participants in this study clearly viewed memory loss and cognitive impairments as detrimental as well. But many of them talked about how they overcame these memory-related difficulties. They talked about reinforcing device benefits, continued perseverance, and I think in particular, the importance of family support. So I think when we think about this clinically, understanding that those with mild cognitive impairment are going to have additional barriers to use is really important. And so highlighting the potential benefits for the patients and their caregivers, and then also really recognizing the importance of caregiver support for

success in hearing aid use in this population I think is really important clinically. So we have covered a lot of ground here in the last 58 minutes or so. So let's go ahead and briefly summarize these multiple studies. Dr. Picou, you wanna start by reviewing yours?

- [Erin] Sure Dr. Ricketts, it looks like we are running out of time, so I think I might just leave these summary and conclusion slides, they're in your handout. And I just kinda wanna skip ahead to this idea, and when we started to put this together, it was more than three months ago. So I wanna just think about how our worlds have changed in the last three months, and how we've really been pivoting our clinical services and think about the results of this study and what they might mean for this remote limited service delivery model. And I just wanna say that the three articles that I summarized really highlight the importance of trained personnel, even in those low service delivery models. So self-management is an important part of hearing aid benefit, so it would be great to help our patients learn how to self-manage their hearing loss, especially those psychosocial aspects. Self-management of hearing aids is also really important to hearing aid satisfaction, and we can help patients learn how to manage their hearing aids, even in this strange new world that we find ourselves in by supporting those tactile practice. We know that the clinician has a large role in helping here, but they're not the only ones.

So it'd be be great, maybe even easier, to involve family members or friends who live with the patient, because they don't have to commute and travel also, because if you're doing a remote fitting or follow up, they will be at home. And then finally, that last study looking at self-fitting hearing aids really highlights the need for, again, assistance and suggests that people who are, not everybody's a good candidate for the kinds of limited service delivery models we were talking about, and really thinking about tailoring the level of support to the patient. So patients who are existing hearing aid users and have mobile phones will probably be better off. Dr. Ricketts, did you wanna say anything about the era we find ourselves in now?

- [Todd] Well I think that you covered it very well because I think that same theme of the importance of caregiver support, and the access to caregiver support certainly comes through in patients with cognitive decline as well.

- [Erin] And I think, I don't know if we have any time for questions. Oh so this used to be my workplace. If we run out of time for questions and you wanna send me an email, you used to be able to find me here. This is where you would find me now. That's a lie also because my house is never that clean and my children are never that patient. This is more like me. But I'm here if you want to email me with any questions. I'm sure Dr. Ricketts' work situation looks sort of similar.

- [Todd] My children are much larger, and so they can still sit on me like that, but the picture is pretty incredible with my kids. Also I'm happy to answer questions by email if you wanna shoot us an email since we did go a little bit long.

- [Carolyn] Thank you both. My picture is much similar to that, except my son is in the basement playing Minecraft when he should be on an online course for college, and my dog is usually barking and scratching at my leg. Thank you so much Dr. Picou and Dr. Ricketts, it really is an honor to have both of you presenting on hearing aids, and on the important information you shared today. I wanna thank everybody for joining today's Vanderbilt Audiology Journal Club. Just a reminder, if you're earning CEUs, please log in to your account at Audiology Online within the next week, or your opportunity to earn CEUs will expire. You have one week to take the outcome exam that goes with today's course. Dr. Picou and Dr. Ricketts, thanks again. We hope to see everybody online soon. Take care everybody.