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Hearing Loss, Hearing Aids, and Dementia: How Might
Recent Studies Inform Patient Care
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Presenter: Brian Taylor, AuD; Gemma Gray, AuD

- Hello and welcome to the Signia Podcast at AudiologyOnline. I'm Brian Taylor. Today's topic, hearing loss, hearing aids, and dementia. How might recent studies better inform patient care? Given that age-related hearing loss is highly prevalent, easily diagnosed, treatable, and a condition that often proceeds the onset of dementia by 5 to 10 years, it is the ideal modifiable risk factor to be targeted as a preventive strategy by the medical community. In addition, there is some emerging research suggesting that amplification could serve as a sort of protection against dementia progressing at a more rapid rate. Let's dig into some of those details in the podcast today. According to the 2017 Lancet Commission, which was updated in 2020, there are 12 potentially modifiable risk factors associated with dementia prevention, intervention, and care.

And according to the Lancet study, in their statistical analysis, hearing loss is the leading modifiable risk factor on that long list of 12. And for the details on that list of 12 modifiable risk factors, I would encourage every, all of our listeners to look at the podcast notes where there'll be a schematic that shows you the modifiable risk factors sort of as a function of age. But you can look at the details on those notes. Anyway, for those reasons, it is essential for hearing care professionals to stay abreast of the latest studies in these areas. After all, when considering changes to how you might work with patients at risk for dementia and cognitive decline in your practice, I think it's really important that audiologists are always cautious.

Clinicians, hearing care professionals, all of us that work with patients must critically appraise new research and the claims that emerged from that research. And it seems like there's always just dozens of studies that are published every year that look at the relationship between the hearing loss, dementia, hearing aid use, and dementia. So with all that said, let me just remind everybody that the purpose of this podcast is to review recent studies that have addressed the topics of hearing loss, hearing aid use, and dementia, and how to apply these findings in the clinic when counseling and

working with patients. Before I introduce our guest and we dive into this topic, it might be helpful to more clearly define the term dementia.

And to do that, I wanna refer to a recent article that was published just a few weeks ago in the Hearing Review, the online edition. The article was authored by Professor Barbara Weinstein, who I'm sure listeners are very familiar with all of her great work in our profession. And in this article, she writes, and let me quote, "Dementia is an umbrella term for a syndrome that includes a wide range of brain changes that can eventuate in one or more behaviors that interfere with a person's ability to perform activities of living independently." She also wants to write, she also goes on to write in the article that dementia diagnosis is typically made when cognitive changes progress to the point that the individual is no longer able to live independently.

I think that's really an important point that she makes. And she also says in the article that there are different causes, reminds everybody there are different causes of dementia, which vary in terms of symptoms and behaviors. Alzheimer's disease, of course, is a leading cause of dementia and represents about 65% of all dementias. But there's also vascular, frontotemporal, and dementia with Lewy bodies that each account for about 5 to 10% of all dementia cases. Considering the complex nature of dementia, diagnostic tools are comprehensive and oftentimes include neuroimaging, cerebral spinal fluid biomarker analysis, along, of course, with functional assessments. In her article, Dr. Weinstein goes on to discuss the importance of conducting a holistic case history, careful observation of behaviors associated with dementia, the minimal competencies required by audiologists to engage in cognitive screening, and the importance of making proper referrals when a person with hearing loss is suspected of having dementia.

Of course, all of those are essential considerations for all hearing care professionals. And in the podcast notes, there's a link to an article that I would hope all of you are

able to read. So now let's finally get to the guest. Here today to help us better understand the relationship between dementia and hearing loss and dementia and hearing aid use is Gemma Gray. She's a doctor of audiology who is heading up the Hear Academy at Hear USA, which is responsible for the learning and development of their hearing care professionals. And I invited Gemma here today as she started her career in dementia research at the Mayo Clinic in Florida. She was working in the lab which was responsible for discovering many of the genes linked to Alzheimer's disease and frontotemporal dementia.

She then left the bench to seek out client, a client-centered career in audiology, and did most of her studying in the UK. While working in their National health service, I was interested to hear how she collaborated with the dementia ward staff, folks like geriatricians and neurologists, where she became, where they became champions of patients dementia care. Together, they defined what clinical practices, what clinical practices should be changed to better suit the special group of individuals. One thing that I'd like to discuss later with you, Gemma, assuming that you're still there after this long-winded introduction, is about the testing protocol you developed for your audiology department and how our listeners might find this useful in their interactions with dementia patients. But for now, let me give you you a hearty welcome to the Signia Podcast.

- Thank you, Brian.

- I usually don't go on at length in my introduction, but I think not only is this a hot topic, but I think that there, for various reasons, is a lot of misinformation and even maybe some confusion about how the research is related to patients, how it's communicated to patients, how it's communicated in clinics marketing. So I wanted to be careful in my introduction and I wanted to say that I'm really excited to have you

here because I think you're an expert in this area and you can really inform our audience on how to better take care of these individuals.

- Thanks, Brian. It is a pleasure to be here talking to you today. Always been fascinated by the link between dementia and hearing loss.

- Good. So I think a good place to probably start is a quick review of the relationship between hearing loss and dementia. And I know there's been a lot over the last decade or so written about this, a lot of research that's been generated. And when it comes to this relationship, maybe you could summarize the latest thinking about the common and causal mechanisms that link these two conditions.

- Absolutely. I think maybe before I go into too much detail, I kind of wanted to start with how I describe it in layman's terms to patients and their significant others. So I tend to think of it as a relationship whereby hearing loss may cause dementia and dementia might actually cause hearing loss. And then there's the overlapping symptomology to be aware of. And I think it's crucial to understand how hearing loss and dementia actually present in the same way, and are affected by, have the same symptoms. So I always use an example when talking to patients and the significant others, like, if someone doesn't remember what their partner's saying, is it that they didn't actually remember? Or is it actually that they didn't hear the conversation well in the first place?

So as an audiologist, you'd want to treat the hearing loss as best as possible and then effectively think of the remaining symptoms likely related to the memory problems. And a lot of my patients' families like this very basic explanation and it encourages them to act quickly to address the hearing loss and then see what's kind of resulting after that, so. But when you're actually considering it as a clinician, the link between hearing loss and dementia is not really that well understood. And there's all this literature coming

out that you do need to kind of scrutinize. So I think the general consensus that we can talk about is, there's two aspects. One is that there's likely to be a common mechanism that causes both the hearing loss and the dementia.

And then there's causal mechanisms whereby the hearing loss might in turn lead to development of cognitive problems and ultimately dementia. So I'll get into those in a bit more detail. But I do recommend taking a look at the article summarizing this in by Churn and Go lab in 2019. We've cited it here in the podcast and there's an interesting image that kind of shows this concept. So yeah, starting with the common cause hypothesis, this suggests that both cognitive and hearing decline are related to a common neurogenerative, neurodegenerative process, and it's affecting both the aging brain and the auditory system. One example is microvascular disease. Another could be attributed to the neuropathological processes, including something like the buildup of beta amyloid plaques or tau protein in the brain.

And actually it's tau, the protein that I was investigating in Alzheimer's disease and frontal temporal dementia in the lab and it's interesting how this protein really accumulates in the disease as the disease progresses. So this common cause theory is plausible, but for this to be the only mechanism at play, then over time, cognitive function should continue to decline regardless of the use of hearing aids, as both the brain and the auditory system are both affected by the same process. However, some studies we will discuss today indicate that such intervention actually does help in certain domains of cognition. So with this being said, we must consider other hypotheses proposing that hearing loss causes dementia. And one such such theory is the sensory deprivation hypothesis.

And this postulates that sensory decline causes more long-term cognitive decline. And basically, the impoverished auditory input from hearing loss can lead to cognitive impairment through decreased stimulation of its cognitive processing. I also think that

this is kind of one of those unfortunate situations where someone with a significant hearing loss might isolate themselves as it's too hard to hear in social situations. And it's this social isolation and loneliness that are risk factors linked to dementia as described in the Lancet Review that you mentioned earlier. So another mechanism at play could also be that the dementia is worsened by depletion of their cognitive reserves. And this cognitive load hypothesis should suggest that hearing loss leads to degraded auditory signals, which in turn requires greater cognitive resources for auditory processing.

This hypothesis describes a situation where hearing impaired people, it's quite hard to perform dual tasks, and that results in cognitive reserve depletion and limited working memory. So basically, the more effort you are placing on listening, it's requiring more executive function and working memory. And this excessive cognitive load eventually leads to structural changes and neurodegeneration. So all in all, there's a lot of hypotheses and they could all be at play and it's entirely plausible that it's very, a complex mechanism might be exclusive to each patient individually and they could all be at play in one person as well so I think there's a lot we have to learn.

- Right, and well, thank you for that review. I think that's helpful. And as you mentioned in our notes, there's a nice schematic that summarizes and illustrates what you just summarized nicely for us. So thank you for that. I'd like to go ahead and dive into some of the studies. As I mentioned in my introduction, it seems like every year over the last couple of years, there's, you know, a dozen or more studies that'll look at this relationship. And so the first study that I wanted to ask you about was published in Lancet Healthy Longevity, I think in November, maybe of last year, a couple of months ago. And the data comes from the Mayo Clinic study on aging, which means that the data was collected on older people that are from the Rochester, Minnesota area, which is not too far from where I am.

And in this study, the researchers looked at the association between age related hearing loss and dementia on 1200 people. Hearing sensitivity was assessed objectively by an audiologist using standard pure tone and word recognition testing. And they also assessed hearing subjectively by asking caregivers and family members how they thought the study participants heard, which I thought was a really interesting component to this study. Anyway, in the study, they followed each participant for about seven years. And Gemma, if you could maybe tell us a little bit about what they found in this study.

- Absolutely. This study was really interesting. They found that 17% of participants went on to develop dementia, and they might have expected to find that these objective measures of hearing loss were associated with an increased risk of dementia, but neither of them was. So this actually contrasts that of the three studies that the Lancet Review was based on, which indicated that hearing loss is the number one modifiable risk factor for dementia. And instead in this Mayo Clinic study, it was actually the informant based hearing difficulties that did show a significant association with the development of dementia. The objective measures of PTA and word recognition score were more predictive of poorer performance on cognitive testing over time, but not actually the development of dementia.

And the participants with the pure tone average higher than 25 decibel hearing level or word recognition score lower than a hundred percent, had significantly worse declines in cognitive testing scores. And this is really important to highlight since these findings suggest that other central processing deficits could potentiate the effects of hearing loss.

- Yeah, that was a really interesting finding and I think it stirred up a lot of conversation amongst the experts about what these findings mean, especially relative to what some of those Lancet Commission studies were based on. As you mentioned, you know, the

informant based hearing difficulties, the caregivers, loved ones, family members that were following somebody in real life, I think, kind of shows how beneficial their input might be. But I also wanted to mention, as a recent commentary on the study noted, age related hearing loss and dementia are complex disorder, are complex disorders and the mechanistic basis underlying their potential association has not yet been clarified. That's what some of the commentary on this study says and which I think kind of makes sense. And given this complexity, what advice would you have for clinicians and how they would interpret these really interesting findings?

- I would say with a pinch of salt and an open mind. But it honestly, as we discussed earlier, we need to be cautious, as there's many, could be many complex mechanisms at play. We need to better understand these by continuing to evaluate and undertake such studies.

- That makes sense. Okay. So that's one study that I think all of our listeners should know about. And I'll remind everybody that the specific study in the link, if it's an open access article or in our notes, so you can find that study if you wanna read the details, if you haven't, if you're not familiar with it. That brings me to the next study that I wanted to ask you about that comes from the Johns Hopkins group using data from the Baltimore Longitudinal Study of Aging. And in this study they looked at, they evaluated 702 adults age 60 and over, global and domain specific, which is language, memory, attention, executive function, visual spatial ability, along with cognitive performance were assessed.

Hearing thresholds were calculated for the better ear pure tone average, and participants were categorized as having hearing loss that was basically better than 25 DB HL PTA or worse than 25 DB pure tone average. Speech and noise performance was assessed with the quick speech and noise, the QuickSIN test, and participants were categorized as having either below median or above median performance on the

QuickSIN. So Gemma, can you tell us what they found in this interesting study using the QuickSIN?

- Yeah. Participants with hearing loss showed a similar baseline cognitive performance, but faster decline in global cognitive function, language, executive function, and attention. So participants with below median QuickSIN scores showed significantly worse baseline cognitive performance in all the domains and faster decline in global cognitive function, language, memory, executive function, and attention, so.

- Okay, well, so putting my clinician's hat on, I'm wondering what these findings might mean. Might they mean that a poor QuickSIN score is a marker for a cognitive decline?

- Yes, absolutely. So speech and noise performance might be a novel marker, which is more sensitive to memory decline, and it's, yeah, another great reason why we should be including QuickSIN in our battery of tests.

- Yeah. Now just as a little bit of a side note, this study I think is really interesting because in my own clinical experience, I, using the QuickSIN for many, many years, occasionally, it'd run into a patient that had, you know, not that much hearing loss, maybe a mild, maybe a high frequency moderate hearing loss. And they would have a poor score on the QuickSIN, like, you know, worse than 10 db, which tells you they really struggle in noise. And I would always think that maybe these patients had some sort of, you know, central auditory processing, some sort of cognitive decline. So perhaps I think obviously we need more information here, but the QuickSIN in might be a useful indicator or maybe a red flag for somebody that's at risk for developing sort of these cognitive issues.

But anyway, thanks for your feedback on the QuickSIN study. I wanna turn our attention now to hearing aid use and dementia. And there have been a couple of recent

studies that clinicians might use to better inform them in their clinical decision making process and how they discuss amplification with older adults who might be at risk for acquiring dementia. The first study that I want to ask you about was a 2021 systematic review article in PLOS, which I believe stands for Public Library of Science, PLOS. And in the review that was published there, that's an open access journal that you can easily find online, they examined the findings of 17 unique studies that looked at this relationship between hearing aid use and dementia. And those 17 studies spanned about 30 years of research and over 3,500 participants. Gemma, can you tell us a little bit about the general conclusions of this analysis, of this review?

- Yeah, this study actually fascinated me, firstly because they focused on reviewing the literature in which hearing aids we used to treat hearing loss in persons without pre-existent dementia, and then they provided an overview of outcomes on the different aspects or domains of cognition. And of the studies they analyzed, they found that their tests fell into assessments for five of the six neurocognitive domains according to the DMSC5 classification. So they are perceptual motor function, executive function, complex attention, language, learning and memory. And then two more broader domains, which is brief mental status and general intelligence. And in this systematic review, they reviewed the test results of each study to determine which domain they were effectively testing and then which were most impacted by amplification.

So really interestingly, this systematic review concluded that the hearing aids might not actually have any effect on the language domain and little if any effect on complex attention and learning and memory. However, the most beneficial impact of hearing aids seem to be on the executive function domain. Six studies displayed such improvement. For example, both studies by Dorothea Etal and Carolina Etal showed that working memory performance significantly improved with hearing aid use after six weeks and by six months respectively. Another study by Maharani Etal had a follow up

of 14 years focusing only on tests of executive function, including immediate and delayed word recall tests and date naming. And they showed that although episodic memory declined significantly with aging, the rate of decline was significantly lower after starting hearing aid use.

And this is really, really promising. However, this study was only one of two that had a follow up longer than 10 years that was included in the systematic review in PLOS. So bearing in mind that cognitive decline is a slowly progressing impairment, it's really impossible to draw conclusions about the effect of an intervention like hearing aids on cognitive function based on all these results, we need more. So the authors of this review suggested that we need more robust studies with longer follow ups. And on this note, the authors also highlighted a really exciting trial called the Achieve trial, which is currently ongoing. And this is a trial of 850 older adults randomized to either a hearing intervention or a different successful aging intervention, which is an interactive health education program. And they're gonna study the effects of cognition and we really eagerly kind of await these results and hopefully they can provide more insight.

- Yeah, I wanna echo that. I think all of us that try to pay attention to the research know that there's no substitute, when you're looking at effective treatments, there's no substitute for a randomized controlled trial and that's what the Achieve Project is. And I know we've been waiting for that for a number of years and we all look forward to hopefully seeing that by the end of 2023. I just also wanted to note, I thought that was a really, this is a really interesting review finding in that executive function seemed to be affected, but those other dimensions of cognition were not. So I also wanted to, that's a really interesting finding. And by the way, I'm just kind of curious, how would executive function sort of become evident in the clinic? What does that, could you kind of explain for listeners what executive function means in maybe practical terms?

- I'd love to, but I wouldn't have a summary. I dunno, what would you say, Brian?

- I mean I would say that it's sort of like navigating, it's able to navigate your world, you know? Like you can get up and make decisions about what you're gonna do in the morning, eat breakfast, get dressed, go to the, go to, you know, make a decision about going to the store. It's like your ability to navigate the, your daily routine. That's what I think about as executive, to kind of think for yourself independently.

- Okay. Yeah, if I kind of say those two sentences, then you expand on, yeah, to think about going to breakfast and things like that, that might be a good little segue into it. So if I, I'll go. Yes.

- Okay.

- Yes, so really, executive function is about going about your day-to-day life. So being able to make decisions and carry out those actions.

- Right. And to do it kind of in an independent way without somebody telling you what to do or overseeing every little movement that you make.

- Yeah. Living independently for sure.

- Right, so the idea there is that hearing aids then I think, there's some evidence that would suggest that hearing aids help a person's, you know, that's one aspect of quality of life, probably, executive functioning, which is part of cognition.

- Definitely.

- Anyway, it's an interesting finding and thank you for sharing on that one. There's one more paper that I wanted to ask you about. This one was published in JAMA Neurology

in December of 2022. So just about a month ago. And I'm guessing that a lot of our readers are probably not subscribers to JAMA Neurology, so it's worth talking about. So it's worth mentioning this one 'cause it's more, maybe one that's not in the, on the tip of the typical research audiologist tongue. Anyway, this study was a systematic review and meta-analysis in which they analyzed the findings of 31 separate studies with more than 137 adults with hearing loss. And in this study, they use this really interesting term, restorative devices, which is because a restorative device in their terminology is either a hearing aid or a cochlear implant.

So the interesting thing about this study is that they looked at hearing aid users and cochlear implant wearers, and the authors determined that adults using restorative devices had a 19% reduction in the hazard of cognitive decline and a 3% improvement in their short-term general cognitive scores when compared to those with hearing loss not using restorative devices. So when you start throwing around percentages and hazard ratios and percent improvements on scores, I think I wanted to kind of get your take on this, Gemma, could you shed any light on how these findings can be applied to clinical practice?

- Yeah, certainly I wouldn't be throwing around exact percentages in practice, but I think it's, it's really nice to have some more evidence that backs this up and it adds to the growing evidence base and it really does serve as an impetus for clinicians treating people with hearing loss to persuade them to adopt hearing aids as soon as possible and to mitigate, in order to mitigate their risk of dementia and cognitive decline. So yeah, I agree. Don't throw around the percentages, but certainly talk about it and share it with your patients.

- Right. And you can rely on your statistician friends to tell you exactly what a 19% reduction in hazard of cognitive decline might mean.

- Exactly.

- It's what I thought was interesting also about that study is it included people with cochlear implants and sometimes we forget that that's part of the world of restorative devices, and it was good to see a study that looked at both hearing aids and implants. But anyway, when it comes to hearing aid use and dementia, those last two papers we discussed, I think should motivate clinicians and people with hearing loss that adopting amplification devices, be it hearing aids or implants, that they have the possibility to reduce the risk of cognitive decline and dementia. Gemma, I'm curious, how would you advise clinicians to discuss hearing aid use with patients who might be at a risk for development or acquiring dementia?

- Well, as a clinician, I always advise that early intervention is key. And because it's very likely that the patient in front of you has waited seven years to actually book the appointment and to seek your help, it's your responsible, your responsibility as a clinician to help them realize that amplification will improve their life in so many incredible ways. So I'm such a firm believer that prevention is better than cure and I really thought that this was such a key message that came across in the Lancet reports. And considering that both hearing loss and dementia are separately very big public health problems, it would be foolish not to treat for the hearing loss. And additionally, we've got dementia, sorry, depression, social isolation, and physical inactivity.

They're all considered separate modifiable risk factors for dementia. Dementia as per the Lancet report. And seeing as hearing loss also effects physical and mental health, treatment with hearing aids could have beneficial effects in multiple dimensions. And we see this in the clinic, we know this is true. So fundamentally hearing aids are obviously used to benefit communication and social functioning. However, we know that they also positively affect mood and overall quality of life. And seeing that hearing

loss is easily diagnosable and well not easily treatable, but we do our best, as clinicians should definitely be vigilant for hearing loss and to counsel patients on the benefits. We should also be informative about hearing loss and cognitive decline in dementia, but certainly not in a scaremongering way or throwing around the percentages that we talked about. It's really about adopting a very caring approach.

- Right. And that's, you know, as we kind of wrap up on time here, Gemma, I think it really, I wanna kind of further elaborate and get your take. My last question, Gemma, is just kind of based on your own experience in the clinic and your experience as a researcher in this area, I'm curious to know from you, how would you adapt your hearing, testing, and case history to better account for patients you suspect might have cognitive decline or dementia?

- I'd love to share what I used to do in clinic. And many years ago when I was working at the Royal Berkshire Hospital in the UK, I created a protocol for testing those with dementia and or even suspected dementia. So I put it together as part of working with the dementia ward staff as they knew their patients best. So the protocol kind of went something like this. Firstly, I'd start off taking the history and I'd really hone in on asking about memory problems and aspects of the dementia and a lot of it focused on what the significant other reports as well. So I think it's really important, as we said earlier, to get their involvement as it's a great predictor of how likely they are to have memory problems.

And so we kind of hone in on whether it was a lack of independence or socialized social isolation or memory problems and how they actually impacted them on a day-to-day. And when I was listening to their concerns, I would also bear in mind that their symptoms of the hearing loss and the dementia could be overlapping, like I said earlier. So during the history, I'd also try to gauge how likely it was to get a full assessment that day. So with cases of dementia, sometimes I would only assess one,

two, and four kilohertz with 500 as well. And then I'd also be testing alternate ears. So I wouldn't just focus on the right then the left or however, I would kind of treat it almost like I would my pediatric patients.

Like the next test, the next result you're gonna get is gonna be your last one, so make it a good one kind of thing. And so I want to do this together, these basics first, and then if you get onto speech testing and QuickSIN then it's absolutely fantastic. Loads of information to go off. And oftentimes, it would take a couple of appointments to gather such a comprehensive overview of their results. You also have to be quite mindful of their exhaustion. You don't want super long appointments. And we know that testing reliability will decline over time as time wears on. So in addition to being quick, I would also sometimes have to adapt my audiometry to look for responses other than the standard kind of pressing a button or raising their hand when they hear a sound.

I've had people with dementia who didn't feel comfortable in the booth and they wanted to keep close to their significant others and really only reacted to sound by either blinking for me or smiling or squeezing their hand, my hand. You kind of have to be quite creative, so you just have to work out what's best and a best way to test them. So once you had enough results, we would amplify immediately. So get the hearing aids on as soon as possible and over time, you're gonna fine tune them as you gather more and more results. So I think it's really about getting the hearing aids on so they can start enjoying the conversation and you can start to gauge which symptoms of the hearing loss and the dementia. And it's so nice, it's such a pleasure to see how much more connected and engaged with their family and friends they can be when they've actually got the hearing aids on. So don't delay.

- Yeah, no doubt about it.

- Yeah, so every patient's different, really, but you know, you can kind of adapt as you go and see what works best for them, so.

- Right. And just as kind of as we put a bow on this podcast and wrap things up, I think one of the most important things you said, Gemma, early in the conversation, was treat the hearing loss first. I think that these days, it's easy to get sort of sidetracked with cognitive screening and we're not gonna get into a debate about is that a thing you do or not. I know there's a lot of debate in the field about certain cognitive screening value protocols that you could use, good or bad, but I think the most important thing to your point is, you know, make sure the person is hearing well first with well fitted amplification. So you wanna maybe chime in one last time about the importance of treating the hearing loss first?

- I think you nailed it. It's very much about getting the hearing aids on to then see what else it they're having problems with. Is it that the quality of life is reduced because of the hearing loss or is it actually due to cognitive decline?

- Right. And then, you know, you think about evidence-based practice, that's our true expertise is providing hearing care services and counseling to support the use of amplification, other assorted interventions to support communication. So that's first and foremost what we bring to the table as practitioners. The last thing I wanted to mention is just about a week ago in Canadian audiologists, there was an excellent review. It's about 25 pages, fully up to date from Kathy Pachora Fuller that is also in our show notes. And I would, if you're gonna read one article from the list that we have in our show notes, I would pick Dr. Pachora Fuller's article because she talks about all of the studies that we mentioned today, plus a few more.

And she does it in the context of the evidence-based practice paradigm and the importance of not overinterpreting study findings. So I think it's responsible practice to

make sure that you don't go off and allege with some of the findings here. You have to temper how you use this information in the clinic. So any final thoughts, Gemma, before I let you go?

- No, it's been fantastic talking to you. But thank you so much Brian.

- Yeah, it was a fun time. Thanks to you and our listeners and hope to have you on sometime soon.

- Thank you. Take care.