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Artificial Intelligence in the Balance: Edge AI Innovations in Balance Assessment and Fall Detection

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This month on Audiology Online, we're celebrating innovation in the hearing industry with our fifth Industry Innovation Summit. Thank you for joining today and we hope to see you in other Summit courses which you will find in our course library. We would like to thank our title sponsor, CareCredit, and all of the companies who are participating in the 2025 summit. And now it's my pleasure to turn the microphone over to Michelle. Thank you Anna.

I am really excited to be here and meet with you regarding what I think is a really important topic, Balance Assessment, Fall detection, something that I think certainly touches many of our lives and so really excited to start off this presentation. But first let's go through a couple of housekeeping notes.

If you do have a question, please feel free to type that into the Q and A and hit send. I will actually be reviewing those at the end of the session and answering those then, so I will be happy to look through those as we get towards the completion of our content. There is a handout a PDF is available for you in this presentation in the chat area as well as under your pending courses at Audiology Online within your account. It's also possible to earn a CEU credit if you are a paid Audiology Online Unlimited CEU member. After completing the course, you'll simply go to your pending courses and be able to access and pass the multiple choice exam as well.

If you have any technical difficulties, feel free to use the Q and a window. Call 800-753-2160 or email customerexperiencecontinued.com the risks and benefits for the course can be reviewed here at your leisure and today's learning outcomes are focusing on attendees being able to identify where in the My Starkey app to be able to enable the Fall Alert to be able to describe the Edge AI Fall Alert process once the fall is detected, as well as be able to list two of the balance assessment tests available with Edge AI and the My Starkey app.

Now let's get into our content and really talk about Edge AI innovations and Balance assessment and Fall detection.

Hearing loss certainly plays a key role in both social and physical activity. And you know, we know that there's often a decline that is seen as a result of hearing loss and by the time hearing loss is either suspected by the individual or, you know, can no longer be denied, they may actually, you know, already start to have begun some of their adjustments to their lifestyle that can heighten the risk for falls. We know patients with hearing difficulty tend to withdraw from social activity that they Once enjoyed. And what happens then? Well, they stay at home more, they spend less time on their feet, they get less exercise, they lose muscle tone, which in turn leads to an increased risk of falling.

And this may certainly sound very familiar. Today's hearing aid technology offers advancements that actually allow us to, you know, really, as hearing professionals, not only deliver better hearing, but also provide tools to help our patients actually live their best and healthiest lives. And many of these capabilities are due to addition of artificial intelligence and hearing aid technology.

Today, Starkey's hearing aids are equipped with artificial intelligence and inertial sensors that are embedded in the hearing aids. And these actually allow the hearing aids to deliver that better hearing technology, but also provide an innovative way to incorporate health and well being features, in particular fall detection and now the potential for fall prevention technology at ear level.

Let's begin by acknowledging that falls are very common. The CDC actually estimates that every second of every day an older adult falls in the United States. And that could lead up to approximately 36 million falls every year. Of those who fall, about 8 million are older adults and are injured as a result. And those injuries lead to about 3 million emergency room visits and nearly a million admissions to the hospital.

Even worse, more than 32,000 individuals die each year from complications of, of a fall. Those are cold, hard, statistical numbers, But I think many of us, me included, know somebody who has fallen that is

close to us. Whether in my case it was a grandparent, some, it may be our parents, friends, loved ones, and likely many of our patients as well. For older patients sustaining a serious fall, this often is a major inflection point in their lives. And usually that's not, you know, on the positive side, about 50% are hospitalized as a result of a fall will die within the next 12 calendar months.

One of the major reasons for that is because the precedent that was set while they or their peers are being hospitalized, even though, you know, it's well intentioned, you know, patients become conditioned to maybe limiting their movement so that they limit their exposure to falls. They stay in bed, they're not moving without assistance. And as a result, the average patient will experience about 10 years worth of natural muscle loss after just a week of being in the hospital. They may also engage in fewer social and physical activities as a result. So their world continues to become smaller and smaller as their physical strength, their flexibility and their endurance decline as they perform fewer and fewer, you know, activities that are part of daily living.

You know, they're walking less, they have potential for poor nutrition, you know, and of course, they're getting less exercise, and, you know, very often we see this lead to more muscle and bone density loss. As they become more sedentary, they become less practiced at walking, less capable of recovering from a balanced disturbance. So they fall again, and only the next time, you know, they have less muscle mass to protect their bones and support them. And so the health outcomes would be expected to be worse as we continue to go forward. So we can see that that fall can quickly become a downward spiral.

That's why it's so important for individuals who are at risk to get early attention with care so that this vicious cycle doesn't even begin.

In 2021, Dr. Franklin's group actually published the results of a study that found people with hearing impairments do indeed have significantly lower levels of physical activity. In fact, the results show that

for every 10 decibels of increase in hearing loss, people spend about eight and a half more minutes per day being sedentary. So again, you know, when we think about a patient, even with a mild hearing loss, they may have on the average of 30 to 40 minutes less physical activity each day than somebody who has no hearing loss at all. And that's same age group.

You know, these are certainly alarming numbers that we're talking about today, especially when we think about older adults being, you know, kind of expected to spend about 80% of their waking hours sedentary.

Also, you know, alarming when we think about a study that was published in Age and Aging that looked at the rate of falls for different groups of older adults. The study found that by achieving 30 plus minutes of exercise that is moderately intense physical activity each day at age 65, that resulted in 35 to 40% fewer falls for the rest of that individual's lives. So if we can start building those habits and those motivations and stick with that, that can reap benefits over the long haul. So if we think about somebody with a moderate to severe hearing loss, it's likely that they're going to be achieving much lower levels of exercise, of course, even during their younger years, maybe when that loss began to set in. And that has those downstream effects on their fall risk later in life.

So do you think that older adults really, you know, risk, you know, discussing, you know, this with their physicians, you know, do they express that they have concerns about falling or that they already have fallen? Well, I think very often, especially, you know, if we, you know, have older parents or grandparents, we know that, you know, that risk is real and that, you know, they're very often not Very open about sharing the accounts of their actual falls. And that can be for a number of reasons. You know, the first one when we think about, you know, us as children or grandchildren or loved ones is that, you know, they. We're just not broaching the topic with them, maybe because of fears on our side.

I know that happens with me. You know, we shouldn't necessarily be offended that they don't bring it up to us because we're not bringing it up to them. And know that their primary care physicians are probably not getting this information either. Often they think falls are just part of the aging process, and so, you know, nothing that can be done about it. This is expected.

They also may fear having that conversation because it could result in them being placed in a nursing home. And of course, we know that that threatens that sense of identity and independence that is so important for older adults. Whatever the case, we know that older adults are often unaware of the risk factors that could be putting them at risk of falling. You know, a good reason for us to be sharing information about this in our offices for more than two thirds of older adults, they don't know that as they age, their bodies are going to metabolize medication different. And that could lead to side effects that increase their chance of falling that maybe they didn't have a number of years ago.

And, you know, not knowing all of this, they may not prioritize regular visits with their physicians or conversations with their pharmacist.

There are a list of modifiable risk factors for falling. And I think just in looking at that, you can see that, you know, we can understand how falls could certainly be prevented. Most of the risk factors are modifiable, and that means that there's something tangible that could be done to help mitigate the risk. Risk. You know, just thinking about, you know, wearing better shoes and, you know, thinking about the environment and, you know, whether it is a trip hazard.

I think of that when I think of my, you know, parents, home and the shoes that my dad often wears. Who is the fall risk in the family? Non modifiable risk factors include age, sex, race, and anesthetic. Fall rates, of course, increase as we age, and women are more likely to fall than men and more likely to incur fall injuries. But actually, men tend to die more as a result of a fall.

And looking at difference across race and ethnicity, there are more first nations people and Alaska natives who fall compared to members of other groups. Of course, being a previous fall participant is going to increase that chance of falling again. And it's actually the number one predictor of a future fall from that history of suffering a previous fall. These risks can certainly be compounded when we think about, you know, individuals who may suffer from one or more of those modifiable risk factors. And if we can intervene, you know, early, it's going to help to be able to prevent falls long term.

I think this information really highlights why it's relevant, you know, for us to be thinking about this topic as hearing professionals. You know, of course we know that, you know, falls are a huge problem, you know, with aging individuals and especially that tie in with hearing loss, you know, so for our patients, it's not just about age, it's about that hearing loss that they're experiencing as well. And so one of the really important findings from Dr. Franklin's research at Johnson Hopkins is that hearing loss itself is an independent risk factor. And you know, they saw in their research that over a 40% increase in self reported fall rate for every 10 decibels of measurable hearing loss.

So that means that somebody with a mild hearing loss is at least three times more likely to fall than an individual of the same age group who doesn't have a hearing loss. Let's also acknowledge the fact that, you know, that hearing loss as a modifiable risk factor, something that could be, you know, of course, managed. There's one particular paper that was published in the American Journal of Preventative Medicine that reported on a cohort analysis of about 53,000 adults. And the purpose of the study was investigating the association between risk of fall and self reported hearing loss. What they found was that patients with self reported hearing loss who did not use hearing aids were 2.7 times more likely to fall with self reported hearing loss than those who were being managed with hearing aids that had that self reported hearing loss.

And patients who used hearing aids were not significantly more likely to fall than patients with normal hearing. So if we think about this in maybe a different way, the findings really support the use of amplification as an evidence based intervention that may help to reduce the risk of falls. And you know, it also supports the notion that the physician should be considering screening for hearing loss as part of their routine falls assessment with this older population. And that would be, I think, a great area for us to be building awareness in our community with our medical arts colleagues. So now let's take a look at how Starkey technology can aid in fall detection.

Starkey created an industry first feature that has the ability to not only detect falls, but also send fall alerts to the patient's caregivers and loved ones that they designate. Once the fall is detected, a signal is sent wirelessly to the patient's smartphone, which then sends the alert via text message to the designated contact. Going to play a short video that allows you to kind of see this process in action. Your hearing health is important and so is maintaining your safety and well being. That's where Fall Alert comes in.

The app feature that enables your hearing aids to detect when you fall. Then send a text message with your location to the people you choose so they can get you help if you need it. False alarm? No problem. You have time to cancel an alert before the text message sends.

To set up Fall Alert and invite a contact, just follow four simple steps from your app Home screen, tap the health icon. Next, scroll to additional setup and tap Set up Fall Alerts. Learn about Fall Alert on the two welcome screens. You can sample the sound indicators you'll hear through your hearing aids if you fall. To familiarize yourself.

When ready, tap. Next, a permission box may appear asking if Fall Alert can access your contacts. This would allow the app to enter your contacts details using your phone's contact list. If you choose not to allow this, simply complete the fields yourself. Now send your Fall Alert invite.

Your app will then confirm the invite has been texted to your contact. You can also invite another contact if you'd like. To find out if your contact has accepted your Fall Alert invite, tap more. Next, tap app settings and then Fall Alert settings. If your contact is listed as pending, they haven't accepted your invite yet.

Here you can resend the invite if you'd like. If your contact is listed as active, they've accepted your invite and will be notified if you fall.

I think you can see how easy that process actually is. Contacts, when they are being invited, have 72 hours to confirm their participation. The user of the hearing aids will receive a notification when there are 24 hours remaining if that contact hasn't confirmed so that they can maybe reach out to them or resend the text message as needed. If they do that, then that starts the 72 hours over again. And if that isn't accepted within that next 72 hours, then they would need to completely re, you know, enter that individual.

The contact gets a text message that requests their participation. They click the link in the text message. They're prompted to enter their phone number, click Submit and it's going to bring them to a screen that lets them know that the hearing aid wear is requesting their participation and that they would get a text message if A fall was detected or a manual alert is initiated. So then they'll be able to follow through that process and confirm participation. And a person actually could be a contact for more than one individual.

It's important to know that iPhones and iPads and Android phones are supported, but Android tablets are not. A couple of very other important pieces are the system will be active once one contact has accepted and there's the possibility for having up to three contacts. The hearing aids need to be powered on the aids and the phone need to be within Bluetooth range of each other so that roughly

30ft. So you can't leave your phone at home. And if you fall at the grocery store, expect that it's going to trigger that alert.

The My Starkey app needs to be running on the device doesn't need to be front and center, but it does need to be up and running somewhere in the background for the feature to be able to function. So how does it really work? Well, there's four basic steps. Either an alert is automatic, automatically detected because of a fall, or there's also a manual alert that we'll talk about in just a moment that the user can initiate. After 60 seconds that alert text message will be sent to the contacts and the user also has the options we saw in the video to cancel that if necessary.

Once the alert is sent, that contact gets a text message. There's also notification within the hearing aids that the alert was received. So there's kind of some back and forth to keep the hearing aid we're aware of where we are in the process. So let's take a little bit of a closer look here. I mentioned that there's two ways alerts can be sent.

Obviously an auto alert is triggered by an actual fall and the manual alert is initiated by the user control. This can actually be used as a backup to falls, you know, if by chance, you know, they're a high risk. Maybe we want to make sure that if for some reason it wasn't detected that they have a way to trigger that using the user control. Or maybe you've got somebody that, you know, goes to environments where they don't often feel safe. I think of realtors who, you know, may be, you know, showing a home and you know, they're by themselves.

It'll be able to allow them to let them know somebody, you know, let somebody know where they are. Or it could be some other non fall related medical concern. And a patient can actually have both auto and manual alert active. The manual alert can be easily enabled within the fitting software from the user control screen by dragging and dropping manual alert to the push and hold gesture. What this means is that if the push and hold, it's going to then send that manual alert as necessary.

And it's going to be a binaural setting so that the hearing aid wearer doesn't have to think about right and left in a stressful moment on which you're depressed.

If a fall is detected or a manual alert is initiated, it starts that timer 60 seconds, which can also be extended to 90 seconds as well. And if the phone is locked, there is going to be a banner notification that will pop up and you'll see that there's a countdown and kind of a, you know, constant up updates as we're getting closer to that 60 seconds and that ability to cancel if necessary. Once the alert is sent, the hearing aid wearer will hear alerts sent and it's going to then send that alert off to those contacts. If an alert is canceled, we do populate a page that's going to ask kind of a why this helps us certainly learn about, you know, maybe the most motivations behind that so that we can continue to make sure that this system is effective for our patients. They also hear alert canceled in their hearing aids.

If they generate that once the alert is sent, the individual who's the contact is going to be able to click on the link in that text message. They're going to enter their smartphone number, they're going to, you know, select alert received so that that hearing aid wearer knows that the alert has been sent on its way. And as long as location services are on on the hearing aid wearer's phone, that will display a map of where they are. So it's important to make sure that disable location settings is not, you know, set up on that phone because we want to be able to show where that individual is when they need help. Now the hearing aid wearer is going to receive notification that the alert was received.

So they'll hear alert received in their hearing aids. So again, they've got that ongoing communication both audibly and visually with the phone. So how accurate is the system? We get a lot of questions about that. And as we were developing it, which was done back in our Livio AI generation of technology, so a number of generations ago, we did a comparative looking at all these types of falls, near falls and daily activities, comparing our fall alert system with the Phillips lifeline alert pendant type of system.

And so we can see that there were a lot of different paces that these individuals were put through to mimic, you know, what happens with an actual fall. And what we found out was that our system was very accurate, much more accurate than the Phillips lifeline system incorrectly identifying falls as well as correctly rejecting non falls. So this, this is a very strong, very accurate system. It's important to know that it is not classified as a medical device within the technology. So it's not something that is governed by the fda.

And so we do make sure that we've got wording around this in the marketing literature. And it's important for your patients to know that this is not intended to diagnose or treat anything fall related. It's also important to know that emergency services will not be notified and you can't make 911 a contact because this is a text based system. So it's designed to provide, you know, that extra communication and, you know, kind of a, you know, a comfort of if somebody does happen to fall. It's also important to know that there may be technical reasons that things go awry, which we know dealing with technology that could be failure of Bluetooth or cellular connectivity as well.

So Starkey has been proud to offer fall detection for a number of technology generations and across all tiers of technology because of the value of this feature. But we also wanted to look at the possibility of preventing the falls from happening in the first place. And to do that, we actually took a look at the core principles of the CDC's fall prevention initiative called steady. And this is a kind of a fun acronym that stands for stopping elderly accidents, Death and injuries. And it was a program that was designed to identify those modifiable risk factors and use that information to provide, you know, details about assessments and treatment.

So this is something that, you know, is readily accessible on the CDC's website. If you're thinking about incorporating questions around fall concerns in your intake forms or in your just conversations with your patients, these are the actual three key questions that are part of that STEADY initiative that are, you

know, can be identified. And if there is a yes response to any of these three questions, that individual has a 95% sensitivity for identifying at risk individuals. So this is something that you know, is very successful. And those questions, as you can see there, are, you know, have you fallen in the past year?

Do you feel unsteady when standing or walking? And do you worry about falling? So as we took, you know, the lead from the cdc, the MY Starkey balance assessment feature incorporates those assessment tools that are part of the study and it allows edge AI where specifically to gain an awareness of their balance with a self guided at home evaluation. This evaluation is made up of four standing and two chair exercises and it was designed to be self guided but is certainly something that you could do with your patient to support them as they are performing the assessment. To begin, they start the assessment from the health tab within the My Starkey app and they're going to get both on screen and voice instructions.

The voice instructions will be streamed to the Edge AI hearing aids, although you can switch the audio routing to the phone if desired. With each exercise, the hearing aids initial sensors are measuring how the user performs, then streaming the data to My Starkey. And an algorithm within the My Starkey app determines the results of those tests and displays them for the user. There is an onboarding process that begins and you'll see first information about what to expect during the assessment. Then you know, the encouragement to consult your medical professional for help if necessary and to also engage the fall alert feature as a safeguard.

And then the final onboarding screen is going to be gathering that demographic information so that we compare the results to the user's peer group, which is very important. They also need to set up their area where they can perform the assessment. It requires a straight backed chair without armrest, a measuring tape, adequate open space and a desk or table. So they'll be shown how to position the

chair and then given the opportunity to adjust their volume volume so they can make sure that they can hear the spoken instructions. So here's just a sample of one of the balance assessment standing exercises and what the wearer would expect during the process.

So they, you know, are going to be guided, you know, with visual and certainly, you know, audible instructions throughout the process and they'll be able to see that information. They can also preview the exercise which can kind of give them idea of what to expect as they are getting those instructions. When they're ready, they tap begin exercise and they'll see the instructions. They're going to set down their mobile device until the exercise is complete and then they should be hearing the audio either through the hearing aids or through the phone. So here's two potential screens that you know, will let us know what we would expect once that particular standing exercise was completed.

If there are no balance concerns, we'll see the screen on the left and they're asked how the exercise went. They can choose it went well and they can proceed to the next exercise or they can try again if there are balance concerns. We'll see the screen on the right and they're given an option to try the exercise again or skip to the next exercise. The results are given in kind of broad wellness terms. If there is a balance concern and the results are inconsistent with their peer group, the assessment will display in orange with that exclamation point.

If there are no balance concerns and the results are consistent with that peer group, we will see that green check mark green being good in that case. And if there is a section that was marked non completed or that was skipped, we're going to see that information and then be able to go back and access that as needed needed. So here's just three examples of those detailed results based on, you know, whether the results were good, whether they fell within that, you know, orange concern area, as well as the generalized information related to gender that we may see based on that earlier demographics. The user can also follow their balance assessment results over time. Looking at that

history from the My Starkey app and you know, the number of assessments that can be saved is really only limited by the smartphone storage capac.

We also offer exercises for balance and stability that can be found in the Learn section of the My Starkey app. So this gives the patient some options to aid in improving their stability and balance with a set of exercises, three in total, for warm ups, stability and balance. So if you know, hearing aid wearer seeking information about what the next step might be, certainly we would want to consider referring them to their primary physicians. Also, keeping in mind that pharmacists are a great resource because they know all of the polypharmacy that tends to go on, you know, with older individuals and can really be a great resource for us. Of course, physical therapists and occupational therapists, you know, would be probably part of the treatment strategy and you know, they may be somebody that you bring in depending on your clinic possibilities at an earlier stage.

And, you know, there's a lot of evidence based fall prevention information available online, of course, on the CDC site. And if you just Google evidence based fall prevention programs, you're going to see information, information that pops up, especially about the National Council on Aging that has a list of programs and resources that can be evaluated. So I think, you know, technology with artificial intelligence, embedded inertial sensors is giving us the capability to provide that more holistic strategy with our patients to be able to not only deliver, you know, a hearing performance that, you know, is what they are seeking, but also the potential for us to, you know, be able to positively affect some other conditions that they may have as a result of that hear loss, you know, with that correlation between hearing loss and fall risk. Know that Starkey is always happy to support you and your patients as you help them move towards hearing better and living better. And we're really proud to be the only manufacturer that offers fall detection and now balance assessment with our technology.

So I want to thank you so much for joining me today. I've got several pages of resources here from the references that were part of the presentation, so feel free to examine those. And again, I will thank you for your time and I'll see if we've got any questions that we need to answer here.

Question about seeing messages. You know, the patient is going to see those on the phone. The contact would see, you know, what is visible on their, you know, text based messaging through that contact, you know, receiving the alert. So, you know, this is also something that with our Hear Share app. Actually the, you know, user of the Hear Share app would be able to view if their hearing aid wear fell, although they might not be part of the contact system that gets the active alert.

So we have several ways in which, you know, there is kind of an awareness and alert system that is possible both on the patient or hearing aid wear side as well as the provider. I'll remain here in the classroom if there's any further questions and otherwise I thank you so much for taking the time to join me today. I think this is such a valuable topic for us to be, you know, building awareness for because of the known correlation between hearing loss and the risk of falling.