

Hearing Health Hour: New Developments in Treating Hearing Loss and Related Conditions: Digital Therapeutics

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>> Hello and welcome to the hearing health webinar, the hearing health hour webinar.

My name is Dr. Anil Lalwani.

We are happy so many of you are kicking off 2021 with another presentation on hear log research from the Hearing Health Foundation if you are new to Zoom, review the technical guide that has been shared in the chat.

Please note that the event has a live captioner.

You can enable closed captions by clicking the CC button in the toolbar at the bottom of your screen.

Again, my name is Dr. Anil Lalwani.

I'm a board member at Hearing Health Foundation where I oversee the emerging research grants program known as ERG.

ERG awards funds to research studying hearing imbalance conditions.

Also professor and vice chair for research in the Department of otolaryngology head and neck surgery at Columbia university College of Physicians and surgeons in New York.

In a minute, I will turn it over to Dr. Nancy Tye Murray who received an ERG grant herself in 1987 through 1989 for her policy research on auditory brain training or training the ear to listen.

ERG grants for many leaders in our field to become successful.

For Dr. Tye Murray, the 42,500 that she received from HHF more than 40 years ago is relevant to her important work today.

This work is only through the generosity of supporters like you.

If you like to support our work on hearing loss, tinnitus and related conditions you can do so at HHF.org/donate.

Again, HHF.org/donate.

Now we will move to the presentation.
New developments in treating hearing loss and related conditions.
Digital therapeutics.

Please do hold your questions for Dr. Tye Murray until the Q&A session at the end.

Dr. Tye Murray

>> Thank you, and it was an honor and privilege to be here.
I'm looking at that 1987 and it's hard to believe it's been that long.
I'm absolutely delighted to be here.

Hearing and I'm delighted to be part of the Hearing Health Foundation.
Most of you know there are at least 35 million adults in the United States alone who suffer and I use the word suffer from hearing loss.

It's so important that we continue to conduct research on ways to alleviate the many consequences of hearing loss.

And that's actually what I will be talking about today.

That being new developments in treating hearing loss and related conditions what we call comorbidities and in particular I will talk about two topics, digital therapeutics and auditory brain training.

I'm having a hard time forwarding this.

There we go.

So first of all let me give you a little background.
I'm a professor in the Department of otolaryngology at Washington School of Medicine and the CEO and founder of cLEAR which has Amptify.

And I purposefully highlighted in yellow my award at the time it was called the deafness research foundation.

In 1987 the first grant I got was for \$42,500 which was quite a bit of money back then and I developed computerized auditory training games for hearing impaired people.

That was a very beginning of my career.

What that led to was this company.

So is that direct result of that investment by you all and you will see I'm a PI of NIH that deals with auditory training.

I had that grant for 15 years now and that too is a direct result of this initial grant.

So as I said, it's a privilege for me to be here because I owe so much to the foundation.

With that disclosure, let's get this going.

You know it is not working.

Laura, maybe you can forward the next slide for me.

There we go.

I will signal you when to forward it because I'm having a problem here.
But the learning objectives.

So by the end of this webinar you will be able to describe hearing related comorbidities.
You will know what digital therapeutic is.
And you will know the benefits of auditory brain training.

When audiologist is in graduate school, when we are in our training we are taught there are three pillars of hearing health care.
The first pillar is diagnostics.

So a patient comes to us thinking they have a hearing loss and we provide a formal diagnosis of that loss.

The second pillar is treatment.

So if appropriate, the patient received amplification.
So usually a hearing aid.

And receives appropriate assistive device technology.

A good example of that is maybe a telephone with an amplifier on it.

And the third pillar is rehabilitation.

So we help the patient learn how to manage the new hearing aid and importantly provide ongoing support in counseling and encouragement as the aural rehabilitation process.

When we get out of school, unfortunately, pillars one and two often are part of our practice but pillar three often is left out and also the best audiologists provide aural rehabilitation, unfortunately, it's not always practical because it's labor intensive in cost and not always cost effective.

So one of our big research goals right now is how do we get pillar three back into the flow of treatment in a way that is beneficial to the patient and in a way that is feasible audiologists to provide.

Next slide, please.

So let's start out with the before we talk about rehabilitation, let's talk about the challenges that we have to address as we rehabilitate.

The obvious ones are directly related to hearing loss.

So hearing loss challenges.

These include impaired sound detection.

Meaning that sound has to be amplified or made louder in order for the person to hear.

Reduced speech discrimination.

So even if the sound is loud enough for the patient to hear, the patient won't understand it.

It will sound mumbled and many words will sound alike.

Poor sound localization.

This is a big one and it's not trivial.

The ability to tell what direction sound is coming from.

Increased perceptual effort.

This is perceptual effort.

It provides so much mental energy to recognize the words that are coming at you that it depletes cognitive resources for understanding what's being said.

You have to exert more effort for understanding.

Stinted conversations.

What I mean by this is that often if you have a significant hearing loss, your conversations are confined to the obvious like how is the weather.

What's for dinner.

Or thins in the room.

Tangible things in the room that you can talk about.

If you get into the esoteric conversational topics, then you will have an increased occurrence of communication break down.

Next slide, please.

But one of my main take home messages for today is hearing loss challenges don't stop at the ears.

There are a lot of comorbidities.

And I designed this slide because because what may be idea this is becoming increasingly known both among researchers and among the public that the comorbidities associated with hearing loss.

So you will see articles in the New York Times, in Reuters, in the trade journals about all of the various complications that are associated with hearing loss.

So comorbidities, and I put at the top of this slide a very important sentence and that is: Health care costs are 46% higher for those with untreated hearing loss.

So that is a whopping cost that our health care system is incurring if hearing loss is not treated.

And some of the comorbidities that occur with untreated hearing loss include social isolation and loneliness.

So there is a reduced quality of life, increased communication difficulties and poor emotional health and well being.

Depression.

The instance of depression increases with hearing loss and the severity of hearing loss.

Hear is an important one.

Falls.

For every 10dB of hearing loss that someone has, that person incurs a 1.4 fold higher risk, increased chance of falling.

Cardiovascular disease.

So that is associated with hearing, untreated hearing loss and there is also a higher risk of strokes.

Finally the strong correlation between diabetes and untreated hearing loss.

And that is not the complete list.

I saved the biggy for the next slide.

So next slide, please.

A co morbidity that's received quite a bit of attention the last four or five years is dementia.

Hearing loss puts people at greater risk for dementia.

And here I've got statistics.

Approximately 1.9 higher risk if the hearing loss is mild.

Approximately three times higher risk if it's a moderate hearing loss.

And almost five times higher risk for a severe hearing loss.

And I would be happy maybe during the question time to talk a little bit more about why this is so.

In a nutshell, this is because of a couple of reasons.

One, a person with hearing loss tends to socialize less so there are fewer conversations to keep those mental wheels rolling.

And number two, some of those regions of the brain that were devoted to listening and auditory

capabilities are either co-opted by other parts of the brain or they cease functioning.

And so cognitive decline happens as a result.

So let's talk go back to that pillar number three that I showed you on one of my first slides.

And what would or should aural rehabilitation include?

And this is just a small sampling of what we audiologists include in aural rehabilitation.

It might be listening strategies.

Strategies for engineering your environment so you can use your residual hearing.

Might be units on how to manage communication breakdowns.

How to prevent that from happening and manage them if they do happen.

It might entail assessing your ability to read lips, speech read and maybe speech reading training.

Stimulating your auditory brain skills.

I will talk a lot about that in a few minutes.

And then staying connected.

So the importance of staying connected.

So these are the kinds of things that we like to put into that third pillar.

It doesn't always happen until very recently.

Next slide, please.

And that is because digital therapeutics are making their way into the hearing health care universe.

This is happened only very recently but this is not only what I think is going to be a very big part of the future of hearing health care, but it is increasingly becoming part of our present thanks to COVID and the coronavirus 19 and that's an oxymoron saying thanks to COVID, but such that it is.

Next slide, please.

So here I'm going to read you the definition of a digital therapeutic because probably many of you in the audience are familiar with this term.

A digital therapeutic is a software based intervention for a disease and/or disorder that is clinically validated to drive a specific positive outcome.

Is it often used in combination with a drug intervention or a medical device.

And in the case of a hearing health care digital therapeutic that is most likely to be a hearing aid

Here are and by the way, digital therapeutics are commonplace in many aspects of medical care.

Until only recently as in the last three to six months have they made an appearance in the hearing health care world.

And here are some examples of digital therapeutics.

WellDoc has the blue star which is designed to treat type one and type two diabetes a patient might take insulin and have a daily kind of lesson on a cell phone on how to manage diabetes.

How to gauge whether it's getting out of control or not.

Propeller health has a digital therapeutic and this is the control asthma or COPD. Often used in conjunction with an inhaler.

And one of a fairly well known one is from Omada and it, too, treats diabetes and hypertension.

So the question is: If you were to come up with a digital therapeutic for hearing health care, what would that include?

And that's what my company has created the first digital therapeutic for hearing loss and I will just briefly, very briefly tell you what the propane components are.

So next slide, please.

A comprehensive tech what a hearing health care digital therapeutic do?

Well, it's designed to treat hearing loss but also those downstream effects that I talked about, those comorbidities.

If we call it when a patient engages in a digital therapeutic, we call it a patient journey.

And so for a hearing health care digital therapeutic, the patient's journey will include the following components.

We would start with participant testing and enrollment.

So many have a hearing test actually built into it.

And enroll.

And these are very important components that we learn from the digital therapeutics that have been designed for diabetes.

A hearing coach.

So an on line hearing professional that provides guidance and support where patients can ask questions directly to the hearing health care professional at any time and receive answers.

It also includes a peer group.

So an on line kind of chat room that is guided and supervised by the hearing health coach.

And especially with hearing loss.

It's such an isolating experience that to be able to engage with other people who also have hearing loss and share solutions and ideas.

I often say only somebody with hearing loss can really understand what it's like to live day to day with a hearing loss.

And to get empathy for someone who shares your experience is very important.

Then there are the next components are engaging tools and connected technology.

In the case of a hearing health care digital therapeutic, these tools and connected technology include two things.

One is a daily curriculum.

So you will see right above this I show those little pictures or what our program should include.

A digital therapeutic would have units on all of these various components that you go through day to day to day.

And importantly and what I will talk about the most are auditory brain training games. Computer games that people can play that exercise and develop their listening skills. Next slide, please.

So this is the Amptify Digital therapeutic. So we have audiologists on staff and we have hearing professionals who are audiologist but have gone through the Amptify training program. And the interactive hearing lessons. Each day you go through a daily curriculum and it has a tab and you click and gives you instructions and it's educational materials. The third view is various games you can play and I will talk about what those games do for you.

And then the fourth view is a just a window of a chat room.

The hearing health coach might ask a provocative question about how do you handle this situation or that situation. And then the members of the community can all weigh in.

And then we create communities by asking questions of people within the app and say, and try to group them together with like interests and like hearing loss.

Here is an example of the interactive hearing health lessons.

There is a lot of trick not tricks.

A lot of guidelines you follow when we put this together. You want things that are bite sized, easy to read. You want them visually attractive and the idea is that you want to engage people in this hearing journey. So we have interactive quizzes that they can do. We have puzzles that they can work. And then information coming at them according to the topic of the week. Next slide, please.

Here is an example of the video training games.

And we have done a lot of research about how do you make auditory training effective.

One of the biggest deals is to make it engaging because if it's not engaging, people won't do it.

So here is an example of one of the games.

It's animated, developed by professional game designers.

You can't hear it but what's happening here is a word is playing over and over in background noise and the patient's job is to direct the rocket into the right word.

And the closer you get to the right word, the softer the background noise gets and the louder the sound.

It's also a way of coupling motoric activity with perceptual activity and this enhances neuroplasticity.

So now I will segue into auditory brain training and why it's so important for people who have hearing loss.

It's not there are several auditory training programs out there.

I would recommend you look for the game modification feature when you are hunting for one.

Let me walk you through what auditory training does for you.

It exercises your listening skills and it helps patients maximally use their residual hearing maximally use their residual hearing.

It's what hearing develops.

Next slide, please.

So what are the auditory skills trained?

One is word discrimination.

The ability to distinguish or discriminate between words that sound similar.

Words such as car and far.

Chair and care.

Tree and be.

Every day familiar words.

So we teach people to recognize very quickly of every day familiar words.

You may not realize this, but during your typical day you hear the same 1,000 words over and over again.

Day after day after day.

Words like table, girl, street, car, chair.

If we can teach you to rapidly recognize those common words, then we can reduce the perceptual effort involved.

It can enhance listening confidence and importantly we focus on developing auditory cognitive skills.

So there are certain skills cognitive skills you need to have up to snuff no matter what you're listening to and no matter who you are listening to.

And these are auditory processing speech, auditory memory and auditory attention.

I will walk you through each one of those.

Next slide, please.

Auditory processing speed.

This is how long it takes you to understand and react to something that someone says.

Next slide.

During every day conversation, even as I'm speaking now, words come at you at 120 to 150 words every minute.

So I'm probably talking at 120 words per minute.

If you are talking to someone New Yorker who had a lot of coffee, he or she is probably giving me 250 words a minute.

And so what happens if you have hearing loss is as these words are coming at you it takes you longer to recognize words because of the hearing loss and so you might be on this word and the talker is 100 words beyond you and you get lost.

And not only do you have to recognize every word, but your brain has to interpret the meaning.

Training auditory processing speed, your ability to recognize the words quickly is very important.

Next slide, please.

Auditory memory is another thing that these auditory training is developing auditory memory. And this is the ability to understand what someone says as they are saying it and thenar to it for later recall.

And the examples would be recalling the details of a funny story or remembering directions that someone has given you.

Auditory memory in detail that have on the right side.

Paying attention.

Listening, processing what you hear.

Storing the information in your brain and recalling it.

And you will see I bolded the word "listening" because if you have trouble with the listening part, everything that follows is hampered or it's compromised.

So it's very important we get that listening.

Next slide, please.

Why listening with hearing loss may detract from understanding.

Brain power goes towards identifying each word and therefore the individuate hearing loss no longer has the intellectual resources available for either processing the meaning or storing the information into memory.

And that's why maybe a week later someone doesn't remember the details of a conversation and this isn't because of a cognitive challenge or cognitive decline, but rather that story or those details never made it to the memory banks because the cognitive resources that would have allowed that are dedicated to recognizing the word.

Next slide.

The final skill is auditory attention.

A person's ability to focus on the speech of a single talker and to ignore other sounds and speech in the listening environment, especially when listening in a noisy room.

Anybody in the audience who has hearing loss will probably agree that the biggest problem that

hearing loss poses is listening when there are other people talking.

That's number one complaint I hear as a hearing professional that I'm fine when it's one on one and it's quiet but in a noisy room where somebody else is talking, I have great difficulty.

So developing auditory attention, your ability to focus on a single talker and follow that speech stream.

Next slide, please.

So why is auditory brain training helpful?

So in this and this goes back to what I was talking about when I mentioned some of the reasons that hearing loss and dementia are connected.

When somebody incurs hearing loss, some of the brain cells dedicated to processing sound and get co opted by other parts of the brain.

9 visual system might take over some of the neurons that were originally meant for processing auditory information.

Other brain cells shut down and stop working.

And over time they have fewer cognitive resources for processing speech.

So this is actually an example of brain neuroplasticity as a result of experience ie, sound deprivation, the brain changes.

The flip side of this is because the brain plasticity neuroplasticity, it can also change back with appropriate stimulation, ie, with a hearing aid and training you can begin to change the brain back to how it used to function.

Next slide, please.

As I mentioned, you saw the gamification, and looking for a program try to find one that has gamified auditory brain training.

It's not that we want we want you to enjoy the time by playing computer games.

You can do that by playing solitaire or Scrabble on your phone.

Why auditory brain training should be gamified.

I bullet point the reasons why.

Playing video games is entertaining.

You having fun and it's engaging.

When you having fun your brain releases a neurotransmitter called dopamine and it works as a messenger between brain cells.

One result of pleasurable activity is a release of dopamine in the brain.

Dopamine actually promotes brain plasticity.

So when you have these chemicals rushing through your brain there is a greater opportunity for change to happen within the architecture of the brain cells.

And more brain plasticity means more auditory learning and more development of auditory brain regions.

That's a neuroscientist explanation of the value of gamification.

Auditory training is backed by peer research and publishing.

One important thing to note when you are talking about digital therapeutics is in order for it to be any digital therapeutic to be approved by the FDA, its effectiveness has to be shown by peer reviewed publishing or peer reviewed research.

And so in my lab as I mentioned we had 15 years of NIH22 study how effective auditory training is and how to make it more effective in a bunch of things.

And published in several peer reviewed journals.

Here are my lab's findings.

Auditory training enhances speech discrimination.

It leads to reduced perceptual effort during listening.

It enhanced the hearing wellness experience.

Increases listening confidence.

Leads to improved communication and interactions between couples.

And it complements hearing aid use.

Greater satisfaction and faster acclimation.

Next slide.

So I will give you an example of one of our studies and I kind of picked one out. And the reason I'm doing this is I want to show you both the rigor that's required when you are developing a digital therapeutic in how scientists go about assessing the benefits.

So rehabilitative techniques.

So I picked one of our studies.

This is one that came out a few years ago and was published in the journal of speech and language research.

And scientists we ask two questions for this study.

First we said what kind of training schedule should we recommend to patients?

And we drew from the literature of cognitive psychology on this one.

There is a lot of literature in cognitive psychology that says spaced training leads to better learning than massed training on such tasks as word learning and game learning.

So what do I mean by spaced and massed training.

Let's say you will have four hours hypothetically of auditory training.

Is it better to have those four hours maybe for ten minutes a day for ten weeks?

Or is it better to mass it all together so over the weekend I'm going to squeeze in four hours of auditory training.

And we hypothesized that spaced training would be more effective and have longer term benefits than the mass.

That was our hypothesis.

And the second question we asked are training gains maintained over time?

If I do train the four hours, will I still have any benefits say two to three months later?

Kind of like if you go to the gym and work out and get really strong and you stop, well, three months later will you still be that really strong even though you haven't been training?

Those were our questions.

Next slide, please.

So here was our experimental design.
We had a total of 67 participants.
24 participants were assigned to the spaced training.
They had train over the course of ten weeks.

23 participants sorry.

I meant to say 47 participants and not 67.

I got a little confused.
23 participants assign nod massed training.
They squeezed in their 28 hours of training into a two week time.
And then we had four different kinds of tests to assess both their benefit of training and retention of training benefits.
We had a test of word recognition.
So say the word car.

Say the word boat.

And you have to repeat the word.

Four choice discrimination.
You hear something like car, far and you have to decide if those are two words are the same or different.
We had four permutations of that word here.
You have to car, car, far, far, car, car and had to pick which of the permutation.
That gives us the idea of speech discrimination.
Fill in the blank.
Could they hear a part of a sentence and fill in the rest of it?

And then their ability to use sentence context.

If we gave them context in a sentence, were they able to utilize it?

Next slide, please.

Here is the training schedule.
As I said, one group the spaced group had their 20 sessions spread over ten weeks and the massed group had it squeezed into two weeks.

We tested them before their training and after their training. Immediately after and then no training for three months but we brought them back and retested them on all of these tests.

You will look at this and whoa, what is this?

You will get the take home message and will walk you through it each one.

These graphs relate to one of the four tests I told you about.

Word identification, discrimination, fill in the blank and context.

The dark bars are those who received massed training and the light bars are those who received spaced training and along the X axis for each of the graphs you will see the pre score, and the post score immediately after training and then three months later.

The take home story was, number one, training is beneficial.

You will see from the first set of bars to the second set of bars for all four graphs you see a big jump in performance.

The second thing much to our surprise is massed and spaced training were equally effective.

So contrary to our hypothesis and contrary to say looking at word learning or athletic skills, there is no difference between the two.

And finally results were maintained three months later.

So to wrap it up, digital therapeutics are coming.

The goals are to help patients maximally utilize their digital experience.

Exercise auditory brain skills.

Increase socialization.

Education patients about hearing loss and management techniques.

And provide ongoing hearing health care from hearing professionals.

I think we are time for questions and answers.

Thank you.

>> Dr. Tye Murray it was a wonderful talk.

I know we have questions from our audience.
One is from Larry.

The subsequent co morbidities with hearing loss that you described, were the increased numbers you mentioned only for untreated hearing loss?

I assume the risks are less if you were to obtain hearing aids or under went training and so on. The question really is, the risk that you talked about, they are for untreated and do the numbers go you lower your chances of getting those things if you have intervention.

>> That is a fabulous question, Larry.
And nice to have you here.

There is a huge study ongoing right now looking right now the relationship is co relation.

Right now there is a study underway seeing if it's causal.
If you don't get a hearing aid, will all of these awful things happen to you?

And if you do get a hearing aid, will you lower your risk?

I'm pretty cautious about saying that, yes, you will lower your risk right now I think you will, but right now it's a correlational relationship.

>> From Jane, there is a limitation to the amount of hearing loss one can have in order to benefit?

>> Yes and no.

If you have a full sound hearing loss you won't benefit from auditory training.
You will benefit from everything the curriculum.

The daily tabs, we call it a curriculum and the social chat room and the hearing health coach, you need some hearing to benefit from auditory brain training.

With that said, we do have quite a few cochlear implant users.

In fact, we were affiliated with one of the cochlear implant companies so that's a profound hearing loss but there is some hearing capability because of the cochlear implant. We recommend the training game for mild, moderate and severe hearing losses.

>> My follow up myself, is your digital therapeutic plan primarily for people who wear hearing aids or is it also for people who don't wear hearing aids or may have mild hearing loss or no hearing loss.

>> Yeah, that is a great question.

So we had a predecessor product called cLEAR for this.

We originally attended this primarily for new hearing aid users.

What has been somewhat surprising we have other kinds of users that come aboard. The I'm not ready for hearing aids yet but I want to do something.

And sometimes playing these auditory training games makes the person realize the magnitude of their hearing loss and they subsequently go out and get a hearing aid.

The other kind of patient that has come on board is the hearing aid user who still wants more.

They are not happy with just a hearing aid.

They want more.

We have a whole range of patients.

>> And there is a question from Robin.

How does this apply to those with tin its I'm thinking tinnitus.

I think that person is talking about digital therapeutic

>> Our digital therapeutics has quite a bit on tinnitus.

On managing tinnitus.

There is no magic bullet for tinnitus.

And probably for many reasons.

One of which there are probably many causes of tinnitus, but there are ways to manage it.

And so the daily curriculum includes tips on managing tinnitus and tips for not for making sure it doesn't get worse.

So prevention.

>> This is a very interesting question.

How different would the findings be with respect to recognition, discrimination, auditory memory, et cetera, by using brain training in individuals with hearing loss versus individuals with auditory processing disorders.

>> Well, that's a great question, too.

And actually when I said we had surprise groups of patients that we weren't expecting, we have quite a few with CAPD.

And I have absolutely no data on the effectiveness of auditory brain training for CAPD, central auditory processing disorder.

And the reason for this is to do the kind of study I just described to you, you need a fairly large in. A large number of participants and CAPD is relatively rare so it's hard to find participants and relatively difficult to diagnose definitively.

And those two reasons have been road blocked from my lab to study the effects of it.

But with that said with our previous product that I just mentioned, probably our second biggest class of users are children, teenagers adults with CAPD.

>> I wonder, could you comment about how training in other sensory systems like the visual systems like smell or taste, would there be any positive benefit to the auditory system because of the cross talkover that occurs between the or just too far fetched of an idea?

>> I think it's a cool idea.

I will tell you what I know that pertains that it pertains to what you just asked.

There is evidence that some whether you realize it or not and though anybody with hearing loss out there does realize it, the visual signal dramatically enhances your ability to understand speech.

So if I'm in a noisy room and I can only hear 30% of what you are saying and if I threw in the visual signal and now you can see me, I would my recognition would pop up to 80% or even higher depending how good of a lip reader I am.

The visual system is extremely important for supplementing residual hearing.

What I think the literature is a little muddy on, this but my having read the literature a lot, my take home is that you are born a good lip reader or not born a good lip reader.

And so the training lip reading has very little effect on listening and vice versa.

>> Continuing the question on the visual theme here, can those with visual impairments benefit from this type of training for hearing loss?

>> Yeah.

So my other my lab at Washington University has two areas of focus. One is auditory training and the second which we have RO1 grant for is lip reading and speech reading.

And one of the studies we did was we systematically blurred the visual signal. So we had one scenario where you could see me very easily.

The next scenario I was a little bit blurred. More blurred, more blurred.

To where and then we had a condition where you saw an oval.

Undulated, like a mouth would in rhythm to the speech.

All of those conditions enhanced recognition.

So the more you can develop your hearing even if you have impaired vision, the better you will be able to understand conversation.

>> Terrific.

Jane wants to know is this training applicable for children as well?

If so what ages?

You might broadly answer the question about your work in children broadly as well.

>> Yeah.

In fact, I have an RO1 looking at children right now.

It's a five year study that just wrapped up so I can really talk about this.

The effects are dramatic for children.

We had 99 children in this study and the auditory training ever performed with children.

We actually so they improved when we trained them we call them generic talkers.

People they don't know.

They showed a dramatic improvement.

I don't want to throw out a number because we had a lot of different tests and any number I can't pull off the number off the top of my head but it was significant and dramatic.

And the coolest thing of this particular study is we trained them on not only generic talkers but a teacher, a classroom teacher.

And our idea is that if a child with hearing loss at the end of May the teacher for next year records a training stimuli, and dump them into the game and they play these games over the summer and then on the first day of school that child recognizes the teacher's voice as speech pattern even though it's unfamiliar and it's also what I call the Oprah Winfrey effect.

Any of Russ walking down the street and we see Oprah Winfrey, we know her.

Oh, there is Oprah.

And so the idea that this teacher will be familiar to the child on the first day of speech and we do and what we found with the training of the familiar talker is that we got an even more dramatic improvement than we did with the generic talkers.

>> With what was the age group for your children in your study?

>> They were between six and 12.

>> Gotcha.

And there is a very interesting question here from Laurie.

I fit a lot of Starkey hearing aids and Starkey offered gamification via the web.

I introduced this to the my patients and the presentation I called physical therapy for your ears.

I got very few patients interested in participating.

What does it take to motivate people to seek aural rehab besides money which is a big motivator. That wasn't part of her question. But she wants to know what do you do to motivate patients to participate?

>> What was your first name?

>> Her name was Laurie divine

>> Laurie divine.

Is that a question that I've asked for 30 years.

What I just showed you was the fruit of 30 years of banging my head against the wall how do you make people not make, how do you entice people to do what is good for them?

And so one thing with gamification, the game it's a bit of a game, we hired professionals, computer game developers and we hired professional graphic designers so you have to make the auditory training per se fun and enjoyable where they want to do it. It can't be drudgery.

I won't name any auditory training programs but there is a really popular one out there that bored patients silly and they didn't do it and the second thing, and this is where the phone app comes in.

You will get pushes from your coach and the interactive nature of it. You know how you see people playing on their phone. There again you have to make that interactive. And you saw the nice graphics we had.

You have to make it visually appealing. You can't have it look like a garage door creation.

So the short answer is look what other people are doing to engage people in technology or in learning or education and emulate that in your digital therapeutics.

>> And this is the last question.

How many sessions do you need before you start to see benefit?

>> So all of the experimental work I've done, we will give about 16 hours of auditory training spread over time.

I never done a study with less than that amount.

I have done a study with more than that amount.

So I had one study where half of the patients got 16 hours and then half of the patients these were kids, by the way, the same kids I talked to you about, got an additional 16 hours over the course of three months.

I think it was three months.

It may have been eight weeks.

Anyway, what happened was the children who kept playing the game kept improving.

Eventually you do plateau.

I think eventually if you don't train your skill set goes down again.

And I will use that gym analogy.

You go to the gym and get strong and fit and you stop and eventually you will be out of shape again.

>> With that, thank you for all of the participants for attending.

Dr. Tye Murray for your inspiring presentation today.

And remember again these presentations like these and research projects like Dr. Tye Murray's are only made possible by supporters like you.

And you can donate and support at hhf.org/donate.

Thank you again, everybody and have a wonderful evening and happy new year.

>> And thank you Hearing Health Foundation.