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EHDI 2019

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Narrative Skills in School Age Children

MARCH 5, 2019

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>> Okay. All right. I will go ahead and start. Hi, I am Elizabeth Walker. I'm an assistant professor at the University of Iowa. I'll just use the laptop. And thanks for coming. I wasn't sure, when I saw I was the last talk of the day, if I would have anybody here. So I'm happy to see there are people here, still hanging in there.

So I'm going to talk today about data from a longitudinal study that I've been a part of since 2009 called the outcomes of children with hearing loss study. And throughout the talk, I'm going to use the acronym that we use to describe the study which is OCHL. So when I talk about OCHL data, I'm talking about outcomes of children with hearing loss. And I'm going to talk about a specific part of our data set which was looking at narrative skills in children who are hard‑of‑hearing in second grade.

And I should acknowledge also my coauthors, Katie Gabel was a undergraduate student who took part in helping to analyze the data that I'm going to talk about today; Mary Pat Moeller, some of you may be familiar with her, she's a now retired researcher from Boystown National Research Hospital in Omaha, and she was one of the principle investigators on the OCHL study.

Okay. So first off, I'm just going to give you a little background on the OCHL project for those of you who aren't familiar with it. This is a multicenter longitudinal study that looked at outcomes of children who are hard‑of‑hearing. So all of the kids in the study had mild to severe hearing loss and they were all bilateral ‑‑ had a bilateral hearing loss.

The children were recruited from three primary sites, the yellow push pins here show children who were recruited from the University of Iowa, so those are the Hawk eyes. The red push pins are the children who were recruited from Boystown National Research Hospital in Nebraska, so red represents the Nebraska Cornhuskers. And then the blue pushpins were children recruited out of University of North Carolina Chapel Hill, so blue represents the Tarheels. So you'll see originally the plan was to recruit from these three states, and we ended up expanding to 16 different states for recruitment for this longitudinal study.

And in total we ended up recruiting 317 children who are hard‑of‑hearing, and 117 children with normal hearing who served as a comparison group.

So this just gives you a little bit more information on the participants in this study. Like I said, the project has been going on for ten years. We're still continuing to follow these kids. They're now moving into junior high. And with the hard‑of‑hearing group and the normal hearing group, they were matched on income and maternal education level. They were also matched on nonverbal IQ skills. And one thing I want to note about the data for any of the stuff when we present data on the OCHL project we tried really hard to recruit from a wide range of socioeconomic status backgrounds, but on average, the ma tern he will education level for both the children with normal hearing, children hard‑of‑hearing, is higher than the typical U.S. population. And this is pretty common in these longitudinal studies, it's a big time commitment for the families, and some of them have to travel pretty far to get to the research appointments so it just ends up being more of a challenge unfortunately to recruit lower income families. But that's why we have the control group, the comparison group with typical hearing to make sure that we are matched on SES. Other things about the children with hearing loss, most of the children had a congenital hearing loss, 76% were identified through newborn hearing screening. On average, they had a moderate hearing loss, it was a pretty even spread with children with mild and moderate hearing loss and then we had some children with severe hearing loss. To participate in the study, they had to be between six months and seven years of age at the time of enrollment, which started in 2009. English had to be the primary language. So we did not include children who were learning Spanish as their first language. We also did not include children who were using American Sign Language because we had a specific test battery we were using and we wanted to make sure that we were focussing on what are the effects of hearing loss on outcomes and so we tried to keep the test battery really consistent.

We did not include children with major secondary, so we didn't include with cognitive impairments, diagnoses of autism or other neuro developmental disorders. And also we excluded children with cochlear implants. So we had some kids in the study who started off in the project who had hearing aids and then pro grossed to cochlear implant. We include their data but only their pre implant data. We really wanted to focus on the population of children that has really been overlooked in the research literature, the children who are hard‑of‑hearing who use hearing aids. There's been a lot of research on children with cochlear implants and so we were focussing on what we call kind of the forgotten population with the children with mild moderate hearing losses. And then finally they had to have a permanent to mild bilateral hearing loss to participate.

And I like to include this quote. Julia Davis was a researcher from the University of Iowa, and she wrote a book called "Our Forgotten Children" that was specifically on children who are hard‑of‑hearing. And in the book, she talks about how these kids aren't always easily recognizable. They are a lot of times in regular education classes, sometimes if they're having behavioral issues in class, they're not ‑‑ it's attributed to oh, they're just not paying attention, not in their hearing loss really isn't taken in to consideration. And so in some educational systems, these are invisible children, and so this is the population we were interested and continue to be interested in looking at as they now progress through the educational system.

So big picture goals for the OCHL study, we wanted to look at the new generation of children who were hard‑of‑hearing who are now a lot of them being identified very early on, being fit with hearing aids at young ages, enrolling in early intervention by six months of age. So we wanted to look at these children, look at their outcomes, and look at what factors support success for these children and what ‑‑ which children seem to be falling through the cracks. So we wanted to see, are these kids who are hard‑of‑hearing, after they've received these intervention services, are they still at risk for delay? And what are factors that lead to success for these children?

So this shows, this figure shows the domain of the OCHL study, all of the different areas we were trying to test. And so you can see there's quite a lot of different tests, our battery takes between four to five hours to complete with the kids. At the Iowa site we actually have white vans, which sounds a little bit creepy, but we have white advance that we go and we actually travel to the families and we do all the testing in the advance. So we're able to give them lots of breaks and get them through the test battery. What I'm going to focus on today is one specific domain of the study which is language skills, and even more specifically, I want to talk about higher level language. So narrative production and comprehension.

All right. So why are we interested in narratives? So we're talking here more about school age children, and narratives are a really important part of education once children getting to the school age range. So good narrative skills mean the ability to effectively tell a story and kids get asked to do that a lot in elementary school and beyond. Most classroom material, so in terms of comprehension, is going to be conveyed in language beyond the sentence level. So they're going to ‑‑ children are going to be hearing stories in the classroom, so they need to understand it. And there's also lots of good evidence with children that having good early narrative skills is going to predict reading development and also has an impact on later academic success. So that's why we're interested in narratives.

Also, not too surprisingly, since there's not a lot of research on children with mild and moderate hearing loss, there have been very few studies have that have actually looked at how do kids who are hard‑of‑hearing do on narrative measures.

So the studies that have been done have been somewhat ambiguous about this research question of is there a ‑‑ are these kids at risk in terms of their narrative skills? So the figure in blue, it shows some studies, a couple of studies that have been done that showed that kids who are hard‑of‑hearing or kids who are deaf do seem to have difficulty compared to children with normal hearing on narrative tests, but the children, the studies in the purple on the right, indicate that they look just like their typical peers. So it's kind of a mixed bag. Some of the research has shown that they seem to have delays. Some of the research has shown that this is not an area of particular weakness.

But there are limitations with some of the studies that have been done before. Particularly, I want to point out the age range and then the status of the kids, the hearing status. A lot of the studies have combined children who are deaf with children who are hard‑of‑hearing or they've just focussed on the severe to profound population. And so we wanted to look just at these kids with moderate and mild hearing loss who are using spoken language and, for the most part, are ‑‑ almost all of our kids are in regular education setting.

Also another limitation of previous research is that it has had a really wide age range, and we know narrative skills develop other time, so, like, for example, some of the studies have had kids looked at kids between five and 13 years of age and then averaged all of that data together. So we want to look at a really specifics age range as well.

So what we wanted to, I guess, what I can say is our first hypothesis is would be that consistent access to speech is going to predict success for children who are hard‑of‑hearing, and, again, the research on this has been somewhat mixed with children with hearing loss, with those studies that I just showed. Some studies have shown the degree of hearing loss leads to better narrative skills. Other studies have shown that any degree of hearing loss is not a risk and there's not a real correlation between degree of hearing loss and narrative production.

It's kind of confusing. Is this going ‑‑ are we going to see the consistent access to speech helps or not?

What we've used to try to explain this, this association between degree of hearing loss and outcomes is what we call our cumulative auditory experience hypothesis, and this is if you look in our supplement in the ear and hearing journal we talk quite a bit about this model and what we're saying here is yes, there's probably an association of degree of hearing loss and outcomes including narrative skills, but there are specific factors for kids who are hard‑of‑hearing that will moderate, that will influence the relationship between degree of hearing loss and outcomes. And these factors include how much access they have through their hearing aids, so their audibility, how much access they have to speech and then how often they're using the hearing aids on a daily basis.

So going back to the original hypothesis, we're predicting that these auditory access factors, aided odd built leering aid use are going to influence the relationship between degree of hearing loss and outcomes.

Our second hypothesis goes along with the idea of cumulative auditory experience is that children who are hard‑of‑hearing who are using spoken language, they're going to particularly experience difficulty in the aspect of language form and, even more particularly, in morphology. So they're going to have difficulty with high frequency, low intensity morphemes, so things like plurals, past tense, regular past tense, ED, which is going to be kind of ‑‑ low intensity, high frequency, possessives, so these things that are really common in the English language, the hearing aids, the bandwidth of the hearing aids is just not going to pick up those sounds very well. So we're really looking at the English language morphological system, some of these morphemes have limited, it is going to be harder for these kids to learn these morphemes.

And more specifically, we're really interested in these bound morphemes. So especially with verbs, these are less salient and they're also less frequent in the input. So a lot of things like third person singular is in the middle of a sentence, he needs to find something, they're often fricatives and they're often in context. So when it comes to narrative skills, we would predict that children who are hard‑of‑hearing are going to have difficulty with this aspect of narratives.

All right. So for our research questions, our first research question was, are children who are hard‑of‑hearing at risk for narrative skills, and I'm looking at both comprehension and production, compared to our typical hearing control group.

And so we, our prediction is the children who are hard‑of‑hearing as a group will perform more poorly on narrative production and comprehension hex, and then our second research question was does cumulative auditory experience, so this idea of aided auditory hearing aid use, affect skills. And here we broke them down by degree of hearing loss which I said isn't always the most effective approach but you'll see why I did that in a little bit. And here we predict children who have a more severe hearing loss because they don't have good access through their hearing aids are going to have more difficulty on narrative tasks compared to children who are mild or moderate and then the mild or moderate kids will have more difficulty compared to children who are normal hearing.

And finally, the third research question was looking specifically at the idea of more following, and so we wanted to see how do children who are hard‑of‑hearing compare to the age match here's on mean length of utterance, total number of utterances and then production of high frequency morphemes. And here we're predicting we're really going to see the deficit in their production of high frequency morphemes so that the children who are hard‑of‑hearing are going to have more trouble in that aspect of the narratives.

Oh, this study included our ‑‑ the children who have gone through our second grade window for the study, so there were 37 children with normal hearing, and 88 children who were hard‑of‑hearing. The test that we used is the test of narrative language, so this is, if you're not familiar with this, this is a standardized test that looks at both comprehension and production of narrative skills. It has been ‑‑ it has normative data. It also has both comprehension and production tasks. So and it is a fairly engaging task, so we were able to get the kids to do it. I'm not going to go into all of the different sub tasks of it. So we were able to test both comprehension and oral narratives.

Another thing that we did isn't part of the TLN, the testing language narrative, is we also took the narrative productions the kids did when they were doing the task, we transcribed them and we put them in salt so we were able to get the mean length of utterance, total number of utterances and the ‑‑ and we looked at how many high frequency morphemes were omitted.

So on to the results, in terms of narrative comprehension and production, we found that for narrative comprehension, it's partially supported our hypothesis, the children who were hard‑of‑hearing performed significantly lower on narrative comprehension, compared to the children who are normal hearing, with typical hearing. But and then we saw marginally significant, he hates when I say it is marginally significant but he's not here, so it was marginally significance differences in narrative production skills.

One thing I want to point out, the hashed region in this figure here, one here, that shows the normative range for the test. So you can see on average the gray bars are the children who are hard‑of‑hearing. They're performing well within the average range, and we see this on all of our tests. If we just compare them to the standardized test norms, these kids look like they're doing okay. But when we compare them to our very carefully matched hearing comparison group, we see significant differences. So I always like to point that out.

Okay. When we look at the impact of cumulative auditory experience but on narrative comprehension skills, we get an effect which supported our hypothesis, partially, that the children with severe hearing loss were performing significantly worse compared to the children with normal hearing. We don't get significant differences between the mild and moderate group, but one thing I want to point out, and you're going to see this again when I show you the production data, we get this pattern, and if you saw Mary Pat Mueller's talk last year on our sarcasm data we got the same pattern, the mild kids, who are the second box over, so mild, moderate, severe, the mild kids looked like they're doing just a little bit worse than the moderate kids. The moderate kids look just like the children with normal hearing, the comparison group. But it was not significant when we broke it down in this analysis.

Here what we find is this was for narrative production skills. We find a significant difference between the children with the normal hearing, the children with severe hearing loss. We also find a significant difference between the children with moderate hearing loss and the children with more severe hearing loss.

We don't get any significant difference, those mild guys are just kind of floating in the middle there. So and you can see that in the data. We actually call this moderate group he can call it our sweet spot. Those kids seem to be doing as well as the typical hearing peers. Some of the kids with the moderate hearing loss, and you can see the outliers there, don't seem to be ‑‑ some of seem to be struggling.

There's a sweet spot. And then you can see there's the outliers here in the mild group.

Okay. So then the third question was looking at when after we transcribe the stories, we looked more specifically at the tactic skills. And in terms of syntax, we just think about grammar. We're not seeing significant differences between the groups at all. So in terms of mean length of utterance, total number of utterances, there weren't any significant differences but consistent with our prediction, we did find that the children who are hard‑of‑hearing were emitting significantly more high frequency morphemes than children with normal hearing. So there seems to be this very specific vulnerability for these kids. If you're just looking at how many utterance they're producing or how many morphemes they're producing, they don't look any different. But if we look at it in a more narrow lens of these high frequency morphemes, we don't see any ‑‑ we do see significant differences.

Okay. So to summarize the findings, and I think I'm getting close to running out of time here, the mean scores for the children who are hard‑of‑hearing were all within the average range of the test norms, comparisons of the control group indicated that they were delays in terms of narrative comprehension. The MLU and mean ‑‑ and number of utterances don't order appear to be sensitive to language difficulties for this population in second grade. But looking at specifically more following, specifically bound morphemes, this does seem to be an area of vulnerability.

And children with more severe hearing loss, definitely appear to be at risk for delays both in narrative comprehension and production skills. So I think what the data kind of big picture what these data suggest is we do want to look at higher level language skills, including narrative, like I said earlier, narrative comprehension and production is a really important part of the educational system. And so this does need to be targeted in assessment and intervention for children with hearing loss, but the children with moderate hearing loss I think are the really interesting ‑‑ well, and the children with mild hearing loss, is an interesting group. They appear to be resilient, and here's my bold prediction, that the children with moderate hearing loss are getting good access through their hearing aids, their hearing aids are appropriately fit, and they wear them consistently. Also, likely, we found ‑‑ and we have ‑‑ the children with moderate hearing loss are also on IEPs. So they are getting some services.

Our children with mild hearing loss present a different picture. We've found consistently that kids with mild hearing loss, their hearing aids may be we will well fit but they're not using them, so they're not wearing the hearing aids consistently and a lot of these kids are not getting IEP services either, they may be on 504 plans.

So these kids may not be wearing their hearing aids all the time. Some of them aren't fit with hearing aids so they don't have any am indication, they don't have FM systems in the school and so they have less cumulative auditory experience and it is having an impact on lower level language skills but also the higher level languages.

Okay. So to kind of sum up where we're going with this study, so OCHL was a study looking up to seven years of age, six years of age, the study has now involved and continues to evolve we're looking at complex listening skills in children who are hard‑of‑hearing, we have a study OCSH, which is looking at second and fourth graders, and our goal is to continue to follow these kids in to area junior high. We're also looking at listening effort right now in elementary and junior high age kids.

If you want more information on the OCHL study, you can go to our webpage which is www.OCHLstudy.org, and we have these brochures and flyers that we've made for people to put in their offices, to share with families, and we will give these ‑‑ we give these to people free of charge. You just have to go to our webpage and say how many you want, and we will ship this tome. So Phonak generously donated some money so they pay for postage for this. So if you want some of these posters, you're happy ‑‑ you're welcome to them. Also we have translated them in to Spanish, French, Greek, I think. And we've had people contact us and ask if we could translate them and said sure, as long as you let us have this translation. So this is on the webpage, these are some of the posters and brochures.

I also want to say, please like us on Facebook if you're interested in our research. We try to post articles that we've had published, talks that are coming up, we have my lab web pang which is the University of Iowa pediatric audiology lab, also the OCHL study Facebook page. We have Instagram but I don't really know how it works. My students run it. And I, that's all I have.

I do want to add, like I said, we are continuing to see kids for this project. We are also continuing to recruit. So if you are ‑‑ have families that are somewhat within the Iowa City driving distance which is, to us, about five hours, we will drive to your families and do testing with them. So if you know families that might be interested in doing research, please come talk to me afterwards, and I'm happy to get some information or give you some information.

Thank you. Thank you.

(Applause)