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Identification of Hearing Impairment in Pediatrics - the Role of Pediatricians and Primary Care Providers

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- [Mary] And I'd like to thank everyone for joining our meeting today, entitled, Identification of Hearing Impairment in Pediatrics: The Role of Pediatricians and Primary Care Providers. My name is Mary Ormson, I'm a Medical Education and Training Manager at Natus Medical Incorporated. I am very pleased to introduce our speaker today, Doctor Andrew Schuman. Doctor Schuman is a clinical assistant professor of pediatrics, Geisel School of Medicine at Dartmouth, and he's been writing about pediatric practice and medical technologies in the pages of Contemporary Pediatrics for over 30 years. Doctor Schuman is presently the Practice Improvement section editor for the publication, and member of the Contemporary Pediatrics Editorial Advisory Board. He is the CEO of Medgizmos, a medical technology review site for primary care physicians. Doctor Schuman started the first newborn hearing program in New Hampshire back in 1996. And, as a side note, he's also developed a mild hearing impairment with age and loves his Bluetooth hearing aids. I'll now turn the presentation over to Doctor Schuman.

- [Andrew] Thank you, Mary and Anna, and welcome to our audience. First and foremost, I'd like to say thank you to all the audiologists out there. I appreciate, as a pediatrician, what you do for children and for primary care providers, so thank you so much for doing what you do. We have some housekeeping to take care of, first of all disclosures. As Mary mentioned, this presentation is sponsored by Natus Medical and Otometrics, which is a subdivision of Natus Medical. And I have developed a technology review site called Medgizmos, and on that site, we have Diane Sabo from Natus Medical, discussing two devices that I will present in the slides set today, and I thought the interview was quite insightful. And I invite you, at your convenience, to visit Medgizmos and take a look at that interview. So, the outcomes today, we will have you be able to describe the incidence of hearing impairments in infants and children, you'll be able to discuss how existing technologies can assist with pediatric referrals for timely diagnostic evaluations, and learners will be able to list ways in which primary care providers can work with audiologists and EMT specialists to assure timely diagnosis and treatment.

The goals and objectives, again, I'm repeating somewhat, but it's important for primary care providers, as well as audiologists, to know about the incidence and causes of hearing impairment in infants and children. And I can see that we have 15 attendees today. I'd like you to show by clicking on the Raise Your Hands icon, how many of you deal with pediatric patients in your audiology practice on a regular basis? Let's see how this works. So at the moment, oh, okay. I'm not seeing Eddie, but that's okay, maybe you will in the future. So, also in today's presentation, I will review how primary care physicians utilize technologies to identify pediatric patients with hearing impairment. We have tools that you are probably familiar with, but you don't use on a regular basis. We don't have your level of expertise, and our practices are quite complicated 'cause we do a variety of things for children, so you see how we fit the technology into our daily practices. There are some interesting technologies that I will share with you that may improve the ability of primary care providers to detect hearing impairment in your pathology over the next month to years. And most importantly, I'd like to discuss opportunities for audiologists and primary care physicians to work better together for the benefit of the hearing-impaired child.

So as Mary mentioned, I became interested in hearing detection in children many years ago. I was Chair of Pediatrics at the Elliot Hospital in Manchester, New Hampshire, and there was a recommendation by the Academy of Pediatrics, way back when, that recommended that we consider implementing Early Hearing Detection intervention programs. So in 1996, I started the first hearing detection program, newborn hearing program, in the state of New Hampshire, it took some time to learn about the technology, the workflow and make the system work, and we were quite successful, in fact, the first child identified in the program was a child in my own practice, so it was quite relevant. I have grown-up twins who when young were speech-delayed, so their hearing was a concern of mine as well. After I developed a newborn hearing screening program, I gave talks throughout the state to encourage other hospitals to adopt similar programs.

So the importance of hearing loss in children and detecting hearing loss in children is pretty straightforward, because without intervention, affected children will fall behind in a variety of aspects of social development, communication, cognition, reading, et cetera. The goal of early hearing detection intervention programs is to get all newborns tested by one month of age, referred infant should be assessed by three months of age and intervention started by six months of age. When I started the program in New Hampshire in 1996, we could identify kids but programs were not in place to provide hearing aids for such children. So the programs have obviously evolved over the last 20-plus years or so. So, for primary care providers, it is important for them to realize that all infants and young children should receive ongoing surveillance of communicative development and hearing throughout childhood, as not all hearing loss in children is detected by the newborn hearing programs that currently exist.

So just to review for you, there's several ways of classifying childhood hearing loss, and this is what audiologists understand by nature, and pediatricians and other primary care providers will benefit from being reminded of, that you can classify hearing loss as to causes, as well as anatomy and physiology. In terms of causes, there are non-genetic and genetic causes of congenital hearing loss. Non-genetic causes include congenital infections, prematurity, CNS injuries, such as CNS bleeds, or drug, or alcohol use by mothers, which unfortunately is a very common and pressing problem. Genetic causes, roughly 50% of congenital hearing loss, include autosomal recessive, as well as autosomal dominant forms. There are also acquired hearing loss throughout childhood, which includes such things as a perforated eardrum from trauma or placement of a tympanostomy tube, otosclerosis, infections in childhood including measles, meningitis, the use of ototoxic medications in children, head injuries, noise exposure, which is a big issue these days, as well as untreated or frequent otitis media. In terms of classifying hearing loss, one can also look at the physiology and anatomy of hearing loss. Conductive hearing loss occurs when you have a problem between the external canal and cochlear. In newborns, this is represented by vernix, cerumen in children, otitis media, and in rare instances, oral atresia. There are sensory issues relating to problems in the cochlea. Things that result in cochlea issues include the ototoxic medications I mentioned earlier, as well as genetic causes. And there are neural causes, including structural problems such as tumors, bleeding, infections, and auditory neuropathy. And of course, you can have all sorts of combinations of these as well. I've written a lot of articles for Contemporary Pediatrics, and I really like to reference numbers 'cause numbers tend to put things in perspective for a listening, a reading audience, and sometimes numbers alone can tell a very dramatic story, such as the case with hearing impairment in childhood.

So I think we're all familiar with the fact that about three per 1,000 newborns in the well nursery are born with a hearing loss. What you also probably know is that there is a slightly increased incidence of newborns who are in the neonatal intensive care units who were born with a hearing loss. In fact, the Academy of Pediatrics came out with recommendations in 2007 recommending that babies in NICUs who spend more than five days in the intensive care unit get screened before discharge, not with otoacoustic emission testing, but with ABR testing. And over two-plus decades of newborn hearing program implementation, now we are proud to boast that 95% of newborns born in the U.S.A. are screened for congenital hearing loss. And if babies have risk factors such as prematurity, one in 75 newborns have a hearing loss, while those without risk factors can have hearing loss as well, one in 811, so it still occurs with some significant frequency.

The goal when we first started with newborn hearing screening, was to get the referral rate under 10%. So nationwide at the present time, five to 7% of newborns are referred for follow-up testing, following a referral upon newborn hearing screening. But the most striking statistic, perhaps among all the numbers I'm presenting today, is the fact that 39% of the babies referred are lost to follow-up. That represents a system failure, and it occurs for a variety of reasons, parents are not impressed upon the importance of making the follow-up appointment, patients may be transitory, communication with a pediatrician is not established to make sure that we assure that patients can follow up, and quite frankly, there are parents who don't have cars, there are transportation issues, et cetera. We'll talk a little bit more about this later.

A number that will establish job security for audiologists, as well as pediatricians, is that in the school-age population, there may be 10% of children with some type or degree of hearing loss, which may be permanent and may be transitory, which may impact school performance. And as a pediatrician, I listen closely to the recommendations of the Academy of Pediatrics that recommends that children be screened for hearing loss at specific times. We have specific recommendations for all our well-child exams. So we use OAE screening devices, at four, five, six, eight and 10 years of age, and whenever risk factors are identified. So there is a opportunity for pediatricians to perform hearing tests at these ages. Before we had OAE screening devices, these were done with pure tone audiometry and they took a long time to accomplish. Between the newborn period and four years of age, we do not, primary care providers do not routinely screen for hearing loss in children. So this is unfortunate because a lot of kids with hearing loss present before four years of age. Between the newborn period and four years of age, there's a continuum of hearing loss that develops in that time period. And I put this slide in here just to demonstrate how well newborn hearing screening programs have done over the years.

So, shortly after I helped develop the newborn hearing screening programs in New Hampshire, it went from 855 babies identified to over 6,000 babies identified in 2016. And as you were probably aware, there are different screening strategies, there are automated ABR screeners, there's OAE screeners, only the ABR screeners can detect auditory neuropathy, and this is quite important, and we'll talk a little bit about auditory neuropathy in a few minutes. One thing that I found extremely interesting in researching this article is that a lot of people are frankly unaware of the significance of congenital cytomegalovirus virus infections in mothers. Approximately one in 200 infants born in the U.S.A., are born with congenital CMV, and that amounts to 25,000 babies per year. It's a common infection and toddlers who attend daycare can bring asymptomatic infections home, and infect their pregnant mothers. 90% of CMV infections are asymptomatic. Symptomatic newborns may have growth retardation, microcephaly, jaundice, seizures, rashes, petechiae. They may be quite sick, but again, 90% of CMV infections are asymptomatic. And the number above is quite striking in that 22 to 65% of children with symptomatic CMV disease have hearing impairment, while up to 23% of children with asymptomatic CMV infections will have hearing impairment. CMV can be detected by identifying CMV DNA in urine, saliva, or blood within three weeks after birth. After this period of time, they could be infected by CMV viruses in the community. So it's quite interesting that several states require each newborn that fails the newborn hearing screening be tested for congenital CMV. And in Illinois, requires that a CMV test be offered to the parents of every child who fails the newborn hearing screen. And what's also interesting is there is a National CMV Foundation, who has made the recommendation that the newborn hearing screening that we currently do on every baby born in the country be expanded to include congenital CMV infections. And this letter was dated May of this year, so we'll see what happens.

So certainly, pediatricians are not aware of this, not enough parents are aware of this, and if they were to do so, they would be more diligent in screening for CMV. The National Health and Nutrition Examination Survey is a series of surveys that have been done over the year. It's done by the National Center for Health Statistics, which is a subdivision of the CDC, and health statistics for the nation is quite interesting. There was a concern many years ago that kids, particularly teenagers, listening to loud noises would be responsible for increased amounts of hearing loss among adolescence. So examination of this data from 1994 to 2010, indicated that this expected hearing loss was not evident. But what's interesting though, is that there is evidence that among teenagers, there is a significant percentage of teenagers with hearing loss. So you can see that in some of these surveys, three to 5% of adolescents have a hearing loss equal to 25 decibels.

So a large percentage of the population has some degree of hearing impairment, assuring work for me and work for you. What are the risk factors for childhood hearing loss? Some are obvious, some are not so obvious. If a caregiver or pediatrician expresses concern about hearing, speech, language or developmental delay, that is a clue that we need to refer a child to an audiologist. If there's a family history of permanent hearing loss, that's a clue that audiologist services need to be involved in that care of that child. As I mentioned earlier, if a child has had a NICU stay of more than five days, or significant medical problems, including assisted ventilation, ototoxic medications, loop diuretics, jaundice, requiring exchange transfusion, that baby should also have audiology follow-up. And I can tell you from firsthand experience, pediatricians don't do a very good job at getting such children to the audiologist. We've talked a little bit about in utero infections, particularly CMV. If a child has a craniofacial abnormalities, including those that are involved with pinna ear canal, et cetera, they should be seen by audiologists. There are a number of syndromes that can be identified either by appearance or genetic markers that warrant audiologist assessment, as well as neurodegenerative disorders. Culture-positive postnatal infections can be associated with sensorineural hearing loss. Meningitis used to be a problem before we had the number of vaccines that we give today. And that's one of the nice things about being a pediatrician that's seen the quality of care change for my patients, in that we see a lot less kids with meningitis these days, which is a wonderful thing because a lot of kids had significant se-kwe-ly from meningitis. Head trauma, pediatricians and primary care providers need to keep in mind that significant head trauma can result in hearing problems. If a child has had a cancer, received chemotherapy, they should have audiology follow-up. And perhaps the most important thing for primary care providers to keep in mind is that a lot of kids have ear infections, we'll talk about that a little bit later, and if they do, they are at risk for hearing loss from the infection, from persistent fluid, et cetera.

Let's move on to the next slide. So to summarize the points I've been trying to make, the bottom line is that primary care providers, in my opinion, could do a lot better in identifying kids with potential hearing loss, getting kids to the audiologist, working closer to audiologists. There are many newborns who refer following newborn hearing screening that are lost to follow-up, lot of kids will develop hearing impairment from otitis media throughout their young years. Pediatricians need to keep in mind that the kids that we see with speech delay, or developmental delay, may have an associated hearing impairment. And one of the things I learned in preparing this webinar is how common auditory neuropathy is. It's been written about for several years, I've seen one figure that it may be as high as 13% of the hearing-impaired child population, but OAE test Which is commonly utilized in the pediatrician, or primary care office, will not identify kids with auditory neuropathy and may be falsely reassuring to the provider as well as the parents.

And as mentioned, a significant number of kids will develop hearing impairment due to a variety of causes, in part due to genetics, trauma, et cetera. So, we all need to remain diligent regarding the presence of possible hearing problems. In one source, I found that by kindergarten, the incidence of hearing impairment is six per 1,000. Okay, so, primary care providers need to do a better job and we need to communicate better with you guys. What are things that should alert pediatricians primarily that a child may need audiology evaluation? Certainly, delayed speech. Most commonly, if there's a child with delayed speech, my first referral is not to the audiologist, but it's to the speech pathologist. So in large measure, we are dependent on speech pathologists to make a determination if a audiogram or a audiologic evaluation should be generated. We do screen for developmental delays, particularly autism, throughout the early years, but, the evaluation is done by behavioral pediatricians and in the many referrals and reports that I get back, I see very few mention of the need for a hearing evaluation, and I think there's a danger in not being thorough in getting such children evaluated by audiologists. Kids may have syndromes associated with hearing impairment, as I mentioned previously, and just recently this week, I referred a child to a audiologist who was eight months of age and the parents noticed the child was not seemingly responding to noise.

So, again, we're all on the same team, primary care providers, parents and audiologists, and it should not take much for someone, or a primary care provider, to refer a child to a hearing specialist. So, in all fairness, I hope your lives are not as complicated as mine, in that medical care has become ever more tedious, difficult, frustrating over the last several years. There's a term called physician burnout that you have read about, there's a famous article that was published recently in Forbes, and it was titled "Death by 1,000 Clicks". Doctors are overwhelmed by the EHRs we're forced to use these days, so we're spending more time on paperwork than we are in clinical care. As a consequence of this, we can only see fewer patients per day.

On average, we see 20 per day. I had no trouble before we had EHRs and click buttons to see as many as 30, or even more patients a day. We need to get a lot done in a short visit. The technology that I will recommend, on first view can seem expensive and time-consuming, when in fact they pay for themselves very quickly. The other thing is that often there's poor communication, or insufficient communication between audiologist and primary care providers, okay, we don't talk, we get reports, I sign your reports and file them for inclusion in the EHR. So I think we need to communicate in different ways more effectively 'cause, again, we're on the same team, and I hope that you don't experience the frustration that I'm currently experiencing, and certainly if so, we should all work together to improve the system. So, I love medical technology 'cause it has potential for improving care. And I've written about technology for 30 years now, and it's interesting to see how technology evolves. So because I write for a popular pediatric journal, people are interested in having me review and critique their products, and so forth.

So, somewhere in the mid '90s, I got a call from, I believe it was the CEO of Biologic Systems, who manufactured one of the first OAE in-office devices called the AuDX, and I acquired one, used it regularly, learned all about it, how to implement it in the office, learned how to bill for it, referred to lots of audiologists, and I learned how to use it in the context of kids who, at the time, were having lunch of ear infections and so forth. So, eventually the AuDX OAE was purchased by Natus, and I was very pleased to learn that they kind of reinvented the wheel by creating a couple very innovative devices, the AuDX and the AuDX PRO FLEX, which are very versatile devices for use in the primary care physician's office that provide the primary care office the capability of doing OAE and pure tone audiometry, as well as tympanometry. The devices are affordable, easy to use, and are reimbursable. So the cost of acquisition is really not significant when you consider in how quickly they will pay for themselves.

There are other devices that we currently use for examining the ears. Audiologists, obviously, look in the ears as well as we do. Over 30 years, I can't even contemplate the number of ears I've looked at over my years and the number of things I have seen in those ear canals, but I digress. So, the most important device for primary care physicians has always been the otoscope. However, we are trained to use it with insufflation. Insufflation is this bulb that is attached to the otoscope in the upper left picture of the screen. One gets a seal, one squeezes the bulb, and in a normal ear, you should see that tympanic membrane move back and forth. In reality, I've never seen any pediatrician, myself included, using it, because it takes a little bit extra time and manipulation, and obviously, if we thought it was a valuable device that we needed to use, we would use it, so we don't. There is a device I will talk to you about that was very popular 20 years ago called the acoustic otoscope, and it has a lot of advantages over a tympanometry, and for whatever reason, it fell out of favor, or the company that was selling it went bankrupt, but it's probably coming back next year, and I'll talk about that in a minute.

TomiScope is a experimental device at this moment, but it's getting FDA approval, and I'll talk briefly about what that is, and for primary care provider use and audiologists use, Natus makes the Otocam video otoscope to help visualize the ear canal and eardrum. Let's talk a little bit about OAE and how it can be used by primary care providers. OAE is wonderful because it's quick and it's easy. The current Otometrics biologic AuDX pro and PRO FLEX, have cartoon interfaces to distract and entertain kids while the test is being performed. The reimbursement is very reasonable, at about $25 per test. As I mentioned, it pays for itself fairly quickly, and the two devices are different. The larger device, the PRO FLEX, can include modules that include pure tone audiometry and tympanometry, while the smaller device does audiometry and OAE, so you've got the AuDX and the AuDX PRO FLEX. What's particularly nice is the interface that is demonstrated in the Medgizmos review video that I encourage you to view. And it's very nice 'cause it's very clear, concise, easy to navigate, you can print labels, if you wanna include the reports in the record, you can share these results with parents and explain what they mean. So I think Otometrics did a excellent job in developing the user interface. The PRO FLEX has the capability of doing an acoustic reflex, as well as a tympanometry result, and in the far right of the screen, you can easily and quickly do pure tone audiometry.

So it's nice for primary care providers to have this capability. And one thing that you see, and I see, with too frequent regularity, is something like this, where someone comes in complaining that they can't hear anything. You're looking in the ear and you see this brick wall of cerumen. So, when should primary care providers perform OAE? Basically, whenever you suspect a hearing loss or need to screen for hearing loss, so whenever it is poor school performance, the parents are concerned, there's a history of recurrent impacted cerumen, and the babies who refer a newborn hearing screening for a loss to follow up can be re-screened in the medical home as long as you involve the regional newborn hearing screening system with OAE.

Keep it in mind that OAE will not identify kids with sensorineural hearing loss. So I mentioned cerumen impaction. So, one opportunity to share something that you may or may not already know is if you need to remove this wax gently, now, of course we have ear curettes, but I hate ear curettes 'cause they hurt, and even the plastic ones or flexible metal ones can scrape the wall of the ear canal, or scrape their TM, and you don't make friends by doing that. Instead, you can use a variety of means to flush it out. My go-to is to have a little disposable tip that's available on Amazon attached to a syringe. And I first soften that wax, possibly with hydrogen peroxide, or Debrox-type solution, but one secret that pediatricians know if you use Colace-type liquid stool softener, it seems to do more than an excellent job on liquefying and softening cerumen. So we typically put a few drops of this in both ears, put a cotton ball in to keep it in place for 10 minutes, and typically, we have no trouble removing this wax and the patients are incredibly pleased 'cause now they can hear when they couldn't beforehand.

When should primary care providers perform pure tone audiometry? When a child refers an OAE, it's nice to establish a baseline, 'cause, as you know OAE, 'cause you will pass or refer results, it's nice to have a baseline if your practice has the time to do such a thing. And if a child possesses, or passes OAE, and is old enough to be suspected of having a sensorineural hearing loss, keeping in mind that 20% of children in the three-to-five age group cannot complete pure tone audiometry for some reason. And every December I write an article on new technology for pediatric practice. So, as I mentioned, pneumatic otoscopy is really done by primary care providers. There is a device that's coming out a month from now, called the Wispr that is from Wisconsin Medical. It was developed by an engineer who then went to medical school became an ER doc, and saw a need to improve the standard otoscope. So what he developed was a video otoscope that's handheld with a touch screen that can take excellent pictures, or videos, and enable you to share your observations with the parent or the child immediately. It does not include pneumatic otoscopy, but we'll talk about that in a second, it can fit on standard Welch Allyn heads. And I've been using this for about a week and I've been very impressed by this device. And actually, the first child I tried it on, in the lower left corner, I noted, when previous physicians did not, this proliferation of the tympanic membrane in the four o'clock position, resulting from a extruded tympanometry tube two or three years earlier. So I downloaded this app to the USB drive and emailed it to the ENT doctor who got him an appointment right away, and he was pretty impressed. So the acoustic otoscope has a very long and interesting story, too long to really recount in detail here, but originally, the acoustic otoscope was developed as an alternative to tympanometry as a means to determine whether fluid was in the middle ear space.

So a sonar engineer and a pediatrician got together and invented a device that emits essentially sonar signals, and it's a handheld device, it requires no seal, it became extremely popular for several years and they even came out with a home-use device, called the middle ear monitor, the company at the time was Becton Dickinson. The professional device was the EarCheck PRO, and the consumer device was the EarCheck Middle Ear Monitor. The technology was called spectral gradient acoustic reflectometry, and it emitted sound bursts of 44 different frequencies at 80-decibel sound level, it incorporated a microphone and a microprocessor. The device analyzes the frequency spectra of the reflected sound, and presents the output as something called a spectral gradient angle, which corresponds to the probability of effusion. You can use it in a streaming trial, no seal is required, and measurement takes seconds, and it's reimbursable under the same code as tympanometry. So if the level is five, the SGA is less than 49 degrees, the risk of effusion is high, if it's level one greater than 95 degrees, it's low. And there were a number of studies comparing the accuracy of SGA measurements to the presence or absence of effusions diagnosed at insertion of tympanostomy tubes, and it showed an excellent correlation. So unfortunately, it fell out of favor. Nurses really liked it, 'cause they would take the measurements, and it actually allowed you to quantify an effusion because the level of the effusion correlated with the amount of fluid there. So one could use sequential SGA measurements and see the effusion disappear. So this is coming back probably early next year. And two ENT doctors actually showed that smartphones could be adapted to perform measurements similar to the acoustic otoscope. And when I communicated by email with one of the authors of this patients, they told me this year that they intend to commercialize a smartphone application that may be available in two years' time, so that would be an interesting development. And the other interesting development is that there are some researchers who have been looking into something called optical coherence tomography, which is a non-invasive imaging that uses light instead of sound to project images of soft tissues in the body.

So they have developed something called a tomiscope, which is near FDA approval, and therefore marketing, which shows cross-sectional images of the middle ear, as shown in the image to the right bottom. And one can use this to make a diagnosis of otitis media. And there's a concept or a thing called a biofilm. Some otitis media is refractory to antibiotics, and it's thought that biofilms are responsible. Apparently, bacteria infecting the ear can exude a slimy matrix which protect it from bacteria, from antibiotics rather, and this tomiscope is capable of identifying these biofilms which need to be treated either with certain antibiotics or a prolonged course of antibiotics. So this is a interesting future development. And I mention tele-audiology because it may be the way of the future. I watched a webinar dealing with tele-audiology and newborn screens have been done in African countries using a remote pediatric audiologist and technicians, and in some states in the United States, there are tele-audiology programs incorporated into the newborn hearing screens in those states because they're poorly, or populated, and there are remote areas that need to have screening performed.

So I wanna spend just a few minutes on otitis media before we conclude the discussion. Otitis media is the most common infection in childhood, and it accounts for the most ED physician visits in the United States. There have been various guidelines listed and endorsed by the American Academy of Pediatrics over the years regarding diagnosis and treatment, and when to treat, and when not to treat. And, we all acknowledge that it's responsible for conductive hearing loss and speech delay, and complications of otitis media may include mastoiditis, perforated eardrums, cholesteatoma, as well as some other problems. According to an article that came out in 2017, by one year of age, 23% of children experience more than one episode of otitis media, by three, 60% have more than one episode, and by age three, 24% had more than three episodes in this time period.

There are risk factors associated with otitis media, including male sex, non-Hispanic white race, family history of recurrent otitis media, daycare attendance, and the younger otitis media occurs, the more likely is it to be a problem. So if we see otitis media in young children, then in all likelihood, that child will have subsequent episodes. It was a recommendation made way back in '04 by the American Academy of Pediatrics, so it's somewhat complicated. And the idea was that otitis media gets better eventually on its own, certainly there was otitis media before there were antibiotics and physicians, and these infections did resolve on their own without intervention, but physicians would like to preserve the utility of antibiotics by avoiding overprescribing of antibiotics. So, essentially, over the years, we have identified the fact that you need to have infection and fluid behind the middle ear, you need to have symptoms of disease, which could be very arbitrary, fever, fretfulness, ear pain, et cetera, and bulging. And you cannot have the diagnosis of otitis media without effusion, so it pretty much recommended, back in '04, that you needed to perform pneumatic otoscopy or tympanometry to confirm otitis media. So keep in mind that pediatricians are busy, we work in what we call the trenches of medical care, and we freely ignore recommendations when we feel it's in our interest, or the best interests of our patients to do so.

 So as I mentioned before, pneumatic otoscopy is really done by pediatricians and few pediatricians perform tympanometry in the setting of a suspected ear infection. Recommendations were subsequently changed in 2'13, six years ago, simplified somewhat, and also allowing us to have more free rein in prescribing antibiotics but again, diagnosis of otitis media should not be made in children who do not have middle ear effusion, based on pneumatic otoscopy with tympanometry. And that's why the acoustic otoscope, coming back, is such a significant thing because it's so easy to use. You can use it to confirm your diagnosis and follow the resolution of an ear infection. Causes and consequences of otitis media is by using sensitive micro biologic testing, you can detect either bacteria and/or viruses, and up to 96% of AOM cases, that is 66% bacteria and viruses together, 27% bacteria alone, and 4% viruses alone. Bacterial pathogens, or Strep pneumoniae, H flu, and Moraxella catarrhalis. Since the onset of pneumococcal vaccine many years ago, the incidence of Strep pneumoniae has declined significantly, and that's the blue line in the graph to the right.

What's very interesting is that middle ear effusion persists and takes time to resolve in ear infections. And 70% of children have middle ear effusions at two weeks after treatment, 40% at one month, and 10 to 25% at three months, and the fluid could interfere with that child's speech development. When I was practicing several years ago, we would always see children back in three or four weeks to make sure the infection has resolved. Pediatricians are not doing that so much these days. Another interesting device that may help us prescribe antibiotics more prudently in the setting of an ear infection is something called a FebriDX. It's a finger stick blood test that helps you distinguish a respiratory viral infection versus bacterial infection, it measures a protein associated with respiratory viruses, as well as a inflammatory marker called CRP, C-Reactive Protein. It's getting FDA approval here in probably two years, it's available overseas, but nobody has researched this in the setting of otitis media.

So it'd be interesting to see if this proves to help us prescribe antibiotics more prudently, and to see if it will help us distinguish bacterial infections from viral ones. Tubes are inserted if a patient has had lots of recurrent otitis media, and the number of ear infections determine whether or not tubes are indicated, three episodes in six months, or four episodes in a year, or one episode in the preceding six months prior to presentation to the ENT doctor. Tympanostomy tubes are not without their problems, which include tympanosclerosis, retraction pockets, chronic perforation, as I discovered in that patient of mine. And I just wanna spend a couple minutes talking about how audiologists and primary care providers can improve relationships and communication.

We need, meaning you, an audiologist, and I as a writer of pediatric articles and an educator regarding the importance of getting patients to audiologist. What does not help is this seems very easy to understand to audiologists, but when a pediatrician or primary care provider gets a report like this with an interpretation, sometimes it's just too complicated. So we need you in your report to just summarize it briefly, succinctly, and say what the follow-up plan and what the diagnosis is. And part of the issue with patient care has always been compliance. We kind of assume that a referral to an ENT will guarantee an appropriate audiologic evaluation and intervention, and in many regards, that is true, but I feel primary care providers should be initiating some referrals direct to audiologists.

So I put this slide in here just to indicate that there are other problems with compliance among patients. I'm actually going to do a study locally, trying to improve compliance among patients who were referred to a vision specialist following referral for a screen test for amblyopia. Because unfortunately, while the referral rate should be 100%, it's only 20 to 50%. So I'm starting a study here at Dartmouth Clinic, Dartmouth-Hitchcock Clinic, where we're going to make appointments with the ophthalmologist before they leave the Clinic, and we're not gonna depend on them to make an appointment or for the clinic to call them back.

So my suggestion to assure audiologic follow-up is to make an appointment before patients leave the primary care office, and I think audiologists need to take the initiative and create readable and meaningful reports, and provide back-line access to facilitate making appointments and communication because everyone hates to stay on hold, and it's very frustrating. And I think that's one significant reason for non-compliance. So, I think audiologists viewing this webinar should consider taking a primary care provider to lunch, pizza is not very expensive, my preference is extra cheese and sausage, and talk to them, show them this webinar, and convince them that you need to work together as a team to provide better screening for hearing impairment among children. So with all this being said, I'm going to open up the floor to any questions. And feel free to ask. People frequently ask how expensive these devices are. There are devices that are reimbursed, such as when you do a OAE screen or pure tone audiometry.

So in my experience, devices such as these get reimbursed within six months to a year of purchase. So that's really cool. There are some other devices like the Wispr video otoscope that is purchased just because it facilitates care. And as a pediatrician, part of my role is to educate patients, part of your role as audiologists is to do likewise, so having a video otoscope via the Otocam, or the Wispr, is nice because parents kind of trust you and your interpretation of what you see, but it's nice to document in your record what the eardrum looks like, what the canal looks like at one point in time, if you're cleaning out cerumen, it's nice to do likewise so you can show them the before and after pictures, it's just a better way of providing care. I will also mention that I am very excited about the potential refer of the acoustic otoscope, 'cause I think audiologist should begin to use it, I'd like to have primary care providers have one in each exam room, and it would facilitate the more accurate diagnosis of otitis media. So, any questions from the audience? If not, it's two o'clock and I'm going to conclude the webinar.

- [Mary] Doctor Schuman, this is Mary.

- [Andrew] Okay.

- [Mary] Hi. I'm sorry, I had to step away for just a moment and I see that there is a question in the question box. I'm not sure if you saw that one and answered it, as I stepped away for a moment--

- Okay, I'm looking in the Q&A and I'm not--

- The question is, can you clarify what the recommended well-baby newborn hearing screening protocols are? So hearing screening protocols for a well-baby nursery, can you expand on that a little bit?

- [Andrew] Okay, well, thank you. My understanding is there are several algorithms that are currently in place. So before discharge from the hospital, and usually at night when mothers are asleep, the baby is taken into a screening room, and, hooked to a screening device, which in this day and age, usually is one of the Natus ALGO devices. So one can do a AVR screen, one can do an OAE screen, and the patient will either pass or refer on the first screen. These screens take minutes to perform. If the patient refers, then before the baby is returned to the room and hours later is re-screened before discharge, and most of the time the baby will be tested again and will pass with a overall referring rate of five to 7%, if the baby refers the second time, then the baby is referred for an outpatient evaluation by a pediatric audiologist, usually with a ABR screen weeks later, and in most states, there are regional centers that do this testing. And this is where the loss to follow-up occurs. There are two phase testing techniques. Some people will test with an OAE screener, and then if they refer, will immediately test with a automated ABR test. My feeling these days is that you get more information if you just do the ABR test. So I hope that answers your question.

- [Mary] Thanks, Doctor Schuman. And this is Mary from Natus, and I can also add just a couple comments about that. Sometimes screenings are done in the room. So we have family-centered care in a lot of hospitals around the U.S., and additionally, as Doctor Schuman mentioned, there are two different protocols, either OAE screening for newborn hearing screening, or ABR screening, and the current guidelines that are published by the American Academy of Pediatrics and the Joint Committee on Infant Hearing, JCIH, say that either OAE or ADR screening, as an initial screening step in the well-baby nursery is appropriate, and the babies that are admitted to the neonatal ICU for five or more days must have an ABR screening. But I think it's important for everyone to keep in mind that OAE screens to the level of the cochlea and ABR screens the auditory pathway. And babies who are screened with OAE, they may or may not have other problems beyond the cochlea, such as auditory neuropathy spectrum disorder, and OAE will not screen for that. So there's additional research out there, I would just encourage everyone to be aware and to read the current research to realize that OAE screening will not catch babies that are born with auditory neuropathy, and those are babies in the well-baby as well as the NICU population. And it looks like we have another question in our meeting room here. Someone's asking for a reference for the AAP guidelines for screening. There is a reference and I can go ahead and provide that too. I'm not sure what the process is with Anna, but there's a PDF that's published. If you google American Academy of Pediatrics in newborn hearing screening, you should be able to find it, but I can find that reference and provide that as well.

- [Andrew] Very good.

- [Mary] Any other questions in the Q&A box? Oh, we have a thank you. You're welcome, Giovanna.

- [Andrew] And thank you so much, and remember the pizza lunch.

- [Mary] Very good. Thank you very much, Doctor Schuman, that was a very informative presentation. We appreciate your time and expertise. And thank you, everyone, for joining our meeting today.