(((SOUND IDEAS

Volume 2, Issue 2 *By the Year 2000, all children with hearing loss should be identified before 12 months of age* *April 1, 1998*

Five Years After the NIH Consensus Conference

On March 3, 1993, the NIH Consensus Development Conference on Early Identification of Hearing Impairment in Infants and Young Children concluded that Aall infants should be screened for hearing impairment ... with a test that measures otoacoustic emissions (OAEs) .... This will be accomplished most efficiently by screening prior to discharge from the well-baby nursery. Infants who fail the OAE screening [should] have additional testing for auditory brainstem response (ABR) .... Those infants who fail ABR should have a comprehensive hearing evaluation no later than six months of age".

Most people were surprised by the recommendations of theConsensus Conference because at that time, less than a dozen hospitals in the U.S. were providing newborn hearing screening to all babies in the hospital prior to discharge. Some people were enthuasiastic about this recommendation, but others were less supportive and pointed out the many problems related to implementing universal newborn hearing screening throughout the country. These perceived problems were related to the practicability of the procedure, the costs, whether appropriate early intervention programs were available, and whether there might be harmful side effects associated with universal newborn hearing screening programs.

What have we learned in the five years since the NIH Consensus Development Conference?

The panel's main conclusions were correct. Even though there were just a handful of universal newborn hearing screening programs at the time the Panel made their recommendations, there have been hundreds of successful programs established since that time. These programs have demonstrated beyond a doubt that hospital-based universal newborn hearing screening programs are practical to do, effective in finding congenital hearing loss, and not unreasonably expensive.

There is not one best protocol. Even though the NIH Consensus Panel recommended a specific two-stage protocol for newborn hearing screening, the reality is that successful programs are using a variety of different protocols in which different types of equipment (TEOAE, DPOAE, AABR, and ABR) are used in combination or singly, and screening is done by people with different types of training and experience, at different times of the day or night, and in different locations in the hospital. In short, many different protocols and procedures are being used in successful programs.

Programs are becoming more and more efficient. All of the different major types of newborn hearing screening equipment are becoming more and more efficient. For exam-

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Distortion Product Otoacoustic Emissions (DPOAEs) in Newborn Hearing Screening

Five years ago, the NIH Consensus Development Conference on Early Identification of Hearing Loss in Infants and Young Children (1993) recommended universal hearing screening for all babies prior to discharge from the hospital. Within the next year, Bess and Paradise (1994) seriously questioned the rationale for universal hearing screening, and for early identification and intervention of hearing loss in general. In support of their conclusions, these authors cited an over-referral rate of 100 to 1 for existing screening technologies. Recently, however, reports of accumulated screening experience for automated ABR with large populations of newborns, including statewide universal hearing screening programs, have repeatedly confirmed acceptably low refer rates (2 to 3%), or a over-referral rate of less than 10 to 1 (Hall, 1998; Hall et al, 1998; Mason and Hermann, 1998). Investigations of DPOAE have also shown that, with an appropriate test protocol and recording techniques specifically adapted to newborn infants in a nursery setting, refer rates of less than 10% are often achieved (Chase and Hall, 1998). The purpose of this brief article is to describe a DPOAE protocol, and a strategy for analysis, that is suitable for newborn hearing screening. This approach is summarized in the following table.

DPOAE Test Protocol and Analyses Strategy

PROTOCOL	RATIONALE
Test parameters	
* Stimulus Intensity: L1= 65 dB L2= 55 dB	See Whitehead et al, 1995
* F2/F1 ratio: 1.2	Typically produces robust DPOAE (Hall and Mueller, 1997)
* Frequency range: F2 from 2K to 5 KHz	Includes upper end of speech frequencies, but avoids excessive noise of lower frequencies (< 1000 Hz) and potential problem of standing wave artifacts of higher frequencies (.> 5000 Hz)
* Frequencies / range: 4 or 6	Avoids reliance on limited number of test frequencies yet test time is reasonable (e.g. < 1 minute/DPgram) See Figure on page 3.
Recording Technique / Screening Strategy	
* High noise configuration	Rigorous algorithm for reduction of measurement noise and DP - Noise Floor (NF) differentiation
* High to low stimulus frequencies	Infant likely to be most restless at beginning of screening procedure. Test begins in low noise (high frequency) region. Test may be stopped prematurely when pass criteria are met (e.g., for first 3 out of 4 stimuli)
* Assess reliability	Record two or three DPgrams removing probe slightly from ear after each (Chase and Hall, 1998)
* Verify stimulus intensity	Within 2 dB of target intensity levels
* Defer screening to > 24 hours if possible	Vernix is most likely to confound DPOAE recording within the first 24 hours after birth. Perform screening close to discharge.
* Perform screening after feeding	Baby most likely to be sleeping
* Use probe tips specially designed for newborn infants	To obtain optimum seal for precise stimulus presentation and ambient noise reduction
Analysis Criteria	
* DP - NF differences > 3 dB and DP amplitude above adult lower limit	Use of a simple DP-NF difference criteria (e.g., > 3 dB) for “pass” may produce false-negative outcomes (McDaniel et al, 1996). Requirement of a “normal” DP assures detection of mild but important hearing loss. See Figure on page 3.
* Attempt to reduce infant NF to below upper limit for adults	Optimize test conditions and reduce over-referrals.
* Pass = 3 or 4/4 test frequencies meet pass criteria	Aberrant DP at one test frequency is overlooked
* Refer = < 3 test frequencies meet pass criteria	

DPOAEs in Newborn Hearing Screening (continued)

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Smaller measurement systems, including hand-held devices with probe tips specially-designed for newborn infants, are now available from various DPOAE manufacturers. Automated recording and analysis features, including user-set protocols and algorithms for DPOAE detection and pass/refer determination and sophisticated stimulus techniques (e.g., sequential presentation of multiple stimuli), are also available from several DPOAE system manufacturers. Before purchasing a device, request from the manufacturer's representative a thorough demonstration of their device under actual test conditions (e.g., with newborn infants in the nursery setting). Also, ask for documentation of test performance for the device in newborn hearing screening clinical trials, and request the names of several audiologists who have clinical experience with the device.

It's important to keep in mind that OAEs are not a test of hearing but, rather, an electrophysiologic measure of outer hair cell functional integrity. Therefore, newborn "auditory neuropathy", and also hearing loss secondary to isolated inner hair cell dysfunction, will not be identified with OAE screening. To reduce the likelihood of an OAE "pass" outcome in a baby with auditory dysfunction of neural origin, perform ABR screening or diagnostic assessment for infants at risk for neurologic deficits (e.g., meningitis, cytomegalovirus, asphyxia, intraventricular hemorrhage, hyperbilirubinemia, degenerative diseases). Infants at risk for progressive hearing loss (JCIH, 1994) must be scheduled for follow-up audiometry, even if the outcome of the screening is "pass". Finally, always clarify to parents and primary care physicians that a "pass" screening outcome of a neonate does not rule out the possibility of acquired hearing loss in infancy. Supplement the screening report with information on language development and signs of hearing loss.

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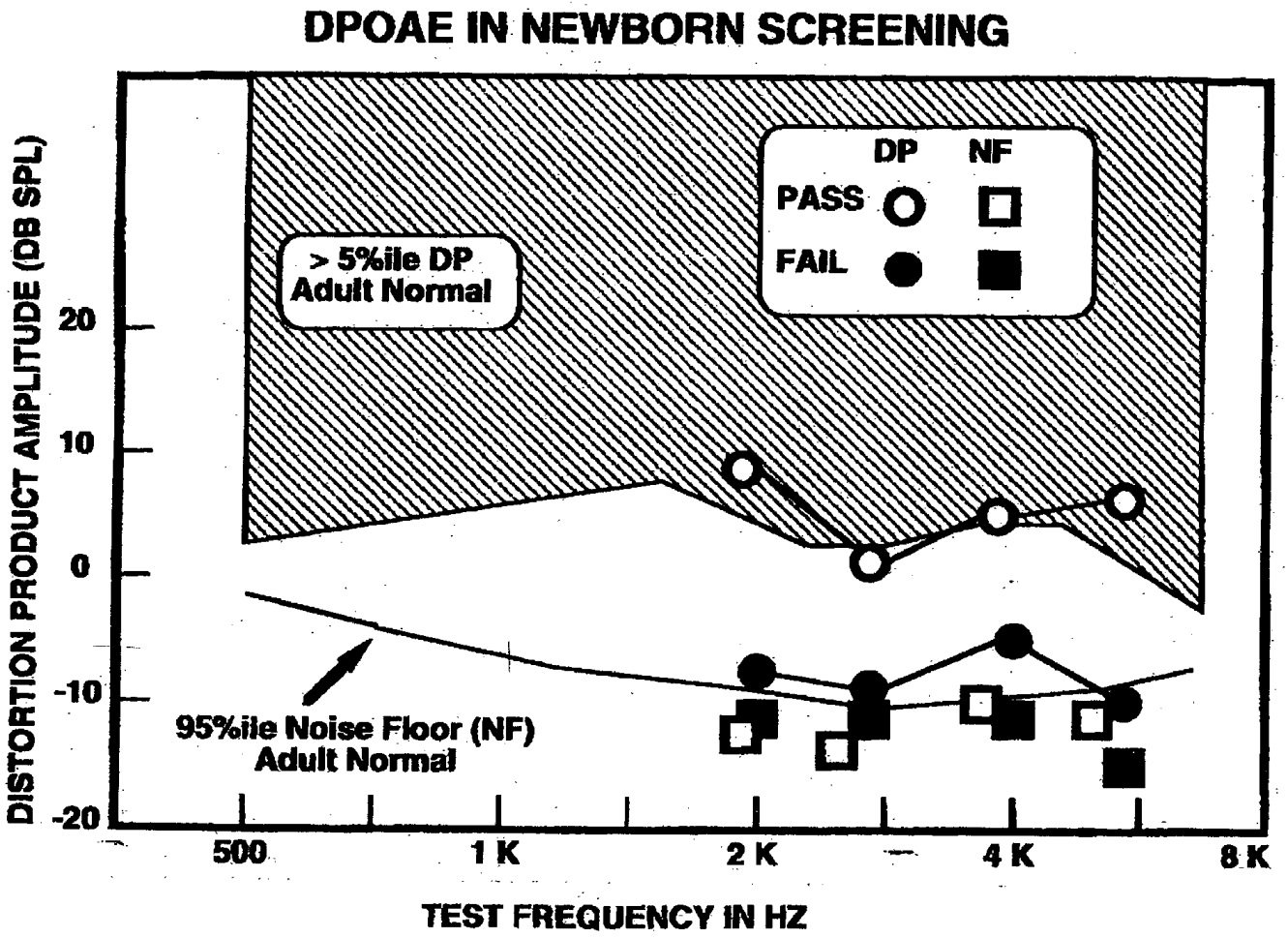
References for this article are on page 9.



Universal Hearing Screening: Observations from the Trenches

The universal newborn hearing program at Methodist Hospitals of Memphis has been in operation for over seven years. Since the fall of 1989, we have screened over 51,00 newborns and identified over 95 children with bilateral hearing loss (defined as hearing loss greater than or equal to 40 dB in the better hearing ear). I am very proud of this accomplishment. On those days when I get frustrated with the logistical problems of operating a program of this size, I can see the faces of those families with whom we=ve worked over the years. It is comforting to know that our group=s efforts have made a difference in each of these family's lives. This is the true reward in operating a newborn screening program - it is a privilege we share as pediatric audiologists. So, every so often, take time to reflect and enjoy this reward. As you know, there are plenty of frustrations that come with newborn hearing screening. However, before I turn too critical, let's first go over our little program and share some of the pearls we have picked up along the way.

Briefly, our detection process is OAE based for infants in the well baby nursery. Exceptions to these are infants who have risk factors for hearing loss of central origin (such as infants with hyperbilirubinemia.) If an infant fails the initial screen, they are scheduled for a follow-up study in two to four weeks. The follow-up study is also OAE based. Infants who fail the second study receive a multi-frequency tympanometric study. Our experience is that this study can be helpful in determining which OAE fails are due to sensorineural hearing loss (I will briefly describe how we do this later). A diagnostic ABR is obtained if an OAE is absent in the presence of a normal multi-frequency tympanometry study, or if a passing study cannot be obtained within six weeks. Except in the most unusual circumstances, we will have a relatively accurate idea of hearing sensitivity by six weeks of age.

Our program differs somewhat from other programs in that audiologists are in charge of reporting test results and planning the follow-up process with the family. There are two goals to this approach. First, we want to put Ahuman touch@ into our hearing detection program. The audiologist who talks to the family on the day of the hearing screen will, in most cases, be the same audiologist who will see the family in follow-up. So this early contact serves to build a relationship with the family. This relationship, in turn, serves to promote compliance and lays the foundation for directive counseling in the future (should it be needed.)

The second aim of the audiologist discussing the test results with the family is to promote the profession of audiology. This is more than just marketing. Available data suggest that in addition to children born with hearing impairment, others will develop significant hearing loss within the first five years of life. As a consequence, our detection efforts must extend beyond the hospital to include the pediatrician and the parents as tutored observers. Families who are seen in the nursery receive information about the importance of early hearing, the signs of early hearing loss, and most importantly, where to go to get their children=s hearing tested if a problem is suspected.

Our program is well funded by the local Mid-South Lion=s Sign and Hearing Service and the Methodist Foundation. Without their support over the years we could not have persevered through the hard times (and there have been plenty of them).

Technical Pearls:

We have learned several things over the years. I have summarized them in two sections. In this section, we review the technical pearls. In the following section, we will go over some of the non-technical issues that truly dictate whether a program will be successful.

We use transient and distortion product evoked otoacoustic emissions interchangeably in our screening program. With the acquisition parameters described below, the performances of both methodologies are identical in our hands. Transient evoked OAEs are elicited from 80 dB peak SPL clicks (+/-3dB) generated by an ILO88 otoacoustic emission system in differential, Aquick screen@ mode (ILO88 version 4.20b+, Otodynamics Ltd, 1993). Screening test results were classified as a Apass@ when the octave band analysis for the click spectrum on the ILO88 had scores of 0.8 or higher for at least three of the four bands between 1600 and 4000 Hz inclusive (energy at 3000 and 4000 Hz must be present).

Distortion product emissions are also used as an initial screen. Either the Grason - Stadler Gsi 60 or Bio-logic Scout otoacoustic emission systems are used. We have more experience with the GSI 60 and so I will limit my comments to this system. Stimuli on the Grason-Stadler system are evoked from four primary sets (1500, 2000, 3000, and 4000 Hz, geometric mean frequency; L1-L2=65-55 dB; F1/F2 = 1.2) The primary sets are presented two at a time. A test was interpreted as a Apass@ if three of four distortion products are detected.

To be considered Adetected@, a putative distortion prod-

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Observations from the Trenches (continued)

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uct must have an absolute amplitude greater than -3 dB, and have a signal to noise ratio of at least 10 dB. If the signal to noise ratio is grater than 15 dB, a distortion product can be considered present without replication. At least two of the recorded distortion products must meet this strict criterion. For the remaining putative distortion products, if the signal to noise ratio is greater than 10 dB, it must replicate within 3 dB absolute amplitude to be considered present. It the signal to noise ratio is less than 10 dB, the distortion product is not considered present because noise alone can produce this result approximately ten percent of the time. (Zapala, 1998 in press)

If you are not totally confused at this point, you should be. We have been trying to settle on a definition of an OAE pass for years. Every time I think we should settle on a more lax definition to decrease our false positive rate I run across an averaged spectrum where the cycle by cycle variability is so great that random peaks of +10 to +14 dB signal to noise ratio can be seen. (To test this, you need to know how your system calculates the signal to noise ratio. Then you calculate the signal to noise ratio of spurious peaks in the spectrum using the exact equation used by your system. Be cautious if random peaks have calculated signal to noise ratios that exceed the minimum criterion you use to detect an OAE). It would be a wonderful addition to current distortion product systems if a probabilistic statement concerning the presence or absence of a distortion product could be generated in real time, based on an analysis of the measured noise spectrum. Until that time comes, we will keep a strict pass definition to avoid missing a hearing impaired infant.

Our detection criteria vary from other research and clinical reports. We have found that extreme care is required when using detection criteria derived from different recording equipment and different recording conditions. Each OAE system uses different signal processing schemes and different recording hardware. Further, noise levels reaching the probe microphone vary across recording settings. Consequently, a detection criterion that is adequate for one recording circumstance may not be adequate for other recording situations. It is therefore vital that local norms be developed under the recording circumstances encountered during routine infant testing. Without this, a rational detection criterion cannot be established in my opinion.

Technical factors also influence auditory brainstem response threshold estimates. Many hospitals use inserts to deliver ABR stimuli to the neonate=s ear canal. Without carefully developed local norms this practice can lead to inaccurate results. The SPL of a click delivered via insert transducer is estimated using a cavity that approximates the adult ear canal. Since the neonate=s ear canal is considerably smaller, a higher SPL will be generated at the tympanic membrane than would be expected based on the dial reading. Our own local norming studies have suggested that this difference is approximately +15dB. That is, a stimulus delivered via insert into a neonate=s ear canal when the dial reading is 35 dBnHL may actually be 50dBnHL. My point is not to assert that inserts are inappropriate for newborn testing. Rather, that mantra Adevelop local norms@ applies here as well.

High frequency tympanomety also plays a role in our follow-up protocol. Several studies have attempted to use multi-frequency tympanometry to detect middle ear effusion in the neonate. Our experience is similar to others in showing almost no relationship between tympanometry data and detectable middle ear effusion. However, we have found a strong relationship between otoacoustic emission, multi-frequency tympanometric data and ABR outcomes in the perinatal period (birth to eight weeks of age, full term population.) Specifically, when 1000 Hz probe tone tympanograms show a peak between +50 and -100 daPa; and otoacoustic emission should be recordable. If the OAE is absent, there is an extremely high probability that a sensorineural hearing loss is present (100% hit rate, n>120 consecutive ears with sensorineural hearing loss >/=40 dB re: ABR threshold). Often, if the tympanogram is outside of the above limits, simply waiting one week and retesting via OAE results in a pass. Since we have technicians perform follow-up OAE studies, this is a considerable cost savings for both the family and the program - so long as the family is compliant with the recommendation to return for follow-up.

Automated ABR play a role in both our initial and follow-up protocols. The ALGO screener is by far the easiest evoked potential system to use. Futher, its automated detection algorithms are incredibly helpful in maintaining consistent accuracy in our assessment efforts. Because of the price structure of our program, it is difficult to use the ALGO as a first line screening tool due to its higher cost / test relative to OAE=s. The ALGO does have a lower false positive rate relative to otoacoustic emissions. In this case, we have made a choice to keep the cost of screening low and, at the same time, place more of a burden on the screened population to return for follow-up study. Ultimately, it is the screened population=s behavior, in terms of the willingness to pay for newborn hearing screenings and comply with follow-up recommendations that determine a program=s efficacy. In my view, the decision to use an automated ABR verses an OAE based detection methodology may differ depending on the perceived behavior of the screened population. This point serves as a good transition into the second section to the preSentation, entitled ANon-Technical Pearls" in infant hearing screening.

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Observations from the Trenches (continued)

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Non-Technical Pearls

How do we define when a hearing loss detection program is successful? On several occasions I have listened to debates over the value of this technique or that. To wit AOAE=s are better than ABR=s are better than Parent Observation,@ad nausium. I find it much more productive to take a broader view of the problem we face. From there, solutions are much more apparent. First, lets look at how hearing loss presents. Table 1 summarizes the possible presentations of hearing loss in the first three years of life. Onset age is designated across the top of the grid and risk factor status is designated down the first column. In each cell, the three possible detection methods are coded as they apply to the particular presentation circumstance. There is one important fact that can be seen form this table. No detection method is sufficient!

Table 1: Possible Presentations of Hearing Loss for Young Children

	Present at Hospital discharge	Delayed onset
Congenital/Non-Genetic	UHS, HHR?	Not Applicable?
Acquired (infection/trauma)	UHS, HHR	CV
Genetic/Random	UHS	CV

UHS= Universal Hearing Screening, HHR= High Risk Register
CV=caretaker vigilance or periodic screening

If we hold that infant hearing loss requires early intervention, it is clear that hospital based screening programs cannot succeed in isolation. Rather, the hospital-based screen is only the start of a community based detection system. Such a system must have caregivers (parents, pediatricians, significant others) that play an important role in the detection process by developing a high index of suspicion when children are encountered. To develop this index of suspicion, caregivers must know three things. First, they must know the importance of hearing in childhood (if it is not important, why look for problems?) Second, they must know the signs and symptoms of hearing loss in childhood. Third, they must know where to go to get an accurate hearing test, and they must want to go. Without empowerment by these three pieces of knowledge, a community-based system fails to detect delayed onset hearing loss. Further, without the desire to act, families will not comply with follow-up recommendations when an infant fails a hearing screen.

We considered the role of the family when we developed our program. Specifically we set the following two goals for our infant hearing loss detection program back in 1989. First, by nine months of age, we wanted all hearing impaired infants to be identified, medically evaluated, aided, placed in a family based habilitation program, and have parents accepting and empowered by their child=s hearing capabilities so that they were actively participating in the treatment process. Second, we wanted the parents of those children who passed our hearing screen to know about the importance of infant hearing, signs of hearing impairment and what to do if a problem is suspected (see above). In view of recent outcome reports, it appears that all of this should occur before six months of age. Never the less, I believe it is important for pediatric audiologists to define success in terms of outcomes that occur far after the infant leaves the hospital. It is not sufficient to test. We must be in the business of changing the behavior of families, caregivers and other professionals so that they act in the best interests of their children.

We did not achieve our goal of early intervention until 1996, a full six years after the start of our program (it turned out that all infants were treated by six months of age that year.) There are many reasons for this, which will not be reviewed here for space reasons. However, what I do know is that there was no one thing that we did to improve our program=s performance (though I=m told if I were a politician, it would all be because of our personal and substantial efforts!). Rather, I think, through the work of many, the community=s values have changed because we were persistent. I think that our hospital and others started their infant hearing screening programs, we stayed the course, were vocal about the needs of hearing-impaired children, and slowly, over years, attitudes about hearing loss changed. Now, families expect to have their children=s hearing screened. Pediatricians complain when we miss a child. Kinks in the community system have smoothed (though there are still many that need attention). We=ve all become wiser. And so that=s the good side of our experience.

The Future:

What I=m going to say now may get me in trouble. But I think it has to be said. Overtime, I have come to believe there is a critical flaw in most, if not all hospital based infant screening efforts. This flaw is that parents cannot substantially invest in the process of detection hearing loss in their infant during the perinatal period. We need parents who know enough to want to have their infants hearing tested. I think we are misinformed if we believe that we can mandate a hearing test, then expect families to docilely do what we tell them to do after a hearing loss is detected. So my sound bit is Afamily centered intervention starts with family centered detection methods@ The fact is, during the birth process,

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hearing screening is not, nor perhaps should it be a priority. Wouldn=t it be more cost effective, wouldn=t parents be more receptive to our suggestions, wouldn=t it be more convenient for all involved if parents routinely had their infants hearing tested at two weeks of age, perhaps in the pediatrician=s office? At present, universal hospital based hearing screening occurs because infants are accessible (a convenience to the screener), and capital equipment can be purchased with an economy of scale. It also occurs because professionals have come to believe (rightly so, I believe for the present) that without universal hospital based hearing screening, too many infant with hearing loss will not experience the benefits of early intervention. However, the first or most do-able solution may not be the best. Perhaps we should be working for the end of universal hospital based hearing screening programs, just as dentists work for the eradication of tooth decay. Maybe, instead of invading one of the most personal, moving experiences of a family's life with our hearing screen, we should work toward multiple, low cost, accessible opportunities for infants and children to have their hearing checked many times during the first few years of life, beginning at 2 weeks of age.

To make this work, we would need to develop technology that is inexpensive to purchase and use. This can happen! Some of us remember when impedance meters were a rarity. We would also have to embark on a massive community awareness campaign to create the demand for multiple periodic hearing checks. This is not impossible to accomplish, in fact we have made great in roads already. Most parents want to do what is best for their children. All we have to do is create the motive and the means.

I know you are probably thinking I=m off my rocker, but I believe this is possible. Last year for the first time, I told a family that their infant had a hearing loss and the first thing out of the father=s mouth was AWhen can we get started with hearing aids?@ This was a second birth. The family already had one child screened in our hospital. They remembered our message even though their first born passed our test. When their second son was delivered in a hospital that did not test newborns hearing, they watched a little more carefully. When this infant didn=t respond to sounds well, they brought him in for a hearing test without even asking their pediatrician. They suspected a hearing problem. I was simply confirming what they already knew. This family was participating in an early intervention program within three weeks of that meeting! If we work in true partnership with our communities, this type of service can work for the betterment of all.

Well, I=ve had my 15 minute of fame. I hope you will write the next column and share your ideas. There is always a better way to do things and I am expecting to learn something from you.

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Product Review

Editors Note: The product review section of this newsletter is not intended as a product endorsement. For further information, please contact the company directly.

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Welch Allyn GSI 60 DPOAE System

The Welch Allyn GSI 60 DPOAE is a Windows-based system available in laptop or desktop versions. The portable version can be used under battery or power line operation. The rechargeable battery provides sufficient power for up to four hours of testing. The system's indicator light alerts the screener when there is less than 30 minutes remaining on the charge. For those already comfortable with Windows and DPOAE screening, it takes about an hour to become familiar with the equipment.

The system specifications are as follows:

Frequency: 500 Hz to 8000 Hz.
Level: 20 to 80dB SPL, selectable in 5 dB steps.

The Welch Allyn system features "Simultaneous DP Testing" permitting multiple DP measurements concurrently, thus shortening test time. Several DPOAE can be displayed on the same screen. This system also provides DP Scoring, an automated scoring process, as well as Password Protection. Screening parameters can be customized and "locked" thereby ensuring greater control over data collection. This feature is especially useful when there are multiple screeners.

Update on Universal Newborn Hearing Screening Legislation

Six states now have legislation mandating screening all newborns for hearing loss. Hawaii was the first in 1990 with Rhode Island following in 1992. Five years later Colorado, Connecticut and Mississippi passed their laws. In all, 1997 was a busy year for newborn hearing screening in the state legislatures with 10 states proposing mandates, and three passing.

In 1998 is also shaping up as another busy year. On March 14th Utah became the sixth state with a legislative mandate (see following story) and California, and Virginia are very close. Federal legislation which would provide financial resources to help states get started has been introduced.

Descriptions of the laws that have passed, as well as those that have been proposed can be found on the NCHAM website (www.usu.edu/~ncham). The following is a summary of the state mandates that have passed.

Six states (California, Maryland, Massachusetts, Pennsylvania, Virginia, West Virginia) have pending universal newborn hearing screening legislation. All have the Department of Health as the agency responsible for some or all of following: developing regulations, establishing an advisory committee, monitoring compliance and tracking infants who do not pass the screen. Newborn hearing screening is established as a covered benefit in four of the proposed bills.

State	Year Passed	Effective Date of Mandate	Responsible Agency	Advisory Committee	Funding	Summary
Hawaii	1990	7/1/1991	Health & Education Dept	No	No	Mandates early screening, identification and follow-up
Rhode Island	1992	7/1/1992	Health Dept	Yes	Covered benefit by all health insurers & state	Mandates newborn screening for hearing loss
Colorado	1997	7/1/1999	Hospitals Health Dept	Yes	No	Mandates parent education - encourages hospitals to begin in 1997. Mandates screening in 1999
Connecticut	1997	7/1/1999	Health Dept	Yes	No	Mandates newborn screening as standard of care
Mississippi	1997	1/1/1998	Health Dept.	Yes	No	Mandates newborn hearing screening
Utah	1998	7/1/1998	Health Dept.	Yes	No	Mandates newborn hearing screening

Utah Governor Signs Newborn Hearing Screening Legislations

On March 14, 1998 Governor Michael Leavitt signed Senate Bill 40 making Utah the sixth state in the country to mandate newborn hearing screening. The law requires that by July 1, 1998 all hospitals with more than 100 births will have to screen all infants for hearing loss prior to discharge. At the present time approximately 80% of Utah's babies are born in 22 hospitalswith universal newborn hearing screening programs. As a result of this legislation 9 additional hospitals will have to establish programs by July 1, 1998. At that time 97% of the births in Utah will be in hospitals with universal newborn hearing screening.

The law also establishes an Advisory Committee and requires all hospitals to report results of the newborn hearing screening program to a statewide Early Hearing Detection and Intervention (EHDI) data-base maintained by the State Department of Health. According to Dr. Kelly Dick, chair of the ad hoc task force that worked for passage of the legislation, the next big step is ensuring that all infants referred from the screening programs receive appropriate and timely diagnostic and intervention services.

Five Years After NIH ..... (continued)

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ple, in the 1990 the Rhode Island Hearing Assessment Program, which provided much of the evidence at the NIH Consensus Conference about the feasibility of universal newborn hearing screening, referred more than 25% of the infants at the time of discharge for a second-stage screening. Today, OAE-based programs are routinely referring less than 10% of infants for second-stage screening. AABR programs have similarly become much more efficient. Not surprisingly newborn hearing screening equipment is becoming cheaper, faster, and easier to use.

Newborn hearing screening is becoming the standard of care. In March of 1993, newborn hearing screening was generally viewed as an experimental procedure. Now, it is increasingly considered to be the standard of care. In 1993, less than 5% of all babies were screened for hearing loss prior to being discharged from the hospital. Today, it is more than 20% and increasing rapidly. Six states now have legislative mandates for statewide universal newborn hearing screening, and the growth in number of hospitals providing such screening has been exponential since the NIH Consensus Development Conference. Because "reasonable practitioners" in every region of the country are doing newborn hearing screening, coupled with the inexpensive availability of easy-to-use equipment, many people believe newborn hearing screening already has become the standard of care.

There is still a long ways to go. Even though the expansion and improvement of universal newborn hearing screening programs have been dramatic, a great deal of work remains to be done. The fact that 30-40 times as many hospitals are now operating universal newborn hearing screening programs as was the case in March of 1993 should not obscure the fact that 90% of all hospitals in this country are not yet doing newborn hearing screening. Furthermore, even though it is clear that screening babies is relatively simple, providing them with appropriate and timely diagnostic and intervention services is still a major challenge.

The accomplishments of the last five years, provide a solid foundation upon which we can continue to build. Making newborn hearing screening the standard of care for all babies born in this country, however, will require continued work from physicians, parents, educators, and audiologists. Clearly, the most successful early hearing detection and intervention programs are those which recognize the need for multi-disciplinary involvement, broad-based community support, and attention to the diverse needs of families. If there is as much growth in the next five years as there has been in the last five years, however, the goal of identifying all children with significant hearing loss before six months of age is within sight.

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(((SOUND IDEAS
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Upcoming Events

April 7, 1998 May 5 1-June 2	Centers for Disease Control and Prevention monthly teleconference on EHDI (Early Hearing Detection and Intervention) related topics. First Tuesday of each month from 2 - 3 PM Eastern Time. Join in by calling 800-311-3437 a few minutes before 2:00 PM. E-mail ehdi@cdc.gov for that month's agenda.
April 23, 1998	Universal Newborn Hearing Screening: From Demonstration to Implementation New York Academy of Medicine 1216 Fifth Avenue New York, NY NY State Department of Health (Disability and Health Program). Empire State Plaza/Corning Tower,
Room	208/Albany, N.Y. 12237
May 15, 1998	ASHA Teleseminars: The Genetics of Hearing Loss and Genetic Counseling: What the Practicing Audiologist Needs to Know. Contact: 1-800-498-2071
May 15-16	European Consensus Development Conference on Neonatal Hearing Screening, Milan, Italy. Contact: G. Tognola at ecdc@elet.polimi.it
August 30, 1998	XXIV International Congress of Audiology. Buenos Aires, Argentina Contact: conginte@mbox.servicenet.com.ar. General Secretariat Congress of Internacionales S.A. Tel: (54-1) 342-3216 Fax: (54-1) 331-0223
November 19-22	1998 ASHA Annual Convention San Antonio, Texas