

The Past, Present, and Future of Universal Newborn Hearing Screening in Taiwan

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Abstract: The Taipei Mackay Memorial Hospital in Taiwan, in collaboration with the Children’s Hearing Foundation, initiated a free newborn hearing screening program using transient evoked otoacoustic emissions (TEOAE) in 1998. During 2003-2013, there were four major phases of implementation and promotion of Taiwan’s universal newborn hearing screening program (UNHS) initiated by the government’s Bureau of Health Promotion. These included (a) establishment of the 2004 Taiwan Guidance of Newborn Hearing Screening Program, (b) completion of the 2008 Taiwan Consensus Statement on Newborn Hearing Screening, (c) implementation of a national government-funded UNHS program in 2012, and (d) the 2014 Taiwan UNHS Revised Guidelines. In summary, in 2016, Taiwan national statistics indicated that for a total of nearly 200,000 babies the coverage rate of newborn hearing screening was up to 98.2%, the refer rate was 1.13%, the return rate of ordinary patient department (OPD) referral was 86.10%, and the incidence of congenital deafness was estimated to be 0.455%.

Key Words: universal newborn hearing screening (UNHS), aABR, congenital deafness

Acronyms: aABR = automated auditory brainstem response; AAP = American Academy of Pediatrics; JCIH = Joint Committee on Infant Hearing; NIH = National Institutes of Health; OAE = otoacoustic emissions; OPD = ordinary patient department; TEOAE = Transient evoked otoacoustic emissions; UNHS = universal newborn hearing screening

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Introduction

In March 1993, the U.S. National Institutes of Health (NIH) concluded, “that all infants should be screened for hearing impairment... This will be accomplished most efficiently by screening prior to discharge (from the birth hospital). Infants who fail hearing screening should have a comprehensive diagnostic hearing evaluation no later than 6 months of age” (p. 215-227). Subsequently, the Joint Committee on Infant Hearing (JCIH, 2007) and the American Academy of Pediatrics (AAP, 2008) both recommended that newborn hearing screening should be conducted by the first month of life, confirmation of congenital hearing loss should be made by three months of age, and intervention and rehabilitation plans should be in place by six months of age. The fact that early diagnosis and intervention of hearing loss has resulted in significant

impacts on the development of children with hearing impairment has been well studied and documented in the United States since 1998 (Downs & Yoshinaga-Itano, 1999; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998).

Based on this, the Taipei Mackay Memorial Hospital in Taiwan, in collaboration with the Children’s Hearing Foundation, initiated a free newborn hearing screening program using transient evoked otoacoustic emissions (TEOAE) in 1998 (Lin, Shu, Chang, & Bruna, 2002). This was followed in 2002 by a call from the Taiwan Ministry of Health and Welfare for research proposals related to the administration of screening procedures and policies as a way of improving the welfare of infant hearing health. As a result, Taipei Mackay Memorial Hospital began to take part in these projects. During 2003–2013, there were four major phases of implementation and promotion of the

universal newborn hearing screening program (UNHS) in Taiwan initiated by the government's Bureau of Health Promotion. First, in 2003, Chang Gung Medical Hospital was commissioned by the Taiwan Ministry of Health and Welfare to evaluate the feasibility of implementing a newborn hearing screening program in Taiwan. The purpose of the project included understanding the feasibility of conducting newborn hearing screening in maternity hospitals and planning the screening procedures during 2003 and 2004. Since 2004, Dr. Hung-Ching Lin of Taipei Mackay Memorial Hospital has played a major role in these 4 major Taiwan UNHS promotion projects, including (a) establishment of the 2004 Taiwan Guidance of Newborn Hearing Screening Program (Bureau of Health Promotion, 2004), (b) completion of the 2008 Taiwan Consensus Statement on Newborn Hearing Screening (Bureau of Health Promotion, 2008), (c) implementation of a national government-funded UNHS program in 2012 (Yoshinaga-Itano et al., 1998), and the 2014 Taiwan UNHS Revised Guidelines (Bureau of Health Promotion, 2014).

In addition, in order to raise public awareness of the importance of UNHS, the 2004 Taiwan Guidance of Newborn Hearing Screening Program (using otoacoustic emissions [OAE] or automated auditory brainstem response [aABR] at parent's own expense) was completed with support from many speech and hearing professionals (Bureau of Health Promotion, 2004). In the same year, the Taiwan Speech-Language-Hearing Association implemented several training courses in the basic concepts of UNHS for speech and hearing professionals.

Nevertheless, by 2007, Taiwan national statistics showed that only 28.7% of medical institutions offered newborn hearing screening services in Taiwan (Bureau of Health Promotion, 2007–2008). Consequently, a national research project commissioned by the Ministry of Health and Welfare was conducted by Taipei Mackay Memorial Hospital with the goal of promoting and studying the effectiveness of UNHS in an effort to increase the coverage rate of newborn hearing screening in Taiwan. A promotion center in Taipei and four hearing screening service centers located in the northern, central, southern, and eastern parts of Taiwan were established to recruit more medical institutions to conduct newborn hearing screening. By 2008, the percentages of medical institutions offering newborn hearing screening service had increased to 39.4% (Bureau of Health Promotion, 2014). Meanwhile, the Taiwan Consensus Statement on Newborn Hearing Screening, 2008 (using aABR at parent's own expense) was completed and endorsed by a panel of international experts from Singapore and Hong Kong (Bureau of Health Promotion, 2008). The four service centers, in collaboration with other associated organizations, began to hold seminars and workshops to facilitate the communication between hearing screening personnel and speech and hearing professionals, and also to improve their clinical skills and knowledge in the area of newborn hearing screening.

Through these efforts, 87% of medical institutions in Taiwan implemented newborn hearing screening programs by 2011–2012 (Bureau of Health Promotion, 2011–2012). At that time, some counties and cities had been implementing newborn hearing screening using either OAE or automated auditory brainstem response aABR; however research by the authors indicated that aABR may be more beneficial and more practical than TEOAE (Lin, Shu, Lee, Lin, & Lin, 2007). Consequently, the Taiwan Ministry of Health and Welfare issued regulations in February 2012 that provided government funding for universal newborn hearing screening using aABR, free of charge to parents, with the policy initiated on March 15, 2012. At the same time, the maternal and child health data management and tracking system to monitor the hearing status of newborns was activated.

After implementation of universal newborn screening in Taiwan in 2012, a monitoring center was established to work together with the four promotion centers across the island to offer consultation and quality control of hearing screening and diagnosis. By 2013, the coverage rate of Taiwan's newborn hearing screening program reached 97.3% (Bureau of Health Promotion, 2011–2012); comparable with the status in the United Kingdom, United States, and Australia. In addition, the 2013 confirmation rate of hearing diagnosis in Taiwan was 81.6%, higher than the 54.1% in the United States in 2012 (Muse et al., 2013). A revised consensus conference for newborn hearing screening, diagnosis, and intervention held and confirmed by U.S. professor Christine Yoshinaga-Itano and Australian professor Joseph Kei in 2014 sought to improve the distribution of medical resources and the referring procedures of early intervention with the goal of improving quality and outcomes of newborn hearing screening programs in Taiwan (Bureau of Health Promotion, 2014).

In summary, the 2016 Taiwan national statistics indicate that for a total of nearly 200,000 babies, the coverage rate of newborn hearing screening was up to 98.2%, the refer rate was 1.13%, the return rate of OPD referral was 86.10%, and the incidence of congenital deafness was estimated to be 0.445% (Bureau of Health Promotion, 2015–2016). This shows that the overall outcome of the Taiwan newborn hearing screening program has approached international performance levels (Huang et al., 2014). In the future, we will be devoted to leading and sharing our experience in establishing infant hearing screening programs to neighboring countries. From our experience in promotion of UNHS in Taiwan, there are five main points we would suggest for others creating a UNHS program.

1. Establish a national guidance and consensus statement for newborn hearing screening in order to bring professional experts together for the work.
2. Publish domestic UNHS related results in international papers to raise your government's attention of its importance and to gain government funding.

3. In order to increase the coverage rate, the UNHS program must be supported with national funding so that parents do not pay for screening. In Taiwan the coverage rate was initially only 70% when parents paid, later increasing to 98.3% with national free UNHS.

4. Monitor UNHS quality to confirm higher coverage and diagnosis rates through projects such as Taiwan's quality control improvement project for newborn hearing screening and confirmed diagnosis (Bureau of Health Promotion, 2015–2016).

5. Create a national UNHS data tracking system. In Taiwan, the national UNHS data tracking system was monitored by Health Promotion Administration, Ministry of Health and Welfare, Taiwan. Our Mackay Memorial Hospital team was commissioned by the government to help audit and promote its qualities, to reduce inappropriately higher referral rates, and to increase diagnostic follow up rates and early intervention rates via this data tracking system.

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