

Congenital hearing loss was not a scary problem: article review

Arie Ika Wardhana Asnar¹, Ernawaty^{2*}

¹Department of Marketing and Financial of Health Service, Faculty of Public Health, Universitas Airlangga, Surabaya 60115 Indonesia

²Department of Health Administration and Policy, Faculty of Public Health, Universitas Airlangga Surabaya 60115 Indonesia

***Corresponding Author: Ernawaty**

Department of Health Administration and Policy, Faculty of Public Health, Universitas Airlangga Surabaya 60115 Indonesia

Email: ernawaty@fkm.unair.ac.id

Abstract: Congenital hearing loss in Indonesia is still not getting optimal treatment. The number of patients from year to year does not get a clear picture and the government program for this problem is still not clearly visible. Patients with hearing loss are a burden of the State response if handled early this problem can show good progress. To Proving that early hearing screening in newborns can reduce complications from congenital hearing loss. Systematic searches were carried out at PubMed, Sciencedirect, ProQuest, Ebsco, and Web of Science to identify peer-reviewed research. The paper used is an original peer-reviewed research article in English that discusses the rehabilitation of children with hearing loss. Papers that meet the criteria are analyzed using PICO. 80% of children with congenital hearing loss identified under the age of 2 years have improved behavior, communication, and knowledge compared to children identified above 2 years. The rehabilitation process for speech ability 83% of children with congenital hearing loss under 2 years have more vocabulary. Rehabilitation costs incurred in children with congenital hearing loss identified >2 years are higher. Early Hearing screening is important to be carried out early on with the aim of preventing speech delay, behavior disorders, and knowledge disturbances.

Keyword: Congenital Hearing Loss, early hearing screening, speech delay

1. Introduction

Congenital hearing loss is a chronic hearing loss with an average of ≥ 40 dB at frequencies of 500 Hz, 1,000 Hz, 2,000 Hz, and 4,000 Hz which is obtained from hearing screening and the condition is commonly found in children. The majority of cases of congenital hearing loss are found in developing countries. The prevalence of permanent hearing loss based on a universal hearing loss screening program of 1.33 per 1,000 newborns and each year that number has increased. In countries without a hearing screening program in neonates it is estimated that 19-24 per 1,000 newborns who have a hearing loss (1).

Congenital hearing loss management currently focuses on hearing screening early. Risk factors for neonates that need to be screened for hearing include a family history of permanent hearing loss, abnormal craniofacial, infection during pregnancy (meningitis, cytomegalovirus, toxoplasmosis, rubella, herpes, and syphilis), admission to the neonatal intensive care unit (NICU) for >2 days, using a ventilator, using drugs ototoxic, and hyperbilirubinemia. Hearing screening can use otoacoustic emission (OAE) and automated auditory brain stem response (AABR). OAE can be examined after one day the baby is born (2, 3). Infants who do not pass

auditory screening require appropriate medical and audit evaluation to confirm hearing loss, ideally screening before 3 months of age. Hearing evaluation includes several examinations, namely OAE, AABR, auditory brain stem response (ABR), Auditory steady state response (ASSR), Visual reinforcement audiometry (VRA) for ages 6-24 months, play audiometry for ages 2-4 years, and standards audiometry for ages >4 years (1, 2).

Patients diagnosed with congenital hearing loss need to use hearing aid (HA) or cochlear implant (CI) to help hear sounds and sounds. The use of HA and CI is very important for the development of speech perception and the amplification of the perception process in children and infants with hearing loss (HL) (1, 2, 4). Congenital hearing loss has a negative impact on the development and health of children including the ability to speak, understand language, literacy, mental health, social and cognitive functions, and achievements in education, employment opportunities, and social economic opportunities. The cost of living ever reported for congenital hearing loss patients due to care and unproductive is estimated at \$ 177 million USD per live birth of 80,000 children. So, to minimize these costs and the negative impact of congenital hearing loss patients in addition to the need to use HA or CI, patients also need to get speech therapy (5, 6).

In Indonesia, hearing screening in newborns is still not optimally performed. Besides the availability of OAE and AABR tools that have not been comprehensive in several regions in Indonesia. Thus, we conducted a management review of congenital hearing loss, specifically the effectiveness of identifying hearing loss for early speech therapy after using HA or CI. The purpose of writing this review is to provide input to policy makers to immediately start early hearing screening.

2. Method

This study used qualitative method. Then the keywords "congenital hearing loss", "delay speech", "speech therapy", "screening hearing test", "hearing aid", "chochlear implaned", and "language development" from January 2019 to August 2019. Our search was conducted on several online data journals namely Ebsco, Proquest, Pubmed, and Scient Direct. The process of screening the total manuscripts that we found is based on the inclusion and exclusion criteria that we have set. Screening the article process can be seen in figure 1.

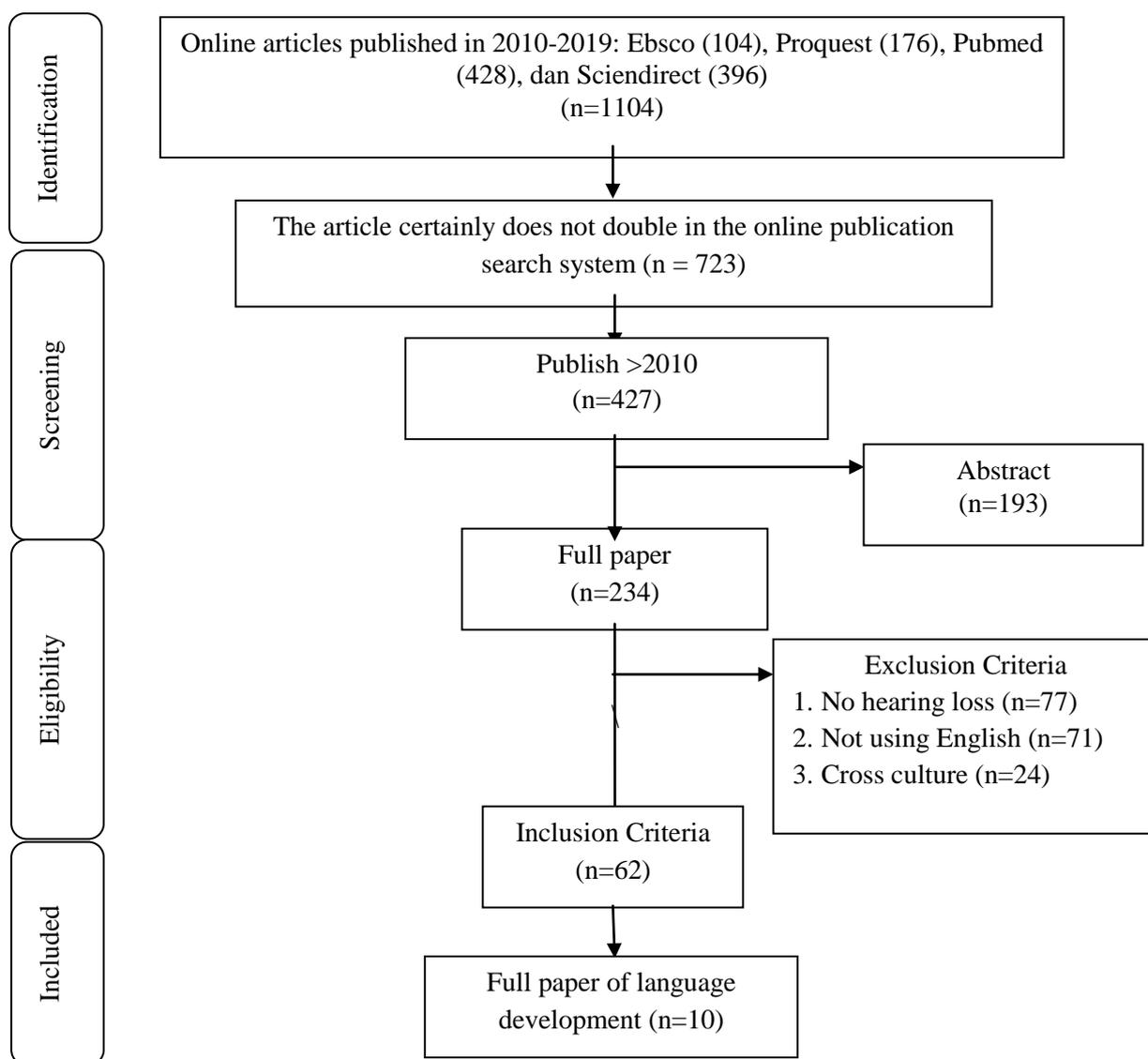


Figure 1. The article filtering process

Inclusion criteria include articles published in English, articles published in >2010, using speech therapy interventions, research subjects in the article are children, subjects using HA or CI, the outcome of the intervention is language development, and the purpose in the article must be clear. Exclusion criteria are articles that discuss cross-cultural related, articles are only abstract, and speech therapy is given to children with disorders other than hearing loss. The priority articles used are articles that independently provide information about participants (the age at which the intervention began and the severity of hearing loss), interventions (type of intervention, dosage, and regulation), clear outcome assessment, and main findings.

The process of analyzing several articles that meet the criteria uses the PICOC (Population, Intervention, Comparison, Outcomes, and Context) model approach, which is arranged in a tabular form to make it easier. The population in the analysis of this article are children with congenital hearing loss who use HA or CI and get speech therapy intervention. Interventions that will be reviewed about speech therapy given early and late given. The conclusions of some of these articles can make good knowledge for management of children

with congenital hearing loss. The outcome used from these articles must be compared with several journals that discuss valid and reliable testing.

3. Results

Search journals carried out in January to August 2019 obtained as many as 1104 journals that match the keywords. The process of selecting articles that the author wants to use to provide input to readers to be more aware of hearing screening early can be seen in Figure 1. The number of articles that meet the criteria of 10 articles. Details of the analysis can be seen in table 1.

Table 1. Analysis of speech therapy for children with hearing loss

Author	Screening	Intervention	Tools	Outcome
Shojaei (7)	One group (3-6 years old) & two group (12-15 months)	HA/CI and Speech therapy	The Persian TOLD-P3	there are differences in synthetic and synthesis skills
Noori (8)	3 – 7 years old in ADHD and non-ADHD patient	HA/CI and Auditory training, speech therapy, occupational therapy	The Newsha developmental scale	Rehabilitation of children with congenital hearing loss needs to be initiated since to improve rehabilitation
Meinzen-Derr (9)	3 – 11 years old	HA/CI and Speech therapy used by augmentative & alternative communication	Oral and Written Language Scales-II, the Preschool Language Scales, Fifth Edition	The latest technology using electronic speech therapy needs to be introduced early to improve children's speech and language skills
Dieleman (10)	To divided into 4 groups based on the etiology of Hearing Loss	HA or CI and Speech therapy (AVT)	Peabody picture vocabulary test, Reynell test, the Danish viborgmaterialet	There is no difference in the causes of congenital hearing loss on speech and language development
Zamani (11)	5.5 – 7 years old	CI and Speech therapy (NBLI)	the Persian version of the Language Sample Analysis test	Improving the structure of sentence pronunciation in children with NBLI compared to conventional speech therapy
Tejeda-Franco (12)	Hearing loss (2 - 6 years old) dan normal (4-6	HA and Speech Therapy	Acoustic evaluation used Ling Waves Software and Atmos	The use of HA and AVT can improve the sound quality of

	years old)	(AVT)	Media Stroboscope	HL children
Ohmori (13)	5-year-old	HA/CI and Speech Therapy	Picture Vocabulary Test (PVT) and original vocabulary checklist	The introduction of newborn hearing screening can improve receptive and vocabulary development
Cuda (14)	2 – 5 years old	CI and Speech therapy	MacArthur-Bates Communicative Development Inventory (MCDI)	The language development of children with CI in the first year is better and the use of CI after 12 months has a significant mild linguistic delay.
Lin (15)	0.1 month/age (early intervention) dan 19.2 month/age (late intervention)	HA/CI and Speech Therapy	The Peabody Picture Vocabulary Test (PPVT)	Children's language skills cannot be separated from family involvement and early intervention
Wu (16)	1 – 24 months	CI and Speech Therapy	The Peabody Picture Vocabulary Test (PPVT)	Age affects language understanding around 37% and the use of CI 5-7 years normal language skills and skills

The majority of articles (90%) claim that CI and HA are tools used to assist patients in hearing. CI and HA are only bridges so that the learning process of children with hearing loss is easier because with the use of HA and CI without the addition of speech therapy and other therapies, the child's condition does not have an improvement on the problems that arise (7-16). The choice of speech therapy is very many types but what is commonly used is the auditory verbal therapy (AVT) method. The majority of journals recommend giving speech therapy to children with hearing loss 2 times a week where each session is 45 minutes (8, 10, 12).

Most articles (80%) state that the age of a child using HA or CI affects the development process and language skills. The younger the children with hearing loss using HA or HI, the faster the language skills of HL children become normal. Interventions in children with HL should be carried out before 6 months of age (15, 16). HL treatment can be implemented early if the auditory screening program is going well. The ability of children with hearing loss is only impaired in hearing but for other aspects they are normal (7, 8). CI and Hearing Aids specifically have their respective advantages and disadvantages but based on the existing article. CI shows better development than HA because CI is directly received by the brain directly.

The average of HL patient was identified / diagnosed at age >15 months (13, 16). The average of early HL patients use HA at >15 months (8, 13, 16) and age of patients using CI >1.5 years (13, 16). This condition shows that the newborn hearing screening program is still

not running optimally. The use of CI / HA early or <6 months can improve the language skills of HL children such as children with normal hearing and reduce lingual abnormalities (7, 14).

4. Discussion

The key to the successful handling of cases of children with HL is the ability of HL language development children like normal children. The majority of articles also mention that early language recognition in children is very helpful in children's speech and language development (6, 7). Language recognition in children with HL will not be effective if children are introduced to language but they cannot hear well. Some studies state that it is important to conduct hearing screening early and in some developed countries it has become a mandatory program for all babies and is known as newborn hearing screening (NHS). The goal of the NHS is to screen infants under the age of 1 month who are at risk of HL to get intervention and treatment early to optimize children's development (1, 3, 5).

Hearing screening is commonly used in developed countries, namely OAE and AABR. OAE consists of two types, namely Transient evoked otoacoustic emissions (TEOAE) and Distortion-product otoacoustic emissions (DPOAE). TEOAE is widely used to identify normal ears around 98%. TEOAE identified normal ears in the range of 20 dB or better and TEOAE could not be recorded if the patient indicated HL >40 dB. DPOAE is stimulation caused by two frequencies and has been used as an indicator of cochlear function (17). How to use it, a lightweight probe is placed in the ear canal and produces a wide-click 'click'. Acoustic energy generated in response to clicks is detected by the microphone inside the probe. OAE Screening automatically displays the test results as a "Pass" or "Refer," which does not require interpretation of tests by screening personnel. This test takes between 1 and 5 minutes in ideal conditions, with optimal test techniques (18). For initial screening using OAE can be done 24 hours after the baby is born. Subsequent screening is done for infants who fail the first stage of screening. They are retested within 10-15 days after birth by OAE and are evaluated again at 3 months of age (19).

After screening the patient with CHL needs to be evaluated by several examinations until the diagnosis of HL is established. HL patients need to use HA or CI to assist patients in the process of hearing (7-16). After using HA or CI the patient must get AVT 2 times a week for 45 minutes (8, 10, 12). When the introduction of HL children to language needs to be done early to be able to provide development of language and speech of children because after the use of HA or CI the ability to speak HL children like normal children takes about 5-7 years (5, 7, 20). Child and family motivation needs to be considered because the success of all treatments always involves the active role of the family and patient (21).

Children with congenital hearing loss identified under the age of 2 have better behavior, communication, and knowledge compared to children identified above 2 years. The treatment process in children identified under the age of 2 years has improved and the time spent is more efficient. Rehabilitation costs incurred for children with congenital hearing loss since identified > 2 years are higher. Early hearing screening is important to do early to maximize the expected results in children with hearing loss (5, 7, 20).

The limitation of this study is the recommendation for hearing hearing screening in newborn children. Related to the implementation of existing policies and legislation and the health system in Indonesia is still not well supported.

5. Conclusion

Hearing screening needs to be carried out on some babies with the risk of hearing loss > 24 hours after birth. Screening is carried out to detect problems early and provide early treatment to infant with HL. Delay in the management of HL affects the child's growth and development stage, especially the ability of language and patient behavior. The language

ability of HL patients can be like normal children after using HA or CI for 5-7 years and after the use of HA / CI is helped by AVT as well. If, this problem is identified early on HL patients are no longer a frightening specter because academically the ability of HL children is the same as normal but they are only disturbed in hearing function. Ear health studies need to be done because research has proven early treatment in children with congenital hearing loss is very good prognosis as long as children do not have concomitant diseases. Regulations related to preventive measures need to be considered by the government and hold policies for hearing screening.

6. Acknowledgement

The author declared no conflict of interest on my paper publish.

7. Funding

None

Reference

- [1] Korver AMH, Smith RJH, Van Camp G, Schleiss MR, Bitner-Glindzicz MAK, Lustig LR, et al. Congenital hearing loss. *Nat Rev Dis Primers*. 2017;3:16094-.
- [2] Patel H, Feldman M. Universal newborn hearing screening. *Paediatr Child Health*. 2011;16(5):301-10.
- [3] Wroblewska-Seniuk KE, Dabrowski P, Szyfter W, Mazela J. Universal newborn hearing screening: methods and results, obstacles, and benefits. *Pediatric Research*. 2016;81:415.
- [4] Bergeson TR, Houston DM, Miyamoto RT. Effects of congenital hearing loss and cochlear implantation on audiovisual speech perception in infants and children. *Restor Neurol Neurosci*. 2010;28(2):157-65.
- [5] Ching TYC. Is Early Intervention Effective in Improving Spoken Language Outcomes of Children With Congenital Hearing Loss? *Am J Audiol*. 2015;24(3):345-8.
- [6] Tomblin JB, Harrison M, Ambrose SE, Walker EA, Oleson JJ, Moeller MP. Language Outcomes in Young Children with Mild to Severe Hearing Loss. *Ear Hear*. 2015;36 Suppl 1(0 1):76S-91S.
- [7] Shojaei E, Jafari Z, Gholami M. Effect of Early Intervention on Language Development in Hearing-Impaired Children. *Iran J Otorhinolaryngol*. 2016;28(84):13-21.
- [8] Noori F, Farahani S, Mokrian H, Asadi M, Mokrian H. Comparison of aural rehabilitation outcomes in presence and absence of back ground noise in hearing impaired children with and without attention deficit hyperactivity disorder (ADHD). *International Journal of Pediatric Otorhinolaryngology*. 2018;114:138-42.
- [9] Meinzen-Derr J, Sheldon RM, Henry S, Grether SM, Smith LE, Mays L, et al. Enhancing language in children who are deaf/hard-of-hearing using augmentative and alternative communication technology strategies. *International Journal of Pediatric Otorhinolaryngology*. 2019;125:23-31.
- [10] Dieleman E, Percy-Smith L, Caye-Thomasen P. Language outcome in children with congenital hearing impairment: The influence of etiology. *International Journal of Pediatric Otorhinolaryngology*. 2019;117:37-44.
- [11] Zamani P, Soleymani Z, Jalaie S, Zarandy MM. The effects of narrative-based language intervention (NBLI) on spoken narrative structures in Persian-speaking cochlear implanted children: A prospective randomized control trial. *International Journal of Pediatric Otorhinolaryngology*. 2018;112:141-50.

[12] Tejada-Franco CD, Valadez V, Hernandez-Lopez X, Ysunza PA, Mena-Ramirez ME, Garcia-Zalapa RA, et al. Hearing Aid Use and Auditory Verbal Therapy Improve Voice Quality of Deaf Children. *Journal of Voice*. 2018.

[13] Ohmori S, Sugaya A, Toida N, Suzuki E, Izutsu M, Tsutsui T, et al. Does the introduction of newborn hearing screening improve vocabulary development in hearing-impaired children? A population-based study in Japan. *International Journal of Pediatric Otorhinolaryngology*. 2015;79(2):196-201.

[14] Cuda D, Murri A, Guerzoni L, Fabrizi E, Mariani V. Pre-school children have better spoken language when early implanted. *International Journal of Pediatric Otorhinolaryngology*. 2014;78(8):1327-31.

[15] Lin H-C, Yang C-C, Chiang Y-W, Hung P-W, Yang EY, Wang L, et al. Effect of identification and intervention age on language development for mandarin-speaking deaf children with high family involvement. *International Journal of Pediatric Otorhinolaryngology*. 2011;75(3):409-14.

[16] Wu CM, Chen YA, Chan KC, Lee LA, Hsu KH, Lin BG, et al. Long-Term Language Levels and Reading Skills in Mandarin-Speaking Prelingually Deaf Children with Cochlear Implants. *Audiology and Neurotology*. 2011;16(6):359-80.

[17] Öntepeli S, Muluk NB, Tuğlu D, Şipal T. Audiometry Results and TEOAE and DPOAE Amplitudes in Men Taking a Phosphodiesterase Type 5 Inhibitor for Erectile Dysfunction. *Ear, Nose & Throat Journal*. 2017;96(7):E34-E9.

[18] Haghshenas M, Zadeh P, Javadian Y, Fard H, Delavari K, Panjaki H, et al. Auditory screening in infants for early detection of permanent hearing loss in northern iran. *Ann Med Health Sci Res*. 2014;4(3):340-4.

[19] Yousefi J, Ajalloueyan M, Amirsalari S, Hassanali Fard M. The specificity and sensitivity of transient otoacoustic emission in neonatal hearing screening compared with diagnostic test of auditory brain stem response in tehran hospitals. *Iran J Pediatr*. 2013;23(2):199-204.

[20] Fulcher A, Purcell AA, Baker E, Munro N. Listen up: Children with early identified hearing loss achieve age-appropriate speech/language outcomes by 3years-of-age. *International Journal of Pediatric Otorhinolaryngology*. 2012;76(12):1785-94.

[21] Harrison M, Page TA, Oleson J, Spratford M, Unflat Berry L, Peterson B, et al. Factors Affecting Early Services for Children Who Are Hard of Hearing. *Lang Speech Hear Serv Sch*. 2016;47(1):16-30.