Pediatric Hearing Loss and the Multidisciplinary Approach. The Hearing Disability Team (HDT) Experience – Pages 50-56

Silvia Palma[1,*], Laura Nascimbeni[2], MariaChiara Pecovela[2], Andrea Ciorba[3], Graziella Pirani[2], Daniele Monzani[4] and Elisabetta Genovese[5]

[1]*Audiology, Primary Care Unit, 41121 Modena, MO, Italy*

[2]*Child and Adolescent Mental Health Service AUSL, 41121 Modena, MO, Italy*

[3]*ENT & Audiology Unit, Department of Neurosciences, University Hospital of Ferrara, 44124 Cona, FE*

[4]*Department of Surgery, Dentistry, Paediatrics and Gynaecology, University of Verona, 37100 Verona, Italy*

[5]*Audiology,Department of Maternal and Child and Adult Medical and Surgical Sciences, University of Modena and Reggio Emilia, 41125 Modena, Italy*

Abstract: Hearing loss is among the utmost common disorders in children and a late diagnosis can impact language and cognitive development. With the aim of implementing an early hearing detection program (EHDP), the Emilia Romagna region has officially approved, since 2012, a NHS program distinguishing well babies and NICU children. Aim of this study is to evaluate the results of the application of these regional guidelines through data flow from the Child and Adolescent Mental Health Services (CAMHS).

Data of children born between 2012 and 2018 and admitted to the service in the same period were collected, 84 children (56 males,28 females) were enrolled; 65% of the children were taken in charge by CAMHS within the first year of life. Concerning the NHS results, 77 (91%) children resulted fail at the screening test (6 unilateral fails), while the result was not available in one case; 6 children resulted pass. Most cases, 79 (94%), presented bilateral hearing loss. In particular, 14 (17.8%) children had a profound hearing loss, 10 (12.6%) a severe hearing loss, 10 (12.6%) a mild hearing loss (6 were conductive), 22 (27.8%) a moderate hearing loss, and 23 (29.2%) a moderate/severe hearing loss. Finally, 5 resulted affected by unilateral hearing loss (2 profound hearing loss, 3 severe).

This study confirmed that regional recommendations about early diagnosis of hearing loss have been applied and most children accessed the CAMHS timely. To this aim synergism between hospital and territorial services, determining the implementation of the organization system was the keystone.

Keywords: Hearing loss, Children, Newborn hearing screening.

INTRODUCTION

Hearing loss is among the utmost common disorders in children; according to the literature data, hearing loss prevalence in the healthy baby population is of 1–3:1000, while in the neonatal intensive care unit (NICU) it can increase variably [1]. The consequences of a late hearing loss diagnosis on language and cognitive development can be detrimental, depending on various factors, among them the severity of impairment and the presence of associated disabilities [2-5]. Therefore, early detection of hearing loss is crucial and newborn hearing screening programs (NHS) are a great tool for this purpose [6].

The goal of screening programs is to guarantee that all children can be identified as soon as possible, in order to eventually achieve the proper treatments, according to specific guidelines [7,]. In particular, the guidelines of the Joint Committee on Infant Hearing (JCIH) suggest that each region could adopt protocols adequate to the local administrative settings [7]; in this way the diagnostic-therapeutic and resource allocation processes can be based on specific local epidemiological data.

With the aim of implementing early hearing detection programs (EHDP), our region has officially adopted since 2012, the NHS program, a NHS program distinguishing well babies and NICU children. The official document published, beyond introducing NHS, guarantees early intervention programs [8], starting from the establishment of the regional hearing disorders team (HDT).

HDT is a multidisciplinary group, with coordination and control functions on both NHS and EHDP. Several professionals are included in the HDT, such as ENT specialists, neuropsychiatrists, audiologists, speech therapists and many more. In our region, territorial Child and Adolescent Mental Health Services (CAMHS)

*Address correspondence to this author at the Audiology, Primary Care Unit, 41121 Modena, MO, Italy; E-mail: silviapalma@inwind.it

E-ISSN: 2311-8687/24

offer speech therapy, and the clinical follow-up. After diagnosis process in hospital audiological services and eventual application of hearing aids or cochlear implant surgery, children will be taken in charge by territorial services. In each of the nine counties of the region, there is also a local HDT, in order to discuss and implement the specific rehabilitative program of each child in charge. As a consequence, HDT represents a strict integration between territorial and hospital services.

This study aims to evaluate results of the application of the regional recommendations concerning early detection of hearing loss cases, through data flow from the CAMHS of the county.

MATERIALS AND METHODS

This was a retrospective study, approved by Modena (AVEN) Ethics Committee.Data of children born between 1 January 2012 to 31 December 2018 and admitted to the service in the same period, were collected, by using a IT management system, named ELEA, and searching for specific related hearing loss codes.

ICD-10 codes for hearing loss (H.90–H.91) selected for this study are listed below:

- H90 Conductive and sensorineural hearing loss:
- H90.3 Sensorineural hearing loss, bilateral;
- H90.4 Sensorineural hearing loss, unilateral with unrestricted hearing on the contralateral side;
- H90.5 Sensorineural hearing loss, unspecified;
- H90.6 Mixed conductive and sensorineural hearing loss, bilateral;
- H91 Other hearing loss:

Furthermore, for each patients other data have been collected: severity of hearing loss, age of first evaluation, age at first speech therapy therapy, use of hearing aid/cochlear implant, bilingualism.

Well babies underwent otoacoustic emission (OAEs) tests in the birth facilities, while NICU babies were tested by OAEs and by clinical ABR/aABR, due to the increased risk of sensorineural hearing loss and auditory neuropathy [9]. A complete audiological evaluation was performed in cases of no definite response.

Audiological services were provided to assure that caregivers could contact the CAMHS service in a short time after they received the diagnosis.

All professionals of local HDT are involved in planning a tailored treatment for each child. Moreover, at least once a year, in each district there is a meeting in which all cases are globally discussed in plenary session.

Hearing loss severity was classified according to WHO criteria: (0-15 db), slight SNHL (sensorineural hearing loss) (16-25 db), mild SNHL (≥ 26 to < 40 dB); moderate SNHL (≥ 41 to < 65 dB), severe SNHL (≥ 66 to < 95 dB) and profound SNHL (> 96 dB) [10].

The prevalence of hearing loss was calculated according to the demographic data of the Regional Health Agency; screening coverage was about 99%.

RESULTS

48.183 children in total were born between 1 January 2012 to 31 December 2018, and 84 children (56 males,28 females) have been enrolled. 69 were born in Modena county, 6 in birth hospitals near the county.9 children moved from other Italian regions or other countries. Hearing impairment prevalence, among the cases, treated resulted 0.17% (84/48183)

Concerning the NHS results, 77 (91%) children resulted fail at the screening test (6 unilateral fails), while the result was not available in one case; 6 children resulted pass.

Audiological risk factors were identified in around 74% of cases. They are detailed in Figure **1**: in 30 % of cases familiarity for hearing loss, in 21.4% syndromes, in 15.5% prematurity, in 7.1% congenital Cmv infection, in 26% unknown.

With regard to the 6 cases that passed hearing screening, only one was possibly related to hereditary factors, 2 were moderate with other disabilities, 1 due to cCMV infection, and one to a cleft palate.

71% of cases received the code associated with bilateral sensorineural hearing loss; 15 % received a generic code (H90.0) and were all due to conductive hearing loss. The results of the search by ICD-10 codes are detailed in Figure **2**.

Most cases, 79 (94%), presented bilateral hearing loss. In particular, 14 (17.8%) children had a profound

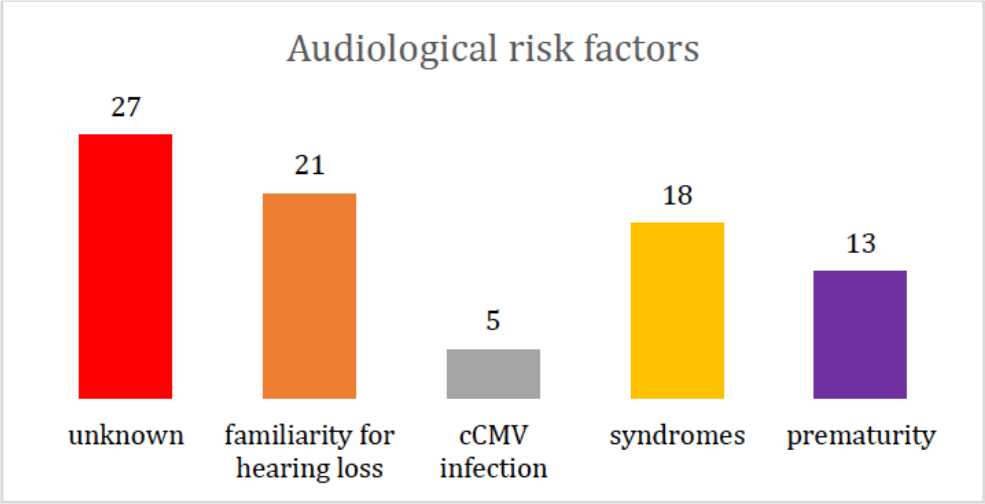

Figure 1: Details of the identified audiological risk factors.

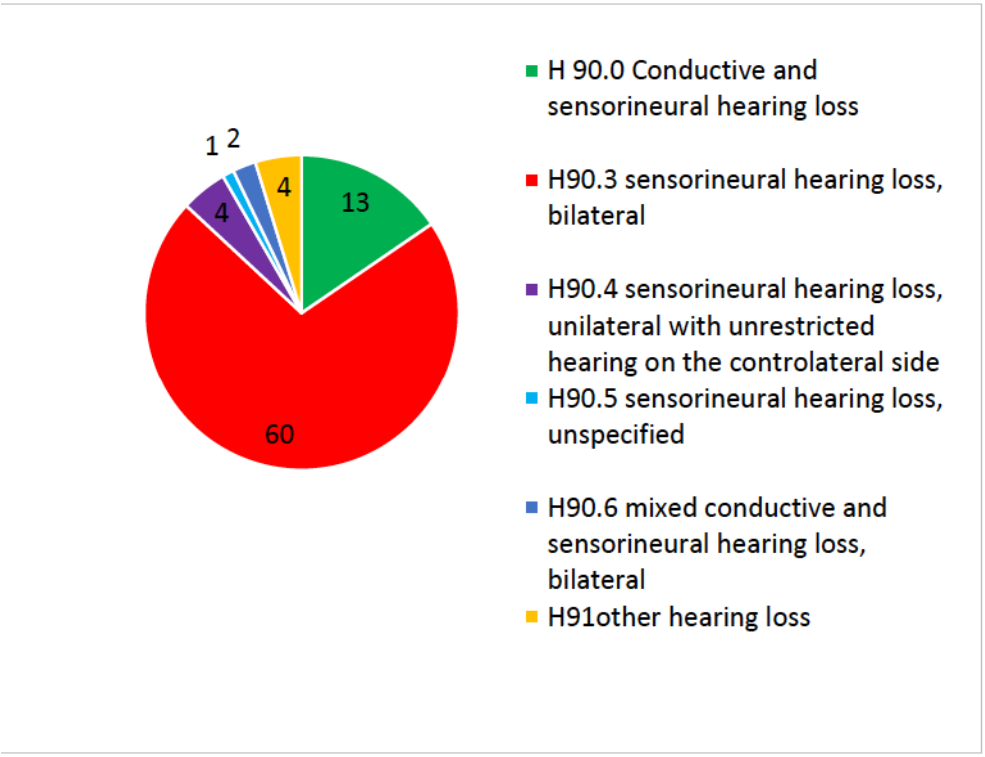

Figure 2: Results from the search by ICD-10 codes.

hearing loss, 10 (12.6%) a severe hearing loss (Figure **3.a**), 10 (12.6%) a mild hearing loss (6 were conductive), 22 (27.8%) a moderate hearing loss (Figure **3.b**), and 23 (29.2%) a moderate/severe hearing loss. Finally, 5 resulted affected by unilateral hearing loss (2 profound hearing loss, 3 severe).

Concerning hearing loss treatment, 54 (64%) cases received hearing protheses, 17 (20%) cochlear implants, while 13 (15%) cases affected by a slight or mild sensorineural or conductive hearing loss (3 of these were unilateral ear malformation) were untreated (Figure **4**).

Forty-one (48%) children were exposed to bilingualism. In 38 cases other clinical conditions were associated with hearing impairment, in particular 28 % of children presented genetic syndromes.

65% of the children were taken in charge by CAMHS within the first year of life (see details in

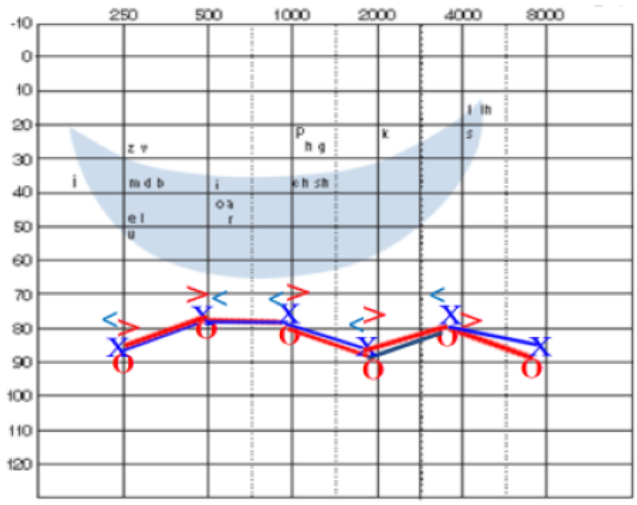

Figure 3a: A case of bilateral, severe sensorineural hearing loss.

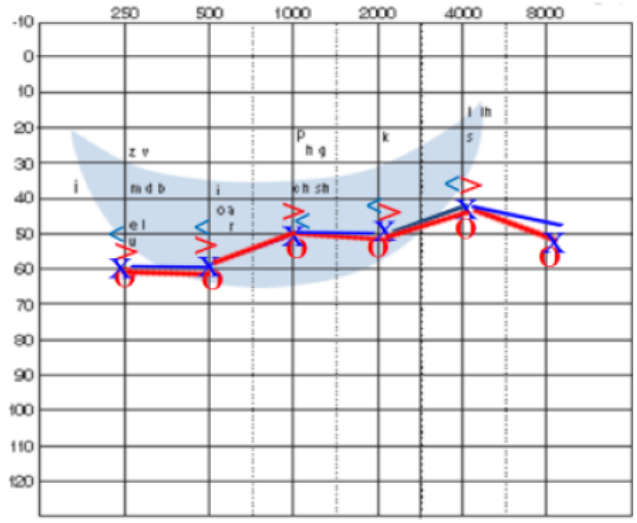

Figure 3b: A case of bilateral, moderate sensorineural hearing loss.

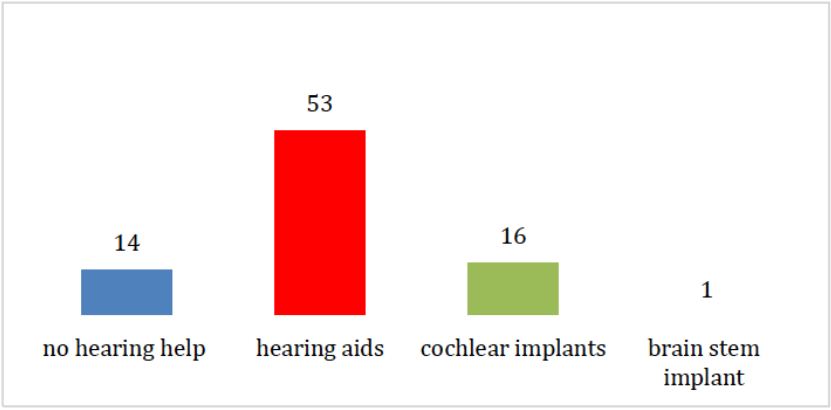

Figure 4: Kind of auditory rehabilitation.

Figure **5**). Eleven children (12%) with mild/moderate hearing loss, accessed CAMHS service after three years of age.

Children age of access at CAMHS service is compared with age of access to speech therapy (see Figure **6**).

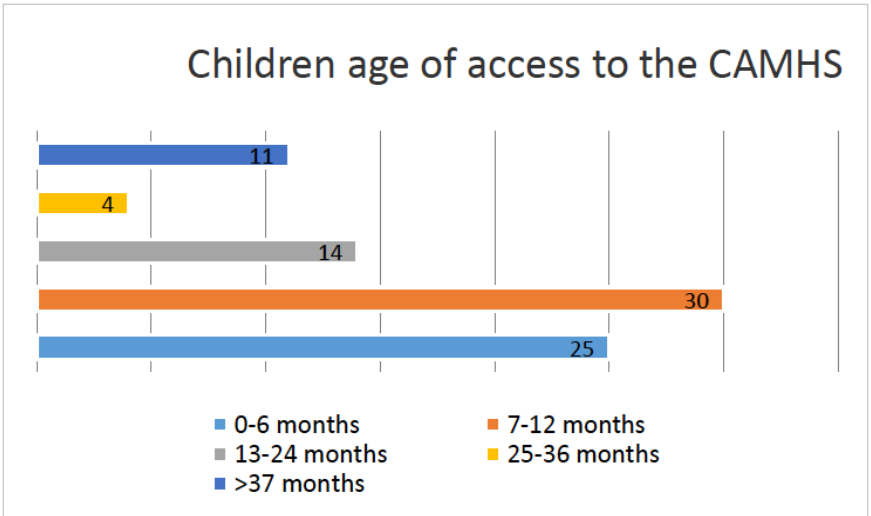

Figure 5: children age at access to the CAMHS.

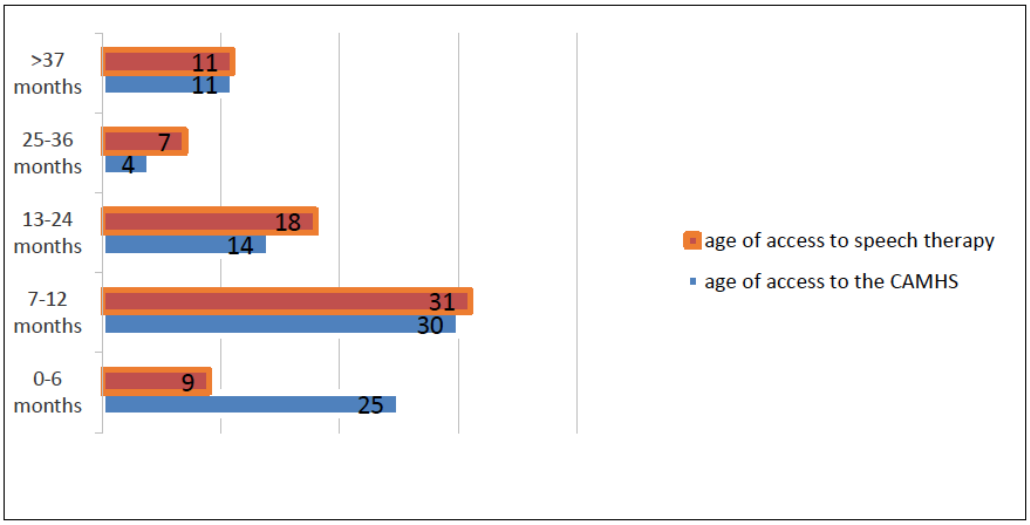

Figure 6: Comparison between age of access to speech therapy and age of access to the CAMHS.

DISCUSSION

This study provides important data about the effectiveness of EHDP in our county after the implementation of the regional NHS program. These data represent an indicator for optimal allocation of the resources of the health system to the program. Most children enrolled were identified through the NHS, demonstrating that the regional recommendations had a significant impact in the organization of the program [11]. A well-organized NHS is critical both for the early detection of hearing loss, and for the identification of children with audiological risk factors. The small percentage of cases that passed the hearing screening was related to progressive or mild hearing loss, those children were in audiological follow up.

Furthermore, these data allow us to estimate the prevalence of hearing loss in the county. In our country only CAMHS can give public healthcare provisions such as speech therapy after hospital treatment has been implemented, or interact with school.

The high percentage of children undergoing CAMHS evaluation in early age demonstrates the positive role of the synergy between hospital and territorial services, considering that the earlier is the intervention, the better are the rehabilitative outcomes obtained [12]. Barriers exist worldwide regarding continued follow-up with hearing assessment beyond infancy [7] and the removal of organizational obstacles appears one of the possible solutions to this question.

The HDT team represents a pillar in the building of our early intervention programs. Timely access of most children to CAMHS allows them to plan a proper answer to the needs of children, in particular when other comorbid conditions are present.

Only 5 children followed by the service were affected by unilateral hearing loss while a recent regional study we presented, has evidenced that the NHS program allowed this diagnosis in a much higher percentage of cases [9]. Formerly, the incidence of unilateral hearing loss was undervalued [13] but probably there is still a lack of awareness of the problem by caregivers [14]. Usually, families are not aware of the detrimental effects of hearing loss on the development of language; and it is possible that some of these children come to the CAMHS service when they are older and attend school, having difficulties in attention and in listening skills.

An important finding of the present study was the percentage of prematurity, around 15%. The survival of preterm newborns has globally improved, and prematurity (< 37 weeks of pregnancy) is the commonest perinatal risk [15, 16].

Several nonsyndromic recessive genes have been linked to progressive sensorineural hearing loss, as well as delayed onset of hearing loss can occur after congenital infections. In these eventualities, children may either pass newborn hearing screening or present with much milder loss that can worsen over time.

The presence of bilingualism resulted quite high. Future research has to evaluate the possibility to implement speech therapy in native language with the support of parents, in selected cases. The organization of the specific services precisely selected for families with special needs must be carefully planned based on the local epidemiological features of infantile hearing loss [17].

In conclusion, this study confirmed that regional recommendations about early diagnosis of hearing loss have been applied and most children accessed the CAMHS timely. To this aim synergism between hospital and territorial services, determining the implementation of the organization system was the keystone.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

[1] Morton, C.C.; Nance, W.E. Newborn hearing screening-A silent revolution. N. Engl. J. Med. 2006, 354, 2151-2164. https://doi.org/10.1056/NEJMra050700

[2] Liberman, Z.; Woodward, A.L.; Keysar, B.; Kinzler, K.D. Exposure to multiple languages enhances communication skills in infancy. Dev. Sci. 2017, 20, e12420. https://doi.org/10.1111/desc.12420

[3] May L, Byers-Heinlein K, Gervain J, Werker JF. Language and the newborn brain: does prenatal language experience shape the neonate neural response to speech? Front Psychol. 2011 Sep 21; 2: 222. https://doi.org/10.3389/fpsyg.2011.00222

[4] Yoshinaga-Itano C. From Screening to Early Identification and Intervention: Discovering Predictors to Successful Outcomes for Children With Significant Hearing Loss. J Deaf Stud Deaf Educ. 2003; 8(1): 11 https://doi.org/10.1093/deafed/8.1.11

[5] Lieu JEC, Kenna M, Anne S, Davidson L. Hearing Loss in Children: A Review. JAMA. 2020 Dec 1; 324(21): 2195-2205. https://doi.org/10.1001/jama.2020.17647

[6] World Health Organization. World Report on Hearing [Internet]. Geneva: World Health Organization; 2021. Report No.: Licence: CC BY-NC-SA 3.0 IGO. Available from: https: //apps.who.int/iris/bitstream/handle/10665/339913/9789240020481-eng.pdf?sequence=1

[7] Joint Committee on Infant Hearing. Year 2019 position statement: principles and guidelines for early hearing detection and intervention programs. JEHDI.2019; 4(2): 1-4

[8] GPG/2011/498 Screening uditivo neonatale e percorso clinico ed organizzativo per i bambini affetti da ipoacusia in Emilia Romagna. In Approvazione Linee Guida per le Aziende Sanitarie.23 Maggio 2011, N. 694; Bollettino Ufficiale della Regione Emilia Romagna: Bologna, Italy, 2011; pp. 18-49

[9] Bianchin G, Palma S, Polizzi V, Kaleci S, Stagi P, Cappai M, Baiocchi MP, Benincasa P, Brandolini C, Casadio L, Di Sarro S, Farneti D, Galli A, Ghiselli S, Iadicicco P, Landuzzi E, Limarzo M, Locatelli C, Murri A, Nanni L, Rozzi E, Sandri F, Saponaro A, Zanotti S, Zarro N, Zucchini E, Ciorba A, Genovese E. A regional-based newborn hearing screening program: the Emilia-Romagna model after ten years of legislation. Ann Ig. 2023 May-Jun; 35(3): 297-307.

[10] WHO. Classification of Hearing Impairment 2013. Available online: http: //www.who.int/pbd/deafness/hearing_impairment_ grades

[11] Bubbico L, Ferlito S, Antonelli G, Martini A, Pescosolido N. Hearing and Vision Screening Program for newborns in Italy. Ann Ig. 2021 SepOct; 33(5): 433-42.

[12] Yoshinaga-Itano, C.; Sedey, A.L.; Coulter, D.K.; Mehl, A.L. Language of early and later identified children with hearing loss. Pediatrics 1998, 102, 1161-1171. [CrossRef] [PubMed https://doi.org/10.1542/peds.102.5.1161

[13] Palma S, Ciorba A, Nascimbeni L, Pecovela M, Negossi L, Pelucchi S, Stagi P, Genovese E. Hearing Loss in Children: Clinical-Epidemiological Data from Two Different Provinces of the Same Region. Audiol Res. 2021 Apr 23; 11(2): 192-199. https://doi.org/10.3390/audiolres11020017

[14] Hamzah NFA, Umat C, Harithasan D, Goh BS. Challenges faced by parents when seeking diagnosis for children with sensorineural hearing loss. Int J Pediatr Otorhinolaryngol. 2021 Apr; 143: 110656. https://doi.org/10.1016/j.ijporl.2021.110656

[15] Korver, A.M.H.; Smith, R.J.H.; Van Camp, G.; Schleiss, M.A.; Bitner-Glindzicz, M.A.K.; Lustig, L.R.; Usami, S.-I.; Boudewyns, A.N. Congenital hearing loss. Nat. Rev. Dis. Primers 2017, 3, 16094. https://doi.org/10.1038/nrdp.2016.94

[16] Gráf, R.; Kalmár, M.; Harnos, A.; Boross, G.; Nagy, A. Reading and spelling skills of prematurely born children in light of the underlying cognitive factors. Cogn. Process. 2021, 22, 311-319. https://doi.org/10.1007/s10339-020-01001-6

[17] Wiley S, Arjmand E, Jareenmeinzen-Derr, Dixon M. Findings from multidisciplinary evaluation of children with permanent hearing loss. Int J Pediatr Otorhinolaryngol. 2011 Aug; 75(8): 1040-4. https://doi.org/10.1016/j.ijporl.2011.05.019

Received on 12-04-2024 Accepted on 09-05-2024 Published on 13-05-2024

DOI: https://doi.org/10.12974/2311-8687.2024.12.07