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The neuropsychological profile of the child with hearing and vision impairment

Florentina Ionela, **LINCĂ**[1],
Florentina Lavinia, **MATEI**[2]

Abstract

This study presents the case of an 11-year-old child diagnosed with hearing impairment and visual impairment. The objective of the study is to establish the profile of cognitive and neuropsychological functioning, but also to establish the necessary intervention directions. ABAS™-II - Adaptive Behavior Assessment System™ - II, a behavioral assessment system focused on broad-band adaptability measurement, was used as a research method. At the international level, it is considered the standard in the complex assessment for awarding the degree of disability. ABAS™-II items indicate the inability or ability of any person between the ages of 0 and 89 to perform age-typical daily living behaviors. The study indicates the following results: according to the WISC IV (Wechsler Intelligence Scale for Children), the level of cognitive development of the patient according to the indices is: verbal comprehension index - composite score 75, located at the 5th percentile; perceptive reasoning index - composite score 91, located at the 27th percentile; working memory index - composite score 91, located at the 27th percentile. Comparison of discrepancies at the level of subtest scores/procedural scores indicates significantly lower performance on the subtest Remembering numbers in direct order (attentional field/phonological loop) - standard score 6, compared with Memory of numbers in reverse order (the ability to temporarily retain in memory and manipulate information to obtain a result) - standard score 14; processing speed index - composite score 97, located at the 42nd percentile; QI =84, which indicates an average-lower level of cognitive functioning.

Keywords: *hearing impairment, visual impairment, children, neuropsychological profile, QI*

[1] Ph.D, University of Bucharest, Romania, florentina-ionela.linca@fpse.unibuc.ro
[2] Ph.D, Valahia University of Targoviste, Romania, lavinia.matei@valahia.ro
The authors have equal contributions.

Introduction

About 19 million of the world's children are visually impaired, while 1.4 million are blind. In countries with high incomes, until the age of 15, the incidence of visually impaired children is high, but the highest incidence occurs in the first year of life(Kvetenska & Myska, 2017;Lincă & Matei, 2023). The numerous and largely uncommon disorders that can cause visual impairment result in a heterogeneous population that includes a substantial proportion of children with additional systemic disorders or impairments whose needs differ substantially from those of those with isolated visual impairments. Pediatricians and other professionals in pedagogy, special psychopedagogy, child psychology have a key role in early detection and multidisciplinary management to minimize the impact of visual impairment in childhood (Lincă & Matei, 2023; Hooks & Chen, 2007; Lincă, 2019; Meis et al, 1998; Mitry et al., 2013; Solebo & Rahi, 2014).

The causality of childhood visual impairments is uncertain. The most common cause of severe visual impairment/blindness in children in industrialized countries such as the UK and USA is neurological or brain disorder affecting the visual system (Kong et al., 2012; Solebo & Rahi, 2014). While US data are based on studies of children enrolled in schools for the blind, UK estimates are drawn from the British Childhood Visual Impairment Study (BCVIS), the only national population-based incidence study of the blind or visually impaired. of severe vision in children. Of the 493 children newly diagnosed with blindness/severe visual impairment in 2000, nearly 50% of the children had cortical visual impairment (Figure no. 1) (Rahi et al., 2003). Optic nerve pathology accounted for 28% of severe visual impairment/blindness in childhood, and retinal disorders (including retinopathy of prematurity) 29%. These three causes (dysfunctions of the cortex, optic nerve and retina) are also the most common causes of blindness or severe visual impairment in children

in other higher-income countries (Kong et al,., 2012). The majority of children in BCVIS (77%) had an additional associated non-ophthalmic disorder, as has been commonly described in similar populations (Kong et al., 2012).

An increased risk of severe ocular pathology in children from ethnic minority groups, socio-economically disadvantaged families and those with low birth weight (<2500 g) was clearly identified, as well as a mortality risk of 10 % in the first year after diagnosis. These findings are echoed by subsequent studies in industrialized countries. Preterm birth, inevitably associated with low birth weight, has increased significantly over the last two decades in the UK and the neurological sequelae of low birth weight are well recognised, with these children being more likely to have white matter lesions affecting visual system or developmental anomalies of the optic nerve(Cumberland et al., 2010; Hellgren et al., 2009; Hintermair, 2011; Pai et al., 2011).

There is also increasing recognition of the impact of preterm birth (between 34 and 36 weeks' gestation) on adverse neurodevelopmental outcomes. The continued increase in the number of preterm births can be expected to have an impact on the frequency of eye pathologies globally, as can the increased survival of children with neurological or neurodevelopmental disorders (Dekker et al., 2012; Engle et al., 2007; Hintermair, 2011; Kerstjens et al., 2011).

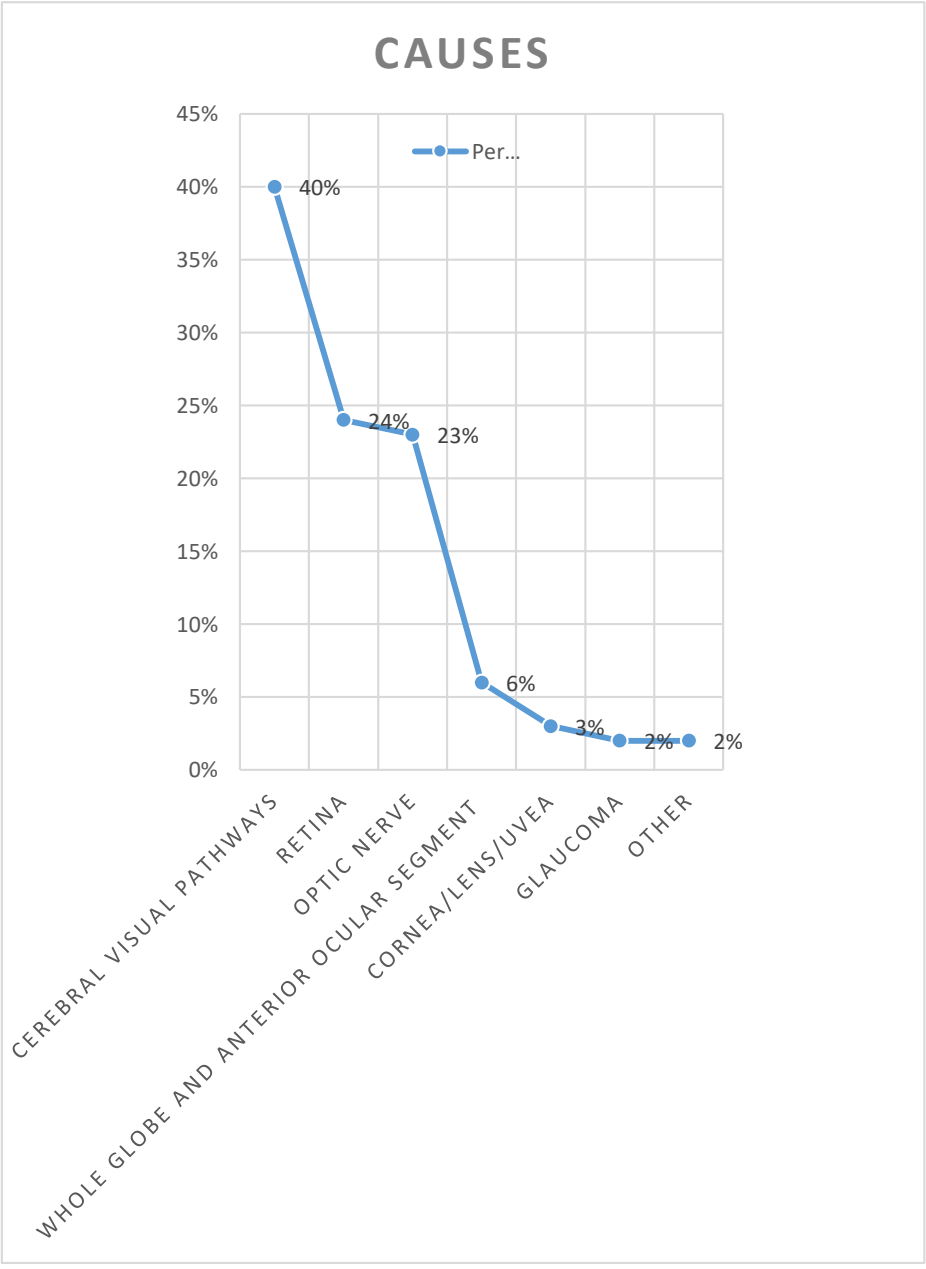

Figure no. 1. Causes of ophthalmological pathology

Visual impairment is often associated with another sensory impairment, namely hearing impairment. Approximately 250 million people worldwide are affected by both impairments (Loy et al., 2010).

Sensory impairments primarily affect participation in home and social activities. Anmyr et al. (2011) and Houwen et al. (2009)argue that both deaf and blind/blind children have difficulty participating in team sports. However, children with a cochlear implant performed better. Hartman et al. (2011)reported that 43% of deaf elementary school children participated in organized sports and showed better motor performance compared to their blind and/or hearing/sighted peers.

When it comes to social participation, the evidence points out that although hearing/visually impaired children show good development, they may have limited social participation as a result of difficulties communicating in groups and problems with social skills (Punch & Hyde, 2011) expressed in any social context (classroom, playground) (Preisler et al., 2005).

However, the desire to socialize is present in children with sensory impairments. Punch & Hyde (2011) found that although children with cochlear implants valued friendships with both deaf and hearing peers, some of them had little contact with other deaf children. Among children with visual impairments, participation in social activities with peers was also reduced in one-to-one interactions and in larger groups. This may result from difficulties with body language, play skills, cooperative skills, and very low expression and recognition skills for emotions (Caballo & Verdugo, 2007) and may have additional negative outcomes. Punch & Hyde (2011) found that adolescents with cochlear implants struggled with feelings of self-consciousness about their deafness and external cochlear implant equipment and expressed concerns about their friendships, dating and future status in the world. In addition, children with sensory

impairments who participated in social activities inside and outside of school had a better quality of life (Hintermair, 2011).

To our knowledge, no study has comprehensively assessed the problems arising from the two sensory deficits. Until now, specific problems of these children are known. The purpose of our study is to reveal the complex difficulties in the development in all areas of a child with visual and hearing impairment.

Our approach is holistic and is a starting point for creating personalized intervention plans.

Research methodology

Materials and methods

One of the authors holds the license for all tests used.

ABAS™-II - Adaptive Behavior Assessment System™ - II (von Buttlar et al., 2021) is a behavioral assessment system focused on broadband measurement of adaptability. At the international level, it is considered the standard in the complex evaluation for awarding the degree of disability.

Compatible with DSM-IV-TR and AAIDD, the ABAS™-II provides a general adaptive composite score (GAC), three intermediate scores: practical, conceptual and social, respectively ten specific skill areas, which recommends the use of the instrument for diagnostic purposes, treatment planning and monitoring. The ABAS™-II items indicate the inability or ability of any person between the ages of 0 and 89 to perform the behaviors of daily living typical of that age.

The ABAS™-II uses four distinct forms based on age range and rater type. The forms dedicated to the assessment of children are exclusively hetero-evaluative, while for adults, the questionnaire can be completed and self-declarative. The ABAS™-II forms are: Parent/Caregiver (0-5 years) - 241 items; Parent (5-21 years) - 232 items; Teacher/Educator (2-5 years) - 216 items; Teacher/Educator (5-21 years old) - 193 items; Adult - 239 items.

WISC IV - ***Wechsler Intelligence Scale for Children – Fourth Edition*** is a clinical tool, administered individually, that evaluates the cognitive ability of children between the ages of 6 years and 0 months and 16 years and 11 months (6:0 – 16:11). The WISC-IV scale provides composite scores that represent intellectual functioning in specific cognitive domains (e.g. Verbal Comprehension Index, Perceptual Reasoning Index, Working Memory Index, and Processing Speed Index), but also provides a composite score that represents the general intellectual ability of the child (eg the total intelligence quotient). The most widely used measure of the cognitive abilities of children and adolescents available in Romania and calibrated on a representative sample of children aged between 6 and 16 years (*Romanian Psychological Testing Services*, 2015).

NEPSY - allows:

1. assessment of neuropsychological functions in the following areas: attention/executive functions, memory and learning, language, sensory-motor functioning, visuo-spatial processing;
2. diagnosis of the normal and atypical profile of neuropsychological development of each child;
3. scientific substantiation of early remedial intervention;
4. longitudinal analysis of the child's neuropsychological development.

NEPSY assessment results:

- A neuropsychological development assessment report is obtained for the 5 functional domains.
- The framework for observing different qualitative aspects during the evaluation is provided.
- Guidance is provided in interpreting the results(Schmitt & Wodrich, 2004).

Case study description

Child aged 11 years and 2 months, from the urban environment, lives with his parents, sister and maternal grandparents. The family climate is calm, balanced, the parents pay a lot of attention to their children. The patient has a sister who is 17 years older.

Regarding the history of the disease, the patient had an abnormal postnatal adaptation, needing to stay in the incubator for a long time, then she had prolonged jaundice. The pregnancy was without problems and she was born at 39 weeks. At the age of 3 months, she had a treatment with Gentamicin following a respiratory infection, then she had adverse reactions to the BCG vaccine. At the age of 5 he was diagnosed with hearing impairment and visual impairment. He was fitted with hearing aids in both ears.

He underwent cataract surgery with lens implants in both eyes at the age of 6. At 7 years old, he was operated on for a Cochlear implant in his left ear (this being more seriously affected), in his right ear he remained with a hearing aid. He has been doing speech therapy since he was 5 years old (he took a 2-year break due to the pandemic).

Regarding the educational history, the child was enrolled in kindergarten at the age of 4, then he was enrolled in school and now he is in the third grade. Homework is currently done together with his mother or sister. From the clinical interview conducted with the patient's teacher, it appears that the patient has slight delays in pronouncing words with several syllables, as well as in understanding the written text (she understands some words, but to solve the homework she needs explanations), her writing is illegible, sometimes she omits or add letters to words. The child likes math, at home he does puzzles, lego and rubik's cube.

He comes to the hospital for a complex evaluation.

Objective

The objective of this study is: establishing the profile of cognitive and neuropsychological functioning but also establishing the necessary intervention directions.

Results

A. WISC IV (WECHSLER INTELLIGENCE SCALE FOR CHILDREN) RESULTS

According to the WISC IV (Wechsler Intelligence Scale for Children), the patient's level of cognitive development according to the indices is:

1. ***Verbal Comprehension Index*** - composite score 75, located at the 5th percentile.
2. ***Perceptive Reasoning Index*** - composite score 91, located at the 27th percentile.
3. ***Working memory index*** - composite score 91, located at the 27th percentile. The discrepancy comparison at the level of subtest scores/procedural scores indicates a significantly lower performance in the subtest Memorizing numbers in direct order (attentional field/phonological loop) - standard score 6, compared to Memorizing numbers in reverse order (the ability to temporarily retain in memory and manipulate information to obtain a result) - standard score 14.
4. ***Processing Speed Index*** - composite score 97, located at the 42nd percentile.
5. ***QI*** =84, which indicates an average-lower level of cognitive functionality.

There are discrepancies between domains (Table 1 and Figure no. 2).

Strengths are in the area of information processing speed (visual-motor coordination, visual perception, ability to plan and learn, cognitive flexibility, visual discrimination).

Weaknesses are recorded in the area of verbal comprehension (comprising skills in the areas of: verbal reasoning and concept formation, long-term memory and language development, and the ability to evaluate and use past experience and the ability to master practical information).

Table no. 1. *WISC IV results*

Index	Score	Percentile
Verbal comprehension	75	5
Perceptual reasoning	91	27
Working memory	91	27
Processing speed	97	42

M=100, SD=50

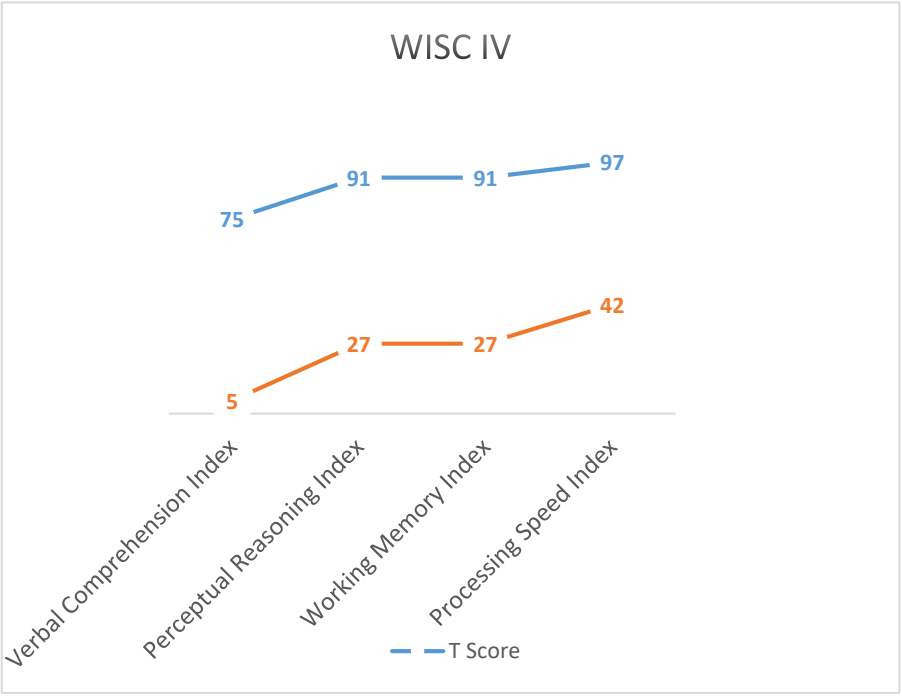

Figure no. 2. Graphic representation of WISC IV scores

B. **ABAS II**

The global level of behavioral adaptability is medium-low, GAC=82.

C. NEPSY- NEUROPSYCHOLOGICAL DEVELOPMENTAL ASSESSMENT BATTERY

Table no. 2. *NEPSY results*

AREAS	ScorE	Percentile
Attention and executive functions	72	19
Language	53	5
Sensoriomotor functions	61	13
Vizuospatial processing	76	12
Memory and learning	76	20

M=100, SD=15

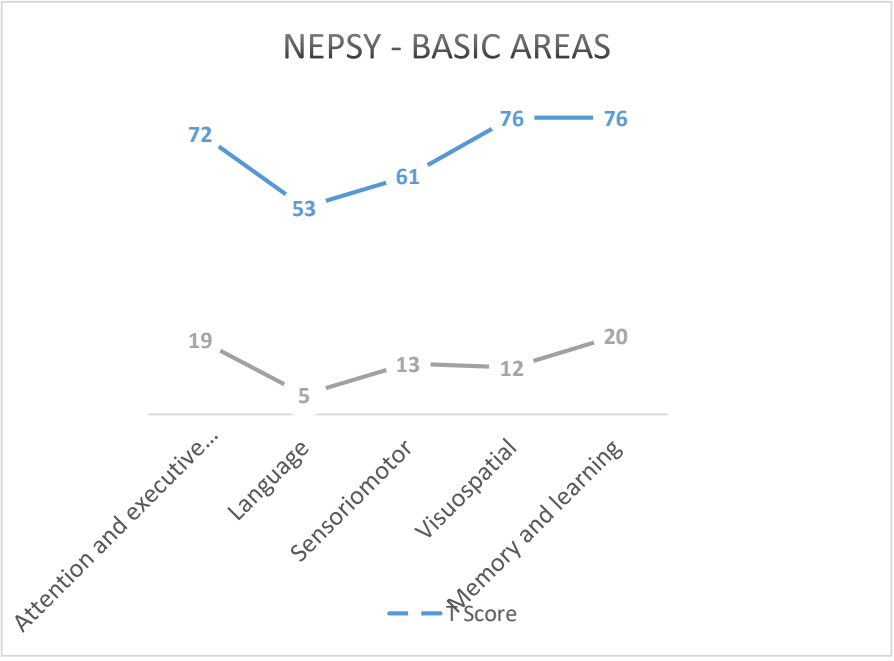

Figure no. 3. Graphic representation of NEPSY scores – basic areas

Deficits were recorded in all basic areas. Baseline analysis of domains shows: Scores for Attention/executive functions,

Visuospatial Processing, Memory and Learning are below the third standard deviation, and for Language and Sensorimotor Functions are below the fourth standard deviation (Table 2, Fig 4 and 3).

Attention / executive functions – Auditory attention is impaired, the patient having a score below the level of her chronological age, standard score ss=6. In addition, a critical point would be visual attention, the patient obtaining a score far below the expected level, ss=4 (the score is located in the third standard deviation below the mean) (Table 2, **Figure no. 3 and Figure no 4**).

Language – there were deficits in the area of phonological processing, in the area of understanding instructions, but also in verbal reproduction, the scores being below the third standard deviation, ss=3, well below the level expected for the chronological age (Table 2, Figure no. 4 and Figure no. 3).

Visuospatial processing – there were deficits in hand-eye coordination, the score obtained being borderline (score Copying the drawing ss=7), but also deficits in spatial orientation and visual organization, the scores being far below the expected level for the chronological age (Arrows score ss=5, Cubescore construction ss=3) (Table 2, Figure no. 4 and Figure no. 3).

Sensorimotor functions – there were deficits in the area of fine manual coordination, the scores being below the level expected for the chronological age (Rhythmic tapping of the fingers and Imitation of hand positions score ss=6), but also deficits in the precision of movements, the scores being well below the level expected (Visuomotor Accuracy Test - score ss=1) (Table 2, Figure no. 3 and Figure no. 4).

Memory and learning – memory and verbal learning are impaired, with the patient scoring well below the expected level for her chronological age. Regarding the reproduction of information from short-term memory, the patient scored borderline.

There was a gap between visual and verbal memory:

- Visual memory skills are poorly developed (Memory of girls subtest standard score 7, score located in the second standard deviation below the average), performance is at the limit.
- Verbal memory skills are very poorly developed (subtest Narrative Memory standard score 4, Repetition of Sentences standard score 5, List Learning standard score 1, scores located in the fourth standard deviation below the average, respectively in the third standard deviation below the average), performance is at the limit.
- The quantitative and qualitative analysis of the errors illustrated an increased number of false words, possibly due to the formation of some associative complexes or low self-control.
- There was a negative effect of the delay on the performance on the verbal memory side (Table 2, Figure no. 3 and Figure no. 4).

Critical point recorded following the evaluations - memory and learning of verbal labels in a task that involves the association of verbal and visual content (Memory of Names subtest standard score 5, score located in the third standard deviation below the average), the performance is below the expected level (Table 2, Figure no. 3 and Figure no. 4).

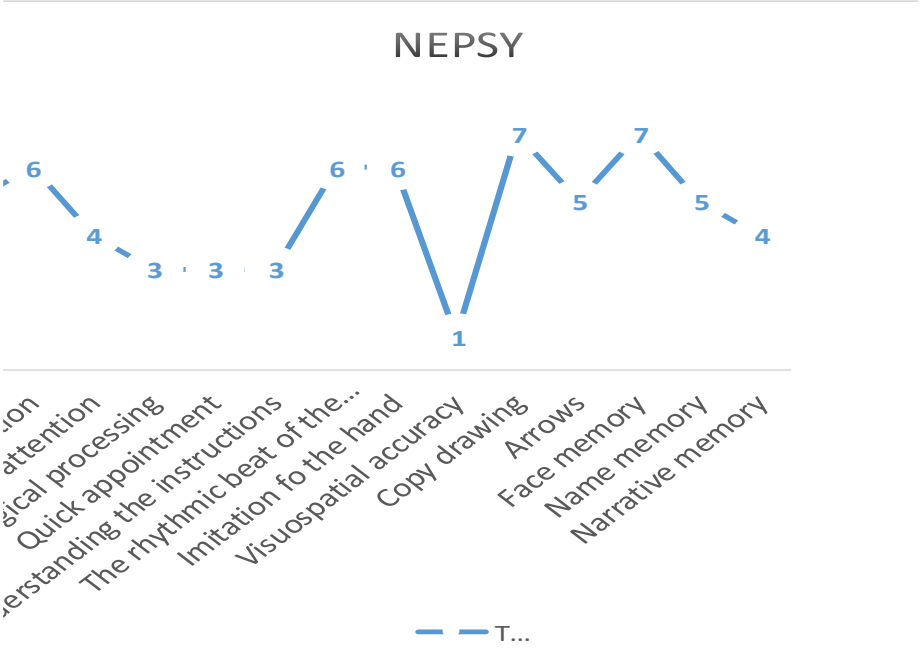

Figure no.4. Graphic representation of NEPSY scores

Behavior during the evaluation (observation and clinical interview)

The patient collaborates in work tasks, is motivated for success, has perfectionist tendencies, enters into competition with herself and others, is concerned about the performance obtained or possible mistakes.

Conclusions

In this case, the level of general intelligence (QI) and the level of behavioral functionality are average-lower. The patient registered deficits in the areas of language and sensorimotor functions, auditory attention and verbal memory (significantly lower scores in the area of memory and verbal learning compared to memory and visual learning). Considering all the above, we recommend the following: involvement in activities that require fine motor coordination;

increased number of repetitions and staggered repetition of verbal materials; the use of mnemonics (grouping of units, categorical association); awareness program and phonological analysis; the development of emotional and social skills.

References

Anmyr, L., Olsson, M., Larson, K., & Freijd, A. (2011). Children with hearing impairment – Living with cochlear implants or hearing aids. *International Journal of Pediatric Otorhinolaryngology*, *75*(6), 844–849. https://doi.org/10.1016/j.ijporl.2011.03.023

Caballo, C., & Verdugo, M. A. (2007). Social skills assessment of children and adolescents with visual impairment: Identifying relevant skills to improve quality of social relationships. *Psychological Reports*, *100*(3 Pt 2), 1101–1106. https://doi.org/10.2466/pr0.100.4.1101-1106

Cumberland, P. M., Pathai, S., Rahi, J. S., & Millennium Cohort Study Child Health Group. (2010). Prevalence of eye disease in early childhood and associated factors: Findings from the millennium cohort study. *Ophthalmology*, *117*(11), 2184-2190.e1-3. https://doi.org/10.1016/j.ophtha.2010.03.004

Dekker, G. A., Lee, S. Y., North, R. A., McCowan, L. M., Simpson, N. A. B., & Roberts, C. T. (2012). Risk factors for preterm birth in an international prospective cohort of nulliparous women. *PloS One*, *7*(7), e39154. https://doi.org/10.1371/journal.pone.0039154

Engle, W. A., Tomashek, K. M., Wallman, C., & and the Committee on Fetus and Newborn. (2007). "Late-Preterm" Infants: A Population at Risk. *Pediatrics*, *120*(6), 1390–1401. https://doi.org/10.1542/peds.2007-2952

Hartman, E., Houwen, S., & Visscher, C. (2011). Motor skill performance and sports participation in deaf elementary school children. *Adapted Physical Activity Quarterly: APAQ*, *28*(2), 132–145. https://doi.org/10.1123/apaq.28.2.132

Hellgren, K., Hellström, A., & Martin, L. (2009). Visual fields and optic disc morphology in very low birthweight adolescents examined with

magnetic resonance imaging of the brain. *Acta Ophthalmologica*, *87*(8), 843–848. https://doi.org/10.1111/j.1755-3768.2008.01365.x

Hintermair, M. (2011). Health-related quality of life and classroom participation of deaf and hard-of-hearing students in general schools. *Journal of Deaf Studies and Deaf Education*, *16*(2), 254–271. https://doi.org/10.1093/deafed/enq045

Hooks, B. M., & Chen, C. (2007). Critical periods in the visual system: Changing views for a model of experience-dependent plasticity. *Neuron*, *56*(2), 312–326. https://doi.org/10.1016/j.neuron.2007.10.003

Houwen, S., Hartman, E., & Visscher, C. (2009). Physical activity and motor skills in children with and without visual impairments. *Medicine and Science in Sports and Exercise*, *41*(1), 103–109. https://doi.org/10.1249/MSS.0b013e318183389d

Kerstjens, J. M., de Winter, A. F., Bocca-Tjeertes, I. F., ten Vergert, E. M. J., Reijneveld, S. A., & Bos, A. F. (2011). Developmental delay in moderately preterm-born children at school entry. *The Journal of Pediatrics*, *159*(1), 92–98. https://doi.org/10.1016/j.jpeds.2010.12.041

Kong, L., Fry, M., Al-Samarraie, M., Gilbert, C., & Steinkuller, P. G. (2012). An update on progress and the changing epidemiology of causes of childhood blindness worldwide. *Journal of AAPOS: The Official Publication of the American Association for Pediatric Ophthalmology and Strabismus*, *16*(6), 501–507. https://doi.org/10.1016/j.jaapos.2012.09.004

Kvetenska, D., & Myska, K. (2017). Multidisciplinary Cooperation For The Benefit Of Endangered Child. *European Proceedings of Social and Behavioural Sciences, Multidimensional Education and Professional Development: Ethical Values*. https://doi.org/10.15405/epsbs.2017.07.03.43

Lincă, F. (2019). Atitudinea profesorilor față de incluziunea elevilor cu tulburare hiperchinetică cu deficit de atenție (ADHD). *Revista de Pedagogie*, *LXVII*(2), 47–63.

Linca, F. I., & Matei, F. L. (2023). *Tulburarea cu deficit de atenție și/sau hiperactivitate (ADHD) (ebook)Aspecte teoretice și practice pentru cadre didactice și psihopedagogi*. București; Ed. TREI.

Lincă, F.-I., & Matei, F.-L. (2023). The Relationship Between Locus of Control and Learning Styles in University Education. *Land Forces Academy Review*, *28*(1), 32–38. https://doi.org/10.2478/raft-2023-0005

Loy, B., Warner-Czyz, A. D., Tong, L., Tobey, E. A., & Roland, P. S. (2010). The children speak: An examination of the quality of life of pediatric cochlear implant users. *Otolaryngology - Head and Neck Surgery*, *142*(2), 247–253. https://doi.org/10.1016/j.otohns.2009.10.045

Meis, P. J., Goldenberg, R. L., Mercer, B. M., Iams, J. D., Moawad, A. H., Miodovnik, M., Menard, M. K., Caritis, S. N., Thurnau, G. R., Bottoms, S. F., Das, A., Roberts, J. M., & McNellis, D. (1998). The preterm prediction study: Risk factors for indicated preterm births. Maternal-Fetal Medicine Units Network of the National Institute of Child Health and Human Development. *American Journal of Obstetrics and Gynecology*, *178*(3), 562–567. https://doi.org/10.1016/s0002-9378(98)70439-9

Mitry, D., Bunce, C., Wormald, R., & Bowman, R. (2013). Childhood visual impairment in England: A rising trend. *Archives of Disease in Childhood*, *98*(5), 378–380. https://doi.org/10.1136/archdischild-2012-301970

Pai, A. S.-I., Wang, J. J., Samarawickrama, C., Burlutsky, G., Rose, K. A., Varma, R., Wong, T. Y., & Mitchell, P. (2011). Prevalence and risk factors for visual impairment in preschool children the sydney paediatric eye disease study. *Ophthalmology*, *118*(8), 1495–1500. https://doi.org/10.1016/j.ophtha.2011.01.027

Preisler, G., Tvingstedt, A.-L., & Ahlström, M. (2005). Interviews with deaf children about their experiences using cochlear implants. *American Annals of the Deaf*, *150*(3), 260–267. https://doi.org/10.1353/aad.2005.0034

Punch, R., & Hyde, M. (2011). Social participation of children and adolescents with cochlear implants: A qualitative analysis of parent, teacher, and child interviews. *Journal of Deaf Studies and Deaf Education*, *16*(4), 474–493. https://doi.org/10.1093/deafed/enr001

Rahi, J. S., Cable, N., & British Childhood Visual Impairment Study Group. (2003). Severe visual impairment and blindness in children in the UK. *Lancet (London, England)*, *362*(9393), 1359–1365. https://doi.org/10.1016/S0140-6736(03)14631-4

Romanian Psychological Testing Services. (2015). Wechsler Intelligence Scale FOR Children – 4th edition – WISC-IV. https://rtscluj.ro/content/view/133/2/

Schmitt, A. J., & Wodrich, D. L. (2004). Validation of a Developmental Neuropsychological Assessment (NEPSY) through comparison of

neurological, scholastic concerns, and control groups. *Archives of Clinical Neuropsychology*, *19*(8), 1077–1093. https://doi.org/10.1016/j.acn.2004.02.002

Solebo, A. L., & Rahi, J. (2014). Epidemiology, aetiology and management of visual impairment in children. *Archives of Disease in Childhood*, *99*(4), 375–379. https://doi.org/10.1136/archdischild-2012-303002

von Buttlar, A. M., Zabel, T. A., Pritchard, A. E., & Cannon, A. D. (2021). Concordance of the Adaptive Behavior Assessment System, second and third editions. *Journal of intellectual disability research : JIDR*, *65*(3), 283–295. https://doi.org/10.1111/jir.12810