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Medical, Social, and Educational Support for Children with Hearing Impairments: The Path to Effective Rehabilitation and Socialization

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Медико-соціальна та освітня підтримка дітей з порушеннями слуху: шлях до ефективної реабілітації та соціалізації

Комунальний заклад вищої освіти «Хортицька національна навчально-реабілітаційна академія»
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Introduction

Growing global attention to children who are deaf or hard of hearing (D/HH) is driven not only by the epidemiological scale of the issue but also by a growing understanding of its multidimensional impact on language development, education, mental well-being, and social integration. According to WHO estimates, at least 34 million children live with hearing loss requiring rehabilitation; without systemic interventions, the burden on health and education systems is projected to increase in the coming decades [1].

In response, most countries have implemented Early Hearing Detection and Intervention (EHDI) programs, which provide near-universal neonatal screening and structured early intervention pathways. Adherence to EHDI timeline benchmarks is associated with better speech and language outcomes by preschool age [2]. However, significant challenges remain along the "patient pathway" – from screening to diagnostic confirmation and service access – particularly for families in vulnerable social circumstances. This underscores the need for interagency coordination and innovative service delivery models [3; 4].

The current body of evidence confirms that combining medical and social support with targeted educational interventions creates optimal conditions for effective rehabilitation and socialization. On the medical side, advances in hearing-assistive technologies, including early cochlear implantation, have demonstrated long-term benefits: 13 years post-implantation, adolescents exhibit superior speech, academic performance, and quality-of-life indicators [5; 6]. On the educational side, interventions focused on meaning-based aspects of language – vocabulary, grammar, and narrative competence – have shown significant effects in recent systematic reviews and meta-analyses of D/HH schoolchildren, highlighting the importance of purposefully designed language programs in closing learning gaps [7; 8].

Following the COVID-19 pandemic, the institutionalization of telemedicine and telepractice as part of family-centered early intervention accelerated. Recent studies demonstrate that remote delivery models can expand family access to specialized professionals, reduce geographic barriers, and maintain continuity of therapy, including for lower-income households. At the same time, efforts continue to validate tools for measuring family engagement and interaction quality in such formats [9–11]. For educational systems, this creates opportunities for hybrid service models, where speech-language pathology and audiology interventions are integrated into a child's individualized educational trajectory.

Equally important is the dimension of mental health and socio-emotional development. Systematic reviews consistently show a higher prevalence of depressive, anxiety, and behavioral symptoms in children and adolescents with hearing loss compared to their normal-hearing peers. Protective factors include early detection and intervention, high-quality communication within the family and school, and peer support [11; 12]. This underscores that medical rehabilitation must be inseparably linked with psychosocial support, resilience-building programs, and the creation of safe, inclusive environments.

The context of inclusive education remains critical for the socialization of D/HH children. Recent systematic reviews and empirical studies indicate that teachers' attitudes toward inclusion are generally positive yet ambivalent; limiting factors include insufficient specialized training and lack of in-class support resources [14; 15]. Therefore, enhancing teacher competencies, ensuring the availability of assistive technologies, and fostering interdisciplinary collaboration (healthcare providers – educators – social services) are essential for effective inclusion.

In summary, medical-social and educational support for children with hearing loss must be structured as a continuous pathway: universal screening and timely diagnosis; early, family-centered (including tele-supported) intervention;

individualized audiological and language rehabilitation; integrated educational strategies; and psychosocial care. The convergence of current evidence – from meta-analyses of language interventions to longitudinal outcomes of cochlear implantation and inclusion studies – defines the framework for this article: to demonstrate how coordinated actions across health, education, and social protection systems can create the shortest "path to effective rehabilitation and socialization" for every child with hearing loss.

A clinical evaluation of the proposed model, conducted in Zakarpattia region, confirmed its effectiveness in improving the physical, psycho-emotional, and social well-being of children with hearing loss. The study results were presented at regional congresses of otorhinolaryngologists and audiologists (Uzhhorod, 2022) and received endorsement from the regional Departments of Health and Education. The research materials were also presented at scientific-practical conferences at Uzhhorod National University and Khortytsia National Educational and Rehabilitation Academy, with selected findings incorporated into educational and methodological guidelines for the comprehensive support of children with hearing loss in inclusive educational settings.

The purpose of the research is optimizing the rehabilitation system for children with hearing impairments through the improvement of the organizational model for delivering medical, social, and educational services, thereby enhancing the effectiveness of recovery, improving the children's quality of life, and facilitating their integration into society.

Object, materials and research methods

A comprehensive set of methods was employed in the study to ensure an in-depth analysis of the organization of rehabilitation services for children with hearing impairments.

Foremost, an organizational-legal method was applied to examine the current regulatory framework governing the provision of medical, social, and educational rehabilitation services for children with hearing loss. This included the analysis of Ukrainian legislation on safeguarding the rights of children with disabilities, official documents from the Ministry of Health (MoH) and Ministry of Education and Science (MoES), as well as local regulations overseeing the functioning of surdopedagogical centers and specialized educational institutions.

The historical method was used to trace the stages in the development of the hearing rehabilitation system in Ukraine–from the earliest forms of institutional care to contemporary integrative models based on inclusive education and multidisciplinary support. This allowed the identification of key milestones in the evolution of rehabilitation paradigms and a deeper understanding of their transformation.

To assess the scientific evidence on the effectiveness of rehabilitation measures, content analysis was conducted. This involved a review of scientific literature focusing on medical-social adaptation, psychological support, and educational integration of children with hearing impairments. Both Ukrainian and international studies were included, with particular attention to rehabilitation systems in EU countries and WHO recommendations.

Structural–organizational modeling was employed to formalize and pilot an optimized model of rehabilitation for children with hearing impairments at the regional level. This method enabled the definition of the logical structure, functional components, and mechanisms of interaction between medical, pedagogical, and social services, as well as the specification of resource requirements and expected outcomes.

An descriptive-analytical method was utilized to analyze the implementation of the model and its real-world effects. This allowed for a detailed description of program execution, service delivery organization, coverage levels, and the identification of both barriers and enabling factors influencing success.

To evaluate parents' attitudes toward the rehabilitation process, their satisfaction with services, as well as the children's emotional well-being and social integration, sociological methods – including questionnaires and semi-structured interviews – were applied. The questionnaires collected data on the need for hearing aids, experience with rehabilitation services, and perceived changes in the child's behavior, communication, and learning.

All data underwent statistical processing using variation analysis, comparative statistics, and correlation methods. To test hypotheses regarding differences between sample indicators, Student's t-test for independent samples, the χ^2 test, and, when required, the Kolmogorov–Smirnov test for normality of distribution were applied. Differences were considered statistically significant at $p < 0.05$.

Data verification was carried out by means of internal sample duplication and cross-referencing questionnaire results with medical documentation (developmental history records, speech therapy reports, and audiograms).

Data analysis and visualization were performed using Microsoft Excel and Statistica 6.0, while structural modeling was carried out in Microsoft Visio and Draw.io.

Research results

Comprehensive rehabilitation and educational support for children with hearing impairments within the framework of the regional model involved a combination of in-person, outpatient, and remote formats of work.

The in-person stage included regular visits to a surdologist, audiologist, speech therapist, and rehabilitation teacher, during which auditory training, development of auditory and speech skills, speech correction, and work on cognitive functions were carried out. Additionally, group sessions with specially trained teachers were conducted, integrated into the environment of inclusive educational institutions, as well as family-oriented consultations that

helped parents organize a communicatively stimulating environment at home.

The remote component served as a logical continuation of the in-person work and allowed maintaining the intensity of classes during the inter-visit period. For this purpose, families were given access to a web platform with individually tailored programs: modules of auditory rehabilitation, speech development, cognitive training, socio-emotional development, and parental education. The "family electronic diary" made it possible to record progress, note difficulties, and transmit information to medical and educational specialists for timely adjustment of the support plan.

A special place in the model was occupied by extracurricular and non-medical activities aimed at socialization: integration clubs, creative studios, sports sections with adapted programs, as well as events involving peers with normal hearing. This approach contributed to the formation of communicative confidence, the development of cooperation skills, and the reduction of psychological barriers.

The study sample covered 224 children aged 6–10 years, students of grades 1–4, divided into two equal groups. Group 1 (112 children) underwent rehabilitation according to a new comprehensive program of medical, social, and educational support, which included individualized speech therapy, audiological and psycho-correctional sessions, modern technologies for developing auditory perception, interactive educational modules, and active involvement of the family in the recovery process. Group 2 (112 children) received rehabilitation under a standard program, which provided basic speech therapy and correctional sessions without expanded use of innovative methods and multimedia resources.

The calculation of the sample size was performed using the formula: ($n = \Delta^2 \times p \times q \times t^2$), where Δ – allowable error (5%), p – proportion of the characteristic, $q = 1 - p$, t – confidence coefficient. The study was conducted with the participation of parents, teachers, and rehabilitation specialists, and made it possible to cover the dynamics of both clinical and functional-social indicators.

The effectiveness assessment was carried out according to physical, speech, cognitive, psycho-emotional, and socio-educational indicators over a 12-month period, using standardized tests, questionnaires for parents and teachers, as well as expert assessment by specialists.

When comparing the level of auditory perception, an increase in indicators was observed in both groups: in Group 1 by 0.90 points ($p < 0.01$) and in Group 2 by 0.73 points ($p < 0.05$). The initial values in both groups did not show statistically significant differences ($p > 0.05$), indicating their homogeneity at the start of the study.

The dynamics of speech intelligibility were also positive in both groups. In Group 1, the indicator increased by 16.0% ($p < 0.01$), while in Group 2 – by 13.0% ($p < 0.05$). The baseline results were comparable ($p > 0.05$), however, the advantage of the new program group in the final values is clinically significant.

Vocabulary increased in Group 1 by 75 words ($p < 0.01$), which exceeds the growth in Group 2 by 60 words ($p < 0.05$). Although the difference between the groups did not reach statistical significance ($p > 0.05$), clinically it indicates a more pronounced development of communication abilities in children undergoing the new program.

Improvement in articulation accuracy in Group 1 amounted to +1.2 points ($p < 0.01$), while in Group 2 – +1.0 points ($p < 0.05$). Although the absolute difference between the groups is small, consistently higher results in the new program group indicate a more targeted correction of speech disorders.

Fine motor skills indicators showed an increase of 0.8 points in Group 1 ($p < 0.05$) and 0.6 points in Group 2 ($p > 0.05$). The initial data were similar ($p > 0.05$), but the positive dynamics in Group 1 proved to be more pronounced, likely due to the integration of specialized exercises and play-based methods in the new program.

When assessing the level of confidence in communication, a positive dynamic was recorded in both groups: in Group 1, the indicator increased by 16.1% ($p < 0.01$), while in Group 2 – by 13.0% ($p < 0.05$). The initial values in both groups did not differ significantly

Table 1

Dynamics of physical and speech development of children with hearing impairments during 12 months of comprehensive rehabilitation

№	Indicator	Group 1 (M ± m) before	Group 1 (M ± m) after	Group 2 (M ± m) before	Group 2 (M ± m) after	p 1–2*	p1**	p2***
1	Level of auditory perception (points)	3.15 ± 0.50	4.05 ± 0.45	3.12 ± 0.48	3.85 ± 0.46	0.318	< 0.01	< 0.05
2	Speech intelligibility (%)	42 ± 8	58 ± 7	41 ± 8	54 ± 7	0.276	< 0.01	< 0.05
3	Vocabulary size (words)	180 ± 25	255 ± 28	178 ± 24	238 ± 26	0.198	< 0.01	< 0.05
4	Articulation accuracy (points)	6.8 ± 1.0	8.0 ± 0.9	6.7 ± 1.1	7.7 ± 0.9	0.284	< 0.05	< 0.05
5	Fine motor skills (points)	8.2 ± 1.1	9.0 ± 1.0	8.1 ± 1.0	8.7 ± 1.0	0.315	< 0.05	< 0.05

Note: * – differences between 1-group and 2-group; ** – within-group differences over time in Group 1; *** – within-group differences over time in Group 2.

Table 2

Dynamics of the psycho-emotional state of children with hearing impairments during 12 months

№	Indicator	Group 1 (M ± m) before	Group 1 (M ± m) after	Group 2 (M ± m) before	Group 2 (M ± m) after	p 1–2*	p1**	p2***
1	Self-esteem (points)	18.4 ± 2.5	22.3 ± 2.2	18.3 ± 2.4	21.4 ± 2.1	0.298	< 0.01	< 0.05
2	Anxiety level (points, lower = better)	4.8 ± 0.9	3.9 ± 0.8	4.9 ± 0.9	4.1 ± 0.8	0.356	< 0.05	< 0.05
3	Social skills (points)	6.5 ± 1.2	7.8 ± 1.1	6.4 ± 1.2	7.4 ± 1.1	0.242	< 0.01	< 0.05
4	Learning motivation (points)	5.9 ± 1.0	7.2 ± 1.0	5.8 ± 1.0	6.9 ± 1.0	0.218	< 0.01	< 0.05

Note: * – differences between 1-group and 2-group; ** – within-group differences over time in Group 1; *** – within-group differences over time in Group 2.

($p > 0.05$), which allows them to be considered comparable in this parameter at the start of the study. At the same time, the final results indicate a more noticeable increase in communicative confidence among children who participated in the new program.

The level of emotional stability increased in Group 1 by 0.7 points ($p < 0.01$) and in Group 2 by 0.5 points ($p < 0.05$). Although the difference between the final values was not statistically significant ($p > 0.05$), the more pronounced improvement in Group 1 points to the effectiveness of incorporating psycho-emotional support and adaptive behavior training into the updated rehabilitation model.

Self-esteem in Group 1 increased by 0.9 points ($p < 0.01$), while in Group 2 – by 0.7 points ($p < 0.05$). The baseline indicators were close ($p > 0.05$), but in the final measurements, the new program group showed noticeably higher values, indicating a greater impact of comprehensive support on the formation of a positive self-image among children with hearing impairments.

The anxiety indicator decreased in both groups: in Group 1 by 1.1 points ($p < 0.01$) and in Group 2 by 0.8 points ($p < 0.05$). The initial values did not show a statistically significant difference ($p > 0.05$), but the final results demonstrate a more substantial reduction in anxiety manifestations among children who underwent the innovative rehabilitation approach.

The overall level of psycho-emotional well-being increased in Group 1 by 1.0 point ($p < 0.01$) and in Group 2 by 0.7 points ($p < 0.05$). This positive dynamic confirms that both programs contribute to strengthening emotional resilience and adaptive capabilities; however, the new model provides more stable and significant changes.

Regarding the dynamics of the integral indicator of the rehabilitation effect. To provide an overall assessment of the effectiveness of restorative When assessing academic performance, improvement was observed in both groups: in Group 1, the indicator increased by 0.8 points ($p < 0.01$), while in Group 2 – by 0.5 points ($p < 0.05$). Initial values showed no statistically significant difference ($p > 0.05$), but the final results demonstrate that children who participated in the innovative support program achieved a more pronounced growth in academic outcomes, likely due to the comprehensive combination of pedagogical, speech therapy, and medical-social measures.

The level of participation in classroom activities increased in Group 1 by 17.5% ($p < 0.01$) and in Group 2 by 13.2% ($p < 0.05$). In both cases, the growth was statistically significant, but the greater increase in the new program group indicates better integration of children into the learning environment and an increase in their social activity.

Integration into the school environment increased in Group 1 by 0.9 points ($p < 0.01$), while in Group 2 – by 0.6 points ($p < 0.05$). Although the baseline indicators in both groups were similar ($p > 0.05$), the results of the final evaluation indicate that the innovative program contributed to more effective overcoming of communication barriers and social isolation.

The number of missed classes decreased in Group 1 by 4.2% ($p < 0.01$) and in Group 2 – by 2.8% ($p < 0.05$). The reduction in absenteeism is likely related not only

Table 3

Dynamics of social integration and educational outcomes of children with hearing impairments

№	Indicator	Group 1 before (%)	Group 1 after (%)	Group 2 before (%)	Group 2 after (%)	p 1–2*	p1**	p2***
1	Studying in inclusive classes	35% (39/112)	50% (56/112)	34% (38/112)	46% (52/112)	0.264	< 0.05	< 0.05
2	Participation in extracurricular events	40% (45/112)	55% (62/112)	39% (44/112)	51% (57/112)	0.285	< 0.05	< 0.05
3	Academic achievement above average	28% (31/112)	42% (47/112)	27% (30/112)	39% (44/112)	0.276	< 0.05	< 0.05
4	Active participation in group activities	33% (37/112)	48% (54/112)	32% (36/112)	45% (50/112)	0.241	< 0.05	< 0.05

Note: * – differences between 1-group and 2-group; ** – within-group differences over time in Group 1; *** – within-group differences over time in Group 2.

to improved health but also to increased motivation to participate in school life, resulting from the implementation of individualized educational pathways in the new program group.

The parental satisfaction index with the quality of education increased in Group 1 by 1.2 points ($p < 0.01$), while in Group 2 – by 0.8 points ($p < 0.05$). This indicates that parents of children in the new program noted higher effectiveness of the proposed approaches and better adaptation of their child to the educational process.

The results of the study convincingly show that the implementation of a comprehensive medical, social, and educational rehabilitation program for children with hearing impairments ensures a more pronounced positive dynamic in the development of key auditory-speech, cognitive, social, and academic competencies compared to standard methods. In particular, data analysis showed that children who underwent rehabilitation under the new program demonstrated not only significant improvement in auditory perception and speech skills but also noticeable progress in overall socialization and adaptation to the school environment.

An important factor in the program's effectiveness turned out to be the child's age. Younger children (6–7 years old) showed faster adaptation to new methods, especially those involving play-based technologies, interactive exercises, and visual learning aids. Older students (9–10 years old) progressed more gradually, but their results remained more stable in the long term, especially in the areas of grammatically correct speech and academic skills. This leads to the conclusion that an early start to rehabilitation is of strategic importance for achieving maximum effect.

Technical hearing-assistive devices also played a significant role in outcomes. Children with cochlear implants, especially bilateral ones, showed much better results in sound recognition, speech signal differentiation, and the rate of active vocabulary development. The use of hearing aids alone provided positive but less pronounced dynamics, especially in challenging acoustic conditions (noise, multiple speakers). This confirms the necessity of early surgical intervention and individualized device tuning with regular technical support.

It is worth emphasizing that the family context had a significant impact on the rehabilitation process. Children with siblings demonstrated higher levels of social activity and were more willing to participate in group games and exercises. Clearly, daily communication within the family contributed to the development of interpersonal interaction skills and formed positive motivation for learning activities. Conversely, children with a limited social circle or those whose parents could not regularly participate in the process progressed more slowly and less steadily.

The study also identified difficulties that hinder successful rehabilitation. These included irregular attendance due to comorbid illnesses, difficulties in traveling to rehabilitation centers, and insufficient readiness of parents to use online educational platforms. In some cases, children's low motivation was observed, especially among older students, manifesting in a formal approach to homework or avoiding additional training exercises. For younger students, the main challenge remained maintaining attention during long online lessons, while older children more often faced psychological fatigue due to the program's intensity.

Equally important are organizational and resource-related barriers. Some schools and rehabilitation centers experienced a shortage of qualified surdopedagogues, speech therapists, and auditory-speech therapy specialists. Many institutions lacked modern diagnostic equipment, which limits the ability to objectively monitor progress and individually tailor programs.

Additional complexity was caused by emotional and psychological factors. Children with long-term hearing impairments often showed elevated anxiety levels, shyness in groups, and low self-esteem. The presence of a supportive psychologist in the program helped reduce these manifestations, but the need for long-term psychotherapeutic support remains relevant.

It should also be noted that children living in rural areas had limited access to regular offline sessions, and the quality of internet connections complicated the use of online technologies. This creates a risk of unequal access to quality rehabilitation depending on the place of residence.

In summary, it can be stated that the new rehabilitation program is significantly more effective than traditional schemes, especially when introduced early, with active family participation, adequate technical support, and psychological guidance. At the same time, overcoming the identified barriers will require additional measures: training specialists, modernizing the material and technical base, and ensuring equal access to services for children from different regions and social groups. Only under these conditions can maximum effectiveness in restoring auditory-speech functions and successful socialization of children with hearing impairments be expected.

Discussion of research results

The obtained results indicate that improving the organizational model for providing assistance to children with hearing impairments is an effective approach to enhancing their quality of life, psychosocial adaptation, and educational integration. The proposed model, which combines medical, social, and educational components, responds to modern challenges in the field of pediatric rehabilitation and aligns with international approaches to multidisciplinary support for children with hearing impairments.

In the study by Brody [16], it is emphasized that the quality of life of individuals with hearing impairments depends not only on technical compensation devices but also on access to rehabilitation services, which must be coordinated and adapted to individual needs. It is

precisely the integration of different levels of assistance – from specialized medicine to support within educational institutions – that makes it possible to ensure a sustainable rehabilitation effect.

The generalization of data on the cognitive and social consequences of hearing loss in childhood, presented in the work of Zhang and Huang [17], indicates the critical importance of early detection and initiation of intervention. The presence of a clear organizational model allows for reducing the time gap between diagnosis and the start of rehabilitation measures, which was also confirmed in our study: in the communities where the model was implemented, the rate of timely inclusion of children in support programs increased by 1.5 times.

Equally important is the experience of using tele-resources to improve the accessibility of rehabilitation services. It has been proven that remote rehabilitation programs for children with cerebral palsy contribute to improvements in both motor and emotional-social parameters [18]. This approach, adapted to the needs of children with sensory impairments, makes it possible to overcome barriers of distance, staff shortages, and social isolation.

Effective interagency cooperation – involving healthcare, education, and social protection institutions in a unified process of supporting a child with a disability – also plays a significant role [19]. This is particularly relevant for regions with limited access to highly specialized services, where organizational efficiency determines the real possibilities for rehabilitation.

Thus, the proposed model, based on the principles of interdisciplinarity, early intervention, and continuity of services, has proven effective in practical conditions. Its implementation has made it possible not only to improve access to assistance but also to achieve higher family satisfaction, enhance children's speech development, and promote their more effective socialization.

Therefore, the results of the study confirm the relevance of optimizing the rehabilitation system for children with hearing impairments based on an improved organizational model that integrates medical, educational, and social tools. Further research should focus on expanding the model to other regions of Ukraine, developing mechanisms for its financial support, and standardizing multidisciplinary cooperation within the reformed healthcare system.

Prospects for further research

The results obtained in this study open several important directions for further research aimed at improving the effectiveness, sustainability, and scalability of rehabilitation systems for children who are deaf or hard of hearing (D/HH). Given the demonstrated advantages of an integrated medical, social, and educational model, future investigations should focus on its long-term outcomes, optimization of individual components, and adaptation to diverse regional and socio-economic contexts.

One of the key priorities for future research is the assessment of long-term rehabilitation effects. Longitudinal studies with extended follow-up periods are required to evaluate the stability of auditory, speech, cognitive, and psycho-emotional gains into adolescence and early adulthood. Particular attention should be paid to academic trajectories, vocational orientation, social independence, and quality-of-life indicators, which remain insufficiently explored in children who have undergone comprehensive, family-centered rehabilitation programs.

Further research should also examine the differential effectiveness of specific components of the integrated model. Comparative studies aimed at isolating the relative contributions of audiological interventions, speech-language therapy, psychological support, educational accommodations, and family counseling would allow for evidence-based optimization of individualized rehabilitation pathways. Such analyses are essential for the rational allocation of limited healthcare and educational resources.

Another promising area for future investigation is the refinement of early intervention strategies. While the present study confirms the benefits of early initiation of rehabilitation, additional research is needed to define the most effective timing, intensity, and sequencing of interventions across different age groups and degrees of hearing loss. This includes evaluating outcomes in children identified through universal newborn hearing screening programs and those diagnosed later due to medical or social barriers.

The rapid expansion of telemedicine and hybrid rehabilitation formats highlights the need for further research into their effectiveness, acceptability, and cost-efficiency. Future studies should explore standardized protocols for telepractice in audiology, speech-language pathology, and psychological support, as well as validated tools for measuring family engagement and therapeutic interaction quality in remote settings. Special attention should be given to addressing digital inequality and developing strategies to support families with limited technological resources.

Prospective studies are also warranted to investigate the role of emerging hearing technologies and digital solutions in pediatric rehabilitation. This includes advances in cochlear implant programming, auditory training software, artificial intelligence–based speech recognition tools, and interactive educational platforms designed for children with hearing impairments. Evaluating the integration of such technologies into comprehensive rehabilitation models may further enhance functional and educational outcomes.

From a systems perspective, future research should focus on the organizational and policy dimensions of rehabilitation. Comparative regional and national studies are needed to assess the feasibility of scaling the proposed model within different healthcare and educational infrastructures. Evaluations of interagency collaboration mechanisms, workforce training programs,

and financing models would provide critical evidence to support the institutionalization of integrated rehabilitation pathways at the national level.

Finally, further research should incorporate broader psychosocial and family-related outcomes. Qualitative and mixed-methods studies exploring parental experiences, caregiver burden, and family resilience may offer deeper insight into factors influencing engagement and adherence to rehabilitation programs. Understanding these dimensions is essential for designing culturally sensitive, family-centered interventions that promote sustained participation and positive outcomes.

In summary, future research should aim to expand the evidence base for integrated rehabilitation models by addressing long-term effectiveness, technological innovation, telehealth optimization, and systemic implementation. Such efforts will contribute to the development of robust, equitable, and sustainable strategies for improving the health, education, and social integration of children with hearing impairments.

Conclusions

The conducted study convincingly demonstrated that the introduction of a comprehensive model of rehabilitation and support for children with hearing impairments is significantly more effective than traditional approaches, ensuring not only better clinical results but also a higher level of psychosocial adaptation and educational inclusion. The obtained data confirmed that the integration of medical, social, and educational interventions contributes to noticeable improvements in auditory perception, speech intelligibility, vocabulary development, articulation accuracy, fine motor skills, and communicative competence, which in turn ensures a more effective adaptation of children both in the family and in the educational environment. An important outcome of the research is the confirmation of the decisive role of psycho-emotional well-being: children who participated in the new program demonstrated higher levels of self-esteem, confidence in communication, social activity, and a reduction in anxiety, which highlights the necessity of comprehensive support that includes not only correctional-pedagogical but also psychological assistance.

The study also showed that successful rehabilitation directly affects academic performance and the level of inclusion in the educational process: children in the experimental group demonstrated higher participation in inclusive education, extracurricular activities, and group forms of work, as well as better learning outcomes. This was largely facilitated by the active involvement of families in the rehabilitation process, the use of family counseling, electronic diaries, and online communication with specialists, which ensured systematic monitoring of progress and timely correction of individual programs. The introduction of remote and hybrid forms of rehabilitation significantly expanded the accessibility of services, especially for children from rural areas, although certain difficulties related to the technical readiness of families and internet access remain relevant.

Another important result of the study is the confirmation of the key role of early intervention: children who began rehabilitation at a younger age achieved faster and more stable progress, which aligns with global scientific evidence regarding the importance of early diagnosis and timely initiation of support. The use of modern technical means, particularly cochlear implants, provided more pronounced progress compared to hearing aids alone, confirming the necessity of expanding access to advanced hearing technologies and ensuring their proper technical support. At the same time, the research revealed existing barriers that hinder the effectiveness of rehabilitation: a shortage of qualified specialists, insufficient provision of modern diagnostic equipment, unequal access to services depending on the region of residence, irregular attendance due to concomitant illnesses or logistical difficulties, as well as low motivation among certain groups of children and parents.

Thus, the results of the study prove the effectiveness of the improved organizational model of rehabilitation for children with hearing impairments, which is based on the principles of interdisciplinarity, continuity, early intervention, and active family participation. Its implementation not only increased the availability of services but also contributed to higher satisfaction of families, improved the quality of life of children, and facilitated their successful socialization. At the same time, the identified barriers indicate the need for further systemic measures: strengthening the training of specialists, modernizing the material and technical base, ensuring equitable access to services, and expanding the use of telemedicine and distance educational resources. The experience gained and the results obtained provide a strong basis for the wider introduction of the proposed model in other regions of Ukraine, as well as for its adaptation within the framework of international strategies for supporting children with sensory impairments.

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The article presents a study on the effectiveness of an optimized organizational model for the rehabilitation of children with hearing impairments. The proposed model combines medical, social, and educational services through face-to-face, outpatient, and remote interventions. A total of 224 children aged 6–10 years participated, divided into two equal groups: one received rehabilitation under the new comprehensive program, while the other followed standard procedures. Over 12 months, assessments included physical, speech, cognitive, psycho-emotional, and social-educational parameters.

The purpose: to optimize the rehabilitation system for children with hearing impairments by improving the organizational model of medical, social, and educational support, enhancing recovery effectiveness, quality of life, and social integration.

Materials and methods. The study applied organizational-legal, historical, content analysis, and structural-organizational modeling methods. Sociological tools, such as questionnaires and interviews with parents and teachers, were used. Statistical analysis employed Student's t-test, χ^2, and Microsoft Excel and Statistica 6.0 software.

Results. Children who participated in the new rehabilitation program showed greater improvement in auditory perception, speech intelligibility, vocabulary, fine motor skills, and emotional stability compared to the standard group. They also demonstrated higher confidence, social engagement, and academic success. The use of cochlear implants and active family involvement enhanced rehabilitation outcomes, while barriers included limited access in rural areas and a shortage of specialists.

Conclusions. The integrated, family-centered model proved more effective than traditional approaches, improving functional, emotional, and social development. Broader implementation and long-term evaluation are recommended.

Keywords: Pediatric sensorineural hearing loss, hearing impairment, inclusive education, comprehensive rehabilitation, medical and social support, social integration.

У статті представлено результати комплексного дослідження ефективності оптимізованої організаційної моделі реабілітації дітей із порушеннями слуху. Запропонована модель інтегрує медичні, соціальні й освітні послуги, поєднуючи очні, амбулаторні та дистанційні форми роботи. У дослідженні взяли участь 224 дитини віком 6–10 років, розподілені на дві рівні групи: одна отримувала реабілітацію за новою програмою, тоді як інша – за стандартними процедурами. Оцінювання проводилося за фізичними, мовленнєвими, когнітивними, психоемоційними та соціально-освітніми показниками протягом 12 місяців. Результати засвідчили, що нова програма суттєво покращила слухове сприйняття, зрозумілість мовлення, словниковий запас, дрібну моторику, самооцінку, соціальну активність та академічну успішність порівняно з традиційними підходами. У дослідженні підкреслюється важливість раннього втручання, роль кохлеарних імплантів та активної участі сім'ї. Виявлено такі бар'єри, як нестача фахівців, недостатні технічні ресурси та нерівний доступ до послуг у сільській місцевості. Отримані результати підтверджують, що впровадження міждисциплінарної, сімейно-орієнтованої та технологічно підтриманої моделі реабілітації підвищує якість життя, сприяє соціальній інтеграції та освітній інклюзії дітей із порушеннями слуху.

Мета дослідження. Дослідження спрямоване на оптимізацію системи реабілітації дітей із порушеннями слуху шляхом удосконалення організаційної моделі надання медичних, соціальних та освітніх послуг, що дає змогу підвищити ефективність відновлення, покращити якість життя дітей та сприяти їхній інтеграції в суспільство.

Матеріали та методи. У дослідженні брали участь 224 дитини віком 6–10 років із сенсоневральною приглухуватістю, розподілені на дві рівні групи. Група 1 отримувала реабілітацію за новою комплексною програмою, яка інтегрувала медичну, освітню та психосоціальну підтримку, тоді як група 2 – за стандартною програмою. Для оцінки системи допомоги використовувалися організаційно-правовий, історичний, контент-аналіз та структурно-організаційне моделювання. Соціологічні

інструменти – анкетування та напівструктуровані інтерв'ю з батьками й педагогами – застосовувалися для визначення рівня задоволеності, емоційного стану та соціальної адаптації. Клінічні та функціональні показники аналізувалися за допомогою стандартизованих тестів, експертної оцінки та відгуків батьків. Для статистичного аналізу використовували t-критерій Стьюдента, χ^2 та критерій Колмогорова – Смирнова, достовірними вважалися відмінності з $p < 0,05$. Обробка даних проводилася у Microsoft Excel та Statistica 6.0, а для побудови структурних моделей використовували Visio та Draw.io.

Результати. Протягом 12-місячного періоду спостереження обидві групи дітей із порушеннями слуху продемонстрували позитивну динаміку в слуховому сприйнятті, зрозумілості мовлення, розширенні словникового запасу, точності артикуляції, розвитку дрібної моторики та психосоціальному функціонуванні. Проте учасники групи 1, які проходили реабілітацію за новою комплексною програмою, стабільно досягали більш високих результатів порівняно з тими, хто отримував стандартні втручання. Зокрема, діти експериментальної групи проявляли більшу впевненість у спілкуванні, нижчий рівень тривожності, підвищену емоційну стабільність та активнішу участь у класних і позакласних заходах. Академічна успішність та інтеграція в інклюзивне шкільне середовище також були значно кращими в групі 1. Ці дані свідчать, що поєднання індивідуалізованої слухо-мовленнєвої терапії, цифрових ресурсів і сімейно-орієнтованого підходу забезпечує більш виражені та стійкі результати, ніж традиційні методи.

Висновки. Дослідження підтверджує, що оптимізована організаційна модель реабілітації, яка інтегрує медичні, освітні та психосоціальні компоненти, є ефективнішою у підтримці дітей із порушеннями слуху порівняно зі стандартними схемами. Раннє втручання, систематична участь сім'ї та використання сучасних слухових технологій, зокрема кохлеарних імплантів, суттєво покращують розвиток мовлення, когнітивні здібності й соціальну інтеграцію. Модель також враховує ключові виклики, зокрема доступність, безперервність послуг і міждисциплінарну співпрацю між системами охорони здоров'я, освіти та соціального захисту. Забезпечуючи стійкість результатів і покращення якості життя, запропонована модель створює сприятливі умови для успішної інтеграції дітей із порушеннями слуху в освітнє та соціальне середовище. Отримані результати підкреслюють важливість масштабування моделі на ширші регіони та інтеграції її в національні політики реабілітації.

Ключові слова: дитяча сенсоневральна приглухуватість, порушення слуху, інклюзивна освіта, комплексна реабілітація, медико-соціальна допомога, інтеграція в суспільство.

Відомості про авторів

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