

# Evidence Based Practices –Opportunities and Challenges

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## Abstract:

Evidence-based practice in pediatric rehabilitation involves integration of best available research, clinical expertise, and values and priorities of children and their families in guiding decisions to optimize outcomes. In this way, EBP systematically brings together these elements to promote individualized, effective, and accountable care for children with special needs provided in healthcare, educational, and community settings. This paper discusses how evidence-based practice can optimize rehabilitation for children with special needs by integrating high-quality research, clinical expertise, and family values across healthcare, education, and community systems. It underlines the role of early intervention, culturally and contextually adapted services, and technology-enhanced approaches, including artificial intelligence, tele-rehabilitation, virtual reality, and mobile apps, in improving developmental outcomes, access, and engagement for diverse pediatric populations. The paper further discusses ongoing challenges, such as research-to-practice gaps, limited resources, practitioner training needs, and heterogeneity in the children's developmental profiles, and puts forward strategies focused on capacity building, policy support, interdisciplinary collaboration, and equity-oriented implementation that could serve to strengthen EBP within pediatric rehabilitation.

**Keywords:** Evidence-Based Practice, pediatric rehabilitation, early intervention, cultural adaptation, artificial intelligence, technology-enhanced interventions, tele-rehabilitation, and children with special needs.

## Introduction

This introduction summarizes the fact that rehabilitative efforts for children with special needs to take the form of a comprehensive, multi-disciplinary approach that has the primary goal of helping to achieve the highest level of developmental potential, maximum functional independence, and improved quality of life. Additionally, this multi-disciplinary approach is based on the paradigm of "evidence-based practice" (EBP). Essentially, EBP utilizes not only the best research evidence available; it also incorporates the knowledge, skills, and experience (clinical expertise) of the professional as well as the unique individual and familial values of children and families that it serves (Frihat & Fuhr, 2025). EBP is an area of critical importance for pediatric rehabilitation because children have such a vast range of diverse and changing developmental needs, that they make rapid changes throughout their development, and because children have such a wide variety of environmental, cultural, and contextual factors affecting their health care outcomes (Antonelli et al., 2020). This research paper will examine the foundational aspects of EBP as it relates to rehabilitation for children with special needs; current applications of EBP in pediatric rehabilitation; cross-cutting themes and issues in the

field; and identification of the challenges to using EBP in providing rehabilitation for children with special needs. In this regard, the paper addresses the importance of providing early intervention services; providing culturally sensitive and contextually adapted EBP; providing technology-enhanced interventions; and providing collaborative efforts among the health care system, the educational system, and the family system. Finally, this paper addresses barriers to the implementation of EBP (e.g., research-to-practice gaps; resource shortages; training needs for practitioners; and the variability of the developmental profiles of children). The paper concludes with recommendations for the future and also for the future possibilities afforded by advances in artificial intelligence (AI), biomarker-driven early intervention services, and technology-based assessment and intervention strategies.

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### **The Foundations of Evidence-Based Practice in Pediatric Rehabilitation**

Evidence-Based Practice is based on a structured approach of using current high-quality clinical research, the experience of the clinician, and the preferences of parents and patients to assist in the decision-making process and improve patient outcomes (Frihat & Fuhr, 2025). EBP in pediatric rehabilitation involves a step-by-step process: formulating answerable clinical questions, Identifying, researching, and critically evaluating the available literature related to those clinical questions, implementing EBP findings into clinical practice, and measuring the effect of EBP on patient outcomes.

The Level of Evidence (LoE) framework developed by Frihat and Fuhr (2025) ranks studies based on their strength of support for evidence-based medicine using a hierarchical format. The highest-ranking studies are Systematic Reviews of Randomised Controlled Trials (SR RCTs), and the lowest-ranking studies are Cases Series. With the LoE framework, clinicians can better prioritise and utilise the most effective clinical interventions and therapies based on the highest level of scientific evidence. However, as noted by Frihat and Fuhr (2025), many medical journals do not specify the LoE. This makes translating research into the practice of medicine difficult. New automated systems now help clinical researchers classify studies automatically, allowing researchers to locate and retrieve the highest-quality evidence quickly to make more informed decisions in clinical practice.

The use of EBP (Evidence-Based Practice) with children is made more complicated than it would be with adult patients due to their being subject to individualized approaches because each child may demonstrate unique developmental needs depending on the type(s) of disability or condition(s) demonstrated by the child. Children

with ASD, CP, or IID present with a wide range of heterogeneous profiles that may not necessarily match with the populations that have been studied when conducting research to identify high-quality research studies (Sideraki & Anagnostopoulos, 2024). Therefore, EBP requires the ability to perform a thorough review of the literature and then be able to modify the intervention(s) based on individual children and family members, and on any cultural or contextual variables involved with that child.

## **Importance of Early Intervention**

### **Biological Basis and Effects**

The role of early intervention is vitally important in pediatric rehabilitation. This point has substantial evidence based on both developmental neuroscience and clinical studies. Antonelli et al. (2020) note the developmental aspects of affective, cognitive, and regulatory neurological systems have a critical period during pregnancy and early infancy, when the child is particularly vulnerable to negative impacts caused by pregnancy-related exposure to environmental stresses. Prenatal stress can result in increased susceptibility for developing neurodevelopmental disorders, such as attention-deficit/hyperactivity disorder (ADHD), emotional regulation problems, and later development of neuropsychiatric disorders.

Recent evidence suggests that when early intervention occurs in conjunction with biological markers (biomarkers), such as epigenetic changes or physiological processes, these interventions will reduce the impact of early adversities, or even reverse the effects (Antonelli et al., 2020). For example, the identification of DNA methylation patterns associated with key genes of stress response (e.g., NR3C1), in infants may serve as a risk marker, and can be used to develop targeted family-centered intervention programs to reduce risk. These programs have demonstrated strong protective effects on the socio-emotional and cognitive functioning of children through improving caregiver-child bonding and daily stimulation.

### **Early Detection and Family-Centered Programs**

Having the ability to identify children at risk for having delays in their development or having disorders is important so that the children can receive help as soon as possible. In addition to identifying children with developmental delays or disorders, Antonelli and others suggest ways to measure physiological signals and to use epigenetic markers (for example, using a saliva test) so that premature to developing behaviour problems can be identified before the identifying behaviours are showing in the child's behaviour. These biomarkers and tests can help determine which interventions or services will be needed for the child

## **Culturally sensitive and Context –Adapted EBP implementation**

### **The Necessity of cultural adaptation**

Family-centered interventions provide preventive measures for many issues that arise during pregnancy and the early years of life. Some of the key components of these family-centered early intervention programs

are the support for activities and behaviours of the caregiver with the child and the development of attachments between the caregiver and child. Not only do family-centred early intervention programs improve the long-term outcomes for children exposed to prenatal and early-life adversity, but they also provide critical support to the family and child in the future. The combination of family-centered early intervention programs and pediatric rehabilitation systems will play an important role in preventing and reducing future neuropsychiatric and developmental problems.

The effectiveness and application of evidence-based practices (EBP) in pediatric rehabilitation are strongly linked to cultural and contextual settings. Evidence-based practices developed within a high resource, Western context may not be readily applicable within a low resource setting, or across populations with varying cultural beliefs, practices and norms related to caregiving (Antonelli et al., 2020). The lack of these cultural considerations may lead to less participation, adherence, and ultimately poorer results.

The cultural influences on maternal levels of stress, as well as parental style and behaviours involved in caregiving, are all discussed by Antonelli et al. (2020). This includes but is not limited to, how family systems perceive and respond to disability; the type of social support available; and how family systems are structured. Therefore, adapting EBP within these definitions will make them more acceptable and feasible to local populations.

### **Strategies for contextualization**

The following strategies can be effectively employed to adapt contextually to the community:

*Community Engagement:* Work together with families, community leaders, and local stakeholders to ensure the delivery of culturally appropriate interventions that meet the needs of the community.

*Capacity Building:* Educating local practitioners and caregivers to deliver evidence-based interventions that are culturally appropriate.

*Resource Adaptation:* Changing the way an intervention is delivered by using resources that are available locally (e.g., utilizing inexpensive technology or group-based interventions in areas with a small number of professionals).

*Continuous Evaluation:* Collecting data to evaluate the effectiveness of an intervention and improve implementation over time.

According to Frihat and Fuhr (2025), another important way that practitioners can incorporate the use of local data and research into the EBP process is through the use of automated tools to assist with the classification and retrieval of evidence, thereby helping practitioners locate relevant evidence that matches their local priorities and limitations.

## Technology-Enhanced Interventions: Tele-Rehabilitation, Apps, and Virtual Reality

### The Rise of Technology in Pediatric Rehabilitation

Technological innovation has transformed rehabilitation, enabling more personalized, scalable, and accessible interventions. Sideraki and Anagnostopoulos (2024) detail the growing use of AI-powered tools, educational robots, augmented and alternative communication (AAC) systems, apps, and virtual reality (VR) in the assessment and intervention for children with special needs, particularly those with autism spectrum disorder. These types of tools allow for the following:

*Individualization* – adaptive tools provide individualized plans for rehabilitation, providing appropriate interventions to the individual child's needs and progress.

*Wider Application* – technology is able to provide interventions to larger populations, including those located in rural and under-served regions.

*Less Subjectivity* – the introduction of artificial intelligence into the assessment of children with Special Needs has allowed for less bias and more consistency throughout the assessment process.

*Increased Engagement and Participation* – the use of gamification, social robots and bot-based interactive applications allows for greater engagement and more active participation in assessments for children who may have difficulty with traditional human-to-human interaction.

### Role of Artificial Intelligence in Assessment and Intervention

AI has proven to be one of the strongest tools so far in both diagnosis and intervention concerning ASD as well as other developmental disorders. Deep learning algorithms allow analysis of biometric, behavioral, and linguistic data derived from video, audio, and wearable sensors with increasingly higher accuracy and timeliness than conventional methods do (Sideraki & Anagnostopoulos, 2024). Automated diagnostic tools foster early detection and lower dependency on subjective clinical judgment.

Intervention involves the use of AI-driven educational robots, such as NAO and Kaspar, which provide structured, repetitive, non-judgmental interactions that have proved particularly efficient in teaching social skills, emotional recognition, and communication. Such robots can be programmed to adapt to the individual needs of each child, catering to his or her engagement level for increased learning and motivation.

AI-driven AAC systems make use of word prediction, voice recognition, and adaptive interfaces in order to support non-verbal children in effectively communicating their utterances. Chatbot applications, trained on large datasets of child-adult conversations, offer personalized language development support, allowing for practice opportunities that are naturalistic yet safe and predictable in nature (Sideraki & Anagnostopoulos, 2024).

### Virtual Reality and Mobile Applications

Virtual reality and mobile applications extend the toolkit for technology-enhanced interventions. VR environments simulate real-life social, academic, or functional scenarios, allowing children to practice their

skills in a controlled and immersive environment. Mobile apps, like Social Mind Autism and ABA Genie, provide tailored educational content, behavioral analysis, and continuous feedback to adapt to each child's evolving needs and abilities (Sideraki & Anagnostopoulos, 2024).

### **Tele-Rehabilitation**

Tele-rehabilitation makes use of videoconferencing, remote monitoring, and digital platforms to provide intervention services to children and families who may face barriers to accessing in-person care. This approach became particularly salient during the COVID-19 pandemic and remains essential for reaching children in rural or low-resource settings. Technology-enhanced peer assessment, as described by Kristanto (2018), illustrates the potential of digital platforms to support collaborative learning and assessment in educational contexts.

### **Evidence of Effectiveness and Ongoing Challenges**

The research has indicated that technology-enhanced interventions bear positive benefits on improving communication, social skills, engagement, and developmental gains for children with special needs (Sideraki & Anagnostopoulos, 2024). At the same time, ensuring long-term sustainability, full individualization, integration into existing support systems, and thorough evaluation of user experience, accessibility, and impact in real-world settings still presents difficulties (Federici et al., 2020; Kristanto, 2018).

### **Collaboration Between Healthcare, School, and Family Systems**

#### **The Need for Integrated, Family-Centered Care**

In the rehabilitation of children with special needs, optimal outcomes require a coordinated and multidisciplinary collaboration among healthcare providers, educators, and families. Antonelli et al. (2020) emphasize how family-centered early intervention programs consider caregivers as core partners in the therapeutic process. Such collaboration reinforces generalization across home, school, and community settings and aligns intervention goals with family priorities and cultural values.

### **School-Based and Community Rehabilitation**

Schools are the main places to develop and socialize with children with special needs. Evidence-based intervention integrated into school routines provides a setting for inclusion, academic achievement, and social participation. Kristanto (2018) documents the effectiveness of technology-enhanced peer assessment in fostering student engagement, reflective learning, and skill acquisition in educational contexts.

Community-based rehabilitation extends support to broader social networks, leveraging community resources and peer support to promote participation, reduce stigma, and enhance access to services.

## **Multidisciplinary and Transdisciplinary Teams**

Multidisciplinary teams comprising physicians, therapists, educators, psychologists, social workers, and family members facilitate effective collaboration. Transdisciplinary models, in which professionals share roles and responsibilities, encourage holistic, coordinated care. Communication, shared decision-making, and mutual respect are cornerstones of these models, which assure that interventions are evidence-based, yet tailored to the unique constellation of needs presented by each child and family.

## **Challenges in Implementing Evidence-Based Practices**

### **Gaps Between Research and Practice**

A sustained challenge within pediatric rehabilitation is how to translate research evidence into real-world clinical practices. As Frihat and Fuhr note (2025), high-quality evidence exists-particularly from RCTs and systematic reviews-but many publications fail to state LoE explicitly, and much of the research itself is not directly applicable to the diverse populations and contexts of practice. The retrieval and application of relevant evidence are now supported by automated classification systems, but translation remains a complex process.

### **Limited Resources and Infrastructure**

Resource constraints, especially in low- and middle-income settings, create significant barriers to the implementation of EBP. These include shortages of trained professionals, limited access to specialized services, insufficient funding, and lack of infrastructure for technology-based interventions (Antonelli et al., 2020). In even higher-resource settings, disparities in access persist for marginalized or rural populations.

### **Practitioner Training and Support**

Practitioners might have insufficient training in the principles of EBP, critical appraisal of research, and/or utilization of new technologies. Continuous professional development of clinicians and educators has been advocated to help develop their capacity and confidence in using EBP. There is also a need for mentorship and access to evidence retrieval tools that are user-friendly to promote EBP (Kristanto, 2018).

### **Variability in Children's Developmental Profiles**

Children with special needs exhibit highly variable developmental trajectories, comorbidities, and responses to intervention. Variability of this sort complicates standard protocol application and underlines the need for individualized, flexible approaches. AI-driven adaptive interventions and continuous data-driven monitoring are possible solutions but require further research and rigorous evaluation. (Sideraki & Anagnostopoulos, 2024)

## **Evaluation of Technology and User Experience**

While technology-enhanced interventions hold promise, their effectiveness, usability, and acceptability must be systematically evaluated. As Federici et al. (2020) mention, the absence of standardized frameworks to assess user experience, accessibility, and integration in daily life hinders a more widespread use of innovative tools such as chatbots and social robots. For this reason, comprehensive methodologies of evaluation that comprise both clinical results and user perspectives are the main priority in future research.

## **Recommendations and Future Directions**

### **Strengthening Research and Local Data**

More high-quality, locally relevant research is needed to advance EBP in pediatric rehabilitation. There is a need for RCTs, implementation studies, and longitudinal outcome evaluations conducted in various contexts and populations. Automated evidence classification tools, such as those developed by Frihat and Fuhr (2025), can support practitioners in rapidly identifying and applying robust evidence aligned with local needs.

### **Integrating Family-Centered, School-Based, and Community Rehabilitation**

Integration of a family-centered approach with school-based and community rehabilitation models will provide comprehensive, coordinated care. Early intervention programs should be implemented at the community level, using available resources and aiming to prepare caregivers and educators to be active partners in the rehabilitation process.

### **Scaling Evidence-Based Approaches Through Policy and Training**

Policymakers should focus on scaling evidence-based approaches through investment in training practitioners, infrastructure development, and adapting interventions to local contexts. Training curricula should include EBP principles, critical appraisal skills, technology literacy, and cultural competence. Additional incentives for ongoing professional development can foster networks for knowledge exchange that further support the implementation of EBP.

### **Enhancing the Use of Technology and Personalized Interventions**

Further development and testing of technology-enhanced interventions, such as AI-driven assessment tools, social robots, AAC systems, tele-rehabilitation platforms, and VR applications, hold great potential for increased access, personalization, and effectiveness. Long-term effectiveness, individualization, integration into the existing system, and overall user experience evaluation are some aspects that further research shall be focused on (Sideraki & Anagnostopoulos, 2024; Federici et al., 2020).

Addressing Equity and Access Equitable implementation of EBP should ensure that all interventions are accessible and acceptable to children and families of all backgrounds, regardless of their economic status, geographic locations, or cultures. This may involve the adaptation of interventions for low-resource settings; cost reduction strategies; leveraging community assets; and addressing social determinants of health. Conclusion Evidence-based practice is at the core of rehabilitation for children with special needs, paving the way for better, fairer, and more customized care. The incorporation of solid research evidence, clinical expertise, and family preferences empowers the development and delivery of interventions that not only have a scientific basis but also answer the specific needs of each child and setting. The field stands at a pivotal juncture, marked by advances in early detection, biomarker-guided intervention, AI-powered assessment and therapy, and technology-enabled service delivery. Nevertheless, large hurdles remain regarding the translation of research into practice, especially within resource-constrained environments and amongst diverse populations. Addressing these important challenges demands dedication to capacity building, cultural adaptation, interdisciplinary collaboration, and ongoing intervention evaluation and refinement. Pediatric rehabilitation can realize its promise of maximizing the developmental potential and quality of life for all children with special needs by embracing a holistic, family-centered, contextually sensitive approach that harnesses the new technologies.

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