

Editorial

Technology for healthcare professionals' education about the early detection of cerebral palsy

Efforts to implement early detection policies for Cerebral Palsy (CP) have gained momentum globally, recognizing CP as a leading cause of physical disability across high-, middle-, and low-income countries. A milestone in this process was the publication of a framework for early detection of CP in 2017.¹ This framework recommends combining magnetic resonance imaging, Precht Qualitative Assessment of General Movements (GMs), and the Hammersmith Infant Neurological Examination for babies with risk factors, achieving high accuracy and detection rates exceeding 97 %.¹

Late CP diagnosis has been linked to limited functional outcomes, reduced social participation, higher caregiver dissatisfaction, delayed interventions, and secondary complications, such as developmental delays and orthopedic issues like hip dislocation.¹ Early detection, on the other hand, unlocks opportunities for interventions during critical neuroplasticity periods of the brain, potentially improving developmental outcomes for children and their families.² Parents overwhelmingly express a desire to know about CP diagnoses as early as possible.

Several high-risk infant follow-up clinics in countries like the United States and Australia have integrated the 2017 framework into clinical practice.^{3,4} These implementations have shown promising results, including good feasibility of the guide, increased screening for infants aged 3–4 months, reduced CP diagnosis age, improved staff awareness, and high acceptability among parents and professionals.^{3,4} Additionally, early identification has facilitated access to tailored interventions.⁴ However, this framework remains underutilized globally, with implementation predominantly limited to high-income countries (HICs).⁵

In low- and middle-income countries (LMICs), where CP prevalence is higher and clinical presentations more severe,⁶ early detection frameworks face barriers such as limited resources, structural healthcare differences, and high costs.⁵ For instance, in Brazil, although many therapists are aware of the framework's tools, most do not apply them in practice.⁷

Inclusive strategies are essential to make the framework accessible

worldwide. The use of technology can be an effective tool in the early detection of CP. Technology emerges as a powerful ally, serving both educational⁸ and clinical decision-making processes.⁹ Digital health technologies, including serious games, virtual and augmented reality, and mobile health (mHealth) applications, can bridge the gap.⁹ mHealth, defined as healthcare practice through mobile devices, is expanding rapidly and demonstrates good feasibility in LMICs.¹⁰

In CP-specific contexts, an app leveraging deep learning to analyze infant general movements has proven as accurate as trained professionals in classifying movements, showcasing technology's potential in clinical decision-making.¹¹ Furthermore, serious games have successfully enhanced healthcare education,¹² boosting knowledge, decision-making skills, and collaboration in safe, simulated environments.¹³ Additionally, the use of mHealth has been applied and tested in various healthcare contexts, such as maternal and child health, and can be a useful tool to assist clinical diagnosis.¹⁴

With over five billion smartphone users worldwide, 70 % in low-resource settings, mobile apps are affordable, accessible, and effective tools for healthcare providers.¹⁵ These technologies can support early CP detection, improving outcomes by empowering professionals with knowledge and diagnostic support. Future research should prioritize developing mobile applications tailored to educating healthcare professionals and aiding clinical decision-making for CP detection, ensuring equitable access to early diagnosis worldwide. Fig. 1 outlines several actions that require further improvement to effectively implement this technology for aiding health professionals in the early detection of CP on a larger scale, particularly in low- and middle-income countries.

Declaration of competing interest

The authors declare no conflict of interest.

Actions that still need improvement in order to implement technology on a larger scale, especially in low- and middle-income countries

- ✓ **Enhancing technology accessibility:** affordable devices; reliable electricity; public Wi-Fi networks for underserved areas; offline tools; and mobile health applications and services that can run efficiently on low-cost devices
- ✓ **Education:** co-design culturally relevant materials in partnership with local healthcare workers, parents, and experts; offer visual, audio, and video content for diverse literacy levels; use relatable images and scenarios; provide training to communities in basic technology skills; ensure that materials are available in multiple languages; develop mobile apps or platforms that provide interactive educational content; create region-specific training; provide ongoing education; use simulations for practical experience; and pair novices with mentors
- ✓ **Economics:** Partner with technology companies for affordable tools; secure grants; use existing telehealth platforms to integrate early detection technologies; advocate for open-source early detection technologies that can be adapted and scaled without prohibitive licensing or software costs, and partner with existing mobile health platforms to integrate early detection technologies into their services
- ✓ **Feasibility:** Implement monitoring tools for real-time adoption tracking; user feedback; long-term evaluations of outcomes and cost-effectiveness; implement community-driven data collection; share best practices via forums and publications; and run pilot programs that define adoption rates, user satisfaction, and health improvements
- ✓ **Collaborate with policymakers:** Engage policymakers with data-driven documents on technology benefits; organize discussions on strategies; advocating for making technologies a standard part of child health programs; and collaborate with health ministries for funding

Fig. 1. Suggested actions to improve the implementation of technology for the early detection of cerebral palsy.

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