Case study

Wearables and sub-movements analysis in pediatric AHC patients

About RARE Hope

RARE Hope is a patient-centered organization dedicated to accelerating the development of therapeutics for rare neurological diseases. Adopting a unique "platform approach," the organization focuses on Alternating Hemiplegia of Childhood (AHC) as a prototype to build a scalable infrastructure for research, biomarker development, and clinical trial readiness. By leveraging common biological mechanisms and a shared scientific and clinical toolkit — and by uniting scientists, clinicians, and patient families — RARE Hope aims to incubate innovation and de-risk the therapeutic pipeline, ensuring that promising treatments can move rapidly from the lab to the patients who need them.

The opportunity

Evaluate objective signals to serve as secondary endpoints in clinical trials.

- With ASO and gene editing programs underway, RARE Hope is working to investigate biomarkers that could serve as surrogate endpoints for future clinical trials.
- There is a critical need to establish robust, objective measures of disease burden and treatment effect in AHC. Integrating digital health technologies (DHTs) into clinical research offers the opportunity to capture high-frequency, real-world data that subjective diaries and episodic clinic visits miss.
- By validating objective digital signals related to motor function, RARE Hope aims to develop reliable secondary endpoints that can sensitively measure efficacy in upcoming clinical trials, ultimately supporting clearer go/no-go decisions for candidate therapeutics.

The challenge

Distinguishing complex, variable motor symptoms in a real-world setting.

- AHC presents a unique measurement challenge due to its dual nature: patients experience unpredictable, paroxysmal episodes (such as hemiplegia and dystonia) on top of chronic baseline motor impairments (such as ataxia).
- Standard clinical rating scales often lack the granularity to detect subtle changes in movement quality ("sub-movements") that may indicate early therapeutic efficacy before gross motor improvements are visible.

The approach

- To address these challenges, Dr. Anoopum Gupta and his team at Harvard/MGH are conducting a pilot study to deploy a sophisticated digital biomarker protocol using machine learning-enabled sub-movement analysis of data derived from at-home used wearables.
- The study utilizes wearable sensors to collect continuous, real-world motion data from pediatric AHC patients in their home environments.
- The team applies a proprietary "sub-movement analysis protocol" integrated with machine learning algorithms. This approach decomposes complex motor actions into elementary kinematic building blocks, allowing for the quantification of fluidity, speed, and consistency.
- Building on Dr. Gupta's successful application of this technology in ALS, ataxia-telangiectasia, and spinocerebellar ataxia, the study aims to train algorithms to specifically identify AHC-associated movement disturbances.

A key goal of the analysis is to distinguish movement differences between children with AHC and children without AHC. A secondary objective is to differentiate paroxysmal episodes from baseline activity, creating a digital "fingerprint" for different disease states that can serve as a responsive outcome measure for trials.

The impact

De-risking clinical trials through quantitative, patient-centric evidence.

- ✔ The successful validation of this sub-movement analysis protocol stands to transform the clinical trial landscape for Alternating Hemiplegia of Childhood (AHC) and potentially other paroxysmal disorders.
- ✔ The project serves as a proof-of-concept for RARE Hope's platform approach, demonstrating how academic innovation (Harvard/MGH) can translate into regulatory-ready tools. It provides a replicable model for developing digital endpoints in other complex neurological conditions characterized by variable motor phenotypes.

> "RARE Hope looks for opportunities to maximize impact by advancing shared infrastructure and tools that can support multiple conditions at once. These core digital measures for pediatric rare disease were developed to be biologically and clinically appropriate for individual conditions while fitting within a shared, scalable framework. Shaped by diverse, multidisciplinary input, they enable consistent, objective, regulator-ready assessment across disorders — delivering tools and infrastructure that can ultimately improve the lives of more patients and families."
>
> **—Nina Frost** *President, RARE Hope*