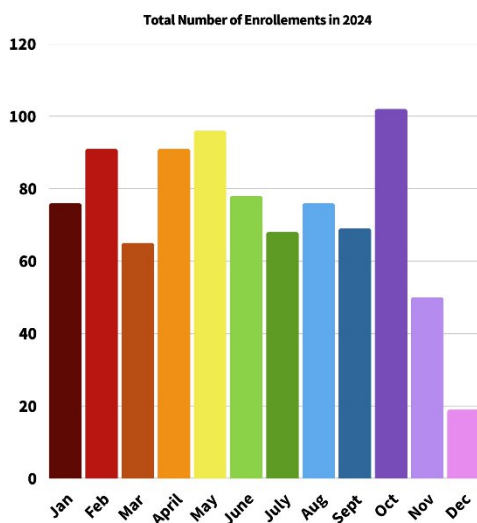# 5000 Baby Project: Screening Newborns to Develop an Algorithm for Early Detection of Neurodevelopmental Disorders

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Abstract

The *5000 Baby Project* aims to transform early detection of developmental delays, enabling timely diagnosis and intervention within the first months of life. This research employs clinical, evidence-based monitoring to analyze infants' natural motor activity before six months of corrected age. Using video-based sensor technology, skeletal tracking, and artificial intelligence, the study identifies abnormal movement patterns associated with neuromuscular disorders such as autism and cerebral palsy. Infants are recruited from the Nationwide Children's Hospital network of clinics and the Mount Carmel St. Ann's birthing unit. To date, over 3,400 infants have been enrolled, with up to six-minute recordings capturing spontaneous movements while supine. The data extraction and analysis team is refining tracking and processing algorithms to classify

Total Number of Enrollments in 2024

movements as typical or atypical, based on long-term developmental outcomes at ages two and three. Preliminary findings indicate that the algorithm effectively differentiates typical from aberrant movement patterns. With continued enrollment, the study aims to refine cohort classification, enhance early identification, and facilitate prompt intervention while uncovering insights into the underlying mechanisms of these disorders. This approach holds promise for improving early diagnosis, treatment initiation, and long-term developmental outcomes, ultimately enhancing quality of life for affected infants.

I. Introduction

The average age of autism spectrum disorder (ASD) diagnosis is approximately 4 to 5 years, delaying critical early intervention (Lord et al., 2020).[1] Similarly, cerebral palsy (CP) is typically diagnosed around age 2, despite evidence that early intervention significantly improves outcomes (Novak et al., 2017).[2] Research indicates that interventions during infancy can enhance motor, cognitive, and social development (Zwaigenbaum et al., 2015).[3]

The *5000 Baby Project* seeks to address this issue by developing an AI-powered application that analyzes infant motor activity within the first six months of life. By detecting subtle movement abnormalities relative to age-matched norms, the app facilitates earlier diagnosis of ASD and CP.

Early detection enables timely intervention, potentially reducing long-term complications. This technology has the potential to transform neurodevelopmental screening, improve outcomes for at-risk children, and allow clinicians to diagnose disorders at a younger age.

II. Methods

Early intervention in abnormal movement patterns in infants is crucial, as it enables healthcare providers to identify potential neurological and developmental disorders while intervention remains effective. By leveraging technology that distinguishes between normal and abnormal movements, the healthcare system could evolve to facilitate early diagnosis of conditions such as cerebral palsy, developmental delays, and neuromuscular disorders (CDC, 2025).[4]

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[1] Lord, C., Elsabbagh, M., Baird, G., & Veenstra-VanderWeele, J. (2020). *Autism spectrum disorder.* The Lancet, 395(10242), 508-520.
[2] Novak, I., Morgan, C., Adde, L., Blackman, J., Boyd, R. N., Brunstrom-Hernandez, J., ... & Badawi, N. (2017). *Early, accurate diagnosis and early intervention in cerebral palsy: Advances in diagnosis and treatment.* JAMA Pediatrics, 171(9), 897-907.
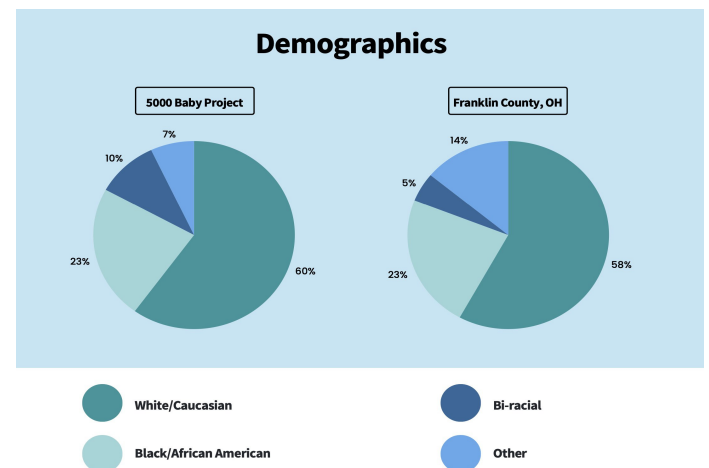[3] Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D., ... & Natowicz, M. R. (2015). *Early intervention for children with autism spectrum disorder under 3 years of age: Recommendations for practice and research.* Pediatrics, 136(Suppl 1), S60-S81.
[4] Centers for Disease Control and Prevention (CDC). *(n.d.). Learn the signs. Act early.* National Center on Birth Defects and Developmental Disabilities.

Furthermore, physical and occupational therapy has been shown to improve motor function and cognitive development (AAP, 2025).[5] This, in turn, could enhance long-term outcomes by reducing the severity of developmental impairments and promoting neuroplasticity through personalized treatment plans (NICHD, 2025).[6] The future of healthcare aims to promote health equity by ensuring that these advancements are accessible to all populations, regardless of background. Developing a cost-effective platform for easy implementation would integrate this technology into routine pediatric checkups, reducing barriers to access currently faced by families seeking specialized diagnostic tools (WHO, 2025).[7] Additionally, collaboration with community health organizations and government programs could help ensure equitable access to publicly funded technology for all infants (WHO, 2025).[7]

III. Results

While the technology is still in the developmental stages, pilot analyses suggest its capability to distinguish between normal and abnormal movements. In 2024, we successfully enrolled nearly 900 infants across all clinics and the birthing hospital, with the following racial demographics: 60% White/Caucasian, 23% Black/African American, 10% biracial, and 7% classified 58% White, 23% Black, 5% biracial, and 5% Asian (Census Reporter, 2025).[8] Of those enrolled, 480 were under one month old.

Demographics

5000 Baby Project — 7%, 10%, 23%, 60%

Franklin County, OH — 14%, 5%, 23%, 58%

White/Caucasian
Black/African American
Bi-racial
Other

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[5] American Academy of Pediatrics (AAP). *(n.d.). Developmental surveillance resources for pediatricians.* AAP Patient Care.
[6] National Institute of Child Health and Human Development (NICHD). *(n.d.). Infant care.* NICHD.
[7] World Health Organization (WHO). *(n.d.). Health equity.* WHO Health Topics.
[8] Census Reporter. *(n.d.). Franklin County, OH.* Census Reporter.

IV. Discussion

This study recruits infants from birth to six months of corrected age from Nationwide Children's Hospital clinics, the main hospital, and St. Ann's birthing unit. To date, over 3,400 infants have been enrolled. After obtaining parental consent, the infant is placed on a mat, wearing only a diaper, and their natural movements are recorded for up to six minutes. The technology used for recording is the "ACTIVEmini," which is connected to a camera positioned 3 feet above the baby. Parents also complete a pregnancy and birth history questionnaire to document any birth complications, which are then factored into the analysis. The advanced sensor technology, skeletal tracking, and AI algorithms analyze these recordings, working alongside data scientists to identify and differentiate typical versus atypical movement patterns. To validate these results, participants' charts are reviewed up to 18 years of age as a follow-up to determine if a motor and/or developmental diagnosis was made, serving as a control measure. This allows researchers to compare the predicted diagnosis with actual neurodevelopmental outcomes.

Acknowledgments:

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2. Centers for Disease Control and Prevention (CDC). (n.d.). Learn the signs. Act early. *National Center on Birth Defects and Developmental Disabilities.* https://www.cdc.gov/ncbddd/actearly/index.html

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7. World Health Organization (WHO). (n.d.). Health equity. *WHO Health Topics.* https://www.who.int/health-topics/health-equity#tab=tab_1

8. Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D., ... & Natowicz, M. R. (2015). Early intervention for children with autism spectrum disorder under 3 years of age: Recommendations for practice and research. *Pediatrics, 136*(Suppl 1), S60-S81. https://doi.org/10.1542/peds.2014-3667E