Acceptability and Feasibility of a Community-Delivered Digital Tool for Neuro-developmental Profiling

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Background

- In many low-and-middle income countries (LMICs), early identification of children with neuro-developmental difficulties, including autism, remains limited due to the lack of effective developmental surveillance systems. As a result, children who are faltering in their development often go unnoticed and unsupported, missing the opportunity for timely intervention and hindering their ability to reach their full potential.

- Barriers include:
  - Scarcity of trained professionals
  - Services predominantly located in urban, private clinics
  - Dependence on time-intensive, specialist-driven assessments developed, normed, and marketed for high-income countries (HICs)

- Neuro-developmental assessment tools should be:
  - Administrable by non-specialist workers (NSWs) in community settings
  - Culturally adaptable
  - Scalable through innovative digital infrastructure

Features

- ✓Gamified tasks for cognitive, social, and motor development
- ✓Observational assessments and parent-reports
- ✓Audio/video recording and flexible surveys
- ✓Enabled offline data collection for remote settings
- ✓Secure data management with multiple access levels for data privacy
- ✓Intuitive content management system

Methods

- Scalable TRansdiagnostic Early Assessment of Mental health (STREAM): an open-source, tablet-based application assessing neurodevelopment at 0–6 years.

- Administrable by NSWs

- Piloted in 2 LMICs: New Delhi, India and Blantyre, Malawi, with children aged 0-72 months, including both typically developing *(community sample)* and neurodivergent children *(enriched sample)*

- Integrates 3 validated developmental assessment tools into a unified platform, optimized through workshops and iterative pilot testing:

  - DEvelopmental assessment on an E-Platform (DEEP) - Gamified cognitive assessment *(Bhavnani et al., 2019)*

  - Screening Tools for Autism Risk using Technology (START) - Mobile platform evaluating social, sensory, and motor behavioural domains linked to autism through both child performance and caregiver report *(Dubey et al., 2023)*

  - Malawi Developmental Assessment Tool (MDAT) - Observational and caregiver-report *(Gladstone et al., 2010)*

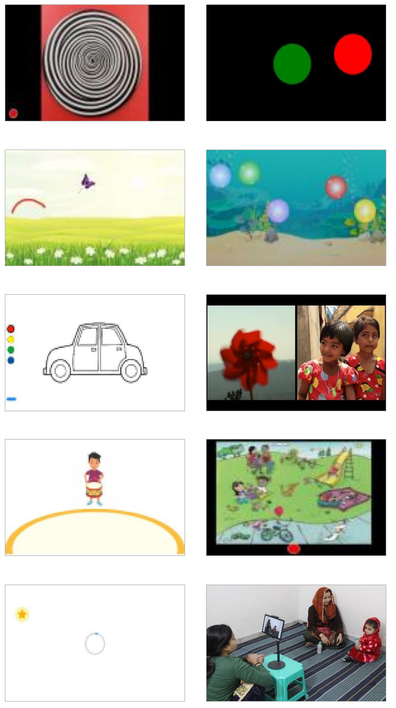
Results

Characteristics	India		Malawi	
	Community sample	Enriched sample	Community sample	Enriched sample
Sample size	1851 (50% girls)	104 (33% girls)	1880 (50% girls)	155 (39% girls)
Participation rate	97.3%	64.2%	99.4%	97.8%
Stunting	26%	24.3%	32.4%	40.7%
Task completion	100% *At least 6/12 tasks*	~18%-99% *Varied tasks*	100% *At least 4/12 tasks*	~18%-99% *Varied tasks*

*Completion rates for remaining tasks was ~97%-99.5% across both sites.
*Simple gaze and visuo-motor were the tasks most often completed among enriched sample

DEEP

MDAT



START

Discussion

- STREAM is a feasible and acceptable tool for assessing early neurodevelopment when used by NSWs in low resource settings.

- High task completion rates support consistent engagement, while children's ability to engage with a wide range of tasks highlights the tool's versatility in accommodating both typically developing and neurodivergent children.

- STREAM demonstrates strong scalability for low-resource settings, enabled by its capacity for offline data collection and subsequent secure data upload once internet connectivity becomes available.

Future Implications

- To test STREAM's potential for adaptability and task-shifting, it will be implemented across diverse, low-resource settings with non-specialist users.

- To test its effectiveness in early detection, STREAM will be further validated and evaluated for impact on early intervention.

- To test its scalability and potential for integration into digital health platforms for real-time monitoring, self assessment, and population-level data collection - enabling future research and refinement of current diagnostic methods.

References

- Bhavnani, S., Mukherjee, D., Dasgupta, J., Verma, D., Parameshwaran, D., Divan, G., Sharma, K. K., Thiagarajan, T., & Patel, V. (2019). Development, feasibility and acceptability of a gamified cognitive developmental assessment on an e-platform (DEEP) in rural Indian pre-schoolers – A pilot study. *Global Health Action, 12*(1), 1548005. doi: 10.1080/16549716.2018.1548005

- Dubey, I., Bishain, R., Dasgupta, J., Bhavnani, S., Belmonte, M. K., Gliga, T., Mukherjee, D., Lockwood Estrin, G., Johnson, M. H., Chandran, S., Patel, V., Gulati, S., Divan, G., & Chakrabarti, B. (2023). Using mobile health technology to assess childhood autism in low-resource community settings in India: An innovation to address the detection gap. *Autism, 28*(3), 755–769. doi: 10.1177/13623613231182801 *(Original work published 2024)*

- Gladstone, M., Lancaster, G. A., Umar, E., Nyirenda, M., Kayira, E., van den Broek, N. R., & Smyth, R. L. (2010). The Malawi Developmental Assessment Tool (MDAT): The creation, validation, and reliability of a tool to assess child development in rural African settings. *PLoS Medicine, 7*(5), e1000273. doi: 10.1371/journal.pmed.1000273

Partners

For more project details scan here