Penn Computerized Neurocognitive Battery Cutoff Scores: Moving from Research to Impact

Branch, KB; Moore, TM; Scott, JC; Lowenthal, ED

Johns Hopkins University, School of Medicine; University of Pennsylvania, Perelman School of Medicine

Children affected by human immunodeficiency virus (HIV) are at elevated risk for neurodevelopmental delays, underscoring the need for accessible cognitive assessment in high HIV-prevalence settings such as Botswana, where screening remains uncommon due to limited access to appropriate tools. The Penn Computerized Neurocognitive Battery (PCNB), culturally adapted and validated for use in Botswana, offers a feasible approach to assessing cognitive performance across 14 tasks spanning executive functioning, psychomotor/processing speed, episodic memory, and complex cognition. However, translating PCNB performance into information that can inform individual support remains a challenge. Multivariate normative comparison (MNC), commonly used in PCNB studies to identify overall neurocognitive impairment, provides a global measure of performance that may obscure domain-specific weaknesses masked by relative strengths in other areas. To address this limitation, we designed a domain-based "2-flag" system that identifies individuals with ≥ 2 scores below a standard deviation cutoff within a singular domain. Using data from 628 Botswana students aged 7-<18, we evaluated different standard deviation cutoffs, compared the 2-flag system with MNC, refined the approach to account for missing data, and manually reviewed discordant cases for practical relevance to school-based implementation. MNC picked up 85 individuals as impaired, compared with 147 identified by the 2-flag system, with 62.4% agreement. Importantly, individuals identified by the 2-flag system but not MNC generally exhibited domain-specific weaknesses rather than patterns suggestive of false-positive classification, as these weaknesses were observed in cognitive domains commonly affected among children living with or affected by HIV. The 2-flag system provided more interpretable cognitive profiles that highlighted both areas of concern and relative strengths, while its simplicity and scalability support automated implementation. By moving beyond a single global measure of impairment to identify domain-specific patterns of performance, this approach represents a step toward translating a research-based neurocognitive tool into a practical resource that can generate actionable information for children, educators, and other stakeholders.