

Validation of a Rapid Neurodevelopmental Assessment Tool for 5 to 9 Year-Old Children in Bangladesh

Naila Z. Khan, MBBS, FCPS, PhD¹, Humaira Muslima, MBBS, DCM¹, Shams El Arifeen, MBBS, PhD², Helen McConachie, PhD³, Asma Begum Shilpi, MSc¹, Shamim Ferdous, MBBS, DCH⁴, and Gary L. Darmstadt, MD, MS⁵

Objective To validate a rapid neurodevelopmental assessment tool for use by child care professionals to determine neurodevelopmental impairments (NDIs) in children ages 5-9 years (61-108 months) in Bangladesh.

Study design In a convenience sample of community children (n = 18), interrater reliability was determined between 6 testers. Validity was determined in 121 children by simultaneous administration of a test of adaptive behavior (AB) (ie, the Independent Behavior Assessment Scale, or Gold Standard I) and IQ tests (Wechsler Preschool and Primary Scales of Intelligence or the Wechsler Intelligence Scales for Children, or Gold Standard II) by child psychologists.

Results Interrater reliability was excellent ($\kappa = 1.00$). Significantly lower scores were obtained on AB and IQ tests in those identified with “any (≥ 1) NDI” and most specific NDIs. Sensitivity and specificity for “any NDI” with (a) “significant difficulties” (defined as AB z-scores < -2 SD and/or IQ < 70) or (b) “mild difficulties included” (AB z-scores < -1 SD and/or IQ < 85) were 84% and 57%; and 83% and 70%, respectively.

Conclusion The rapid neurodevelopmental assessment tool shows promise as a tool for use by a range of professionals for identifying NDIs in children of primary school age. Further refinement for identifying specific impairments is needed. (*J Pediatr* 2014;164:1165-70).

In Bangladesh the proportion of children ages 2-9 years at-risk from neurodevelopmental impairments (NDIs) and disabilities has increased from an estimated 8% in 1988¹ to 18% in 2005.² With more than one-fifth of school-enrolled children ages 5-9 years dropping out,³ a simplified system of neurodevelopmental surveillance is needed to identify those with functional limitations who may benefit from appropriate interventions, leading to greater rates of school completion.

Available systems of surveillance are cumbersome for application nationwide in developing countries. A 2-stage procedure of home-based screening for childhood disabilities by frontline workers, followed by multiprofessional assessment of children ages 2-9 years, although validated across cultures,⁴ has proven to be too expert-dependent to be feasible in most countries.² As a result, even though the Ten Questions (TQ) is the most frequently used home-based neurodevelopmental screening tool worldwide,⁵ children’s specific functional limitations, important for planning appropriate intervention programs, generally remain undetermined.

In acknowledgment that impairments (ie, temporary functional limitation) and disabilities (ie, permanent functional limitation) exist in a continuum as defined by the International Classification of Functioning of the World Health Organization,⁶ there is a need to identify specific NDIs in at-risk children to most effectively prevent or ameliorate progression to disabilities. On the basis of this concept, we have reported the validation of simplified tools for use by nonspecialist health professionals in younger children (ie, ages 0-2 years⁷ and 2-5 years).⁸ The objective of this study was to validate a rapid neurodevelopmental assessment (RNDA) tool for use in children ages 5-9 years by multiple types of child care professionals to assess children comprehensively for a range of NDIs.

Methods

For all children assessed with the RNDA, a written consent form was signed by literate mothers, and verbal consent was taken for those who were nonliterate. Logistic support (ie, travel cost and lunch) was provided to the families for attending the assessment session. The research protocol was approved by the Affairs of the NGO Bureau, Chief Advisor’s Office, Government of Bangladesh.

BPF	Bangladesh Protibondhi Foundation
FSIQ	Full Scale IQ
IBAS	Independent Behavior Assessment Scale
NDI	Neurodevelopmental impairment
RNDA	Rapid Neurodevelopmental Assessment
TQ	Ten Questions
TQP	Ten Questions Plus
WISC-R	Wechsler Intelligence Scale for Children, Revised
WPPSI	Wechsler Preschool and Primary Scales of Intelligence

From the ¹Child Development Center, Department of Pediatric Neuroscience, Dhaka Shishu (Children’s) Hospital, Sher-e-Bangla Nagar, Dhaka, Bangladesh; ²Center for Child and Adolescent Health, International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B), Mohakhali, Dhaka, Bangladesh; ³Department of Child Clinical Psychology, Newcastle University, Newcastle upon Tyne, United Kingdom; ⁴Bangladesh Protibondhi Foundation, Mirpur, Dhaka, Bangladesh; and ⁵Global Development, Bill & Melinda Gates Foundation, Seattle, WA

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RNDA for >5- to 9-Year-Old Children

The RNDA consists of a structured form with items arranged under the following 8 neurodevelopmental domains: gross motor, fine motor, vision, hearing, speech, cognition, behavior, and seizures. All items are designed for administration by a single tester. Individual items across these domains that were considered for inclusion in the tool were those age-referenced in assessment procedures worldwide and from our own clinical experience (Table I; available at www.jpeds.com).^{6,9-25} In an attempt to adapt the International Classification of Functioning⁶ for children, items have been considered from both the category of “body functions” (eg, global, psychosocial, attention, emotions, intellectual, seeing, hearing) and “activities” (eg, gross motor, fine motor, communication, self-care). Inability to perform an activity is considered under the generic umbrella of “impairments,” with “disabilities” included within this label.

A Summary Sheet for the 8 domains is completed during the assessment. For every NDI, severity is recorded based upon criteria provided in the RNDA form (Figure 1; available at www.jpeds.com). Outcomes of the severity ratings are not reported in this article. The RNDA comes with a detailed user manual.

Additional information collected before the administration of the RNDA includes: (1) determination of gestational and chronological ages; (2) a short history that includes sociodemographic information, birth history, nutritional information, and any health or developmental worries of care-providers; (3) anthropometry; and (4) a general physical examination. Administration and scoring of the RNDA takes, on average, about 30 minutes, compared with a comprehensive multidisciplinary neurodevelopmental assessment by a physician and a psychologist that would take about 3 hours.

Testers

Six professionals, experienced in providing holistic intervention to children with NDIs, and with a minimum work experience of 4 years, served as testers. Four testers were developmental therapists (ie, generic therapists with training, but no formal degree, in a combination of physio-, occupational, and speech and language therapy, within a developmental framework), and 2 testers were special education teachers (ie, Masters in Special Education, but with no previous experience in conducting neurodevelopmental assessments). Because the underlying concept of the test is based on observation of functional abilities of children by professionals with some (but not necessarily extensive) experience in children’s development, it was assumed that the testers would be able to administer the RNDA validly, irrespective of their varied professional backgrounds. A 2-week training course for the testers was conducted on the procedures.

Interrater Reliability

Children in the target age group (>5-9 years) who were either siblings of those attending an inclusive primary school of the Bangladesh Protibondhi Foundation (BPF) or who lived in the adjacent community were invited by

convenience sampling for testing on the RNDA. The RNDA was administered by one main tester at a time, and others observed the procedure and marked the child’s functions on the Summary Sheet, without consultation with each other. Each tester administered the RNDA to at least 2 children.

Validity

Study Population. An initial door-to-door survey of children ages 0-9 years for NDIs was conducted in 2 urban wards within Dhaka city, the capital of Bangladesh: Mirpur (ward number 7) and Malibag (ward number 54). A total of 1000 children were screened as per the 2-stage study design of “rare disorders” of Shrout and Newman,²⁶ where a 10% “screen positive” rate is expected. Community workers with at least 10 years of schooling visited the households and conducted interviews of mothers using an adapted version of the TQ^{1,4} (ie, the TQ Plus [TQP]),²⁷ which includes an additional question on behavior²⁸ (Figure 2; available at www.jpeds.com). Of the 1000 children screened, 514 were ages >5 to 9 years, of whom 78 (15.2%) screened positive. All screen-positives (n = 78) and a subsample of age- and sex-matched screen-negative children (n = 43) were invited to the BPF school closest to their residence for assessment on the RNDA. The assessors were blinded to screening results.

Follow-Up. After each administration of the RNDA, the child’s neurodevelopmental status was discussed with the parents. They were given advice on nutrition, interactive play and story-telling, and strategies to reduce maternal stress, which have been found to optimize development in low-resource settings.²⁹ Specific interventions and referrals were advised as appropriate. All children with one or more NDI on the RNDA were invited back to the BPF for a more comprehensive, third-stage multidisciplinary specialist assessment (ie, the General Developmental Assessment) at a later date, mainly for diagnostic purposes (not reported in this work).

Gold Standard I Test of Adaptive Behavior: Independent Behavior Assessment Scale.

The Independent Behavior Assessment Scale (IBAS) was developed in Bangladesh for the assessment of adaptive behavior of children ages 2-9 years.²⁰ Test items were modified from western adaptive behavior scales and were made more contextually relevant based on ecological inventories of real-life functional situations of urban and rural Bangladeshi children, who may not have access to formal learning facilities. Through maternal recall and direct testing, children were evaluated on the following 4 subscales: motor, socialization, communication, and activities of daily living. Norms are presented as means and SD and as percentile ranks for each of the subscales in each age group. A full-scale score and percentile rank also were calculated.

Gold Standard II: IQ Tests. Tests for measurement of IQ were administered by psychologists according to the

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