Research in Developmental Disabilities 35 (2014) 733–740

Contents lists available at ScienceDirect

Research in Developmental Disabilities

# Movement Assessment Battery for Children-2: Translation, reliability, and validity for Brazilian children

N.C. Valentini [a], M.H. Ramalho [b], M.A. Oliveira [c,*]

[a] Department of Physical Education, School of Physical Education, Federal University of Rio Grande do Sul, Rua Felizardo 7500, Bairro Jardim Botânico, Porto Alegre, Rio Grande do Sul, Brazil
[b] Department of Physical Education, State University of Santa Catarina, Rua Pascoal Simone 358, Coqueiros, Florianópolis, Santa Catarina, Brazil
[c] School of Public Health, University of Maryland, College Park, MD, USA

ARTICLE INFO

*Article history:*
Received 16 May 2012
Received in revised form 23 October 2013
Accepted 28 October 2013
Available online 27 November 2013

*Keywords:*
Movement Assessment Battery for children
Developmental Coordination Disorder (DCD)
Construct validity
Content validity

ABSTRACT

The Movement Assessment Battery for Children 2nd edition (MABC-2) is a well-recognized assessment used to identify children with Developmental Coordination Disorder (DCD). Although researchers and practitioners across Brazil have used the MABC-2 to identify children with motor deficits, its validation for this particular population has yet to be investigated. In this study, we translated all MABC-2 items and validated them with respect to content, construct and criteria validity. The validation process involved 13 experts in Motor Development and a total of 844 children (3–13 years old) from two different states in Brazil. A cross-cultural translation method yielded a Brazilian–Portuguese version of the battery. The expert panel confirmed language clarity and pertinence of the items. High intra- and inter-rater reliability and internal consistency for the MABC-2 was established for Brazilian children. A discriminant analysis confirmed the MABC-2 power (.80) to differentiate children with DCD and those at risk for DCD from typically developing children. Predictive validity was observed for the impairment scores and a percentile main effect was found in the repeated measures ANOVA (*ICC*: .93 and .73, respectively). Although our data are not representative of the entire country, this study is the first to confirm that the original standardized scores established for the MABC-2 are valid in Brazilian children.



## 1. Introduction

Children with difficulties in the execution of gross (Geuze, 2005; Missiuna, Gaines, & Soucie, 2006) and fine motor skills (Summers, Larkin, & Dewey, 2008) and lacking postural control (Summers et al., 2008) have been diagnosed with Developmental Coordination Disorder (DCD). Research has shown that DCD has adverse effects on children's everyday life and the reported prevalence varies across countries, including USA – 6% (APA, 2000), UK – 2% (Lingam, Hunt, Golding, Jongmans, & Emond, 2009), and Greece – 19% (Tsiotra et al., 2006). There has been an increased focus on the diagnosis and assessment of this disorder as these difficulties are not due to an identifiable neurological or sensory problem (APA, 2000).

Several assessment tools are used to identify children with DCD including the Bruininks–Oseretesky Test of Motor Proficiency (Bruininks, 1978), the Motor Dysfunction Index (Gillberg, Carlstrom, Rasmussen, & Waldenstrom, 1983), and the

* Corresponding author at: School of Public Health, University of Maryland, Room 2242-C, SPH Building, College Park, MD, USA. Tel.: +1 301 405 2454.
*E-mail addresses:* nadiacv@esef.ufrgs.br (N.C. Valentini), mhelena.ramalho@gmail.com (M.H. Ramalho), marcio@umd.edu (M.A. Oliveira).

0891-4222/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ridd.2013.10.028

first edition of the Movement Assessment Battery for Children – MABC-1 (Henderson & Sugden, 1992). Overall, the MABC-1 is the most common assessment tool used to assess children with motor impairments (Geuze, Jongmans, Schoemaker, & Smith-Engelsman, 2001). The MABC-2 (Henderson, Sugden, & Barnett, 2007) has been widely adopted by clinicians and researchers in several countries (Chow & Henderson, 2003; Croce, Horvat, & McCarty, 2001; Ellinoudis et al., 2011; Engel-Yeger, Rosenblum, & Josman, 2010).

One of the obstacles faced by practitioners and researchers is the absence of translated and validated versions of the MABC-1 and MABC-2 for different geographic, socioeconomic and cultural backgrounds (Engel-Yeger et al., 2010). To our knowledge, although frequently employed in Brazil, the MABC-2 has not been properly validated for this population. This is a critical problem because the diagnosis of DCD, similar to other movement disorders, depends on the use of reliable and valid instruments (Netelenbos, 2005; Wiart & Darrah, 2001; Yun & Ulrich, 2002). Although not yet validated in Brazil, there have been studies on MABC-2 validation in other countries. For example, a study conducted in Greece revealed adequate coefficients of test–retest reliability for children in Age Band I (*ICC* = .85) (Ellinoudis et al., 2011). Furthermore test–retest reliability was also confirmed for a group of Taiwanese children with DCD (*ICC* = .97; Wuang, Su, & Huang, 2012a; Wuang, Su, & Su, 2012b). These studies provided support for the reliability of MABC-2; however, they were restricted to specific ages and groups of children. Moreover, although the factorial validity of the MABC-2 has been reported in the literature (Ellinoudis et al., 2011; Wagner, Kastner, Petermann, & Bös, 2011), there is a lack of studies that report discriminant validity (Brown & Lalor, 2009; Venetsanou et al., 2011; Wagner et al., 2011).

Accurate and valid assessment techniques are imperative to promote global understanding and multicultural relationships of DCD. As researchers envision collaborating and developing large data sets (big data) to investigate developmental disorders, common standards must be established. Currently, researchers investigating DCD employ different assessment tools and behavioral measures, leading to differential diagnostics. In many cases, assessment tools are selected according to access, availability and psychometric properties, and used based on the assumption of universal application. However, as researchers have previously emphasized, it is unusual to find translated and validated assessment tools in which the procedures are adequately described and standardized adjustments are published (Bhui, Mohamud, Warfa, Craig, & Stansfeld, 2003; Vallerand, 1989). Yet, content validity should be strengthened in different cultures in order to trust test results (Bhui et al., 2003). Furthermore, investigations of cultural clarity, pertinence, reliability and validity are critical prior to the use of instruments for individuals with different cultural backgrounds (Cicchetti & Rourke, 2004; Cronbach, 1989; Vallerand, 1989). Unreliable assessment will inevitably lead to misdiagnoses (Yun & Ulrich, 2002), resulting in generating false alarms or failing to detect a disorder (Henderson et al., 2007).

Reliable and valid assessment tools allow for international comparative studies of incidence, prevalence and individual profiles. These particular studies contribute to knowledge about the epidemiology of different disorders (Bhui et al., 2003). Yet, since the reliability and validity of a single assessment are not constant across populations of individuals the psychometric proprieties of an assessment must be investigated in order to comprise a suitable body of knowledge (Yun & Ulrich, 2002). Therefore, the aims of this study were to: (1) translate the MABC-2 into the Brazilian–Portuguese language; and (2) examine the reliability and validity of the translated MABC-2.

## 2. Method

### 2.1. Participants

A total of 844 children (440 boys and 404 girls) between 3 and 13 years of age (*M* = 8.31, *SD* = 2.91) were participants in the study. Participants (59.6% white and 40.4% non-white) attended public schools and had no known history of physical and/or learning disabilities. Consent was obtained from the custodial caregivers of each child as well as from each professional participating in the study. All caregivers were informed about the test results and received a report with the participant's motor performance scores. Information about public services was provided to those children identified with low motor scores (at or below 15% percentile). Table 1 provides detailed information about the participants. The school boards of education from 6 cities from two states in the south of Brazil (Rio Grande do Sul and Santa Catarina) approved the research procedures in 14 schools and mediated the contact between the researcher and the schools' administrators and teachers. The objectives and relevance of this study were presented to teachers and administrators. Informed consent was sent home by classroom' teachers.

### 2.2. Assessment

Children were assessed using the MABC-2 (Henderson et al., 2007). The MABC-2 is designed to assess motor impairments of children in different age bands (AB) from 3 to 16 years old (AB1: 3–6 years; AB2: 7–10 years; AB3: 11–16 years). The MABC-2 comprises 8 tasks, 3 tasks measuring manual dexterity (MD) (posting coins/placing or turning pegs; threading lace/set-up triangle; drawing), 2 tasks measuring ball skills (BS) (throwing/aiming and catching) and 3 tasks measuring balance (B) (one or two leg balance; walking lines; jumping or hopping). The entire assessment takes an average of 30 min for each child to complete. Motor impairment scores are acquired and compared to standardized norms. The norms were established on a standardization sample of 1172. An impairment score at or below the 5th percentile is the standard cut off for severe motor coordination difficulties and serves as an indication that the child has DCD. Children scoring between the 6th and 15th