

Original article

# Applicability of the Movement Assessment Battery for Children-Second Edition to Japanese children: A study of the Age Band 2

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## Abstract

**Background:** The diagnosis of Developmental Coordination Disorder (DCD) requires a precise assessment of motor skills via a standardized tool such as the Movement Assessment Battery for Children-Second Edition (MABC-2). Although the MABC-2 has been widely used in English-speaking countries, to the best of our knowledge, no studies have examined its applicability to Japanese children. Thus, it has been difficult to diagnose DCD in Japan.

**Aims:** As a preliminary investigation preceding its formal standardization in Japan, we examined the applicability of the MABC-2.

**Methods and procedures:** Participants comprised 132 typically developing Japanese children who completed a test set of the MABC-2 for Age Band 2. We analyzed both internal consistency and factorial validity for our Japanese sample. We also included a comparison between our sample of Japanese children and the normative sample of the MABC-2, as well as an examination of gender differences.

**Outcomes and results:** Our results indicated acceptable internal consistency and scale homogeneity. High factorial validity, which has not been examined in other populations, was also confirmed for the test set. Moreover, we found differences in component scores between the Japanese and normative children with respect to Manual Dexterity and Balance. We also found that girls obtained superior Manual Dexterity and Balance scores compared with boys.

**Conclusions and Implications:** The present findings represent the first step towards the standardization of the MABC-2 in a Japanese population.

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**Keywords:** Movement Assessment Battery for Children-Second Edition (MABC-2); Developmental Coordination Disorder (DCD); Japanese; Structural equation modeling

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## 1. Introduction

Developmental Coordination Disorder (DCD) is a neurodevelopmental disorder characterized by severely impaired motor ability, including fine and gross motor skills, postural control, and movement coordination [1]. DCD is diagnosed based on precise assessments of motor skills via standardized tests with good reliability and validity. DCD is frequently assessed using the Movement Assessment Battery for Children-Second Edition (MABC-2), which was developed based on normative sample in the UK by Henderson and her colleagues [2] as a revision of the previous version [3]. The MABC-2 has been widely used in English-speaking countries, and several researchers have translated and adapted the battery for use in additional global regions [4–6]. However, to the best of our knowledge, no research groups have attempted to create a Japanese version of the MABC-2, which is desperately needed for the reliable diagnosis and treatment of children with DCD. Therefore, it is necessary to examine the applicability of the MABC-2 to Japanese children in preparation for the formal standardization of a Japanese version of this test.

The MABC-2 has been tested outside the UK. In China and Greece, studies examined the test set in a group of preschoolers (aged 3–6 years) [4,5], and a study in Brazil assessed children in a wider age range (aged 3–13 years) [6]. These studies demonstrated that the test instructions and procedures outlined in the original manual are applicable to children in the above-mentioned countries. However, performance on each test item varied by country; for example, the time required to complete the same test item differed by over 10 s between Chinese and Greek preschool children [4,5]. Note that this difference in time is almost equivalent to one standard deviation in the normative data. These findings indicate that while Japanese children are expected to be able to complete all test items given sufficient understanding of the test instructions and procedures, their performance must be checked with the normative data.

The above-mentioned studies also examined the psychometric properties of the MABC-2 and reported several types of reliability, such as test–retest reliability, inter-rater reliability, and internal consistency. Among them, the first two were confirmed to be excellent in all previous studies. For instance, the Brazilian study obtained high inter-rater reliability with intraclass correlation coefficient values ranging from 0.86 to 0.99 [6]. These excellent reliability values are likely due to the consistency of the standardized procedure with which each tester conducts the tests. Internal consistency, in contrast, while not excellent, was acceptable. This is likely due to the low number of test items on the MABC-2 [4,5]. Thus, although we would not expect a

drastic improvement with respect to the previously published values, examination of the internal consistency in a Japanese sample would be beneficial.

Regarding the validity of the MABC-2, the results of previous studies are not consistent, especially with respect to factorial validity. Both the Chinese and Greek studies performed structural equation modeling to test factorial validity using the three-domain model originally proposed by Henderson et al. [2]. In the Greek study, the model was validated with eight test items, as with the original model [4]. However, the Chinese study reported that the model became more stable when using six rather than eight test items (i.e., removing two items) [5]. Factorial validity is a fundamental issue in verifying the MABC-2 because it substantially affects several important aspects of the test. These include correspondence between the domains and test items, and the calculation of domain and total scores. Thus, examination of factorial validity in a Japanese sample is necessary.

Motor skills in Japanese children have been previously investigated using the older edition of the MABC-2 (i.e., Movement ABC [3]). In a study by Miyahara and his colleagues [7], the performance of Japanese children aged 7–11 years was compared with that of a group of same-age peers in the United States (US), revealing several differences in performance. The Japanese children exhibited a partial reduction in Manual Dexterity compared with the US children, as reflected by poorer performance in a tracing and trailing task, and this tendency was more prominent in boys than in girls. Such performance gaps are not likely to be attributable exclusively to cultural factors [7]. Moreover, it is difficult to directly apply such findings to the present data because we used a different test set and normative sample. Thus, it is necessary to examine whether Japanese children exhibit poor performance on MABC-2 test items compared with the normative samples.

In the present study, we examined the applicability of the MABC-2 in a sample of Japanese children. This was meant as a preliminary investigation preceding the formal standardization of this test in Japan. We focused on a test set for children aged 7–10 (i.e., the test set for Age Band 2 of the MABC-2), which has not been tested for factorial validity in other countries. We expected that Japanese children would be able to complete all of the test items without any problems that could be ascribed to the test instructions and procedures. We analyzed both internal consistency and factorial validity for our Japanese sample, as both of these varied among previous studies. We also included a comparison between our sample of Japanese children and the normative sample of the MABC-2, as well as an examination of gender differences. These examinations should provide valuable information regarding the standardization of the MABC-2 and its potential as a diagnostic tool for DCD in Japan.

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