



# Fine and gross motor performance of the MABC-2 by children with autism spectrum disorder and typically developing children



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## ABSTRACT

The purpose of this study was to investigate the fine and gross motor performance of children with autism spectrum disorder (ASD) and age-matched typically developing children as measured by the Movement Assessment Battery for Children-2 (MABC-2). Thirty children with ASD (ages 3–16 years, male = 25, female = 5) and 30 age-matched typically developing children (male = 16, female = 14) performed the MABC-2. Group differences on MABC-2 percentile scores were analyzed using descriptive data and one-way ANOVAs. Effect sizes were also calculated for practical significance. Descriptive data showed that all typically developing children were classified in the green zone on MABC-2. However, the majority of children (80%) with ASD were categorized in the red and amber zones suggesting they experienced motor difficulty or were at risk for motor delay. In addition, children with ASD showed significantly lower MABC-2 percentile scores than the typically developing children on manual dexterity, ball skills, and static and dynamic balance,  $F(1, 59) = 109.043$ ,  $p < .001$ , and the effect sizes were large ( $>.80$ ). In conclusion, children with ASD were delayed in both fine and gross motor skill performance on MABC-2 when compared to their age-matched typically developing children.

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## 1. Introduction

Although motor performance is not part of the diagnostic criteria for children with autism spectrum disorder (ASD), the severity of motor impairment is so widespread that some autism researchers have discussed including motor impairments as part of the diagnostic criteria (Liu, 2012; Ozonoff et al., 2008; Papadopoulos et al., 2012; Vasileva, 2012; Whyatt & Craig, 2012). Other researchers study the motor skills of infants in the hopes of identifying a potential avenue for earlier diagnosis of ASD (Lane, Harpster, & Heathcock, 2012; Liu, 2012; Mulligan & Prudhomme White, 2012; Teitelbaum et al., 2004). Furthermore, early educational intervention has been found to be the only effective treatment for symptoms of ASD (Corsello, 2005; National Research Council, 2001). Thus, it is of critical importance to understand the motor abilities of children with ASD as a pathway to early intervention.

Fundamental fine and gross motor skill development forms the building blocks of future physical activity (Clark & Metcalfe, 2002). Early motor skill development has been found to predict later cognitive development (Hill, 2010) and is

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related to engagement in physical activity (Stodden et al., 2008) and perceived competence (Robinson, 2011). Motor development may mediate the relationship between cognitive and social skills, as research has suggested that opportunities affording the practice and refinement of fine and gross motor skills are also an authentic setting to practice social and communication skills (Lloyd, MacDonald, & Lord, 2013; Schmidt, Fitzpatrick, Caron, & Mergechea, 2011). Numerous interventions have targeted the issue that children with ASD often have difficulty with communication (reviewed by Rhea, 2008) and social interactions (reviewed by Kasari & Patterson, 2012; American Psychiatric Association, 2000).

For children with ASD, fine motor delays may adversely impact handwriting and/or keyboarding ability, thus, leading to challenges in communication. Gross motor delay may negatively impact balance, social appearance, and motivation to engage in social activities involving gross motor behaviors (e.g., playing ball games at recess). Both types of motor delays may influence the frequency of challenging behavior, especially avoidant behavior such as tantrums. These behaviors are commonly reported for children with ASD in physical education classes and during writing tasks (Fittipaldi-Wert & Mowling, 2009). This suggests a specific need for intervention in this population so that they can improve their fine and gross motor skills early enough to fully participate in different types of sport and physical activity. However, few interventions to target motor skill development have been developed for children with ASD. This may be due to the questions pertaining to the validity of measurement of motor development by children with ASD (Berkeley, Zittel, Pitney, & Nichols, 2001; Breslin & Rudisill, 2011; Brown & Lalor, 2009; Green et al., 2009; Liu & Breslin, 2013; Staples & Reid, 2010).

The literature reports that children with ASD are delayed in terms of their motor skill development as compared to their typically developing peers, regardless of whether researchers measure fine or gross motor skills (Baranek, Parham, & Bodfish, 2005; Berkeley et al., 2001; Breslin & Rudisill, 2011; Dziuk et al., 2007; Green et al., 2002, 2009; Jansiewicz et al., 2006; Liu, 2012; Liu & Breslin, 2013; Lloyd et al., 2013; Pan, Tsai, & Chu, 2009; Provost, Lopez, & Heimerl, 2007; Staples & Reid, 2010; Whyatt & Craig, 2012). However, the methodologies used to obtain these results varied. Several of these studies compared a group of children with ASD to typically developing peers (Dziuk et al., 2007; Pan et al., 2009), while others compared performance to that of standardized normative data (Berkeley et al., 2001; Breslin & Rudisill, 2011; Liu & Breslin, 2013; Staples & Reid, 2010). Furthermore, the assessment tools utilized varied. Three of these studies used the Test of Gross Motor Development-Second Edition (TGMD-2) to assess fundamental gross motor skill development (Berkeley et al., 2001; Breslin & Rudisill, 2011; Staples & Reid, 2010), and two used the Movement Assessment Battery for Children-Second Edition (MABC-2) to assess gross and fine motor skills (Liu & Breslin, 2013; Whyatt & Craig, 2012). Although both of these are valid standardized assessments measuring motor skills (Henderson, Sugden, & Barnett, 2007; Ulrich, 2000), they measure different aspects of motor skill development (Logan, Robinson, & Getchell, 2011).

The MABC-2 is a valid and reliable assessment of fine and gross motor skills that has been used with children with ASD (Brown & Lalor, 2009; Henderson et al., 2007; Green et al., 2002, 2009; Liu & Breslin, 2013; Whyatt & Craig, 2012). The strengths of the MABC-2 include its ability to assess children using a different combination of fine and gross motor skill items appropriate for the three different age groups within the range of 3–16 years (Brown & Lalor, 2009). Specifically, the MABC-2 examines the constructs of manual dexterity, ball skills, and static and dynamic balance. In one study, the impact of using visual supports to provide instructions to children with ASD during the MABC-2 was measured. 76% of participants were found to be delayed (or at risk for delay) in terms of their motor skill development regardless of how instructions were provided (Liu & Breslin, 2013). In another study, performance on the MABC-2 by children aged 7–10 years with ASD was compared to that of receptive vocabulary and IQ matched peers (Whyatt & Craig, 2012). These children with ASD were found to be delayed in terms in both fine and gross motor skills. However, the delays were found to be caused by delays in terms of manual dexterity and ball skills only. In Green et al. (2002) study, children with Asperger's aged 6–10 years were compared to a group of age-matched children with motor delays. The children with Asperger's syndrome were best identified through aiming and catching tasks, and found to have a slight delay on the manual dexterity and ball skills tasks compared to the children diagnosed with motor delays (but not Asperger's syndrome). In a final study evaluating the motor skill development of children with ASD, participants aged 10–14 years were assessed using the MABC and using a retrospective parent questionnaire examining gross and fine motor skills called the Developmental Coordination Disorder Questionnaire (Green et al., 2009). The motor development of a majority of participants was found to be delayed using the MABC and the Developmental Coordination Disorder Questionnaire. Nonetheless, none of these studies sought to compare the fine and gross motor skills of children with ASD across the entire age range eligible for evaluation using the MABC-2 to that of their typically developing peers.

To fill the gap in the literature comparing the motor development of children with ASD to their typically developing peers, the purpose of this study was to compare the fine and gross motor skills of children with and without ASD aged 3–16 years using the MABC-2. It was hypothesized that children with ASD aged 3–16 would be delayed in their motor skill development compared to their age-matched typically developing children. A secondary hypothesis was that across the three constructs of the MABC-2, children with ASD would be delayed compared to their age-matched typically developing peers.

## 2. Methods

### 2.1. Participants

A total of 30 children with ASD (3–16 years, 25 males, 5 females) and 30 age-matched typically developing children (16 males, 14 females) participated in this study. It was difficult to match typically developing children with children with ASD in

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