



Motor skill abilities in toddlers with autistic disorder, pervasive developmental disorder-not otherwise specified, and atypical development

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ABSTRACT

Motor skills were assessed in 397 toddlers, and it was demonstrated that typically developing toddlers exhibited significantly greater motor skill abilities than toddlers with autistic disorder. No significant difference on gross or fine motor skill abilities were found between typically developing toddlers and toddlers with pervasive developmental disorder-not otherwise specified (PDD-NOS), or between toddlers with autistic disorder and toddlers with PDD-NOS. Gross and fine motor skills were found to be more impaired for toddlers with autistic disorder compared to the atypical development group. Furthermore, differences in gross or fine motor skills between the autistic disorder and the PDD-NOS group approached significance. Approximate effect sizes were also calculated. Implications of the results are also discussed.

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Autistic disorder and pervasive developmental disorder-not otherwise specified (PDD-NOS) are types of Autism Spectrum Disorders (ASDs) characterized by social deficits, communication impairments, as well as stereotyped and repetitive interests and behaviors (Matson, 2007a, 2007b; Matson, Matson, & Rivet, 2007a). Although motor impairments are not a core feature of ASDs, many children with autistic disorder, PDD-NOS, and Asperger's syndrome display impairments in motor functions (Green et al., 2002; Hilton et al., 2007; Manjiviona & Prior, 1995; Ming, Brimacombe, & Wagner, 2007; Page & Bouchert, 1998; Provost, Lopez, & Heimerl, 2007; Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998). These deficits may at least in part account for problems these individuals display with respect to a host of adaptive behaviors (Kuhn & Matson, 2002; Matson et al., 1996; Matson, Bamburg, Smalls, & Smiroldo, 1997; Matson, Fodstad, & Boisjoli, 2008; Naoi, Tsuchiya, Yamamoto, & Nakamura, 2008).

Teitelbaum et al. (1998) examined motor abilities in home videos of children with autistic disorder when they were 4–6 months of age. Infants who were later diagnosed with autistic disorder displayed delayed sitting, crawling, walking, and rolling over skills. Among young children 21–41 months of age with an ASD, 84% scored at least two standard deviations below the mean on a standardized test of motor abilities which measured object manipulation, grasping, as well as gross and fine motor skills (Provost et al., 2007). Using a sample of 33 children with autistic disorder, Page and Bouchert (1998) found that 79% of these children displayed oromotor deficits, 55% had manual skills deficits, and 17% had impairments in gross motor skills (e.g., running, walking, etc). Through retrospective review of clinical records, Ming et al. (2007) examined the lifetime prevalence of types of motor impairments in people 2 through 18 years of age with an autistic disorder, PDD-NOS, and Asperger's syndrome. Fifty one percent of the children and adolescents demonstrated hypotonia, 34% motor apraxia, 19%

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toe walking, 9% gross motor delay, and 2% displayed decreased ankle mobility at one period of time in their life (Ming et al., 2007).

Also demonstrating high levels of motor impairment are children and adolescents with Asperger's syndrome (Green et al., 2002; Hilton et al., 2007) and high functioning autism (Manjiviona & Prior, 1995). Approximately 67% of children and adolescents with high functioning autism and 50% of people with Asperger's syndrome demonstrated clinically significant deficits in motor skills (Manjiviona & Prior, 1995). Eighty-nine percent of children with Asperger's syndrome scored one standard deviation below the mean on a standardized assessment of motor skills (Hilton et al., 2007), and all children with Asperger's syndrome met criteria for developmental disorder of motor function (Green et al., 2002).

Not only do people with ASD display impairments in motor skills, but they do so more than typically developing peers on home videos and on various standardized measures of motor skills (Adrien et al., 1992; Hilton et al., 2007; Jansiewicz et al., 2006; Noterdaeme, Mildenberger, Minow, & Amorosa, 2002; Ozonoff et al., 2008; Sparrow, Cicchetti, & Balla, 2005). Some studies have also compared motor skill abilities between children with various ASDs and developmental disabilities without a diagnosis of ASD (Provost et al., 2007), expressive language disorders (Noterdaeme et al., 2002), learning disorder (Miyahara et al., 1997), or intellectual disability (Perry, Flanagan, Geier, & Freeman, 2009). All studies found no significant differences, except for Miyahara et al. (1997), who found that children with learning disability displayed significantly greater impairments in manual dexterity than children with Asperger's syndrome.

There are some studies that compare motor skill abilities between children and adolescents with autistic disorder, PDD-NOS, and Asperger's syndrome (Ghaziuddin & Butler, 1998; Ozonoff et al., 2008; Perry et al., 2009). Ghaziuddin and Butler (1998) used the Bruininks Oseretsky Test of motor coordination and found that only children with PDD-NOS displayed significantly greater impairments than children with autistic disorder and Asperger's syndrome. However, when controlling for intellectual functioning, there were no significant differences between any ASD groups. The mean ages of all groups were 10–11 years of age. Similarly, Perry et al. (2009) found no significant differences in gross or fine motor skills between children 22 through 71 months of age with autistic disorder and PDD-NOS. Furthermore, Ozonoff et al. (2008) did not report any significant differences between autistic disorder with regression and without regression on retrospective reports of developmental milestones or retrospective videos. Studies comparing children and adolescents with Asperger's syndrome and high functioning autism on motor skills found no significant differences between these two groups (Ghaziuddin, Butler, Tsai, & Ghaziuddin, 1994; Jansiewicz et al., 2006; Manjiviona & Prior, 1995).

Overall, there is a paucity of research comparing motor skills between people with autistic disorder and PDD-NOS. The majority of research examining motor skill deficits between the ASD groups does not include infants or toddlers. There are only a few studies analyzing motor skills across different ASDs in infants and toddlers (Ozonoff et al., 2008; Perry et al., 2009). Although both of these studies found no significant differences between the ASD groups, Ozonoff et al. (2008) only compared autistic regression to non-regression in children later diagnosed with autistic disorder when they were 11–12 months of age. Furthermore, Perry et al. (2009) did not have any toddlers under 22 months of age in their sample when they compared the motor skills with young children with autistic disorder and PDD-NOS.

Greater motor skills abilities have been tied to decreased severity of ASD later in life (Sutera et al., 2007) and higher cognitive abilities later in life (Piek, Dawson, Smith, & Gasson, 2008). Due to the effect of motor skill ability on imitation skills, these abilities may be useful in determining the most effective communication interventions (Tincani, 2004). Researchers have called for more research on motor skills in the ASD population to determine whether these skills can help facilitate early diagnosis (Dudley et al., 2003). Additionally, given the focus on early intervention, such data could have important implications for treatment (Ben-Itzhak, Lahat, Burgin, & Zachor, 2008; Matson & Smith, 2008). As such, research analyzing the differences between motor skills in infants and toddlers with various ASDs and atypical development is necessary. Based on the fact there is limited data in young children comparing autistic disorder, PDD-NOS and atypical development, our hypotheses would be based on studies that are not very applicable. Therefore, the purpose of this study was primarily an exploratory investigation to further deduce the differences in infants and toddlers with autistic disorder, PDD-NOS and atypically developing controls without an ASD diagnosis.

1. Method

1.1. Participants

The participants in this study were 397 caregivers of toddlers 17 through 36 months of age ($M = 26.11$, $SD = 4.76$) who received services through early steps. EarlySteps is Louisiana's Early Intervention System under the Individuals with Disabilities Education Act, Part C, which provides services to infants and toddlers and their families from birth to 36 months. Children qualify if they have a medical condition likely to result in a developmental delay, or have developmental delays.

There were three groups in this study: autistic disorder, pervasive developmental disorder-not otherwise specified (PDD-NOS), and atypical developing toddlers who did not meet criteria for an ASD. To diagnose toddlers with autistic disorder or PDD-NOS, a licensed clinical psychologist (first author) used scores from the Battelle Developmental Inventory, 2nd Edition (BDI-2; Newborg, 2005), M-CHAT scores (Charman et al., 2001; Robins, Fein, Barton, & Green, 2001), DSM-IV-TR criteria, as well as clinical judgment. This clinical psychologist has over 30 years of experience working with individuals with developmental disabilities and was blind to BISCUIT scores. Similar diagnostic methods for research purposes have been used in the literature (Fombonne et al., 2004). Interrater reliability was determined for a subset of the toddlers diagnosed

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