

## Motor Proficiency of the Head Start and Typically Developing Children on MABC-2

Ting Liu\*, Michelle Hamilton, Sean Smith

Department of Health and Human Performance, Texas State University, USA

\*Corresponding author: Ting Liu, Department of Health and Human Performance, Texas State University, USA, Tel: 512-245-8259; Fax: 512-245-8678; E-mail: [tingliu@txstate.edu](mailto:tingliu@txstate.edu)

Received date: March 05, 2015, Accepted date: March 30, 2015, Published date: April 03, 2015

Copyright: © 2015 Liu T et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

### Abstract

**Objective:** To investigate both fine and gross motor proficiency in preschool children enrolled in Head Start in comparison to their age-matched typically developing peers.

**Methods:** Thirty-seven children from a local Head Start program and 37 typically developing children participated in this study. Movement Assessment Battery for Children-2 (MABC-2) was used to assess children's fine and gross motor performance in manual dexterity, aiming and catching, balance, and the child's overall motor performance. A one-way MANOVA was used to analyze the group differences on MABC-2 percentile scores for each subtest and the overall performance with the alpha level set at  $p < .05$ .

**Results:** The results revealed that the Head Start children performed significantly poorly than their age-matched typically developing children on balance,  $F(1, 72) = 26.032, p < .01$ , and the total percentile score,  $F(1, 72) = 10.455, p < .01$ . Conclusions and implication: It is suggested that future educators should design interventions with broader subset of skills to maximize motor proficiency for the economically disadvantaged preschool children to prevent long-term negative consequences associated with motor delays.

**Keywords:** Fine motor skills; Gross motor skills; prekindergarten; Disadvantaged children; Low SES; Hispanic

### Introduction

Motor proficiency is essential in early childhood for overall motor development and considered as the basis and building blocks of more complex movements skills [1,2]. Critical ages for children to develop motor proficiency occur between ages two and seven with the ideal age being three or four [3]. Children who are more proficient in motor skills are more likely to actively participate in physical activities and in more advanced sports skills [4,5]. In addition, young children who are physically active are more likely to maintain health-related fitness throughout adolescence and adulthood [6]. With age, sports and game play becomes more complex and fundamental movements are required in order to participate. Children without motor proficiency may have a harder time keeping up with their peers and might make them less likely to participate. Children do not "grow out" of motor difficulties naturally; they have to develop the motor proficiency. Otherwise, children's physical activity, fitness, and motor skill might decline as they enter adolescence [7]. The absence of both fine and gross motor proficiency may negatively impact children's relationships with peers as well as their participation in future physical activity. For example, Thompson et al. [8] found that skill development, social interaction, and health were at risk in children with movement difficulties.

The Individuals with Disabilities Act part A and B [9] suggests that motor skill data can be used to determine the presence of developmental delay for preschool children. In the past decade, there has been a plethora of research demonstrating that young children who are economically disadvantaged show significant delays in gross

motor skills such as locomotor and object-control skills. For example, Goodway et al. [10] examined gross motor proficiency using the Test of Gross Motor Development-2 (TGMD-2) [11] with 469 disadvantaged Hispanic and African American preschoolers in the Midwest and Southwest. The results showed that the majority of preschoolers scored between the 10th and 17th percentile for locomotor skills and the 16 percentile for object-control skills. In addition, Pope et al. [12] assessed object-control skills in 111 Hispanic children enrolled in a Head Start program using TGMD-2 and found 83% of the preschool-aged children scored in the poor performance category, which was below 25th percentile. Similar findings of the motor proficiency delays in object and locomotor skills have been noted in intervention studies with preschool children prior to the intervention [13-15].

Although gross motor skills are important, so is the development of fine motor skills. Fine motor skills are essential in writing because they help form letters and numbers accurately and "can only be produced by proper timing and force control of coordinated arm, hand, and finger movement" [16]. Pienaar et al. [17] reported a strong relationship between math, reading, writing performance and motor proficiency in boys and girls in disadvantaged children in South Africa. Children with lower motor proficiency had poor performance in these academic areas. Hand strength and visual-motor development can directly affect writing and is found to be more challenging in children from low socioeconomic (SES) backgrounds [18]. Lust and Donica [19] implemented a pre and post motor intervention with a Handwriting Without Tears-Get Set for School Program to assess the relationship between handwriting and fundamental motor performance in low SES children enrolled in Head Start. They found significant improvements in handwriting readiness skills for children

in low SES after the intervention. This finding suggests that a handwriting curriculum, in conjunction with fine motor training can significantly improve Head Start children's academic performance and school readiness [19].

Furthermore, Piek et al. [20] reported that fine motor ability could be predicted by socioeconomic standing. Children who attended Head Start were found to have "significantly lower fine motor skills in kindergarten than children who did not attend Head Start" [21]. This suggests that Head Start children with delayed fine motor skills may be less prepared for kindergarten. Marr et al. [22] examined fine motor skills in four-year-old Head Start and kindergarten children to determine if children in the Head Start program were adequately prepared for kindergarten. Children in Head Start spent 37% of their day learning fine motor activities while kindergarten children spent 46% with 42% being pencil and paper activities [22]. This shows that fine motor skills in kindergarten are much more utilized and children in Head Start are not adequately prepared for the work demands required in kindergarten.

It is important to assess young children's fine and gross motor skill performance because research has shown that a strong, positive relationship exists between fine motor skills and academic success. That is, children that perform fine motor skills better tend to be more academically successful than that of children who do not. Likewise, children that perform gross motor skills are more likely to be included in play and sport, thus leading to physically active lifestyles. Many studies use TGMD-2 to assess gross motor skills in preschool children. However, Movement Assessment Battery for Children-2 (MABC-2) assesses both fine and gross motor skills in three different categories including manual dexterity, aiming and catching, and balance [23]. Similarly, Smits-Engelsman et al. [24] found that the MABC-2 was a reliable test to examine motor performance in children as young as three. By using MABC-2, both fine and gross motor skills can be tested

and used to determine motor skill deficiencies in children and is important for discriminating amongst preschool children with motor impairments [25]. The MABC-2 can also help the educators to develop interventions implemented in children with motor impairments early on so they can be included in sports and play more.

Nationally, efforts to influence policy, practices, and guidelines of physical activity programs have been established. However, few comprehensive studies on the developmental delays in fine and gross motor skills with the Head Start children have been noted. Therefore, the purpose of this study was to investigate both fine and gross motor skill performance in preschool children enrolled in Head Start and their typically developing age-matched peers. It was hypothesized that the children enrolled in Head Start would perform poorly and show motor delays when compared to their age-matched typically developing children on MABC-2.

## Methods

### Participants

Thirty-seven preschool children from Head Start (80% Hispanic) and 37 age-matched typical developing children participated in the study. Head start is a federal program that primarily serves children and their families from a disadvantaged socioeconomic status (i.e., low SES) in early childhood development [5,26]. Low SES is defined by the U.S. Census Bureau [27] as a family that falls below the poverty line and the family's income is less than the average family's threshold and attending day care setting not qualifying for subsidy. Typical families are defined as being above the poverty line. Parental consent was obtained prior to each child's motor assessment. Participants' demographic information is presented in Table 1. The University internal review board approved this study.

	Mean age (year)	N	Gender	
			Male	Female
Head Start children	4.41	37	22	15
Typical children	4.27	37	18	19

**Table 1:** Demographic information for participant's age and gender

### Instrument

The MABC-2 measures risk for motor impairment with eight subtests in three different areas of fine and gross motor skills: manual dexterity (three subtests), aiming and catching (two subtests), and balance (three subtests) [23]. These motor skills are assessed in three different age bands: 3-6 years, 7-10 years, and 11-16 years. A total score is calculated by adding the eight subtests together. In the MABC-2 Manual, a norms table is used to determine the percentile of the total test score. The percentile scores are described by a traffic light system. Red zone represents a significant motor impairment with the percentile score is  $\leq$  5th percentile. The amber zone percentile score is between the 5th and 15th and indicates that the child is "at risk" for a motor impairment. Finally, the green zone represents no motor impairments have been detected with the percentile score is  $>$ 15th percentile.

### Procedure

Verbal descriptions along with accurate demonstrations for each MABC-2 task were given to the participants prior to their skill performances. Instructions were given in Spanish or English for each child to make sure directions were understood. A practice trial was then provided and feedback was given if the child made mistakes during the practice trial. Additional demonstration and practice were provided when the child did not understand what needed to be done. The primary investigator and a research assistant administered the test at a local school gym according to the MABC-2 Manual and then evaluated each child's performance for each task. Each child's performance was videotaped and reviewed by the investigator and her assistant for an accurate assessment if the score was not initially agreed upon. A high inter-rater reliability of 99% was obtained between the primary investigator and her research assistant in the MABC-2 tasks.

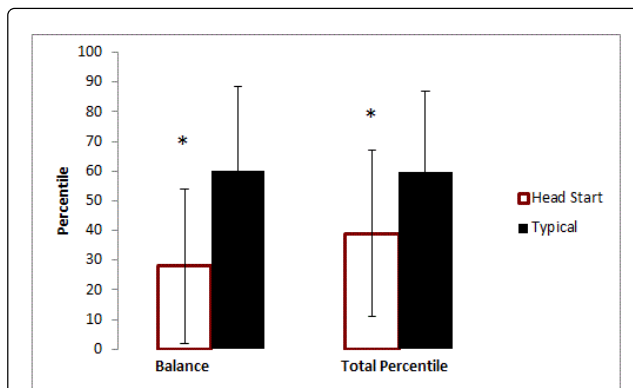
## Data Analysis

Descriptive statistical analysis was used to describe children's fine and gross motor performance. MABC-2 percentile rank from each area (i.e., manual dexterity, aiming and catching, balance), and total percentile score (overall performance) was calculated for both Head Start and the typically developing children groups. A one-way MANOVA was used to analyze the group differences on MABC-2 percentile scores for each subtest and the overall performance. The alpha levels were set at  $p < .05$ .

## Results

Descriptive analysis showed that the typically developing children scored higher than the Head Start children in both fine and gross motor skills. About 6.67% of Head Start children were in the red zone and none of the typically developing children were categorized in the red zone indicating more Head Start children experienced motor delays.

The MANOVA analysis on percentile scores (i.e., manual dexterity, ball skills, static and dynamic balance, and total percentile score) revealed a significant difference between the Head Start children and their age-matched typically developing children on the balancing subtest,  $F(1, 72) = 26.032, p < .01$ . A significant between group difference was also found for the total percentile rank,  $F(1, 72) = 10.455, p < .01$ . These findings indicated that Head Start children performed significantly lower on one (balance) of the three main subtests (manual dexterity, aiming and catching, and balance) and they were outperformed by their age-matched typical peers on those fine and gross motor skills.



**Figure 1:** Children in Head Start scored significantly lower than their age-matched typically developed children on balance and total percentile scores. \* Indicates significant differences between the groups.

## Discussion

The purpose of this study was to investigate motor proficiency of children enrolled in Head Start program in comparison to their age-matched typically developing peers. The findings supported our hypothesis that the children in the Head Start program performed significantly worse than their age-matched typically developing peers on balance and overall percentile rank. There is no known research that examines motor skill performance between Head Start and

typically developed age-matched peers on MABC-2, which makes our findings unique. Motor proficiency of fine and gross motor skills is important because fine motor skills have been shown to affect children's kindergarten academic performance while gross motor skills are shown to help with skill development, physical activity, and healthy life style [8,16,28]. In addition, competence in motor proficiency increases the likelihood that children will become active and maintain health-related fitness in adolescence and into [4-6].

There are important implications for the findings in this study. First, it is important to have a complete understanding of both fine and gross motor delays in children enrolled in Head Start. More research is needed on these children to provide comprehensive developmental profiles in comparison with their peers. Previous research has been limited to report gross motor delays in economically disadvantaged preschool children [10,13,15]. Our findings show that Head Start children scored significantly below their age-matched peers in the areas of balance, gross and fine motor skills. A second implication is that gross motor delays are often attributed to lack of instruction, experience, feedback and opportunity [15,29,30]. It is suggested that an impoverished environment could also lead to low motor proficiency in Head Start children. An impoverished environment for fine motor development could be a lack of materials at home such as scissors, pencils, and paper. The third implication is that more comprehensive interventions focusing on both fine and a gross motor skill development are needed for Head Start prekindergarten programs. Interventions targeting gross motor performance in children who are economically disadvantaged have resulted in significant improvements in motor proficiency following the interventions [13,15,31]. Other researchers have found improvements in gross motor skills can help facilitate social interaction and also increase participation in learning advanced motor skills [5,32,33]. The results of this study recommend preschool educators to include fine motor skills in the interventions to maximize motor proficiency in Head Start program. In addition, the benefits of fine motor skill intervention are not limited to improvements in motor proficiency. They have been shown to affect math and reading performance [28]. Educators and practitioners can add a handwriting curriculum in conjunction with fine motor training in the intervention program to improve Head Start children's academic performance and school readiness [19]. Future studies may include an academic component as well as a fine and gross motor skill component between Head Start and typically developing children to determine the level of academic and motor performance differences between the two groups.

In summary, preschool children enrolled in Head Start program were delayed in the motor proficiency when compared to their typically developing children. This delay could negatively impact their academic performance, physical activity, and health-related fitness later in life. It is suggested that future educators should design interventions with broader subset of skills to maximize motor proficiency for the economically disadvantaged preschool children.

## References

1. Clark JE, Metcalfe JS (2002) The mountain of motor development: A metaphor. In: Clark JE, Humphrey JH (Edn). *Motor Development: Research and Review* NASPE Publications, Reston, VA.
2. Gallahue DL, Ozman JC, Goodway JD (2012) *Understanding motor development: Infants, children and adolescents and adults* (7th Edn.). Boston MA: McGraw Hill.
3. Sanders SW (1992) *Designing preschool movement programs*, Human Kinetics, Champaign, IL.

4. McKenzie TL, Sallis JF, Broyles SL, Zive MM, Nader PR, et al. (2002) Childhood movement skills: predictors of physical activity in Anglo American and Mexican American adolescents? *Res Q Exerc Sport* 73: 238-244.
5. Woodard RJ, Yun J (2001) The performance of fundamental gross motor skills by children enrolled in Head Start. *Early Child Dev Care* 169: 57-67.
6. Vlahov E, Baghurst TM, Mwavita M (2014) Preschool motor development predicting high school health-related physical fitness: a prospective study. *Percept Mot Skills* 119: 279-291.
7. McPhillips M, Jordan-Black JA (2007) The effect of social disadvantage on motor development in young children: a comparative study. *J Child Psychol Psychiatry* 48: 1214-1222.
8. Thompson LP, Bouffard P, Watkinson EJ, Dunn JL (1994) Teaching children with movement difficulties highlighting the need for individualized instruction in regular physical education. *Phys Educ Rev* 17:152-159.
9. Individuals with Disabilities Education Act of 2004 (2004) Part A and B. *Pub L No 3*: 108-446.
10. Goodway JD, Robinson LE, Crowe H (2010) Gender differences in fundamental motor skill development in disadvantaged preschoolers from two geographical regions. *Res Q Exerc Sport* 81: 17-24.
11. Ulrich DA (2000) *Test of Gross Motor Development (2nd edn)* Pro-Ed Inc, Austin, TX.
12. Pope ML, Liu T, Getchell N (2011) Object-control skills in Hispanic preschool children enrolled in Head Start. *Percept Mot Skills* 112: 193-200.
13. Goodway JD, Branta CF (2003) Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Res Q Exerc Sport* 74: 36-46.
14. Goodway JD, Crowe H, Ward P (2003) Effects of motor skill instruction on fundamental motor skill development. *Adapt Phys Act Q* 20: 291-314.
15. Hamilton M, Goodway JD, Haubenstriker (1999) Parent-assisted instruction in a motor skill program for at-risk preschool children. *Adapt Phys Act Q* 16: 415-426.
16. Tseng MH, Chow SM (2000) Perceptual-motor function of school-age children with slow handwriting speed. *Am J Occup Ther* 54: 83-88.
17. Pienaar AE, Barhorst R, Twisk JW (2013) Relationships between academic performance, SES school type and perceptual-motor skills in first grade South African learners: NW-CHILD study. *Child Care Health Dev* 40: 370-378.
18. Bowman OJ, Wallace BA (1990) The effects of socioeconomic status on hand size and strength, vestibular function, visuomotor integration, and praxis in preschool children. *Am J Occup Ther* 44: 610-621.
19. Lust CA, Donica DK (2011) Effectiveness of a handwriting readiness program in head start: a two-group controlled trial. *Am J Occup Ther* 65: 560-568.
20. Piek JP, Dawson L, Smith LM, Gasson N (2008) The role of early fine and gross motor development on later motor and cognitive ability. *Hum Mov Sci* 27: 668-681.
21. West J, Denton K, Germino-Hausken E (2000) *America's kindergartners*. Washington, DC: National Center for Education Statistics, U.S. Department of Education.
22. Marr D, Cermak S, Cohn ES, Henderson A (2003) Fine motor activities in Head Start and kindergarten classrooms. *Am J Occup Ther* 57: 550-557.
23. Henderson S, Sugden D, Barnett A (2007) *Movement Assessment Battery for Children-2*. London: Pearson Assessment.
24. Smits-Engelsman BC, Niemeijer AS, van Waelvelde H (2011) Is the Movement Assessment Battery for Children-2nd edition a reliable instrument to measure motor performance in 3 year old children? *Res Dev Disabil* 32: 1370-1377.
25. Livesey D, Coleman R, Piek J (2007) Performance on the Movement Assessment Battery for Children by Australian 3- to 5-year-old children. *Child Care Health Dev* 33: 713-719.
26. Hillemeier MM, Morgan PL, Farkas G, Maczuga SA (2013) Quality disparities in child care for at-risk children: comparing Head Start and non-Head Start settings. *Matern Child Health J* 17: 180-188.
27. US Census Bureau (2014) *Poverty Definition: Allegany County, N.Y.*
28. Dinehart L, Manfra L (2013) Associations between low-income children's fine motor skills in preschool and academic performance in second grade. *Early Educ Dev* 24: 138-161.
29. Branta CF, Goodway JD (1996) Facilitating social development in urban preschool children through physical education. *Peace Confl* 2: 305-319.
30. Goodway JD, Smith DW (2005) Keeping all children healthy: challenges to leading an active lifestyle for preschool children qualifying for at-risk programs. *Fam Community Health* 28: 142-155.
31. Goodway JD, Rudisill ME (1996) Influence of a motor skill intervention program on perceived competence of at-risk African American preschoolers. *Adapt Phys Act Q* 13: 288-301.
32. Robinson LE, Webster EK, Logan SW, Lucas WA, Barber LT (2012) Teaching practices that promote motor skills in early childhood settings. *Early Child Ed J* 40: 79-86.
33. Smith MR, Danoff JV, Parks RA (2002) Motor Skill Development of Children with HIV Infection Measured with the Peabody Developmental Motor Scales. *Pediatr Phys Ther* 14: 74-84.