

Original paper

Fundamental movement skills among Australian preschool children

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Abstract

Early childhood is a critical period for the development of fundamental movement skills (FMS). Children who do not master FMS are more likely to experience failure in the motor domain and less likely to participate in sport and games during childhood and adolescence. Studies among primary school aged children report low levels of FMS mastery indicating the need to implement FMS programs during the preschool years. Cross-sectional study of 425 children attending preschools in the Sydney, Australia in 2008. FMS were assessed using the Test of Gross Motor Development-2 including locomotor (run, gallop, hop, horizontal jump) and object control (strike, catch, kick overhand throw) skills. Data were analysed using linear regression and chi-squared analyses. Total locomotor score was higher among girls compared with boys ($p < 0.00$); however only the hop was significantly different ($p = 0.01$). Boys had higher total ($p < 0.00$) and individual object control scores compared with girls, except the catch ($p = 0.6$). The prevalence of mastery differed across each FMS. Girls generally had higher mastery of locomotor skills and boys had higher mastery of object control skills. These findings highlight the need to provide structured opportunities which facilitate children's acquisition of FMS, which may include providing gender separated games, equipment and spaces. That mastery of FMS is low in primary school children indicates the importance of early intervention programs in preschools. Preschools and child care centers hold promise as a key setting for implementing FMS programs.

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1. Introduction

Preschool and the early elementary years are critical to a child's development and mastery of fundamental movement skills (FMS). The acquisition of FMS are developmentally sequenced¹ and are contingent upon multiple internal and external factors (biological, psychological, social, motivational, cognitive, etc.) and the process of acquisition occurring through a range of active play experiences and structured programs. These skills allow children to interact and explore their environment.² Furthermore, research among school aged children^{3–6} shows that mastery of FMS is correlated with higher levels of physical activity, and there is emerging evidence among preschoolers that FMS,⁷ and

in particular locomotor skills⁸ are also positively associated with physical activity.

Basic descriptive epidemiological information on FMS among preschool aged children (i.e., 2–5 years) is limited. Studies among primary school aged children indicate low levels of FMS mastery^{9,10} and given that children with low FMS competence are less likely to participate in and enjoy many physical activities compared with their skilled peers,⁶ it appears prudent to examine FMS in preschool aged children. Socio-demographic differences in FMS have been noted in school aged children, albeit inconsistently. There is some evidence which suggests socioeconomic status was positively associated with FMS among girls^{9,11} and children from non-English-speaking backgrounds had lower levels of FMS mastery.^{12,13}

Over 56% of 4-year-old Australian children attend preschool¹⁴ indicating that this sector could be a key setting for intervention programs. Preschool years are an optimal

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time to introduce FMS because movement patterns are not entrenched. Therefore, early childhood programs can play a key role in promoting opportunities for young children to routinely practice a range of FMS through structured activities and free play.

In order to establish relevant and sustainable programs which focus on FMS development within the early childhood sector detailed information about the acquisition and mastery level of preschool aged children is required. Ideally, a holistic assessment of FMS incorporates locomotor, manipulative (object control) and stability skills.² In this study the Test of Gross Motor Development-2 (TGMD-2)¹⁵ protocols were used to examine a subset of locomotor and manipulative skills which are related to activities and games in which children are most likely to participate during the preschool years. Stability, which measures balance skills, occurs very early in development and because ceiling effects may be observed was not assessed in this study.

The TGMD-2 is a criterion- and norm-referenced instrument designed to assess gross motor development among children aged between 3.0 and 10.11 years. It is a valid and reliable (test–retest reliability = 0.88–0.96) process-orientated test which is used for FMS research among young children. Process-oriented tests assess whether the form of the movement skill incorporates the observed performance criteria in a mature pattern and therefore more accurately identify specific characteristics of the movement which reflect the developmental skill level rather than the physical growth and maturational levels of children.

Given the lack of basic descriptive information on preschooler's FMS, the primary purpose of this study was to describe the prevalence and socio-demographic distribution of FMS and secondly to describe the performance criteria of each skill among 4-year-old children attending preschool in the Sydney area of New South Wales (NSW), Australia.

2. Methods

All preschools that were operated under the auspices of the NSW Department of Education in the Sydney, Western Sydney and South Western Sydney regions of NSW were invited to participate in the study. Children and their parents were recruited from those preschools which agreed to participate. Data were collected between May and June 2008. Informed consent by the child's parent or guardian was a requirement for participation and ethics approval was given by The University of Sydney Human Research Ethics Committee.

Parents completed a survey which included information on their child's sex, date of birth, postcode of residence and the main language spoken at home. Postcode of residence was used as a proxy for socioeconomic status (SES), based on the Australian Bureau of Statistics' Index of Relative Socioeconomic Disadvantage (IRSD),¹⁶ and was used to rank students in tertiles of SES (low, medium or high). The IRSD describes the socioeconomic aspects of geographical

areas and includes indices on income, educational attainment, unemployment and proportion of people in unskilled occupations. Language spoken most at home was used to categorize students into English-speaking and non-English-speaking backgrounds (NESB).¹⁷

Eight FMS were assessed; four locomotor skills (run, gallop, hop, horizontal jump) and four object control skills (striking a stationary ball, catch, kick, overhand throw) using the Test of Gross Motor Development-2 (TGMD-2).¹⁵ The TGMD-2 comprises sub-tests which assess locomotor skills which measure the coordinated movement of the centre of gravity from one point to another and object control skills which measure the projecting and receiving of objects. These skills were selected for assessment because they facilitate the development of more advanced movement skills.

Each skill comprises 3–5 performance criteria which are scored as either present or absent and scored over two test trials. Scores for each child were calculated by totaling the correctly performed criteria for two trials for each skill (i.e., if a skill comprises three performance criteria the score range is 0–6). The maximum sub-test scores for locomotor and object control skills were 38 and 32, respectively, with a minimum of 0. The sum of both sub-tests yielded the total gross motor skill score (total FMS). Raw scores were used in the data analysis as this is recommended for research purposes.¹⁵ Skill mastery was determined when the child correctly demonstrated each performance criteria of the skill on both trials.

Prior to testing the field team were trained on the administration of the TGMD-2 by two of the authors (LH, RM) who have experience in FMS assessment. The inter-rater reliability, determined by the intra-class correlation coefficient, was 0.9 for the total test. The children were tested in small groups (one assessor per child) in an outside area and each skill was demonstrated prior to testing including providing a verbal description of the skill. The children were allowed to practice each skill before being scored on the two test trials. If an assessor was unsure about a child's performance on a skill the child was asked to repeat the skill and the other assessors were consulted. The child was then scored according to agreement among the assessors. There was no specific order to administer the tests and a standard scoring sheet was used to record each child's performance.

Data were analysed using SPSS Complex Samples (version 16) to account for the clustered design of the study and adjust for the standard errors and 95% confidence intervals. The CSPlan procedure was used to allow for stratification by education region and clustering within preschools and the data were analysed using general linear models (CSGLM). For the analysis, SES and language backgrounds were dichotomized into low and middle/high SES groups and English-speaking and non-English-speaking backgrounds (NESB). Descriptive statistics including proportions and means based on raw scores were used to describe the mastery of FMS separately for boys and girls. Statistical significance was set at $p < 0.05$.

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