

A Population Study of Parenting and Biological Risk Factors for Children's Developmental Coordination Disorder

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Received date: June 25, 2014; Accepted date: Nov 27, 2015; Published date: Nov 30, 2015

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Abstract

Objective: This paper was aimed to examine the prevalence of developmental coordination disorder (DCD) in preschool children aged 3 to 6 years old in Jiangsu province, China, and to find out the parenting and biological risk factors of DCD.

Method: 5691 children were randomly selected from the 25 kindergartens distributed throughout Jiangsu Province. A social-demographic questionnaire was asked to fill out by their parents, and the motor coordination of children was assessed with the Movement Assessment Battery for Children-2nd edition (MABC-2). According to the assessment, the 5th percentile was used to define DCD, and the 15th percentile to suspicious DCD. Children with any known neurological conditions or an IQ<70 were excluded.

Result: 5601 children were available with complete data. 336 children met the criteria for DCD, resulting in a prevalence of 6.0%, with a mean age of (4.94 ± 0.80) years. There were 231 boys and 105 girls with a gender ratio of 2.2 to 1. Additionally, 540 children were considered as suspicious DCD, resulting in a total suspicious prevalence of 15.6%. When classified into different age groups, there are more DCD children in the younger group (3-5 y) than the older group (5-7 y). The children with a birth weight<2500 g, with a history of jaundice or those born before 37 weeks' gestation, are more likely to suffer from DCD. Different care givers, low social-economic status, and low education of parents, are the parenting risk factors of DCD.

Conclusion: Prevalence of DCD in preschool children of Jiangsu in China, is reported in this study, the result indicates that DCD is an important cause of disability in early childhood, especially in children with the risk factors. Besides the biological risk factors, DCD is also related to the parenting factors, which we can give our effort to do some help.

Keywords: Risk factors; Children; Developmental coordination disorder

Introduction

DCD is one of the developmental disorders that focus on motor coordination impairment. According to the diagnostic and statistical manual of mental disorders 4th edition (DSM-IV), developmental coordination disorder is a condition marked by a significant impairment in the development of motor coordination, which interferes with academic achievement and/or activities of daily living. These difficulties are neither due to general medical condition (eg., cerebral palsy), nor any mental retardation if present [1].

To be a developmental disorder highly occurring in children, DCD does a great harm to children's physical and psychological development. Children with DCD will affect their daily life and academic achievement, and will cause depression, anxiety and low self-conscious. Meanwhile, DCD children always avoid doing sports because of their poor motor coordination, and cause overweight with a poor condition [2-4]. What's more, DCD usually combids with other

developmental disorders, especially ADHD, which will lead children's development to be much worse [5].

DCD has a high prevalence in children around the world as researches said. Prevalence varies from 1.4% to 19% throughout the world, as different diagnosis criteria and the methods. American Psychiatric Association reported 6 of 100 children aged 5-11 had DCD [1,6,7]. In Taiwan, prevalence was reported to be 3.5%~17.9% [8]. In Mainland China, our group has done a population study in Suzhou, and a prevalence of 9.0% was reported [9]. The pathogenesis of DCD remains unclear, but studies show that it has a relationship with preterm birth, low birthweight, and the social-economic environment also plays an important role [10-12].

This paper reported a large population study of Jiangsu province in China, and aimed to find out present situation and probable risk factors, especially the parenting risk factors of DCD in preschool children aged 3-6 in China, using the Movement Assessment Battery for Children-2nd edition (MABC-2), a widely accepted movement assessment [13].

Methods

Study sample

Children aged 3-6, were randomly selected from 25 public nursery schools throughout Jiangsu, China. A total of 5691 children were recruited in the study. Their parents were asked to fill out a social-demography questionnaire concerning children's development and families' economical situation. Finally, 5601 children finished all the 8 items, including 3210 boys and 2391 girls, at a mean age of (5.21 ± 0.91) years. This study was affirmed by the Local Commitment of Soochow University. Every one of the folks of the members were both orally and composed educated, and composed educated assents were acquired from them.

Instruments

Movement assessment battery for children-second edition (mabc-2): The Movement Assessment Battery for Children-Second Edition (MABC-2) is an ecological approach to intervention for children with Developmental Coordination Disorder and other movement difficulties [14]. It is composed of a performance test, a checklist, and a manual. The test refers to a series of fine, gross, and balance motor tasks [14]. In this study, we preferred the age band 1 of the MABC-2 test which refers to children aged 3-6 years old.

Eight tasks are grouped in the following three motor subtests: (1) manual dexterity, which is composed of posting coins, threading beads and drawing trails; (2) aiming and catching, which consists of catching a beanbag and throwing a beanbag onto a mat; and (3) balance, which includes the one-leg balance, walking heels raised, and jumping on mats. Ten raw scores obtained from the eight MABC-2 tasks were recorded and then converted into standard scores. The better performance a child does, the higher the standard score is. The standard scores of "Posting coins" and "One-leg balance" both with preferred and non-preferred limbs, were combined by finding the average standard score. The scores were then rounded downward when they were below average, and rounded upward when they were above average. The test scores of three components were the sum of the standard scores of their corresponding items. The total score of MABC-2 was the sum of the standard score of all eight items. The validity and reliability of Chinese version of age band 1 MABC-2 has been examined to be quite good and implied that it could be a useful approach to assess children's motor coordination [15].

China-wechsler yonger children scale of intelligence, c-wycsi: Wechsler Preschool and Primary Scale of Intelligence (WPPSI) is an intelligence test designed for children ages 2 years 6 months to 7 years 3 months developed by David Wechsler. It provides subtest and composite scores that represent intellectual functioning in verbal and performance cognitive domains, as well as providing a composite score that represents a child's general intellectual ability, that is the full scale IQ. It has been translated into Chinese and was proved to be acceptable and widely used as a diagnostic tool for assessing children's cognition (16). Children with an IQ of <70 points was considered to be extremely low and were excluded. The test has been translated and revised in Chinese version (China-Wechsler Yonger Children Scale of Intelligence, C-WYCSI) which has appeared to have great unwavering quality in Chinese kids [16-20].

Procedure

Forty-two testers gathered together to learn the Chinese version test guidance, and then carried out a series of practice assessment on a small number of children agreed to participate the practice assessment. During training period, any problem of administration was clarified by the research administrator before the test started. According to the MABC-2 manual instructions, children were asked to accomplish all the 8 tasks and scored by the trained testers individually in a safe and quite place.

Data analysis

Statistical analysis was performed using Statistical Package for the Social Sciences Version 17.0 (SPSS Inc., Chicago, IL, USA). Demographic factors of the "DCD or probable DCD" and "non-DCD" groups were compared by using either unpaired Student's t tests or X2 tests, as appropriate.

Results

Prevalence of DCD

339 children met the DSM-IV inclusion criteria for DCD, that is, had severe motor coordination difficulties (the lowest 5th percentile of the MABC-2). 3 children with a known an IQ of <70 were excluded, leaving 336 children were diagnosed as DCD, resulting a prevalence of 6.0%, at a mean age of 4.94 ± 0.96 y. There were 231 boys and 105 girls with a ratio of 2.2 to 1. Additionally, 540 children were diagnosed as probable DCD: MABC-2 score between the 5th and 15th percentile. As such, 876 children, could be considered to have DCD or probable DCD, The prevalence of DCD was 15.6%, thus 156 per 1000 children at a mean age of 5.03 ± 0.91 y. The gender ratio was 1.9:1 males to females [20-23]. Exclusion of those 26 children with an IQ of <70 or a known neurologic diagnosis decreases the denominator to 5575 but does not alter the prevalence of DCD.

The age of DCD children (5.03 ± 0.91) y, were younger than the control group (5.21 ± 0.91) y ($t=3.656$, $P<0.001$). When classified by age into four groups, that is 3-4 y, 4-5 y, 5-6 y, and 6-7 y group, there is a great difference among the different age groups ($X^2=37.633$, $P<0.001$). Much further, there is no significant difference between the younger group (3-4 y and 4-5 y group) ($X^2=1.119$, $P=0.290$), and the older group (the 5-6 and 6-7 y group) ($X^2=0.372$, $P=0.542$), but there are more DCD/pro-DCD children in the younger group than the older group (Table 1).

	DCD/pro-DCD (n, %)	Non-DCD (n, %)	X ²	P
Age (y)			37.633	<0.001
3-4	111(20.7)	426(79.3)		
4-5	333(18.6)	1455(81.4)		
5-6	243(12.9)	1644(87.1)		
6-7	189(13.6)	1200(86.4)		

Table 1: Comparison among different age groups.

Risk factors of DCD

Biological risk factors of DCD: DCD was found an association with lower birth weight<2500 g, younger gestation<37 weeks and a history of jaundice during infants, but there is no linkage between mother's maternal age at delivery (Table 2).

	DCD/pro-DCD	Non-DCD	T/ X ²	P
Maternal age	25.61(4.20)	25.58(4.03)	0.095*	0.924
XSDy				
Gestation weeks			27.381**	<0.001
≥37 w n%	783(15.0)	4449(85.0)		
<37 w n%	93(25.2)	276(74.8)		
Total n%	876(15.6)	4725(84.4)		
Birth weight			20.259**	<0.001
≥2500 g n%	810(15.2)	4533(84.8)		
<2500 g n%	66(25.6)	192(74.4)		
Total n%	876(15.6)	4725(84.4)		
History of jaundice			13.564**	<0.001
Negative n%	774(15.1)	4353(84.9)		
positive n%	102(21.5)	372(78.5)		
Total n%	876(15.6)	4725(84.4)		

* Student's t test. ** X² test

Table 2: Biological risk factors of DCD.

Parenting risk factors of DCD: There was an increased risk of DCD or probable DCD in lower maternal socio-economic group. Renting a house, parents with low education level, living with grandparents, are the risk factors of DCD or probable DCD (Table 3).

	DCD/pro-DCD	Non-DCD	T/ X ²	P
Care giver			43.375**	<0.001
Parents n%	624(14.0)	3828(86.0)		
Grandparents/others n%	252(21.9)	897(78.1)	19.912**	<0.001
Total n%	876(15.6)	4725(84.4)		
Resident				
Rent n%	666(14.6)	3894(85.4)		
Owned n%	210(20.2)	831(79.8)	65.379**	<0.001
Total n%	876(15.6)	4725(84.4)		
Mother's education history				
≤6 y n%	69(21.1)	258(78.9)		
6-12 y n%	639(17.9)	2925(82.1)		

≥12 y n%	168(9.8)	1542(90.2)		
Total n%	876(15.6)	4725(84.4)		
Father's education history			68.219**	<0.001
≤6 y n%	78(18.7)	339(81.3)		
6-12 y n%	636(18.2)	2853(81.8)		
≥12 y n%	162(9.6)	1533(90.4)		
Total n%	876(15.6)	4725(84.4)		

* Student's t test. ** X² test.

Table 3: Parenting risk factors of DCD.

Discussion

Our study reports the prevalence of DCD in Jiangsu, China, using MABC-2 as the motor coordination test, and also taking IQ into concerned according to DSM-IV criteria. Our prevalence of 6.0%, or 15.6% when both DCD and probable DCD is concerned, is comparable to previous large studies reporting the prevalence of DCD in other countries. The statistics show that DCD is one of the common developmental disorders in the early childhood in China. An UK population-based study reported 1.8% when using a strict DSM-IV criteria. As our study showed, younger children, especially younger than 5, are more likely to suffer the motor coordination problems, as the motor ability in daily life will develop when children grow up, which may partly interpret the difference of the prevalence. But concerning of earlier recognition of DCD, in order to avoid a series of psychological and social problems, examinations must be done before a child is 5 years old, while a formal diagnose should never be made until he/she reaches 5.

As other studies found, there is an increased risk of DCD in children born prematurely. Lower gestation and birth weight are associated with DCD, and children with a history of pathology jaundice during their first month of life also have a high risk of DCD. Prematurely born children may have a loss or delay of the cerebellar development, especially the corpus callosum development, which connects the homologous and nonhomologous areas of the 2 cerebral hemispheres, may explain the motor impairment. As motor learning depends on the primary motor cortex (M1), and it is now known that modulations of interhemispheric interactions are involved in the control of the unimanual and bimanual coordinations that produce the spatially and transiently exact facilitated appendage developments that empower people to perform diverse developments [21-23].

Parenting during the stage of typical motor development plays a critical role in children with DCD. As recent studies have revealed that the modulation of interhemispheric interactions relates to neural plasticity, which refers to the ability of the brain to develop new neuronal interconnections, acquire new functions, and compensate for impairments. While the development of new neuronal interconnections needs more practices. As our study indicates, an increased risk was also found in lowest social-economic families, because of their poor living condition, lacking for public basic facilities necessary for children's motor development. Low education level of parents indicates their limited income, long working hours, lack of parenting knowledge and patience, all of these will lead to few motor

practices. It is easy to learn that care giver plays a same role during children's development. Unfortunately, children are always left to grandparents, and get overprotective because of the tradition and "one-child" policy in China, which also deprive a lot of motor develop opportunities.

Conclusion

We found that 6% of preschool aged 3-6 years have DCD according to DSM-IV criteria and that 156 of 1000 have DCD or probable DCD in Jiangsu of China. Except for the biological risk factors, parenting is critical to child's motor develop, which is changeable. To develop effective prevention and targeted intervention strategies, future longitudinal research should aim to identify which of these children with motor coordination difficulties are at risk of long-term psychological morbidity and educational failure.

Acknowledgements

The study was supported by the Science and Technology Commission of Jiangsu Province (BE2011273), and the Science and Technology Commission of Suzhou City (SYS201145). The authors wish to thank the participated researcher. Special acknowledgment is due to all the families who took part in this study. We also thank the class teachers for distributing and collecting the questionnaires.

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