Original Article (short paper)

Socio-demographic factors influences on guardians' perception of Developmental Coordination Disorder among Brazilian schoolchildren

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Abstract – Aim: The objective of this study was to identify socio-demographic factors that are associated with the guardians' perception of developmental coordination disorder among schoolchildren from seven to ten years old. **Methods:** The parents/guardians of 361 children completed the Developmental Coordination Disorder Questionnaire (DCDQ) and a socio-demographic questionnaire in this cross-sectional study. The univariate relationship between the DCDQ and socio-demographic factors was tested by the chi-square test. The odds ratio (OR) with 95% confidence interval was calculated. Socio-demographic variables with $p \leq 0.20$ were included in the logistic regression analysis. **Results:** The child's age (B = 0.40; OR = 1.49; $p < 0.01$) and the guardian undergoing treatment for illness (B = 0.97; OR = 2.65; p = 0.02) were retained in the final regression model. **Conclusion:** Thus, increasing children's' age and guardians undergoing treatment for illness increased the guardians'perception of developmental coordination disorder.

Keywords: motor skills disorder, socioeconomic factors, maternal behavior, children disorders, maternal health.

Introduction

Developmental coordination disorder (DCD) have a significant impact on school life and daily activities[1] because it impair motor coordination. DCD is recognized by the *American Psychiatric Association*[2], through its *Diagnostic and Statistical Manual of Mental Disorders – Fifth edition* (DSM-5).

DCD involves a complex set of features that makes it a challenge to identify[3,4]. Children with DCD may present challenges in tasks which requires fine motor skills or global coordination ability, or in many cases, a combination of both[2]. Children with DCD tend to be more introspective, insecure, anxious and participate less in physical and recreational activities[5–7].

There are four diagnostic criteria for DCD identification according DSM-5: A – motor performance significantly lower than expected for age; B – motor impairment interfering with activities of daily living, school and leisure; C – these implications have emerged in the early stages of child development; and D – these motor impairments do not show a deficit related to intellectual or visual impairment or neurological disorders resulting from cerebral paralysis, muscular dystrophy or any other medical condition[2].

In order to make an effective identification of DCD, specific diagnostic instruments are commonly used in the literature, such as the Movement Assessment Battery for Children – Second edition (MABC-2), which is considered the gold standard assessment for the diagnosis[8]. However, access to this instrument is not always possible, especially in developing countries, due to the costs of the equipment and evaluators training, which justifies the use of more affordable instruments that, at the same time, might offer similar screening accuracy for children with indications of DCD.

The *Developmental Coordination Disorder Questionnaire* (DCDQ) allows the screening of children based on the guardians' perception concerning the children motor behavior. The application of DCDQ makes it possible to provide potential indicators of DCD, which can provide early care and follow-up referral to further evaluations[9]. This questionnaire has shown good psychometric properties, with a Cronbach's alpha coefficient of 0.94, a sensitivity of 85% and a specificity of 71%[10]. Validation and transcultural adaptation of the DCDQ has been carried out in several countries[11–14], including Brazil[15] .

Taking into account that the DCDQ is a screening questionnaire based on the guardian's perception, it is relevant to investigate whether there is relationship between the guardian's perception and the socio-demographic context of the families; and, whether there is any factor that influences the perception of DCD among guardians of school-aged children.

Other studies have already identified the level of the mother's schooling, family income, type of housing, among other variables, to be associated with the risk of impairment in the child development[16,17]. The child's motor development should be viewed through the interrelationship between the individual, the environment and the task[18], thus the socio-economic factors are essential in this field.

Considering the relevance of sociodemographic factors on the children development as well as assuming the importance of investigate potential variables associated with the perception of DCD among schoolchildren guardians, we formulated this research question: Are there sociodemographic factors related to the parents' perception about Developmental Coordination Disorder in their children?

Therefore, the objective of this study was to identify socio-demographic factors associated with the perception of indicators

of Developmental Coordination Disorder by parents/guardians among schoolchildren from seven to ten years old.

Methods

Study design

This is a cross-sectional study carried out in public and private schools in the city of São Carlos, São Paulo, Brazil.

Local and Target population

The target group of this study consisted of school-aged children from seven to ten years from São Carlos. This age group was chosen because it is the school age period, when children are beginning to deal with more complex motor activities, both inside and outside of the school. For the selection of the target group, a prior survey was conducted in the Municipal and State Education boards of São Carlos, about the quantity of public and private schools in the city, that covered child enrollment in this age group. The survey revealed a total of 43 schools, 19 public and 24 private.

Ten schools, located within a 10km radius from the University were visited, seven public and three were private. Of this total, four schools authorized the research, three in the public and one in the private sector. Each school was visited by the researchers and during these visits the objectives of the research were explained, with a view to securing from the school managers/coordinators, access for the researchers to the schools in order to collect data. These ten schools were chosen for convenience, aiming to optimize the data collection and minimize the transport costs.

Inclusion/exclusion

The study included children of both sexes, aged from seven to ten years old, who were enrolled in one of the participant schools, whose parents had signed the Informed Consent Form (ICF).

The study excluded children whose returned questionnaires were incomplete or illegible. Children with disabilities, autism or learning deficits were also excluded, based on the teacher report.

Variables and instruments

Developmental Coordination Disorder (DCD) – To screen for DCD, the Brazilian version[15] of the *Developmental Coordination Disorder Questionnaire* (DCDQ) was used. DCDQ is a validated questionnaire to identify children with DCD through parental reporting, via the completion of 15 items and is based on a Likert scale that ranges from one to five. The DCDQ score enables the classification of the child motor behavior compared to a peer of the same age. The classification is provided by the sum of the scores to each question, scores < 46 are considered positive, for children with five to seven years and 11 months, <55, for eight to nine years and 11 months, and <57 for 10 to 15 years and six months[15]. The term 'perception' was used due the authors agreed that is the best understanding concerning the classification given by DCDQ, since this questionnaire evaluate children's motor impairments under their parents report. In other words, the DCDQ is enabling to access how parents are able to perceive motor delays in their children.

Socio-demographic factors – To evaluate socio-demographic factors we used a questionnaire developed for this study, containing 40 questions (20 closed). This questionnaire was developed to assess the potential sociodemographic factors regarding to the family context. This socio-demographic questionnaire was previously tested in a pilot study to verify its feasibility.

Regarding the characteristics of the parents/guardians, the following questions entered into the analysis:

- Sex: male or female;
- Conjugal status: with or without marital life;
- Schooling: completed elementary school, completed high school, completed university degree;
- Number of rooms in the house: ≤ 4 rooms or > 4 rooms;
- Religion: Catholic, Protestant, Spiritist, Candombl é, other;
- Self-reported health perception: very bad, bad, fair, good or very good;
- Monthly income: ≤ 2 minimum wages (MW), 3 to 5 MW, ≤ 5 MW. The MW was R$ 880 in Brazil in 2016.

In addition, dichotomous answers (yes or no) were considered for the following variables: receive benefits from the government, undertaking paid work, undertaking physical exercise, suffering from any illness, undergoing treatment for the illness, having any food restriction, use of controlled drug, use of alcohol, use of tobacco, use of other drugs.

Regarding the characteristics of the children, the following questions were identified and entered into the analysis:

- Age: seven, eight, nine or ten;
- Housing type: owner, renting, borrowed, donated, others;
- Number of residents in the home: ≤ 4 people or > 4;
- Health perception: very bad, bad, fair, good or very good;

As in the case of the parents/guardians, some dichotomous variables were included: having food restriction, use of controlled drug, living with the biological father.

Procedures

The researchers undertook a preliminary survey of the number of existing elementary schools in the São Carlos, through the data from the State and Municipal Education boards, available on the official websites and directly at the headquarters of these institutions. Subsequently, initial contact was made with head teachers and/or coordinators, along with visits to the institutions, to request authorization to carry out the study.

Following the school approval, contacts were made in the classrooms with each teacher, and the nature and procedures of the study were explained to the students. The DCDQ and socio-demographic questionnaires were handed out, together with two copies of the consent form in a sealed envelope to each child so that they could be taken home for the parent/guardian to complete and sign. One week after the material had been distributed, the researchers returned to the schools to collect the questionnaires. Out of 863 questionnaires handed out in four schools, 509 (59%) returned, of which 361 (42%) were fully completed, along with the signed consent form. Only the fully completed questionnaires were used for tabulation and data analysis.

Ethical aspects

The study followed the ethical recommendations applied to human research, which is consistent with the principles of the Declaration of Helsinki. The research project was approved by the Research Ethics Committee of the Federal University of São Carlos (CEP/UFSCar), with Protocol number: 47091115000005504. All children's guardians signed the Informed Consent Form (ICF).

Statistical analysis

A descriptive analysis was initially undertaken. For univariate analysis, the chi square test was applied with a 5% significance level and an odds ratio (OR) with 95% confidence interval, taking the DCDQ as the dependent variable and socio-demographic factors as the independent variables. The independent variables with $p \leq 0.20$ values in the univariate analysis were included in the logistic regression analysis. The 0.2 level is a conservative value that include all potentially predictors.

A binary logistic regression model was applied, with stepwise method to include the socio-demographic variables that might account for the DCDQ score. All analyses were performed using SPSS version 20.0 software for Windows.

Results

Among the respondents, 103 children were screened as positive for DCD, which represents 28.5% of the 361 children included in the study. The mean age of the children was 7.97 (SD=0.95) years and the mean age of the guardians was 35.75 (SD=9.12) years. In most cases, the person responsible for the information collected was the child's mother (78.67%).

Table 1 shows the univariate analysis of the guardians' characteristics according to the DCDQ classification. A significant association was found between DCDQ classification and the guardian physical exercise and treatment for a medical condition; indicating that physically active guardians and the ones that receive treatment are more aware to the signs of DCD among their child.

Table 2 highlights the univariate analysis of the characteristics of children according to the DCDQ classification. A significant association was observed between the child's age and the DCDQ perception, indicating that the DCD signs were more frequent among older schoolchildren.

Table 1 – Parents/guardians socio-demographic factors between children classified as DCDQ positive (DCDQ+) and DCDQ negative (DCDQ -)

Variables	DCDQ + n (%)	DCDQ – n (%)	Total n (%)	p-value	OR (CI: 95%)
Sex					
Male	15 (24.6)	46 (75.4)	61 (100)	0.49	1.24 (0.66 to 2.35)
Female	88 (29.3)	212 (70.7)	300 (100)		
Conjugal situation*					
With married life	65 (27.7)	170 (72.3)	235 (100)	0.47	1.19 (0.73 to 1.93)
No married life	37 (31.4)	81 (68.6)	118 (100)		
Education*					
Completed primary school	24 (32.4)	50 (67.6)	74 (100)		
Completed high school	59 (28.5)	148 (71.5)	207 (100)	0.67	_____
University graduate	20 (26.0)	57 (74.0)	77 (100)		
Number of rooms					
≤four rooms	32 (28.3)	81 (71.7)	113 (100)	0.95	0.98 (0.60 to 1.61)
> four rooms	71 (28.6)	177 (71.4)	248 (100)		
Religion*					
Catholic	53 (26.1)	150 (73.9)	203 (100)		
Protestant	16 (37.2)	27 (62.8)	43 (100)		
Spiritist	05 (29.4)	12 (70.6)	17 (100)	0.56	_____
Candomblé	00 (0.0)	02 (100)	02 (100)		
Other	24 (28.9)	59 (71.1)	59 (100)		

Monthly income					
Up to two salaries	62 (31.8)	133 (68.2)	195 (100)		
Between three-five salaries	27 (22.7)	92 (77.3)	119 (100)	0.21	_____
Over five salaries	14 (29.8)	33 (70.2)	47 (100)		
Receives government benefits*					
Yes	10 (34.5)	19 (65.5)	29 (100)	0.50	1.31 (0.59 to 2.95)
No	87 (28.5)	218 (71.5)	305 (100)		
Work activity*					
Yes	13 (26.0)	37 (74.0)	50 (100)	0.47	1.28 (0.64 to 2.53)
No	81 (31.0)	180 (69.0)	261 (100)		
Self-reported health perception *					
Very poor	01 (50.0)	01 (50.0)	02 (100)		
Bad	03 (50.0)	03 (50.0)	06 (100)		
Fair	22 (40.7)	32 (59.3)	54 (100)	0.13	_____
Good	55 (27.2)	147 (72.8)	202 (100)		
Very good	20 (23.3)	66 (76.7)	86 (100)		
Undertakes exercise*					
Yes	33 (22.3)	115 (77.7)	148 (100)	**<0.01**	**1.78 (1.09 to 2.88)**
No	69 (33.8)	135 (66.2)	204 (100)		
Disease has*					
Yes	13 (68.4)	06 (31.6)	19 (100)	0.06	2.65 (0.95 to 7.39)
No	62 (44.9)	76 (55.1)	138 (100)		
Treatment for disease*					
Yes	18 (50.0)	18 (50.0)	36 (100)	**<0.01**	**2.92 (1.45 to 5.89)**
No	80 (25.5)	234 (74.5)	314 (100)		
Has food restriction*					
Yes	09 (42.9)	12 (57.1)	21 (100)	0.15	1.93 (0.78 to 4.73)
No	94 (28.0)	242 (72.0)	335 (100)		
Uses prescription drugs*					
Yes	15 (42.9)	20 (57.1)	35 (100)	0.05	2.02 (0.99 to 4.12)
No	88 (27.1)	237 (72.9)	325 (100)		
Alcohol use*					
Yes	07 (58.3)	05 (41.7)	12 (100)	0.43	1.60 (0.48 to 5.30)
No	67 (46.5)	77 (53.5)	144 (100)		
Smoker*					
Yes	12 (38.7)	19 (61.3)	31 (100)	0.17	1.69 (0.78 to 3.63)
No	87 (27.2)	233 (72.8)	320 (100)		
Use of other drugs*					
Yes	00 (0.0)	01 (100)	01 (100)	1.00	_____
No	103 (28.8)	255 (71.2)	358 (100)		

*data did not analysed with total sample

Table 2 - Positive or negative characterization of children based on the DCDQ classification

Variables	DCDQ + n (%)	DCDQ – n (%)	Total n (%)	p-value	OR (CI: 95%)
Sex					
Male	55 (30.1)	128 (69.9)	183 (100)	0.51	0.85 (0.54 to 1.35)
Female	48 (27.0)	130 (73.0)	178 (100)		

Age*					
Seven years	23 (16.3)	118 (83.7)	141 (100)	**< 0.01**	_____
Eight years	46 (40.7)	67 (59.3)	113 (100)		
Nine years	25 (32.9)	51 (67.1)	76 (100)		
10 years	09 (32.1)	19 (67.9)	28 (100)		
Food restriction*					
Yes	08 (42.1)	11 (57.9)	19 (100)	0.18	1.88 (0.73 to 4.83)
No	94 (27.8)	244 (72.2)	338 (100)		
Prescription drug use*					
Yes	08 (32.0)	17 (68.0)	25 (100)	0.66	1.21 (0.50 to 2.90)
No	92 (28.0)	237 (72.0)	329 (100)		
Lives with biological father*					
Yes	77 (29.3)	186 (73.3)	263 (100)	0.63	0.87 (0.51 to 1.50)
No	24 (26.7)	66 (70.7)	90 (100)		
Type of housing of the child*					
Own	69 (28.0)	177 (72.0)	246 (100)	0.05	_____
Leased	21 (24.4)	65 (75.6)	86 (100)		
Borrowed	06 (46.2)	07 (53.8)	13 (100)		
Donation	00 (0.0)	01 (100)	01 (100)		
Others	05 (71.4)	02 (28.6)	07 (100)		
Number of residents in child's home					
≤ four people	79 (30.9)	177 (69.1)	256 (100)	0.12	0.66 (0.39 to 1.12)
> four people	24 (22.9)	81 (77.1)	105 (100)		
Child health*					
Bad	00 (0.0)	01 (100)	01 (100)	0.13	_____
Fair	04 (66.7)	02 (33.3)	06 (100)		
Good	49 (31.4)	107 (68.6)	156 (100)		
Very good	48 (26.2)	135 (73.8)	183 (100)		

*Data did not analysed with total sample

Table 3 presents the results from the logistic regression model. The significant variables were parent/guardian being treated for illness and the child's age. The R^2 found in the final model was 0.07.

Table 3 - Final model of binary Logistic regression of factors associated with DCD by DCDQ

Likelihood of associated factors	B	Exp (B)	p-value	Constant	-2 log
Final model				-4.287	329.045
Treatment informant disease	0.974	2.650	0.02		
Child's age	0.397	1.488	<0.01		

Discussion

This study aimed to identify socio-demographic factors that are associated with the guardians' perception of DCD among schoolchildren from seven to ten years old. Before explore the associated socio-demographic variables, it seems relevant to discuss the DCD prevalence found in this study. Primarily, because DCDQ is a parent-report measure and not a formal diagnosis for DCD. The screening performed by DCDQ is only one step composing the diagnostic criteria for DCD recommend by literature[2]. Indeed, this criterion is recommended to detect potential children who have risk for motor coordination problems regarding to DCD[19]. Further, Brazilians studies concerning the prevalence of DCD by DCDQ are scarce, which prevent a deeper discussion of this finding. Valentini, Clark and Whitall[20] found a prevalence of 18% of Brazilian children with probable DCD by DCDQ. Likewise, Campbell, Missiuna and Vaillancourt[21] found 20% of school-aged children with probable DCD through the DCDQ in Canada. Despite of lower prevalence found for both Brazilian and Canadian studies, our prevalence (28.5%) is still

high considering the known global prevalence (5-6%) of DCD in school-aged children[22,23] when all recommend diagnostic criteria are followed[2].

Considering the relevance of additional support in DCD identification provided by DCDQ as well as the unclear evidence about prevalence of DCD in Brazil, sociodemographic variables investigated in this study indicate a promising way to clarify the understanding of high indicative of DCD in Brazilian children. Following this argument, study conducted in Brazil[20] identified the socioeconomic status as the strongest variable associated with motor impairment in children with probable DCD. In contrast to the Brazilian study[20] and other studies[16,22,24], in this study, the issue of family income was not associated with increased the guardians perception of DCD. However, among the variables analyzed in this study the child's age and the guardians undergoing treatment for illness were associated with higher chances of perceiving signs of DCD through the DCDQ, according to the perceptions of these parents/guardians.

Guardians of older children more frequently perceived the characteristics of motor impairment through the DCDQ, characteristics that may be related to more sedentary habits of children. Although the present study did not specifically investigate maturational issues in children (e.g., bone and sexual age) and levels of physical activity, it may be inferred that among older children (nine and ten years), exposure to many different motor skills would be more common, and consequently, changes in the coordination of movements would become more noticeable. This accounts for the fact that parents notice indicators of DCD more commonly. Similarly, Valentini, Clark and Whitall[20] also found more risk of DCD in older children (9-10 years old), which support the maturational issues addressed in this study.

The first years of a child's life are crucial for their potential to be stimulated so that a whole variety of motor skills may be further developed at later ages[18]. Studies have reported that early maturational processes in boys seem to promote the reduction in their levels of physical activity[25,26]. In addition, the effect of maturation establishes different relationships in levels of physical activity in different age groups[27], which could indicate a possible explanation of why DCD indicators in older children were most commonly perceived by their parents/guardians in this study.

The parents/guardians which seek health treatment showed greater awareness of indicators of DCD in their child through DCDQ. We may infer that by looking for health assistance for themselves, they are more prone to concern about the limitations and weaknesses that could harm their health and quality of life. Consequently, they become more sensitive to perceive changes and/or impairments in the motor functions of their children. Recent studies have shown that the family environment with regards child care can be a determining factor in the greater risk for children of preschool age to present DCD[28,29]. It is important to highlight that this study used the DCDQ, a tool to identify children with DCD, based on the perception of their parents/guardians. Even though the parents' reports involve subjective aspects (parental characteristics), objective components were considered, such as the characteristics and behavior of the child, which is shown to reflects real characteristics of children[30]. Furthermore, these components may provide useful data for evaluations and diagnoses of children, such as the identification of motor changes, arising from the parental perception that may indicate DCD, as through the DCDQ, for example.

Therefore, this study found that the DCDQ, together with a socio-demographic questionnaire enable to find interesting results. Thus, the use of the DCDQ together with socio-demographic factors may satisfy more completely the requirements for DCD diagnosis[2]. Coupled with the fact that broad participation in daily life activities is closely related to the healthy development of school children[31], it is fundamental to explore the family context of children with DCD to better understand this process.

Although the logistic regression model was insufficient to account for the associations with DCD in children aged seven to ten years old, the results of this study may help to gain a better understanding of the role of parents in determining children's habits. Parents may limit their children, accounting of their own feelings of limitation with practical activities[32], or avoiding exposing their children to practical situations they consider complex, Then, the parents of children with DCD may limit the participation of their children, with the intent of protecting them from exposure to embarrassing and intimidating situations[33].

Further, variables related to maternal care, such as greater health concerns, such as undergoing treatment when suffering an illness were more strongly associated with increased perception of DCD through the DCDQ. This finding provides support to previous observations on the impact of maternal health to increase the risk of children DCD. Different factors related to maternal health could constitute the etiology of DCD[34]. Given the design of this study, it is not possible to explain the causal relationship between the associated variables. However, the results of this study may help future longitudinal studies to better explain the etiology of DCD, including maternal variables in their investigations.

On the other hand, the high prevalence of DCD encountered by means of the DCDQ (28.5%) differs from other studies[22,23], which, together with the fact that it was not possible to investigate the types and specificities of the diseases nor the treatments, may account for the weak logistic regression model found in this study. Another issue is the guardians' health perception, since the classification very bad, bad, fair, good or very good were arbitrarily assigned. However, this classification type has often been used in the literature[35] and supports investigations based on self-reporting of participants. In addition, our finding were based on parents report instead of children motor assessment, which does not allow us to affirm that it is a DCD identification, but only a indicative based on the parents' perception.

Conclusion

The child's age and the guardian undergoing treatment were associated with increased perception of DCD signs among schoolchildren. However, the explained variance was low (7%), indicating that other potentially relevant factors requires investigation.

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Acknowledgements

We would like to thank all the schools that have authorized this research and all parents who voluntarily participated in this study.
This study was supported by São Paulo Research Foundation (FAPESP), grant 2015/24291-0.

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Manuscript received on January 22, 2018
Manuscript accepted on March 14, 2018