

Specificity and Sensitivity of the DCDQ for children aged 8 to 10 years in Brazil

Especificidade e Sensibilidade do DCDQ para crianças de 8 a 10 anos no Brasil

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ABSTRACT: *Objectives:* To evaluate the sensitivity and specificity of the Developmental Coordination Disorder Questionnaire (DCDQ) – Brazil for a group of children aged 8, 9 and 10 years, using the Movement Assessment Battery for Children (Mabc-2) as the gold standard, and to identify the cut-off point for each specific age. *Method:* We evaluated the motor skills of 100 students through DCDQ-Brazil and Mabc-2. The collected data were submitted to statistical analysis of association; cut-off points were defined through the Youden index and Roc curve (Receiver Operator Characteristic). This survey was submitted and approved by the Ethics Committee of Research on Human Beings of the Federal University of São Carlos (CEP-UFSCar). *Results:* The data revealed that DCDQ-Brazil does not show satisfactory validity for the analyzed Brazilian context in the sample of children aged 8 and 10, because the cut-off points are higher than what was defined in this research, in a ratio that varies from 4 to 7 points. *Conclusions:* there is need for future investigations on the data regarding the age of 9 years in order to use the DCDQ adapted to Brazilian children aged 8-10 years, in order to favor the early identification of DCD.

Keywords: Patient health questionnaire. Sensitivity and specificity; Motor skills disorders; Occupational therapy; Child; Brazil.

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RESUMO: *Objetivos:* Avaliar a sensibilidade e a especificidade do Developmental Coordination Disorder Questionnaire (DCDQ) - Brasil para um grupo de crianças de 8, 9 e 10 anos utilizando como padrão ouro o teste *Motor Movement Assessment Battery for Children Test (Mabc-2)* e identificar o ponto de corte para cada idade específica. *Método:* Foram avaliadas habilidades motoras de 100 escolares por meio do DCDQ-Brasil e Mabc-2. Os dados coletados foram submetidos à análise estatística de associação e os pontos de corte definidos através do índice de Youden e curva Roc (Receiver Operator Characteristic). *Resultados:* Os dados revelaram que o DCDQ-Brasil não possui validade satisfatória para o contexto brasileiro analisado na amostra nas idades de 8 e 10 anos, sendo seus pontos de corte mais altos que os pontos de corte definidos nessa pesquisa, numa proporção que varia de 4 a 7 pontos. *Conclusões:* Há necessidade de futuras investigações para aprofundar os dados relativos à idade de 9 anos a fim de utilizar o DCDQ-Brasil de forma adaptada às crianças brasileiras na faixa de 8 a 10 anos favorecendo o processo de identificação precoce do TDC.

Descritores: Questionários de saúde do paciente; Sensibilidade e especificidade; Terapia ocupacional; Transtorno das habilidades motoras; Criança; Brasil.

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INTRODUCTION

According to the diagnostic criteria of the latest Diagnostic and Statistical Manual of Mental Disorders (DSM-5), children who have significant difficulties in the acquisition and performance of motor skills in daily and/or academic life, without any apparent medical cause, when compared to their peers, may have a condition called Development Coordination Disorder (DCD)¹.

Children with no early diagnosis of DCD are often labeled as clumsy, lazy, unmotivated and uncoordinated, thus experiencing frustration and failure in their daily and academic life. Because of this, they may develop secondary complications of social, emotional and behavioral order. Although these kids, in a way, may have basic motor skills such as locomotion and posture maintenance, the problems that result from the disorder are not spontaneously resolved and may bring serious consequences for the children's adult life^{2,3}.

Therefore, children with DCD are more likely to develop low self-esteem and depression, as well as obesity and coronary vascular disease, due to their low physical fitness and reluctance to engage in activities that require good motor skills, such as sports games. The literature points out the main compromises faced by individuals with DCD: difficulty with motor tasks (e.g., running, jumping and skipping rope), reading, writing (e.g. dysgraphia), mathematical reasoning (e.g. arithmetic and geometry), attention and psychosocial adjustment (e.g. isolation), influenced by a deficit of body image, spatial and temporal orientation, low coordination and balance, difficulties regarding the visuospatial working memory, verbal working memory and literacy learning⁴.

Despite the gravity that these complications may bring to the child's life, difficulties and challenges can be mitigated through proper and early intervention. Thus, for the impact of the DCD not to be more devastating, it is necessary to recognize the condition as early as possible and to start therapeutic intervention. To make this possible, researchers point out that it is essential to apply a reliable instrument with good tracking capability^{5,6}.

Unfortunately, the shortage of validated and Brazilian-Portuguese-translated motor tests in Brazil to identify the DCD, added to the professionals' ignorance about the disorder, the lack of professionals to join the team (especially doctors) and the difficulty in finding appropriate and controlled spaces for the motor assessment in schools have created real barriers for the investigation of DCD in

the Brazilian scenario^{7,8,9}.

The *tracking* tests, also known as *screening* tests, are characterized by the rapid application and are typically recommended for initial procedures. Administering a motor test typically demands a lot of time and has a high cost to be done in screening situations; therefore, questionnaires for parents or teachers can be a good alternative to identify children that are likely to have DCD, so then the motor tests can be applied¹⁰.

A recognized and widely used instrument for this purpose is the Developmental Coordination Disorder Questionnaire (DCDQ), developed in Canada and intended for parents identify children who may have DCD¹¹. It is easily and rapidly applied, besides having a low cost for researchers and institutions, which are important aspects in the Brazilian context. The DCDQ was translated and adapted to Brazil in 2007, where it is called DCDQ-Brazil. Although widely used in the country, its scoring criterion is standardized to the Canadian reality¹².

The literature points to the need for defining the instrument's scoring system based on the motor performance of Brazilian children, and thus increase its *sensitivity* and *specificity*, which corresponds respectively to the likelihood of a test identifying individuals who actually have the disease as "patients", and identifying people who in fact are not sick as "not sick"^{12,13}. When these two properties are verified, the instrument's validity can be measured – the validity is the ability to discriminate the sick from the healthy¹⁴.

Considering the importance of investing in studies that investigate the properties of an instrument to assist in the precocious diagnosis of DCD, this study aimed to evaluate the specificity and sensitivity of DCDQ-Brazil for a group of children aged 8 to 10 years and to identify the cut-off point for each specific age in this range.

METHOD

This is a cross-sectional, descriptive exploratory study, with a quantitative approach.

This survey was conducted in the city of Rio Claro-SP, in the period from June to August 2015. According to data provided by the Municipal Department of Education, the municipality has 21 Educational Units (EUs) of the Public System, that provide Elementary education, and all of them are municipal. Five schools were drawn from different geographical areas of the city. One hundred students of both genders participated in the research; they belonged to the age group of 8 to 10 years.

Selection of participants

For participate in the research, the following inclusion criteria were determined: being 8, 9 or 10 years old in the period of the data collection, being registered in the city's public education system, being authorized to participate in the study by the parents or guardians through a Free and Informed Consent Statement (FICS), and agreeing to participate in the research, having signed the Underage Assent Term. As exclusion criteria children could not have neurological sequels, motor, sensory or mental deficiencies that temporarily or definitively prevent sampling, according to DSM-5 Criterion D, in which it states that such conditions exclude the possibility of a diagnosis of DCD.

Instruments

- Standard Economic Classification Criteria of Brazil – CPCEB. This is used to classify the population into “social classes”, estimating the purchasing power of individuals and families in urban areas¹⁵.

- Motor test Mabc-2. The tool evaluates children aged 3 to 16 years; the ones who reach a score below or equal to the 5th percentile are framed in the rating table's red zone, which indicates “severe motor difficulties”, i.e. they probably have DCD; those who score between the 5th and the 15th percentile are framed in the yellow zone, signaling “moderate motor difficulty”, which suggests risk for development; and the ones who score above the 15th percentile are framed in the green zone, which is described as “no motor difficulty”, that is, there are no signs of impairment in motor development¹⁶.

- Developmental Coordination Disorder Questionnaire – DCDQ-Brazil. It consists of 15 items in which parents (or guardians) provide information about the motor skills of their children. The cut-off points used were the standards for Canadian children under the age of 8 to 9 years and 11 months, and from 10 to 15 years. The employed classifications were: “*Probable DCD*” and “*does not have DCD*”^{17,18}.

Methodological procedures

Contacts were made with the Secretary of Education of the city of Rio Claro-SP, in order to obtain the authorization for developing the study in the public schools and the data about the participants in the range of 8 to 10 years. In order to define the size of a representative sample, we admitted the prevalence of 10%, with 90% of test power, which indicates a good level of confidence, and 5% first-rate error probability. The prevalence adopted was based

on literature evidence that estimates an existing 5% to 15% prevalence of DCD in school children^{19,20}. Following the indications of Hanley and McNeil (from 1982), the final calculation of the sample resulted in 100 children (N = 100).

After the definition of the sampling plan, we then selected the schools. We then contacted the educational institutions, and submitted the goals and benefits of the project to the pedagogical direction in order to obtain the permission to develop the research in these places. After it, we then raised the data of the enrolled children and screened the ones that met the inclusion and exclusion criteria for a new selection draw. After the draw and recruitment of the children, the researcher established contact with the respective parent/guardian, aiming at achieving the consent for the participation of their child in the study (FICS) and applying the questionnaires about the motor performance of children and the socioeconomic status of the family (DCDQ-Brazil and Brazil Criteria).

After that, the terms of assent were giving to the children, in which all agreed to contribute to the study and then the individual motor skills evaluation sessions were run using Mabc-2.

Ethical aspects

This survey was submitted to the Ethics Committee of Research on Human Beings of the Federal University of São Carlos (CEP-UFSCar) and approved under the Advice no. 1,067,373.

After data collection and analysis a feedback was given for the educational institutions and parents/guardians in order to meet the ethical and social research commitments. Reports on the questionnaires and tests conducted with each child were handed. Children classified as “probable DCD” or who had detected motor development delays were sent to the city's Specialized Service Centers, and their parents/guardians and teachers were provided guidelines to ensure greater adherence to treatment.

RESULTS

Sample characterization

There were 100 children who participated in the study; 49 of them were girls and 51 were boys, all of them enrolled in the 2nd to the 5th grades of Elementary School. According to the results obtained with the DCDQ-Brazil, 37% of these children were classified as “Probable DCD”, and 63% were classified as not having DCD. The Mabc-2 results showed that 23% presented *moderate delay*, requiring only greater monitoring and attention; 17% presented *severe delay*, indicating that the children possibly had DCDC; and

60% presented *typical development* for their age.

It is observed that in both tests more than half of the children showed good performance during the motor tasks, that is, although the Mabc-2 classified the children in the categories *moderate* and *severe* motor difficulty, the total of the two classifications (corresponding to 40%) is similar to the quantity tracked by the DCDQ as Probable DCD (corresponding to 37%).

Sensitivity, Specificity and Cut-off Point for the DCDQ-Brazil

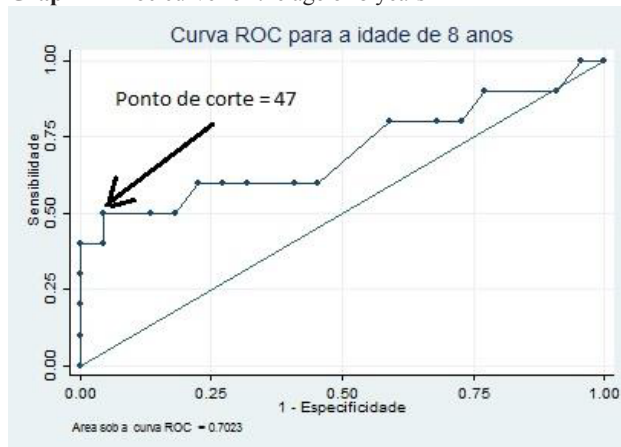
The following are the measures of sensitivity, specificity, and the cut-off point definition from DCDQ-Brazil, as well as the comparison between the Canadian cut-off points and the identified cut-off points for Brazilian children aged 8 to 10 years in this research. In this perspective, the reference cut-off points were taken from the Mabc-2, a *gold standard test*.

Children aged 8 years

The Youden index was used for the identification of the optimal cut-off point with the maximum sensitivity and specificity for the DCDQ-Brazil at the age of 8 years. The index showed the highest cut-off point at 47, which is an excellent specificity of 95%, still keeping an average sensitivity of 50%.

In the Roc curve (*Receiver Operator Characteristic*) graph, that is utilized to help select the best cut-off point for a given diagnostic test through the representation of sensitivity and specificity values, an area under the curve of at least 70% was considered satisfactory²¹. The graph was constructed in Stata software (Graph 1).

Graph 1 – Roc curve for the age of 8 years



Confidence Interval of 95%.

Applying the cut-off point of 47 in the Roc curve, the area under the curve reaches the value of 0.7023 (70%). According to the authors of the area, good validity tests (that is, tests with good ability to distinguish patients from non-patients) present the a Roc curve formation near the upper left corner of the graph; the larger the area under the curve, the greater the discriminatory ability of the test¹⁴.

With the graph, the point identified for 8 years means that the condition “Probable DCD” covers the scores ≤ 47 , and the condition “does not have DCD” covers scores ≥ 48 , which diverges from the Canadian cut-off point: it shows scores ≤ 54 for the condition “Probable DCD” and ≥ 55 for “does not have DCD”. The difference between the cut-off points is 7, being the Brazilian score criterion lower than the Canadian ones.

Other important parameters can be observed with the here established cut-off point: Prevalence, Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV).

It is possible to notice in Table 1 that when applying the new cut-off point, the prevalence of children with Probable DCD is 31%, which tracks 6 children. However, when the instrument was applied using the Canadian criteria, 9 children were identified with the condition. Therefore, it is possible to affirm that DCDQ-Brazil, although widely used, may be tracking children who do not present the disorder as “Probable DCD”.

Table 1 – Parameters observed with the cut-off point of 47 for the age of 8 years

Parameter	Value (%)	Confidence Interval (95%)	
Prevalence	31.0	16.0	50.0
Sensitivity	50.0	18.7	81.3
Specificity	95.5	77.2	99.9
Positive Predictive Value (PPV)	83.3	35.9	99.6
Negative Predictive Value (NPV)	80.8	60.6	93.4

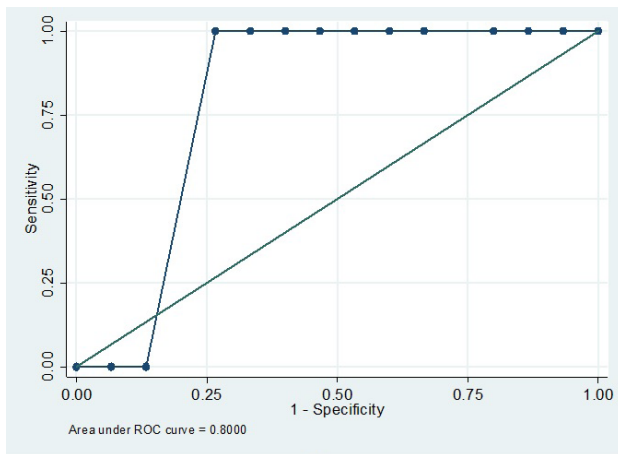
The Positive Predictive Value (PPV) for the age was 83.3% and the Negative Predictive Value (NPV) was 80.8%. These calculated values are excellent for the test, assuring a good probability of the individual having the disorder (when the questionnaire confirms it as positive), or not having it (given a negative result)¹³. Despite the average sensitivity, the test has an excellent specificity (95.45%), which according to the literature is considered the most important fact when selecting people with an impairment within a group¹⁴.

Children aged 9 years

The Youden index was also used in an attempt to identify the set of cut-off points, with the best sensitivity and specificity for this test at the age of 9. Thus, the calculated cut-off point was 56, with 67% sensitivity and 60% specificity. Applying the Roc curve by gender, it shows a value for the curve area of 0.8000 (80%) for girls and 0.4500 (45%) for boys. This means that the area under the curve presented a good result for the female gender, but very low for the male gender, with a poor selection of the affected children.

In relation to the girls, due to the fact that there was only one girl with severe impairment, there were many repeated values, which generated a very deviant curve, rendering it impossible to calculate the confidence intervals (Graph 2). That is, there is a good area, but the confidence in the results is not. In spite of this, the impairment of the analysis of the 9 years range happens especially due to the boys.

Graph 2 – Roc curve for the age of 9 years – girls



Confidence Interval of 95%.

Children aged 10 years

For the age of 10 years, the Youden index has its highest cut-off point at 52. This point generates a good specificity of 71% and an excellent sensitivity of 100%. However, the choice was only confirmed after the calculation of the positive and negative predictive values (PPV and VPN).

As well as for children aged 8 and 9 years, the graphic representation of the Roc curve (Graph 3) was also built using Stata software, in which the cut-off point of 52

for children aged 10 years resulted in an area under the curve of satisfactory value (0.08266 or 82.7%).

Graph 3 – Roc curve for the age of 10 years



Confidence Interval of 95%.

The identified point means that the condition “Probable DCD” covers the scores ≤ 52 , and the condition “does not have DCD” covers scores ≥ 53 , which diverges from the Canadian cut-off point that comprises scores ≤ 56 for the condition “Probable DCD” and ≥ 57 for “does not have DCD”. The difference between the cut-off points is 4, being the Brazilian score criteria lower than the Canadian ones.

As shown in Table 2, the prevalence of children who probably have the disorder, when applying the 52 score, is 11%, in which 13 children are identified with the condition. This differs from the result of the test using the Canadian cut-off point, which tracked 17 children.

Table 2 – Parameters observed with the cut-off point of 52 for the age of 10 years

Parameter	Value (%)	Confidence Interval (95%)	
Prevalence	11.0	3.2	26.7
Sensitivity	100.0	39.8	100.0
Specificity	71.0	52.0	85.8
Positive Predictive Value (PPV)	30.8	9.1	61.4
Negative Predictive Value (NPV)	100.0	84.6	100.0

It is possible to say that for this age the DCDQ-Brazil is probably tracking children without the disorder as “probable DCD”. The calculated PPV is considered low, but for an instrument in which it is necessary to avert the false positives, such as the DCDQ-Brazil, this is not the most important issue. The VPN is considered high because there is no risk of a child assessed as “does not have DCD” being, in fact, a “Probable DCD”²².

Disagreements between the tests

It was found that 10 children aged 8 and 10 years showed unequal results from the assessment of DCDQ-Brazil (new cut-off points) and Mabc-2: half of them were classified as “probable DCD” by the DCDQ-Brazil, which opposes the Mabc-2 results, and the other half was classified by the motor test as suggestive for DCD, diverging from the results indicated by questionnaire.

By correlating the items of DCDQ-Brazil with the motor skills evaluated in Mabc-2, it was noted that the answers to the questionnaire presented (to a greater or lesser occurrence among parents) discrepancy in relation to the results of the motor test evaluated by the researcher. This fact may be related to the parents’ difficulties in interpreting and understanding the issues, since they replied to the questionnaire in this research independently.

Items 7, 8 and 9 of the questionnaire showed the most differed results from the motor test, which related to fine motor skills and manual dexterity. These issues require specific notions about the writing performance of the child, which may explain the inaccuracy and inconsistency of the parents’ responses. It is then possible to infer that the participation of the teacher when applying the questionnaire can contribute to a greater reliability of responses in this regard.

DISCUSSION

Considering the negative impact that the DCD on the everyday activities and productive activities of children at school age, efforts for cross-cultural adaptation and validation of the DCDQ in different countries have been studied in the literature.

In this sense, the present study is aimed to enhance the ability of the DCDQ-Brazil to discriminate Brazilian individuals with DCD from the ones who do not have the disorder, in order to increase the diagnostic accuracy for

Brazilian children. Therefore, the aim of this study was to evaluate the sensitivity and specificity of this instrument in the 8, 9 and 10 years age groups and to identify the best cut-off point for each age.

In the study of cultural translation and adaptation of the DCDQ to Brazil, 30 children with typical development and 15 children from the age group of 7 to 12 years¹⁸ with coordination problems were selected. Three versions of the questionnaire were applied in this research: the original one, version A, and version B. Version A, currently used in Brazilian studies, proved to be the most appropriate option based on the data relating to the test-retest reliability, which went from 95% on the original version to 97%; the internal consistency of the items was raised from 91% to 92%; the sensitivity went up from 67% to 73%; and the specificity reached 87%, from the original 83%; the PPV was raised from 67% to 73%; and the NPV went from 86% to 87%.

However, the results of the present inquiry reveal that the DCDQ-Brazil with Canadian scoring criteria did not have a satisfactory validity for the sample studied in this research, which occurred in the Brazilian context with children aged 8 and 10 years; that is, the questionnaire in this sample showed to be not very sensitive or specific on the discrimination of individuals that possibly have DCD and of the ones who do not have it; its cut-off point was higher than the cut-off point for the children with the respective ages, in a ratio that varies from 4 to 7 points. This difference suggests that the Canadian children reach a higher average motor performance than the Brazilian children at these age ranges. The presented results may contribute to the validation of the instrument in the Brazil, revealing cut-off points with 71% specificity, 100% sensitivity, 30% PPV, and 100% NPV to the age of 8 years; and 95% specificity, 50% sensitivity, 83% PPV, and 80% NPV to the age of 10 years.

According to what was presented, Jóia⁸ calculated the specificity and sensitivity of DCDQ-Brazil for Brazilian children aged 7 years (n=101) in this study, which identified a difference of 4 points more than the cut-off point for Canadian children. That is, children may be passing unnoticed when being analyzed by defaults from another country. In this way, although the data of the present study identify a lower score, both studies indicate the need for adjustments in the score of instruments for children to receive accurate and appropriate interventions.

Another national research in which it was verified the most appropriate cut-off points for the questionnaire

in the age group of 5 to 7 years and 11 months (GI), 8 to 9 years and 11 months (GII), and 10 to 13 years and 11 months (GIII), identified, for the GII, a specificity of 80% and sensitivity of 100%, with 50% PPV and 100% NPV for the cut-off point ≥ 58 , from a representative sample of 66 children; for the GIII, the cut-off point ≥ 58 was calculated, with 76.3% specificity, 96.7% sensitivity, 50.9% PPV, and 98.9% NPV, from a sample of 148 children²².

These results reveal higher cut-off points than those defined in this study for the ages of 8 (≤ 47) and 10 (≤ 52) years, being this factor justified by the difference in sample size between the two studies; however, both point to a lower score system than the one established for Canadian children.

According to Cardoso and Magalhães⁷, due to the scarcity of standardized instruments for Brazilian children and the difficulty of access to foreign instruments, because of the high import cost, the Motor Coordination and Dexterity Assessment (ACOORDEM, in Portuguese) has been developed to be an auxiliary test to detect the DCD, with for the motor performance observation items and a questionnaire to parents. In order to contribute to the validation, these researchers and the present study adopted the Mabc-2 as the reference benchmark and the DCDQ-Brazil for the screening. The concurrent validity between the Mabc-2 and the ACOORDEM was analyzed using the Spearman test (5% significance level), and a good correlation between the tests was also found. The predictive validity for the age of 8 years was evaluated by the indexes of sensitivity (74%), specificity (90%), PPV (67%) and NPV (93%). The *Receiver Operating Characteristic Curve* (Roc curve) was also used to measure the optimal cut-off point with a 5% significance level. The prevalence identified in this research by applying the new cut-off points was 31% for children aged 8 years, and 11% for children aged 10 years.

It is observed that the prevalence calculated for the age of 8 years is very high when compared to the ones found in national studies, ranging from 6 to 11.4%^{9,23,24}.

The incidence verified for the age of 10 years is within expectations.

In view of the studies' results, new investigations, with larger samples, to evaluate the sensitivity and specificity of the other age groups of the DCDQ-Brazil are needed, in order to standardize the questionnaire's scoring criteria for the Brazilian reality and to increase the accuracy of detecting the DCD.

FINAL CONSIDERATIONS

This study concludes that the investment in the validation of tests that identify the DCD in Brazilian children will require the union of researchers' efforts in favor of the children's quality of life. With validated tests, conditions can be provided for an effective diagnosis and the consequent insertion of the child with DCD in intervention programs. This is intended to minimize the probable functional, social and emotional damages caused by the disorder.

As a limitation of this study, we highlight the impossibility of identifying the specificity and sensitivity related to the age of 9 years, which demands new research focusing on this age group with larger representative samples. For future Brazilian researches involving the standardization of the instrument on the identification of DCD, it is suggested to adopt a unified methodology in order to facilitate the comparison of results and consensus among the researchers.

Finally, some of the contributions of Occupational Therapy in this process of TDC detection are verified. The scope of their actions in a multidisciplinary team is initially defined when parents, teachers and other professionals contribute with relevant information about the performance of the child. In addition, the set of national studies developed in the scope of Occupational Therapy can assist and compose with national epidemiological studies on the condition.

Authorship and Indication of Responsibility: T.F.S Sarraf was responsible for creating, collecting and analyzing data and writing the manuscript; C.M.S. Martinez was responsible for the research, development and critical review of the manuscript; and J.L.F Santos was responsible for data processing.

REFERENCES

1. Associação Psiquiátrica Americana (APA). Manual diagnóstico e estatístico de transtornos mentais: DSM-5. Porto Alegre: Artes Médicas; 2014.
2. Ferreira LF, Nascimento RO, Apolinario MR, Freudenheim AM. Desordem da coordenação do desenvolvimento. Rev Motiz. 2006;12(3):283-92. Disponível em: http://www.educadores.diaadia.pr.gov.br/arquivos/File/2010/artigos_teses/EDUCACAO_FISICA/artigos/Ferreira.Lucio_et_al_Artigo.pdf.
3. Plata R, Guerra G. El niño con trastorno del desarrollo de la coordinación, ¿Um desconocido en nuestra comunidad? Norte Salud Mental. 2009;8(33):18-30. Disponível em: http://kulunka.org/wp-content/uploads/2013/12/doc_19.pdf.
4. Pulzi W, Rodrigues GM. Transtorno do Desenvolvimento da coordenação: uma revisão da literatura. Rev Bras Educ Esp (Marília). 2015;21(3):433-44. doi: 10.1590/S1413-65382115000300009.
5. Gibbs J, Appleton J, Appleton R. Dyspraxia or developmental coordination disorder? Unravelling the enigma. Arch Dis Child. 2007;92(6):534-9. doi: 10.1136/adc.2005.088054.
6. Missiuna C, Moll S, King S, King G, Law M. A trajectory of troubles: parents' impressions of the impact of developmental coordination disorder. Phys Occup Ther Pediatr. 2007;27(1). https://doi.org/10.1080/J006v27n01_06.
7. Cardoso AA, Magalhães LC. Análise da validade de critério da Avaliação da Coordenação e Destreza Motora: ACOORDEM para crianças de 7 e 8 anos de idade. Rev Bras Fisioter. 2012;16(1):16-22. doi: 10.1590/S1413-35552012000100004.
8. Jóia AF. Transtorno do desenvolvimento da coordenação em crianças de 7 anos de idade matriculadas em escolas públicas do município de Araraquara-SP [Dissertação]. São Carlos: Programa de Pós-graduação em Terapia Ocupacional da Universidade Federal de São Carlos; 2014. Disponível em: <https://repositorio.ufscar.br/handle/ufscar/6880>.
9. Silva AFR. Prevalência do transtorno do desenvolvimento da coordenação em crianças de 7 anos de idade matriculadas em escolas públicas de Itirapina-SP [Dissertação]. São Carlos: Programa de Pós-graduação em Terapia Ocupacional da Universidade Federal de São Carlos, São Carlos; 2015. Disponível em: <https://repositorio.ufscar.br/bitstream/handle/ufscar/6906/6818.pdf?sequence=1&isAllowed=y>.
10. Green D, Wilson BN. The importance of parent and child opinion in detecting change in movement capabilities. Can J Occup Ther. 2008;75(4):208-19. doi: 10.1177/000841740807500407.
11. Salamanca Duque LM, Naranjo Aristizábal MMC, González Marín AP. Traducción al español del cuestionario para diagnóstico de trastorno del desarrollo de la coordinación. Rev Cien Salud. 2012;10(2):195-206. Disponível em: <http://www.redalyc.org/pdf/562/56223856003.pdf>.
12. Prado SS, Magalhães LC, Wilson BN. Cross-cultural adaptation of the Developmental Coordination Disorder Questionnaire for brazilian children. Rev Bras Fisioter (São Carlos). 2009;13:236-43. doi: 10.1590/S1413-35552009005000024.
13. Benseñor IM, Lotufo PA. Epidemiologia: abordagem prática. 2a ed. São Paulo: Medicina, Ciência e Arte; 2011.
14. Passos ADC, Ruffino-Neto A. Características dos instrumentos de medida. In: Medronho RA, et al. Epidemiologia. 2a ed. São Paulo: Atheneu; 2008.
15. Associação Brasileira de Empresas de Pesquisa (ABEP). Critério de classificação econômica Brasil, 2007 [citado 23 ago. 2015]. Disponível em: <http://www.abep.org/>.
16. Henderson S, Sugden DA, Barnett A. Movement assessment battery for children. 2nd ed. San Antonio: Harcourt Assessment; 2007.
17. Wilson BN, Crawford S, Kaplan BJ, Roberts G. Further validation of the Developmental Coordination Disorder Questionnaire. Calgary: Health Region and Department of Pediatrics, University of Calgary; 2006.
18. Prado MS. Tradução e adaptação cultural do *Developmental Coordination Disorder Questionnaire* (DCDQ) [Dissertação]. Belo Horizonte, MG: Escola de Educação Física, Fisioterapia e Terapia Ocupacional, Universidade Federal de Minas Gerais – UFMG; 2007. Disponível em: <http://www.bibliotecadigital.ufmg.br/dspace/handle/1843/MSMR-777JBN>.
19. Missiuna C. Children with developmental coordination disorder: at home and in the classroom. Ontário, Canadá: CanChild; 2003.
20. Miranda TB, Beltrame TS, Cardoso FL. Desempenho motor e estado nutricional de escolares com e sem o transtorno do desenvolvimento da coordenação. Rev Bras Cineantropom Desempenho Hum (Florianópolis). 2011;13(1):59-66. doi: 10.5007/1980-0037.2011v13n1p59.
21. Medronho RA, Perez MA. Testes diagnósticos. In: Franco LJ, Passos ADC. Fundamentos de epidemiologia. 2a ed. Baurer: Manole; 2011.
22. Coppede AC. Transtorno do desenvolvimento da coordenação em escolares prematuros: estudo bibliométrico e de prevalência [tese]. São Carlos: Universidade Federal de São Carlos – UFSCar; 2015. Disponível em: <https://repositorio.ufscar.br/handle/ufscar/7486?show=full>.
23. Miranda TB. Perfil motor de escolares de 7 a 10 anos de idade

com indicativo de Desordem Coordenativa Desenvolvimental [Dissertação]. Florianópolis, SC: Centro de Ciências da Saúde e do Esporte, Universidade do Estado de Santa Catarina; 2010. Disponível em: http://bdtd.ibict.br/vufind/Record/UDSC_87846f84f7b35ff8ce6bfa87e7a47572.

24. Santos VAP, Vieira JLL. Prevalência de desordem coordenativa desenvolvimental em crianças com 7 a 10 anos de idade. Rev Bras Cineantropom Desempenho Hum. 2013;15(2):233-42. doi: 10.5007/1980-0037.

