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CHAPTER 4
THE DCDDAILY-Q

59

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INTRODUCTION

Children with developmental coordination disorder (DCD) experience motor difficulties in a broad range of activities of daily living (ADL), such as mobility, personal hygiene, feeding, and dressing; handwriting and doing craftwork; ball skills and riding a bike.[1-4] Moreover, due to their motor difficulties in ADL, children's participation may be restricted, and psycho-social consequences may arise, such as low self-esteem and social exclusion.[4, 5] The great impact of DCD on children's daily lives necessitates proper assessment of ADL, to support diagnosis and intervention, in order to limit the consequences of the disorder.[6, 7]

For optimal insight into children's daily functioning, ADL assessment should address both children's capacity in ADL and performance of ADL.[8, 9] Capacity in ADL, as assessed with a standardized clinical test, reflects what a child is capable of in a standardized environment, i.e. what children can do.[8, 9] Performance, assessed with a parental or teacher questionnaire, addresses the child's daily life performance, i.e. what children actually do during everyday life.[8-10] Both are of interest, as what children are able to do in a standardized test does not always reflect what they do in daily life according to parents or teachers.[8, 9] For example, in clinical assessment, children might perform worse than during daily life due to the pressure they feel, or better, due to their focussed attention and the guidance of the assessor. Questionnaires on the other hand, may be subjective, although parents and teachers provide a valuable source of information.[10, 11] A combination of assessment tools is preferred to provide a more complete representation of children's difficulties.[6, 12] The combination of a standardized clinical test and a questionnaire holds another advantage, as ADL may be addressed with questionnaires that are difficult to include in clinical assessments, such as swimming or riding a bike. The assessment of a comprehensive range of ADL is particularly important in children with DCD, as it is a heterogeneous disorder that is represented by a wide range of variation in everyday functioning.[13]

As comprehensive assessment of ADL was lacking for children with (or suspected to have) DCD, the DCDDaily and DCDDaily-Q were developed.[2, 14, 15] With the DCDDaily, professionals are enabled to assess children's capacity in ADL in an objective and standardized way.[14] The DCDDaily-Q is a parental questionnaire to address children's performance of ADL. Together, the instruments may provide complete assessment of ADL as recommended in the International Practice Guideline for DCD.[2] The current study presents the DCDDaily-Q. The DCDDaily-Q is the first questionnaire (a) to address the broad range of ADL that children with DCD face trouble with according to the literature, (b) covering the three domains of ADL relevant for children: "self-care and self-

maintenance," "productivity and schoolwork," and "leisure and play".[3, 4, 7, 13, 16-18] The aim of this study is to investigate the psychometric properties of the DCDDaily-Q.

METHODS

Participants

Two groups of five to eight-year-old children were included in this study, a DCD group (n = 25; 21 boys; mean age in years (SD) = 6.8 (1)) and a normative reference group (n = 193; 90 boys; mean age (SD) = 6.5 (1); see Table 1 for a complete description of the sample).

All children in the DCD group were referred to a rehabilitation centre or physical therapy centre in the Netherlands and diagnosed by a medical doctor, according to the diagnostic criteria for DCD operationalized in the clinical practice guideline for DCD.[2, 19] The reference group comprised a sample of the Dutch population of five to eight-year-old children, selected from ten mainstream primary schools throughout the Netherlands. Schools were selected from various geographic locations, accounting for possible differences between larger cities and smaller villages. From the participating schools, all children aged five to eight years were included, with no exclusion criteria applied.

As a control group for validity analysis, a third group was composed from children in the reference group to enable comparison of children with DCD and typically developing children, i.e. without any known clinical condition. First, children in the reference group were preliminary selected for the control group when they had no known clinical condition such as uncorrected visual problems, and were not at risk for DCD (a score equal to or lower than the 16th percentile on the Movement Assessment Battery for Children-2 (MABC2) Test[20]). Second, from this preliminary selection, children were randomly selected, blinded for outcomes, to match for age (within one year) and gender with the DCD group (n = 25).

Instruments

DCDDaily and DCDDaily-Q

The design of the DCDDaily and DCDDaily-Q comprised four phases (extensively described in the article on the design of the DCDDaily)[14]: (a) description of a theoretical model; (b) setting specifications for the instruments to fulfil, of which the following specifications were applicable to the questionnaire: "encompassing the domains of ADL relevant for children" and "actual daily activities for children five to eight years of age"; (c) literature study and expert interviews in order to select possible items for inclusion; (d) expert meeting to discuss the list of relevant items. A limited but broad range of ADL was included in the DCDDaily; a more complete range of ADL was included in the research

version of the DCDDaily-Q (see Table 2 and Appendix A). Subsequently, as described in the current study, the number of items of the research version of the DCDDaily-Q was reduced, and the psychometric properties of the final version were investigated.

The DCDDaily-Q is a parental questionnaire to address children's performance in a broad range of ADL, designed to be completed by parents of five to eight-year-old children. An overview of the items of the DCDDaily-Q is provided in Table 2 and Appendix A. Parents rate their children's performance on a three-point scale for each item (1 = good, 2 = medium, 3 = poor). The DCDDaily-Q total score is the sum of the 23 item scores, ranging from 23 (good) to 69 (poor). The questionnaire was designed such that each item can be marked "good" when the child usually performs the activity without trouble, and "poor" when the activity can usually not be performed without dropping things, knocking things over, or falling, or when the child is not able to complete the activity (see Appendix B for an illustration and general instructions). The questionnaire takes 15 minutes to complete.

MABC2 Test

The MABC2 Test is recommended for the operationalization of the first diagnostic criterion for DCD.[1, 2, 20] It is designed to classify 3 to 16-year-old children according to degree of motor impairment (scores range from .1 to 99, a higher score indicates better performance; a score <5th percentile is classified as motor impairment, a score between the 5th and 16th percentile is classified as at risk).[20] Validity and reliability of the instrument are good.[21]

MABC2 Checklist and DCDQ

The MABC2 Checklist and DCDQ are currently used for the operationalization of the second diagnostic criterion for DCD.[1, 2, 19, 20, 22] The MABC2 Checklist is designed for teachers to identify 5 to 12-year-old children with motor difficulties (total scores range from 0 to 120; a higher score indicates poorer performance).[20] Validity and reliability of the instrument are good.[23] In the Dutch manual of the MABC2 Checklist, reliability and validity data, as well as norm scores, are provided separately for completion by teachers and parents.[24] The parental norm scores were used in this study. The DCDQ was designed to identify motor problems in 5 to 15-year-old children (total scores range from 0 to 75; a higher score indicates better performance).[22]

Procedure

The study was approved by the Medical Ethics Committee of the University Medical Center Groningen in the Netherlands. After informed consent was obtained from their parents, children were subsequently assessed with the DCDDaily and MABC2 Test, in a

separate room in their school or rehabilitation centre, between September 2008 and March 2012.[14, 20] Assessors were advanced students with a background in human movement sciences or physical therapy, who were trained in the assessment of the tests, but who had not been involved in the design of the instruments. The DCDDaily-Q, MABC2 Checklist and Developmental Coordination Disorder Questionnaire (DCDQ) were sent to the parents, who returned these to the researchers after completion within three weeks after assessment.[20, 22]

Statistical analysis

Standards of the American Educational Research Association were used for statistical testing.[25] Analyses were performed using SPSS (IBM SPSS, version 20.0, Chicago, IL, USA). Missing values were replaced with the mean item score of the child's group (reference or DCD). A maximum of four questions was found unanswered per questionnaire; in total, less than 1% of all answers was found missing. As the distribution of the data was not normal, non-parametric tests were used.

In order to provide a reliable and valid questionnaire, item reduction and the factor structure of the DCDDaily-Q were explored stepwise. First, redundant items were excluded when item-total correlation was < .30; when < 10% of the combined sample showed poor performance; or when items did not discriminate. Second, an exploratory factor analysis was performed and further items were removed when communality was < .20; when the highest factor loading was < .40; or when an item had similar loadings on different factors. Thirdly, the number of factors was determined using exploratory factor analyses following five criteria: (a) all potential model factors have Eigenvalues greater than 1.0; (b) a scree plot shows a change in slope; (c) the model explains a reasonable amount of variance in the data; (d) the model contains the smallest number of factors possible while grouping items together logically by content; (e) no factor contains fewer than 4 items. Finally, a Principal Component Analysis was performed with Varimax rotation of the forced number of factors, to result in the final version of the DCDDaily-Q. The Kaiser-Meyer-Olkin measure was used to analyse the sampling adequacy; the Bartlett's test of sphericity was used to analyse whether the correlations between items was large enough for Principal Component Analysis.

The internal consistency of the final version of the DCDDaily-Q was calculated for the test as a whole and for the factors found, with .70 taken as an acceptable level. Discriminant validity of the DCDDaily-Q was determined by calculating differences between the DCD group and the control group for mean item scores and mean total scores, using Mann-Whitney U tests. A receiver-operator characteristics curve was composed in order to investigate to what extent the DCDDaily-Q discriminates between children with and without DCD, using data of the DCD group and the control group. An

appropriate cut-off point was determined for the DCDDaily-Q total score to indicate DCD, accounting for optimal sensitivity and specificity, e.g. at or above .80 and .90 respectively. The area under curve statistic was calculated to reflect the probability that a child diagnosed with DCD had a worse DCDDaily-Q total score than a typically developing child, with a value above .80 considered high. Concurrent validity was determined by calculating Spearman's ρ between mean DCDDaily-Q total scores and mean MABC2 Checklist total scores and mean DCDQ total scores, as well as mean MABC2 Test percentile scores and mean DCDDaily total scores, for the reference group and DCD group separately.[14, 20, 22] Finally, in order to determine the incremental validity of the DCDDaily-Q, a binary logistic regression analysis was performed to predict the presence or absence of DCD with the questionnaires used as predictors. In Step 1, mean DCDDaily-Q total scores were entered. In Step 2, mean MABC2 Checklist total scores were entered. In Step 3, mean DCDQ total scores were entered.

RESULTS

Descriptive statistics on age, gender, and MABC2 Test percentile scores and DCDDaily total scores are shown in Table 1. This table demonstrates the reference group to comprise a balanced number of children across age and gender. Furthermore, the MABC2 Test percentile scores in the reference group (.5 - 99) covered the full range of possible scores almost completely, with a mean score near the 50th percentile.[20]

Table 1 also shows mean total scores on the final version of the DCDDaily-Q, and the MABC2 Checklist and DCDQ. In the reference group, mean scores on the final version of the DCDDaily-Q revealed better performance for older children than younger children (F (3, 189) = 15.04, p < .001). The Bonferroni post hoc test for age revealed a significant difference between the group of five-year-old children and the groups of six (p = .001), seven and eight-year-old children (p < .001).

Table 1. Age, gender, mean MABC2 Test percentile scores, mean DCDDaily total scores, mean DCDDaily-Q total scores, mean MABC2 Checklist total scores, and mean DCDQ total scores, for all groups.

	N	Male: Female	MABC2 Test % Mean (SD; range)	DCDDaily Mean (SD; range)	DCDDaily-Q Mean (SD; range)	MABC2 Checklist Mean [b] (SD; range)	DCDQ Mean [b] (SD; range)
Reference group	193	90:103	47 (28; .5-99)	23 (4; 18-39)	31 (6; 23-48)	4 (5; 0-20), q=186	63 (10; 21-75), q=192
Age 5	41	23:18	40 (26; .5-98)	27 (4; 21-35)	35 (5; 26-46)	6 (5; 0-17)	59 (11; 21-74)
Age 6	63	26:37	46 (29; 1-99)	24 (4; 18-39)	31 (6; 23-48)	4 (5; 0-20)	63 (9; 30-75)
Age 7	51	22:29	50 (28; .5-98)	21 (2; 18-28)	29 (4; 23-37)	3 (4; 0-15)	66 (8; 45-75)
Age 8	38	19:19	53 (30; 5-95)	21 (3; 18-29)	28 (5; 23-44)	3 (5; 0-20)	64 (11; 37-75)
DCD group	25	21:4	6 (6; .1-16)	30 (6; 22-43)	46 (7; 28-60)	22 (13; 0-51), q=23	41 (16; 19-71), q=21
Age 5	4	4:0	5 (3; 1-9)	38 (6; 30-43)	44 (5; 40-51)	14 (7; 7-23)	59 (7; 52-66)
Age 6	5	5:0	6 (6; .5-16)	33 (4; 30-40)	46 (7; 35-55)	22 (11; 6-36)	39 (14; 22-59)
Age 7	9	7:2	9 (6; 2-16)	28 (4; 24-37)	48 (7; 38-60)	24 (15; 0-44)	37 (17; 19-71)
Age 8	7	5:2	1 (2; .1-5)	27 (4; 22-32)	44 (8; 28-51)	25 (16; 12-51)	38 (16; 19-61)
Control group	25	21:4	55 (27; 25-99)	24 (4; 19-34)	30 (5; 23-40)	3 (5; 0-20), q=25	63 (10; 43-75), q=25
Age 5	4	4:0	38 (18; 25-63)	30 (5; 23-34)	34 (3; 31-38)	5 (6; 0-13)	63 (12; 46-71)
Age 6	5	5:0	43 (19; 25-63)	26 (2; 25-30)	34 (7; 25-40)	8 (9; 0-20)	59 (10; 46-70)
Age 7	9	7:2	68 (28; 25-99)	22 (3; 19-27)	28 (3; 23-33)	2 (3; 0-8)	66 (7; 57-75)
Age 8	7	5:2	57 (28; 25-91)	21 (1; 20-22)	27 (5; 24-36)	1 (2; 0-4)	63 (12; 43-75)

Notes: [a] MABC2 Test % = Movement Assessment Battery for Children-2 percentile score; DCDDaily = DCDDaily total score; DCDDaily-Q = DCDDaily-Q total score - *final version*; MABC2 Checklist = Movement Assessment Battery for Children-2 Checklist total score; DCDQ = Developmental Coordination Disorder Questionnaire total score; [b] q = the number of questionnaires completed per group; [c] DCD = developmental coordination disorder

From the 38-item research version of the DCDDaily-Q, first, eleven items were removed due to: an item-total correlation < .30 (putting on a jacket); because < 10% of the combined sample showed poor performance (opening and closing a lunchbox, putting on trousers, sweater and jacket, walking the stairs, climbing, and computer use); or because items did not discriminate between the DCD group and the control group (walking the stairs, laying the table, tying shoe laces, cycling, and skating; see Appendix A). Second, four items were removed because: the highest factor loading was < .40 (putting on a backpack and walking with a chair); or because items had similar loadings on different factors (running and swimming). Third, the number of factors was determined, with seven factors showing Eigenvalues > 1, and the scree plot showing a change at three or four factors. The model with three factors showed the items to group logically. These three factors explained 48% of the total variance. The Kaiser-Meyer-Olkin measure demonstrated the sampling adequacy to be good, with KMO = .897. The Bartlett's test of sphericity indicated the correlations between items to be sufficiently large for Principal Component Analysis (X^2 (253) = 1939.75, p < .001).

The final version of the DCDDaily-Q comprised 23 items covering three underlying factors (see Table 2). Factor 1 was found to reflect fine motor activities; Factor 2 was found to reflect activities of self-care and self-maintenance; and Factor 3 was found

to reflect gross motor playing activities. Further reliability analyses showed the internal consistency of the 23 items of the DCDDaily-Q to be good: Cronbach's α = .85 for the reference group and .84 for the DCD group. For the age groups separately, Cronbach's α ranged from α = .73 to α = .87 in the reference group and from α = .70 to α = .88 in the DCD group. Further, Cronbach's α was found > .70 for each of the factors, as specified in Table 2.

The final version of the DCDDaily-Q showed excellent discriminant validity. Parents rated the ADL performance of children in the DCD group to be significantly poorer than the performance of children in the matched control group, both for the DCDDaily-Q total score (p < .001) and all 23 item scores (p ≤ .005): Figure 1 provides an overview of the differences in item scores between the groups (see also Appendix A).

The receiver-operator characteristics curve for the DCD group and control group also demonstrated the ability of the DCDDaily-Q to differentiate between children officially diagnosed with and those without DCD (see Appendix C). With a cut-off score of 39, sensitivity and specificity were found to be 88 and 92%. The area under curve characteristic was found to be .961.
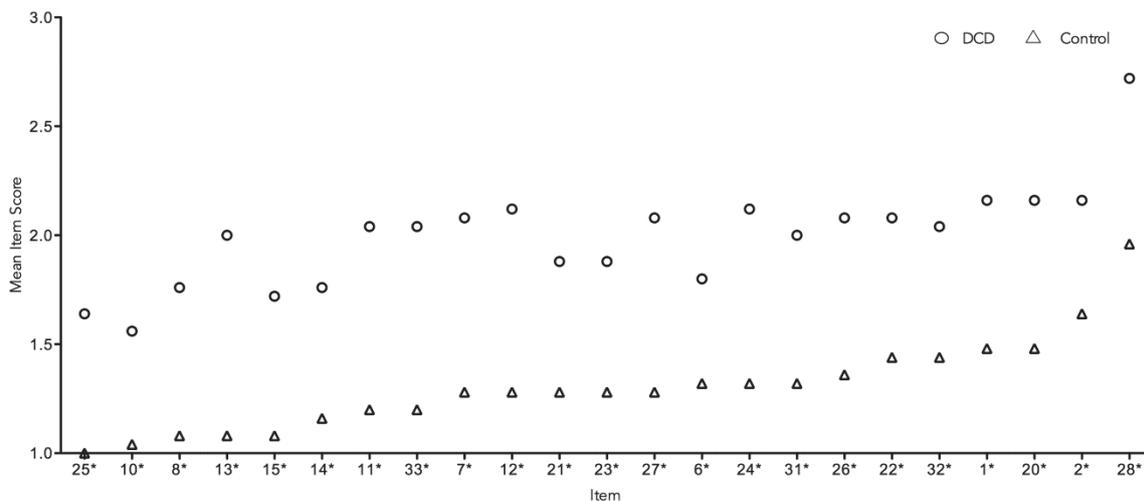
Figure 1. Mean DCDDaily-Q item scores for the DCD group and matched control group.

Notes: Items are sequenced for the difficulty of items according to the mean scores in the control group; DCD = developmental coordination disorder; Explanation of the item numbers: 1 = Buttering a sandwich, 2. Cutting a sandwich, 3 = Pouring juice, 4 = Opening a wrapper/package, 5 = Eating soup with a spoon, 6 = Washing hands, 7 = Drying him/herself after a shower or bath, 8 = Brushing teeth, 9 = Handling a key, 10 = Putting on socks, 11 = Writing, 12 = Gluing paper using a glue stick, 13 = Folding paper sheets/slips, 14 = Colouring a picture, 15 = Cutting paper using scissors, 16 = Lego® building, 17 = Moving pawns (on a board), 18 = Playing hopscotch, 19 = Jumping a rope, 20 = Throwing a tennis ball, 21 = Catching a ball, 22 = Kicking a football, 23 = Playing marbles; * = Significant difference between mean scores in the DCD group and matched control group, p < .05

For the reference group, moderate but significant correlations were found between DCDDaily-Q total scores and the questionnaires (MABC2 Checklist: Spearman's ρ = .489, p < .001; DCDQ: ρ = -.638, p < .001) and tests (MABC2: Spearman's ρ = -.360, p < .001; DCDDaily: ρ = .454, p < .001). For the DCD group, moderate to low correlations were found (MABC2 Checklist: Spearman's ρ = .350, p = .102; DCDQ: ρ = -.562, p = .008; MABC2: ρ = -.374, p = .066; DCDDaily: ρ = .037, p = .862).

Table 2. Summary of the Principal component Analysis of the DCDDaily-Q.

	Rotated factor loadings		
	Fine motor activities	Self-care and self-maintenance	Gross motor playing activities
1. Buttering a sandwich	.37	**.47**	.21
2. Cutting a sandwich	.21	**.46**	.39
3. Pouring juice	.07	**.60**	.22
4. Opening a wrapper/package	.21	**.45**	.42
5. Eating soup with a spoon	.26	**.59**	.12
6. Washing hands	.19	**.62**	.07
7. Drying oneself after a shower or bath	.11	**.62**	.08
8. Brushing teeth	.05	**.69**	.25
9. Handling a key	.19	**.51**	.29
10. Putting on socks	.43	**.44**	.06
11. Writing	**.66**	.07	.28
12. Gluing paper using a glue stick	**.70**	.24	.15
13. Folding paper sheets/slips	**.80**	.25	.15
14. Colouring a picture	**.78**	.03	.22
15. Cutting paper using scissors	**.71**	.27	.21
16. Lego® building	**.42**	.24	.11
17. Moving pawns (on a board)	**.46**	.17	.44
18. Playing hopscotch	.28	.38	**.51**
19. Jumping a rope	.29	.25	**.50**
20. Throwing a tennis ball	.13	.19	**.79**
21. Catching a ball	.25	.07	**.75**
22. Kicking a football	.07	.23	**.73**
23. Playing marbles	.35	.16	**.46**
Eigenvalues	8.02	1.68	1.41
% Variance	34.87	7.32	6.15
Cronbachs α, Reference group	.77	.70	.74
Cronbachs α, DCD group	.81	75	.72

Note: DCD = developmental coordination disorder

Considering incremental validity, the DCDDaily-Q total scores predicted the presence or absence of DCD significantly better than the MABC2 Checklist and DCDQ (see Table 3). The DCDDaily-Q identified 93.8% of the children correctly, the MABC2 Checklist 81.3%, and the DCDQ 78.3%.

Table 3. Results of logistic regression analysis with the DCDDaily-Q total scores, MABC2-Checklist total scores, and DCDQ total scores as predictor variables, and an official diagnosis of DCD as criterion variable, for the control group and DCD group.

	B(SE)	p-value	Odds ratio (95% CI)
Step 1			
DCDDaily-Q	0.60 (.23)	.01	1.82 (1.16 - 1.88)
Step 2			
DCDDaily-Q	0.56 (.25)	.02	1.75 (1.08 - 2.84)
MABC2 Checklist	0.06 (.08)	.51	1.06 (0.90 - 1.25)
Step 3 [a]			
DCDDaily-Q	0.56 (.26)	.03	1.75 (1.05 - 2.93)
MABC2 Checklist	0.05 (.08)	.52	1.05 (0.90 - 1.23)
DCDQ	-0.03 (.06)	.66	0.97 (0.87 - 1.10)

Notes: [a] All steps were repeated with age included as a confounder, measured for boys only (a limited number of girls diagnosed with DCD was included in the study), showing the same results (e.g., for the DCDDaily-Q in Step 3, B(SE) = .66 (.32), p = .04, Odds ratio (95% CI) = 1.93 (1.02-3.62), R^2 = .87 (Nagelkerke)); [b] For step 1, R^2 = .65 (Cox and Snell), R^2 = .87 (Nagelkerke); for Step 2, R^2 = .66 (Cox and Snell), R^2 = .88 (Nagelkerke); for Step 3, R^2 = .66 (Cox and Snell), R^2 = .88 (Nagelkerke); [c] MABC2 = Movement Assessment Battery for Children-2; [d] DCD = developmental coordination disorder

DISCUSSION

The aim of this study was to investigate the psychometric properties of the DCDDaily-Q, a new parental questionnaire on ADL performance in five to eight-year-old children, comprising a comprehensive range of ADL. The final version of the DCDDaily-Q included 23 items, covering three factors. The DCDDaily-Q showed good reliability, good discriminant validity, good sensitivity and specificity, and it showed better ability to predict the presence or absence of DCD than currently used questionnaires.

The internal consistency of the DCDDaily-Q was found to be good, both for the 23 items together and for each of the three factors, demonstrating the reliability of the questionnaire. The three factors "self-care and self-maintenance," "fine motor activities," and "gross motor playing activities" seem to correspond with the three domains of ADL found in the literature, e.g. "self-care and self-maintenance," "productivity and schoolwork," and "leisure and play".[4, 7, 16-18] This finding demonstrates the ability of the DCDDaily-Q to reflect the broad range of relevant ADL.

The DCDDaily-Q further demonstrated the ability to discriminate between typically developing children and children with DCD: parents rated the ADL performance of children in the DCD group to be significantly poorer, for the DCDDaily-Q total scores and all 23 individual items. Both the sensitivity (88%) and specificity (92%) of the DCDDaily-Q met the required standard, indicating that the DCDDaily-Q correctly identified difficulties in ADL performance in children diagnosed with DCD, and the absence of difficulties in ADL performance in children in the control group [19]. A combination of satisfactory sensitivity and specificity (at or above 80 and 90% respectively) has not been found for currently used questionnaires (sensitivity and

specificity were found 62 and 66% for the MABC2 Checklist, and 82 and 84% for the DCDQ).[23, 26]

In addition, the logistic regression analysis showed the DCDDaily-Q better able to predict the presence or absence of DCD than the MABC2 Checklist and DCDQ. This may be explained by the comprehensive range of ADL included in the DCDDaily-Q, addressing those items that children with DCD face trouble with according to the literature. The fact that the DCDDaily-Q addresses more aspects of ADL performance than currently used questionnaires may also explain its' medium concurrent validity (moderate correlations were found between the DCDDaily-Q and the instruments used in this study). This reasoning also holds for other instruments available such as the Activity Scale for Kids, Life-Habits, and Vineland Adaptive Behavioural Scale-2, among others.[27-29] These instruments address several constructs such as activities and participation in daily living skills as well as communication and socialization.[30] The DCDDaily-Q and DCDDaily concisely address capacity and performance in specifically those ADL that children with DCD face trouble with.[14]

Several explanations can be given for the low correlation found between the DCDDaily-Q and DCDDaily in the DCD group. First, a small number of children diagnosed with DCD was included in this study. Second, parental reports may differ from objective information obtained through assessment by a clinician.[8, 9] Finally, DCD is a heterogeneous disorder, which requires comprehensive assessment of ADL. With only partially overlapping items, differences between DCDDaily-Q and DCDDaily total scores were expected. Together, the DCDDaily and DCDDaily-Q complementary address a comprehensive range of ADL, at both capacity and performance level.

In future studies, we recommend further investigation of the relation between the DCDDaily-Q and the DCDDaily, specifically for the twelve overlapping items. Future studies may also address additional aspects of reliability, such as test-retest reliability, which was not addressed in the current study. Furthermore, more girls and young children diagnosed with DCD may be included, in order to analyse the validity and reliability of the DCDDaily-Q per group of age and gender. The DCD group included in the current study is in agreement with the DCD population: DCD is diagnosed more often in boys than in girls, and children five or six years of age are often not yet diagnosed, as the clinical process is initiated around school age.[31, 32] Finally, the DCDDaily-Q as currently presented is applicable to Dutch children only. Future use in other countries may require cultural adaptation and validation of the list of items, i.e. activities that are performed daily by most children in a particular country.

The DCDDaily-Q may inform researchers, adding to their understanding of the difficulties of children with DCD, and it may support clinicians in guiding the planning of intervention for the individual child.

CONCLUSIONS

The current study showed the DCDDaily-Q to be a valid and reliable parental questionnaire on children's ADL performance. It is the first questionnaire to provide insight into the broad range of ADL that children with DCD experience difficulties with during daily functioning. The DCDDaily-Q is better able to predict the presence or absence of DCD than currently used questionnaires.

APPENDICES

Appendix A. Items of the *final version* of the DCDDaily-Q and the 15 redundant items of the *research version*, in the three domains of ADL.

"Self-care and self-maintenance"	"Productivity and school"	"Leisure and play"
1. Buttering a sandwich 1.48 (0.65); 2.16 (0.55); *U* = 143.00, *p* < .001*	11. Writing 1.48 (0.65); 2.16 (0.75); *U* = 162.50, *p* = .002*	16. Lego® building 1.00 (0.00); 1.64 (0.70); *U* = 150.00, *p* < .001*
2. Cutting a sandwich 1.64 (0.70); 2.16 (0.55); *U* = 183.00, *p* = .005*	12. Gluing paper using a glue stick 1.28 (0.46); 1.88 (0.44); *U* = 134.00, *p* < .001*	17. Moving pawns (on a board) 1.16 (0.37); 1.76 (0.72); *U* = 167.00, *p* = .001*
3. Pouring juice 1.32 (0.48); 1.80 (0.41); *U* = 162.50, *p* = .001*	13. Folding paper sheets/slips 1.44 (0.51); 2.08 (0.70); *U* = 161.50, *p* = .001*	18. Playing hopscotch 1.28 (0.46); 2.08 (0.64); *U* = 116.50, *p* < .001*
4. Opening a wrapper/package 1.28 (0.46); 2.08 (0.64); *U* = 116.50, *p* < .001*	14. Colouring a picture 1.28 (0.46); 1.88 (0.73); *U* = 170.00, *p* = .002*	19. Jumping a rope 1.96 (0.73); 2.72 (0.54); *U* = 138.50, *p* < .001*
5. Eating soup with a spoon 1.08 (0.28); 1.76 (0.60); *U* = 123.00, *p* < .001*	15. Cutting paper using scissors 1.32 (0.48); 2.12 (0.53); *U* = 105.00, *p* < .001*	20. Throwing a tennis ball 1.32 (0.56); 2.00 (0.76); *U* = 159.50, *p* = .001*
6. Washing hands 1.04 (0.20); 1.56 (0.71); *U* = 186.00, *p* = .001*		21. Catching a ball 1.44 (0.58); 2.04 (0.54); *U* = 153.50, *p* = .001*
7. Drying oneself after a shower or bath 1.20 (0.40); 2.04 (0.79); *U* = 130.00, *p* < .001*		22. Kicking a football 1.20 (0.41); 2.04 (0.74); *U* = 120.00, *p* < .001*
8. Brushing teeth 1.28 (0.46); 2.12 (0.60); *U* = 104.00, *p* < .001*		23. Playing marbles 1.36 (0.57); 2.08 (0.57); *U* = 128.50, *p* < .001*
9. Handling a key 1.08 (0.28); 2.00 (0.65); *U* = 82.50, *p* < .001*		
10. Putting on socks 1.08 (0.28); 1.72 (0.61); *U* = 135.50, *p* < .001*		

Opening and closing lunchbox
1.00 (0.00); 1.28 (0.46); *U* = 225.00, *p* = .005*
Opening and closing backpack
(0.00); 1.4 (0.58); *U* = 200.00, *p* = .001*
Walking with a chair
1.08 (0.28); 1.56 (0.65); *U* = 185.50, *p* = .002*
Laying the table
1.16 (0.37); 1.36 (0.49); *U* = 250.00, *p* = .111
Tying laces
1.88 (0.78); 2.20 (0.58); *U* = 238.00, *p* = .113
Putting on trousers
1.04 (0.20); 1.44 (0.58); *U* = 199.50, *p* = .002*
Putting on a sweater
1.00 (0.00); 1.40 (0.58); *U* = 200.00, *p* = .001*
Putting on a jacket
1.04 (0.20); 1.28 (0.46); *U* = 237.50, *p* = .022*
Walking the stairs
1.04 (0.20); 1.20 (0.50); *U* = 274.50, *p* = .156

Climbing
1.00 (0.00); 1.36 (0.57); *U* = 212.50, *p* = .002*
Running
1.04 (0.20); 1.52 (0.71); *U* = 198.50, *p* = .002*
Cycling
1.12 (0.33); 1.36 (0.57); *U* = 248.50, *p* = .084
Swimming
1.16 (0.27); 1.80 (0.76); *U* = 162.50, *p* = .001*
Skating
2.00 (0.65); 2.08 (0.57); *U* = 292.50, *p* = .649
Using a computer
1.04 (0.20); 1.36 (0.57); *U* = 224.50, *p* = .010*

Notes: [a] The following data is shown for the 23 remaining items (final version) and the 15 redundant items of the research version of the DCDDaily-Q: item score mean(SD) in the control group; item score mean(SD) in the DCD group, Mann-Whitney U Test value for the difference between the groups; [b] Significant difference between mean scores in the control group and DCD group are marked with an * (alpha < .05)

Appendix B. Illustration and general explanation for the questions in the DCDDaily-Q.

Illustrative item DCDDaily-Q

1.	**a. Activity** *Buttering a sandwich*	**b. Correct performance** (example) *The right amount of butter is neatly and evenly spread, at a normal pace, without making a mess and without dangerous situations involving the knife*
c. Quality My child can do this... □ 1. well □ 2. sometimes well and at other times less well □ 3. not very well (or badly) most of the time		

Note: the complete DCDDaily-Q (in Dutch or English) is available on request from the authors

General explanation

In column **c. Quality** you are asked to choose the option that best describes the way your child performs the activity described. You tick
1. *well* when your child generally performs the activity *as described* in **b**;
2. *sometimes well and at other times less well* when your child does not always perform the activity as described in **b**. Your child occasionally gets butter on his/her fingers or on the table, for instance;
3. *not very well (or badly) most of the time* when your child as a rule does not perform the activity as described in **b**. Your child tends to be messy or has more difficulty buttering his/her sandwich or takes longer than other children of his/her age.

Appendix C. Receiver-operator characteristics curve for DCDDailyQ total scores of the DCD group and control group.
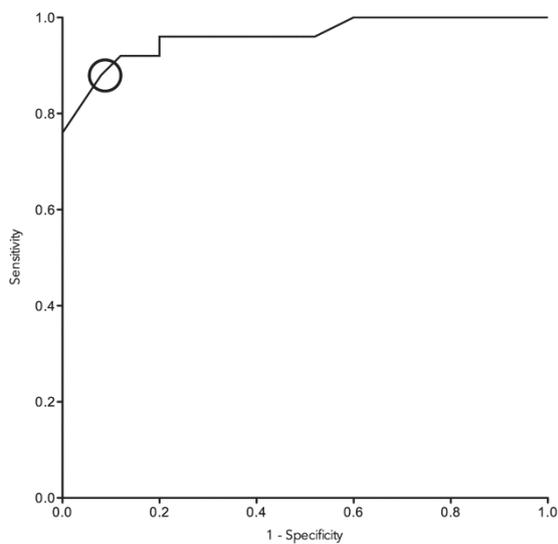
Notes: [a] Analyses were performed with DCDDaily-Q total scores of children in the DCD group (n = 25) and their matched controls (n = 25); [b] ROC = Receiver-operator characteristics; for a cut-off at 39, sensitivity was found 88% and specificity was found 92%; the area under curve characteristic was found to be 0.961; [c] DCD = developmental coordination disorder

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CHILDREN WITH DEVELOPMENTAL COORDINATION DISORDER (DCD) FACE EVIDENT MOTOR DIFFICULTIES IN DAILY FUNCTIONING. LITTLE IS KNOWN, HOWEVER, ABOUT THEIR DIFFICULTIES IN SPECIFIC ACTIVITIES OF DAILY LIVING (ADL). FOR 23 ESSENTIAL ADL, THE RECENTLY DEVELOPED DCDDAILY-Q ASSESSES CHILDREN'S PERFORMANCE, DELAYS IN LEARNING, AND FREQUENCY OF PARTICIPATION. WITH THIS PARENTAL QUESTIONNAIRE, (A) DIFFERENCES WERE INVESTIGATED BETWEEN A CLINICAL SAMPLE OF CHILDREN DIAGNOSED WITH DCD (N = 25, AGE RANGE 5-8 YEARS; 21 MALES) AND THEIR TYPICALLY DEVELOPING PEERS (25 MATCHED CONTROLS), FOR ADL PERFORMANCE, LEARNING, AND PARTICIPATION, AND (B) THE PREDICTIVE VALUES OF THESE ASPECTS WERE EXPLORED. COMPARED TO PEERS, CHILDREN WITH DCD SHOWED POOR PERFORMANCE OF ADL (P / .001 FOR MEAN TOTAL SCORES, P /= .005 FOR ALL ITEMS), DELAYS IN LEARNING OF ADL (P /= .001 FOR MEAN TOTAL SCORES, P /= .002 FOR ALL ITEMS), AND LESS FREQUENT PARTICIPATION IN ADL (P = .001 FOR MEAN TOTAL SCORES, P /= .05 FOR 6 OUT OF 23 ITEMS). CHILDREN WITH DCD DEMONSTRATED HETEROGENEOUS PATTERNS OF PERFORMANCE (POOR IN 10 - 80% OF THE ITEMS) AND LEARNING (DELAYS IN 0 - 100% OF THE ITEMS). IN THE DCD GROUP, DELAYS IN LEARNING OF ADL WERE A PREDICTOR FOR POOR PERFORMANCE OF ADL (P = .001), AND POOR PERFORMANCE OF ADL WAS A PREDICTOR FOR LESS FREQUENT PARTICIPATION IN ADL COMPARED TO PEERS (P = .040). THIS STUDY HIGHLIGHTS THE IMPACT OF DCD ON CHILDREN'S DAILY LIVES AND THE NEED FOR TAILORED INTERVENTION.