

Article

Children Suspected for Developmental Coordination Disorder in Hong Kong and Associated Health-Related Functioning: A Survey Study

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Abstract: Children with developmental coordination disorder (DCD) have motor difficulties that interfere with their daily functions. The extent to which DCD affects children in Hong Kong has not been established. In this study, we aimed to estimate the prevalence of children suspected of DCD (sDCD) in Hong Kong and to examine the relationship between motor performance difficulties and health-related functioning. We conducted a cross-sectional survey of parents of children aged 5 to 12 years across Hong Kong ($N = 656$). The survey consisted of the Developmental Coordination Disorder Questionnaire (DCDQ) and short forms on global health, physical activity, positive affect, and cognitive function of the Patient-Reported Outcome Measurement Information System (PROMIS[®]) parent-proxy report scales. We found that the total DCDQ score categorized 18.29% of the children as sDCD. Logistic regression revealed that household income ($OR\ 0.776$, $p < 0.001$) and child age ($OR\ 1.012$, $p = 0.004$) contributed to being categorized as sDCD. Children categorized as sDCD had lower global health ($p < 0.001$), less positive affect ($p < 0.001$), and more impaired cognitive function ($p < 0.001$) than children categorized as probably not DCD (nDCD). The findings of this study contribute to clarifying the extent to which DCD might affect Hong Kong children and serve as a basis to advocate for programs that address motor, health, affective, and cognitive outcomes. Further research is recommended to estimate the prevalence of a DCD diagnosis in Hong Kong.



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1. Introduction

Children with developmental coordination disorder (DCD) experience impaired motor skills that interfere with age-related daily activities, which may be in the context of home, school, or play [1]. Movement difficulties often lead to issues in psychosocial skills, learning abilities, and participation in various forms of daily activities. DCD is typically diagnosed when children are aged between five and eleven years, usually without any other medical or neurologic diagnosis. DCD affects approximately 5% to 6% of children globally, but owing to the use of different diagnostic criteria, the prevalence of DCD varies across countries, ranging from 2% to 20% [2]. For example, studies have reported prevalence rates of 2% in

Turkey [3], 9% in Taiwan [4], 11% in South Korea [5], and nearly 20% in Brazil [6]. Despite its prevalence, DCD is often underrecognized and underdiagnosed, leading to frustration for families seeking help [7].

Children are diagnosed with DCD when they meet the criteria set by the Diagnostic and Statistical Manual of Mental Disorders—5th edition (DSM-5) [1]. These criteria include (i) learning and execution of coordinated motor skills being below the expected level for age, given opportunities for skill learning; (ii) significant interference of motor skill difficulties with activities of daily living, impacting academic/school productivity, prevocational and vocational activities, as well as leisure and play; (iii) onset during the early developmental period; and (iv) motor skill difficulties not better explained by intellectual delay, visual impairment or other neurological conditions affecting movement. The first criterion is typically assessed using examiner-administered standardized measures of motor performance, whereas the second criterion may be assessed using parent- or teacher-proxy reports of children's performance in daily functions related to motor skills [2]. The latter two criteria are assessed based on clinical history and additional neurological tests, which necessitate that DCD is often diagnosed in settings where detailed assessments can be conducted. This rigorous framework poses significant challenges when it comes to estimating prevalence rates. The reliance on detailed assessments and the need for trained professionals make widespread screening impractical in diverse populations. Practical challenges in assessing prevalence have led researchers to explore alternative screening methods.

Given the difficulties associated with estimating prevalence through test batteries of motor coordination due to time and cost constraints, motor-based questionnaires to be completed by children, teachers, and parents have been designed as a more practical screening alternative. Self-report measures are particularly valuable because they allow for quick and efficient assessment of children's motor skills without the need for extensive resources or trained professionals. Among these questionnaires, the Developmental Coordination Disorder Parent Questionnaire (DCDQ) has been validated extensively in the literature [8,9]. A recent systematic review and meta-analysis revealed that the DCDQ has acceptable diagnostic accuracy and adequate predictive validity to be a suitable screening tool for identifying children with motor coordination difficulties [10]. It has also been used as a supplementary tool to aid diagnosis in clinical settings. DCDQ focuses on parent-reported activity levels of the child (e.g., self-care, ball skills) and underlying body functions, highlighting the motor difficulties experienced by children. Although DCDQ may not lead to an accurate DCD diagnosis, it can provide valuable information on the extent to which DCD affects a population. Based on DCDQ scores, children are categorized as either suspected for DCD (sDCD) or probably not DCD (nDCD). For example, it was estimated that 12% of children in mainstream schools in Spain were classified as sDCD [11]. A child being categorized as sDCD may not lead to a diagnosis, but it reflects the need for specialized support and ongoing monitoring to ensure that their needs in managing motor difficulties are effectively addressed.

The challenges associated with diagnosing DCD are particularly pronounced in Hong Kong, where limited awareness and resources complicate the identification and support of affected children. Currently, there is no reported official prevalence of DCD among children in Hong Kong. Previous studies that screened primary school children for participant recruitment (i.e., not to estimate prevalence) using movement battery tests reported a range of 6% to 21% of children categorized as DCD [12–14]. On the other hand, a study that validated DCDQ for Hong Kong reported that 13% of their convenience sample was categorized as sDCD [15]. These previous studies did not aim to estimate prevalence rates or have population-representative samples, limiting generalizability. While the education sector has increasingly strengthened programs for children with special educational needs,

there continues to be limited awareness of DCD in Hong Kong. This limited awareness and attention is likely due, in part, to the lack of knowledge about the extent to which DCD affects the local population. Therefore, we aimed to estimate the extent to which children in Hong Kong might be suspected for DCD.

Understanding the prevalence of DCD is crucial not only for raising awareness but also for recognizing the broader challenges faced by affected children. Children with DCD not only face motor difficulties but also face challenges in other domains of health and development [2]. For example, they tend to be less physically active than peers without DCD [16]. A study in Hong Kong reported that only one out of three children with DCD met physical activity guidelines [14]. Additionally, children with DCD may also have impaired psychosocial skills, learning difficulties, and short attention spans [17,18]. These developmental issues tend to have a negative impact on their participation in daily life activities and education outcomes [2]. Some evidence of this in Hong Kong has been reported, where children with DCD were found to have low emotional and social efficacy and have difficulty participating in home- and community-based activities that require motor, communication, or organizational skills [15]. As such, in estimating the extent to which DCD affects children in Hong Kong, it is also important to assess the associated difficulties in health and daily functioning to inform policies that support children in navigating their social and learning environments [19].

Currently, knowledge of the extent to which DCD might affect children in Hong Kong is inadequate to inform the direction of public policy and practice. To help address this gap, the primary aim of this survey study is to estimate the prevalence of children classified as sDCD in Hong Kong, with consideration for individual and family characteristics. The secondary aim of this study was to explore the associations of motor difficulties with health-related daily functioning. We hypothesized that children who are categorized as sDCD will have poorer outcomes in terms of global health, physical activity levels, positive affect, and cognitive function than children who are categorized as nDCD.

2. Materials and Methods

2.1. Participants and Procedures

While early identification of children with motor difficulties is recommended for early intervention [20,21], diagnosing DCD before the age of five is generally discouraged. This is due to several challenges: young children may show delayed motor development that resolves on its own; their cooperation and motivation during assessments can be inconsistent, leading to unreliable results; and there is high variability in the ability to acquire activities of daily living skills [2,22]. As such, the current study focused on children aged 5–12 years.

All procedures were reviewed and approved by the institutional research ethics committee (Ref. 2021-2022-0446). Quota sampling was adopted to recruit participants whose children represented the population distribution across the three areas of Hong Kong (i.e., Hong Kong Island, Kowloon, and New Territories) and the proportions of male and female children. The recruitment was conducted through Qualtrics online research panels, and the data collection took place between October and December 2022. Informed consent was obtained online from parents, who directly participated in the study and provided information about their children through the DCDQ. We received 716 responses from parents who met the following eligibility criteria: (i) had at least one child aged 5–12 years and (ii) resided in Hong Kong. Because the recruitment and questionnaire administration were conducted through online platforms, parents were excluded if they (i) were unable to read and/or understand the text on screens and (ii) were not engaged with or did not have access to online digital platforms. The final sample ($N = 656$) includes those who submitted

complete responses to the questions in the DCDQ and those related to health-related daily functioning, which exceeded our target sample size based on the global DCD prevalence of 6%, with a confidence interval of 95% and an error of 2%.

2.2. Instruments

The survey included three parts: the Chinese version of the DCDQ [15,23]; the short forms on global health, physical activity, positive affect, and cognitive function of the Patient-Reported Outcome Measurement Information System (PROMIS®) parent proxy scale [24]; and demographic information.

2.2.1. DCDQ

The DCDQ is a parent-report measure used to assist in the identification of children who are likely to have DCD and is suitable for children aged 5–15 years [9]. Parents are asked to compare their child's motor performance to that of his/her peers via a five-point Likert scale across 15 items that are grouped into three factors: control during movement (DCDQ-CM, 6 items), fine motor/handwriting (DCDQ-FM, 4 items), and general coordination (DCDQ-GC, 5 items). The total scores range from 15 to 75, where higher scores reflect better motor performance. Age-specific cutoff scores are applied to classify children as "suspect for" (below the 15th percentile) or "probably not" DCD [15]. International practice recommendations have noted that the DCDQ has good evidence supporting its psychometric properties [2]. In this study, we used the version of the questionnaire developed for Chinese-speaking communities [23], which has been used in Hong Kong and found to have good internal consistency and construct validity [15].

2.2.2. PROMIS®

The Patient-Reported Outcomes Measurement Information System (PROMIS) is a set of person-centered scales that measure physical, mental, and social health in adults and children, including parent-proxy scales for children aged 5–17 years [24]. It consists of item banks that have been extensively tested for validity and reliability [25–27]. The PROMIS items were evaluated using item response theory, such that any subset of items generates standardized scores on the same scale [28]. The parent-proxy report scales include five response options that reflect their child's experiences over the past week. Raw scores are calculated on the basis of the sum of the scale items, which are then converted into t-scores where higher scores reflect better health status [29]. We used parent-proxy report scales for global health, physical activity, positive affect, and cognitive function.

2.2.3. Demographic Information

The demographic information included the child's age and sex, the responding parent's age, sex, educational attainment, and the monthly household income.

2.3. Data Processing and Analysis

Each DCDQ item was scored on a 5-point scale, with negatively worded items scored in reverse. Factor scores were calculated, where the highest possible scores were 30 for DCDQ-CM, 20 for DCDQ-FM, and 25 for DCDQ-GC. Children below the 15th percentile within each age group were categorized as sDCD. Following the DCDQ procedures, the three age groups are 5 years to 7 years and 11 months, 8 years to 9 years and 11 months, and 10 to 12 years.

The PROMIS parent-proxy report items are scored on a 5-point scale. The highest possible scores are 35 for global health, 20 for physical activity, 20 for positive affect, and 35 for cognitive function. Raw sum scores were used because the corresponding t scores were

based on reference data from the USA, which limits their applicability to the Hong Kong population [30].

The internal consistency of the respective items in the DCDQ and PROMIS scales was assessed based on Cronbach's alpha. The Shapiro–Wilk test revealed that the DCDQ and PROMIS scores were not normally distributed; hence, non-parametric inferential tests were used to test the hypotheses. To test whether motor difficulties are associated with demographic characteristics and health-related daily functioning, we calculated Spearman's rank correlation coefficients among the DCDQ scores, demographic data, and PROMIS scores.

Descriptive statistics were used to summarize the characteristics of the sample and to categorize the children into sDCD and nDCD groups. Logistic regression was used to test the contribution of the child's age and sex, parental educational attainment and age, and household income to DCDQ categorization. A complete case analysis approach [31] was adopted when demographic data were missing.

To test whether children categorized as sDCD have lower outcomes in terms of global health, physical activity, positive affect, and cognitive function, we performed Kruskal–Wallis tests to compare the PROMIS scores of children categorized as sDCD and those of children categorized as nDCD.

3. Results

The characteristics of the parent respondents and their children are summarized in Table 1. The mean age of the children was 8.50 ± 2.19 years, and they were grouped into three age groups corresponding to those of the DCDQ cutoff scores (see Table 1). Among the children, 51.83% ($n = 340$) were male, whereas 48.17% ($n = 316$) were female.

Table 1. Descriptive characteristics of the participants ($N = 656$).

	<i>n</i>	Percentage
Age group of child		
5 years–7 years, 11 months	293	44.67%
8 years–9 years, 11 months	156	23.78%
10 years–12 years	206	31.40%
Missing	1	0.15%
Sex of child		
Male	340	51.83%
Female	316	48.17%
Missing	0	0
Age group of parent		
18–24 years	10	1.52%
25–34 years	130	19.82%
35–44 years	370	56.40%
45–54 years	130	19.82%
55–60 years	8	1.22%
>60 years	6	0.92%
Missing	2	0.31%
Education attainment of parent		
Primary education or below	2	0.31%
Secondary education	141	21.49%
Nondegree postsecondary	111	16.92%
Undergraduate degree	298	45.43%
Postgraduate degree	102	15.55%
Missing	2	0.31%
Household monthly income (HK\$)		
<200,000	44	6.71%
20,001–40,000	142	21.65%
40,001–60,000	189	28.81%
60,001–80,000	125	19.06%
80,001–100,000	60	9.15%
>100,000	94	14.33%
Missing	2	0.31%

Among the parents, the largest group was between 35 and 44 years of age (56.40%, $n = 370$). The other age groups included parents aged 25–34 years and 45–54 years, each accounting for 19.82% ($n = 130$) of the respondents. Most parents held an undergraduate degree (45.43%, $n = 298$), followed by those with secondary education (21.49%, $n = 141$) and nonsecondary education (16.92%, $n = 111$). Finally, household income data revealed that most families earned between HK\$40,001 and HK\$60,000 (28.81%; $n = 189$).

3.1. Suspect for DCD (sDCD) Prevalence

The internal consistency is excellent for the DCDQ-CM subscale (Cronbach's $\alpha = 0.90$) and good for the DCDQ-FM (Cronbach's $\alpha = 0.88$) and DCDQ-GC (Cronbach's $\alpha = 0.88$) subscales. Internal consistency is excellent for the PROMIS scales for positive affect (Cronbach's $\alpha = 0.92$) and cognitive function (Cronbach's $\alpha = 0.91$), good for global health (Cronbach's $\alpha = 0.84$), and acceptable for physical activity (Cronbach's $\alpha = 0.67$).

Based on the total DCDQ scores, 18.29% ($n = 120$) of the participants were categorized as sDCD. As shown in Table 2, logistic regression revealed that household income (OR 0.776, $p < 0.001$) and the age of the child (OR 1.012, $p = 0.004$) contributed to children being categorized as sDCD. Those who had a lower household income and were older were more likely to be categorized as sDCD. Child sex, parental age, and educational attainment were not significant predictors of the DCDQ category.

Table 2. Factors contributing to the likelihood of being suspected for DCD ($N = 654$).

Variable	B	SE (B)	Wald X^2	p	OR	95% CI
Household income	−0.253	0.075	11.454	<0.001	0.776	0.671 to 0.899
Child's age (months)	0.012	0.004	8.513	0.004	1.012	1.004 to 1.020
Child's sex (male)	−1.221	0.649	3.543	0.060	0.295	0.083 to 1.052
Parent's education	−0.057	0.064	0.776	0.378	0.945	0.833 to 1.072
Parent's age (years)	−0.026	0.140	0.036	0.850	0.974	0.741 to 1.280

Notes: OR, odds ratio; CI, confidence interval.

Considering the contribution of age to being categorized as sDCD, we further examined the distribution of participants to sDCD and nDCD in the three age cutoffs in the DCDQ. Among children aged 5 years to 7 years and 11 months, 13.31% ($n = 39$) were categorized as sDCD. Among children aged 8 to 9 years and 11 months, 20.52% ($n = 32$) were categorized as sDCD. Among children aged 10 to 12 years, 23.78% ($n = 49$) were categorized as sDCD.

3.2. Motor Difficulties and Associated Health-Related Daily Functioning

Table 3 illustrates the associations between the DCDQ scores and aspects of health-related daily functioning. Significant correlations were found between the total DCDQ score and global health ($r = 0.52$, $p < 0.001$), positive affect ($r = 0.38$, $p < 0.001$), and cognitive functioning ($r = 0.34$, $p < 0.001$). In contrast, the association between the total DCDQ score and physical activity was not significant ($r = 0.06$, $p = 0.15$). Only the DCDQ-GC subscale was significantly correlated with physical activity ($r = 0.08$, $p = 0.04$). Overall, Table 3 summarizes the correlations among the DCDQ total scores and subscales in relation to health-related functioning scales.

Table 3. Correlations among the DCDQ and PROMIS scales ($N = 656$).

	Mean (SD)	Correlation Coefficient (r) Significance (p)						
		1	2	3	4	5	6	7
1. DCDQ total	61.58 (12.89)	-						
2. DCDQ-CM	24.32 (5.37)	0.93 * <0.001	-					
3. DCDQ-FM	16.93 (3.79)	0.91 * <0.001	0.78 * <0.001	-				
4. DCDQ-GC	20.325 (4.61)	0.94 * <0.001	0.79 * <0.001	0.82 * <0.001	-			
5. GH	26.74 (4.07)	0.52 * <0.001	0.45 * <0.001	0.46 * <0.001	0.53 * <0.001	-		
6. Pact	9.67 (2.72)	0.06 0.15	0.05 0.17	0.01 0.75	0.08 * 0.04	0.04 0.36	-	
7. Paff	15.36 (3.19)	0.38 * <0.001	0.35 * <0.001	0.32 * <0.001	0.38 * <0.001	0.56 * <0.001	0.15 * <0.001	-
8. CF	23.00 (5.78)	0.34 * <0.001	0.27 * <0.001	0.36 * <0.001	0.34 * <0.001	0.41 * <0.001	−0.06 0.13	0.22 * <0.001

Notes: DCDQ-CM, control of movement; DCDQ-FM, fine motor; DCDQ-GC, general coordination; GH, global health; Pact, physical activity; Paff, positive affect; CF, cognitive functioning. * statistically significant correlation.

Significant differences were found in global health ($H(1) = 73.95, p < 0.001$), positive affect ($H(1) = 63.79, p < 0.001$), and cognitive function ($H(1) = 30.94, p < 0.001$) between the sDCD and nDCD groups of children (see Figure 1). Children in the sDCD group had significantly lower scores than those in the nDCD group did. There was no statistically significant difference in the physical activity score between the two groups ($H(1) = 0.15, p = 0.70$).

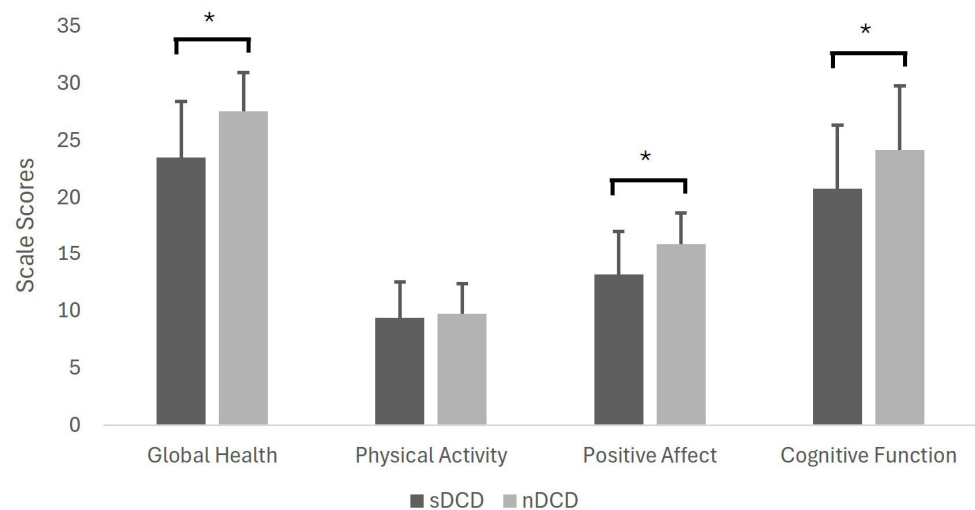


Figure 1. Comparison of global health, physical activity, positive affect, and cognitive function among children categorized as sDCD and nDCD ($N = 656$). * Statistically significant difference.

4. Discussion

We aimed to estimate the prevalence of sDCD in a large sample of children in Hong Kong while considering individual and family characteristics. Our findings revealed a relatively high prevalence of sDCD in Hong Kong children aged 5–12 years. The estimate of 18.29% is higher than the reported 13% from the validation study of DCDQ in Hong Kong [15]. While that validation study reported the percentage of those categorized as

sDCD in their sample, their study purpose was not to estimate prevalence rates. As such, the study involved a relatively small convenience sample ($N = 123$) of children aged 6–11 years. In contrast, our current study involves a larger sample representing the distribution of children aged 5–12 years across the territory of Hong Kong, as well as the proportions of males and females. These differences in sample characteristics could be related to the discrepancy in the observed prevalence estimates.

The relatively high prevalence of sDCD that we found in this study might also be related to the recent COVID-19 pandemic. We note that we gathered data in late 2022, which was a period when school-aged children in Hong Kong were still affected by pandemic-related restrictions. In-person classes fully resumed in November 2022 for secondary schools and in December 2022 for primary schools, subject to vaccination requirements [32]. Masks in schools remained mandatory, and vaccine requirements limited extracurricular activities (e.g., sports and games) until early 2023. Parents' responses to our survey were likely influenced by the school-related disruptions that children and families experienced during the pandemic. School-aged children also display lower physical activity levels and longer screen time during periods of school suspension [33]. Such changes in movement behaviors could have influenced parents' perceptions of their children's motor difficulties and daily functioning.

The international clinical practice recommendations for DCD noted that prevalence estimates ranged from 2% to 20%, with 5% to 6% frequently reported as the global prevalence, and that such estimates were largely dependent on the applied selection criteria [2]. Our current estimate is for the prevalence of sDCD, and it is not surprising that it is relatively high compared with the global prevalence estimate of DCD given that DCDQ allows us to confirm only one of the four diagnostic criteria set by the DSM-5 [1]. Compared with the reported range of DCD prevalence estimates, there tends to be a wider and greater range of sDCD estimates that are based on DCDQ alone. For example, other studies that used the DCDQ alone reported sDCD prevalence estimates as low as 12% among children aged 6–12 years in northwest Spain [11] and as high as 30% among children aged 5–14 years in southeastern municipalities in Brazil [34]. Even within one country, prevalence estimates vary across regions, such as 12% among children aged 5–11 years in a southern city in India [35] and 21% among children aged 5–15 years in another city in the southwestern part of the country [36].

In addition to DCDQ generating prevalence estimates of sDCD, which tend to be higher than the prevalence estimates of diagnosed DCD, its parent-reported nature could be affected by rater bias associated with parents' expectations of their children's motor competence. Parent reports of children's movement and health-related behaviors could be subject to social desirability and recall bias [37]. Although significant associations have been found between parent-proxy reports and certain motor skill composites [38], potential bias should be considered when interpreting our study's prevalence rates, as it may lead to an overestimation of motor difficulties in this sample.

The high prevalence rate we observed can be interpreted in two ways. On the one hand, it is important to consider the prevalence rate carefully because of temporal factors and the nature of estimates generated through DCDQ. Follow-up studies are warranted to estimate the prevalence during periods of unrestricted social conditions and typical school programming as opposed to the conditions experienced during the pandemic and to use direct observations of children's motor performance. On the other hand, given the high prevalence of sDCD, programs that support motor development are necessary in schools to address the problem that the recent pandemic may have exacerbated. Our findings further revealed that the prevalence estimate steadily increased across the three age groups, where a higher prevalence of sDCD was found in older children. Researchers have highlighted

that motor problems tend to be heightened in older children because greater demands for motor skills are experienced in both school and social settings [39]. While this may imply that movement programs are especially important in older children, we suggest that supportive programs are equally important in younger children. Earlier work has shown that the motor performance of children first identified with DCD at the age of 7–9 years tends to vary over time, and interventions potentially move children out of the DCD classification [40]. Therefore, we suggest that movement programs in early primary school could mitigate the motor difficulties of children with sDCD, which may otherwise worsen as they grow older. It is also important to consider long-term consequences, especially since motor difficulties in the early primary years tend to contribute to health issues such as insufficient physical activity in adolescence [41].

Studies have shown that children with DCD aged between 6 and 14 years have significantly lower physical activity levels than their typically developing peers do [42], so we expected that children categorized as sDCD would have lower physical activity levels than those categorized as nDCD. Our findings do not support our hypothesis, because low physical activity levels were reported across both categories. A previous study in Hong Kong, on the other hand, showed low compliance with physical activity guidelines among children with DCD [14]. We consider that our current finding highlights the pandemic-related movement behavior changes that children in Hong Kong experienced at the time of data gathering [33]. Notably, physical activity promotion appears to be needed among Hong Kong children, regardless of their motor proficiency. This need is apparent across Asia, where adherence to movement behavior guidelines (i.e., physical activity, sedentary time, sleep) is notably low, with only 3.80% of children meeting these standards compared to other regions such as Oceania (10.87%) and Europe (9.62%) [43]. We propose that our current finding highlights a broader issue that necessitates targeted interventions to enhance physical activity levels among all children.

With respect to aspects of general health, affective state, and cognitive function, our expectation that children categorized as sDCD would have worse outcomes than those in the nDCD category was supported by our findings. Our findings align with previous studies indicating that children with DCD often experience psychosocial skill impairments and learning difficulties [17,18], which can negatively affect their participation in daily life activities [2]. Our current findings show that even when children are only suspected for DCD, they are at risk of experiencing significant challenges, consistent with previous research showing that DCD is associated with a lower quality of life compared to typically developing peers [44]. We also provide further evidence that motor performance difficulties are not issues that simply relate to sports participation or physical education for school-aged children. Specifically, we identified a correlation between lower DCDQ scores and diminished positive affect, highlighting the potential impact of motor performance challenges on emotional well-being. This relationship is consistent with previous research which showed that motor difficulties associated with DCD expose children to secondary stressors that could lead to psychological distress [45,46]. Furthermore, poor motor performance, especially in early childhood, can limit participation in games and play, negatively affecting socialization and potentially contributing to social isolation and reduced positive affect [47]. Our study also revealed a correlation between DCDQ scores and cognitive function, suggesting that motor difficulties may have a significant impact on cognitive development. Previous research has shown that motor difficulties in children with DCD, specifically difficulties with fine motor skills, are associated with poor academic outcomes [48]. In contrast, we suggest that the ability to move proficiently opens a range of opportunities for interactive processes that help facilitate social skills and cognitive development. It is, therefore, highly important that teachers and parents be more aware

that poor motor skills have a negative impact on the overall health and well-being of children categorized as sDCD.

Supportive programs for children categorized as sDCD also need to be holistic to address not only motor difficulties but also self-efficacy and motivation through interventions that are grounded in theory. For example, the Optimizing Performance through Intrinsic Motivation and Attention for Learning (OPTIMAL) theory of motor learning emphasizes that the practice of motor skills should enhance learners' expectations for successful outcomes to motivate children toward increased engagement with the program [49]. Strategies such as errorless motor learning facilitate successful practice experiences [50] that could contribute to such enhanced expectancies.

Finally, we note that children from lower-income households tend to have a greater likelihood of being categorized as sDCD. This finding is consistent with previous research that has shown that having higher household income tends to have a protective effect on the risk of children having DCD [51]. It is generally understood that children from families with low socioeconomic status tend to have less access to resources and opportunities that promote child development [52]. While Hong Kong is categorized by the World Bank as a high-income territory, there has been a significant rise in wealth and income inequality in recent decades [53]. The most recent report based on census data revealed that the overall poverty rate reached 20% [54]. Importantly, the risk of children having developmental disorders, including DCD, increases with worsening poverty in the territory.

Strengths and Limitations

Our study sample represents the proportion of our target population by sex and the distribution across the territory of Hong Kong. It was also sufficiently large to achieve a 95% confidence level and a 2% margin of error. Nevertheless, we emphasize that the DCDQ categorizes children as suspected for or probably not DCD and does not equate to a formal diagnosis of DCD. To establish a prevalence rate for children diagnosed with DCD, further studies are needed that consider the DSM-5 criteria [1] and utilize motor proficiency tests [5], which would likely reveal a different prevalence rate compared with our findings. We also acknowledge that participants' ratings of their children's motor performance and daily functions may have been biased due to self-reports. While we established internal consistency of the DCDQ and PROMIS items, we did not perform any further tests of reliability to help rule out such bias. In addition, online recruitment and questionnaire administration effectively excluded parents who were not engaged on digital platforms, potentially limiting the generalizability of our findings. Future investigations could consider collecting direct observations of children's performance of daily functions combined with an assessment of motor skills. Finally, the cross-sectional associations of the sDCD categorization with health and daily functioning inherently limit causal inference. Longitudinal studies are needed to further establish evidence in this respect.

5. Conclusions

We estimate that up to 18.29% of children in Hong Kong may be categorized as sDCD, with the prevalence rate being higher in older children. Children from lower-income households may be at greater risk of being categorized as sDCD. Motor difficulties are associated with health-related daily functioning, where children categorized as sDCD have significantly worse global health, less positive affect, and greater cognitive difficulties. These findings contribute to a better understanding of the extent to which DCD might affect Hong Kong children and could be used to improve the general awareness of DCD among teachers and parents. Further research is recommended to establish more robust estimates that may be reflective of children diagnosed with DCD.

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