

PEER VICTIMIZATION AND DEPRESSION IN CHILDREN WITH AND WITHOUT MOTOR COORDINATION DIFFICULTIES

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Developmental coordination disorder (DCD) is a chronic disability that impacts children's performance of everyday motor-based activities and is associated with the development of secondary social and mental health problems. The purpose of this study was to investigate peer victimization and depression in children who were and were not at risk for DCD. Selected from a population-based sample, 159 at-risk fifth graders were matched for age and gender to 159 controls. Children completed measures of depression and frequency of peer victimization. Results showed that children at risk for DCD reported more symptoms of depression and more frequent verbal and relational victimization than their peers. Being at risk for DCD and being bullied more frequently, especially relationally, significantly predicted increased depression symptoms. Findings highlight the importance of school psychologists remaining aware that children with DCD are at increased risk of experiencing bullying and depression. © 2012 Wiley Periodicals, Inc.

Developmental coordination disorder (DCD) is a neuro-developmental condition that impacts a child's ability to perform everyday motor-based tasks in self-care, academics, and recreation. Children with DCD are not just low in athletic ability; they struggle to perform the everyday activities that most of us take for granted—zipping a knapsack, tying shoes, printing, using scissors, or buttering bread. As a consequence, parents of children with DCD are stressed, teachers are not adequately prepared to manage this condition in the classroom, and children become frustrated (Missiuna, Moll, King, King, & Law, 2006). The motor difficulties of children with DCD occur despite the fact that they do not have a pervasive developmental delay or known medical condition, such as cerebral palsy or muscular dystrophy.

DCD was first included in the *Diagnostic and Statistical Manual of Mental Disorders—Third Edition, Revised*, in 1987 (American Psychiatric Association [APA], 1987); yet, few healthcare providers or educators know about it (Hamilton, 2002). There may be several reasons why this is the case: the motor difficulties of children with DCD are not as severe as those accompanying conditions like cerebral palsy (Missiuna, Moll, King, King, & Law, 2006); the presence of co-occurring behavioral disorders, such as attention deficit/hyperactivity disorder, or pronounced emotional difficulties may obscure the presence of motor coordination problems (Heath, Toste, & Missiuna, 2005; Rivard, Missiuna, Hanna, & Wishart, 2007); or the discrepancy between intellectual abilities and motor skills may lead to the incorrect assumption that children with DCD simply need to try harder (Missiuna, Moll, King, et al., 2006). Children are diagnosed with DCD when, in the absence of any other neurological disorder, their motor skill delay and poor coordination interfere with the performance of self-care activities and academic achievement beyond what would be anticipated,

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given their age and intellectual ability (APA, 2000). When these criteria are met, a diagnosis of DCD can be made by a psychologist or a physician; however, supportive documentation may be required from occupational or physiotherapists to determine the motor skill delay and from parents and/or teachers to determine the impact on academic and self-care activities (see Missiuna, Gaines & Soucie, 2006; Missiuna & Pollock, 2005, for more information about recognizing and diagnosing DCD).

Even though prevalence estimates of 5% to 6% (APA, 2000) indicate that DCD is a common condition that affects, on average, one child in every classroom, most of these children are never clinically identified as having DCD. They are, however, perceived as different by peers and teachers (Missiuna, Moll, Law, King, & King, 2006). Conventional views of DCD used to suggest that, if left alone, children would outgrow their coordination difficulties (Fox & Lent, 1996; Polatajko, 1999). However, empirical evidence points to the fact that DCD is a chronic health condition that persists well beyond childhood (Cantell, 1998; Cantell & Kooistra, 2002; Losse et al., 1991; Missiuna, Moll, King, Stewart, & Macdonald, 2008).

Although the etiology of DCD is unknown, there is increasing awareness that motor coordination difficulties like those seen in DCD frequently co-occur with peer relationship difficulties (Missiuna, Moll, King, King, & Law, 2007; Poulsen, Ziviani, Cuskelly, & Smith, 2007) and emotional problems such as low self-esteem (Geuze & Borger, 1993; Maeland, 1992; Piek, Dworcan, Barrett, & Coleman, 2000; Skinner & Piek, 2001), as well as mental health problems like depression (Kadesjo & Gillberg, 1998; Rasmussen & Gillberg, 2000) and anxiety (Shafer et al., 1986; Sigurdsson, Van Os, & Fombonne, 2002). This study examined the mental health implications of DCD by investigating the risk of peer victimization and depression in fifth-grade children with and without poor motor coordination and explored the degree to which poor motor coordination and peer victimization predicted depression in this group of children. An enhanced understanding of how poor motor coordination impacts children socially and psychologically is necessary so resource personnel, such as school psychologists, become better equipped to provide supports for these children, their teachers, and their families.

WHY MIGHT CHILDREN WITH DCD BE DEPRESSED?

Empirical evidence directly examining the connection between DCD and depression is beginning to emerge, in part, because many of the secondary consequences associated with DCD are known risk factors for depression. For example, regular involvement in physical activity by children and youth has been shown to result in positive physical and psychological health outcomes (Calfas & Taylor, 1993; Epstein & Goldfield, 1999; Horn & Claytor, 1993; Ma, 2000; Morrow & Freedson, 1994; Pellegrini, 1995); however, children with DCD show progressive and significant withdrawal from participation in physical activity due to their inadequate motor performance (Bouffard, Watkinson, Thompson, Dunn, & Romanow, 1996; Cairney, Hay, Faught, Wade et al., 2005; Wall, Reid, & Paton, 1990). In childhood, many recreational activities are motor based; therefore, children's withdrawal from physical activity may have long-lasting effects, not only on their movement skills but also on their social contacts and friendships (Dewey, Kaplan, Crawford, & Wilson, 2002; Pellegrini, 1995; Wittchen, Stein, & Kessler, 1999).

Social isolation secondary to the physical limitations of DCD may very well be one of the factors linking DCD to depression (Wittchen & Fehm, 2003). Teachers report that school-aged children with DCD have fewer friends and are more socially isolated than their peers (Piek, Barrett, Allen, Jones, & Louise, 2005; Schoemaker & Kalverboer, 1994). Parents report that older children with DCD are less sociable, more passive, and display inappropriate and socially penalizing behaviors (Dunn et al., 1996; Knight, Henderson, Losse, & Jongmans, 1992). Indeed, children identified with DCD at age 6 were found to be shy and withdrawn, with personality and social problems 10 years later

(Knight et al., 1992). Several studies also have shown that adolescents with DCD view themselves as being less socially competent than their peers (Cantell, Smyth, & Ahonen, 1994, 2003; Losse et al., 1991; Piek et al., 2000).

A qualitative study by Missiuna et al. (2007) suggested that parents of children with DCD first report social problems and decreased self-worth in late childhood, with symptoms of depression evident by early adolescence. More recently, Missiuna, Cairney, Pollack, Cousins, & Macdonald (2009) conducted a large population-based study in which they found that school-age children with DCD experience significantly greater symptoms of depression and anxiety than their same-age peers without motor coordination difficulties. However, this study did not examine the association between mental health difficulties and peer relationship problems. According to Cairney, Veldhuizen, and Szatmari (2010), DCD may act as a primary stressor that exposes children with DCD to a cascade of negative secondary consequences, including social isolation and vulnerability to bullying. These secondary consequences, in turn, may lead to negative self-appraisals that are distressful and eventually manifest as mental health problems.

IS AN INCREASED SUSCEPTIBILITY TO BEING BULLIED A POTENTIAL FACTOR CONTRIBUTING TO PSYCHOLOGICAL DIFFICULTIES IN CHILDREN WITH DCD?

Bullying, or peer victimization, occurs when one child repeatedly uses aggressive behavior to manipulate and distress others who are vulnerable because of their physical, mental, or social characteristics (Craig & Pepler, 2007; Olweus et al., 1999). Bullying can take many forms, including physical victimization (e.g., kicking or hitting), verbal victimization (e.g., name-calling, teasing), and relational victimization (e.g., gossiping, social exclusion, or ostracism; Lamb, Pepler, & Craig, 2009; Storch & Ledley, 2005; Vaillancourt et al., 2010). The social and emotional risks to victims of bullying are considerable, including increased likelihood of depression, anxiety, loneliness, and low self-esteem (Hawker & Boulton, 2000). Being a victim of bullying is an established risk factor for mental health problems, and the problem is sufficiently serious that countries around the world, including Canada and the United States, have identified bullying prevention and intervention as a significant child health priority (Craig & Pepler, 2007). Moreover, recent longitudinal studies of children not identified as having DCD consistently demonstrated a temporal sequence from poor treatment by peers to depression (e.g., Kim, Leventhal, Koh, Hubbard, & Boyce, 2006).

Children with DCD exhibit several traits and behaviors that may increase their vulnerability to being bullied: they are clumsy and awkward (Rivard, Missiuna, Pollock, & David, 2011); they are poorly organized and have difficulty performing many basic academic skills, such as handwriting (Missiuna, 2002); they often do not achieve their academic potential (Cantell, 1998); they struggle to perform basic self-care tasks that other children master easily (Cermak, Gubbay, & Larkin, 2002); they tend to be less physically fit and more obese (Cairney, Hay et al., 2010); and they are often socially isolated (Piek et al., 2005; Poulsen et al., 2007). Qualitative research suggests that social problems, such as bullying, are a significant concern for parents of children with DCD (Missiuna, Gaines, Soucie, & McLean, 2006). Similar concerns also have emerged in other studies involving parents who describe the world as a "hostile place" for their child with DCD (Mandich, Polatajko, & Rodger, 2003; Segal, Mandich, Polatajko, & Cook, 2002; Stephenson & Chesson, 2008).

The findings from these qualitative studies indicate that parents of children with DCD notice and worry about their child being bullied. However, to our knowledge, only one published study has specifically focused on the risk of being bullied among children *with and without* motor coordination problems. Piek and colleagues (2005) investigated self-reported victimization in 86 children aged 7 to 11 years, 43 of whom were considered to be at risk for DCD (i.e., scored below age expectations on a validated screening measure of motor ability). Although there were no overall group differences in the amount of peer victimization reported by the two groups, Piek et al. found that being bullied

had different consequences for boys and girls at risk for DCD. Specifically, exposure to verbal victimization had a significant and negative impact on the self-worth of girls at risk for DCD. Boys with DCD who reported being exposed to a similar amount of verbal victimization showed no decrease in their self-worth. Thus, based on these preliminary findings, it seems possible that girls with DCD may be especially vulnerable to the negative mental health impacts associated with being bullied.

STATEMENT OF PURPOSE AND RESEARCH QUESTIONS

The purpose of this study was to compare levels of depression and peer victimization in children who were and were not at risk for DCD, as well as to explore the degree to which motor coordination status and peer victimization predicted children's self-reported feelings of depression. Because Piek et al. (2005) found that the impact of peer victimization was different for boys and girls at risk for DCD, this study also included an examination of possible gender differences. To this end, we posed the following research questions:

1. Are children with DCD more depressed and more frequently bullied than children who do not have motor coordination problems?
2. Does gender impact the level of depression and exposure to bullying reported by children with and without DCD?
3. Do motor coordination status, gender, and exposure to bullying predict children's risk for depression?

METHOD

Participants

Participants included 318 fifth-grade students from a large public school district in Ontario, Canada, who were screened for inclusion from a larger pool of 1,023 fifth-graders taking part in the first wave of a longitudinal study about the stability of social experiences and mental health from childhood to adolescence. Children in the fifth grade were selected for participation because the impact of school transitions on children's experiences with bullying was of interest in the larger study; students in the fifth grade would have the opportunity to transition from elementary school to middle school and from middle school to high school during the study period.

Within the sample of 318 children, 159 were selected to be in a probable DCD group (pDCD; 77 boys and 82 girls; mean age = 10.90 years; $SD = 0.47$) if they had a score of 57 or less on the Developmental Coordination Disorder Questionnaire (DCDQ'07; Wilson & Crawford, 2009). By using this cut-off score, it was expected that approximately 20% of children screened would be identified as pDCD. This criterion is recommended for capturing those children from a population most likely to be at risk for motor coordination problems (Wilson & Crawford, 2010). As suggested by Cairney and colleagues (Cairney, Hay, Faught, Mandigo, & Flouris, 2005), the term pDCD is used here because diagnosis of DCD was not verified through professional assessment. Children in the control group included those who scored above 58 on the DCDQ'07 and were matched to the pDCD group on gender (77 boys and 82 girls) and age ($M = 10.91$; $SD = 0.34$; $t(268.88) = 0.39$, $p > .05$). An independent t test confirmed that the pDCD group ($M = 49.23$; $SD = 6.66$) performed significantly poorer than the control group ($M = 66.33$; $SD = 4.90$) on the DCDQ'07 ($t(290.06) = 26.07$, $p < .001$), which corresponded to a large effect size ($d = 2.96$).

Measures

Motor Coordination. The DCDQ'07 (Wilson et al., 2009) is a 15-item parent-report measure for the identification of DCD that has been evaluated as a screening tool in Canada (Cairney, Missiuna, Veldhuizen, & Wilson, 2008) and internationally (Civetta & Hillier, 2008; Green et al.,

2005; Loh, Piek, & Barrett, 2009; Schoemaker et al., 2006; Tseng, Fu, Wilson, & Hu, 2010; Wang, Tseng, Wilson, & Hu, 2009). Normative data provided in the test manual indicate that for children between the ages of 10 and 15 years, a score equal to or less than 57 provides optimal sensitivity and specificity to DCD (i.e., 88.5% sensitivity and 75.6% specificity). Children who score at or below this level are considered likely to have motor coordination problems and to be at risk for having DCD. The DCDQ'07 has been found to have acceptable psychometric properties (Civetta & Hillier, 2008; Loh et al., 2009; Tseng et al., 2010; Wilson et al., 2009; Wilson, Kaplan, Crawford, Campbell, & Dewey, 2000), including high internal consistency reliability (coefficient alpha of 0.94; Wilson et al., 2009). Concurrent validity studies have shown DCDQ'07 scores to be moderately and significantly correlated with children's performance on direct tests of motor skills (Wilson & Crawford, 2010).

Peer Victimization. Participants completed a self-report screening measure about their experiences with bullying using procedures and questions validated in a population-based study of nearly 17,000 Canadian schoolchildren aged 8 to 19 years (Vaillancourt et al., 2010). First, children read a definition of bullying that differentiated it from fighting, aggression, and teasing (Vaillancourt et al., 2008). Next, children were asked about their experiences with specific forms of bullying, using the question, "How often have you been [physically, verbally, or socially] bullied at school during the past 3 months?" For each question, several behavioral examples were provided: *physical bullying* (being hit, kicked, shoved, etc.); *verbal bullying* (insults, put downs, or threats); and *social bullying* (exclusion [being left out], rumors, or someone getting others not to like you). A 5-point rating scale was used to assess frequency, ranging from 0 (*never*) to 4 (*several times a week*). Vaillancourt et al. (2010) demonstrated this measure's enhanced sensitivity and specificity for detecting children's involvement in bullying compared with a screening tool that asked children only about their general exposure to bullying, without regard to specific forms.

Depression. Symptoms of depression were assessed using the validated Behavior Assessment System for Children—Second Edition (BASC-2; Reynolds & Kamphaus, 2004). The BASC-2 is a multimethod, multidimensional measure of behavior and self-perceptions of people between the ages of 2 and 25. It is used to make differential diagnoses based on categories outlined in the *DSM-IV-TR*. (APA, 2000). Participants endorse 13 statements using either a true/false format (true = 2 and false = 0) or a 4-point frequency rating scale (never = 0, sometimes = 1, often = 2, and almost always = 3). Examples of statements from the depression subscale include: "I feel depressed" and "I don't seem to do anything right." The internal consistency reliability of the depression subscale is reported to be good (median coefficient alpha of 0.86; Frick, Barry, & Kamphaus, 2010).

Procedure

The McMaster Community-University Research Alliance is a federally funded partnership between academic scholars and community agencies to address local, national, and international concerns about bullying among children and youth. As part of that initiative, 50 schools in a large Ontario school district were selected at random to participate in a longitudinal study about the risk and protective factors contributing to students' involvement in bullying. Ethics approval was obtained from both the school board and the McMaster University Research Ethics Board prior to data collection.

Participating schools distributed consent forms to all students in the fifth grade. Parents were asked to provide consent for their children to complete a questionnaire during class time about the children's social and emotional experiences. All children who returned a completed form received a small reward, regardless of whether or not their parent provided consent for participation. A total of

1,121 (73%) children received permission to take part in this study. Of this group, 64 children were absent when the questionnaire was administered at school, and 34 declined assent. Thus, a total of 1,023 children participated in the first wave of the prospective study. Data for these 1,023 students were collected during the spring. Students were given 50 minutes to complete the questionnaires; however, on average, they required only 35 minutes to do so. Questions were administered in a standardized order.

In addition to requesting consent for children to participate in this study, all parents also were invited to complete a 20-minute telephone survey about their child's physical development, behavior, social experiences, and family background. A total of 903 parents agreed to the phone interview, with 86% successfully contacted at follow-up. Together, a subset of 716 parent-child dyads had both complete student questionnaires and parent interviews. Pertinent to the present study, of the subset, 1 parent did not complete the DCDQ'07, and 14 children were excluded because they had not completed all of the peer victimization ($n = 9$) and depression ($n = 5$) items from the questionnaires. Of the remaining 701 potential participants, 159 had scores ≤ 57 on the DCDQ'07 and met the criterion for pDCD (Wilson & Crawford, 2009), whereas the remainder had scores ≥ 58 and were candidates for the control group. To finalize the control group for the present study, 82 girls and 77 boys were selected at random using SPSS (Version 16.0) to form a gender- and age-matched comparison group.

Data Analysis

SPSS (Version 16.0) was used for analysis. Analyses of variance (ANOVAs) were used to test for between-group differences and linear regression was employed to examine the predictive relationship between gender, motor coordination status, peer victimization, and depression.

RESULTS

Means and standard deviations for the three types of peer victimization and depression for the pDCD and control groups are reported in Table 1. Group and gender differences were investigated for each dependent variable, using 2×2 ANOVAs. For depression, there was a significant main effect for group, $F(1, 314) = 17.05$, $p < .001$, partial $\eta^2 = .05$, with participants in the pDCD group rating themselves as significantly more depressed than participants in the control group. No main effect for gender, $F(1, 314) = 1.51$, $p = .22$, and no interaction between the two, $F(1, 314) = 0.07$, $p = .79$, were found. There also were significant main effects for group on both verbal and relational victimization items, $F(1, 314) = 8.72$, $p < .01$, partial $\eta^2 = .03$, and $F(1, 314) = 4.25$, $p < .05$, partial $\eta^2 = .01$, respectively. Specifically, participants with pDCD reported more frequent exposure to these two forms of bullying than did their peers. Main effects for gender were not statistically significant for either verbal or relational victimization, $F(1, 314) = 0.05$, $p = .82$, and $F(1, 314) = 2.56$, $p = .11$, respectively; nor was there any interaction between gender and group for these two variables, $F(1, 314) = 0.31$, $p = .57$ and $F(1, 314) = 0.53$, $p = .47$, respectively. Finally, the main effect for gender was statistically significant with respect to physical victimization, $F(1, 314) = 5.55$, $p < .05$, partial $\eta^2 = .02$, with boys reporting more exposure to this type of bullying than girls. Neither the main effect for group nor the interaction between group and gender were statistically significant for physical victimization, $F(1, 314) = 0.01$, $p = .93$, and $F(1, 314) = 0.18$, $p = .67$, respectively.

A hierarchical regression was performed to examine the predictive relationship between peer victimization and depression as a function of gender and group membership. Group and gender were entered on the first step, with the three forms of peer victimization (physical, verbal, and relational) entered on the second step. As seen in Table 2, group membership but not gender accounted for a

Table 1

Means and Standard Deviations for the Peer Victimization Items and Depression Measure by Group and for the Total Sample

	pDCD Group			Control Group			Total Sample	
	Total (<i>n</i> = 159)	Girls (<i>n</i> = 82)	Boys (<i>n</i> = 77)	Total (<i>n</i> = 159)	Girls (<i>n</i> = 82)	Boys (<i>n</i> = 77)	Girls (<i>n</i> = 164)	Boys (<i>n</i> = 154)
Depression								
<i>M</i>	8.47 ^a	9.04	7.86	5.21 ^a	5.57	4.82	7.30	6.34
<i>SD</i>	7.95	7.61	8.31	5.93	6.58	5.16	7.30	7.06
Physical Victimization								
<i>M</i>	0.81	0.70	0.92	0.79	0.63	0.96	0.66 ^b	0.94 ^b
<i>SD</i>	1.11	1.02	1.20	0.99	0.99	0.98	1.00	1.09
Verbal Victimization								
<i>M</i>	1.57 ^c	1.55	1.60	1.14 ^c	1.20	1.08	1.37	1.34
<i>SD</i>	1.43	1.33	1.56	1.18	1.16	1.21	1.25	1.41
Relational Victimization								
<i>M</i>	1.31 ^d	1.45	1.16	1.04 ^d	1.10	0.99	1.27	1.07
<i>SD</i>	1.26	1.25	1.27	0.98	0.95	1.02	1.12	1.15

Note. Means in the same row that share superscripts differ significantly. ^a $F(1, 314) = 17.05, p < .001$. ^b $F(1, 314) = 5.55, p < .05$. ^c $F(1, 314) = 8.72, p < .01$. ^d $F(1, 314) = 4.25, p < .05$.

statistically significant proportion of the variance in depression scores on Step 1, $F(2,315) = 9.35, p < .001, R^2 = .05$. The addition of peer victimization on Step 2 added significantly to the variance accounted for above and beyond group membership, $F_{change}(3,312) = 53.81, p < .001, R^2_{change} = .32$. That is, the three types of peer victimization jointly explained 32% of the variability in participants' self-reported depression. In addition, Table 2 shows that the three types of peer victimization were significantly correlated with participants' depression scores, and each accounted for a significant and unique amount of the variance in this variable. The squared partial correlations between each peer victimization variable and depression indicate their unique contribution to predicting depression once the influence of all of the other predictors was controlled. For example, exposure to relational victimization accounted for the largest portion (11%) of unique variance in children's depression

Table 2

Summary of Hierarchical Regression Analyses for Variables Predicting Self-Reported Depression in Children With and Without Motor Coordination Difficulties

Variable	ΔR^2	<i>B</i>	<i>SE B</i>	β	<i>r</i>	pr^2
Step 1	.05**					
Gender		0.97	0.79	0.07	0.07	0.005
Group		3.26	0.79	0.23**	0.23	0.05
Step 2	.32**					
Gender		0.86	0.66	0.06	0.07	0.005
Group		2.30	0.65	0.16**	0.23	0.04
Physical Victimization		1.33	0.35	0.19**	0.40	0.04
Verbal Victimization		0.83	0.313	0.15*	0.47	0.02
Relational Victimization		2.20	0.36	0.35**	0.54	0.11

Note. *N* = 318; *r* = zero-order correlation; pr^2 = squared partial correlation.

* $p < .01$. ** $p < .001$.

scores after controlling for any overlap it might have with the other forms of victimization, gender, or group membership. This was followed by smaller but equal unique contributions from exposure to physical victimization and being at risk for DCD (4% of unique variance, respectively). Finally, exposure to verbal victimization uniquely explained about 2% of the variation in participants' depression scores.

DISCUSSION

In the present study, children at risk for DCD were found to report more symptoms of depression than did their peers without motor coordination difficulties. This finding is consistent with Missiuna et al.'s (2009) report that school-aged children with DCD who were selected from a population-based sample have greater levels of depression than do their typically developing peers. Our results also complement those of previous studies that have found DCD to be associated with a heightened risk for psychological distress (Dewey et al., 2002; Rasmussen & Gillberg, 2000; Shafer et al., 1986; Sigurdsson et al., 2002). In addition, children at risk for DCD in this study were more likely to report having been the target of their peers' name-calling, insults, and verbal threats, as well as being purposefully excluded and ostracized by their peers. The only form of peer victimization that they did not encounter any more often than their peers was being hit, kicked, or pushed. That children with motor coordination problems were more likely to report being teased and socially excluded from peer interactions is consistent with previous studies documenting parents' concerns about the social vulnerabilities of their children with DCD (Mandich et al., 2003; Missiuna, Moll, Law, et al., 2006; Stephenson & Chesson, 2008), as well as with studies documenting that children with DCD are more likely to report feeling socially isolated and lonely (Poulsen et al., 2007) and less satisfied with their lives (Poulsen, Ziviani, & Cuskelly, 2006).

Interestingly, our findings contrast with those of Piek et al. (2005), who found no differences in how frequently children at risk for DCD were bullied relative to their same-age peers with no motor coordination difficulties. There are at least three possible explanations for this difference. First, the two studies utilized different measures to screen for DCD. In particular, we utilized a parent-report tool, whereas Piek et al. directly measured children's motor ability. Both approaches may be considered valid for screening children with motor coordination difficulties. However, parent-report tools like the one used in this study focus on the impact of motor problems in everyday functional activities (e.g., being able to print fast enough to keep up with classmates), whereas direct measures focus on the performance of individual motor skills (e.g., finger tapping or heel-toe walking). Thus, it is possible that the children at risk for DCD in this study may have had more evident motor coordination difficulties than those seen in the Piek et al. study, and thus, may have been more vulnerable targets for bullying. Alternatively, it may be that differences in sample size across the two studies contributed to the divergent findings for peer victimization. Given that our sample was nearly four times larger than the sample included in the Piek et al. (2005) study, it is possible that the latter did not detect differences in self-reported victimization because that study did not have the required statistical power. Finally, the participants in this study were, on average, a year older than those in the Piek et al. study and may have more accurately reported how often they were bullied. Indeed, all of the participants in this study were 10 years old, whereas some children who participated in the Piek et al. study were as young as age 7. Children who are typically developing generally do not accurately report their self-perceptions until age 8 or older, unless the task is very concrete and highly visual (Harter, 1990). In comparison, children with DCD may become aware of their limitations relative to their peers by age 5 or 6, owing to the visible nature of their difficulties (Missiuna, 1998). However, this earlier awareness and ability to self-report applies to the physical rather than the social domain (Missiuna, Pollock, & Law, 2004), and it is the latter that was of interest in this study.

The earlier work by Piek et al. (2005) also suggested that girls with DCD may be a particularly vulnerable group in terms of the impact that being bullied has on their mental well-being; however, we did not find an interaction between gender and group membership for either boys' or girls' self-reported depression or exposure to the three types of bullying. Rather, where differences existed between children who were and were not at risk for DCD, they applied to both genders. Again, there may be multiple reasons for the differences between the two studies, which makes it difficult to draw firm conclusions about the role of gender.

PREDICTING DEPRESSION FROM CHILDREN'S MOTOR COORDINATION STATUS, GENDER, AND EXPOSURE TO PEER VICTIMIZATION

Being at risk for DCD and being exposed to physical, verbal, and relational bullying were all significant predictors of children's self-reported depression. Together, these four variables explained nearly 40% of the variation across children's depression scores. Gender did not appear to be a major contributing factor, which suggested that boys and girls, whether or not they were at risk for DCD, were more likely to report greater levels of depression if they were bullied. The positive association between being bullied and experiencing higher levels of depression has been reported in the peer victimization literature (see Hawker & Boulton, 2000). Indeed, this study found that being bullied was more predictive of depression than motor coordination status. Moreover, exposure to relational bullying, where children were socially isolated and ostracized by their peers, was the single strongest predictor of depression among the variables examined in this study, uniquely explaining 11% of the variation evident across children. Given that the children at risk for DCD reported significantly higher rates of being targeted by this type of peer aggression and significantly greater levels of depression, the impact of relational victimization may be an area particularly worthy of further research in this population.

Study Limitations

Although all parents who consented to their child's participation were invited to complete a telephone interview, approximately 30% declined to take part or could not be contacted at follow-up. Thus, we did not know the motor coordination status of these children. For the children whose parents completed the DCDQ'07, information for peer victimization and depression as reported on the student questionnaire was not available for every child; however, the large majority had completed these items. In addition, this population-based study utilized a parent-report screening measure to identify children who were at risk for having DCD; DCD status as specified in the *DSM-IV* (APA, 2000) was not confirmed through professional assessment. Although the DCDQ'07 is psychometrically sound and possesses good sensitivity, we cannot state with certainty that all of these children had DCD. The findings cannot be generalized beyond the age group and grade level of the children in this study; further, information regarding students' educational identification or the presence of other medical diagnoses was not obtained and would be important to include in future studies of this population. The measure of peer victimization utilized in this study was also a screening tool; however, it, too, has been found to have good sensitivity and specificity (Vaillancourt et al., 2010). In future studies, researchers may consider using a multi-axial assessment approach, in which information is obtained from multiple sources (e.g., parents, teachers, peers, self-report, and direct observation) to comprehensively investigate the association between motor coordination, gender, peer victimization, and depression. Hartung, Little, Allen, and Page's (2011) recent study of the psychometric properties of instruments to measure bullying suggests that the Reynolds Bullying-Victimization Scale (Reynolds, 2003) may provide a more comprehensive measure of some of these issues. Finally, the results reported in this study are based on the first wave of a longitudinal

project, which means that the present data are cross-sectional. In future work, we will be able to utilize multiple waves of data, making it possible to test the nature of the relationship between peer victimization and depression in children at risk for DCD over time.

CLINICAL IMPLICATIONS AND CONCLUSIONS

The results of this study add to the literature by providing new evidence that children who have motor coordination difficulties consistent with DCD are at greater risk for being bullied. In addition, the children in this study with motor coordination problems were more likely to have higher levels of depression than children who were not reported to have any motor coordination difficulties. Together with the findings of Missiuna et al. (2009), these population-based studies add support to the assertion that children with DCD are as a group at heightened risk of social and psychological distress.

Given that mental health difficulties are clearly present by the middle-school years and the fact that many children who have DCD are not likely to have been identified (Missiuna, Moll, Law, et al., 2006), it is important for health care providers, school psychologists, and educators to work together to identify motor coordination problems earlier in this group of children. To do so, all professionals need to become educated about the typical characteristics associated with DCD, what child behaviors they should look for in the classroom and on the playground, and strategies they can use to accommodate the needs of these children. For example, "They're Bright but Can't Write: Developmental Coordination Disorder in School-aged Children" provides an accessible, evidence-based tutorial designed specifically for school personnel who are working with a child who has or is suspected of having DCD (Missiuna, Rivard, & Pollock, 2004). In addition, school psychologists who receive referrals regarding behavior problems and academic underachievement can be alert to several indicators that might suggest the possible presence of DCD (see Appendix for examples). Further guidance regarding the psychologist's role in recognizing and referring children with DCD is provided in Missiuna and Pollock (2005). Finally, Rivard et al. (2007) outline key issues to be aware of when making observations of children with potential movement problems who initially present with behavioral difficulties in the classroom.

If motor coordination problems are suspected, school psychologists may consider making a referral to an occupational therapist for assessment of the child's motor coordination abilities and evaluation of any impact on self-care, school, and leisure activities (Missiuna et al., 2008). Parents may also be encouraged to see their family physician to rule out other conditions that might explain difficulties with motor coordination (Missiuna, Gaines, Soucie et al., 2006). In cases in which DCD is suspected or identified, school personnel will need to be aware of the increased vulnerability for social and emotional problems in this population, including vulnerability to bullying. If social problems are evident, school psychologists may wish to discuss with parents and teachers the appropriateness of including these children in school-based anti-bullying or social skills programs. Ultimately, an increased awareness of what DCD is, how to recognize it, and the implications for the child's academic, social, and emotional well-being is of value to school psychologists, many of whom are instrumental in providing psychoeducational assessment and school-based mental health support services.

APPENDIX

Concerns other adults may report that would suggest a possible presence of DCD:

- Child has difficulty with age-appropriate self-care activities, such as buttoning a shirt, using cutlery, or tying shoelaces.

- Child has difficulty with activities requiring fine motor skills, such as printing, cutting, copying, opening containers, or completing puzzles.
- Child avoids sports or active play activities; watches peers instead of playing.
- Child seems to tire or become fatigued more easily than other children.
- Teacher describes a significant discrepancy between oral and written work; child is slower to complete schoolwork than others are.
- Parents or teachers report that they have to assist the child with self-care activities more than they believe they should.

Behaviors you may observe in the classroom or during assessment that would suggest possible presence of DCD:

- Sitting posture is slumped and/or child rests head in hand.
- Child is fidgety, restless, and constantly shifting seat position.
- Child does not use nondominant hand to assist with tasks (e.g., steadying paper when writing).
- Child awkwardly grasps pencil, grips it very tightly, or pencil pressure is too high or too low; poor legibility of written work; writing is very brief, with simple vocabulary.
- Child is clumsy with blocks, scissors, tools; movements look choppy.
- Child displays facial grimacing or tongue movements when working.
- Child is easily frustrated or overwhelmed by what seem to be basic tasks.

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