Research in Developmental Disabilities 35 (2014) 1198–1207

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Psychological distress in children with developmental coordination disorder and attention-deficit hyperactivity disorder

Cheryl Missiuna [a,b,*], John Cairney [a,b], Nancy Pollock [a,b], Wenonah Campbell [a,b], Dianne J. Russell [a,b], Kathryn Macdonald [a], Louis Schmidt [a], Nancy Heath [c], Scott Veldhuizen [d], Martha Cousins [a,b]

[a] McMaster University, Hamilton, Ontario, Canada
[b] CanChild, Centre for Childhood Disability Research, Hamilton, Ontario, Canada
[c] McGill University, Montreal, Quebec, Canada
[d] Centre for Addiction and Mental Health, Toronto, Ontario, Canada

ARTICLE INFO

Article history:
Received 1 October 2013
Received in revised form 3 January 2014
Accepted 6 January 2014
Available online 19 February 2014

Keywords:
Developmental coordination disorder (DCD)
Attention-deficit hyperactivity disorder (ADHD)
Population-based
Depression
Anxiety

ABSTRACT

This study explored whether or not a population-based sample of children with developmental coordination disorder (DCD), with and without comorbid attention deficit/hyperactivity disorder (ADHD), experienced higher levels of psychological distress than their peers. A two-stage procedure was used to identify 244 children: 68 with DCD only, 54 with ADHD only, 31 with comorbid DCD and ADHD, and 91 randomly selected typically developing (TD) children. Symptoms of depression and anxiety were measured by child and parent report. Child sex and caregiver ethnicity differed across groups, with a higher ratio of boys to girls in the ADHD only group and a slightly higher proportion of non-Caucasian caregivers in the TD group. After controlling for age, sex, and caregiver ethnicity, there was significant variation across groups in both anxiety (by parent report, $F(3,235) = 8.9$, $p < 0.001$; by child report, $F(3,236) = 5.6$, $p = 0.001$) and depression (parent report, $F(3,236) = 23.7$, $p < 0.001$; child report, $F(3,238) = 9.9$, $p < 0.001$). In general, children in all three disorder groups had significantly higher levels of symptoms than TD children, but most pairwise differences among those three groups were not significant. The one exception was the higher level of depressive symptoms noted by parent report in the ADHD/DCD group. In conclusion, children identified on the basis of motor coordination problems through a population-based screen showed significantly more symptoms of depression and anxiety than typically developing children. Children who have both DCD and ADHD are particularly at heightened risk of psychological distress.

1. Introduction

Developmental coordination disorder (DCD) is a neuro-developmental condition that impacts a child's ability to perform everyday tasks in self-care and academics. Prevalence estimates of 2 to 5% suggest that it is a common condition (American

* Corresponding author at: McMaster University, School of Rehabilitation Science, 1400 Main St West, IAHS 414, Hamilton, ON L8S 1C7, Canada. Tel.: +1 905 525 9140x27842; fax: +1 905 524 0069.
E-mail addresses: missiuna@mcmaster.ca (C. Missiuna), cairnej@mcmaster.ca (J. Cairney), pollock@mcmaster.ca (N. Pollock), campbelw@mcmaster.ca (W. Campbell), russelld@mcmaster.ca (D.J. Russell), kmacdona@mcmaster.ca (K. Macdonald), schmidtl@mcmaster.ca (L. Schmidt), nancy.heath@mcgill.ca (N. Heath), scott_veldhuizen@camh.net (S. Veldhuizen), mcousin@mcmaster.ca (M. Cousins).

0891-4222/$ – see front matter © 2014 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ridd.2014.01.007

Psychiatric Association [APA], 2000; Kadesjo & Gillberg, 1999; Lingam, Hunt, Golding, Jongmans, & Emond, 2009). Children with DCD have trouble performing everyday activities such as printing, using scissors, doing up buttons or zippers, opening juice-boxes, putting things in their knapsack, and climbing stairs (Missiuna, Moll, King, King, & Law, 2007; Summers, Larkin, & Dewey, 2008; Wang, Tseng, Wilson, & Hu, 2009). Parents often notice that something is wrong when their child is young but children usually are not referred for help until they begin to struggle at school. Most of these children are never recognized or diagnosed as having DCD (Gaines, Missiuna, Egan, & McLean, 2008; Missiuna, Moll, Law, King, & King, 2006). There is now strong scientific evidence that DCD is a chronic physical health condition, with motor problems persisting through childhood (Cantell & Kooistra, 2002; Losse et al., 1991), adolescence (Cantell, Smyth, & Ahonen, 2003), and into adulthood (Cousins & Smyth, 2003; Drew, 2005; Fitzpatrick & Watkinson, 2003; Kirby, Edwards, & Sugden, 2011; Missiuna, Moll, King, Stewart, & Macdonald, 2008). More importantly, studies in the last two decades have shown that motor difficulties are frequently associated with mental health concerns (Gaines et al., 2008; Missiuna et al., 2008).

Children with DCD are socially isolated (Poulsen, Ziviani, Johnson, & Cuskelly, 2008), sedentary children who are at increased risk of obesity (Cairney, Hay, Faught, & Hawes, 2005; Cairney, Hay, Veldhuizen, Missiuna, & Faught, 2010; Schott, Alof, Hultsch, & Meermann, 2007). They frequently have attentional difficulties (Dewey, Kaplan, Crawford, & Wilson, 2002; Querne et al., 2008), and may be over-represented within high school dropouts (Cantell, Smyth, & Ahonen, 1994) and adult mental health clinics (Drew, 2005; Rasmussen & Gillberg, 2000). Empirical evidence directly examining the co-occurrence of motor co-ordination difficulties and depression is growing (Campbell, Missiuna, & Vaillancourt, 2012; Gillberg & Gillberg, 1989; Pearsall-Jones, Piek, Rigoli, Martin, & Levy, 2011; Piek, Rigoli, et al., 2007). Indeed, there is good reason to believe that by late childhood and adolescence these health conditions are quite likely to co-occur (Cairney, Veldhuizen, & Szatmari, 2010; Gillberg & Gillberg, 1989; Kashani et al., 1987; Piek, Pitcher, & Hay, 1999; Piek, Rigoli, et al., 2007). For example, many of the social consequences associated with DCD are known risk factors for depression, including: withdrawal from participation in physical activity (Cairney, Hay, Veldhuizen, Missiuna, Mahlberg, et al., 2010; Missiuna et al., 2008; Poulsen, Ziviani, Cuskelly, & Smith, 2007; Poulsen, Ziviani, & Cuskelly, 2007; Poulsen et al., 2008); inadequate motor performance and reduced social acceptance by peers (Dunford, Missiuna, Street, & Sibert, 2005; Poulsen & Ziviani, 2004); fewer social contacts and friendships (Cairney, Hay, Wade, Faught, & Flouris, 2006; Causgrove Dunn & Dunn, 2006; Dewey et al., 2002; Pellegrini, 1995; Poulsen et al., 2008; Watkinson et al., 2001; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006); poor social skills (Tseng, Howe, Chuang, & Hsieh, 2007); increased social exclusion and risk of being bullied (Campbell et al., 2012; Chen & Cohn, 2003; Piek, Barrett, Allen, Jones, & Louise, 2005; Poulsen, Ziviani, Cuskelly, et al., 2007; Poulsen & Ziviani, 2004; Schoemaker & Kalverboer, 1994; Smyth & Anderson, 2000); decreased self-esteem and perception of competence (Cairney et al., 2006; Cantell et al., 2003; Missiuna et al., 2007; Piek et al., 2005; Piek, Baynam, & Barrett, 2006; Schoemaker & Kalverboer, 1994); and generalized vulnerability resulting from atypical brain development (Kaplan, Crawford, Cantell, Kooistra, & Dewey, 2006; Visser, 2003).

Children with DCD also have been shown to have higher levels of anxiety than children without the disorder (Hellgren, Gillberg, & Gillberg, 1994; Kristensen & Torgersen, 2008; Rasmussen & Gillberg, 2000). Links have been demonstrated between children's perceptions of physical competence and low self-worth (Cairney et al., 2006; Schoemaker & Kalverboer, 1994; Sigurdsson, Van Os, & Fombonne, 2002). In turn, a connection between these perceptions and anxiety has been suggested with anxiety shown to increase with age (McCarty, Vander Stoep, & McCauley, 2007; Sigurdsson et al., 2002; Skinner & Piek, 2001). Retrospectively, adults with DCD have described the anxiousness that they felt about their movement problems in settings such as physical education and recess (Fitzpatrick & Watkinson, 2003). In particular, adults with DCD and parents of children with DCD describe school anxiety, social anxiety, and physical symptoms of anxiety such as heart palpitations (Fitzpatrick & Watkinson, 2003; Missiuna et al., 2007). Fear of failure, ridicule, and embarrassment among children with DCD are beginning to be studied (Grills & Ollendick, 2002; Piek et al., 2005), but age effects and the manner in which this impacts on their mental health is unknown.

The co-morbidity between DCD and ADHD is very high (Cruddace & Riddell, 2006; Iwanaga, Ozawa, Kawasaki, & Tsuchida, 2006; Kaplan et al., 2006; Piek, Rigoli, et al., 2007; Piek, Dyck, Francis, & Conwell, 2007; Tseng et al., 2007). Indeed, multiple authors have concluded that "pure" ADHD is the exception rather than the rule (Dewey et al., 2002; Hamilton, 2002; Missiuna, Gaines, & Soucie, 2006). They urge practitioners to evaluate all children who present with attention problems for signs of motor impairment because the motor difficulties are often overlooked. Studies of population-based and clinically referred samples of children with ADHD have established prevalence estimates as high as 50% for DCD (Dewey et al., 2002; Fliers et al., 2008; Fliers, Vermeulen, et al., 2009; Martin, Piek, & Hay, 2006). Thus, it is of great concern that the presence of both ADHD and DCD has been found to be an early predictor of poor mental health outcomes in adulthood (Rasmussen & Gillberg, 2000). Specifically, children who have both ADHD and DCD have more mental health problems than children with ADHD only (Martin et al., 2006; Rasmussen & Gillberg, 2000). This includes more cases of depression (Piek, Rigoli, et al., 2007), depression as a comorbidity in children with ADHD (Biederman et al., 2008; Daviss, 2008; Daviss, Diler, & Birmaher, 2009), other psychiatric disorders (Hellgren et al., 1994) and an increased requirement for services (Tervo, Azuma, Fogas, & Fiechtner, 2002; Tseng et al., 2007).

Yet even though the overlap between ADHD and DCD is significant, it is far from complete (Dewey et al., 2002; Fliers et al., 2008; Fliers, Franke, et al., 2009; Kadesjo & Gillberg, 1998; Piek, Rigoli, et al., 2007). Moreover, unlike ADHD, most children with DCD are never diagnosed (Gaines et al., 2008; Missiuna, Gaines, et al., 2006). Consequently, it is a significant concern that large numbers of children with motor coordination impairments may be struggling with mental health issues and/or psychological distress without any recognition of their difficulties. Indeed, we know of no study in the published literature