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# Developmental coordination disorder and internalizing problems in children: The environmental stress hypothesis elaborated

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## ABSTRACT

There is a growing literature connecting poor motor coordination to physical and mental health outcomes in children and adolescents. These studies suggest that children with disorders such as developmental coordination disorder (DCD) are at greater risk for depression and anxiety, as well as obesity, and poor physical fitness. With regard to internalizing problems (symptoms of depression and anxiety), there is also evidence to suggest that the environment may play an important role in the etiology of psychological distress in this population. Cairney, Veldhuizen, & Szatmari, 2010 used the phrase “environmental stress hypothesis” to highlight the role that negative exposure to personal and interpersonal stressors might play in accounting for higher rates of internalizing symptoms in children with DCD. In this paper, we elaborate further on this basic premise, offering a model linking DCD to internalizing problems based on Pearlin’s stress process framework. In addition to stressors (risk) and protective factors, we incorporate both physical activity and obesity into our stress model. Next, we review the existing literature to see if there is evidence supporting specific components (pathways) of the model. In doing so, areas in need of further research are identified. Implications for intervention are also provided.

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## Introduction

Developmental coordination disorder (DCD) is a prevalent and serious condition characterized by problems with fine and/or gross motor coordination that result in impairment in everyday functioning, play, and academic achievement (Gibbs, Appleton, & Appleton, 2007). A diagnosis is made when the motor coordination ability of the child is well below that expected for the child's age and level of intellectual functioning, and when there is evidence of significant impact to performance of everyday activities (e.g., self-care, play) and/or scholastic achievement. The criterion also stipulates that other neurological disorders (e.g., cerebral palsy) must be ruled out (American Psychiatric Association, 2000). On average, DCD affects between 1.8% and 6% of children (American Psychiatric Association, 2000; Lingam, Hunt, Golding, Jongmans, & Emond, 2009). Although there are clear diagnostic criteria (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012), DCD is seldom recognized or diagnosed (Missiuna, Moll, King, Law, & King, 2006), and as a result, the difficulties experienced by children at school and at home are often mistakenly ascribed to oppositional behavior, learning or attention difficulties, or simply laziness (Missiuna et al., 2006). While there is some evidence that a subgroup of children with DCD show improvements in motor ability during adolescence (Cantell, Smyth, & Ahonen, 2003), DCD is generally thought to persist throughout adolescence into adulthood (Cantell et al., 2003; Rasmussen & Gillberg, 2000).

While the motoric impairments associated with DCD are troubling in their own right, numerous secondary physical and mental health concerns have been identified in the literature which are perhaps of greater concern in terms of the health and well-being of children with this condition. For example, the difficulties children with DCD experience in relation to play have been linked to physical inactivity (Rivilis et al., 2011), which in turn is associated with increased risk of obesity and other cardiovascular risk factors (Cairney, Hay, Faight, & Hawes, 2005; Faight, Hay, Cairney, & Flouris, 2005). Physical awkwardness or clumsiness has also been linked to social participation – children with DCD are more likely to be teased, ridiculed and bullied than typically developing children, which may account for the increased social isolation observed in this population. Numerous psychological impacts have also been described including reduced sense of self-worth (Skinner & Piek, 2001), lower levels of perceived competence related to interpersonal and individual functioning (Piek, Baynam, & Barrett, 2006; Skinner & Piek, 2001), and increased risk of anxiety and depression (Campbell, Missiuna, & Vailancourt, 2012; Piek et al., 2007; Pratt & Hill, 2011).

The question of concern is why do children with DCD appear to be at greater risk for these problems? Are these indeed secondary to DCD, or is there some other explanation as to why these problems co-occur in the same child? In a previous paper, the *environmental stress hypothesis* was identified, describing one possible explanation for why children with DCD have higher levels of depression and anxiety than typically developing children (Cairney, Veldhuizen, & Szatmari, 2010). The term *environmental* referred to the core role that negative social or interpersonal experiences play in the etiology of negative affect in children with DCD. Although this hypothesis is a plausible explanation (among others) for increased risk of secondary psychological and psychosocial problems in children with DCD, it remains under-developed conceptually and largely untested empirically. This paper will address the former concern; we will propose an analytic framework that can be used to understand the association between poor motor coordination and mental health in children. In doing so, the linkage between DCD, inactivity and obesity will also be addressed as we believe both inactivity and obesity are important factors that shape mental health in children with this condition.

## DCD versus poor motor coordination

Throughout the paper, we have chosen to use the diagnostic term DCD, rather than the myriad of alternate descriptors (e.g., physical awkwardness, clumsiness, motor coordination problems, etc.) that also appear in the literature. While specific diagnostic criteria for the disorder are available (APA, 2000; Blank et al., 2012), and some studies use this for identification of cases (e.g., Lingam et al., 2009), most do not (e.g., Cairney, Hay, Faight, & Hawes, 2005; Livesey, Lum Mow, Toshack, & Zheng,

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