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## Motor impairment among different psychiatric disorders: Can patterns be identified?

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## ABSTRACT

The aim of this study was to explore motor impairment in male adolescents suffering from psychiatric conditions. Taking into account the heterogeneity of a clinical population, motor profiles of distinctive diagnostic groups were evaluated. Whether or not motor ability discriminates between several diagnostic categories was investigated.

The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) was administered to examine a detailed motor profile. The motor abilities of a clinical population ( $n = 144$ ) were compared to those of typically developing peers ( $n = 87$ ), using independent  $t$ -tests. To account for differences in intellectual functioning, a one-way ANCOVA was performed. To investigate the extent to which a specific diagnosis contributes to variation in motor scores a stepwise linear regression approach was applied.

Results indicated that the clinical group performed significantly worse in comparison to the control group on all BOT-2 scales, even after controlling for IQ. The constructed models indicated that diagnostic categories accounted for a significant amount of the variance in motor ability scores.

The results imply that motor ability of adolescents with a psychiatric disorder is in need of attention, regardless of the diagnosis and support the notion that objective motor assessment should be part of routine clinical practice.

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### 1. Introduction

It is well recognised that co-occurring motor problems are common in children and adolescents with a psychiatric disorder. Several studies indicate that motor impairment is a feature of various child psychiatric disorders, including developmental disorders, emotional disorders and behavioural disorders (Emck, Bosscher, Beek, & Doreleijers, 2009). In general, these individuals perform worse on standardised motor assessment instruments in comparison to typically developing peers or norm populations (Emck, Bosscher, Van Wieringen, Doreleijers, & Beek, 2011; Simons, Vanderheyden, Nilius-Hoffmann, & Vandenbussche, 2011; Simons, Verscheure, Vandenbussche, Adriaenssens, & Delbroek, 2013).

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Given the continuous interaction between different developmental domains, it is not surprising that the presence of motor impairment has a significant impact on mental as well as on physical health. Quite a number of studies have shown that motor impairment in childhood predisposes for a range of social, emotional, physical and academic problems (Dewey, Kaplan, Crawford, & Wilson, 2002; Piek, Bradbury, Elsley, & Tate, 2008; Rivilis et al., 2011; Schoemaker & Kalverboer, 1994; Skinner & Piek, 2001). For instance, motor ability plays an important role in establishing an individual's reputation among peers and in the development of self-esteem (Piek, Baynam, & Barret, 2006; Simons, Capio, Adriaenssens, Delbroek, & Vandebussche, 2012). This is particularly relevant for individuals with a psychiatric condition, as they demonstrate a high incidence of motor problems that are serious enough to interfere with daily life. The combination of behavioural and emotional problems with motor problems makes these children especially vulnerable and can result in a negative outcome on participation and activity level (Iversen, Knivsberg, Ellertsen, Nødland, & Larsen, 2006).

Previous research has investigated the motor abilities of children and adolescents with psychiatric disorders. There is an increasing body of literature, demonstrating the high prevalence of motor impairment in individuals with Attention Deficit Hyperactivity Disorder (ADHD) (Fliers et al., 2009; Piek, Pitcher, & Hay, 1999; Pitcher, Piek, & Hay, 2003) and Autism Spectrum Disorders (ASD) (Downey & Rapport, 2012; Fournier, Hass, Naik, Lodha, & Cauraugh, 2010). In contrast, evidence regarding other child psychiatric disorders, such as Disruptive Behaviour Disorders (DBD) and depression, continues to be limited in scope. Moreover, the interest of prior research is mainly directed towards children.

Apart from the fact that motor impairment has repeatedly been shown to be associated with ADHD and ASD, the results are inconsistent. The discrepant findings can be explained, at least in part, by the use of different motor assessment instruments and conceptualisations of motor impairment. Typically, a rather poor agreement between different standardised motor assessment instruments has been established, indicating that they measure different aspects of a similar concept (Logan, Robinson, Rudisill, Wadsworth, & Morera, 2014; Spironello, Hay, Missiuna, Faught, & Cairney, 2010). Consequently, directly comparing the results across studies that use different assessment instruments would be incorrect. In addition, the use of different cut-off points results in highly variable prevalence rates of motor impairment and complicates generalisation of findings (Geuze, Jongmans, Schoemaker, & Smits-Engelsman, 2001).

Because motor impairment is seen in the majority of individuals with a psychiatric disorder, there is a need to compare the motor profiles of several diagnostic groups. These kinds of comparisons can possibly provide evidence for specific areas of impairment that may occur with a certain diagnosis. In addition, the association of specific motor profiles related to a diagnosis, may lead to the identification of clinically relevant endophenotypes. Although motor impairment has repeatedly been associated with psychiatric disorders, the underlying and contributing neurobiological aspects are incompletely understood. In answer to the high co-occurrence rates of motor impairment in paediatric mental health disorders, several hypotheses have been raised and a variety of theoretical frameworks have been proposed. For instance, Gilger and Kaplan (2001) presented the conceptual framework of 'atypical brain development'. They suggest that, due to the overlapping nature of developmental disorders, diffuse rather than specific areas of the brain may be involved. Depending upon the extent of the disruption of brain development, children may have one or more disorders (Zwicker, Missiuna, Harris, & Boyd, 2012). Likewise, with regard to specific mental health disorders, some additional features have been identified. For instance, Martin, Piek, and Hay (2006) describe shared genetic factors, underlying both ADHD and DCD and structural differences in brain areas related to both executive functioning and motor planning have been established (McLeod, Langevin, Goodyear, & Dewey, 2014). In children with ASD, morphological changes in the brain (Stanfield et al., 2008) and abnormal brain connectivity have been documented (Müller et al., 2011). These neurobiological factors provide an explanation, at least in part, for the notion that developmental disorders are typically nonspecific and heterogeneous. However, other contributing factors are not ruled out. For instance, several studies have shown that the presence of motor impairment hampers participation in physical activity. Which in turn leads to a restriction in the number of opportunities that those children will experience to enhance their motor proficiency. Moreover, this restriction will limit their opportunities to interact with peers, which in turn might influence the development of social skills (Leonard & Hill, 2014).

A detailed examination of motor profiles is an inexpensive and non-invasive method that possibly can provide further insight into the neurobiological underpinnings of these disorders (MacNeil & Mostofsky, 2012). Despite being valuable, previous research tended to focus on comparing motor abilities of individuals with a psychiatric disorder to typically developing peers or norm populations, rather than investigating differences among distinctive diagnostic groups. So far, only a handful of studies made comparisons across different clinical groups (Dewey, Cantell, & Crawford, 2007; Emck et al., 2011; Kooistra, Crawford, Dewey, Cantell, & Kaplan, 2005; Kopp, Beckung, & Gillberg, 2010; Pan, Tsai, & Chu, 2009; Skirbekk, Hansen, Oerbeck, Wentzel-Larsen, & Kristensen, 2012). Occasionally, limited comparisons were made, addressing only differences in the total motor score on a given motor assessment instrument. In order to examine a detailed motor profile that enables to identify possible differences across several motor areas, a comprehensive motor assessment instrument that covers a wide variety of skills across the full range of ability should be administered.

Another topic of considerable importance is the comorbidity issue. As the overlap between different child psychiatric disorders is substantial, it is extremely difficult to obtain an adequate number of participants with only one diagnosis of interest. Part of the difficulty with past research is the failure to adequately control for co-occurring disorders. The fact that uncomplicated conditions are hard to find puts a challenge to the field of motor ability research.

In this study, the focus lies on the motor abilities of male adolescents. This choice originated and resulted from several arguments. First, gender differences in motor ability have been reported in typically developing individuals (Barnett, van Beurden, Morgan, Brooks, & Beard, 2010). Second, when using the Bruininks-Oseretsky Test of Motor Proficiency, Second

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