



Autism spectrum disorder symptoms in children with ADHD: A community-based study



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ARTICLE INFO

Article history:

Received 18 December 2014

Received in revised form 16 September 2015

Accepted 17 September 2015

Available online 1 October 2015

Keywords:

Attention-deficit hyperactivity disorder

Autism spectrum disorder

ABSTRACT

This study examined the prevalence of autism spectrum disorder (ASD) symptoms in a community-based sample of children with attention-deficit/hyperactivity disorder (ADHD) and non-ADHD controls. We also examined the relationship between ASD symptoms and ADHD subtype, ADHD symptom severity and child gender. Participants were 6–10-year-old children (164 ADHD; 198 non-ADHD control) attending 43 schools in Melbourne, Australia, who were participating in the Children's Attention Project. ADHD was assessed in two stages using the parent and teacher Conners' 3 ADHD index and the Diagnostic Interview Schedule for Children IV (DISC-IV). ASD symptoms were identified using the Social Communication Questionnaire (SCQ). Unadjusted and adjusted linear and logistic regression examined continuous and categorical outcomes, respectively. Children with ADHD had more ASD symptoms than non-ADHD controls (adjusted mean difference = 4.0, 95% confidence interval (CI) 2.8; 5.3, $p < 0.001$, effect size = 0.7). Boys with ADHD had greater ASD symptom severity than girls with ADHD (adjusted mean difference = 2.9, 95% CI 0.8; 5.2, $p = 0.01$, effect size = 0.4). Greater ADHD symptom severity was associated with greater ASD symptom severity (regression co-efficient = 1.6, 95% CI 1.2; 2.0, $p < 0.001$). No differences were observed by ADHD subtype. Greater hyperactive/impulsive symptoms were associated with greater ASD symptoms (regression coefficient = 1.0; 95% CI 0.0; 2.0, $p = 0.04$) however, this finding attenuated in adjusted analyses ($p = 0.45$). ASD symptoms are common in children with ADHD. It is important for clinicians to assess for ASD symptoms to ensure appropriate intervention.

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What this paper adds:

This study builds on the limited existing body of research examining ASD symptoms in community samples of children with ADHD. We found strong evidence that children with ADHD had elevated ASD symptoms across all symptom domains, compared to non-ADHD controls. There was little evidence of a relationship between ADHD subtype and ASD symptom severity although ADHD symptom severity was associated with greater ASD symptoms. Boys with ADHD had significantly greater ASD symptoms than girls with ADHD, particularly within the stereotyped behaviors domain. All results held when excluding children with a pre-existing ASD diagnosis.

1. Introduction

The comorbidity between autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) is topical, given the release of the DSM-5, which now allows for these conditions to be diagnosed simultaneously (Konst, Matson, Goldin, & Rieske, 2014; Reiersen, 2011). Research of late has focused particularly on the genetic overlap and familial transmission of ADHD and ASD (Polderman, Hoekstra, Posthuma, & Larsson, 2014), with Musser et al. (2014) recently finding that the offspring of mothers with ADHD were more likely to have an ASD, compared to offspring of typically developing mothers. Young children with ADHD present with multiple functional impairments including higher rates of internalizing and externalizing disorders, peer relationship problems, language and academic difficulties, when compared to children without ADHD (Efron, Hazell, & Anderson, 2011; Sciberras, Fulton, Efron, Oberklaid, & Hiscock, 2011; Sciberras, Lycett, Efron, Mensah, Gerner, & Hiscock, 2014; Sciberras, Mueller, et al., 2014; Sciberras, Roos, & Efron, 2009). These difficulties may be, in part, related to comorbidity with other disorders including ASD (Grzadzinski et al., 2011). It appears that more children with ADHD show features of ASD than complete comorbidity (Ronald, Larsson, Anckarsater, & Lichtenstein, 2014), suggesting that examining symptom co-occurrence, rather than complete comorbidity, may be helpful in research and clinical work (Reiersen, 2011). This paper examines comorbid ASD symptoms in a large community-based sample of children with ADHD and non-ADHD controls. A more thorough understanding of the type and prevalence of ASD symptoms in children with ADHD may assist in early identification and treatment of ASD symptoms in this group of children (Davis & Kollins, 2012).

Children with ADHD have significantly higher scores on measures of ASD symptoms compared to children without ADHD (Kochhar et al., 2011b; Kroger et al., 2011; Reiersen, Constantino, Volk, & Todd, 2007). Studies have reported that 18% to 50% of children with ADHD present with clinical levels of ASD symptoms (Kochhar et al., 2011a, 2011b; Ronald, Simonoff, Kuntsi, Asherson, & Plomin, 2008; Van der Meer et al., 2012). While some studies report that children with ADHD exhibit elevated ASD symptoms across the three main core domains of ASD (based on the *Diagnostic and statistical manual of mental disorders*, 4th ed. (DSM-IV-TR) criteria: social interaction, communication and repetitive behaviors; Nijmeijer et al., 2009), others report elevation in the social interaction (Clark, Feehan, Tinline, & Vostanis, 1999), repetitive and stereotyped behavior (Polderman et al., 2014) or communication domains alone (Kochhar et al., 2011b). ADHD symptom severity and ADHD combined subtype have been associated with the presence and severity of ASD symptoms (Reiersen et al., 2007; Van der Meer et al., 2012). Recent research has shown that children with persistent ADHD symptoms tend to also have persistent ASD symptoms, suggesting that the presence of social and communication difficulties may contribute to greater stability of ADHD symptoms over time (St. Pourcain et al., 2011). It also appears that children with ADHD and social communication difficulties are also at risk for other psychological comorbidities (Jang et al., 2013; Reiersen, 2011).

The small body of research examining the relationship between gender and ASD symptoms in children with ADHD has produced mixed findings (Nijmeijer et al., 2009; Reiersen et al., 2007). A community-based study found that boys with ADHD had more ASD symptoms than girls with ADHD (Reiersen et al., 2007), but that there were a greater proportion of girls with ADHD who had ASD symptoms in the clinical range (75%), compared to boys with ADHD (25%) (Reiersen et al., 2007). Nijmeijer et al. (2009) reported that girls with ADHD had more ASD symptoms than boys with ADHD. However, research in this area has focused on predominantly male samples.

Despite the recent increase in research examining the overlap between ADHD and ASD, existing studies have some key limitations. Of note, most studies examining the relationship between ADHD and ASD have focused on clinical samples (St. Pourcain et al., 2011). It is well known that clinical samples of children with ADHD are more likely to include boys and those presenting with more severe symptoms and comorbidities, which consequently may inflate the comorbidity observed between ADHD and ASD observed in these samples. Reiersen's population-based study examining ASD symptoms in children with ADHD has advanced our understanding of the comorbidity of these two conditions (Reiersen et al., 2007). However, there were some limitations. Participants ($n = 946$) ranged from 8 to 25 years of age when ASD symptoms were measured, which was up to 5 years after information was collected about ADHD symptoms, and the study included a small sample of girls with ADHD ($n = 19$) (Reiersen et al., 2007). More recent studies have relied on clinician diagnosis of ADHD and ASD only, which has not been confirmed by the research team (Musser et al., 2014), or measures of autism spectrum disorder symptoms that are not well validated (e.g. self-report checklist of 12 items based on DSM-5 criteria (Polderman et al., 2014) and the Autism, Tics, AD/HD and other comorbidities telephone interview (A-TAC) (Ronald et al., 2014). Far less research has

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