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Brief Report

The role of every-day executive function in social impairment and adaptive skills in Autism Spectrum Disorder with intellectual disability



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ABSTRACT

Background: Although executive function (EF) deficits are a recognised component of the cognitive phenotype of Autism Spectrum Disorder (ASD), particularly in children without general intellectual delay, little is known about ecological measures of EF and their outcome correlates among individuals with ASD and co-occurring intellectual disability. This exploratory study examined every-day EF in the classroom among children and adolescents diagnosed with both ASD and intellectual disability (ASD-ID) and their correlations with social impairment and adaptive functioning.

Method: Teachers of 40 children and adolescents diagnosed with ASD-ID completed the Behavior Rating Inventory of Executive Function, the Vineland Adaptive Behavior Scales, and the Social Responsiveness Scale.

Results: A global executive dysfunction profile was found in ASD-ID, with most prominent deficits occurring in shifting. Results also showed that metacognitive executive processes predicted adaptive communication skills above and beyond IQ and social impairment in ASD-ID.

Conclusions: Our findings corroborate a specific metacognitive executive function-adaptive communication association in ASD. EF interventions might be important treatment targets for improving functioning, especially in the communicative domain, in ASD-ID.

1. Introduction

In order to organise one's self and effectively respond to the environment, executive function (EF) is necessary. EF refers to a set of higher-order cognitive control processes, such as inhibition, shifting, organisation, planning, self-monitoring, and working memory (Anderson, 1998; Gioia, Isquith, & Guy, 2001). Deficits in EF are common and have been conceptualised as an associated cognitive feature in several Autism Spectrum Disorder (ASD) samples (Demetriou et al., 2018; Hill, 2004). While not a core symptom of ASD, EF has been shown to be a predictor of key social and behavioural outcomes (Kanne et al., 2011; Pellicano, 2010). Despite research having addressed the EF impairments of individuals with ASD, questions remain.

First, the literature on EF in ASD is dominated by utilisation of performance-based EF tasks. Cross-sectional studies on children and adolescents with ASD, using performance-based EF measures, have revealed significant deficits in shifting/flexibility, planning, working memory and inhibition aspects (for a review see Kenworthy, Yerys, Anthony, & Wallace, 2008). These studies though have only focused on ASD individuals with normal intellectual ability (IQ > 70). Intellectual Disability (ID) has been found in an estimated 31% of children with ASD in a recent report (Developmental Disabilities Monitoring Network Surveillance Year 2010 Principal

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Investigators; Centers for Disease Control and Prevention (CDC), 2014). This means that there is currently a lack of knowledge on how EF is reflected in the ASD population with ID (ASD-ID).

In addition, a recent meta-analysis (Demetriou et al., 2018) showed that performance-based EF measures did not achieve clinical utility in differentiating between ASD and typical controls, while informant-based ecological measures such as the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia, Isquith, Guy, & Kenworthy, 2000) achieved clinical marker criteria. This lends further support to the proposition that measures with ecological validity, commonly known as “every-day” EF rating scales, may be more appropriate in clinical practice. A possible advantage of ecologically valid EF assessments is their potential utility for individuals with co-occurring ASD and ID who may find it difficult to complete performance-based EF tests. Most importantly performance-based EF tasks include additional language and cognitive demands that might exacerbate EF deficits in those individuals.

Based on ratings from the BRIEF across development, it has been found that every-day EF deficits in ASD without ID were prominent across all subdomains, with a peak difficulty noted in shifting (Granader et al., 2014; Wallace et al., 2016). Nevertheless, very little work to date has examined the profiles of every-day EF among individuals with ASD-ID. One exception is the work of Panerai, Tasca, Ferri, Genitori D’Arrigo, & Elia (2014) who found that individuals with ASD-ID showed shared EF deficits to ASD without ID. Panerai et al. (2014) however only recruited 8 individuals with ASD-ID, and therefore utilisation of the BRIEF on a larger sample is needed to establish an executive dysfunction profile of ASD-ID.

Another open field of investigation is the relation between every-day EF, social impairment and adaptive functioning. Thus far, there is contradicting evidence regarding whether every-day EF is associated with social impairment in ASD without ID. For example, Leung, Vogan, Powell, Anagnostou, and Taylor (2016) demonstrated a distinct metacognitive EF-social impairment link in ASD, whilst Kenworthy, Black, Harisson, Della Rossa, and Wallace (2009) found no link between BRIEF and social symptoms. No study to date has investigated such association in ASD-ID. With respect to adaptive behaviour, Gilotty, Kenworthy, Sirian, Black, and Wagner (2002) reported that EF deficits in metacognition domain were important predictors of maladaptive skills in ASD. The nature of the relationship was extended by Pugliese et al. (2015) reporting significant cross-sectional and longitudinal associations between BRIEF scores and adaptive functioning in children and adolescents with ASD. Wallace et al. (2016) also found that both behavioural regulation and metacognition were important predictors of adaptive functioning for adults with ASD. However, Panerai et al. (2014) in the only study to date to include ASD-ID in their sample ($N = 8$) demonstrated contradictory findings as no correlations were found between BRIEF and adaptive skills within the ASD group in their study. Studies have not yet been published exploring these relationships in a pure ASD-ID sample; whether the same pattern of results would be found amongst individuals with ASD-ID remains to be explored.

The primary focus of this exploratory study is thus to fill in the theoretical breach that previous research has created, hence the focus on those individuals within ASD-ID. To the authors' best knowledge, the present study is the first to examine EF profiles employing ecological every-day EF measures among a sample of children and adolescents with ASD-ID. The second aim was to investigate the role of every-day EF on social impairment and adaptive skills within ASD-ID. It was predicted that ASD-ID children and adolescents would show deficits in EF domains relative to the population mean. It was also expected that shifting would be the greatest weakness within this group. Finally, we hypothesised that impaired EF aspects, especially in metacognition, would be associated to social impairment and maladaptive skills.

2. Methods

2.1. Participants

Participants were 40 children and adolescents, diagnosed with ASD and comorbid ID, aged between 6 and 16 years (12 females). All children possessed a formal diagnosis of intellectual disability and received a score of < 70 , as determined by the abbreviated version of the Wechsler Intelligence scales (two subtests: vocabulary and matrix reasoning; Wechsler, 1999) (see Table 1 for details). All participants also held an official ASD diagnosis by a qualified clinician using DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th Edition) or DSM-V (5th edition) criteria (American Psychiatric Association (APA), 1994, 2013), and qualified for a

Table 1

Participant characteristics ($N = 40$) including mean age, IQ as well as executive function index scores, adaptive functioning and social impairment scores.

Measure	M	SD	Range (Minimum-Maximum)
Age	9.20	3.44	6–16
Full scale IQ	52.80	7.10	46–68
SRS	120.23	27.36	69–179
BRIEF BRI	79.63	18.24	58–118
BRIEF MI	77.23	11.82	60–111
VABS socialisation	63.33	12.47	42–103
VABS communication	57.77	13.11	31–86
VABS daily living	54.63	12.33	23–78

Note. SRS = Social Responsiveness Scale; BRIEF = Behavior Rating Inventory of Executive Function; BRI = Behavioural Regulation Index; MI = Metacognition Index; VABS = Vineland Adaptive Behavior Scales.

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