Research in Autism Spectrum Disorders 54 (2018) 27–36

Contents lists available at ScienceDirect

Research in Autism Spectrum Disorders

journal homepage: www.elsevier.com/locate/rasd

Aging with elevated autistic traits: Cognitive functioning among older adults with the broad autism phenotype

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ARTICLE INFO

Number of reviews completed is 1

Keywords:
Aging
Broad autism phenotype
Executive function

ABSTRACT

Background: Little is known about the impact of aging with autism spectrum disorder (ASD) on cognition. As a first step in addressing this gap in our knowledge, the current study examined cognitive functioning among older adults with elevated, but subclinical levels of autistic traits (i.e., the Broad Autism Phenotype; BAP) compared to older adults without the BAP.

Method: Forty older adults (aged 60–91, M = 73 years) were recruited and classified as meeting criteria for the BAP (n = 20) or not (control older adults, COA; n = 20). Different components of executive function as well as episodic memory were measured using standardized performance-based neuropsychological assessments in addition to a self-report questionnaire of executive function difficulties.

Results: Despite no differences in age, sex ratio, educational history or IQ, the BAP group demonstrated poorer performance on measures of executive function and episodic memory compared to the COA group. The BAP group also self-reported more executive function difficulties in everyday settings. Moreover, differences in working memory and attentional shifting were maintained after accounting for the influences of IQ and both depression and anxiety symptoms.

Conclusions: These findings suggest that aging with the BAP confers additional risk to cognitive function for older adults. As the BAP forms a bridge in the continuum from typical to atypical levels of autistic traits, these findings suggest that individuals with ASD might also incur cognitive costs as they age into older adulthood.

1. Introduction

The Broad Autism Phenotype (BAP) describes a set of subclinical behaviors in unaffected individuals that are associated with and qualitatively similar to the dyad of impairment (i.e., social-communication and restricted and repetitive patterns of behavior) found in autism spectrum disorder (ASD; Bolton et al., 1994; Constantino & Todd, 2003; Ronald, Happé, & Plomin, 2005; Ruzich et al., 2015; Skuse, Mandy, & Scourfield, 2005). Although these behavioral traits are expressed to a milder degree in the BAP than in ASD, examining the BAP may prove particularly insightful, especially vis-à-vis unique subgroups in ASD or where recruitment difficulties occur. For example, although there is growing awareness that the number of older adults with ASD is increasing due to an increasing aging population and our understanding of aging in ASD is strikingly limited, studies struggle to recruit older adults with ASD to participate in research (Stuart-Hamilton et al., 2009). Even when these studies are completed, they are often hampered with cohort issues wherein older adults with long-held ASD diagnoses are much more likely to have co-occurring intellectual disability compared

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https://doi.org/10.1016/j.rasd.2018.06.009
Received 21 December 2017; Received in revised form 11 June 2018; Accepted 22 June 2018

to those now receiving the diagnosis in childhood, for example. Examining the BAP in older adults circumvents these issues while also informing aging with ASD.

With prevalence estimates of ASD being around 1% and the older adult population increasing, it is estimated that in the UK 153,000 individuals with ASD are over 60 years old (UK Office for National Statistics, 2017). It is not yet clear how the aging process impacts individuals with ASD. As studies of young adults have demonstrated differences in brain structure (e.g., Ecker et al., 2012, 2013; Wallace, Dankner, Kenworthy, Giedd, & Martin, 2010, 2013) and difficulties in some aspects of cognitive function (e.g., Sachse et al., 2013; Wallace, Kenworthy et al., 2016), adults with ASD may be more vulnerable to age-related declines compared to typical older adults (Geurts & Vissers, 2012). Alternatively, these differences in brain structure and cognitive function may mean that adults with ASD have always processed information differently from typical adults, and may be protected, at least to some degree, against age-related declines. So far the literature in support of either of these outcomes is limited; therefore, examining the BAP in older adults might provide insight into the likely outcome.

There are a growing number of studies examining cognitive functioning in ASD across the adult lifespan. Many studies have focused on adults with ASD who have IQ in the normal range but studies vary in which aspects of cognition are examined. For some abilities (e.g., semantic fluency, planning, verbal memory), adults with ASD have shown the same pattern of age-related decline as typical adults, that is, poorer performance with increasing age (Davids, Groen, Berg, Tucha, & van Balkom, 2016; Geurts & Vissers, 2012). However, different age-related trajectories in ASD have been noted in certain domains of cognition. A steeper age-related decline has been reported in visual memory, whereas phonemic fluency, working memory, digit symbol substitution, and category learning have demonstrated less age-related decline in ASD when compared to typical adults (Geurts & Vissers, 2012; Happé et al., 2016; Lever & Geurts, 2016a; Powell, Klinger, & Klinger, 2017). Many of the cognitive abilities examined can be classified as executive functions (EF). EF is an umbrella term used to describe goal-directed behaviors (including planning, cognitive flexibility/set-shifting, inhibitory control, and working memory), which are known to be prone to age-related decline.

To date, the domains of EF most commonly explored in aging with ASD are generativity/spontaneous flexibility (measured by verbal fluency), reactive flexibility (measured by Trails tasks or a modified Wisconsin Card Sorting Test), planning (measured by towers tests such as the Tower of London), and working memory (measured by spatial span or N-back tasks) (Davids et al., 2016; Geurts & Vissers, 2012; Lever & Geurts, 2016a; Lever, Werkle-Bergner, Brandmaier, Ridderinkhof, & Geurts, 2015; Powell et al., 2017). Although all these EF abilities decline with increasing age, the age at which decline begins and the trajectories of decline differ across domains (Amieva, Phillips, & Sala, 2003; Baltes & Lindenberger, 1997; Hasher, Zacks, & Rahhal, 1999). Furthermore, although several studies exploring cognition in aging with ASD have utilized either the same or very similar measures, the pattern of results is inconsistent across studies (Davids et al., 2016; Geurts & Vissers, 2012; Lever et al., 2015; Powell et al., 2017). While there are differences between the samples in these studies, there are no characteristics that obviously account for the pattern of results. Given that studies of children and young adults with ASD show both differences across domains of EF and in trajectories with age, it is imperative to explore age effects on EF widely in this early stage of ASD-aging research (Hill, 2004; Kenworthy, Yerys, Anthony, & Wallace, 2008; Wallace, Yerys et al., 2016).

To our knowledge, only one study has previously examined EF in later life within the BAP (Wallace, Budgett, & Charlton, 2016). Wallace, Budgett et al. (2016) examined self-reported BAP traits, EF difficulties, and both depression and anxiety in adults over 60 years old. Individuals who met criteria for being above cut-off on the BAP Questionnaire (Hurley, Losh, Parlier, Reznick, & Piven, 2007) reported more EF difficulties compared to those below the cut-off (i.e., control older adults, COA). Furthermore, individuals classified as expressing the BAP, reported higher levels of depression and anxiety symptomatology than COA. Nevertheless, this study relied on self-ratings alone to characterize EF difficulties. To our knowledge, no studies have utilized performance-based measures to assess EF and other aspects of cognition among older adults with and without the BAP. Most other studies of cognitive functioning in the BAP have examined (young to middle-aged adult) parents and (mostly pediatric) siblings of children with ASD. Although results are mixed, many studies have demonstrated poorer EF abilities (particularly in planning and flexibility) in parents of children with ASD compared to parents of typically developing children (Delorme et al., 2007; Hughes, Leboyer, & Bouvard, 1997; Piven & Palmer, 1997), while others do not (Losh et al., 2009). These findings suggest that BAP traits could represent an additional risk factor, exacerbating normative age-related cognitive declines.

Additional factors that influence outcomes both in aging and in ASD are the presence of depression and anxiety. ASD is associated with higher rates of depression and anxiety among children and adolescents (Salazar et al., 2015; Strang et al., 2012). Similarly, among young and middle-aged adults, individuals with ASD are more likely to experience depression and anxiety compared to their same age peers (Croen et al., 2015; Lever & Geurts, 2016b). Paralleling these studies, high rates of depression and anxiety have also been identified in individuals with BAP traits (Wainer, Block, Donnellan, & Ingersoll, 2013) and in family members of individuals with ASD (Ingersoll, Meyer, & Becker, 2011; Wilcox, Tsuang, Schnurr, & Baida-Fragoso, 2003). To date, only one study has examined mood in BAP older adults, and found greater self-reported depression and anxiety in those meeting criteria for the BAP than COA (Wallace, Budgett et al., 2016). Rates of depression among neurotypical older adults are no lower than across the lifespan (Beekman, Copeland, & Prince, 1999). However late-life depression is also associated with poorer outcomes, including residual executive dysfunction even when mood has stabilized (Alexopoulos et al., 2005; Barch et al., 2012). Although some studies have suggested that anxiety may reduce in typical aging, other studies have found that rates of anxiety and presence of anxiety symptoms remains high in later life (Mehta et al., 2003; Vink, Aartsen, & Schoevers, 2008). Furthermore, anxiety has been found to be more common in older adults living in care homes or with comorbid health problems, as well as remaining highly associated with presence of depression (Bryant, Jackson, & Ames, 2008; Vink et al., 2008). Therefore autistic older adults reporting depression and anxiety may be at an elevated risk for poorer outcomes and cognitive decline.

This study investigates whether the presence of the BAP among healthy older adults (aged 60–91 years), negatively impacts