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Exploring the anxiety and depression profile in individuals diagnosed with an autism spectrum disorder in adulthood

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ABSTRACT

Symptoms of anxiety and depression are commonly reported by adults diagnosed with an autism spectrum disorder (ASD), and their presence can exacerbate core autism symptoms and lower quality of life. This study investigated the symptom profile of anxiety and depression, and its correlates (i.e., age at diagnosis, gender, and ASD severity) in a group of adults who were referred to a specialist diagnostic centre for autism and whose diagnosis was confirmed. It explored whether this profile was different in adults who were referred to the same clinic and where the diagnosis was not confirmed. The results showed that 37% and 46% of adults who received a diagnosis of ASD in adulthood reported symptoms that reflected moderate or severe anxiety or depression. In addition, (lower) age, female gender and autism severity contributed independently to individual differences in self-reported anxiety symptoms. Autism severity and the number of adults who reported severe (vs. minimal) anxiety symptoms were increased in the diagnosed (versus the non-diagnosed) adult group. We discuss the implications for prevention and treatment and directions for future research.

1. Introduction

Autism Spectrum Disorder (ASD) is a set of neurodevelopmental conditions characterised by a range of difficulties associated with reciprocal social interaction and communication, and restricted, stereotyped, repetitive behavior or interests (American Psychiatric Association, 2013). Around 1% of adults have a diagnosis of ASD and it is more commonly diagnosed in males (Werling & Geschwind, 2013). Researchers have highlighted challenges associated with understanding factors that affect daily functioning in adults diagnosed with ASD (Howlin, 2015). Several studies suggest that co-occurring depression and anxiety symptoms can exacerbate core symptoms of ASD across development, leading to reduced communication, social withdrawal, and increased psychomotor agitation, stereotypical and obsessive behaviour (Duvekot, van der Ende, Verhulst, & Greaves-Lord, 2018; Kelly, Garnett, Atwood, & Peterson, 2008; Sterling, Dawson, Estes, & Greenson, 2008). Related research that has explored correlates of anxiety and depression found that increases in the severity of ASD symptoms is associated with the presence of any anxiety disorder (Lever & Geurts, 2016; Sukhodolsky et al., 2008) and depression (review by DeFilippism, 2018).

Research investigating ASD and comorbid anxiety and depression in childhood and adolescence has generally reported more symptoms in individuals diagnosed with ASD, compared with typically developing populations (e.g., Kim, Szatmari, Bryson, Streiner,

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& Wilson, 2000). In typical development (TD) the lifetime prevalence of anxiety disorders and major depressive disorder (MDD) is approximately 30% and 17% respectively (Kessler et al., 2005). Reported rates of anxiety and major depressive disorder in children and adolescents diagnosed with ASD range from 17 to 70% and 42 to 56% respectively (review by Mazzone, Ruta, & Reale, 2012). Consistently, Kuusikko et al. (2008) found elevated symptoms of parent-reported anxiety and depression symptoms in 8-15-year-olds diagnosed with high functioning autism or Asperger syndrome (versus TD controls) and increased self-reported symptoms associated with social anxiety in adolescents aged 12 years and above.

Recent studies indicate that the increased prevalence and associated challenges linked to anxiety and depression in children and adolescents diagnosed with ASD are also evident in adult populations. Buck et al. (2014) explored anxiety symptoms in adults referred for an ASD diagnosis earlier in development (between the ages of 3 and 25). In this group of individuals, current and lifetime prevalence rates of anxiety disorder were 40% and 53% respectively. Lever and Geurts (2016) found that up to 79% of adults with ASD met criteria for a psychiatric disorder at least once in their lives, with anxiety (26%) and depression (42%) being the most common. Moreover, these rates were elevated compared with a TD control group and, though diagnostic symptoms declined with age, differences were evident across the lifespan. In a further study, Joshi et al. (2013) compared psychiatric symptoms in adults who attended a specialised ASD clinic with a group of TD individuals referred for general mental health issues, and matched for age, gender and IQ. The results showed that current and lifetime diagnoses of anxiety and depression (respective rates of current diagnosis were 38% and 31% and with lifetime rates up to 77%) were elevated in adults diagnosed with ASD compared with the TD group (comparable rates were 11% and 23%, with lifetime prevalence up to 26%).

It is common in both TD and ASD populations for a person to be diagnosed with comorbid anxiety and depression (Hirschfeld, 2001). In support, Lever and Geurts (2016) found that over 65% of adults with ASD meeting criteria for any lifetime mood or anxiety disorder also met the criterion for the other co-occurring disorder. In the TD population, anxiety disorders typically have an earlier onset than mood disorders and show stability throughout a person's lifetime (Kessler et al., 2005; Roza, Hofstra, Van Der Ende, & Verhulst, 2003). The mean age of onset for depression is around 15 years and prevalence rates increase with age (Gayman, Lloyd, & Ueno, 2011; Merikangas et al., 2010). In addition, depression is often chronic and recurrent episodes have been linked to reduced psychosocial functioning over time (Wilson, Hicks, Foster, McGue, & Iacono, 2015). Several studies have found that age is also an important risk factor in the ASD population. For example, Roy, Prox-Vagedes, Ohlmeier, and Dillo, (2015) explored the presence of a diagnosis of anxiety and depression in adults referred for ASD. They found that anxiety and depression and other psychiatric conditions (e.g., eating disorders) were more common in this group compared with published numbers in the general population (e.g., 48% versus 17% for a diagnosis of major depressive disorder). In addition, they found that older (40–62 years old) compared with younger adults (20–39 years old) were at most risk for poor mental health.

Further studies show that the male to female prevalence ratio for any anxiety disorder is around 1:1.7; and women are twice as likely to have a diagnosis of depression compared with men (e.g., McLean, Asnaani, Litz, & Hofmann, 2011). In a TD population, gender differences in relation to symptoms of anxiety emerge in childhood (Beesdo, Knappe, & Pine, 2009; Copeland, Angold, Shanahan, & Costello, 2014) and continue through adolescence (Merikangas et al., 2010) and adulthood (Leach, Christensen, Mackinnon, Windsor, & Butterworth, 2008). The findings for gender differences in the ASD population are mixed. Several studies have found no gender difference for either anxiety or depression in individuals with ASD (De-la-Iglesia & Olivar, 2015; Lai et al., 2011). In contrast, Lever and Geurts (2016) found that female gender was a significant predictor of any mood disorder, but not of any anxiety disorder. Further studies have found that females diagnosed with ASD are at increased risk of developing anxiety or depression (e.g., Solomon, Miller, Taylor, Hinshaw, & Carter, 2012). Gotham, Brunwasser, and Lord, (2015) identified a different developmental trajectory for both anxiety and depression in the ASD population between genders. In late school age, males with ASD were found to have higher levels of anxiety than females, but females showed a greater increase in symptoms through adolescence, and by the age of 21, there was no significant gender difference. The developmental pathway of depression similarly showed that females with ASD followed the TD pattern with increasing depressive symptoms over time, while males with ASD tended to have elevated levels of depressive symptoms during school age that remained stable through young adulthood, leading to no significant gender difference at the age of 21.

Existing research has been important in informing the psychiatric profile of adults diagnosed with ASD to identify those individuals most at risk of poor mental health. Jones, Goddard, Hill, Henry, and Crane, (2014) highlighted that adults who seek a diagnosis of autism in adulthood typically experience social interaction difficulties and report elevated symptoms of anxious and depressed affect. In this context, the authors noted that diagnostic referral pathways become confused and in some cases adults are misdiagnosed with mental health issues and not autism, delaying appropriate support (Jones et al., 2014; see also Punshon, Skirrow, & Murphy, 2009).

Given the inconsistencies in the experiences of individuals referred for diagnoses in adulthood, and a lack of consistency between adult diagnostic pathways and processes, the current study aimed to replicate and extend current findings to explore patterns of self-reported anxiety and depression symptoms in individuals who were referred for a diagnosis of ASD in adulthood, and where the diagnosis was confirmed or not confirmed¹. The primary aim was to contribute to a growing evidence base to explore symptom

¹ Two recent explorations of this population of adults who were referred for a diagnosis of ASD in adulthood both reported the difference in autism severity between groups whose diagnosis was confirmed or not confirmed, as measured by the Autism Spectrum Quotient (Baron-Cohen et al., 2001; see Happé et al., 2016; Russ, Kovshoff, Brown, Abbott & Hadwin, 2018). In addition, Happé et al., noted the presence of psychiatric comorbidity in this population of referred adults (including anxiety and depression). Russ et al., found that empathising skills were important in understanding group differences in social-processing.

associations with age, gender and ASD severity. We hypothesized that the reporting of anxiety and depression symptoms would be elevated in adults diagnosed with ASD, compared with prevalence reported in the general population. While associations between age, gender symptoms are mixed in existing research, we anticipated that symptoms of anxiety and depression would be positively correlated with autism severity, elevated in females and would decrease across adulthood. The data also allowed a unique opportunity to consider anxiety and depression symptoms in a group of adults who were referred to a diagnostic clinic and whose diagnosis of ASD was not confirmed. This comparison is important for understanding whether there are distinctive comorbid psychiatric conditions in individuals diagnosed with ASD in adulthood compared with adults who do not meet diagnostic criteria, but who may be experiencing challenges later in life.

2. Method

2.1. Participants

The participants were part of a group of 205 adults who were referred by their general practitioner (GP) to the Autism Diagnostic and Research Centre (ADRC) in Southampton between 2011 and 2015 for a diagnosis of ASD. The ADRC is a not-for-profit charity providing an ASD diagnostic service for a wide area in the south of England, including the Isle of Wight, Wiltshire and Oxfordshire. Of the 205 adults who visited the ADRC, 151 gave permission for their data to be used for research. Of this number, 118 received a diagnosis of ASD and for 28 adults a diagnosis was not confirmed. The remaining five adults were referred for additional services ($N = 1$), did not complete the relevant assessments ($N = 3$) or were younger than 18 years ($N = 1$). Questionnaire self-report data were available from $N = 88$ adults who received a diagnosis of ASD (mean age = 32.45 $SD = 13.06$, range = 18 to 74 years, 64 males) and for $N = 28$ adults who did not receive a diagnosis of ASD (mean age = 36.38², $SD = 13.61$, range = 17–66, 24 males). There was no age difference between groups (Welch's $F < 2$ and $p > .1$, see Table 1).

2.2. Diagnostic procedure

Referrals for a diagnosis of ASD were sent to the ADRC from an individual's general practitioner (GP). One the referral letter is received at the ADRC the person was contacted and asked to provide written consent and permission to ask the GP for relevant medical history. In order to obtain further information adults were also asked to complete questionnaires related to e.g., autism severity. The person was then invited to attend a full day appointment accompanied by someone who has known them since early childhood and who is able to provide details about their developmental history. Adult diagnostic procedures at the ADRC follow the National Institute of Clinical Excellence guidelines (National Institute for Health & Clinical Excellence, 2012), and incorporate DSM (American Psychiatric Association, 2000; 2013) and ICD-10 diagnostic criteria (World Health Organization, 1992). The diagnostic process includes the Adult Asperger Assessment (Baron-Cohen, Wheelright, Skinner, Martin, & Clubley, 2001), the Autism Diagnostic Interview-Revised (Lord, Rutter, & Le Couteur, 1994) and the Autism Diagnostic Observation Schedule (Lord et al., 1989; see Russ, Kovshoff, & Brown, 2018). As part of the diagnostic process individuals were asked to complete measures related to developmental history, a history of the onset and recognition of difficulties, as well as any other relevant medical and family history and areas of specialist interest. After an informal lunch (which formed part of the assessment process), a neuropsychological assessment was conducted, followed by the completion of the anxiety and depression questionnaires.

The clinicians scored the assessments, discussed findings and wrote up their report, which included a diagnostic decision, summary of the assessment, recommendations, and resources for further information. A second meeting was arranged to present the findings and to hand over the report to the individual.

2.3. Anxiety and depression symptoms

We used the Beck Anxiety Inventory (BAI) and the Beck Depression Inventory (BDI; Beck & Steer, 1993; Beck, Steer, & Brown, 1996) to measure self-reported symptoms of anxiety and depression. Each questionnaire includes 21 items and respondents indicate how much they have been experienced each symptom over the previous month on a four-point Likert scale from 0 to 3 to generate a possible score from 0 - 63. BAI scores from 0 to 9 indicate minimal, 10–18 mild, 19–29 moderate, and 30–63 severe anxiety. The respective BDI score ranges are 0–13 (minimal), 14–19 (mild), 20–28 (moderate) and 29–63 (severe). The internal consistency for both questionnaires was $> .90$ in the current study.

2.4. Autism severity

We used the Autism Spectrum Quotient (AQ) (Baron-Cohen et al., 2001) to measure autism severity. The AQ is a 50-item self-report questionnaire that measures autism traits. It includes items linked to social skill, attention switching, attention to detail,

²Note that the date of completing measures was not available for the group of adults who did not receive a diagnosis. In order to provide some guidelines for age in this group, we calculated an age estimate from their date of birth and the mid-point of data collection point in the time period (December 31, 2012) meaning that the relative age between participants was maintained, but where age could be marginally under or over-estimated.

Table 1

Mean, standard deviation and range (in parentheses) for age and for each questionnaire for all adults who were and were not diagnosed with ASD. Inter-correlations between variables relate only to data from adults diagnosed with ASD.

| Variable | ASD diagnosis disconfirmed | | | | | | ASD diagnosed confirmed | | | | | | 1 | 2 | 3 | 4 |
|---------------------------|----------------------------|----------------|-------------------|----------------|-------------------|-----------------|-------------------------|----------------|--------------------|----------------|-------------------|----------------|-------------------|-------------------|------------------|---|
| | Male (N = 24) | | Female (N = 4) | | Total (N = 28) | | Male (N = 64) | | Female (N = 24) | | Total (N = 88) | | | | | |
| | Mean | SD Range | Mean | SD Range | Mean | SD Range | Mean | SD Range | Mean | SD Range | Mean | SD Range | | | | |
| 1.Age (years) | 36.38 | 12.99 17-63 | 39.25 | 18.15 29-66 | 36.38 | 13.42 17-66 | 32.53 | 13.57 18-74 | 32.25 | 11.87 18-57 | 32.45 | 13.06 18-74 | - | | | |
| 2.Anxiety ¹ | N/A | N/A | N/A | N/A | 15.17 | 8.26 (0-29) | 15.06 | 12.39 0-52 | 22.38 | 16.11 0-60 | 17.06 | 13.81 | -.18 [#] | - | | |
| 3.Depression ² | N/A | N/A | N/A | N/A | 15.61 | 10.57 (1-36) | 18.22 | 12.37 0-51 | 20.50 | 16.85 0-60 | 18.84 | 13.67 | -.12 | .69 ^{**} | - | |
| 4.AQ ³ | 26.65 | 10.50 4-46 | 33.00 | 9.06 26-45 | 27.59 | 10.40 (4-46) | 34.74 | 7.14 12-47 | 37.17 | 6.77 19-47 | 35.40 | 7.09 12-47 | .21 [#] | .26 [*] | .20 [#] | - |

¹ Beck Anxiety Inventory and ²Beck depression Inventory, ³Autism Quotient. For the diagnosis disconfirmed group only N = 19 male participants completed the anxiety and depression questionnaires, represented in the total column. N = 24 males and N = 4 females completed the AQ questionnaire. For the diagnosis confirmed group N = 62 males and N = 23 females completed the AQ questionnaire. * $p < 0.05$, ** $p < .01$, # $p < .1$.

communication, and imagination. Individuals are asked to indicate on a four point Likert scale the extent to which they agree or disagree with each item. Scores can range from 0 to 50 and previous research has found that 80% of individuals diagnosed with Asperger’s Syndrome scored 32 or higher, though a cut-off score of 26 is suggested when screening adults in a clinical setting. The AQ has demonstrated good diagnostic validity and reliability (e.g., Woodbury-Smith et al., 2005).

2.5. Data analysis

All questionnaires (the AQ, BAI and BDI-II) were normally distributed within the ASD and the non-ASD groups. We conducted Pearson’s product-moment correlation coefficients and regression analyses to assess the relationship between age, gender, AQ, and total anxiety and depression symptoms for those adults diagnosed with ASD. In addition, to understand associations with age more clearly, we presented mean anxiety and depression symptoms between gender and across three age categories reflecting young adulthood (18–25), adulthood (26–29), middle/ later adulthood (40+). Considering diagnostic groups, we explored mean differences for autism severity, anxiety and depression symptoms between the diagnosis confirmed and not confirmed groups with one-way ANOVAs. In the context of group analyses with unequal sample sizes and to address the violation of the homogeneity of variance for some variables, all comparisons were made using Welch’s F. To consider categorical differences in anxiety and depression symptoms between groups and with a specific focus on the relative distribution of individuals who reported minimal versus severe symptom levels we used Barnard’s test.

3. Results

3.1. Adults diagnosed with ASD

Table 1 provides the descriptive statistics for all questionnaires. Within this sample, scores on the AQ are consistent with an autism profile. Considering published AQ cut-off scores in the diagnosis confirmed group, 91% met scores that were > 26 and 62% of scores were > 32 respectively. Table 2 summarises the clinical severity frequencies for total anxiety and depression scores from the BAI and BDI, and indicates the frequencies using the respective scale cut-offs and based on gender. It shows that for females and males respectively 58% and 30% of the population met criteria for moderate or severe anxiety. Comparative numbers for depression were 50% and 44% of females and males meeting the criteria for moderate/severe symptoms respectively.

Table 1 also displays the Pearson’s correlations between the key outcome measures. This table shows a positive correlation between total anxiety and total depression scores. In addition, anxiety symptoms were positively and significantly correlated with AQ scores and marginally significantly negatively correlated with age ($r = -.18, p = .09$), indicating that for adults diagnosed with ASD symptoms increased with autism severity and decreased with age. Depression was not significantly correlated with any other variable, though the positive correlation with the AQ questionnaire was marginally significant, ($r = .20, p = .07$). Further analysis indicated that females reported more anxiety symptoms (mean = 22.38, SD = 16.11, CI = 15.57–29.18) compared with males (mean = 15.06, SD = 12.39, CI = 14.13–19.98), and this difference was marginally significant (Welch’s $F(1, 87) = 4.05, p = .052$). Gender differences for depression were not significant (Welch’s $F < 1$). See Table 1.

Regression analyses with anxiety as an outcome variable and its correlates as predictors showed that age, gender and autism severity (AQ) independently contributed to the variation in anxiety symptoms, collectively accounting for 16% of the variance in symptoms across the sample ($F(3,84) = 5.18, p = .002, R^2 = .16$). Standardised beta coefficients are shown in Table 3, highlighting significant associations between anxiety with age and autism severity, and marginal associations with gender.

Table 2

Beck depression and anxiety inventories mean symptom count and clinical severity indices and frequencies of total anxiety and depression symptom scores across male and female participants who did and did not receive a diagnosis of ASD.

| Severity | Adults diagnosed with ASD | | | Adults ASD diagnosis disconfirmed | | | | |
|----------------------------|---------------------------|------------------|-----------------|-----------------------------------|-------------|------------|------------------------------|------------|
| | Male N = 64 | Female N = 24 | Total N = 88 | Male % | Female % | Total % | Total [*] N = 18 | Total % |
| Anxiety symptoms | | | | | | | | |
| Minimal | 27 | 7 | 34 | 42 | 29 | 39 | 5 | 28 |
| Mild | 18 | 3 | 21 | 28 | 13 | 24 | 6 | 33 |
| Moderate | 10 | 6 | 16 | 16 | 25 | 18 | 7 | 38 |
| Severe | 9 | 8 | 17 | 14 | 33 | 19 | 0 | 0 |
| Depression symptoms | | | | | | | | |
| Minimal | 27 | 11 | 38 | 42 | 46 | 43 | 9 | 50 |
| Mild | 9 | 1 | 10 | 14 | 4 | 11 | 3 | 17 |
| Moderate | 14 | 4 | 18 | 22 | 17 | 21 | 4 | 22 |
| Severe | 14 | 8 | 22 | 22 | 33 | 25 | 2 | 11 |

* Only males in the diagnosis disconfirmed group of adults completed the anxiety and depression questionnaires.

Table 3

Regression analysis with age, gender and autism symptoms (using the Autism Quotient) predicting self-reported anxiety symptoms in adults who received a diagnosis of autism in adulthood.

| Variable | B | SEB | β |
|----------|-------|------|-------|
| Age | -.26 | .11 | -.24* |
| Gender | -6.02 | 3.23 | -.19# |
| AQ | .55 | .21 | .28* |

Regression analysis used the enter method; $R^2 = .16$, $p < .01$; * $p < .05$, # $p = .066$.

Further exploration of the data considered anxiety and depression symptoms between gender and across three age categories. Numbers in each group included N = 35 (9 female) for young adulthood (18–25), N = 33 (11 female) for adulthood (26–39), and N = 20 (4 female) for middle/ later adulthood (40+). Consistent with the analysis above, Fig. 1, shows that anxiety symptoms for females (at the level of the group mean) were elevated across adulthood, and did not drop to levels equivalent to those reported by males until middle/ later adulthood (40+). While the above analysis above showed no relationship between age and gender with symptoms of depression, Fig. 1 indicates that the relative pattern between males and females is similar to the symptom profile for anxiety.

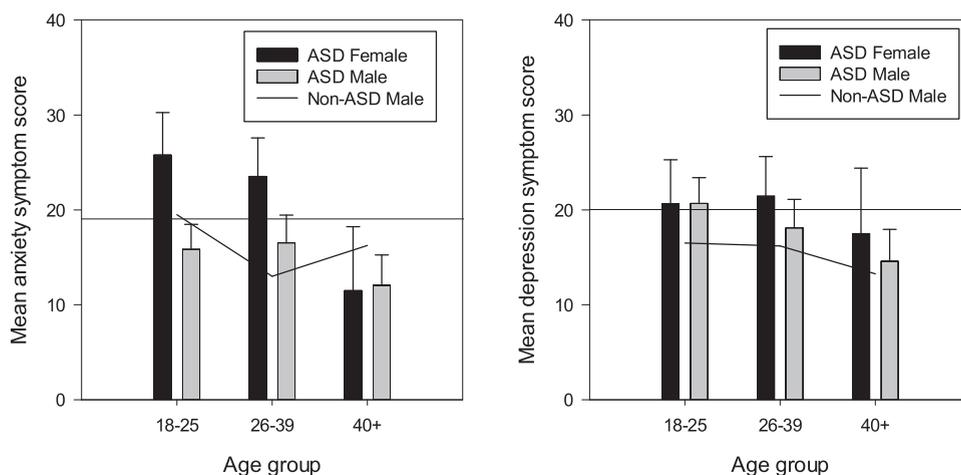


Fig. 1. Anxiety (LHS) and depression (RHS) mean symptom score (and standard error bars) across male and female adults who received a diagnosis of ASD and across three age groups. Numbers in each age group are N = 26, 22, 16, (male) and N = 9, 11, 4 (female). The scores below the reference line in each graph indicate mild/minimal symptom count and above the reference line a moderate/severe symptom count (Beck et al., 1996). The group where the diagnosis was dis-confirmed is represented as a line for each age category and is for reference only. This group includes only adult males (respective numbers across the four age categories are N = 4, 10, 4).

3.2. Adults who did and did not receive a diagnosis of ASD³

3.2.1. Autism questionnaires

N = 28 adults (26 males) were referred to the ADRC and did not go on to receive confirmation of an autism diagnosis and gave permission for access to and use of their data. Of these individuals N = 27 (25 males) completed the AQ questionnaire measures and 18 completed the anxiety and depression questionnaires (all males). AQ scores that were respectively > 26 and > 32 were reported by 52% and 29% of adults respectively. The results highlighted significant group differences for the AQ (Welch's $F(1,111) = 13.27$, $p < .01$), highlighting increased AQ scores in the diagnosis confirmed (mean = 35.40, $SD = 7.08$, $CI = 33.87$ – 39.93) versus the diagnosis disconfirmed (mean = 27.59, $SD = 10.39$, $CI = 22.48$ – 31.71) group, see [Table 1](#).

3.2.2. Anxiety and depression symptoms

We compared mean anxiety and depression differences between the groups, as well as the respective proportion of adults in each group who reported minimal symptom levels versus severe levels. The results showed no mean difference between groups with respect to self-reported anxiety or depression symptoms (in both cases Welch's $F < 1.3$; see [Table 1](#)). Considering the categorization of scores within groups as minimal versus severe highlighted a marginal group difference for anxiety (Wald statistic = 1.55, $p = .072$); 5 adults whose diagnosis was not confirmed reported symptoms consistent with minimal anxiety and no participant reported symptoms that were severe (and respective numbers in the diagnosis confirmed group were 34 and 17). Comparing minimal versus severe symptoms of severity between groups showed no difference for depression symptoms ($p = .19$). The number of adults reporting minimal and severe symptom levels for the diagnosis disconfirmed and the diagnosis confirmed groups were numbers were N = 9 and N = 2 compared with N = 38 and N = 22 (see [Table 2](#)).

4. Discussion

This study explored self-reported symptoms of anxiety and depression and their correlates (age, gender, ASD severity) in a sample of individuals referred for an ASD diagnosis in adulthood. In addition, it compared self-reported symptoms of anxiety and depression in a small group of adults who were referred for a clinical ASD assessment and where the diagnosis was not confirmed. The results highlighted elevated symptoms of anxiety and depression symptoms in the diagnosed population; 37% of the population met criteria for moderate or severe anxiety, and 46% met criteria for moderate or severe depression. They further indicated that anxiety was associated with (lower) age, increased self-reported autism symptom severity, and was marginally more elevated in females, and where this elevation was most evident in young to middle adulthood. Each of these factors was independently associated with variation in anxiety symptoms, indicating that younger females with increased autism severity may be most at-risk of developing anxious affect. Adults who received a diagnosis of ASD were also more likely to report severe (versus minimal) anxiety symptoms, compared with adults whose diagnosis was disconfirmed. The results did not find any links between depression symptoms with other factors; depression symptoms were elevated in males and females in young adulthood and decreased thereafter, with the decrease in males occurring earlier in adulthood.

The current findings support previous studies that have found elevated anxiety and depression in adults diagnosed with ASD (e.g., [Jones et al., 2014](#)). Given that adults who were diagnosed with ASD (versus those who did not receive a diagnosis) reported marginally more severe symptoms of anxiety, suggests that this group of individuals may be at increased risk for the development of psychiatric comorbidity and specifically anxious affect. The results are also consistent with studies that have found increased anxiety prevalence for females diagnosed with ASD (e.g., [Solomon et al., 2012](#)) and that have reported no gender difference for depression symptoms (e.g., [Lai et al., 2011](#)). Similar to previous studies in TD and ASD populations, gender differences were evident for anxiety, with females showing increased symptoms (review by [Werling & Geschwind, 2013](#)). The current paper extends these studies to show that across adulthood, females reported elevated anxiety symptoms in young to middle adulthood and symptoms decreased thereafter. The result fits with recent frameworks that work to understand shared and unique characteristics of males and females diagnosed with ASD ([Lai, Lombardo, Auyeung, Chakrabarti, & Baron-Cohen, 2015](#)). Lai and colleagues highlighted female characteristics that may increase risk for anxious affect, including an increased desire to engage in social interaction, combined with behaviours reflecting more inhibition or shyness.

Though there was statistically significant relationship between age and depression, elevated reports of depression symptoms in young adulthood in both males and females supports previous research ([Gotham et al., 2015](#)). It is possible that this elevation in symptoms across genders reflects the co-occurrence of seeking diagnosis, alongside difficulties in social adaptation around the time of transition from adolescence to adulthood. Elevated depression during this transition in TD populations, for example, has been found to reflect several salient challenges, including concerns about social relationships with parents and peers, worries about the future and difficulties negotiating mental health services ([Kuwabara, Van Voorhees, Gollan, & Alexander, 2007](#)). Further studies have highlighted similar social challenges in adults diagnosed with ASD that might provoke increased anxiety and depression (e.g., increased employment and fewer instances of effective relationships and marriage; see [Roy et al., 2015](#)).

Consistent with previous findings, autism severity (in this study indicated by higher AQ scores) was found to be positively linked to self-reported feelings of anxiety (and marginally to depression) symptoms ([Lever & Geurts, 2016](#); [Sukhodolsky et al., 2008](#)). Recent

³ Because the majority of adults in the diagnosis disconfirmed group were male, we re-ran all analyses with male participants only and the pattern of results between groups and for all questionnaires did not change.

research has demonstrated causal pathways from anxiety that worsen symptoms of ASD over time. Duvekot et al. (2018), for example, found that elevated anxiety symptoms in middle childhood predicted increased difficulties in social communication two years later (and not vice-versa). Further longitudinal studies would allow the development of a clearer understanding of causal links between the emergence of anxiety and depression symptoms and autism severity across development.

The NICE (2012) guidelines recognise the presence of comorbid mental health disorders in adults diagnosed with ASD and associated need for appropriate intervention. The findings in this paper indicate that it may be beneficial in clinical practice to more routinely assess risk or screen for elevated anxiety in the presence of high AQ scores and to ensure that targeted care pathways are put in place (see also Jones et al., 2014; Punshon et al., 2009). Research has shown, for example, that individuals with autism who report elevated anxiety in school show benefits of reduced symptoms following cognitive behavioural therapy (CBT; e.g., Luxford, Hadwin, & Kovshoff, 2017). Similarly, a recent meta-analysis investigating the effectiveness of CBT for the reduction of anxiety (but with some studies considering depression and emotion regulation) in children, adolescents, and adults with ASD highlighted small to medium effect sizes for treatment outcomes (Weston, Hodgekins, & Langdon, 2016). The review outlined a need for more rigorous and larger scale randomised control studies to understand treatment effectiveness in individuals diagnosed with ASD. Future intervention studies for the treatment of anxiety and depression should aim to measure not only the impact of symptoms on mental health, but also some consideration of whether CBT can positively influence broader daily challenges associated with the severity of reported autism symptoms.

The current study has highlighted several risk factors that independently contributed to variation in anxiety symptoms in adults who were given a diagnosis of ASD in adulthood. There are several limitations to this study. The study was not longitudinal and therefore unable to determine the direction of effects found. In addition, it only considered current self-reported trait symptoms of anxiety and depression (versus a comprehensive clinical diagnosis or a pattern of lifetime experiences). It therefore represents a snapshot of difficulties experienced at a time when individuals were about to undertake a potentially life changing diagnosis. In addition, only trait measures of anxiety and depression were explored and further research should aim to replicate previous work to understand whether adults diagnosed with ASD are at more or less risk of experiencing specific anxiety disorders (see Maddox & White, 2015). A greater understanding of the emergence and symptom profile of psychiatric disorders in individuals diagnosed with ASD is important for the prevention and treatment of adults with ASD with comorbid anxiety and depression to ensure good mental health and quality of life.

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