Loneliness and social anxiety mediate the relationship between autism quotient and quality of life in university students

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Abstract

Traits associated with autism, along with depression, anxiety, loneliness, quality of life, and social anxiety were investigated by self-report questionnaires in a university student population (N=413). In the sample, which was recruited online, 8% had scores above cut-off on the Autism Spectrum Quotient (AQ) self-report questionnaire. There were significant differences in AQ between students studying physical sciences and both social sciences and arts/humanities. Higher AQ scores were associated with higher scores of loneliness, social anxiety, depression, and anxiety, as well as with lower scores of quality of life (QoL). QoL was best predicted for by scores of depression, loneliness, and social anxiety; the latter two variables mediated the relationship between autism traits and QoL. The identification and support of such students who may be vulnerable is of utmost importance.

Key words: autism traits, quality of life, broader autism phenotype, student

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) emphasises both deficits in social communication and social interaction across multiple contexts, and restricted, repetitive patterns of behaviour, interests, or activities, being present from early in development, in its criteria for autism spectrum disorder (ASD). Such characteristics can be conceptualised as being distributed along a spectrum of impairment ranging from the mild to very severe levels with those with an ASD diagnosis (e.g., Volkmar, Lord, Bailey, Schultz, and Klin, 2004). However, these characteristics are also found within the general population who do not hold an ASD diagnosis (e.g., Baron-Cohen, Wheelwright, Skinner, Martin, and Clubley, 2001; Jobe and White, 2007; Piven and Palmer, 1999; Sasson, Nowlin, and Pinkham, 2012). Such traits can be measured using the autism quotient (AQ) scale (Baron-Cohen et al., 2001). Of some potential importance is the finding that individuals with high levels of autism traits display increased prevalence of psychiatric issues, such as depression and anxiety (Kunihira, Senju, Dairoku, Wakabayashi, and Hasegawa, 2006; White, Ollendick and Bray, 2011), as well as increased loneliness and social anxiety (Freeth, Bullock and Milne, 2013; White et al., 2011).

The associated psychological and social problems for those with a high AQ may have some practical and clinical importance, especially if these traits and relationships are not fully recognised or understood in particular contexts, such as the workplace or college. In this respect, it should be noted that having a high AQ score does not necessarily mean having an ASD. However, the percentage of students at university with clinically-relevant levels of autism traits has been estimated at 2% (White et al., 2011), 3.5% (Freeth et al., 2013), and 6% (Baron-Cohen et al., 2001), depending on the institution and degree course undertaken. Many of these individuals may not have an ASD diagnosis that enables them to access support services (Freeth et al., 2013), and this group with high levels of autism-like traits, or

even undiagnosed ASD, may require extra support to overcome potential problems introduced by these autism-related traits (VanBergeijk, Klin & Volkmar, 2008).

In this context, Freeth et al. (2013) noted that students who exhibited greater levels of autism traits reported more loneliness and also exhibited high levels of social anxiety than students lacking high levels of these traits (see also Berman and Sperling, 1991; Sandstrom and Zakriski, 2004; for reports of loneliness in student populations). Similarly, White et al. (2011) noted that high autism traits were associated with social isolation in university students – and it should be noted that aloneness is not necessarily a preferred state in these individuals (Freeth et al., 2013). University students who report high levels of loneliness often show a deficiency in the social skills necessary to develop interpersonal relationships and alleviate the situation (Jones, Hobbs, and Hockenbury, 1982), which may be an issue for those with high AQ scores (Freeth et al., 2013; Sasson et al., 2012).

These considerations imply that some aspects of university life might be particularly problematic for students with high AQ scores, as university life is typically very social – with lectures, group presentations, and living arrangements, often involving a great deal of interaction with other students and staff. In addition to the potential detrimental impact on university success, it has also been found that loneliness in university students is significantly associated with depression (Russell, Peplau, and Cutrona, 1980). Whitehouse, Durkin, Jaquet, and Ziatas (2009) demonstrated that individuals with Asperger syndrome reported stronger feelings of loneliness and depression, as well as poorer quality of friendships, and a lessened motivation to develop friendships. This supported previous findings that showed individuals with Asperger syndrome to exhibit far greater levels of depressive symptoms when compared to the general population (Ghaziuddin, Weidmer-Mikhail, and Ghaziuddin, 1998). This finding has also been noted for individuals with higher AQ scores (Kunihira et al., 2006). Thus, this particular cluster of issues may be problematic for those university

students with higher AQ scores, as such a combination has been found to be significantly associated with an increased risk of prematurely leaving education (Glennon, 2001; Van Ameringen, Mancini, and Farvolden, 2003; VanBergeijk et al., 2008).

This educational attrition may well be due to highly negative impacts on quality of life, rather than with any academic problems. Quality of life (QoL) has been found to correlate with levels of depression and loneliness in the general population (Aigner, Förster-Streffleur, Prause, Freidl, Weiss, and Bach, 2006), but there is minimal research examining QoL in individuals with ASD, let alone QoL for university students as a function of their level of autism traits. White et al. (2011) found that students who displayed higher autism traits reported less satisfaction in college and life overall. These same students tended to have stronger academic performances overall, so it could be concluded that academic performance contributes only in small part to a student's general satisfaction in university life and experience, and that other aspects, such as relationships and social life, could be significantly more important to their wellbeing (White et al., 2011).

Given the above considerations, the present study had a number of aims: 1) to assess the degree to which autism traits were present in a university sample; 2) to establish whether a relationship exists between the subjects participants read at university and autism traits; 3) to examine whether there was a relationship between autism traits and quality of life, and also with other psychological factors such as depression, anxiety, loneliness, and social anxiety; and 4) to determine whether any relationship between autism traits and the quality of life was mediated by any of these other factors that are known to be associated with high levels of autism traits.

Method

Participants

The sample included 413 university students aged between 18 and 41 (Mean: 21.40 ± 3.35) years. There were 168 males (age 21.86 ± 3.66; range = 18 – 41 years) and 245 females (age 21.09 ± 3.08; range = 18 – 38 years). Of the participants: 26.6% (80 male, 30 females; mean age = 21.95 ± 3.42 years) reported that they were enrolled on a physical science degree program; 52.3% (54 males; 162 females; mean age = 21.14 ± 3.64 years) were enrolled on a social science degree; and 21.1% (34 male; 53 female; mean age = 21.36 ± 2.29 years) were on an arts or humanities degree.

The participants volunteered in response to adverts on social media, websites, and emails distributed within six university departments across the UK. The adverts for the study contained a URL link, which led participants to a webpage containing information about the study. To proceed to the study, participants clicked a 'Next' button, giving their consent to take part in the study.

Measures

Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001) is a self-report questionnaire consisting of 50 statements that measure traits associated with ASD. Participants respond on a 4-point scale, using the responses "definitely disagree," "slightly disagree," "slightly agree," and "definitely agree", to each item. Scores can range from 0 to 50, with higher scores indicating more autism traits. A clinically-significant cut-off point is taken to be 32. The scale has an internal consistency (Cronback α) of .80 (Baron-Cohen et al., 2001).

Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983) is self-report questionnaire consisting of 14 statements, with 7 items assessing anxiety and 7 items assessing depression. Participants respond using a 4-point scale to each item using the responses: "yes definitely", "yes sometimes", "no, not much", and "no, not at all". The score

son each scale range from 0 to 21, and the cut-off points for both scales are 8. The HADS has an internal consistency of .87 for general population (Bjelland, Dahl, Haug, and Neckelmann, 2002).

UCLA Loneliness Scale (Russell, 1996) is a self-report scale designed to assess loneliness, and consisting of 20 statements. Participants respond on a 4-point scale, using the answers: "I often feel this way", "I sometimes feel this way", "I rarely feel this way", and "I never feel this way". The total score ranges from 0 to 60, with a higher score indicating more loneliness. The scale has an internal consistency of .92 (Jobe and White, 2007).

Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) is a 24-item questionnaire which can be completed as a self-report scale (Rytwinski et al., 2009). Participants rate their fear of each situation on a four-point scale: "none", "mild", "moderate" and "severe"; and rate their level of avoidance in each situation on a four point scale: "never", "occasionally", "often", and "usually". Each item is scored from 0-3, with higher scores indicating higher levels of fear/avoidance (total scores range from zero to 72 on each subscale; thus, 144 overall). The self-report version has an internal consistency of between .91 and .92, and has convergent and discriminant validity and test-retest reliability (Bishop, Maybery, Maley, Wong, Hill, and Hallmayer, 2004).

World Health Organisation Quality of Life (WHOQoL-BREF; WHOQOL Group, 1994, 1998*)* is a self-report questionnaire consisting of 26 items assessing quality of life in four domains: physical health, psychological health, social relationships and environment, which sum to give a total quality of life index. The items are scored using a 5-point scale, Previous testing has shown the scale to have an internal consistency of .89 (Krägeloh, Henning, Hawken, Zhao, Shepherd, and Billington, 2011).

Procedure

The five questionnaires were congregated together in one website, which also included questions to determine demographic information, such as age, gender, and university subject. The link was distributed via emails within various universities. The information presented about the study was:

"*We want to know how students find being at university, and we want your feedback! This is a simple questionnaire study aimed at finding out students' opinions on their quality of life and other aspects of wellbeing whilst living and studying. It should take no longer than 30 minutes to complete the questionnaires. If you are interested in participating in this research please click on the link below. If you would like more information, please contact the researchers.*"

Participants who wished to complete the questionnaire could then click on the link taking them to information about the study, and they could then decide whether or not to take part. If they consented, they could click "Next" to proceed to the questionnaire, which would take them around 20 minutes to complete. Once the participants completed the entire questionnaire they would be taken to a final web page explaining the intent behind the study, and what exactly it was measuring. Data was automatically recorded once participants had completed the questionnaire, and was collated in an Excel document for statistical analysis. Ethical approval for this study was obtained from the University Psychology Department Ethics Committee. As the data were collected anonymously, it was not possible to identify individuals who had high scores on any scale to offer help. However, the debrief form did give the contact details of student wellbeing services and the authors should the participants feel they were affected by the issues raised in the questionnaires. If the participants did not complete the questionnaires, this was considered as withdrawal, and their data were not considered (this happened in only 5 cases).

Results

Table 1 about here

Table 1 displays the mean AQ scores for the sample, as well as their range and the percentage of the sample exceeding the cut-off point. It also displays these data broken down by gender and subject area. These data show a higher mean AQ score for males than for females, with a greater proportion of males falling above the cut-off. A t-test conducted between the genders revealed a significantly higher score in males than females, $t(411) = 3.70$, $p < .001$, $d = .368$. These data also show a higher mean AQ score for participants studying physical sciences than the other two types of subject, $F(2,410) = 22.79$, $p < .001$, *partial eta*$^2 = .100$. Tukey's Honestly Significance Difference (HSD) tests revealed that physical sciences had a higher AQ score than either social science or arts and humanities, *p*s < .001, the latter two subjects did not differ from one another, $p > .80$.

Figure 1 about here

Figure 1 shows the quality of life scores for the subscales of the WHOQoL for the groups of participants scoring above and below the mean AQ score for the sample (i.e., for the lower group, AQ < 17; and for the higher group, AQ = 17+). This split created two groups, a lower AQ group ($n = 235$; mean = 11.04 $\pm$ 3.44, range = 3 – 16), and a high AQ group ($n = 178$; mean = 24.50 $\pm$ 6.54, range = 17 – 46). Inspection of the quality of life data from the (WHOQoL-BREF) shows that the lower AQ group had a significantly higher quality of life scores for all sub-scales, with there being a strong-sized effects for: Physical Health , $t(410) = 5.99$, $p < .001$, $d = .590$; Psychological Health, $t(410) = 8.31$, $p < .001$, $d =$

.821; Social Relationships, $t(410) = 6.31$, $p < .001$, $d = .620$; and a moderate-sized effect for Environment, $t(410) = 3.99$, $p < .001$, $d = .393$.

Table 2 about here

Table 2 displays the means for the sample in terms of the depression (HADS-D), anxiety (HSADS-A), loneliness (UCLA), social anxiety (LSAS), and quality of life (WHOQoL) scales. Significant correlations were found between all of the variables and between these variables and the AQ scores. To further explore this relationship, a series of regressions were conducted to determine whether the relationship between AQ and QoL was mediated by any of the other variables. Given that there were significant differences in the AQ scores between the genders, this factor was included as a covariate in these analyses. There was a significant relationship between AQ and QoL when the other variables were not considered ($\beta = -.737$, $t(410) = 10.04$, $p < .001$). There were also significant regressions between AQ and: depression ($\beta = .216$, $t(410) = 11.56$, $p < .001$); anxiety ($\beta = .247$, $t(410) = 10.85$, $p < .001$); loneliness ($\beta = .998$, $t(410) = 14.75$, $p < .001$); and social anxiety ($\beta = 1.422$, $t(410) = 13.27$, $p < .001$). In terms of the relationships between the potential mediators and QoL there were significant regressions between depression ($\beta = -.384$, $t(410) = 2.15$, $p < .05$); loneliness ($\beta = -.529$, $t(410) = 9.96$, $p < .001$); and social anxiety ($\beta = -.119$, $t(410) = 3.92$, $p < .001$); but not between anxiety and QoL ($\beta = -.110$, $t < 1$, $p > .40$). A mediation analysis was conducted using the bootstrap method with bias corrected confidence estimates (Mackinnon, Lockwood, and Williams, 2004; Preacher and Hayes, 2004). In the present study, the 95% confidence interval of the indirect effects was obtained with 500 bootstrap samples (Preacher and Hayes, 2004). Results of the mediation analysis confirmed the mediating role of loneliness ($\beta = -.528$; CI = -.735 to -.349), and social anxiety ($\beta = -.169$;

CI = -.317 to -.054) in predicting quality of life. However, there was no mediating role for depression (β = -.083; CI = -.200 to -.020) or anxiety (β = -.027; CI = -.126 to -.064). In addition, the results indicated that the direct effect of AQ on quality of life became nonsignificant (β = -.057, $t < 1$, $p > .50$). See Figure 2 for a summary of the results.

Figure 2 about here

Discussion

Clinically relevant levels of autistic traits, as suggested by those exceeding the AQ cut-off of 32, were present in around 8% of the present sample. This was a very similar result to the one found by Baron-Cohen et al (2001), but higher than that noted by Freeth et al. (2013). The present study also noted that AQ scores were higher for males than females, and also for students in the physical sciences (including physics, computer science, and mathematics), than for students in arts and humanities or social sciences (including medical and health sciences and psychology). These results are also broadly in line with those noted by Baron-Cohen et al. (2001; Baron-Cohen, Wheelwright, Burtenshaw, & Hobson, 2007). Although cross study comparison is made difficult as there may be differences in what motivated the students to participate in the different studies.

The range and distribution of AQ scores in this university sample supports the idea that ASD, as a spectrum disorder, has a large range of scores, which applies to the general population as well as those diagnosed with ASD (Baron-Cohen et al., 2001; Happé and Ronald, 2008). It also suggests that there may be a large and undiagnosed population of students with ASD within the higher education sector, especially in those subjects falling under the umbrella of physical sciences. The suggested levels of individuals with potentially

clinically-relevant ASD traits is much higher in this (and other university samples; Baron-Cohen et al., 2001; Freeth et al., 2013), and suggests that extra resources may be needed to identify and these individuals as they have been found to be at risk for leaving higher education early (Glennon, 2001; Van Ameringen et al., 2003; VanBergeijk et al., 2008), especially if they do not receive support due to lack of identification of the condition (VanBergeijk et al., 2008). Of course, it needs to be acknowledged that diagnosing ASD relies on more than a psychometric score (even if instruments such as the ADOS are used), and scores above cut-off do not necessity imply a diagnosis of ASD. Thus, caution is needed when estimating the numbers of students with ASD from data such as those obtained in the current stusy.

The current study also noted that those individuals scoring more highly on the AQ scale, also showed a reduced quality of life, as indexed by their responses to the WHOQoL-BREF. This finding held across all of the sub-domains of the scale, and was particularly strong for psychological health related quality of life. This finding corroborates the results of previous investigations of QoL and ASD (Lee et al., 2008). The negative relationship between autism traits and quality of life in the current sample of university students is consistent with findings suggesting less satisfaction with college experience in those with ASD (Freeth et al., 2013; White et al., 2011). In addition, associations were also noted between levels of autism traits and a range of other psychological variables, such as: depression, anxiety, loneliness, and social anxiety. All of these relationships have bene noted for those with a diagnosed ASD (see Ghaziuddin et al., 1998), and some of these associations have also been established previously for with high AQ scores (see Freeth et al., 2013; Kunihira et al., 2006; White et al., 2011). This was consistent with the suggestion that there would be strong relationships between these variables, and consistent with previous findings

that autistic traits commonly coexist with psychiatric comorbidities (Freeth et al., 2013; White et al., 2011).

However, an aim of this research was to investigate QoL as an outcome, and examine the degree to which this outcome might be predicted and mediated by the various factors. A mediational analysis suggested that while autism traits were associated with a reduced quality of life in university students; loneliness and social anxiety mediated any relationship between autism traits and quality of life. This finding suggests that, contradictory to previous research assuming that those with autism have a diminished QoL because of the autism traits (Lee et al., 2008), it is the comorbidities commonly associated with those traits, such as loneliness, that predict quality of life in university students. From this analysis it could be speculated, for example, that it is not autism, or autistic traits, which produce vulnerability or a diminished wellbeing in individuals, but the psychosocial difficulties which are commonly associated with autism. It is possible that the diagnosis of an ASD may not produce any of the comorbidities often linked to the disorder, such as depression, loneliness or lower QoL, but the way the diagnosis is perceived, managed and handled throughout life may in fact produce them. This finding does not deny the fact that those with ASD may be a vulnerable population needing support, however, it sheds light on the idea that this vulnerability may not be due to their diagnosis, but due to comorbidities associated with it. It might be noted that the current work was conducted within a university population, and the degree to which this would generalise outside this population is unclear. The current sample included some older participants who were at university and it is unclear from the current data if the relationship for these students, who typically do not live in university housing, etc., would be mediated by the same social factors as the younger participants.

In order to produce strong and legitimate conclusions from this research, further work would need to be conducted in some areas of this study to validate the current findings. The

sample used within this study was collected via the distribution of recruitment emails throughout various universities, with the intention of gathering a wide range of participants. However, the students who agreed to take part may not reflect the entire student body, and replications involving different recruitment procedures would be informative. The inclusion of English-speaking participants outside of the UK, and data regarding the ethnicity of the particionats, would also help to strengthen the generalizability of these findings. Research into social cognition and the broad autism phenotype has sometimes used the Broader Autism Phenotype Questionnaire (BAPQ; Hurley, Losh, Parlier, Reznick, and Piven, 2007). Unlike the AQ (Baron-Cohen et al., 2001), the BAPQ was specifically created to catch broader autism phenotype traits, and psychometric analysis suggests that it may be a more effective measure than the AQ at assessing this phenotype's traits in the general population (Ingersoll, Hopwood, Wainer, Donnellan, 2011). Further replications of this study could include this measure. Finally, a limitation of the current research is its use of a cross-sectional strategy to collect data, and a longitudinal study following students across their university degree may allow information about the development of these relationships across time.

In summary, this study supports previous findings, which suggest a significant population of those in university possess subthreshold autistic traits, and that the majority who do tend to read subjects relating to physical science. Also, there were strong relationships between variables such as AQ, depression, and loneliness. The most unexpected finding was that scores on the AQ test did not directly predict quality of life. This challenges previous assumptions that individuals with autism or autistic traits consequentially have a diminished QoL, suggesting in fact that a lower QoL may be due to significant psychosocial difficulties and comorbidities commonly associated with autism, such as depression or loneliness. This is an area worth focusing on in the future for the further understanding of, and developing support for individuals with ASD traits. The ability

to identify those in the community that may not have been previously diagnosed or considered as needing support, and to understand their needs, should be of paramount importance in the field of autism.

Compliance with Ethical Standards

There were no potential conflicts of interest for any author. The research was given ethical review and approval by the Ethics Committee of the Psychology Department of the University, All participants were given information about the study prior to commencing, informed of the right to withdraw at any time, and indicated consent by clicking a consent button on the survey.

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Figure Captions

Figure 1. Mean scores from the subscales of the WHOQoL-BREF for participants scoring below (lower AQ) and above (higher AQ) the mean on the AQ scale. Error bars are standard deviations.

Figure 2. Results of a mediational analysis between the variables and quality of life (solid lines are significant relationships, dotted lines represent nonsignificant relationships).

Figure 1

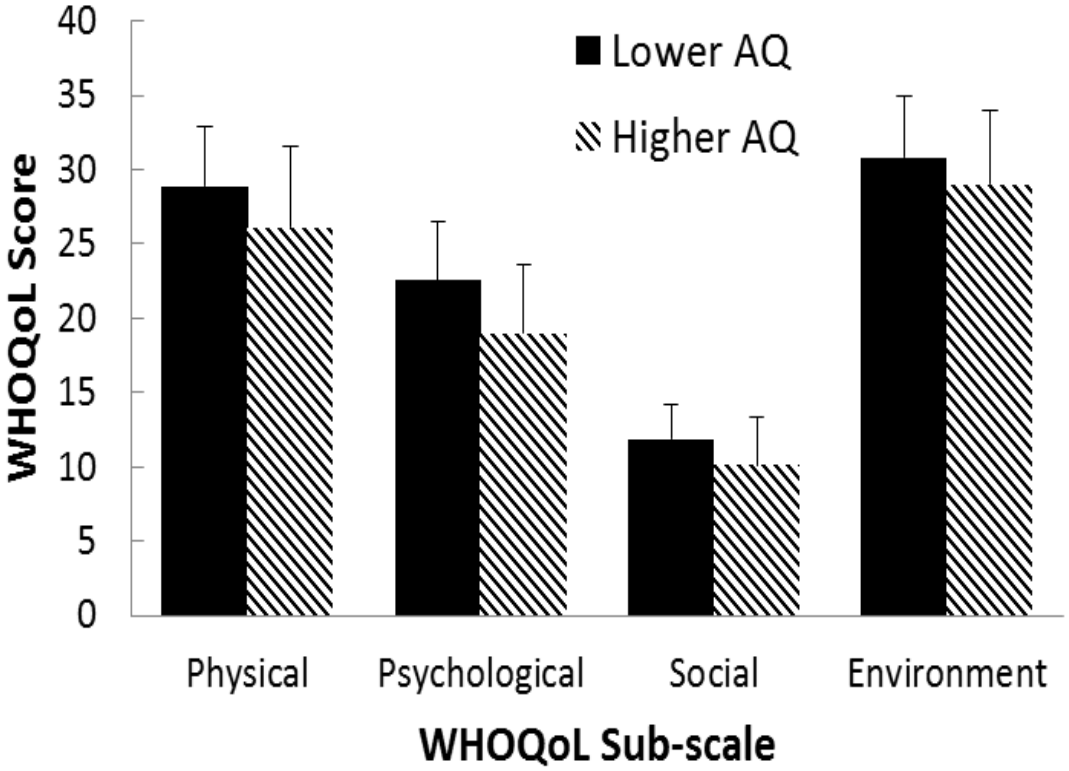
40
35
30
25
20
15
10
5
0
WHOQoL Score
Lower AQ
Higher AQ
Physical
Psychological
Social
Environment
WHOQoL Sub-scale

Figure 2

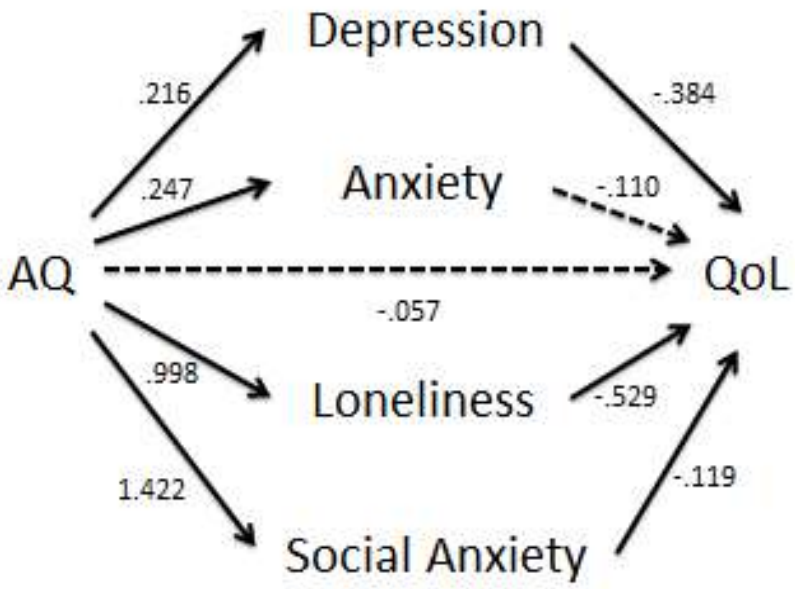
Depression
.216
-.384
Anxiety
.247
-.110
AQ
QoL
-.057
.998
Loneliness
-.529
1.422
-.119
Social Anxiety

Table 1: Mean AQ scores, with standard deviations and ranges, as well as percentage exceeding the cut-off point.

	Mean (SD)	Range	Exceeded cut off
Sample	16.84 (8.35)	3 – 46	8.5% (35/413)
Male	18.65 (8.77)	4 – 46	13.1% (22/168)
Female	15.60 (7.82)	3 – 39	5.3% (13/245)
Physical science	21.20 (8.89)	6 – 46	20.0% (22/110)
Social science	15.09 (7.78)	3 – 46	4.6% (10/216)
Arts/Humanities	15.65 (6.97)	5 – 38	3.4% (3/87)

Table 2: Pearson correlations among autism traits (AQ), depression (HADSD), anxiety (HADSA), loneliness (UCLA), social anxiety (LSAS), and quality of life (WHOQoL) (EI)

	Mean (SD)	HADS-D	HADS-A	UCLA	LSAS	AQ
QoL (WHOQoL)	89.89 (13.78)	-.451***	-.495***	-.706***	-.532***	-.444***
Depression (HADS-D)	7.95 (3.55)		.559***	.553***	.273***	.491***
Anxiety (HADS-A)	8.36 (4.28)			.620***	.462***	.450***
Loneliness (UCLA)	19.37 (13.88)				.597***	.564***
Social Anxiety (LSAS)	54.59 (21.21)					.551***

*p < .05 level; ***p* < .01; ****p* < .001.