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Examining the Use of Common Self-Report Measures for Depression and Anxiety in Adults with Autism Spectrum Disorder

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Abstract

This study investigated whether self-report measures for depression and anxiety are appropriate for use among persons with Autism Spectrum Disorder (ASD). Thirty-four adults with ASD (18-64 years) and 21 neurotypical controls (18-62 years) completed the Beck Depression Inventory II (BDI), Depression Anxiety and Stress Scale-21 (DASS), Minnesota Interpersonal Neuropsychiatric Inventory (MINI), Wechsler Abbreviated Scale of Intelligence II (WASI-II), Adult-Theory of Mind(A-ToM) and the Ritvo Autism Asperger Diagnostic Scale-Revised (RAADS-R). Reliability, sensitivity and specificity were calculated for the DASS depression and anxiety scales and the BDI. Additionally, the relationship between A-ToM, RAADS-R and verbal IQ and self-reporting accuracy was investigated. Individuals with ASD reported higher levels of depression and anxiety than controls. While test-retest reliability was acceptable for the BDI and DASS, there was more variability among the ASD group. The DASS depression scale was the more sensitive of the self-report measures among the ASD sample. Lower rates of specificity were found among individuals with ASD, suggesting over-reporting of symptomatology when using self-report instruments as compared to the MINI. No variables measured were associated with poorer accuracy in self-reporting among the ASD sample. Self-report instruments may provide useful information about depression and anxiety in the ASD population, yet caution should be used when interpreting these data due to the possibility of over-reporting symptomatology.

Keywords: Adult; Autism Spectrum Disorder; Self-Report

Overview

In order to receive a diagnosis of Autism Spectrum Disorder (ASD) an individual must present with two core deficits; difficulties with communication and social interaction, and engagement in restricted, repetitive behaviours, interests or activities [1]. While it is commonly acknowledged that comorbid disorders are widespread among individuals diagnosed with ASD [2], research regarding the nature and the prevalence of psychiatric comorbidity in adults with ASD is inconsistent [3]. Although depression and anxiety are reported, with some regularity, as the most common comorbid conditions, prevalence rates for these disorders vary [4,5]. The detection and reporting of comorbid conditions such as depression and anxiety in adults with ASD are often achieved through the use of self-report measures [2,4]. Yet the effective use of self-report measures assumes certain skills of the individual, such as a requisite level of intelligence to correctly interpret items and a degree of insight to self-reflect and respond accurately.

There have been suggestions that the core features of ASD may impact on one's ability to accurately self-report, especially when requiring one to reflect upon internal emotional states [3,6]. One of the core deficits thought to be present among individuals with ASD is the ability to predict and assume another's mental state, referred to as Theory of Mind [7]. It has been argued that this deficit extends to difficulties with emotional introspection, interpreting one's own emotional cues and communicating them appropriately; skills which are considered essential for self-reporting [2,8].

A further potential complication to the use of self-report measures among individuals with ASD is that symptoms of ASD are similar to those reported in depressed and anxious individuals[3,9,10]. Due to this overlap in symptomatology there may be a greater likelihood that individuals with ASD endorse depressive or anxious items on a self-report measure which actually

reflect ASD symptoms. Further, psychiatric self-report measures may include items that require the individual to reflect on their social responses [11]. However, individuals with ASD maybe unaware of their dysregulated behavior, or endorsing ASD symptoms such as a repetitive motor mannerism (e.g., a restless leg), may then be endorsed as an anxious behavior on these measures. While the use of such self-report measures for individuals with ASD has not been well established in the empirical literature, these tools are commonly used among the ASD population. The knowledge of whether these self-report measures are reliable and valid in the ASD population will aid in determining their usefulness in research and clinical settings.

The Use of Self-Report Measures in ASD

Self-report tools are a common and efficient method for evaluating psychological distress as it is thought individuals are best placed to comment on their own thoughts and feelings. Self-reports are inexpensive, time-efficient, easy to administer and are not influenced by interviewer bias. Asking individuals to provide insight on their current situation may provide a quick yet accurate snapshot for the clinician to use as a starting point for therapy.

However, the use of self-report tools among the ASD population has drawn concern from various researchers [3,12] astheir use within the ASD population has not been extensively explored [13,14] and may not be appropriate for the ASD population [3]. Yet despite concerns researchers frequently use and report findings from psychiatric self-report measures among this population. For example, recent studies have found that individuals with ASD have reported higher levels of depression using the Beck Depression Inventory (BDI) than matched controls [2]. Such results have been reported in the research literature as evidence of increased prevalence of depression in individuals with ASD without questioning the appropriateness self-report measures in the ASD population.

Variables That May Impact Self-Report in ASD

While self-report measures have been commonly used to assess psychiatric conditions in ASD adults, there are a growing number of researchers questioning the validity of their use in the ASD population. Researchers have proposed that certain characteristics inherent to ASD may disadvantage individuals accurately describing their emotional state in measures designed for a typical population [3,15]. Given the heterogeneity of the disorder, it is reasonable to suspect that the ability to self-report may vary between individuals and while some individuals have the requisite skills, some may not.In addition to the potential for overlapping symptomatology between ASD and psychiatric disorders, it is proposed that characteristics associated with ASD such as (i) emotional insight, (ii) ASD severity and (iii) intelligence may impair one's ability to accurately use self-report measures. Emotional insight: One characteristic associated with ASD that may impairthe ability to self-report includes difficulty with emotional insight. Persons with ASD are thought to lack appreciation of the cognitive and emotional underpinnings used to understand behaviour [16] which is often referred to as Theory of Mind (ToM).Studies have shown that individuals with ASD are able to make physical and concrete references to themselves but may have difficulty identifying and relating to themselves in the context of others thoughts and actions [17]. Due to difficulties in being able to hold complex views of self, persons with ASD also have difficulties using their concepts of self in a social context [17,18]. These difficulties may impact their ability to report these social and emotional experiences via self-report methods.

ASD severity:A further variable that may impact effective self-reporting may be the severity of ASD symptoms. The authors of the DSM-5 acknowledge that severity of ASD contributes to different lifetime outcomes and to the amount of support needed for the individual with ASD [1]. It is reasonable to propose that increased ASD symptomatology may impact on the effective use of psychological self-report measures. For instance, increased ASD symptomatology suggests individuals are increasingly limited in areas of communication, social skills and flexible thinking, all of which may be necessary for emotional self-reflection [19]. Therefore, an increased severity of ASD symptoms may impact on an individual's ability to reliably report their internal state [19].

Intelligence:The appropriate use of self-report measures in any individual depends upon their ability to read, comprehend, interpret and respond to test items [20]. Although self-report measures for depression are considered appropriate for persons with mild to moderate intellectual disability [21] no studies have explored the use of self-report in persons with an intellectual disability and ASD. Therefore, only persons with ASD without a comorbid intellectual disability will participate in this study. The relationship between intelligence and the accuracy of self-report in an ASD population without intellectual disability will be explored.

Common Self-Report Measures That May be Impacted by ASD

A frequently applied psychiatric self-report measure in research and clinical settings is the Beck Depression Inventory-II (BDI-II; [22]). The BDI-II (from here forth referred to as BDI) is a commonly used self-report measure to assess depression in the ASD literature. Despite this, it has not been comprehensively evaluated for use in adults with ASD [2,23]. Another regularly employed measure in research and clinical settings to assess depression, anxiety, stress and therapeutic progress is the Depression Anxiety and Stress Scale (DASS; [11]). Of interest in the present study is how variables relating to ASD such as ToM, intelligence and ASD severity impact on the effective use of the BDI and the DASS, among persons with ASD.

Method

Participants

Participants included 34 individuals with an ASD diagnosis (17 female; 17 male) aged between 18-62 years (M = 31.7, SD = 14.0), and a group of 21 participants with no ASD diagnosis (18 female; 3 male) aged between 18-60 years (M = 29.5, SD = 11.6). Participants with an ASD diagnosis were sourced from a database of individuals who had given their consent to be contacted for research involving ASD. These participants were all registered for services with the state autism association, a prerequisite for which is a diagnosis of the disorder by two accredited professionals trained in the diagnosis of ASD. Neurotypical participants were recruited from the first year psychology student pool at the university.

Materials

Psychiatric self-report measures

Depression Anxiety and Stress Scale-21:The DASS-21[11]is 21-item tool used commonly in Australia that assesses severity of depression, anxiety and stress of individuals. The measure consists of three subscales: depression, anxiety and stress and each subscale is comprised of seven items. The DASS has been found to reliably distinguish between these three emotional states and has good internal consistency [11]. It uses statements regarding low mood, anxiety and stress and asks the individual to rate these statements on a four-point scale (0 = Never and 3 = Almost Always).

TheBeck Depression Inventory-II:The BDI-II [22]comprises of 21 items that assess an individual's propensity towards clinical depression on a four point scale, where each item addresses a particular feature of depression (e.g., 0 = I do not feel sad, 1 = I feel sad much of the time, 2 = I am sad all the time, 3 = I am so sad or unhappy I can't stand it). It has been demonstrated consistently to have good psychometric properties with a high internal consistency and can differentiate subtypes of depression and discriminate depression from anxiety [24]. Total scores were collapsed in to "Depression severity groups" based on scoring guidelines recommended by Beck et al. (1996)[22]: 0-13: minimal depression, 4-19: mild depression, 20-28: moderate depression, 29-63: severe depression. Beck et al. (1996)[22] reported the BDI-II to have a high one-week test-retest reliability (Pearson r =0.93), suggesting that it was not overly sensitive to daily variations in mood. The test also has high internal consistency (α=.91).

Structured clinical interview: The Mini Interpersonal Neuropsychological Interview (MINI) was used to assess validity of the BDI and DASS self-report measures. The MINIwas designed as brief structured interview for the major Axis I psychological disorders from the Diagnostic Statistical Manual-IV [25]. Validation and reliability studies comparing the MINI to other valid diagnostic interviews and have shown the MINI to have acceptably high validation and reliability scores, but can be administered in a much shorter period of time in around 15 minutes[26]. Inter-rater reliability is high for the MINI with kappa scores ranging from .88 to 1.0 [26]. The items involve simple questions that require a "yes" or "no" answer. For the current study only Section A: Major Depressive Episode and Section O: Generalised Anxiety Disorder was administered to determine diagnosis for a major depressive episode and generalised anxiety amongst participants.

Intellectual functioning:Each participant's IQ was assessed using the Wechsler Abbreviated Scale of Intelligence, second edition (WASI-II). This scale is comprised of four subscales: vocabulary, similarities, block design, and matrix reasoning. Together, the vocabulary and similarities subtests form the Verbal Comprehension Index (VCI), while the block design and matrix reasoning form the Perceptual Reasoning Index (PRI). Internal consistency (Cronbach's α) for each of the subtests has been found to range between .90 and .92 and test-retest reliability between .83-.94 [27]. Concurrent validity has been demonstrated, with correlations between the WASI-II and theWechsler Abbreviated Scale of Intelligence (WASI), the Wechsler Intelligence Scale for Children, fourth edition (WISC-IV), and the Wechsler Adult Intelligence Scale, fourth edition (WAIS-IV), ranging between .71 and .92 [27].

Theory of Mind (ToM):ToM was additionally assessed using the A-ToM([28]; See Appendix A). Participants were required to watch 12 videos of acted out social situations, which have been adapted from written vignettes presented in the Strange Stories Task (n = 8), or represent novel scenarios (n = 4). Of the 12 videos, six are 'social' stories, which depict different social behaviors (e.g., white lie, sarcasm) and require participants to perceive the mental state of the protagonist. The six remaining videos are 'physical' stories, which are used as control items and do not involve drawing inferences about mental states. Following each video, a question was presented on the screen enquiring about why something in the scene occurred (e.g., "Why does X say this?"). For two of the videos, participants were also first asked to answer whether something said in the video was true, and provide a yes/no response. Responses to each of the items must be provided within one minute after each scene has ended, in order to increase the likelihood of the score being reflective of ToM ability in the social environment (i.e., where there is limited time to respond). Responses were scored 0, 1, or 2, where a higher score indicated better ToM ability. A score of two was awarded if the response indicated a thorough understanding of the behavior or action in the scene. A score of one was awarded if the response was more general (i.e., was correct, but lacking explanation), and no points were awarded if the response was incorrect.

Social story	
Script	**Scoring Criteria**
Jim's dad is sittingat thekitchen table Readingthe newspaper. Jim storms in. Jim: "Dad, where arethechocolates?" Dad: "What chocolates?" Jim: "Dad,Iknowyou'vehidden them. Wherearethey?" Dad: "Well maybeIhid them becauseI didn't wantyoueatingthem all." Jim:"PleaseDad,Ijustwant one. I've looked everywhere." Dad: "Well, obviouslynot everywhere." Jim: "Okay. I'velookedeverywhere except under thebedand in thecupboard." Dad: "They'reunder the bed." Jim immediatelyignores his dad and goes straight to the cupboard. Heopens it up and finds the boxof chocolates. He takes them, glares at him dad, and then storms out. Fade to black Q: Whydoes he look in the cupboardforthe chocolates?	2 points -referenceto thedad having lied/being A liar/heknows his dad is lying/ tryingto deceive him/tryingto hidechocolates from him/ distrusts his father/fatheris tryingto deceive him/fatheris tryingto hide from him etc. 1 point-referenceto facts without explicit mention of lying(e.g., that's whereit reallyis) 0 points-referenceto general, story-nonspecific info (e.g., thingsareusuallyleft in cupboards)

Appendix A: Sample script from A-ToM social video (Brewer &Young, unpublished).

ASD severity:The Ritvo Autism AspergerDiagnostic Scale-Revised(RAADS-R: [29]) consists of 80 statements about the behavior, feelings and experiences of respondents such as "I often don't know how to act in social situations." Participants rate these statements asTrue now and when I was young, true only now, true only when I was younger than 16 and never[29].Total scores were calculated for each participant with a possible range of 0 to 240. Scores of 65 and above suggest an ASD diagnosis may be considered and indicate a greater prevalence of "Circumscribed Interests," "Social and communication difficulties" and "Sensory-Motor" behaviors[29]. Psychometric evaluations of the RAADS-R have demonstrated that this measure has fair to excellent internal consistency for both the total score ($\alpha = .92$) and subscales ($\alpha = .79$ to .92; [29]). In addition, the RAADS-R has been found to have favourableconstruct validity and diagnostic accuracy, correlating strongly with the Autism Spectrum Quotient ([20], 2001; $r = .84$, $p = .001$) with high sensitivity (91% to 97%) and specificity (91% to 100%; [29]).

Procedure

Initially participants wereadministeredthe MINI as a way of providing a clinical diagnosis of depression and anxiety levels not dependent upon self-report measures and reflecting strict diagnostic criteria for the disorders [25]. Participants were then presented with the A-ToM [28], followed by the BDI-II [22] and the DASS [11], the order of which was counter-balanced.Participants then completed the WASI-II. Lastly, the BDI-II and DASSwere administered again approximately 60 minutes after completion of first administration. Sessions lasted for approximately 2-3 hours.

Results

The current study had two research aims. First, to determine the psychometric properties of the BDI and DASS in a sample of individuals with ASD compared to a sample of neurotypical controls. Second, to determine if intellectual functioning, ToMand ASD symptom severity predict self-reporting accuracy.

Data Screening

Data were collected from 55 participants: 34 participants with a diagnosis of ASD and 21 neurotypical controls (NT). Skewness and kurtosis for each variable was within the accepted range of +/- 2.075 when analysing the groups separately and together, therefore no transformations of the data were necessary (Tabachnick & Fidell, 2013)

Descriptive Statistics

The ASD and NT samples differed significantly on the BDI, DASS depression and anxiety, and the RAADS-R, as shown in Table 1. The higher depression and anxiety scores among persons with ASD wereconsistent with previous literature [2]. As these variables all met assumptions of normality, a parametric analysis (t test) was used.

	ASD (n = 34)	NT (n = 21)	t [CI 95%]	d
DASS depression (T2) Mean (SD) Range	7.59 (5.81) 0-18	1.43 (1.83)** 0-5	-5.77 [-8.31,-4.00]	1.43
DASS anxiety (T1) Mean (SD) Range	6.50 (4.24) 0-15	1.90 (2.10)** 0-7	-5.35 [-6.32,-2.87]	1.37
DASS anxiety (T2) Mean (SD) Range	6.06 (4.46) 0-15	1.81 (1.83)** 0-5	-5.71 [-7.54,-3.61]	1.43
DASS depression (T2) Mean (SD) Range	7.59 (5.81) 0-18	1.43 (1.83)** 0-5	-5.77 [-8.31,-4.00]	1.43

DASS anxiety (T1) Mean (SD) Range	6.50 (4.24) 0-15	1.90 (2.10)** 0-7	-5.35 [-6.32,-2.87]	1.37
DASS anxiety (T2) Mean (SD) Range	6.06 (4.46) 0-15	1.67 (2.18)** 0-7	-4.90 [-6.21,-2.91]	1.25
RAADS-R Mean (SD) Range	129.18 (44.0) 42-213	39.81 (20.44)** 9-79	-10.2 [-106,-71.8]	2.6
VCI Mean (SD) Range	110.21 (14.56) 73-142	112.14 (12.71) 88-128	0.50 [-5.80, 9.67]	0.14
PRI Mean (SD) Range	107.40 (14.25) 79-136	108.29 (11.51) 87-136	0.24 [-6.52, 8.28]	0.07
A-ToM social Mean (SD) Range	9.29 (2.58) 3-12	10.60 (1.35)* 6-12	2.44 [-1.05,4.11]	0.64
A-ToM physical Mean (SD) Range	8.21 (2.91) 1-12	8.45 (2.60) 4-12	0.31 [-1.76,1.76]	0.09
*= p< .005 level ** = p< .001 level				

Table 1: Means and standard deviations for ASD and NT with effect sizes.

Reliability of self-report responses over time

Test-retest reliability of the self-report measures across Time 1 (0 minutes) and Time 2 (60 minutes) was investigated using Pearson product-moment correlation coefficient. The BDI demonstrated strong reliability between the two administrations for both the ASD group, $r(32) = .97$, $p < .01$,and control group,$r(19) = .90$ $p < .01$. Additionally the DASS depression scale demonstrated strong test-retest over Time 1 and Time 2 for the ASD group, $r(32) = .93$, $p < .01$, and the neurotypical group, $r(19) = .86$, $p < .01$ as did the DASS anxiety scale for the ASD group, $r(32) = .95$, $p < .01$, and neurotypical group, $r(19) = .95$, $p < .01$.To assess each participants' reliability in self-reporting, the difference from the participants' total scores from Time 1 (0 minutes) and Time 2 (60 minutes) was also calculated and standardised for each self-report measure: the BDI, DASS depression and DASS anxiety. The difference scores were converted to absolute scores to remove negative values and were transformed to remove positive skewness. The resulting variable for each self-report measure was termed the 'Reliability Score', where a higher reliability score (a larger difference between Time 1 and Time 2) represented less reliable reporting referred to a consistency. While a lower consistency score (a smaller difference between Time 1 and Time 2) represented more reliable self-reporting. As displayed in Table 2, results revealed significant differences between the ASD and neurotypical groups on consistency scores for the DASS depression, DASS anxiety, and for the combined consistency score of all three measures, yet no significant difference for the BDI.

	ASD (n = 34)	NT (n= 21)	d
BDI consistency Mean (SD)	0.18 (0.18)	0.11 (0.14)	0.4
DASS depression consistency Mean (SD)	0.30 (0.26)	0.14 (0.12)**	0.8
DASS anxiety consistency Mean (SD)	0.24 (0.23)	0.15 (0.08) *	0.5
Combined DASS and BDI consistency Mean (SD)	0.72 (0.53)	0.40 (0.18) **	0.8
* = p at 0.05 level ** = p at 0.01 level			

Table 2: Means, standard deviations and effect sizes of consistency scores across BDI, DASS depression and DASS anxiety.

Sensitivity and Specificity

The BDI and DASS were evaluated to assess their accuracy (validity) in identifying depression and anxiety compared to the MINI. First, cross tabulation tables were performed. Cohen's κ was used to determine whether the self-report measure (BDI, DASS depression or DASS anxiety) agreed with the diagnosis as determined by the MINI. For the ASD group, the DASS depression measure had the best overall agreement with the MINI for major depressive disorder as shown in Table 3,4,5. According to McCauley and Swisher (1984)[30], ideal levels of sensitivity and specificity should be over 80%. Each self-report measure had lower than desired specificity (true negative rate), most notable the BDI. Given the low number of NT individuals with depression and anxiety, sensitivity and specificity did not provide useful interpretations for this group.

			DASS No depression	DASS depression	Sensitivity %	Specificity %	PPV %	NPV %	κ (p)
ASD n = 34	MINI Major Depressive Episode	No major depression	16	5	92.3	76.2	70.6	94.12	.65 (<.01)
		Major depression	1	12					

NT n = 21	MINI Major Depressive Episode	No major depression	20	0	100	0	0	100	1.0 (<.01)
		Major depression	1	0					

Table 3: Cross tabulation of MINI major depression against DASS depression scale for both groups.

			DASS no anxiety	DASS anxiety	Sensitivity %	Specificity %	PPV %	NPV %	κ (p)
ASD n = 34	MINI Generalised Anxiety	No anxiety	11	5	77.8	68.8	73.7	73.3	.467 (<.01)
		Anxiety	4	14					
NT n = 21	MINI Generalised Anxiety	No anxiety	19	0	100	100	100	100	1.00 (<.01)
		Anxiety	0	2					

Table 4: Cross tabulation of MINI generalised anxiety against DASS anxiety scale for both groups.

			BDI No depression	BDI depression	Sensitivity %	Specificity %	PPV %	NPV %	κ (p)
ASD n = 34	MINI Major Depressive Episode	No major depression	12	9	100	57.1	59.0	100	.51 (<.01)
		Major depression	0	13					
NT n = 21	MINI Major Depressive Episode	No major depression	18	2	0	90	0	90	-.07 (.74)
		Major depression	1	0					

Table 5: Cross tabulation of MINI major depression against BDI scale for both groups.

Variables associated with ASD and self-report accuracy

The second aim of the study was to determine whether variables associated with ASD (intelligence, theory of mind and ASD severity) were able to predict self-report accuracy across the whole sample of participants.Self-report accuracy was measured as a dichotomous variable of participants who scored a false positive (i.e., those participants whowere classified as not being anxious or depressed via the MINI but was identified as having anxiety or depression on the self-report measure) or a false negative (i.e., those participants that were classified as being anxious or depressed via the MINI but were not identified as having anxiety or depression on the self-report measure) on the DASS depression, DASS anxiety or BDI, as determined by diagnosis on the MINI. Participants who fell in to the false positive and false negative groups were classified as 'less accurate' self-reporters, as their diagnosis as determined by the MINI did not match with their self-reported score on the DASS or BDI. Eighteen participants identified as 'Less Accurate' self-reporters; 15 from the ASD group and three were from the typical group.The remaining participants were classified as 'more accurate'.

A Pearson product-moment correlation was performed among the combined sample to assess relationships among the variables, as displayed in Table 6. Results revealed a moderate positive correlation between the RAADS-R and self-reporting accuracy.

	1.	2.	3.
Self-report accuracy			
RAADS-R	.27* (55)[a]		
A-ToM social	.00 (55)	-.13 (54)	
WASI Verbal IQ	-.04 (53)	-.04 (53)	.32* (53)
**p≤.01, *p≤.05. [a]Sample sizes (n's are included in parentheses)			

Table 6: Correlations between self-report accuracy, RAADS-R, A-ToM social, and VCI.

	1.	2.	3.
RAADS-R	-		
A-ToM social	-.22	-	
VCI	-.03	.22	-

Table 6: Correlations between RAADS-R, A-ToM social, and VCI.

Direct logistic regression was performed to assess the impact of RAADS-R, A-ToM, and VIQ on self-reporting accuracy. The full model containing all predictors was not significant, χ^2 (3, n = 54) = 6.99, p = .072, indicating that the model was not able to distinguish between accurate and less accurate self-reporters. The model as a whole explained between 12.1% (Cox and Snell R square) and 16.9% (Nagelkerke R squared) of the variance in self-reporting accuracy, and correctly classified 70.4% of cases. As

shown in Table 7, only the RAADS-R made a unique statistically significant contribution to the model. However, the odds ratio for the RAADS-R was close to 1, indicating that it did not increase the odds of identifying a less accurate self-reporter.

	B	S.E	Wald	Df	p	Odds Ratio	95% C.I for Odds Ratio	
							Lower	Upper
RAADS-R	0.01	0.00	5.69	1	.02	1.00	1.00	1.03
A-ToM	0.08	0.14	0.33	1	.57	1.08	0.83	1.42
VIQ	-0.02	0.02	0.50	1	.48	0.98	0.94	1.03
Constant	-1.10	2.76	0.16.	1	.69	0.33		

Table 7: Logistic Regression Predicting Self-Reporting Accuracy.

Discussion

The first aim of this study was to determine the psychometric properties of the BDI and DASS in a sample of individuals with ASD, compared to a neurotypical control sample. Test-retest reliability for the ASD and the NT sample were highly positively significant, yet further investigation revealed that although highly correlated, the ASD group varied on their self-report scores to a greater extent on the DASS depression scale and DASS anxiety scale over a 60-minute interval. There was no significant difference between reliability scores for the ASD and neurotypical groups for the BDI.

Sensitivity and specificity of the DASS and BDI, when compared to a structured clinical interview (MINI) revealed the DASS depression scale to have the best overall agreement of the self-report measures. According the McCauley and Swisher (1984)[30] acceptable levels of sensitivity and specificity should be over 80%. For the ASD group, the DASS depression scale met criteria for sensitivity but narrowly fell short in specificity. While results on the BDI indicate perfect sensitivity, the measure had poor specificity and tended to identify ASD individuals with depression when they had not met major depression criteria on the MINI. These data suggest that ASD individuals tended to over-report their symptoms when using the BDI. Overall, results suggest for individuals with ASD the DASS may be more appropriate as an initial screening measure and the BDI as more appropriate as a secondary measure to provide a more robust measure of depression symptomatology.

The second aim of this study was to determine if any of the variables associated with ASD were able to predict one's accuracy in self-reporting. Participants whose self-reporting was inconsistent with the MINI were regarded as 'less accurate' self-reporters. Logistic regression involving verbal intelligence, ASD symptom severity and theory of mind were unable to predict self-reporting accuracy. Given that theory of mind was only slightly poorer in the ASD group than the typical group, and intelligence was not significantly lower in the ASD sample than the neurotypical control sample (as would generally be expected according to the research literature), it is reasonable that neither variable significantly contributed to self-reporting accuracy. However, while the RAADS-R was a significant predictor, it did not increase the odds of identifying a less accurate self-reporter.

A limitation of this study was the control group did not have comparable rates of depression and anxiety; therefore, the neurotypical group was a less useful source of comparison when evaluating levels of sensitivity and specificity. Future researchers in this area may be interested in obtaining a control sample with similar self-reported rates of depression and anxiety. A further limitation of this study was the small and uneven sample sizes for each group, a larger clinical sample size would provide results with greater power. Additionally, future studies may be able to expand and use a combination of more robust structured diagnostic interview like the Structured Clinical Interview for DSM Disorders (SCID) and clinical interpretation to provide the 'gold standard' when comparing to self-report measures. Given the lengthy time taken and the training needed to administer the SCID, its use was not practical for the present study.

The use of self-report measures in the ASD population is an area that requires further attention and research to ensure appropriate use and accuracy in a population that may find it difficult to report their internal state. Given comorbid mental health issues are understood to be a significant issue for the ASD community, research seeking to understand best practice for identification and diagnosis of such conditions is vital for understanding and providing support.

References

1. American Psychological Association (2013) Diagnositc and Statistical Manual (5th Edition ed.). Arlington, VA: American Psychiatric Publishing, USA.

2. Berthoz S, Hill EL (2005) The validity of using self-reports to assess emotion regulation abilities in adults with autism spectrum disorder. European Psychiatry 20: 291-298.

3. Mazzone L, Ruta L, Reale L (2012) Psychiatric comorbidities in asperger syndrome and high functioning autism: diagnostic challenges. Annals of General Psychiatry 11: 16.

4. Gotham K, Unruh K, Lord C (2014) Depression and its measurement in verbal adolescents and adults with autism spectrum disorder. Autism 19: 491-504.

5. Joshi G, Wozniak J, Petty C, Martelon MK, Fried R, et al. (2013) Psychiatric Comorbidity and Functioning in a Clinically Referred Population of Adults with Autism Spectrum Disorders: A Comparative Study. J Autism Dev Disord 43: 1314-1325.

6. Stewart ME, Barnard L, Pearson J, Hasan R, O'Brien G (2006) Presentation of depression in autism and Asperger syndrome: A review. Autism 10: 103-116.

7. Baron-Cohen S (1995) Mindblindness: An essay on autism and theory of mind. Boston: MIT Press.

8. Berthoz S, Lalanne C, Crane L, Hill EL (2013) Investigating emotional impairments in adults with autism spectrum disorders and the broader autism phenotype. Psychiatry Res 208: 257-264.

9. Grondhuis, Sabrina N, Aman, Michael G (2012). Assessment of anxiety in children and adolescents with autism spectrum disorders. Research in Autism Spectrum Disorders6: 1345-1365.

10. Leyfer OT, Folstein SE, Bacalman S, Davis NO, Dinh E, et al. (2006) Comorbid psychiatric disorders in children with autism: interview development and rates of disorders. J Autism Dev Disord 36: 849-861.

11. Lovibond PF, Lovibond SH (1995) The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behaviour Research and Therapy 33: 335-343.

12. Matson JL, Nebel-Schwalm MS (2007) Comorbid psychopathology with autism spectrum disorder in children: An overview. Research in Developmental Disabilities 28: 341-352.

13. Ghaziuddin M, Zafar S (2008) Psychiatric comorbidity of adults with autism spectrum disorders. Clinical Neuropsychiatry 1: 9-12.

14. Kim JA, Szatmari P, Bryson SE, Streiner DL, Wilson FJ (2000) The Prevalence of Anxiety and Mood Problems among Children with Autism and Asperger Syndrome. Autism 4: 117-132.

15. Mazefsky CA, Kao J, Oswald DP (2011) Preliminary evidence suggesting caution in the use of psychiatric self-report measures with adolescents with high-functioning autism spectrum disorders. Research in Autism Spectrum Disorders 5: 164-174.

16. Frith Uta, Frith CD (2003) Development and neurophysiology of mentalizing. Philos Trans R Soc Lond B Biol Sci 358: 459-473.

17. Hobson RP, Meyer JA (2005) Foundations for self and other: a study in autism. Developmental Science 8: 481-491.

18. Lee A, HobsonRP (1998) On Developing Self-Concepts: A Controlled Study of Children and Adolescents with Autism. J Child Psychol Psychiatry 39:1131-1144.

19. Hofvander B, Delorme R, Chaste P, Nydén A, Wentz E, et al. (2009) Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. BMC Psychiatry 9: 35.

20. Baron-Cohen S, Wheelwright S, Skinner R, Martin J, Clubley E (2001) The autism-spectrum quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. Journal of Autism and Developmental Disorders 31: 5-17.

21. McBrien JA (2003) Assessment and diagnosis of depression in people with intellectual disability. Journal of Intellectual Disability Research 47: 1-13.

22. Beck A, Steer RA, Brown GK (1996) Manual for Beck Depression Inventory-II. San Antonio: Psychological Corporation.

23. Cederlund M, Hagberg B, Gillberg C (2010) Asperger syndrome in adolescent and young adult males. Interview, self - and parent assessment of social, emotional, and cognitive problems. Research in Developmental Disabilities 31: 287-298.

24. Beck A, Beck R, Steer M (1988) Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. Clinical Psychology Review 8: 77-100.

25. Sheehan DV, Lecrubier Y, Sheehan KH, Amorim P, Janavs J, et al. (1998) The Mini- International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. The Journal of Clinical Psychiatry 59: 22-23.

26. Lecrubier Y, Sheehan DV, Weiller E, Amorim P, Bonora I, et al. (1997) The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: Reliability and validity according to the CIDI. European Psychiatry 12: 224-231.

27. McCrimmon AW, Smith AD (2013) Review of the Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI-II). Journal of Psychoeducational Assessment 31: 337-341.

28. Brewer N, Young RL, & Barnett E (2016) Measuring Theory of Mind in Adults with Autism Spectrum Disorder. Manuscript submitted for publication.

29. Ritvo RA, Ritvo ER, Guthrie D, Ritvo MJ, HufnagelDH (2011) The Ritvo Autism Asperger Diagnostic Scale-Revised (RAADS-R): A scale to assist the diagnosis of autism spectrum disorder in adults: an international validation study.(ORIGINAL PAPER). Journal of Autism and Developmental Disorders 42: 1076-1089.

30. McCauley RJ, Swisher L (1984) Use and Misuse of Norm-Referenced Test in Clinical AssessmentA Hypothetical Case. Journal of Speech and Hearing Disorders 49: 338-348.