Self-focused attention and depressive symptoms in adults with autistic spectrum disorder (ASD)

Author Note

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Author contribution

AB conceived of the study, participated in its design, inputted the data, performed the statistical analysis and interpreted the findings and drafted the initial manuscript. MI participated in the design of the study, facilitated participant recruitment, contributed to the interpretation of the findings and provided critical revisions of the draft manuscript. KW acted as chief investigator, participated in the coordination and design of the study, provided technical support with the statistical analysis, contributed to the interpretation of the findings and provided critical revisions of the draft manuscript. All authors read and approved the final manuscript.

Abstract

Adults with autistic spectrum disorder (ASD) are at high risk of developing comorbid depressive symptoms and in the general population self-focused attention has been associated with depression. Here, we aimed to examine the relationships between aspects of self-focused attention and symptoms of depression in individuals with a diagnosis of ASD. 113 adults with a diagnosis of ASD completed self-report questionnaires. Results found that higher levels of brooding, and to a lesser degree, reflection predicted increased depressive symptoms. However, higher levels of private self-consciousness actually predicted *decreased* depressive symptoms. Differential relationships were observed for males and females. The current study highlights the importance of using a multidimensional approach to examining self-focused attention in ASD, and its important relationship with depression.

Individuals with ASD are at a high risk for developing mood disorders, including depression (Lugnegard, Hallerback & Gillberg, 2011) although risk factors are poorly understood (Meyer, Mundy, Van Hecke & Durocher, 2006). Higher cognitive ability, less social impairment, other psychiatric symptoms and rumination have all been associated with depression in adults with ASD (Crane, Goddard & Pring, 2011; Gotham, Bishop, Brunwasser & Lord, 2014; Sterling, Dawson, Estes & Greenson, 2008). Comorbid mental health difficulties also occur in individuals with ASD and an intellectual disability (Smith & Matson, 2010), however the present research focuses on individuals within the average intellectual range because intellectual disability may represent an additional risk factor for mood disorder (Munir, 2016).

Depression and ASD

Reported rates of depression in adults with ASD range from 31% (Cassidy et al., 2014) to 70% (Lugnegard et al., 2011), which is high relative to the rate in the general population (World Health Organisation, 2017). Furthermore, depression appears to have distinct characteristics in ASD relative to the general population. For example, it is unclear whether the higher rates of depression in females compared to males, which hold in the general population (Richards et al., 2016), are evident in ASD populations (Cassidy et al., 2014; Hofvander et al., 2009; Lugnegard et al., 2011). Affective symptoms of depression are reported less in ASD populations (although it has been suggested that this may be linked to alexithymia; Cassidy et al., 2014). Depression in individuals with ASD may also manifest as a potentiation of ASD symptoms. For example, increased restricted repetitive behaviours, including obsessionality (Ghaziuddin, Ghaziuddin & Greden, 2002; Stewart, Barnard, Pearson, Hasan & O'Brien, 2006); and increased attenuated symptoms (up to 20% of young people with ASD also have diagnosis of catatonia; Breen & Hare, 2017).

The impact of depression on individuals with ASD is notable. Increased social withdrawal, suicidality, and in some cases the development of catatonia, can result from the occurrence of depression in individuals with ASD (Breen & Hare, 2017; Cassidy et al., 2014; Ghaziuddin, et al., 2002). Furthermore unfavourable psychosocial outcomes of depression such as high unemployment, low rates of independent living and low rates of long-term relationships have been described (Hofvander et al., 2009). Individuals with ASD are a marginalised group (Davidson & Henderson, 2010), and the high rates of comorbid depression put this group at risk of becoming further marginalised by the presence of mental health difficulties (Henderson, Evans-Lacko, & Thornicroft, 2013). Thus, it is critical to understand potential risk factors for the development of depression for individuals with ASD, as a way to inform evidence based interventions.

Self-focused attention and depression

Self-focused attention – awareness of internally generated information relevant to the self (Ingram, 1990) – plays an important role in depression in the general population. Self-focused attention is thought to increase the salience of perceived negative parts of the self, and so lead to perpetuating depressive cognitions (Mor & Winquist, 2002). Most contemporary research into self-focused attention has focused specifically on rumination, which involves prolonged attention to one's mood, with increased rumination being associated with increased depressed mood (Aldoa, Nolen-Hoeksema & Scweizer, 2010; Johnson & Whisman, 2013; Olatunji, Naragon-Gainey, & Wolitzky-Taylor, 2013). This research has provided support for the Response Style theory of depression, which posits that rumination maintains and worsens mood by increasing negative thought content, interrupting problem solving and instrumental behaviour, and – as a consequence of excessive rumination with others – reduces social supports (Nolen-Hoeksema et al., 2008). Indeed, rumination

appears to increase the risk of onset of depression in adolescents (Rood, Roelofs, Bogels, Nolan-Hoeksema & Schouten, 2009), contribute to the higher rates of depression in women than men (Johnson & Whisman, 2013) and mediate the relationship between depression and a number of other cognitive vulnerability factors (Lo, Ho & Hollon, 2008; Merino, Senra & Ferreiro, 2016; Senormanci, Yilmaz, Saracli, Atasoy, Senormanci & Atik, 2014). However, more recent research suggests that this entirely negative view of the role of self-focused attention in depression may be overly simplistic (Olatunji, et al., 2013). Alongside rumination, the self-focused attention construct additionally includes private self-consciousness and public self-consciousness, which focus on different types of information relevant to the self and not exclusively mood (see table 1 for summary; Fenigstein, Scheier & Buss, 1975, p. 525). Furthermore, even rumination can be further subdivided into brooding and reflection, based on whether that attention on negative mood is passive (brooding) or active (reflection) (Treynor, Gonzalez & Nolen-Hoeksema, 2003). Meta-analytic data suggest that private and public self-consciousness differentiate in their relationship to depression (stronger relationship with private self-consciousness; Mor & Winquist, 2002). Mor and Winquist (2002) highlight some controversies and inconsistencies on the research into private self-consciousness, with some suggestion that private self-consciousness is a self-regulatory process and thus, has the potential to have a positive influence on mood. A two factor structure of the private self-consciousness subscale has been proposed consisting of self-reflection and internal state awareness (Burnkrant & Page, 1984). Self-reflection is defined as a 'tendency to focus on oneself repeatedly' and is associated with lower levels of psychological wellbeing whereas (Harrington & Loffredo, 2011, p. 40) internal state awareness, defined as a 'tendency to maintain a general awareness of one's feelings and mental process' (Harrington & Loffredo, 2011, p. 40) is associated with increased levels of wellbeing (Mor & Winquist, 2002; see Trapnell & Campbell, 1999 for an overview).

Furthermore, although both brooding and reflection appear to mediate the relationship between negative affect and depression (Iqbal & Ahmad Dar, 2015), reflection appears to be less strongly associated with concurrent depression than brooding (Treynor et al., 2003), and to predict a decrease in depressive symptoms and greater chance of recovery over time (Arditte & Joorman, 2011).

 (insert table 1)

Self-focused attention and ASD

Empirical evidence shows that at a group level, self-focused attention is on average diminished in adults with ASD (Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007; Millward, Powell, Messer & Jordan, 2000; Rogers, Kuiper & Kirker, 1977; Toichi et al., 2002). Indeed, such group level reductions in self-focused attention supports the "absent self" hypothesis of ASD (Frith, 2003; Lind, 2010). In light of the preceding discussion on the role of self-focussed attention in depression, these group level reductions in self-focussed attention are challenging to reconcile with the elevated levels of depression in the ASD population, underscoring the possibility that self-focused attention may play a distinct role in depression in ASD populations.

Depression, ASD and self-focused attention

In one attempt to draw together work on self-focused attention across multiple clinical presentations, Philippi and Koenigs (2014) proposed an inverted U shape relationship, with moderate levels of self-focused attention commensurate with psychological well-being, heightened levels as a central feature of anxiety and depression (rumination), and low levels evident in ASD. However this model does not address the multi-faceted nature of self-

focused attention discussed above, and it fails to account for the apparent paradox of increased levels of comorbid depression in adults with ASD who, as a group, evidence diminished self-focused attention.

Furthermore, many of the studies pointing towards reduced self-focused attention in individuals with ASD have employed cognitive paradigms manipulating attention and recall (Millward et al., 2000; Rogers, Kuiper & Kirker, 1977; Toichi et al., 2002). When examining rumination using self-report, in a manner corresponding to that which has been used with the general population, both rumination and depressed mood have been reported as higher in adults with ASD compared to typical controls (Crane et al., 2011); and increased rumination has been associated with increased depressed mood (Crane et al., 2011; Gotham et al., 2014). These findings are consistent with theoretical accounts that increased self-awareness across individuals with ASD may act as risk factor for psychopathology (Barnhill, 2001; Blackshaw, Kinderman, Hare & Hatton, 2001; Meyer et al., 2006; Tantum, 2000; Wing, 1981). Although these prior studies provide a good starting point for the examination of the role of self-focused attention in individuals with ASD, they have been limited in the inferences they can make by small sample sizes and have not addressed the multi-faceted nature of self-focused attention.

Research aims

The primary aim of the current study was to explore the relationship between self-focused attention (namely the sub-components private self-consciousness, public self-consciousness, brooding and reflection) and depression in adults with ASD. Overall, we hypothesised that increased self-focused attention would be associated with increased depressive symptoms in individuals with ASD. Specifically, we expected that private self-consciousness would be more strongly associated with symptoms of depression than public-

self-consciousness; and further that brooding would be more strongly associated with symptoms of depression than reflection. Given females in the general population report higher levels of rumination than males (Johnson & Whisman, 2013; Rood et al., 2009), and gender may mediate the relationship between rumination and depression (Nolen-Hoeksema, Larson & Grayson, 1999), we also planned to explore gender differences in the relationship between self-focused attention and depression.

Method

Procedure

The study was designed in accordance with the British Psychological Society's Code of Human Research Ethics (2010) and Ethics Guidelines for Internet-Mediated Research (2013). NHS and charitable organisations ethics approval for the study was granted by North East - Newcastle & North Tyneside Research Ethics Committee. The study was also approved by the Research and Development Department in both South Eastern Health and Social Trust and Northern Health and Social Care Trust in Northern Ireland.   A mixed method of internet and paper based surveys were used to recruit and gather responses. All participants completed the surveys independently in their own homes. For the paper based surveys, respondents were sent out a research pack containing the study information, the survey and a prepaid envelope to return their responses. Participants recruited via the web based survey were emailed an encrypted web link which brought them to the Qualtics platform. From here, they were furnished with the same information provided via the postal research pack. Mixed methods optimise response rates without compromising the validity of responses (Greenlaw & Brown-Welty, 2009). The paper and internet based test batteries

were identical in terms of question ordering and content. Informed consent was obtained from all individual participants included in the study. All responses were anonymous.

Participants

Convenience sampling was used to recruit participants via two NHS adult ASD services located in Northern Ireland and three Northern Ireland based charities. There was a total of 180 responses, however, within the web responses there was a 28.3% non-completion rate. Thus, a total of 128 participants completed the questionnaire packs; 13 participants reported a self-diagnosis and another two failed to report how they received their diagnosis. These participants were excluded on the basis that their diagnosis was not confirmed by a health or educational professional. This step was taken given that no confirmatory clinical interview was carried out to confirm diagnostic status. This left a final sample of 113.

Participants had a mean age of 33.28 (SD 13.27[1]). Fifty six percent of participants responded via traditional mail and were recruited from adult ASD teams within Northern Ireland. Forty four percent completed the questionnaire via a web link; these participants were largely recruited from Northern Ireland based ASD charities. There were no significant differences between the paper and web sample in terms of age, years in education, mean scores on AQ-10, public self-consciousness, private self-consciousness, brooding, reflection or BDI-II. Eighty eight percent reported their diagnosis was made by a health professional, 1.8% by an educational professional, 7.1% by a private practitioner and 2.7% by other. Sixty percent of participants were male, 38.9% female and 0.9% transgender. There was a significant difference in gender between the two response methods with a higher proportion

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[1] Participants over age 65 was an original exclusion criterion in order to increase the generalisability of the results. However two participants over 65 (<69 years old) completed the survey. These responses were included in the final analysis as it was judged that these data would not reduce the overall representativeness of an adult sample.

of females completing the web questionnaire than the paper questionnaire (chi-square X^2 (2, N=113) = 8.18, p=.017, Cohen's d =.55).

Ninety four percent of participants attended mainstream school, 5.3% attended special education provision, 24.8% had statement of education needs, 19.5% had classroom assistant. The majority of the sample had a minimum of GCSE or equivalent level of education (see table 2.).

(Insert table 2 here)

Materials

  Autism Quotient 10 item (AQ-10). The AQ-10 was developed as a short screen of ASD symptoms in order to aid healthcare professionals' decision making about onward referral for diagnostic assessment (Allison, Auyeung & Baron-Cohen, 2012). It was derived from the AQ 50 item full version which was originally designed to measure the degree to which an adult of normal cognitive ability has ASD traits (Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001). The predictive validity of the AQ-10 is excellent and is equivalent to the full version of the AQ (Booth, Murray, McKenzie, Kuenssberg, O'Donnell & Burnett, 2013). The AQ 50 item has been used within research to establish the degree of ASD severity (Lombardo et al., 2007; Verhoeven et al., 2012). The AQ-10 has very similar discriminative power to the AQ 50 item version (Booth et al., 2013). It is a 10 item self-report questionnaire with a 4 point scale which is treated dichotomously for scoring purposes (e.g. *definitely agree/slightly agree=1, definitely disagree/slightly disagree=0 on items 1, 7, 8, and 10).* A cut off score of 6 or more demonstrates 88% sensitivity and 91% specificity for identifying individuals with ASD. The measure has good internal consistency (alpha coefficient >0.85) (Allison et al., 2012).

Self-consciousness scale revised. The Self-consciousness Scale revised was developed to measure public and private self-consciousness (Scheier & Carver, 1985; Fenigstein et al., 1975). It is a 22 item self-report scale asking respondents to rate the extent each statement is like them using a 4 point scale ('a lot like me' to 'not at all like me') (Scheier & Carver, 1985). It consists of three subscales; private self-consciousness (private SC), public self-consciousness (public SC) and social anxiety. For the purposes of this study the private and public subscales were used (16 items). The measure has acceptable internal consistency with a Cronbach's alpha of 0.75 for private self-consciousness and 0.84 for public self-consciousness. The private self-consciousness scale has previously been used with ASD populations (Blackshaw et al., 2001; Lombardo et al., 2007).

Ruminative Response Scale (RRS). The Ruminative Response Scale is a 22 item scale which was originally developed as part of the Response Style Scale (Treynor et al., 2003). It contains self-focused, symptom focused and consequence focused statements measured on a 4 point scale (1=almost never, 4=almost always). It has good construct and discriminant validity (Roelofs, Muris, Huibers, Peeters and Arntz, 2006) with high internal consistency of 0.90 (Nolen-Hoeksema, 2000). An abbreviated version was developed by Treynor et al., (2003); which removed items that overlap with depressive symptoms. The 10 item version is not confounded by depression related content and is superior to the 22 item version as it eliminates the possibility that the associations found between depression and rumination are purely down to item overlap. It consists of two factors; reflection (5 items) and brooding (5 items) (Treynor et al., 2003). It has acceptable reliability with the coefficient alpha for reflection and brooding 0.72 and 0.77 respectively. Reflection and brooding scores are derived by summing the 5 items on each subscale. The RRS 22 item scale has been used with individuals with ASD (Gotham et al., 2014; Crane et al., 2011).

Beck Depression Inventory-II (BDI-II)

The BDI-II is a 21 item self-report questionnaire which measures the cognitive-affective and somatic symptoms of depression. It has good concurrent validity and high internal consistency (0.90) (Storch, Roberti & Roth, 2004). Severity of depressive symptoms is scored on a 4 point scale (ranging from 0 to 3) and scores are derived by summing responses of the 21 items (range 0-63). It has been used in ASD populations (Crane et al., 2011; Gotham et al., 2014) and has shown good internal consistency with this population (0.87; Gotham, Unruh & Lord, 2015). Gotham and colleagues (2015) examined the BDI-II's ability to identify depressed and non-depressed individuals with ASD and found that 70% of those who met criteria for clinical depression scored in the clinical range for depression on the BDI-II and 77.5% of the non-depressed participants scored in the no concern range on the BDI-II. The authors therefore recommend the BDI-II as a suitable measure of self-reported depressive symptoms for adults with ASD.

Statistical Analysis. A sample size calculation was carried out using an effect size of 0.67 (Cohen's d) based on Mor and Winquist's meta-analysis of the relationship between private self-consciousness and depression (Mor and Winquist, 2002). A sample of approximately 112 was estimated to detect an effect size in a regression model with 4 main predictor variables (private self-consciousness, public self-consciousness, brooding and reflection) with 80% power.

The pen and paper data were inputted into IBM SPSS version 23 independently by two members of the research team. The datasets were cross checked for any inconsistencies and inconsistencies in the data were corrected using the original participant responses. This step was taken to reduce systematic error in the data. This dataset was then combined with

the internet data which was downloaded from Qualtrics, an online survey platform
(www.qualtrics.com).

Descriptive statistics were carried out to explore the demographics of the sample as
well as symptom scores on the various measures. Pearson correlations were carried out to
explore the relationships between depressive symptoms (as measured by the BDI-II) and AQ-
10 scores, public self-consciousness, private self-consciousness, brooding and reflection.
Backward stepwise multiple linear regression examined BDI-II total scores as the dependent
variable and private self-consciousness, public self-consciousness, brooding, and reflection
scores as the independent variables. Gender differences were explored by splitting the sample
by gender and re-running the regressions separately for males and females. Following
planned analyses, exploratory regression analyses on distinct subcomponents of private self-
consciousness were conducted in a comparable way to the primary regression analyses. Tests
of normality, homoscedasticity, multicollinearity, linearity and outliers were run for each
regression model and all assumptions were met.

Results

Descriptive statistics

There was no significant difference between males and females in age, self-reported
ASD symptoms, years in education, public self-consciousness, private self-consciousness,
brooding and reflection. Males and females did not differ in the severity categories in the
BDI-II (X^2 (3, N=113) = 0.75, p=.86, Cohen's d =.16). However there was a significant
difference between males and females in overall BDI-II scores (t(110) = -2.26, p=.026,
Cohen's d =-.43), with females reporting more symptoms of depression (mean: 30.69; SD:

15.19) than males (mean: 24.37; SD: 14.94). Table 3 provides a summary of mean scores and internal consistency for each of the measures. The total RRS score observed in the current study was higher than previous studies that have examined rumination in adults with ASD (Crane et al., 2013 - mean RRS total score 50.11, SD = 9.4; Gotham et al., 2014 - mean RRS total score 47.7, SD = 14.3). Of note, in the current study the AQ-10 had low internal consistency with a Cronbach's α of .63 therefore failing to meet the threshold of .70 required for adequate internal consistency (Cicchetti, 1994). However, all other measures demonstrated acceptable internal consistency (Cicchetti, 1994).

(insert table 3 here)

Twenty two percent of the sample was identified as having low levels of AQ symptoms and 77.9% of the sample was classified as high levels of AQ symptoms based on a clinical cut off of 6.

Almost half of the sample (46%) reported depressive symptoms in the severe range (20.4% minimal; 13.3% mild and 20.4% moderate).

Correlational analysis

ASD symptoms (AQ-10), public self-consciousness, private self-consciousness, brooding and reflection were all positively and significantly associated with depressive symptoms (see table 4). To compare the relationship between rumination and depressive scores with previous research on rumination in ASD samples, the RRS 22-item version was correlated with BDI-II scores. The 22-item RRS does not have depression related content removed and so the results of the correlation will be confounded with item overlap with depressive items on the BDI-II. As expected, a strong positive relationship was found

between the RRS 22-item and BDI-II $r(111) = .73$, p<.001. This was substantially stronger

than the relationship found by Crane et al., (2013; r = .65).

(insert table 4 here)

Regression model

The backward stepwise multiple linear regression showed that brooding, reflection

and private self-consciousness (but not public self-consciousness) were all significant

predictors of depressive symptoms and explained 39.7% of the variance in depressive scores

($F(4, 109) = 25.59$, p<.001; see table 5). [2]. Increased brooding and reflection predicted

higher depressive scores, however private self-consciousness actually predicted lower

depressive scores. Although the bivariate correlations suggested a positive relationship

between public self-consciousness and symptoms of depression, public self-consciousness

did not make a significant independent contribution to depressive symptoms and was

removed from the first step in the model (standardised β=-.06, t=-.53, p=.595).

(insert table 5 here)

Gender. Correlational analysis suggested differential associations between

depressive symptoms and measures of self-focused attention by gender in the present sample

(see Table 6).

(insert table 6 here)

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[2] A regression model was run including AQ-10 scores as a predictor. This model was statistically significant
and explained 40.9% of the variance in depressive scores however a decision was made to remove this variable
given the low α .63. Removal of the AQ-10 did not significantly reduce the model's predictive ability to explain
variance in depressive scores. The sample was then split two ways on the basis of AQ-10 scores, a) using
clinical cut off of 6 and b) using the median score which resulted in a more evenly split sample. Results were
equivalent to those reported in Table 5, supporting the assertion that ASD symptom severity as measured by the
AQ-10 did not influence the relationship between depression and self-focused attention.

Splitting the sample by gender, produced different results in the backward stepwise multiple linear regressions in males versus females (see table 7). For the male sample 50.1% of the variance in BDI-II scores was explained by private self-consciousness, brooding and reflection ($F(3, 64) = 23.41$, p<.001), in the manner that corresponds to the results described for the whole sample. However, for the female sample 20.7% of the variance in BDI-II is explained by brooding alone, with higher brooding predicting greater symptoms of depression ($F(1, 42) = 12.23$, p=.001). Assumptions of normality, homoscedasticity, multicollinearity, linearity and outliers were met.

(insert table 7 here)

Exploratory analysis

Private self-consciousness. In light of the results reported above, further exploratory analyses were conducted to explore if a two factor structure of the private self-consciousness subscale might account for the unexpected finding that private self-consciousness is inversely related to depressive symptoms. Subscales were derived for self-reflection (5 items) and internal state awareness (3 items) based on the factor structure of the revised self-consciousness scale (Martin & Debus, 1999). A backward stepwise linear regression model was run with BDI-II scores as the dependent variable and public self-consciousness, self-reflection (mean score 9.65, SD = 3.63, α .70), internal state awareness (mean score 5.42, SD = 2.54, α .60), brooding and reflection as the independent variables. Assumptions of normality, homoscedasticity, multicollinearity, linearity and outliers were met. The model was significant, with brooding, reflection and internal state awareness explaining 47.9% of the variance in depressive scores ($F(3, 109) = 35.29$, p<.001); see Table 8). Importantly, whilst brooding and reflection contributed in similar ways as described in the primary analyses, only internal state awareness and not self-reflection remained in the model.

Increased internal state awareness predicted decreased symptoms of depression. Thus, awareness of internal states appears to be adaptive, with higher awareness of states being linked to lower depressive scores.

(insert table 8 here)

Discussion

The aim of the current study was to examine how different aspects of self-focused attention, namely private self-consciousness, public self-consciousness, brooding and reflection are related to depressive symptoms in adults with ASD, with a view to developing a better understanding of the vulnerability for developing depression within this population.

The findings provide clear evidence that self-focused attention is important in understanding depression in adults with ASD. Increased brooding, and to a lesser degree reflection, conferred a risk for depressed mood. Importantly increased levels of private self-consciousness, specifically, a balanced self-awareness as measured by the internal state awareness factor appears adaptive in response to depressed mood. The profile of risk and resilience factors in depression in adults with ASD is different for males and females with brooding being the main risk factor for depression in females, and brooding and reflection conferring risk in males. Private self-consciousness appears to be adaptive for males but not females, in response to depressed mood.

The relationship between self-focused attention and depression

Despite both the absent self-hypothesis and the transdiagnostic model of self-focused attention both hypothesising diminished self-focused attention in ASD, the present results are consistent with other empirical studies reporting evidence that self-reported self-focused attention in is not excessively diminished ASD (Crane et al., 2011; Gotham et al., 2014;

Lombardo et al., 2007). Further research is required to attempt to replicate the findings of the current study. And perhaps to refine the complex conception and expression of self in ASD, since it has been postulated that this may be atypical (Frith and Happe, 1999; Wing, 1981).

The observation that in the present sample increased brooding predicted increased symptoms of depression, more strongly than increased reflection, is consistent with research within the general population (Watkins, 2009). Longitudinally, reflection has been shown to be adaptive with its use at one time uniquely and significantly predicting greater chance of recovery from depression 6 months later (Arditte & Joorman, 2011). Further, brooding but not reflection has been shown to mediate the relationship between dysfunctional attitudes and depression, despite both reflection and brooding showing the same strength of relationship concurrently (Senormanci et al., 2014). The present positive concurrent relationship of reflection and brooding with depression therefore supports the idea that individuals with ASD may use a combination of adaptive and maladaptive strategies when experiencing low mood (Arditte & Joorman, 2011). Additional longitudinal research with ASD populations is required in order to establish if reflection has adaptive potential over time, in response to depressed mood.

Interestingly, the directionality of private self-consciousness was not expected. Within the current sample, increased levels of private self-consciousness are associated with decreases in depressive symptoms, suggesting that private self-consciousness may have adaptive qualities for individuals with ASD (at least males). Due to its repetitive nature, associations have been suggested between some aspects of self-focused attention and the repetitive behaviours and interests that form a core feature of ASD (Gotham et al., 2014). Different types of repetitive behaviours and interests linked to ASD have been shown to serve a variety of functions, some of which are adaptive (Tantum, 2000). It is therefore possible

that private self-consciousness is adaptive – in terms of protection from symptoms of depression – for some individuals with ASD in part because of its repetitive nature. This possibility requires further investigation.

Within the general population, female dominated samples yield stronger effect sizes for the relationship between self-focused attention and negative affect (Mor & Winquist, 2002) and women tend to engage in more brooding and rumination than men (although this effect is small, Johnson & Whisman, 2013). Some caution is warranted when interpreting the present gender specific findings because they may have been underpowered. However, the absence of private self-consciousness as a protective factor within the female sample may perhaps be explained by the higher rates of brooding and depression in females. Perhaps for females, these higher levels of depression prevent the use of a curious enquiry about the self and lead to self-focused attention being dominated by maladaptive brooding.

Previous research has demonstrated that private self-consciousness is positively associated with negative affect (Fejfar & Hoyle, 2000; Mor & Winquist, 2002) however there are controversies within the private self-consciousness literature (Anderson, Bohon & Berrigan, 1996). Using the two factor model of private self-consciousness, internal state awareness has been found to be associated with good mental health and some suggest that to treat private self-consciousness as a unitary concept 'glosses over an important distinction' (Anderson et al., 1996, p. 146). The inverse relationship of internal state awareness and depression in the current sample strongly supports the role of internal state awareness in reducing depressive symptoms in adults with ASD. It is important to consider these finding within the context of the absent-self hypothesis of ASD; perhaps in the presence of ASD some individuals on the spectrum engage in more deliberate and balanced self-focused attention as a way to understand their own minds and others minds. Consistent with the

adaptive nature of balanced self-awareness in response to depressed mood in the current sample, Lombardo et al., (2007) conclude that 'people with ASD need to be more self-focused and have more metacognitive ability to accurately reflect on themselves in order to mentalize with others' (p. 9). Further research would be required to answer these questions.

Conceptualisations and psychometric evaluation of the two sub factors of private self-consciousness have not been without controversy and limitations, particularly in relation to the low internal consistency of the measures, and few items on the internal state awareness subscale (Burnkrant & Page, 1984; Martin & Debus, 1999). Consistent with these limitations internal state awareness evidenced low internal consistency in the current study (<.70). Trapnell and Cambpell (1999) developed the Rumination-Reflection Questionnaire in an attempt to overcome the shortcomings of the two factor solution of private self-consciousness, and conceptually this appears to measure aspects of brooding and reflection (Nolen-Hoeksema et al., 2008). Since the factor structure of neither of these measures has been examined in ASD populations, convergent validity studies across measures are much needed to operationalise which aspects of self-focused attention are being measured by the various scales in adults with ASD.

Levels of depression in adults with ASD

The level of depressive symptoms in the current sample is notable, with symptom severity as measured by the BDI-II more akin to that seen in clinically depressed samples (Merino et al., 2016; Steer, Ball, Ranieri & Beck, 1999; Whitmer & Gotlib, 2008). This is consistent with the increased rates of depression in ASD samples that have been reported previously (Crane et al., 2011; Hofvander et al., 2009). The present sample evidenced somewhat higher rates of depression than these previous studies, which is consistent with the

present recruitment strategy, with over half the sample being recruited from adult ASD teams within the NHS.

Levels of self-focused attention in adults with ASD

Observed total rumination scores (based on the 22-item RRS) in the current study were higher than those reported in two previous studies that examined rumination in adults with ASD (Crane et al., 2013; Gotham et al., 2014). Additionally, the association between rumination (as indexed with the 22-item measure) and depression in the current sample was notably stronger than the associations in the Crane et al., study. Notwithstanding the limitations of the 22-item RRS mentioned previously, higher rumination scores may be a product of a more depressed sample. Consistent with this, the levels of rumination observed in the current study are more in keeping with clinically depressed samples within the general population (Joorman et al., 2006; Merino et al., 2016). Whilst public self-consciousness has not been studied in adults with ASD before, the levels reported in the current study are consistent with the original norms of the scale, derived from an undergraduate sample (Scheier & Carver, 1985). The studies that have previously examined private self-consciousness (Blackshaw et al., 2001; Lombardo et al., 2007) used Fenigsteins original version of the private self-consciousness scale, so direct comparison cannot be made, but as with public self-consciousness, levels of private self-consciousness are consistent with the original norms derived from an undergraduate sample (Scheier & Carver, 1985).

Limitations

An important strength of the current study is its large sample size, however statistical power was reduced in the gender subgroup analysis, therefore caution is warranted when interpreting these findings. Particularly in relation to females; a reduced number of predictive variables in this model may have been due to insufficient statistical power to detect

these relationships, as opposed to an absence of a relationship. Generalisability of the sample is also a consideration, since there is a higher proportion of females in the present sample than expected (Werling & Geschwind, 2013), and a wide age range (specifically, age of diagnosis may impact on support received throughout life). Measurement related issues, and particularly the variable internal consistency reported of the RRS reflection subscale (Joorman et al., 2006; Schoofs, Hermans & Raes, 2010; Whitmer & Gotlib, 2011), were also mentioned above. There is also a fundamental challenge in measuring dimensional concepts of self-focused attention, which may be exacerbated in individuals with ASD, given that a degree of self-awareness is required (Aldoa et al., 2010). Response bias (Armstrong & Overton, 1977) may have led to individuals who struggled with introspection dropping out of the study; or individuals considering themselves to be experiencing mood problems may have been more likely to participate.

Clinical Implications

Consistent with the evidence base for the general population, rumination may be one of a number of vulnerabilities that confer risk for depression in individuals with ASD (Olatunji et al., 2013, p .228). Psychological therapies that target this type of ruminative self-focused attention and capitalise on the open curious quest for self-knowledge, may therefore prove effective interventions to treat depression in adults with ASD. Mindfulness as well as acceptance and commitment therapy aim to enhance balanced self-awareness and reduce ruminative self-focused attention by enhancing an individual's ability to notice thoughts and feelings in the present moment, and respond to them in an accepting and non-judgemental way (Spek, van Ham & Nyklicek, 2013). Evidence is emerging to support the use of these approaches in individuals with ASD as a way to alleviate psychological distress (Kiep, Spek & Hoeben, 2015; Spek et al., 2013; Pahnke, Lundgren, Hursti & Hirvikoski, 2014). Future

research into the relationship between self-focused attention and depression and the effectiveness of possible intervention correlates is recommended.

Conclusions

The current study provides an important contribution to the emerging evidence base on risk factors for depression in adults with ASD. Overall, self-focused attention is important for understanding vulnerabilities and protective responses to depression within this population. Despite empirical evidence to support diminished self-focused attention in ASD, the current study highlights the importance of using a multidimensional approach to examining self-focused attention in ASD, and its important relationship with depression.

Ethical approval: "All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

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Table 1

Aspects of self-focused attention

Construct	Description	Example Questionnaire items
Public self-consciousness	Paying attention to self in relation to others; the self as a social stimulus	*I care a lot about how I present myself to others[a]* *I'm self-conscious about the way I look [a]*
Private self-consciousness	Privately thinking about the self	*I'm always trying to figure myself out [a]* *I often daydream about myself [a]*
Brooding	Prolonged and persistent passive focus on negative mood	*Think "What am I doing to deserve this? [b]* *Think "Why do I always react this way? [b]*
Reflection	Curious active pondering about one's negative mood	*Analyse recent events to try to understand why you are depressed [b]* *Go away by yourself and think about why you feel this way [b]*
Self-reflection[d]	Tendency to focus on the self	*I'm constantly thinking about my reasons for doing things [a]* *I sometimes step back (in my own mind) in order to examine myself from a distance [a]*
Internal state awareness[e]	Having a general awareness of one's own feelings and states	*I'm quick to notice changes in my mood [a]* *I generally pay attention to my inner feelings [a]*

Source   [a] *Self-consciousness Scale revised (Scheier & Carver, 1985)*

[b] *Ruminative Response Scale (Treynor et al., 2003)*

[d] Sub-factor of the Private self-consciousness scale (Burnkrant & Page, 1984)

[e] Sub-factor of the Private self-consciousness scale (Burnkrant & Page, 1984)

Table 2

Highest reported qualification (n=110)

Qualification	Percentage
No formal qualification	8.8%
GCSE	30.1%
A level	20.4%
3rd level	36.3%
Doctoral level	1.8%

Table 3

Mean and standard deviation on measures

Measure	Male (n=68) Mean (standard deviation)	Female (n=44) Mean (standard deviation)	Total (n=113) Mean (standard deviation)	Cronbach's alpha (n=113)
AQ-10	7.14 (2.30)	7.34 (2.31)	7.22 (2.28)	.63
Public SC	11.95 (6.25)	13.30 (5.17)	12.49 (5.84)	.85
Private SC	17.10 (6.20)	17.34 (4.48)	17.12 (5.59)	.73
RRS total	58.00 (15.91)	61.12 (14.66)	59.20 (15.37)	.94
Brooding	13.63 (4.31)	14.42 (4.05)	13.95 (4.19)	.85
Reflection	12.30 (3.38)	12.54 (3.52)	12.37 (3.41)	.76
BDI-II	24.37 (14.94)	30.96 (15.19)	27.05 (15.28)	.93

Table 4

Pearson correlation coefficients between the self-report measures (n=113)

	AQ-10	Public SC	Private SC	Brooding	Reflection	BDI-II
AQ-10		-.12	-.15	.03	.10	.20*
Public SC			.63**	.59**	.48**	.28**
Private SC				.51**	.53**	.20*
Brooding					.68**	.60**
Reflection						.52**
BDI-II						

* p <.05

** p <.001

Table 5

Regression model with private SC, public SC, brooding and reflection as independent

variables

	Standardised beta	t	p
Private SC	-.22	-2.41	.018
Brooding	.52	5.05	<.001
Reflection	.28	2.70	.008

Table 6

Pearson correlation coefficients for BDI-II grouped by gender

	Male (n=68)	Female (n=44)
AQ-10	.22	.18
Public SC	.35*	.11
Private SC	.33*	-.04
Brooding	.67**	.48**
Reflection	.62**	.39*

* p <.05

** p <.001

Table 7

Regression model by gender

	Male (n=68)			Female (n=44)		
	Standardised β	t	p	Standardised β	t	p
Private SC	-.25	-2.4	.038			
Brooding	.55	4.22	<.001	.48	3.50	.001
Reflection	.38	2.96	.004			

Table 8

Regression model using 2 factor model of private SC

	Standardised β	t	p
Brooding	.51	5.44	<.001
Reflection	.31	3.24	<.005
ISA	-.36	-4.87	<.001

Appendix

Appendix A - Technical appendix

Comparison between paper and web responses

Table 9. Independent t test for paper and web responses

	t	df	p
Age	.38	110	.70
Years in education	-1.13	108	.26
AQ-10	.49	111	.62
Public SC	.08	111	.93
Private SC	-.09	111	.92
Brooding	.15	111	.87
Reflection	-.36	111	.71
BDI-II	.30	111	.76

Comparison between males and females

Table 10. Independent t test for males and females

	t	df	p
Age	-1.36	109	.17
Years in education	-.602	107	.54
AQ-10	-.435	110	.66
Public SC	-1.192	110	.23
Private SC	-.22	110	.82
Brooding	-.96	110	.33
Reflection	-.36	110	71
BDI-II	-2.26	110	.02

Statistical assumptions data for whole sample regression (IV – public SC, private SC, brooding and reflection)

Normality – histogram of residuals
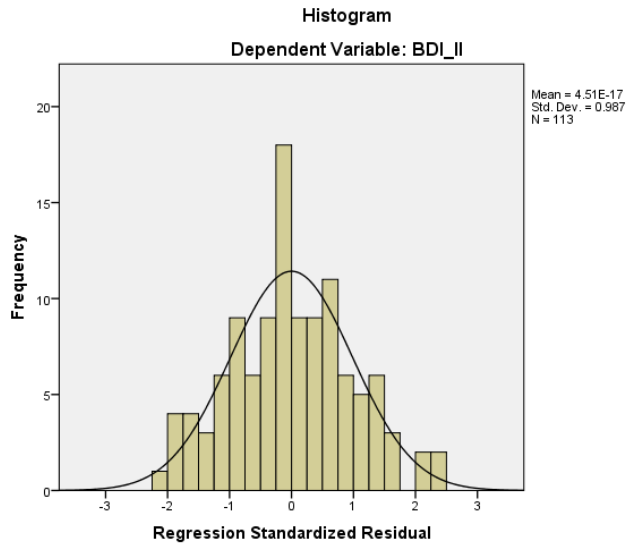
Fig. 2 Histogram of residuals for whole sample

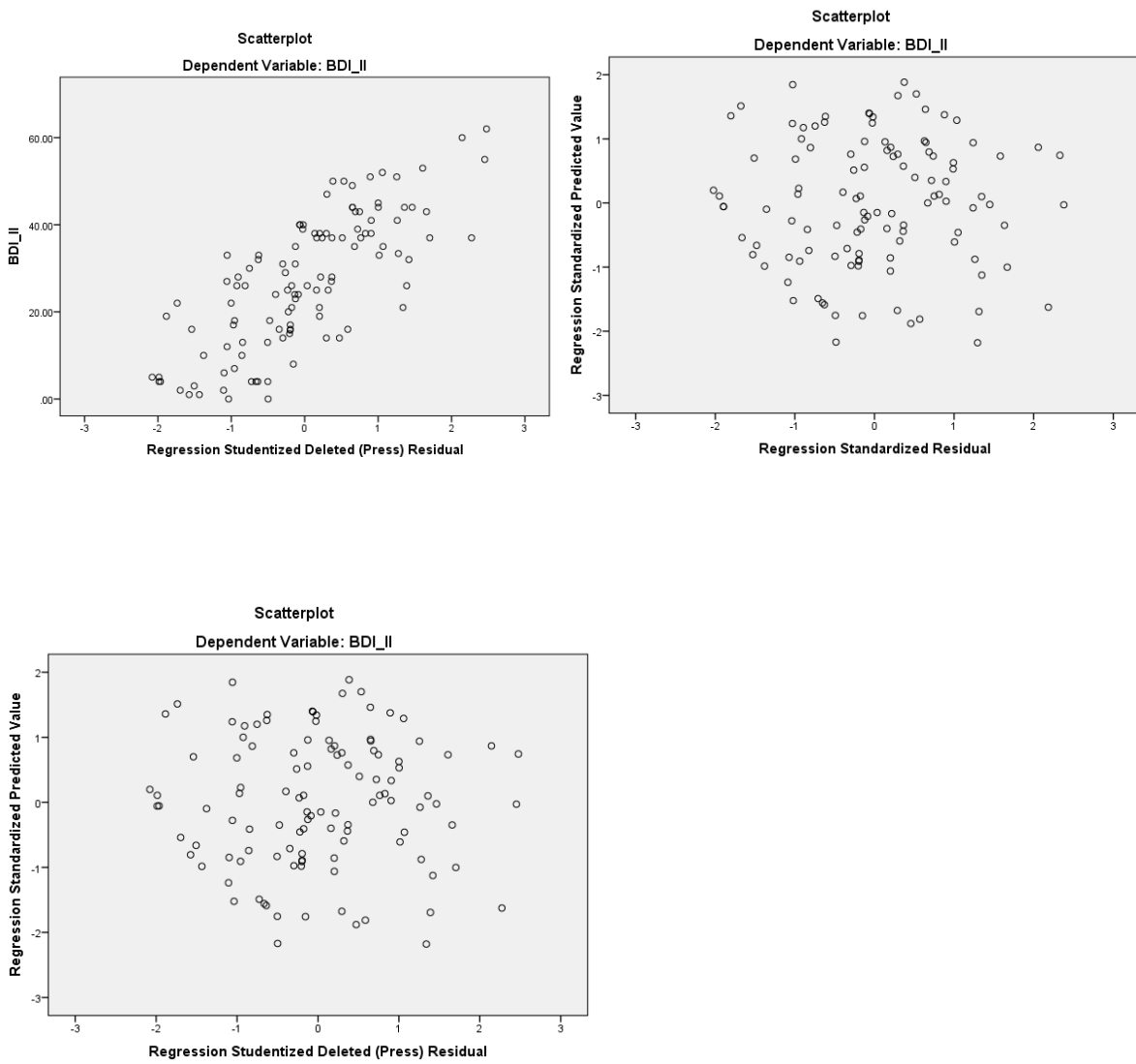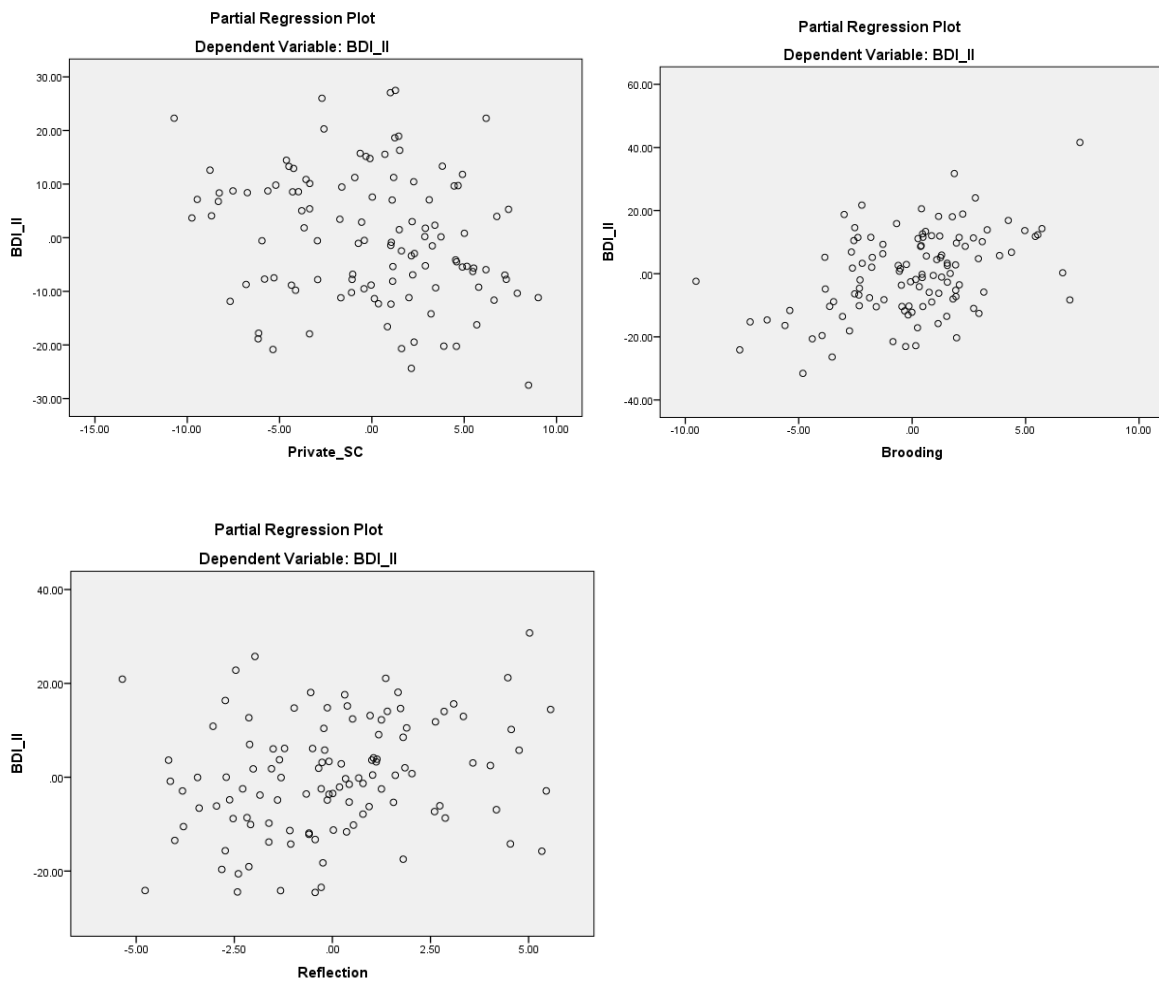Homoscedasticity – standardised residual plots

Fig. 3 Standardised residual plots for whole sample

Linearity – partial regression plots

Fig. 4 Partial regression plots for whole sample

Multicollinearity statistics

Table 11. Multicollinearity statistics

	Tolerance	VIF
Private SC	.67	1.48
Brooding	.51	1.96
Reflection	.50	2.02
Cook's distance	Mean .01	

Regression model including AQ-10 as predictor variable

A backward stepwise multiple linear regression was carried out with BDI-II total scores as the dependent variable and private SC, public SC, brooding, reflection and AQ-10 scores as the independent variables. A significant regression equation was found ($F_{(4, 108)} = 20.410$, $p<.001$) with an R^2 of .409 (see table 12). Brooding, reflection, autism symptoms and private SC explain 40.9% of the variance in depressive symptoms scores. Brooding ($p<.001$) and reflection ($p=.019$) were significant predictors of depressive symptoms. Assumptions of normality, homoscedasticity, multicollinearity, linearity and outliers were met.

Table 12. Regression model with private SC, public SC, brooding, reflection and AQ-10 scores as predictors

	Standardised beta	T	P
AQ-10	.14	1.81	.074
Brooding	.52	5.09	<.001
Reflection	.25	2.37	.019
Private SC	-.18	-1.94	.055

Interaction of autism symptoms on the relationship between self-focused attention and depression

Table 13. Partial correlations when controlling for AQ

	Public SC	Private SC	Brooding	Reflection	BDI-II
Public SC		.63**	.60**	.50**	.31**
Private SC			.52**	.56**	.24*
Brooding				.68**	.61**
Reflection					.51**
BDI-II					

* $p <.05$
** $p <.001$

Table 14. Partial correlations, controlling for AQ, for male and female participants

	BDI-II	
	Male	Female
Public SC	.40**	.12
Private SC	.39**	-.03
Brooding	.71**	.45*
Reflection	.64**	.36*

* p <.05
** p <.001

Table 15. Regression model with AQ-10 scores split based on clinical cut off (>6)

	Low AQ (n=23)				High AQ (n=87)			
	Standardised β	t	p	Adjusted R^2	Standardised β	t	p	Adjusted R^2
Brooding	.63	-1.12	.001	.37	.59	-.19	<0.001	.34

*Assumptions all meet

Table 16. Regression model with AQ-10 scores split based on median score (>8)

	<8 AQ (n=58)				=>8 AQ (n=53)			
	Standardised β	t	p	Adjusted R^2	Standardised β	t	p	Adjusted R^2
Brooding	.62	-.93	<0.001	.37	.54	.30	<0.001	.27

*Assumptions all meet

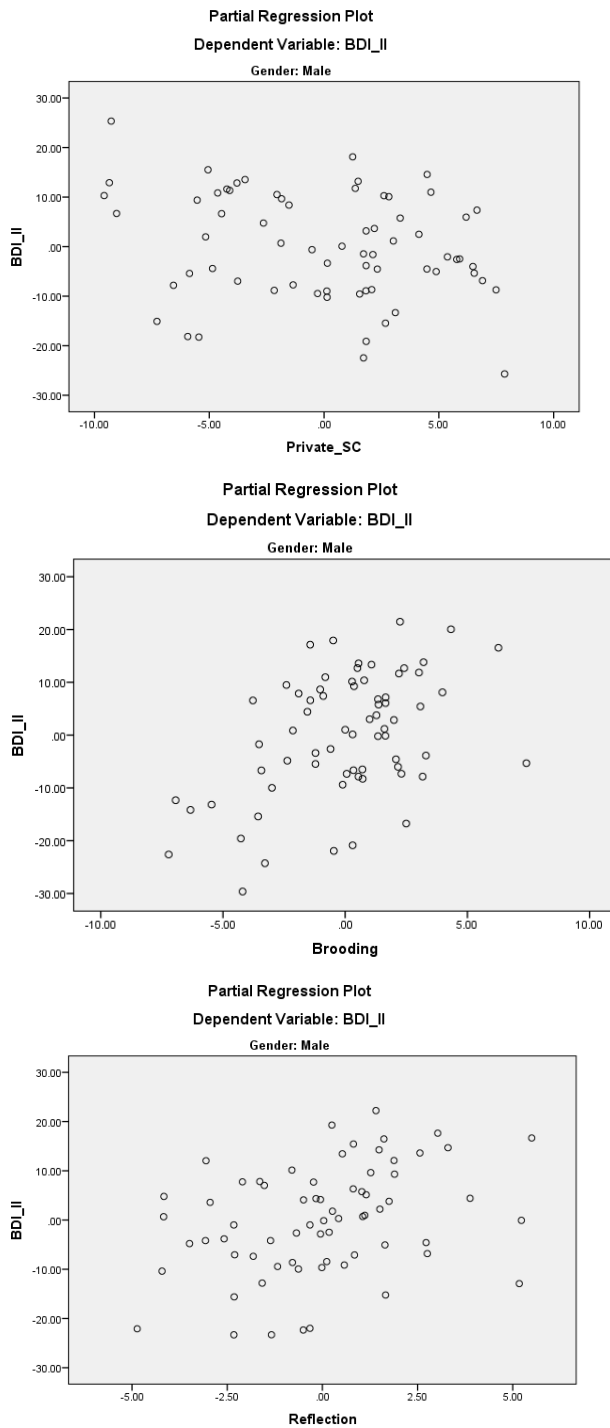*Statistical assumptions data for male sample regression (IV – public SC, private SC, brooding and reflection)*

Normality – histogram of residuals
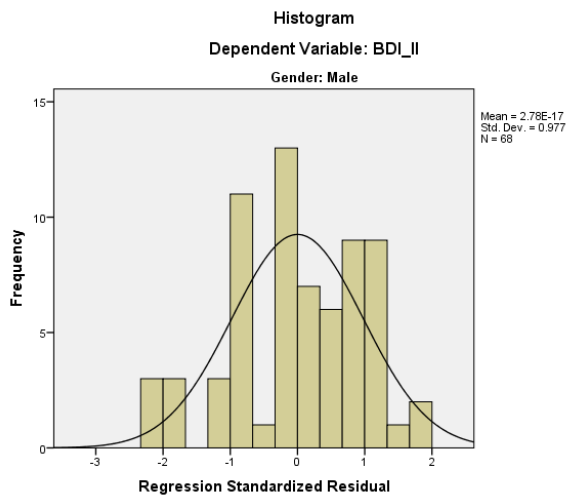
Fig. 5 Histogram of residuals for male sample

Homoscedasticity – standardised residual plot
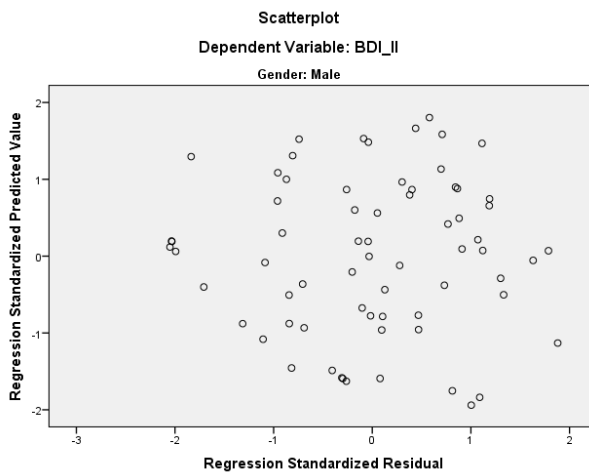
Fig. 5 Standardised residual plot for male sample

Linearity – partial regression plots

Fig. 6 Partial regression plots for male sample
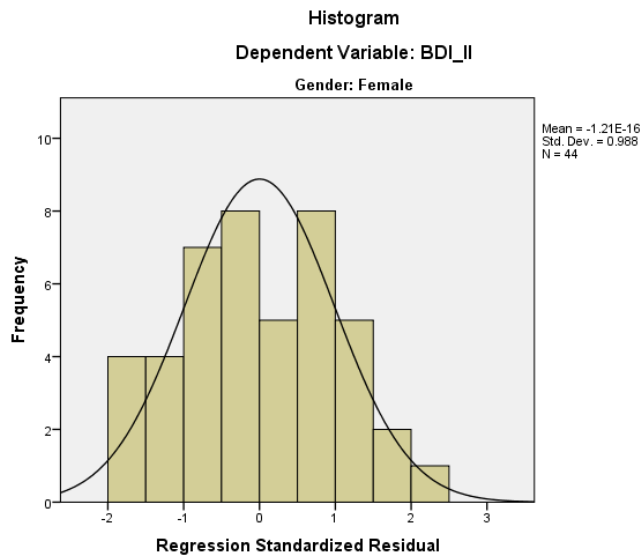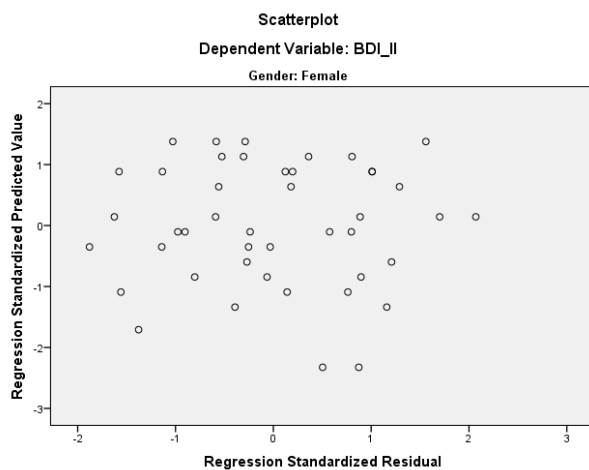
Multicollinearity statistics

Table 17. Multicollinearity statistics for male sample

	Tolerance	VIF
Private SC	.55	1.81

Brooding	.44	2.27
Reflection	.45	2.25
Cook's distance	Mean .01	

Statistical assumptions data for female sample regression (IV – public SC, private SC, brooding and reflection)

Normality – histogram of residuals

Fig. 7 Histogram of residuals for female sample

Homoscedasticity – standardised residual plot
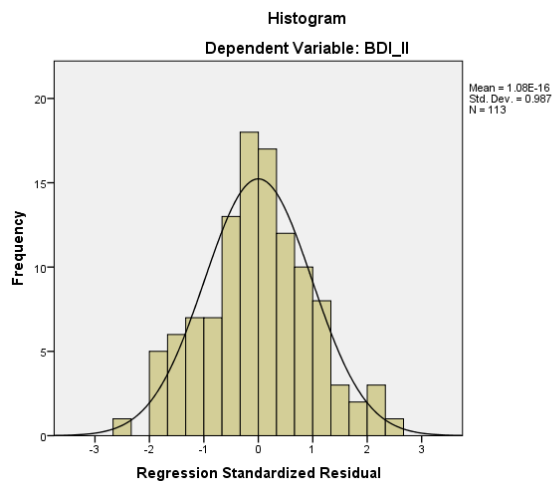

Fig. 8 Standardised residual plot for female sample

Multicollinearity statistics

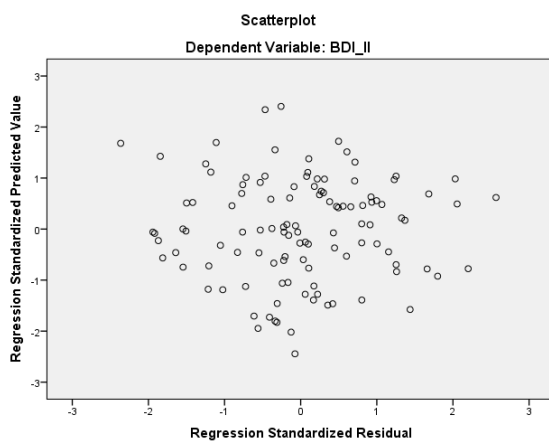**Table 18.** Multicollinearity statistics for female sample

	Tolerance	**VIF**
Brooding	1	1
Cook's distance	Mean .02	

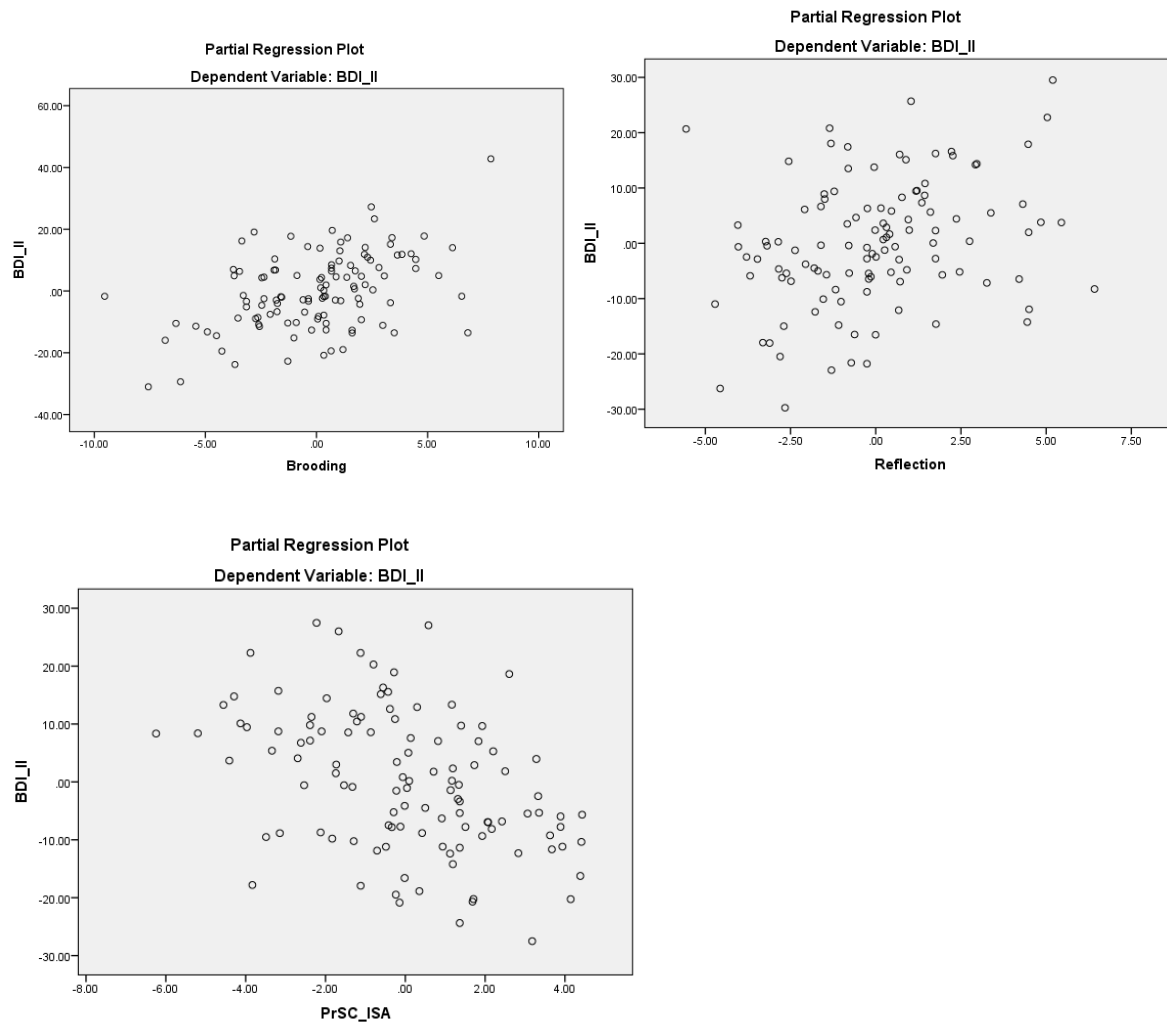*Statistical assumptions data for whole sample regression (IV – public SC, SR, ISA, brooding and reflection)*

Normality – histogram of residuals

Fig. 9 Histogram of residuals for whole sample (2 Factor private SC)

Homoscedasticity – standardised residual plots

Fig. 10 Standardised residual plot for whole sample (2 Factor private SC)

Linearity – partial regression plots

Fig. 10 Partial regression plots for whole sample (2 Factor private SC)

Multicollinearity statistics

Table 19. Multicollinearity statistics for whole sample (2 Factor private SC)

	Tolerance	VIF
Brooding	.54	1.87
Reflection	.52	1.93
ISA	.86	1.17
Cook's distance	Mean .01	