Forensic Psychology BSc, Staffordshire University
Psychology Project Report

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Is there a relationship between emotion regulation, empathy and depression in healthy individuals reporting ADHD traits?

- I confirm that a copy of the Project Log signed by my supervisor has been included in my project (please tick): ✓
- I confirm that I have provided my supervisor with evidence of data collection (please tick): ✓
- I understand that it is my responsibility to ensure the statements above are correct. I also understand that if any of the information referred to above is missing, my project may not be given a pass mark.

Student's signature: C Sheen

Supervisor: I have been provided with evidence of data collection

Supervisor's signature: __J.L.Drakeford_____

Supervisor: JD

ABSTRACT

The purpose of this study was to examine the relationship between depression symptoms, ADHD traits, emotion regulation and empathy in a non-clinical community samples of adults. Previous research has identified high levels of comorbidity between depression symptoms and non-clinical ADHD traits in youths and this study aimed to ascertain whether this relationship is also present in adults. Furthermore, it also attempted to identify the underlying mechanism between depression symptoms and ADHD traits in adults. 41 healthy adults with no previous psychiatric diagnosis took part in the study. Symptoms were assessed using the Adult ADHD Self-Report Scale, The Difficulties in Emotion Regulation Scale, the Centre for Epidemiologic Studies Depression Scale and the Empathy Quotient. A multiple regression was conducted with depression symptoms as the criterion to identify relationships between the variables. As the study met the assumptions for mediation, indirect effect analysis was conducted to identify a mediator between depression symptoms and ADHD traits. The regression analysis identified emotion regulation as a predictor of depression symptoms. ADHD was a predictor of depression until emotion regulation was included, although this may have been explained due to high intercorrelation. Therefore, mediation analysis was conducted which confirmed that the relationship between depression symptoms and ADHD traits was mediated by emotion regulation. The results of this study advance understanding of adults with ADHD traits within the current literature, by presenting the first study to explore potential mediators between depression symptoms and ADHD traits in adults.

INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopment disorder displaying a pattern of inattentive, hyperactive-impulsive or combined behaviours as outlined in the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013). The worldwide prevalence of ADHD in childhood is estimated to be between 2.2% to 17.8% (Skounti, Philalithis, & Galanakis, 2007), with evidence of persistence into adulthood in 2% to 5% of cases although some research suggests that less than 20% of adults experiencing ADHD symptoms are formally diagnosed (Polyzoi, Ahnemark, Medin, & Ginsberg, 2018). Previously in the literature, ADHD has been thought to be more prevalent in males with a sex ratio of 3:1 in childhood (Willcutt, 2012). However, research in adults with ADHD have identified a sex ratio closer to 1:1 (Williamson & Johnston, 2015), suggesting potential re-referral bias (Froehlich et al., 2007) or differences in developmental trajectories across both sexes (Murray et al., 2019). Approximately 35% to 50% of adults diagnosed with ADHD will also experience depression symptoms ranging from brief episodes to major depressive disorder during their lifetime (Kooij, 2014; Sobanski, 2006).

Combined diagnosis of both ADHD and depression can lead to increased severity and persistence of symptoms and reduce response to treatment than peers diagnosed with either disorder alone (Bron et al., 2016). For example, females with ADHD reported longer and more frequent periods of depression; greater depression-associated impairments were more likely to require hospitalisation and a higher rate of suicidality then neurotypical peers (Biederman et al., 2008). Further, Pinkhardt et al. (2009) identified adults with ADHD traits are more likely to experience and develop antisocial personality disorder, mood disorders and drug and alcohol misuse disorders. Pinkhardt et al. (2009) highlighted abnormally high usage of nicotine, alcohol and other illegal substances, which they

theorised was a form of ‘self-medication’ due to their influence on dopaminergic pathways, an area within the brain commonly found to experience dysfunction in those with ADHD (Blum et al., 2008).

Despite the elevated levels of impairment reported by individuals with ADHD and depression, very limited research exists exploring the underlying mechanism between the two. One potential mechanism is emotion regulation as deficits have been found in adults with both ADHD (Bodalski, Knouse, & Kovalev, 2019; Hirsch, Chavanon, Riechmann, & Christiansen, 2018), depression (Gotlib & Joormann, 2010) and has been identified as a mediator in youth studies (Anastopoulos et al., 2011; Seymour et al., 2012). Emotion regulation has been conceptualised as involving numerous processes, such as attentional control, reward-processing, motivational states, and behavioural inhibition, which influence our ability to initiate, modulate and express emotions to achieve a goal or adapt situationally (Seymour, Chronis-Tuscano, Iwamoto, Kurdziel, & MacPherson, 2014). Surman et al. (2011) found that adults with ADHD experience greater difficulties with controlling and regulating emotions in comparison to controls. Moreover, when adults with ADHD who experienced difficulties in emotion regulation were compared to those without emotion dysregulation it was found that the former group displayed significantly more impairments in close relations, such as with family, in work and previous academic experiences (Wehmeier, Schacht, & Barkley, 2010). Emotion regulation has also been widely recognised for its role in maintaining depression (Gotlib & Joormann, 2010) through the use of more maladaptive strategies in regulating affect and deficits in adaptive strategies (Joormann & Stanton, 2016).

Another potential underlying mechanism which may help explain the relationship between depression and ADHD is empathy. Deficits in empathy have been reported in both ADHD

(Abdel-Hamid et al., 2019) and depression (Schreiter, Pijnenborg, & aan het Rot, 2013). Abdel-Hamid et al. (2019) conducted a study that examined the levels of empathy of 30 adults diagnosed with ADHD compared to matched controls. They found ADHD adults displayed significantly impaired empathy compared to controls. Whilst in depression, empathic stress has been associated with increased feelings of depression (Schreiter, Pijnenborg, & aan het Rot, 2013).

Traditionally, research focused on clinically diagnosable levels of ADHD and depression. However, more recent research has supported a shift in approach towards recognising ADHD in a dimensional view with ADHD traits existing on a continuum with clinically diagnosed ADHD representing an extreme presentation (Elisa & Parris, 2015; Heidbreder, 2015; Katzman, Bilkey, Chokka, Fallu, & Klassen, 2017). This acknowledgement of ADHD traits existing on a continuum has been supported by research that identified that adults with elevated but subclinical levels of ADHD and depression still experience difficulties associated with clinical ADHD in areas such as education, work, relationships and report lower quality of life compared to neurotypical peers (Able, Johnston, Adler, & Swindle, 2007). Neuroimaging studies further add support with findings that non-clinical participants who reported higher levels of ADHD traits displayed abnormalities in brain functions which coincided with the results from clinical studies (Cocchi et al., 2012; Stark et al., 2011). This allows research to utilise the benefits of non-clinical samples in a few ways. First, it allows for analysis of the full range of symptom severity and increasing understanding of symptoms within the general population (Elisa & Parris, 2015). It also allows for investigation of ADHD traits independent of potential cognitive dysfunction, development delays and influences of mediation (Cocchi et al., 2012). This may be increasingly important when considering research on ADHD traits and depression as Biederman, Monuteaux, Spencer, Wilens, and Faraone (2009) identified that children diagnosed with

ADHD and treated with stimulants were significantly less likely to have develop depression at a 10 year follow up. Therefore, non-clinical samples may build a more comprehensive image of the relationship between ADHD and depression, by utilising a wider range of ADHD traits rather than extreme presentations of the disorder (Seymour et al., 2014).

It is, therefore, important to consider ADHD traits, depression symptoms, emotion regulation and empathy in the context of non-clinical samples to compliment research on clinical samples. Nevertheless, adult studies looking at ADHD traits in relationship to depression symptoms and emotion regulation are sparse, although limited research in youth samples does exist (Lundervold, Hinshaw, Sørensen, & Posserud, 2016; Seymour et al., 2012, 2014; Seymour & Miller, 2017).

Lundervold et al. (2016) investigated the frequency and severity of ADHD symptoms which co-occurred with depression in a gender balanced community sample. They assessed 9614 16-19 year olds using the Mood and Feelings Questionnaire as a proxy for depression severity and the Adult ADHD Self-report Scale (ASRS) to assess presence and severity of ADHD traits. Lundervold et al. (2016) found that ADHD traits were more commonly reported by females, and with each ADHD trait reported the severity of the depression increased. Moreover, they identified that within the sample they identified as depressed, more than 20% reported six or more ADHD traits within the inattention subscale. However, more research in this area would be needed to discern if the presence of depression caused an increase in apparent inattentive type ADHD traits, or if they exist independently to depression and potentially act as a risk factor for the development of depression.

One potential factor explaining commonly report comorbidities between depression and ADHD traits is empathy. Previous research in depression and empathy (Schreiter,

Pijnenborg, & aan het Rot, 2013) identified that empathic stress; a person's ability to relate and experience another's distress as their own, is highly associated with depression. This often requires average or high levels of emotional empathy. However, Groen, den Heijer, Fuermaier, Althaus, and Tucha (2018) using the Dutch version of the empathy quotient identified that the non-clinical ADHD group displayed impaired emotional empathy compared to controls, which reflects research on ADHD participants (Abdel-Hamid et al., 2019). This suggests that although empathy is implicit in both depression and ADHD it is unlikely to mediate the relationship between the two. However, due to the non-clinical ADHD participants still experiencing empathy within normal parameters, it may still present a potential explanation (Groen et al., 2018).

Despite acknowledgement in previous literature of the impact of adult ADHD traits and their relationship with depression, there is a lack of research exploring emotion regulation as a potential underlying mechanism in adults, although it has been implicated in both depression (Gotlib & Joormann, 2010) and clinical ADHD (Bodalski et al., 2019); with increases in emotion dysregulation associated with increasing severity of ADHD symptoms (Surman et al., 2013). Although there is a lack of research in non-clinical samples, research has explored the potential relationship between emotion regulation, depression and ADHD traits in youth samples with two clinical and one non-clinical study being identified (Anastopoulos et al., 2011; Seymour et al., 2012, 2014). Seymour et al. (2012) used cross-sectional data to examine emotion regulation as a mediator between depression symptoms and clinical depression, using both youth self-report and parent ratings of depression and emotion regulation. They found that emotion regulation mediated the relationship between ADHD and depression symptoms. However, they found that youth self-report of emotion regulation using the difficulties in emotion regulation scale did not mediate the relationship between depression and ADHD whilst parent reported

emotion regulation did. Furthermore, Anastopoulos et al., (2011) found that ADHD youths demonstrated high levels of emotional lability compared to their neurotypical siblings, and emotional lability mediated the relationship between ADHD and depression symptoms. Similar findings were also found in a non-clinical sample of children displaying ADHD traits (Seymour et al., 2014). Using a longitudinal study with three annual assessments to examine the relationship between ADHD traits, depression symptoms and emotion regulation, Seymour et al. (2014) concluded that the development of ADHD traits may lead to greater difficulties in emotion regulation resulting in greater levels of depression at the three year follow up assessment. This further supports the importance of emotion regulation as a mediator between ADHD traits and depression in youths.

From the previous literature, it could be argued that those with non-clinical ADHD experience many of the same difficulties as those with clinical ADHD (Bodalski et al., 2019; McIntyre et al., 2010; Seymour et al., 2012, 2014). One of the most prominent difficulties is the development of depression symptoms coinciding with ADHD traits (Lundervold et al., 2016) and reported lower quality of life for adults with undiagnosed ADHD (Able et al., 2007), with females, in particular, experiencing the worst outcomes with higher reported rates of antisocial personality disorder, drug or alcohol dependency and high rates of depression (Pinkhardt et al., 2009). However, research exploring potential underlying mechanisms between depression and ADHD traits in adults have not yet been conducted. Therefore, the aim of the present study is to expand the current literature on ADHD traits and depression symptoms and explore potential mediators of this relationship. This study used self-report scales to measure ADHD traits, depression symptoms, empathy and emotion regulation in an opportunity sample of healthy adults. It then conducted a correlation matrix and regression with depression symptoms as the criterion to identify intercorrelations between variables and their relationship with depression score.

A mediation analysis was then conducted to further explore the relationship between depression symptoms and ADHD traits and emotion regulation. To meet the aim of the study, two objectives were developed. First, the study would examine if there is a relationship between ADHD traits, emotion regulation, empathy and depression. The second objective is to explore if emotion regulation mediated the relationship between depression symptoms and ADHD traits.

METHOD

Design

The current research uses a cross-sectional, correlational design. A multiple regression was conducted with age, gender, ADHD traits, emotion regulation and empathy quotient scores as the predictor variables and depression symptom scores as the criterion variable. A mediation analysis was conducted to ascertain if emotion regulation mediated the relationship between ADHD traits and depression symptoms.

Participants

A prospective power analysis was conducted to determine the necessary number of participants needed for a medium effect size with the alpha set to .5 and a power of .8. According to Cohen (1988) a sample of 120 participants would be appropriate for a multiple regression with seven predictor variables. Before participants were recruited, the study gained ethical approval from the Staffordshire University ethics committee. A total of 41 participants were recruited using opportunity sampling. Four males and 37 females were recruited with ages ranging from 18 to 59 years (mean = 28, SD = 11.6).

Materials

An advert (Appendix A) was produced to advertise the study to potential participants. The materials presented to participants during the study consisted of an information sheet (Appendix B), consent form (Appendix C), and debrief sheet (Appendix D1).

The study used four previously validated and reliable self-report questionnaires (outlined below).

Attention Deficit Hyperactivity Disorder Traits

The Adult ADHD Self-report Scale (ASRS) (Appendix E) was constructed by Adler, Spencer, Faraone, Kessler, Howes, Biederman and Secnik (2006) who also assessed it for reliability and validity. The scale measures ADHD traits using 18 items based on the DSM-IV criteria of ADHD with a total score of 90, although it is not a standalone diagnostic measure. Participants select a response from a score of 0-4 (Never, Rarely, Sometimes, Often, Very Often). It can also be analysed using the subscales for Inattention which consists of nine items, such as “How often do you make careless mistakes when you have to work on a boring or difficult project?” and Hyperactivity-impulsivity which also consists of nine items, such as “How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?” (Lundervold et al., 2016). For the purpose of this study, the scale was scored by adding all the responses together, with a higher score interpreted as a greater presence of ADHD symptoms.

Emotion Regulation

The Difficulties in Emotion Regulation Scale (DERS) (appendix F) was contrasted by Gratz and Roemer (2004) and has been assessed for reliability and validity. It was designed to assess multiple elements of emotion dysregulation. The DERS contains 36 items with a total score of 180 and participants select a response of 1-5 (Almost never, Sometimes,

About half the time, Most of the time, Almost always). A higher score of the scale suggests greater difficulties in emotion regulation and can be used as a total score by reverse coding the appropriate items and adding the scores together or can be broken down into six subscales with an individual score per subscale. The example questions from the six subscales are as follows: Non-acceptance “When I’m upset, I feel guilty for feeling that way”; Goals “When I’m upset, I have difficulty getting work done”; Impulse “When I’m upset, I have difficulty controlling my behaviours”; Aware “I pay attention to how I feel (reverse)”; Strategies “When I’m upset, I believe that wallowing in it is all I can do”; and Clarity “I have no idea how I am feeling”. For the purpose of this study, the overall score was used.

Depression Symptoms

Centre for Epidemiologic Studies Depression Scale (CES-D) (appendix G) was constructed by Radloff (1977) to measure depression symptoms in non-clinical sample and has been tested for reliability and validity (Hann, Winter, & Jacobsen, 1999). It includes 20 items with a maximum score of 60 and participants select a response from: Rarely (Less than a day), Sometimes (1-2 days), Occasionally (3-4 days) and Most of the time (5-7 days). The score is the sum of the 20 questions including reverse scoring four of the questions. A higher score suggests greater depressive symptomology. It includes items such as “My sleep was restless”. It has no subscales.

Empathy

The Empathy Quotient (EQ) (appendix H) was constructed by Baron-Cohen and Wheelwright (2004)and was designed to measure empathy in adults and has been tested for reliability and validity. It contains 40 empathy questions and 20 filler questions with a maximum score of 80 and is scored by the sum of all items. Participants select a response

from Strongly agree, Slightly agree, Slightly disagree and Strongly disagree and responses are scored either 2, 1 or 0. A higher score represents higher levels of empathy. It includes empathy items, such as; “I tend to get emotionally involved with a friend's problems”.

Procedure

Participants were recruited using SONA for internal university students, or via adverts on social media which included an email address using an opportunity sampling method. When participants either responded to the advert or accessed it through SONA, they were provided a link to the study which was housed on Qualtrics survey software. Participants were first shown an information sheet which explained that they would be required to fill out four questionnaires as part of a university student’s final year psychology project. The information sheet explained the purpose of the study, the exclusion criteria, where the study would take place, explained that due to complete anonymity being used within data collection participants would be unable to withdraw after they had submitted their responses, and included some examples of questions they may be asked to allow to them to make an informed decision if they wanted to take part. Participants were then shown a consent form which they were required to sign before they could continue with the study. Participants were then asked to provide demographic information including their age and gender at birth. Once demographic information had been completed, participants completed the four questionnaires in order of DERS, CES-D depression inventory, EQ and finally ASRS. At the bottom of each page participants were given the option to withdraw using a question asking if the participant would like to exit the study and go to the debrief. Once the participant had completed all the questionnaires, they were shown the debrief which provided participants with further details of the current study, contact numbers for support organisations, and requested that participants who were happy to submit their answers to the study clicked submit otherwise their responses would not be saved. Once

participants submitted their answers, they were thanked for their time. Participants had 45 minutes to complete the study and students who were entitled to SONA credits were given 3 credits. Participants who chose to withdraw during the study where taken straight to the debrief form but had modifications which removed the request to select submit and explained their answers would not be saved or stored (Appendix D2).

Ethical Considerations

Due to the sensitive nature of the questions included in the questionnaires, an additional question was added on the debrief form asking participants “I am happy to submit my answers” with an option to select “submit”. Any participants who did not submit had their data automatically deleted and was not able to be viewed by the researcher. Due to the sensitive nature of the question’s participants would be asked to answer, some additional modifications were included in the study. Firstly, participants with any history of mental illness were excluded from participation due to the potential risk of the questions causing elevated levels of distress due to previous history. Secondly, every page of the study included an additional question at the bottom asking, “Would you like to exit the study and go to the debrief?” followed by a “yes/no” option. This allowed participants to leave the study at any time but still access the debrief form which closing the study otherwise would not allow. Any participant who chose to leave the study prior to completion was taken to a modified debrief form without the option to submit which explained that their answers to that point would be deleted. All uncompleted data was automatically deleted without the researcher having access. All debrief forms included numbers for local and national help lines, advised to contact general practitioner or the university as a student, for support if required.

RESULTS

Analysis Plan

Analysis for this current research followed the Clark-Carter (2019) methodology for conducting a multiple regression. The analysis includes data screening and assumption checks such as sensible values, outliers, distribution of variables and linearity of relationship between predictor and outcome variables. A sequential regression was conducted and the following assumptions where checked afterwards: leverage and influence; multicollinearity and residual plots. Missing data analysis was not conducted as no missing data was present. Sensitivity analysis was conducted including the male participants and removing Cook's outlier. Mediation Analysis was then conducted following (Hayes, 2020) guidance on Mediation using the PROCESS SPSS plug in.

Data Screening

The data was checked for sensible values and outliers. Sensible data analysis showed the data contained sensible values and no missing data across any of the variables. The data was checked for outliers. The outliers identified were within the sex variable (Appendix I) and were the four male participants present in the study and thus left a female only participant sample. They were removed and used in later sensitivity analysis. Scatter graphs of the criterion variables against each predictor variable and between each pair of predictor variables were conducted, checked for curvilinearity and displayed no curvilinear relationship. A Bivariate correlation matrix was conducted to give a preliminary check for multicollinearity prior to conducting the multiple regression. All the predictor variables displayed a correlation value under .8 suggesting multicollinearity would not be an issue. The correlation matrix (Table 1) displayed a significant positive correlation between the criterion variable CES-D score and predictor variables ASRS scores and CES-D and DERS. Interestingly, ASRS scores also correlated significantly with DERS scores.

Table 1

Results of correlation matrix including age, ADHD traits, emotion regulation, empathy and depression symptoms

	1	2	3	4	5
1 Age	a.				
2 ADHD traits	-.030	a.			
3 Depressive symptoms	-.345*	.555*	a.		
4 Emotion regulation	-.245	.713**	.826**	a.	
5 Empathy	-.010	-.228	-.205	-.168	a.

*Note. *. Correlation is significant at the 0.05 level (2-tailed)*

***. Correlation is significant at the 0.01 level (2-tailed)*

Multiple Regression

In total 37 females were included in the analysis with a mean age of 29.59 years (SD = 11.91). The means and standard deviations for the participants scores across all the variables can be found in table 2.

Table 2

The mean and standard deviation for the descriptives of participants for all variables

	Mean	*Standard Deviation*
Age	28.68	11.650
Depression symptoms	45.12	14.58
ADHD traits	50.34	12.54
Emotion regulation	99.39	27.24
Empathy Quotient	45.68	13.83

A multiple sequential regression (Appendix J1) was conducted to evaluate the extent that ADHD traits, difficulties in emotional regulation and empathy predicted (Appendix J2) the likelihood of experiencing depression (Table 3). The predictor variables were added into the regression in the order of age, ADHD traits, emotion regulation, and empathy.

Table 3
outcome of regression including scores for models and predictors with depression symptoms as criterion variable

Mode	Factors	*b*	β	*t*	*p*	R^2	F	*p*
1						.119	4.729	.037
	Age	-.434	-.345	-	.037			
2						.416	12.12	.000
	Age	-.413	-.329	-	.017			
	ADHD traits	.634	.545	4.160	.000			
3						.704	26.12	.000
	Age	-.186	-.148	-	.148			
	ADHD traits	-.029	-.025	-.183	.856			
	Emotion regulation	.437	.808	5.669	.000			
4						.710	19.62	.000
	Age	-.188	-.150	-	.146			
	ADHD traits	-.050	-.043	-.304	.763			
	Emotion regulation	.436	.806	5.630	.000			
	Empathy	-.090	-.081	-.827	.414			

Table 3 shows the variance each model explains and the influence of entered predictor variables on predicting depression.

In model one the predictor (age) explained 11.9% of the variance in depression symptoms (R2 = .119, $F_{(1,35)}$ = 4.729, p = .037) and Age was a significant predictor (β = -.345, p = .0379).

In model two, adding ADHD traits significantly increased R2 by 0.297 and explained 41.6% of the variance in depression symptoms (R2 = .416, $F_{(2,34)} = 12.120$, $p < .0001$) and in this model age (β = -.329, p = .017) and ASRS score (β = .545, p < .0001) were significant predictors.

Model three shows that emotion regulation score significantly increases R2 by .288 and explained 70.4% of the variance in depression symptoms (R2 = .704, $F_{(3,33)} = 26.191$, $p < .0001$). Emotion regulation (β = .808, p <.0001) was a significant predictor in this model.

In model four, adding Empathy increased R2 by .006 and this model explained 71% of the variance in depression symptoms (R2 = .710, $F_{(4,32)} = 19.627$, $p < .0001$). Emotion regulation (β = .806, p <.0001) significantly predicted depression symptoms whereas age (β = -.150, p = .146), ADHD traits (β = -.043, p = .763) and empathy (β = -.081, p = .414) did not significantly predict depression scores.

Assumption Checks

Multicollinearity was checked for using tolerance and variance inflation factor (VIF), and multicollinearity was within the acceptable values of above .10 for tolerance and below 10 for VIF (Appendix J2). When checking standardised residuals for outliers, both the highest (2.134) and lowest (-2.034) values were within the +/- tolerance (Appendix K). Residual plots were checked for distribution, relationship between residuals and predicted values, and leverage and influence. Checking for distribution using residual plots displayed normal distribution (Appendix L1). A scatter graph of the regression standardised residuals and regression standardised predicted values plotted displayed homoscedasticity and no curvilinearity and the plots displayed no obvious pattern (Appendix L2). Leverage and influence were assessed by plotting Cook's distance against leverage. The scatter graph displayed one participant with an outlier Cook's distance value (Appendix M).

Model validation (Appendix N) was conducted by calculating predicted residual sum of squares (R^2_{PRESS} = .633). Therefore, suggesting that although the predictor variables were a good predictor of depression scores, the regression may have overestimated the amount of variance explained.

Sensitivity Analysis

Sensitivity analysis was conducted including the male participants removed as outliers during data screening and concluded in a decrease in variance (R2 = .706, $F_{(5,35)}$ = 16.820, p < .0001) and no change in significance of predictor variables (Appendix O1). When running sensitivity analysis, removing the Cook's outlier participant an increase in variance was observed (R2 = .712, $F_{(4,31)}$ = 19.114, p < .0001) and no change in significance of predictor variables (Appendix O2). Therefore, from the sensitivity analysis it can be concluded the findings of the regression were robust as neither of the changes to the data impacted on significance of predictors, with the inclusion of the four male participants reducing total variance explained by .004% and the exclusion of Cook's outlier raising the total variance explained by .002%.

Mediation Analysis

Mediation analysis was conducted using PROCESS plugin for SPSS and used the indirect effect method. To investigate if behavioural traits impact reported depression scores, an indirect effect analysis was performed using PROCESS plugin for SPSS. The outcome variable for the analysis was depression symptoms. The predictor variable for the analysis was ADHD traits and the mediator variable for the analysis was emotion regulation. Age and empathy where omitted from the analysis.

Results indicated that ADHD traits were a significant predictor of emotion regulation (β = 1.53, $F_{(1,35)} = 36.224$, $p < .0001$) (Appendix P1), and that emotion regulation score were a significant predictor of depressive symptoms (β = .473, $F_{(2,34)} = 36.898$, $p < .0001$) (Appendix P1). These results support the mediational hypothesis. ADHD traits was no longer a significant predictor of depression symptoms after controlling for the mediator, emotion regulation, (β = -.0801, p = .619) (Appendix P1), consistent with the assumptions of mediation. Approximately 68.46% of the variance in depression symptoms was accounted for by the predictors (R2 = .6846). The indirect effect was tested using a percentile bootstrap estimation approach with 5000 samples, implemented with the PROCESS macro Version 3.4 (Hayes, 2020). These results show the indirect effect of ADHD traits on depression symptoms through emotion regulation score was significant (β = .6241, SE = .1702, 95% CI = .4702, 1.1565) (Appendix P2). Inference of significance was gained using bootstrapping method as outlined in Hayes and Rockwood (2017).

DISCUSSION

The present study aimed to expand current literature on ADHD traits and depression symptoms in a non-clinical community sample of adults and hypothesised that a relationship would exist between ADHD traits, depression symptoms and emotion regulation. To the best of the researcher's knowledge, no studies have been conducted which considered the relationship between empathy, emotion regulation, depression and subclinical ADHD or explored potential mediators between subclinical ADHD and depression symptoms in a non-clinical community sample of adults and previous research has focused on childhood studies.

To test this hypothesis, the study contained two objectives. The first objective was to examine if there was a relationship between ADHD traits, emotion regulation, empathy and

depression in a non-clinical community sample of adults using a sequential multiple regression. In the current literature, children and youth studies have suggested a positive relationship would exist between depressive symptoms, ADHD traits, emotion regulation (Lundervold, Hinshaw, Sørensen, & Posserud, 2016; Seymour, Chronis-Tuscano, Iwamoto, Kurdziel, & MacPherson, 2014) and empathy (Groen, den Heijer, Fuermaier, Althaus, & Tucha, 2018; Schreiter, Pijnenborg, & Aan Het Rot, 2013) The second objective of the present study was to explore if emotion regulation mediated the relationship between depression symptoms and ADHD traits. This relationship was explored as the preliminary correlation matrix displayed a significant relationship between ADHD traits, depression symptoms and emotion regulation, prior to conducting the regression. Preliminary checks confirmed that ADHD traits were a significant predictor of emotion regulation was a significant predictor of depression symptoms. ADHD traits were a significant predictor of depression symptoms prior to the inclusion of emotion regulation, thus meeting the criteria to perform a mediation analysis of indirect effect.

The present study yielded several important findings. The regression analysis revealed deficit emotion regulation contributed to and predicted the occurrence of depression symptoms. Contrary to expectations, ADHD traits did not contribute to the depression symptoms of the participants once emotion regulation was included, although this could be explained by the correlation identified between emotion regulation and ADHD traits prior to conducting the regression. This suggests that although multicollinearity was not statistically outside the acceptable values, it may have resulted in the predicted values being unstable. Therefore, mediation analysis was conducted to explore the intercorrelation between depression symptoms, ADHD traits and emotion regulation. The results of the mediation analysis confirmed the present study's hypothesis; that a relationship between ADHD traits, depressive traits, and emotion regulation exists.

However, it evidenced that the nature of the relationship is more complex than first assumed, with the relationship between ADHD traits and depression symptoms being mediated through the indirect effect of emotion regulation. This suggests that within adults, as found in previous youth studies (Seymour et al., 2012, 2014), emotion regulation presents as an important mechanism in the relationship between ADHD traits and depressive symptoms. The present study found that in adults displaying high levels of ADHD traits subsequently displayed high levels of depression symptoms and deficits in emotion regulation, but that the relationship between depression symptoms and ADHD traits only occurred in the presence of deficit emotion regulation.

Overall, the most significant finding of this study was the novel finding that emotion regulation mediated the relationship between depression symptoms and ADHD traits in a non-clinical sample of adults, suggesting the findings of previous youth studies may be applicable to adult populations and paving the way for future research to further explore the nature and the mechanisms of this relationship.

The relationship between depression symptoms and emotion regulation has been well reported in previous literature (Garber, Braafladt, & Weiss, 1995; Gotlib & Joormann, 2010; Joormann & Stanton, 2016). The unsuccessful use of emotion regulation strategies, such as using less distraction and problem-focused strategies and depending on avoidant, aggressive and passive strategies, has been associated with high levels of reported depression in youth (Garber, Braafladt, & Weiss, 1995). This finding is also present in adults, according to Gotlib and Joormann (2010) who acknowledge the importance of the successful use and implementation of regulation strategies to be able to overcome the negative affect associated with depression. The importance of emotion regulation has been highlighted in the present study when conducting a regression with depression

symptoms as the criterion variable as both ADHD traits and empathy did not display a significant relationship with depression once emotion regulation was included in the analysis.

The loss of significance of ADHD traits was contrary to previous research which found a strong correlating relationship between depression, ADHD traits (Lundervold et al., 2016) and emotion regulation (Seymour et al., 2014), although it may be explained by differences in methodology. Lundervold et al. (2016) explored the impact of co-occurring ADHD symptoms on a depressed sample of youths and found that for each severe symptom of ADHD reported the severity of reported depression increased , although their analysis broke down ADHD traits into the subscales of inattention and hyperactivity/impulsivity and compared depression severity against individual ADHD traits. Due to the present study only considering ADHD traits as a combined score across the whole scale, and not running analysis on individual scale items, this may explain the non-significant finding in the present study. The research by Lundervold et al (2016) also did not consider the impact or control for deficits in emotion regulation which could have potentially caused the study to yield similar results to the present study.

When considering the differences between the findings of the present study and Lundervold et al. (2016), it could be concluded that emotion regulation mediated the relationship between depression and ADHD traits as found in previous research by Seymour et al., (2014) and therefore a direct relationship was not able to be detected. Therefore, the present study explored the indirect effect of emotion regulation as an underlying mechanism on the relationship between depression symptoms and ADHD traits further. Empathy was not included in any further analysis as it displayed no significance or intercorrelation with the other variables. This result was not surprising due to previous

research into depression and empathy highlighting deficit empathy as being the result of depressive symptoms and the mediator between depression and further difficulties, in areas such as social functioning, rather than empathy itself being a predictor or a factor in the etiology of depression (Schreiter, Pijnenborg, & Aan Het Rot, 2013).

Currently research studies which look at the relationship between ADHD and depression in children and/or youths who do not meet the diagnosable thresholds or have not previously sought a diagnosis are very limited (Lundervold et al., 2016; Seymour et al., 2014). There is even less research which has considered emotion regulation as the mediator between ADHD and depression (Anastopoulos et al., 2011; Seymour et al., 2012, 2014), and none within non-clinical adult populations to the researchers knowledge. However, previous literature suggests that individuals with both non-clinical and clinical ADHD displayed a higher risk of developing depression, with poorer long-term outcomes than when diagnosed with either disorder alone (Bron et al., 2016).

The findings that emotion regulation acts as a underlying mechanism between depression symptoms and ADHD traits reflects previous findings in cross-sectional youth studies (Anastopoulos et al., 2011; Seymour et al., 2012) which have also been further confirmed in longitudinal non-clinical youth studies (Seymour et al., 2014). The results also reflect previous findings within clinical samples that adults with ADHD display difficulties in emotion regulation (Bodalski et al., 2019; Martel, 2009) and have a greater risk of experiencing depression and low mood (Bond et al., 2012; McIntyre et al., 2010). Therefore, the results suggest that adults with subclinical levels of ADHD or without diagnosis display difficulties with depression and emotion regulation similar to a clinical population with ADHD (Seymour et al., 2012). This study has sought to extend previous literature by examining the relationship between depression and ADHD traits in a non-

clinical sample of adults and has sought to identify an indirect effect of emotion regulation using previous youth studies to inform its process.

The present study has several limitations which must be addressed. This data should be interpreted with caution due to the use of mediation analysis with a cross sectional design. Maxwell, Cole, and Mitchell (2011) argue that mediation analysis provide the best inference when conducted using longitudinal data as mediation consists of causal processes which develop over time. This argument against the use of cross-sectional data is rebuffed, however, by Hayes (2017) the author of the process plugin used to conduct the mediation analysis who takes the approach that it is the responsibility of the researcher to view all data with caution and common sense, but rebukes the concept that mediation analysis should not be conducted on cross-sectional data. However, Hayes (2017) does acknowledge that some caution needs to be taken not to overstate inference of the causality of the results. Due to the cross-sectional nature of the study it is also impossible to further explore the nature of the relationship between depression symptoms, ADHD traits, and emotion regulation and ascertain which occurred first and limiting any examination of a potential causal relationship. A second issue identified with the design of the study was the small sample size. This may also present issues with regression and mediation analysis as it is possible that due to a limited sample size there was insufficient power to detect a significant direct effect of ADHD traits on depression symptoms, and it may also present an inflated indirect effect (Hayes & Rockwood, 2017). Therefore, indirect effect using bootstrapping was utilised to minimise any adverse effect on the mediation analysis. Although steps were taken to limit the impact of a small sample on the analysis it is still preferable that replication with a larger sample size is conducted to ensure the results are consistent, as no previous studies on non-clinical adults exist to compare.

The studies reliance on a single self-report measure of emotion regulation is also a limitation. Emotion regulation is a complex neurobiological construct and although self-report scales acknowledge the subjective nature of emotion regulation, self-report scales are unable to measure and provide information on the more specific processes and allow examination of neural and biological factors (Bunford, Evans, & Wymbs, 2015). Therefore, the study would have benefitted from utilising multi-modal measures of emotion regulation such as physiological measures and behavioural tasks, which would have been able to capture its multifaceted nature and provide a greater insight into the influence of emotion regulation on adults experiencing ADHD traits and depression symptoms (Bunford et al., 2015). Secondly, emotion regulation rating scales typically rely on the assumption that all items have are equivalent within its relevance of emotion regulation which may not result in accurate representation of the phenomenological experience of emotion regulation (Bunford et al., 2015). Finally, a limitation with the use of the difficulties in emotion regulation scale (Gratz & Roemer, 2004) is that it is not appropriate for assessing the dysregulation of positive emotions, or able to differentiate between the effects of different emotions. In particular, the difficulties in emotion regulation scale is focused on negative emotion with a majority of its items beginning with “When I am distressed” or “When I am upset” (Bunford et al., 2015).

These findings may be further limited by a lack of controls for commonly reported comorbidities, such as oppositional defiant disorder (Seymour & Miller, 2017). Previously literature has acknowledged the common comorbidity between ADHD and oppositional defiant disorder and has theorised that it may present a potential explanation of the emotion regulation difficulties often reported (Murphy & Barkley, 1996). However, more recent studies exploring emotion regulation as a mediator between depression and ADHD in youth have found that even when oppositional defiant disorder is included as a covariate

within mediation analysis, emotion regulation still fully mediated the relationship between depression and ADHD (Seymour et al., 2012; Seymour & Miller, 2017). These findings were also present when the relationship was explored in a non-clinical community sample of youth (Seymour et al., 2014).

Despite the limitations, this study presents significant implications for further research. Firstly, this study provides evidence that difficulties in emotion regulation and occurrence of depressive symptoms prevalent in clinical ADHD samples may also occur within a subclinical or community sample. Previous studies (Hirsch et al., 2018; Shaw, Stringaris, Nigg, & Leibenluft, 2014) have identified emotion regulation occurs in 34-70% of adults with an official diagnosis of ADHD. The findings of the present study suggest that this prevalence may also occur within non-clinical samples displaying ADHD traits. This is further supported by Lundervold, Hinshaw, Sørensen, and Posserud (2016) who found that as the number of clinically relevant traits of ADHD in a community sample increased, so did the reported severity of depression. This suggests that it may be beneficial when providing therapeutic assessment and intervention for persistent depressive symptoms to test for ADHD traits and emotion regulation difficulties, but further research would be needed in adult populations to confirm the findings. A second implication of this study also further highlights the increased importance of considering the possibility of ADHD traits and emotion regulation difficulties when working with female populations. Female samples with clinical ADHD are well reported to experience higher comorbidities of depression (Panevska, ZafirovaIvanovska, Vasilevska, Isjanovska, & Kadri, 2015) and display more impairment and greater difficulties with emotion regulation in comparison to males (Robison et al., 2008). However, research by Murray et al. (2019) identified that women are underrepresented in ADHD diagnosis due to the differing presentation of symptoms, such as symptoms presenting later in adolescence, displaying less challenging

behaviours, resulting in them being excluded due to the rigidity of the diagnostic criteria. This was further supported by Katzman, Bilkey, Chokka, Fallu, and Klassen (2017) who agreed that ADHD in females goes largely unrecognised. Therefore, further study on the presentation and prevalence of ADHD symptoms across the lifespan of females is recommended. Thirdly, due to the insight this study provides into the potential underlying mechanism of emotion regulation as an explanation of the comorbidity of ADHD traits and depression symptoms, further research into which of the individual facets of emotion regulation contribute to the relationship between depression and ADHD in both clinical and non-clinical populations. Current research exploring which of the facets of emotion regulation mediate the relationship between depression and ADHD in children focuses on frustration tolerance (Seymour, Macatee, & Chronis-Tuscano, 2019; Seymour & Miller, 2017), but research exploring this same relationship in adults would be beneficial to increasing understanding of the comorbid relationship between depression and ADHD and the role of emotion regulation. The final implication of note is that the present study adds support to Heidbreder's (2015) motion of ADHD being assessed using a dimensional or spectrum approach rather than categorical. This approach is supported by the evidence that deficits in functioning and difficulties that occur within clinical samples of ADHD are also present within non-clinical samples. This finding suggests that the difficulties associated with ADHD occur within a spectrum of impairment rather than either being present or absent (Heidbreder, 2015).

In conclusion, the results of the present study advance the understanding of adults with ADHD traits within the current literature, presenting a finding which may help explain the relationship between depression and ADHD within non-clinical samples. It was identified that although ADHD traits were not a predictor for depression when emotion regulation was included as a variable, this finding was explained by the fact emotion regulation

mediated the relationship between depression symptoms and ADHD traits. Investigating this relationship between depression and ADHD through emotion regulation may help to increase understanding and present potential directions for further research.

Report Word Count (max 7000/8000): 7379

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APPENDICES

Appendix A – advert produced to advertise for participants online using social media

Appendix B – Information sheet provided to participants prior to their participation in the study. It included all the relevant information required for participants to give informed consent to take part.

Information Sheet

Who is doing this research?

The research will be conducted by Catherine Sheen , a 3rd year Psychology Student at Staffordshire University.

What is the research about?

I am conducting a study looking at how certain behavioural traits impact depression symptoms, empathy and emotional regulation.

Why am I being invited to participate?

I am asking people over the age 18 years to take part in my research. Unfortunately due to the nature of the research being conducted anyone with a official diagnosis of a mental health condition or disorder will be unable to participate. Examples of conditions include but are not limited to: depression, ADHD, autism spectrum disorder, schizophrenia.

What is required of me?

I am asking you to take part in a study lasting approximately 60 minutes. This will involve being asked your age and gender and then asked to complete a series of questions. *The questions you are asked may include:*

- *I felt that everything I did was an effort.*
- *I tend to get emotionally involved with a friend's problems.*
- *How often do you make careless mistakes when you have to work on a boring or difficult project?*
- *When I'm upset, I feel ashamed with myself for feeling that way*

Where will the study/experiment take place?

This is a online study hosted on Qualtrics. Therefore you will be able to take part in the study at any time and a location of your convenience. You will need to complete the study in one sitting and it is recommended you chose a time and place you will not be disturbed.

What if I want to drop out?

If you wish to drop out at any stage during the study, please click on the 'exit' button available on every page of the study. It is not recommended you close your browser as we will be unable to debrief you. Due to the anonymous nature of the study the researchers will be unable to identify your data. Therefore please note that you are free to withdraw at any point during the study but it is not possible to withdraw your data after completing the study due to no identifying information being recorded.

Will the information I give you be kept confidential?

The information obtained will be treated with the strictest confidence throughout the study and the data will be stored safely in a secure location to which only the researcher has access.

What if I don't want to answer any particular questions?

If you do not wish to answer any of the questions that are included in the study, you are free to do so, without penalty.

What if I am upset by anything during the course of the study?

If this happens, you might like to take a break, or if you prefer, you can decide to end your participation and withdraw from the study at that point by pressing 'exit'. If you decide to withdraw by pressing 'exit' you will be provided with a copy of the debrief sheet.

Who will have access to my data?

Only the researcher and the researcher's supervisor will have access to the raw data.

Who will see the finished report?

All data in the finished report will be presented in the form of group statistics. The final report will be seen by the researcher's supervisor and a second marker from the Psychology department, and possibly by an external examiner. In addition, the completed report may also be made available to future Staffordshire University students for teaching/reference purposes.You will not be identifiable from the write up of the studies results or the summery of statistics.

What will happen to my responses to the study?

All data will be kept in secure storage (to which only the researcher has access) for ten years, according to departmental policy, and it will be destroyed after that.

Who has given approval for this study?

Approval for this study has been granted by Staffordshire University, Division of Psychology, Sport and Exercise, Ethics Committee.

Is there anyone I can talk to about the study before I take part?

If you wish to talk to someone else about my study before taking part then please feel free to contact my project supervisor:

Supervisor contact details: Dr Justine Drakeford, Email: J.Drakeford@staffs.ac.uk

I know a friend who may be interested; can s/he participate in your study?

Yes, as long as your friend meets the criteria mentioned above. Your friend should contact me directly to discuss the study and make arrangements for an interview. My contact details are given below.

If you have any further questions, please do not hesitate to contact me.

Thank you for your time and if you decide you would like to participate in my study please contact me. My contact details are as follows:

Catherine Sheen
c.sheen@student.staffs.ac.uk

Appendix C – Participants were required to give informed written consent prior to participating in the study

ELECTRONIC CONSENT FORM

I am over 18 years of age and I voluntarily agree to participate in a research project conducted by YOUR NAME, a 3rd year Psychology student at Staffordshire University.	Yes /No
I have read the information sheet and understand that this research is being conducted as part of a psychology undergraduate's third year project.	Yes/No
I understand that I am being asked to participate in a study lasting approx. 60 minutes and I will be asked to fill in 4 separate questionnaires.	Yes/No
I understand that I may withdraw from participating without penalty if I so wish and my data will be destroyed. I have been informed that withdrawal after completing the study will not be possible	Yes/No
I understand I will be fully protected in accordance with the Data Protection Act of 2018, and in compliance with the British Psychological Society ethical guidelines, and that my data will be kept confidential and anonymous until they are securely destroyed.	Yes/No
I understand that any personal details will be anonymised in any report based on this study. I agree that any of the data I provide may be used in the researcher's report and possibly used for publication in academic journals.	Yes/No
I understand that in the case that the data are used for publication, they will be kept until ten years after the article has been published, and then destroyed.	Yes/No

If you have any further questions about this study please contact the researcher or the Project Supervisor before proceeding:

Researcher:

Catherine Sheen

c.sheen@student.staffs.ac.uk

Supervisor:

Justine Drakeford

j.drakeford@staffs.ac.uk

Appendix D – All participants were shown a debrief sheet on either completion or withdrawal from the study

Appendix D1 – Debrief shown to participants who complete the study

If you are happy to submit your answers please select submit at the bottom of this page

Participant Debrief

Project Title:
Is there a relationship between emotional regulation, empathy and depression in healthy individuals reporting ADHD Traits?

Researchers Name:
Catherine Sheen

Researchers Email:
c.sheen@student.staffs.ac.uk

Thank you for taking part in this study. The purpose of this study was to find out if there is a relationship between low and high ADHD traits, depression symptoms, emotional regulation and empathy in healthy individuals. The hypothesis for this study is that the more ADHD traits an individual present, the greater the difficulties in regulating emotions and empathy will be. It is therefore hypothesised that individuals reporting greater difficulties in regulating emotions and empathy will report more depression symptoms.

For more detailed explanations, or if you wish to know the results of the study, please contact the researcher using the contact details below. Please be reminded that individual results are not able to be provided for any element of this study.

Your details will always be kept confidential, and complete anonymity will be maintained. Raw data will be kept on password-protected computer, which will only be accessible to myself and my supervisor. Raw data will be destroyed after ten years. In the case of the data being used for academic publication, materials may be kept until ten years have passed from the date of publication.

If you are happy for your responses to be used in the study please select the submit button before closing the window, otherwise if you wish to withdraw your responses please close the window without submitting your answers.

If you have been affected by some of the issues raised in this study, and would like to talk to someone in confidence about it, you may wish to contact the following organisation(s):

- *Staffordshire Mental Health Help Line: 0808 800 2234*
- *North Staffs Mind: 01782 262100*
- *The Samaritans 116 123*
- *For students at Staffordshire university the student wellbeing team can be contact on: 01782 294976*
- *Your General Practitioner (GP)*

Thank you again for your participation.

Researcher's contact details:
Catherine Sheen
c.sheen@student.staffs.ac.uk

Supervisor's contact details
Dr Justine Drakeford
j.drakeford@staffs.ac.uk

I am happy to submit my answers

○ Submit

Appendix D2 – modified Debrief form for participants who chose to withdraw during the study

Pariticpant Debrief

Project Title: Is there a relationship between emotional regulation, empathy and depression in healthy individuals scoring high and low for ADHD Traits?

Researchers Name: Catherine Sheen

Researchers Email: c.sheen@student.staffs.ac.uk

Thank you for taking part in this study. The purpose of this study was to find out if there is a relationship between low and high ADHD traits, depression symptoms, emotional regulation and empathy in healthy individuals . The hypothesis for this study was to find out if there was to find out if there is a difference in reported depression symptoms, empathy and emotional regulation depending on the amount of ADHD like traits reported.

For more detailed explanations, or if you wish to know the results of the study, please contact the researcher using the contact details below.

Your details will be kept confidential at all times, and complete anonymity will be maintained. Raw data will be kept on password-protected computer, which will only be accessible to me and my supervisor. Raw data will be destroyed after ten years. In the case of the data being used for academic publication, materials may be kept until ten years have passed from the date of publication.

If you have been affected by some of the issues raised in this study, and would like to talk to someone in confidence about it, you may wish to contact the following organisation(s):

- *Staffordshire Mental Health Help Line: 0808 800 2234*
- *North Staffs Mind: 01782 262100*
- *The Samaritans 116 123*
- *For students at Staffordshire university the student wellbeing team can be contact on:* 01782 294976

Thank you again for your participation.

Researcher's contact details:

Catherine Sheen

c.sheen@staffs.ac.uk

Supervisor's contact details

Justine Drakeford

j.drakeford@staffs.ac.uk

Appendix E – The Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist

Items 1- 4 and 7 – 11 measure Inattentive traits and 6 – 7 and 12 – 18 measure hyperactive-impulsive traits.

	Never	Rarely	Something	Often	Very Often
How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?	○	○	○	○	○
How often do you have difficulty getting things in order when you have to do a task that requires organisation?	○	○	○	○	○
How often do you have problems remembering appointments or obligations?	○	○	○	○	○
When you have a task that requires a lot of thought, how often do you avoid or delay getting started	○	○	○	○	○
How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?	○	○	○	○	○
How often do you feel overly active and compelled to do things, like you were driven by a motor?	○	○	○	○	○
How often do you make careless mistakes when you have to work on a boring or difficult project?	○	○	○	○	○
How often do you have difficulty keeping your attention when you are doing boring or repetitive work?	○	○	○	○	○
How often do you have difficulty concentrating on what people say to you, even when they are speaking to you directly?	○	○	○	○	○
How often do you misplace or have difficulty finding things at home or at work?	○	○	○	○	○
How often are you distracted by activity or noise around you?	○	○	○	○	○
How often do you leave your seat in meetings or other situations in which you are expected to remain seated?	○	○	○	○	○
How often do you feel restless or fidgety?	○	○	○	○	○
How often do you have difficulty unwinding and relaxing when you have time to yourself?	○	○	○	○	○
How often do you find yourself talking too much when you are in social situations?	○	○	○	○	○
When you're in a conversation, how often do you find yourself finishing the sentences of the people you are talking to, before they can finish them themselves?	○	○	○	○	○
How often do you have difficulty waiting your turn in situations when turn taking is required?	○	○	○	○	○
How often do you interrupt others when they are busy?	○	○	○	○	○

Appendix F – The Difficulties in Emotion Regulation Scale

	Almost Never	Sometimes	Half the time	Most of the time	Almost Always
I am clear about my feelings	○	○	○	○	○
I pay attention to how I feel	○	○	○	○	○
I experience my emotions as overwhelming and out of control	○	○	○	○	○
I have no idea how I am feeling	○	○	○	○	○
I have difficulty making sense out of my feelings	○	○	○	○	○
I am attentive to my feelings	○	○	○	○	○
I know exactly how I am feeling	○	○	○	○	○
I care about what I am feeling	○	○	○	○	○
I am confused about how I feel	○	○	○	○	○
When I'm upset, I acknowledge my emotions	○	○	○	○	○
When I'm upset, I become angry with myself for feeling that way	○	○	○	○	○
When I'm upset, I become embarrassed for feeling that way	○	○	○	○	○
When I'm upset, I have difficulty getting work done	○	○	○	○	○
When I'm upset, I become out of control	○	○	○	○	○
When I'm upset, I believe that I will remain that way for a long time	○	○	○	○	○
When I'm upset, I believe that I will end up feeling very depressed	○	○	○	○	○
When I'm upset, I believe that my feelings are valid and important	○	○	○	○	○
When I'm upset, I have difficulty focusing on other things	○	○	○	○	○

	Almost Never	Sometimes	Half the time	Most of the time	Almost Always
When I'm upset, I feel out of control	○	○	○	○	○
When I'm upset, I can still get things done	○	○	○	○	○
When I'm upset, I feel ashamed at myself for feeling that way	○	○	○	○	○
When I'm upset, I know that I can find a way to eventually feel better	○	○	○	○	○
When I'm upset, I feel weak	○	○	○	○	○
When I'm upset, I feel like I can remain in control of my behaviours	○	○	○	○	○
When I'm upset, I feel guilty for feeling that way	○	○	○	○	○
When I'm upset, I have difficulty concentrating	○	○	○	○	○
When I'm upset, I have difficulty controlling my behaviours	○	○	○	○	○
When I'm upset, I believe there is nothing I can do to make myself feel better	○	○	○	○	○
When I'm upset, I become irritated at myself for feeling that way	○	○	○	○	○
When I'm upset, I start to feel very bad about myself	○	○	○	○	○
When I'm upset, I believe that wallowing in it is all I can do	○	○	○	○	○
When I'm upset, I lose control of my behaviour	○	○	○	○	○
When I'm upset, I have difficulty thinking about anything else	○	○	○	○	○
When I'm upset I take time to figure out what I'm really feeling	○	○	○	○	○
When I'm upset, it takes me a long time to feel better	○	○	○	○	○
When I'm upset, my emotions feel overwhelming	○	○	○	○	○

Reverse-scored items (place a subtraction sign in front of them) are numbered 1, 2, 6, 7, 8, 10, 17, 20, 22, 24 and 34.
Calculate total score by adding everything up. Higher scores suggest greater problems with emotion regulation.
SUBSCALE SCORING:** The measure yields a total score (SUM) as well as scores on six sub-scales:

1. Nonacceptance of emotional responses (NONACCEPT): 11, 12, 21, 23, 25, 29
2. Difficulty engaging in Goal-directed behavior (GOALS): 13, 18, 20R, 26, 33
3. Impulse control difficulties (IMPULSE): 3, 14, 19, 24R, 27, 32
4. Lack of emotional awareness (AWARENESS): 2R, 6R, 8R, 10R, 17R, 34R
5. Limited access to emotion regulation strategies (STRATEGIES): 15, 16, 22R, 28, 30, 31, 35, 36
6. Lack of emotional clarity (CLARITY): 1R, 4, 5, 7R, 9

Total score: sum of all subscales

Appendix G – Centre for Epidemiologic Studies Depression Scale

	Rarely (less then a day)	Sometimes (1-2 days)	Occasionally (3-4 days)	Most of the time (5-7 days)
I was bothered by things that don't usually bother me	○	○	○	○
I did not feel like eating; my appetite was poor	○	○	○	○
I felt that I could not shake of the blues even with help from my family or friends	○	○	○	○
I felt that I was just as good as other people	○	○	○	○
I had trouble keeping my mind on what I was doing	○	○	○	○
I felt depressed	○	○	○	○
I felt that everything I did was an effort	○	○	○	○
I felt hopeful about the future	○	○	○	○
I thought my life had been a failure	○	○	○	○
I felt fearful	○	○	○	○
My sleep was restless	○	○	○	○
I was happy	○	○	○	○
I talked less then usual	○	○	○	○
I felt lonely	○	○	○	○
People were unfriendly	○	○	○	○
I enjoyed life	○	○	○	○
I had crying spells	○	○	○	○
I felt sad	○	○	○	○
I felt that people dislike me	○	○	○	○
I could not get going	○	○	○	○

Appendix H – The Empathy Quotient

	Strongly agree	Slightly Agree	Slightly Disagree	Strongly Disagree
I can easily tell if someone else wants to enter a conversation	○	○	○	○
I prefer animals to humans	○	○	○	○
I try to keep up with the current trends and fashions	○	○	○	○
I find it difficult to explain to others things that I understand easily, when they don't understand it the first time	○	○	○	○
I dream most nights	○	○	○	○
I really enjoy caring for other people	○	○	○	○
I try to solve my own problems rather than discussing them with others	○	○	○	○
I find it hard to know what to do in a social situation	○	○	○	○
I am at my best first thing in the morning	○	○	○	○
People often tell me that I went too far in driving my point home in a discussion	○	○	○	○
It doesn't bother me too much if I am late meeting a friend	○	○	○	○
Friendships and relationships are just too difficult, so I tend not to bother with them	○	○	○	○
I would never break the law, no matter how minor	○	○	○	○
I often find it difficult to judge if something is rude or polite	○	○	○	○
In a conversation, I tend to focus on my own thoughts rather than on what my listener might be thinking	○	○	○	○
I prefer practical jokes to verbal humour	○	○	○	○
I live life for today rather than the future	○	○	○	○
When I was a child, I enjoyed cutting up worms to see what would happen	○	○	○	○
I can pick up quickly if someone says one thing but means another	○	○	○	○
I tend to have very strong opinions about morality	○	○	○	○

	Strongly agree	Slightly Agree	Slightly Disagree	Strongly Disagree
It is hard for me to see why some things upset people so much	○	○	○	○
I find it easy to put myself in somebody else's shoes	○	○	○	○
I think that good manners are the most important thing a parent can teach their child	○	○	○	○
I like to do things on the spur of the moment	○	○	○	○
I am good at predicting how someone will feel	○	○	○	○
I am quick to spot when someone in a group is feeling awkward or uncomfortable	○	○	○	○
If I say something that someone else is offended by, I think that's their problem, not mine	○	○	○	○
If anyone asked me if I like their haircut, I would reply truthfully, even if I didn't like it	○	○	○	○
I can't always see why someone should have felt offended by a remark	○	○	○	○
People often tell me that I am very unpredictable	○	○	○	○
I enjoy being the centre of attention at any social gathering	○	○	○	○
Seeing people cry doesn't really upset me	○	○	○	○
I enjoy having discussions about politics	○	○	○	○
I am very blunt, which some people take to be rudeness, even though this is unintentional	○	○	○	○
I don't tend to find social situations confusing	○	○	○	○
Other people tell me I am good at understanding how they are feeling and what they are thinking	○	○	○	○
When i talk to people, I tend to talk about their experiences rather thean my own	○	○	○	○
It upsets me to see animals in pain	○	○	○	○
I am able to make decisions without being influenced by other people's feelings	○	○	○	○
I can't relax until I have done everything I had planned to do that day	○	○	○	○

	Strongly agree	Slightly Agree	Slightly Disagree	Strongly Disagree
I can easily tell if someone else is interested or bored with what I am saying	○	○	○	○
I get upset if I see people suffering on news programmes	○	○	○	○
Friends usually talk to me about their problems as they I am as they say I am very understanding	○	○	○	○
I can sense if I am intruding, even if the other person doesn't tell me	○	○	○	○
I often start new hobbies but quickly become bored with them and move on to something else	○	○	○	○
People sometimes tell me that I have gone too far with teasing	○	○	○	○
I would be too nervous to go on a big rollercoaster	○	○	○	○
Other people often say that I am insensitive, though I don't always see why	○	○	○	○
If I see a stranger in a group, I think that it is up to them to make an effort to join in	○	○	○	○
I usually stay emotionally detached when watching a film	○	○	○	○
I like to be very organised in day to day life and often make lists of the chores I have to do	○	○	○	○
I can tune into how someone else feels rapidly and intuitively	○	○	○	○
I don't like to take risks	○	○	○	○
I can easily work out what another person might want to talk about	○	○	○	○
I can tell if someone is masking their true emotions	○	○	○	○
Before making a decisions I always weigh up the pros and cons	○	○	○	○
I don't consciously work out the rules of social situations	○	○	○	○
I am good at predicting what someone will do	○	○	○	○
I tend to get emotionally involved with a friend's problems	○	○	○	○
I can usually appreciate the other person's viewpoint, even if I don't agree with it	○	○	○	○

Appendix I – Table of descriptive statistics for Zscores. This shows the max and min scores thus indicating which variables contain outliers

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Zscore: Please enter your sex at birth	41	-3.00406	.32476	.0000000	1.00000000
Zscore: Please enter your age in numbers	41	-.83115	2.60233	.0000000	1.00000000
Zscore(ASRS_SCORE)	41	-2.18083	2.52518	.0000000	1.00000000
Zscore(CESD_SCORE)	41	-1.51716	1.70618	.0000000	1.00000000
Zscore(DERS_SCORE)	41	-1.81342	1.78477	.0000000	1.00000000
Zscore(EQ_SCORE)	41	-2.07341	1.68552	.0000000	1.00000000
Valid N (listwise)	41				

Outliers were removed by using select cases > condition satisfied if > variable <3, variable ->3, variableB <3… > copy selected cases to new data set

Appendix J – Multiple Regression

Appendix J1 – ANOVA table from multiple regression results for overall models

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	960.233	1	960.233	4.729	.037[b]
	Residual	7107.497	35	203.071		
	Total	8067.730	36			
2	Regression	3357.897	2	1678.949	12.120	.000[c]
	Residual	4709.832	34	138.524		
	Total	8067.730	36			
3	Regression	5681.536	3	1893.845	26.191	.000[d]
	Residual	2386.194	33	72.309		
	Total	8067.730	36			
4	Regression	5731.505	4	1432.876	19.627	.000[e]
	Residual	2336.225	32	73.007		
	Total	8067.730	36			

a. Dependent Variable: CESD_SCORE

b. Predictors: (Constant), Please enter your age in numbers

c. Predictors: (Constant), Please enter your age in numbers, ASRS_SCORE

d. Predictors: (Constant), Please enter your age in numbers, ASRS_SCORE, DERS_SCORE

e. Predictors: (Constant), Please enter your age in numbers, ASRS_SCORE, DERS_SCORE, EQ_SCORE

Appendix J2 – Coefficient table from regression showing order variables were added, p values for individual predictors and multicollinearity results.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	57.535	6.349		9.062	.000		
	Please enter your age in numbers	-.434	.199	-.345	-2.175	.037	1.000	1.000
2	(Constant)	25.274	9.361		2.700	.011		
	Please enter your age in numbers	-.413	.165	-.329	-2.508	.017	.999	1.001
	ASRS_SCORE	.634	.152	.545	4.160	.000	.999	1.001
3	(Constant)	8.858	7.357		1.204	.237		
	Please enter your age in numbers	-.186	.126	-.148	-1.480	.148	.897	1.114
	ASRS_SCORE	-.029	.161	-.025	-.183	.856	.469	2.132
	DERS_SCORE	.437	.077	.808	5.669	.000	.441	2.266
4	(Constant)	14.228	9.838		1.446	.158		
	Please enter your age in numbers	-.188	.126	-.150	-1.490	.146	.897	1.115
	ASRS_SCORE	-.050	.163	-.043	-.304	.763	.459	2.181
	DERS_SCORE	.436	.077	.806	5.630	.000	.441	2.266
	EQ_SCORE	-.090	.109	-.081	-.827	.414	.947	1.056

a. Dependent Variable: CESD_SCORE

Appendix K – Residual statistics table checking max and min standardised residuals are within +/-3 range.

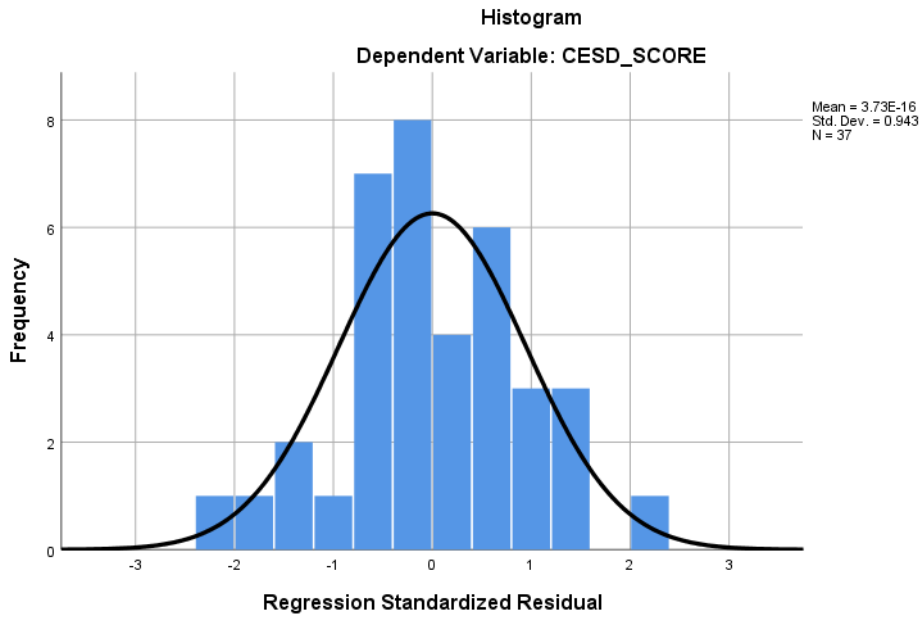
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	24.0785	66.8596	44.7027	12.61778	37
Std. Predicted Value	-1.635	1.756	.000	1.000	37
Standard Error of Predicted Value	1.800	5.514	3.036	.816	37
Adjusted Predicted Value	22.8872	67.4551	44.5960	12.59399	37
Residual	-17.38213	18.22966	.00000	8.05575	37
Std. Residual	-2.034	2.134	.000	.943	37
Stud. Residual	-2.104	2.259	.006	.999	37
Deleted Residual	-18.60118	20.43225	.10671	9.07253	37
Stud. Deleted Residual	-2.231	2.425	.007	1.027	37
Mahal. Distance	.624	14.020	3.892	2.843	37
Cook's Distance	.000	.229	.025	.042	37
Centered Leverage Value	.017	.389	.108	.079	37

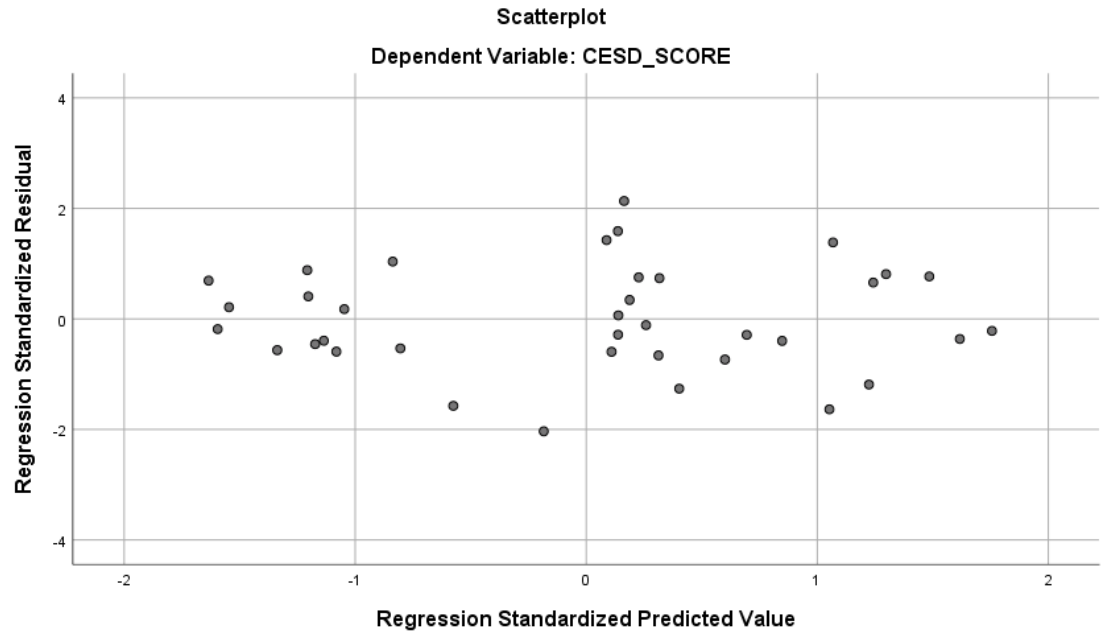
a. Dependent Variable: CESD_SCORE

Appendix L – residual plots

Appendix L1 – Histogram displaying normally distributed residuals

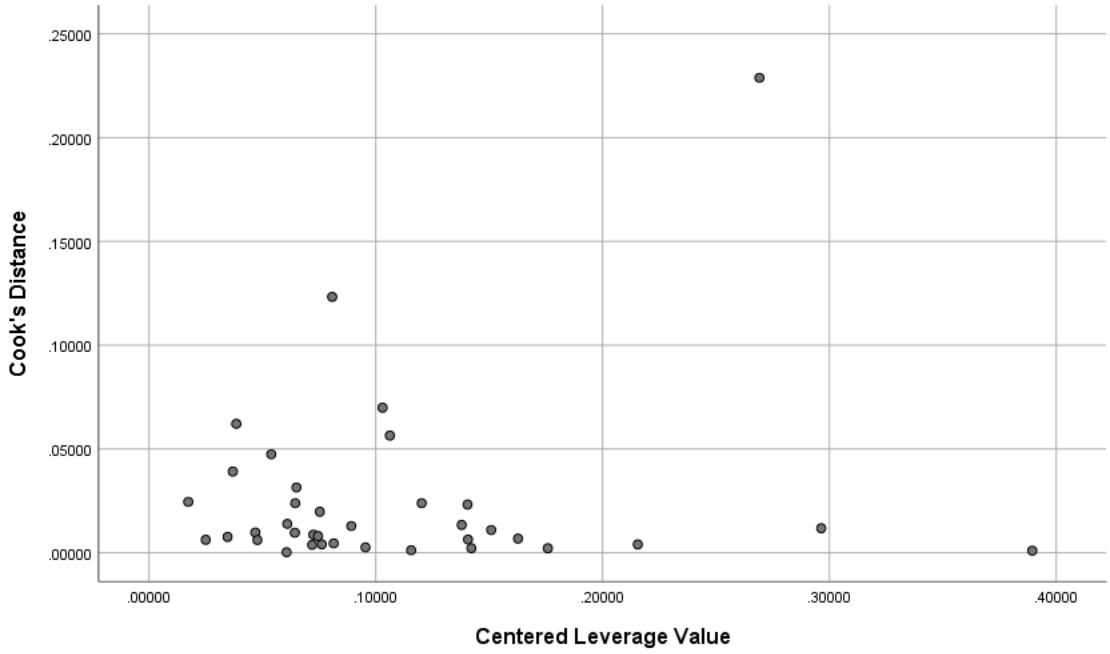


Appendix L2 – scattergram displaying Regression standardised residuals and regression standardised predicted values plotted against each other



displayed homoscedasticity and no curvilinearity and the plots displayed no obvious pattern

Appendix M – Scattergram of Leverage plotted against Cook's distance



Leevrage assesses if an individual's scores across predictors is considered a multivariate outlier and Cook's distance represents the degree outliers will affect the regression. Plotting Leverage against Cooks resulted in one participant being identified as an outlier due to a high Cooks score.

Appendix N – calculation for Model Validation using predicted residual sum of squares (PRESS)

R2PRESS = 1- (PRESS/total sum of squares)

= 1 – (2963.61/8067.730)

= 0.6326587528

The PRESS statistic is calculated by squaring the deleted residuals and is the total sum of the squared deleted residuals.

This is then divided by the Total sum of squares from the regression output.

This value is then subtracted from 1.

If the R^2_{PRESS} statistic is largely different from the original R^2 value of the regression, you have to question the reliability of your result.

Appendix O – Sensitivity Analysis

Appendix O1 – Regression including the male participants removed as outliers

R2 and variance explained decreased by .004%

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.349[a]	.122	.075	14.01992
2	.596[b]	.355	.302	12.17882
3	.834[c]	.696	.662	8.47113
4	.840[d]	.706	.664	8.45024

a. Predictors: (Constant), Please enter your sex at birth, Please enter your age in numbers

b. Predictors: (Constant), Please enter your sex at birth, Please enter your age in numbers, ASRS_SCORE

c. Predictors: (Constant), Please enter your sex at birth, Please enter your age in numbers, ASRS_SCORE, DERS_SCORE

d. Predictors: (Constant), Please enter your sex at birth, Please enter your age in numbers, ASRS_SCORE, DERS_SCORE, EQ_SCORE

e. Dependent Variable: CESD_SCORE

There was no change in model or predictor significance.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	58.043	14.368		4.040	.000
	Please enter your age in numbers	-.435	.196	-.348	-2.220	.032
	Please enter your sex at birth	-.231	7.603	-.005	-.030	.976
2	(Constant)	25.095	15.396		1.630	.112
	Please enter your age in numbers	-.418	.170	-.334	-2.451	.019
	Please enter your sex at birth	1.893	6.630	.039	.286	.777
	ASRS_SCORE	.564	.154	.485	3.655	.001
3	(Constant)	2.697	11.273		.239	.812
	Please enter your age in numbers	-.179	.124	-.143	-1.439	.159
	Please enter your sex at birth	3.438	4.618	.071	.744	.461
	ASRS_SCORE	-.058	.145	-.050	-.400	.692
	DERS_SCORE	.442	.069	.826	6.362	.000
4	(Constant)	6.640	11.817		.562	.578
	Please enter your age in numbers	-.179	.124	-.143	-1.446	.157
	Please enter your sex at birth	4.700	4.751	.097	.989	.329
	ASRS_SCORE	-.093	.148	-.080	-.625	.536
	DERS_SCORE	.447	.069	.836	6.438	.000
	EQ_SCORE	-.112	.103	-.106	-1.085	.285

Appendix O2 – regression with Cook's outlier removed

Model variance and R2 increased by .002%

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.334[a]	.111	.085	13.91729
2	.604[b]	.365	.327	11.93851
3	.842[c]	.710	.682	8.19879
4	.844[d]	.712	.674	8.30414

a. Predictors: (Constant), Please enter your age in numbers

b. Predictors: (Constant), Please enter your age in numbers, ASRS_SCORE

c. Predictors: (Constant), Please enter your age in numbers, ASRS_SCORE, DERS_SCORE

d. Predictors: (Constant), Please enter your age in numbers, ASRS_SCORE, DERS_SCORE, EQ_SCORE

e. Dependent Variable: CESD_SCORE

There was no change in model or predictor significance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	56.018	6.270		8.935	.000
	Please enter your age in numbers	-.404	.196	-.334	-2.063	.047
2	(Constant)	25.860	9.889		2.615	.013
	Please enter your age in numbers	-.410	.168	-.339	-2.443	.020
	ASRS_SCORE	.619	.170	.504	3.634	.001
3	(Constant)	11.151	7.199		1.549	.131
	Please enter your age in numbers	-.147	.123	-.121	-1.196	.240
	ASRS_SCORE	-.180	.175	-.147	-1.031	.310
	DERS_SCORE	.474	.077	.901	6.162	.000
4	(Constant)	13.871	9.564		1.450	.157
	Please enter your age in numbers	-.150	.125	-.124	-1.205	.237
	ASRS_SCORE	-.182	.177	-.148	-1.030	.311
	DERS_SCORE	.471	.078	.896	6.035	.000
	EQ_SCORE	-.048	.109	-.043	-.440	.663

a. Dependent Variable: CESD_SCORE

Appendix P – Mediation Analysis using PROCESS

Appendix P1 – assumptions of mediation

```
**************** PROCESS Procedure for SPSS Version 3.4.1 ****************

         Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2018). www.guilford.com/p/hayes3

**************************************************************************
Model  : 4
    Y  : CESD_SCO
    X  : ASRS_SCO
    M  : DERS_SCO

Sample
Size:  37

**************************************************************************
OUTCOME VARIABLE:
 DERS_SCO

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .7132      .5086   387.2289    36.2240     1.0000    35.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant    21.4661    13.1212     1.6360      .1108    -5.1718    48.1040
ASRS_SCO     1.5323      .2546     6.0186      .0000     1.0155     2.0492

**************************************************************************
OUTCOME VARIABLE:
 CESD_SCO

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .8274      .6846    74.8432    36.8975     2.0000    34.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     2.3171     5.9850      .3871      .7011    -9.8462    14.4803
ASRS_SCO     -.0801      .1597     -.5014      .6193     -.4046      .2444
DERS_SCO      .4733      .0743     6.3692      .0000      .3223      .6243

************************** TOTAL EFFECT MODEL ****************************
OUTCOME VARIABLE:
 CESD_SCO

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .5552      .3083   159.4524    15.5965     1.0000    35.0000      .0004

Model
              coeff         se          t          p       LLCI       ULCI
constant    12.4772     8.4199     1.4819      .1473    -4.6164    29.5707
ASRS_SCO      .6452      .1634     3.9492      .0004      .3135      .9769
```

Appendix P2 – indirect effect of ADHD on depression though emotion regulation

```
************** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y **************

Total effect of X on Y
     Effect         se          t          p       LLCI       ULCI       c_ps       c_cs
      .6452      .1634     3.9492      .0004      .3135      .9769      .0431      .5552

Direct effect of X on Y
     Effect         se          t          p       LLCI       ULCI      c'_ps      c'_cs
     -.0801      .1597     -.5014      .6193     -.4046      .2444     -.0053     -.0689

Indirect effect(s) of X on Y:
             Effect     BootSE   BootLLCI   BootULCI
DERS_SCO      .7253      .1748      .4702     1.1565

Partially standardized indirect effect(s) of X on Y:
             Effect     BootSE   BootLLCI   BootULCI
DERS_SCO      .0484      .0114      .0332      .0775

Completely standardized indirect effect(s) of X on Y:
             Effect     BootSE   BootLLCI   BootULCI
DERS_SCO      .6241      .1096      .4449      .8736

************************ ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

NOTE: Variables names longer than eight characters can produce incorrect output.
      Shorter variable names are recommended.
```

Appendix X – Progress Log

Psychology Project Progress Log

Complete one section at each meeting and **include the log as an Appendix to your final report**. Supervisor's signatures are to indicate that next meeting dates and actions have been set. They are *not* to indicate that targets from the previous meeting have been met.

	Supervisor signature
Student met with supervisor in first 3 weeks of autumn term Yes	JLD

Meeting date	Date of next meeting	Planned action before next meeting	Supervisor signature
30/09/2019	09/10/19	Obtain scales and design project	JLD
09/10/19	06/11/2019	Complete ethics form	JLD
06/11/2019	18/02/2020	Amend ethics form	JLD
18/02/2020	26/05/2020	Complete data analysis	JLD
26/05/2020		Complete dissertation	JLD

THIS SECTION SHOULD ONLY BE COMPLETED BY STUDENTS WITH A LEARNING SUPPORT AGREEMENT (LSA), WHO HAVE HAD AN EXTENSION REQUEST AUTHORISED FOR THIS ASSIGNMENT PRIOR TO THE ASSIGNMENT DEADLINE

Please copy the confirmation email from the module leader, confirming that your request for an extension has been authorised. Ensure that the date and time that the email was sent is included. This information will be used to corroborate the information provided with our records.

LUCAS Erica <E.Lucas@staffs.ac.uk>
28/05/2020 14:34

To: SHEEN Catherine M

HI Catherine

Yes sorry, I missed this when we changed the deadline. The 1st f June it is

Erica