EXPLORING SEX DIFFERENCES IN THE CLINICAL COGNITIVE AND BEHAVIOURAL PROFILES OF ADOLESCENTS AND ADULTS WITH AUTISM SPECTRUM DISORDER (ASD)

Ewelina Rosiecka

Doctoral thesis submitted for the degree

Doctor of Philosophy

Psychology

ASTON UNIVERSITY

August 2023

Thesis Summary

Autistic females are often diagnosed later than males and present with higher rates of internalising conditions like anxiety and depression. Current diagnostic criteria for autism spectrum disorder (ASD) tend to be focused on the 'male' presentation of the condition derived from the earliest descriptions of the condition. There is growing recognition, however, that ASD may present differently in males and females. Emotion regulation (ER) has been proposed as a potential mechanism underpinning differences in the clinical profiles of autistic males and females.

Six studies examined sex differences in ER and its relationship with alexithymia, internalising issues and camouflaging within the ASD population. The results were compared to typically developing individuals to determine if the differences observed were gender or diagnosis-specific.

While no major significant sex differences were found in the presentation of autistic traits in adolescent and adult samples, there were differences found in the cognitive and behavioural profiles of ER and in its relation to internalising issues, alexithymia and camouflaging. Therefore, it is concluded within this thesis that differences in emotion regulation between males and females should be considered during diagnostic procedures, as well as when referrals for such diagnoses are considered.

KEYWORDS
autism, age at diagnosis, sex differences, female autism, emotion regulation, cognitive reappraisal, expressive suppression, alexithymia, internalising issues, camouflaging

Acknowledgements

So here I stand, at the culmination of a six-year journey that has been both joyfully enlightening and, at times, challenging. This chapter marks the end of an adventure filled with moments of triumph and the occasional bitter taste of adversity.

I am truly grateful to my supervisor, Dr Sarah Carrington, for your unwavering support, guidance, and encouragement throughout this journey. You never lost faith that I could do it, not even when I did! Your presence was a constant source of reassurance, and your willingness to engage in insightful discussions has been truly inspiring. Your valuable advice has illuminated my path during this journey, and I loved all your comments on my written work. It has made my writing much better since I started. Your warmth has made this experience even more rewarding. Thank you for being an exceptional supervisor, always there when needed! To Prof Adrian Burgess, I am grateful for your invaluable guidance and advice on statistical analyses and the practical aspects of crafting this thesis. Your support has been greatly appreciated. Thank you for joining me in my journey.

I would like to express my deepest gratitude to the Birmingham Children's Hospital Research Foundation for funding this research. Special thanks to all the clinicians from Forward Thinking Birmingham for all your help with recruitment for this study, especially to Dr Andrew Surtees, Dr Ashley Liew, Dr Katy Robson, and Dr Jo Garstang from the community paediatrics team. Without your support, this project would not have happened in the first place.

Thank you to my family. I love you so much and am forever grateful for your support. I especially thank you to my loving and supportive husband, who has stood as my rock throughout this journey. Your continuous encouragement and understanding made all the difference. To my dear daughter, you were my constant motivation whenever doubts crept in; I kept your presence in mind, reminding myself of "who is watching". Your belief in me pushed me forward, and I am deeply grateful for your presence in my life. I promise we will catch up on all the fun things we had to sacrifice for this thesis to be written. To my mum and my sister, your love and care have fuelled my determination, and I am deeply grateful for having you both in my life.

Thank you to all my friends who stood by me when I had to put my life on hold to complete this thesis. Knowing that you were there, cheering me on, made all the difference. Thank you for being true friends and for being with me every step of the way. To my Leicester CAHMS LDT colleagues, thank you for all the support you provided me over the last year. Your encouragement and solidarity were invaluable, making a significant difference in my journey. Thank you for standing by me and being a source of strength during this time.

Finally, last but not least, I am deeply grateful to all the participants who made this research possible, from the children, adolescents, and parents who graciously contributed their time and insights to all the dedicated adults who participated online. Your involvement has been instrumental in shedding light on important aspects of this study, and your willingness to contribute has left a lasting impact on its success. Thank you for being a vital part of this journey.

List of Contents

List of Abbreviations

ADDM – Autism and Developmental Disabilities Monitoring

ADHD – Attention Deficit Hyperactivity Disorder

ASD – Autism Spectrum Disorder

BAPQ – Broad Autism Phenotype Questionnaire

BEQ – Berkeley Expressivity Questionnaire

BERQ – Behavioural Emotion Regulation Questionnaire

BFNES – Brief Fear of Negative Evaluation Scale

CAM – Children's Alexithymia Measure

CAT-Q – Camouflaging Autistic Traits Questionnaire

CBT – Cognitive-Behavioural Therapy

CERQ – Cognitive Emotion Regulation Questionnaire

CR – Cognitive Reappraisal

DISCO – Diagnostic Interview for Social and Communication Disorders

DSM–5 – Diagnostic and Statistical Manual of Mental Disorders

DSM-IV-TR – Diagnostic and Statistical Manual of Mental Disorders, fourth edition

EI – Emotional Intelligence

ER – Emotion Regulation

ERQ – Emotion Regulation Questionnaire

ES – Expressive Suppression

HADS – Hospital Anxiety and Depression Scale

ICD-10 – International Classification of Diseases (ICD) 10th Revision

ID – Intellectual Disability

PDD-NOS – Pervasive Developmental Disorder Not Otherwise Specified

PRI – Perceptual Reasoning Index

REC – Research Ethics Committee

RSE – Rosenberg Self-Esteem Scale

SQ-A - Signposting Questionnaire for Autism

TAS-20 – Toronto Alexithymia Scale

TD – Typically Developing

VCI – Verbal Comprehension Index

WASI-II – Wechsler Abbreviated Scale of Intelligence – Second Edition

List of Tables

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

List of Figures

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 1 – Introduction

In this thesis, the terms "sex" and "gender" are used interchangeably to refer to the interrelated concepts of biological sex and sociocultural gender. Additionally, the terms "autism spectrum disorder," "ASD," and "autism" are used interchangeably due to the variety present in the literature discussed.

1.1 – Literature review

1.1.1 Autism spectrum disorder (ASD) – characteristics, prevalence and diagnosis

Autism spectrum disorder (ASD) is a lifelong neurodevelopmental condition that, due to the lack of specific biomarkers, is primarily diagnosed based on behavioural observations. Autism is characterised by impairments in social interaction, communication and the presence of restricted and repetitive behaviours (ICD-10; World Health Organisation, 1993).

The publication of the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM–5) in 2013 marked a significant turning point in the conceptualisation of autism spectrum disorder (ASD; American Psychiatric Association, 2013). This term is now used as an umbrella term to describe four subgroups of pervasive developmental disorders: childhood autism, atypical autism, Asperger's syndrome and pervasive developmental disorder not otherwise specified (PDD-NOS), which were previously known as separate disorders in the previous versions of diagnostic criteria for DSM-IV-TR (American Psychiatric Association, 2000) and ICD-10 (World Health Organisation, 1993). A significant movement occurred in conceptualising the dimensional approach to diagnosis with the publication of the fifth edition of the DSM. As a result of this transition, autism was joined into a single diagnosis, including all these aforementioned subgroups. According to the DSM-5, autism is now classified as a spectrum disorder on five main domains (A-E), embracing various severity symptoms (Levels 1-3; Level 1 – requiring support; Level 2 – requiring substantial support; Level 3 – requiring very substantial support).

After revisions, the current diagnostic criteria for autism merge three core symptoms into two domains, with language removed as an independent specifier. Thus, social interaction and communication form one fundamental domain (A), while restricted or repetitive behaviours or

interests with the sensory hyper- or hyposensitivity added form the second domain of symptoms (B). Additional subdomains are embedded within these two domains (three in domain A (A1. Deficits in socio-emotional reciprocity; A2. Deficits in non-verbal communicative behaviours used for social interaction; A3. Deficits in developing and maintaining relationships appropriate to developmental level (beyond those with caregivers); and four in domain B (B1. Stereotyped or repetitive speech, motor movements, or use of objects; B2. Excessive adherence to routines, ritualised patterns of verbal or non-verbal behaviour, or excessive resistance to change; B3. Highly restricted fixated interests that are abnormal in intensity or focus; B4. Hyper or hypo-sensitivity to sensory input or unusual interest in sensory aspects of the environment). Individuals need to score in all three subdomains of domain A and at least two subdomains of domain B. Additionally, DSM-5 specifies that individuals experience these symptoms early in their development – domain (C). However, it is accepted that these may not manifest fully in childhood or be masked by learned strategies. Additionally, symptoms must greatly impact daily functioning – domain (D) and cannot be better explained by intellectual disability (ID) – domain (E) (APA, 2013).

In 2020, Maenner et al., for the Autism and Developmental Disabilities Monitoring (ADDM) Network, stated that 1 in 36 8-year-old children were diagnosed with ASD in the United States across 11 sites they monitored. This reflects an increase in prevalence from 1 in 68, as reported in 2016 by Christensen et al. from the same surveillance group. Similarly, a study by Russell et al. (2022) investigating trends in autism diagnosis in the UK population data from a 20-year period found a general 787% rapid growth in autism diagnoses. They suggested that either a rise in prevalence or diagnosis reporting and application may be responsible for this increase. However, more diagnoses among adults, women, and individuals without intellectual disability (ID) suggest increased recognition, as the fastest growth in diagnostic rates was observed in those groups. Autism is more commonly diagnosed in males than females (Fombonne, 2009; Russell et al., 2011). However, there is a growing recognition that the commonly cited 4:1 male-to-female ratio in ASD may overestimate sex differences in the prevalence of the condition (Zwaigenbaum et al., 2012). For example, for autistic individuals with a co-occurring intellectual disability, this ratio often goes up to 2:1 (sometimes 1.8:1), while for individuals without intellectual impairment (sometimes also referred to as high-functioning individuals), the male-to-female ratio is often reported as low as 8:1 (e.g., Halladay et al., 2015; Werling et al., 2013).

Females are diagnosed with autism less frequently than males with the same levels of traits (Goin-Kochel et al., 2006; Russell et al., 2011; Shattuck et al., 2009). The so-called female protective effect, or FPE, has become a "hot topic" (e.g., Robinson et al., 2013). This effect suggests that females with ASD may be able to tolerate a higher aetiological load before presenting with clinically significant characteristics of ASD, which can lead to a later diagnosis. Our knowledge of the 'typical' female

profile of ASD, on the other hand, is constrained by possible nosological and diagnostic biases that favour the more conventional 'male' profile (Lai et al., 2015). This misinterpretation of the presentation of autistic traits in females without ID could lead to wrong referrals and misdiagnosis (Holtmann et al., 2007). This is an important issue because underdiagnosis of females with autism leads to their underrepresentation in autism research. This lack of representation means that our understanding of autism is skewed, and the development of diagnostic tools, interventions, and support systems does not adequately address the needs of females with autism. Without proper diagnosis and support, autistic females may struggle to reach their full potential in educational and professional settings. They may face difficulties with organisation, communication, and social interactions, which can hinder their academic performance and career progression (White et al., 2011). Therefore, this disparity in diagnosis rates between males and females reflects broader systemic inequalities in healthcare and social support systems. Addressing this gap is essential for ensuring that all autistic individuals, regardless of gender, receive equitable care and opportunities.

In addition to being diagnosed less frequently than males, females, especially those without ID, are often diagnosed with autism later in life (e.g., Begeer et al., 2013; Kirkovski et al., 2013; Rutherford et al., 2016). Begeer et al. (2013) found that girls with higher ability were diagnosed approximately 1.8 years later than males. Indeed, a survey by the National Autistic Society (Bancroft et al., 2012) reports that by the age of 11, only one-fifth of females had been diagnosed with Asperger syndrome or high-functioning autism, compared to half of males of the total number of more than 8,000 people from the UK participating in the survey. Additionally, autistic females are often not recognised as such when seen for the first time in clinical settings. 42% of female respondents were already diagnosed with another condition when they finally received an ASD diagnosis, compared to 30% of males (Bancroft et al., 2012). This misdiagnosis can lead to inappropriate treatments that do not address the core issues related to autism, potentially exacerbating their difficulties. Early diagnosis of autism is crucial for accessing appropriate support, interventions, and therapies that can significantly improve quality of life and developmental outcomes. When diagnosis is delayed, females miss out on these crucial early interventions. While autism rarely occurs in isolation and is often diagnosed alongside other conditions, known as co-occurring diagnoses, it is usually crucial to understanding difficulties in daily functioning. However, the presence of co-occurrent conditions adds complexity to the diagnostic process.

1.1.2 Co-occurrent issues

Co-occurrent mental health conditions are common in ASD (e.g., APA, 2013; Underwood et al., 2019). The most prevalent affective conditions associated with ASD are depression and general anxiety (e.g., APA, 2013; Croen et al., 2015; Lugo-Marin et al., 2019; Simonoff et al., 2008; Underwood et al., 2019).

This pattern is especially noticeable in the group of autistic individuals without ID (Day et al., 2019; Nimmo-Smith et al., 2020). Autistic individuals are four times more likely than the general population to experience internalising mental health issues (like anxiety and depression) over the course of their lives, and rates of these rise with intelligence and with age within this population (for a review, see Hollocks et al., 2019).

Epilepsy, sleep problems, gastrointestinal symptoms, toileting problems, behavioural problems (Lai et al., 2015; Leader et al., 2016), as well as conditions like attention-deficit hyperactivity disorder (ADHD), social anxiety, oppositional defiant disorder, conduct disorder (Simonoff et al., 2008), and various genetic syndromes like Fragile X or Rett syndrome, are also common co-occurrent conditions co-occurring with ASD (see Hirota et all., 2023 for a review). Various studies show that in a population of children and adolescents diagnosed with autism, approximately 70% would also have at least one co-occurrent diagnosis, with social anxiety being the most reported one. Approximately 40% would also have two or more additional diagnoses, while around 30% have three or even more (e.g., Lai et al., 2015; Leader et al., 2016; Kent & Simonoff, 2017). Several studies have also shown that co-occurring disorders frequently cooccur with ASD. For instance, Stevens et al. (2016) observed that 59% of children diagnosed with autism were also diagnosed with attention deficit hyperactivity disorder (ADHD). About 40% of autistic children also have one or more anxiety disorders (general anxiety disorder, separation anxiety disorder, and obsessive-compulsive disorder) or phobias (Zaboski & Storch, 2018). Epilepsy affects 5–46% of autistic children but only 1–2% of neurotypical children (Spence & Schneider, 2009). Finally, individuals with autism show much higher rates of depression than the general population, with lifetime prevalence estimates as high as 40% (Angel et al., 2023) and higher rates of emotional dysregulation (irritability), with rates around 80% (Mayes et al., 2017). Early recognition of autism can facilitate a comprehensive approach to diagnosing and managing these co-occurring conditions. Addressing these conditions early, including autism in the holistic presentation of the cooccurring issues, can reduce the risk of ineffective or harmful interventions (i.e. overmedication when some behavioural strategies could be sufficient), and it can prevent them from becoming more severe and improve the overall quality of life. Families often experience significant stress and confusion when a child's behaviours are not understood. An early diagnosis provides clarity and access to resources, support groups, and training that can help families manage challenges more effectively and reduce overall stress. Early diagnosis empowers parents and caregivers to advocate for their child's needs. It provides them with the knowledge and tools to seek out appropriate services and supports, ensuring their child receives the best possible care and opportunities. All these aspects are extremely important, especially since the human brain is most adaptable (neuroplastic) during early childhood (Kempermann, 2011). Intervening during this period can profoundly impact the child's development, maximising their potential for independence and functional skills in adulthood.

1.1.2.1 Sex differences in rates of anxiety and depression

As discussed above, there is substantial evidence indicating that females, particularly those without ID, are less likely to be identified during diagnostic processes than males (Russell et al., 2011; Loomes et al., 2017) and are more often initially diagnosed with internalising disorders like anxiety or depression (e.g., Crick & Zahn-Waxler, 2003; May et al., 2014). Additionally, social and communication difficulties, characteristic traits of ASD, have been found to be an important risk factor for developing social anxiety in typically developing young people and those with autism (Pickard et al., 2017). Social anxiety affects up to 50% of individuals with autism (Bellini, 2004; Maddox & White, 2015; Spain et al., 2016), a much higher proportion than in non-autistic populations where rates range from 7-13% (NICE, 2013). Young people with social and communication difficulties often have negative social experiences, such as bullying, rejection, or misunderstanding by peers. These negative interactions may increase fear of social situations and increase the risk of developing social anxiety. Social and communication difficulties can create a feedback loop where anxiety leads to poor social performance, which then leads to more anxiety, and the mechanism likely repeats itself in the form of a vicious cycle. This cycle can be particularly pronounced in individuals with autism, who might already face significant challenges in social contexts. Young people with social and communication difficulties may develop coping mechanisms such as avoidance or withdrawal to avoid the discomfort associated with social interactions. While these behaviours might provide short-term relief, they often exacerbate social anxiety in the long term by preventing the development of necessary social skills. Therefore, addressing these difficulties through early intervention, social skills training, and supportive environments can potentially help reduce the risk of social anxiety and improve social functioning. Both autistic and typically developing young people who have social difficulties may become overly concerned about being judged or criticised by others. This fear can create a heightened sense of self-consciousness and contribute to low self-esteem. Additionally, the negative self-perception and low self-esteem associated with social anxiety can further contribute to depressive thoughts and feelings.

A systematic review and meta-analysis by Hollocks et al. (2019) reports that in the general population, the prevalence of anxiety and depression is estimated to be 1-12% for anxiety and 7% for depression. By contrast, the lifetime prevalence of anxiety disorder is 41.9% in autistic children, and the incidence of depressive conditions is 1.4%. In 18-year-olds with ASD, it is predicted to be 39.6% for anxiety disorders and 20-35% for depression. In autistic adults, the lifetime prevalence of anxiety and depression is estimated to be 42% and 37%, respectively (see Hollocks et al., 2019 for review). This suggests a massive increase in low mood disorders that develop in this group during adolescence and remain at high rates in adulthood.

While sex differences in the prevalence of social anxiety in typical development are not always significant (Christensen, 2016), anxiety and depression are more common in females. A longitudinal study by Patalay and Fitzsimons (2017) with a sample of nearly 20,000 typically developing children born across the UK in 2000/2001 reported that from ages 3 to 11 years, a similar percentage of males and females (12%) suffered from emotional problems, such as feeling anxious or depressed. Nonetheless, at the age of 14, 24% of girls and only 9% of boys reported suffering from high symptoms of emotional difficulties. Therefore, this longitudinal study suggests that between the ages of 11 and 14 years, typically developing females are significantly more likely than males to experience mental health issues. The same tendency is evident regarding anxiety disorders and eating disorders, which are more common in females than males at a ratio of at least two to one and are known to have a peak onset in adolescence (for review, see Martel, 2013). Similarly, according to clinical observations, Altemus et al. (2014) state that females demonstrate more internalising coping styles, like rumination, than males even before puberty. However, sex differences in the prevalence of generalised anxiety, panic disorder, and major depression are not evident until adolescence, suggesting that hormonal changes caused by the onset of the ovarian cycle may significantly contribute to increased rates of these disorders in women (Altemus et al., 2014). In their review, Lai and Szatmari (2020) concluded that girls may face more problems with social challenges and adaptive functioning in adolescence than males, which may explain why their difficulties become more apparent. What is then happening in adolescence, that rates of these internalising issues like anxiety and depression rise so drastically in both typically developing and autistic females?

1.1.3 Adolescence

The beginning of adolescence is often defined as the onset of puberty, a biological event, while the end of adolescence is often defined socially as the attainment of relative self-reliance (Blakemore & Mills, 2013). Adolescence is a difficult time for typically developing children because peer pressure, social rejection concerns, and the desire to be popular can significantly impact their behaviour (Forbes & Dahl, 2010). As a result, adolescence is a time when hormonal changes that affect behaviour coexist with increased social challenges. When children reach that age, they enter a more complex social environment where they spend more time with their peers than with their parents. What if they have trouble fitting in? Vickerstaff et al. (2007) reported that autistic children without ID entering adolescence (7-13 years old) were more likely to have low self-perceived social competence. Furthermore, they are often more able to recognise their own social deficiencies than autistic individuals with ID and, as a result, may be at greater risk for developing internalising symptoms such as depression (Wing, 1992). Multiple studies show that autism is almost always accompanied by a

range of additional emotional and behavioural problems that emerge in adolescence, such as irritability and aggression, anxiety, and depression (e.g., Joshi et al., 2010; Simonoff et al., 2008; Oswald et al., 2016). Although some studies report no sex differences in a range of externalising symptoms like conduct problems, aggression, or disruptive and oppositional behaviour, or internalising problems like anxiety or depression in children and adolescents with ASD (e.g., Brereton et al., 2006; Postorino et al., 2015; Nasca et al., 2020), sex differences were found in both externalising and internalising behaviours in various other studies. For example, both children and adolescent autistic females were found more likely to experience internalising conditions such as depression and anxiety (De Giambattista et al., 2021; Dillon et al., 2021; May et al., 2015; Solomon et al., 2012; Wieckowski et al., 2020), which have been linked to lower life satisfaction and less adaptive behaviour in young adulthood (Gotham et al., 2015). In contrast, males with autism (children and adolescents) were found more likely to experience externalising behaviours such as aggression, conduct problems and hyperactivity (Bolte et al., 2011; Mandy et al., 2012; May et al., 2016; Szatmari et al., 2012). One possible explanation why autistic adolescent males may present with more externalising behaviours, while females may struggle more with internalising issues, might be a difference in how they cope with demanding situations arising during adolescence and regulate their emotions. Understanding these potential differences in emotion regulation is essential for our understanding of how autism may present differently in males and females, as well as for developing effective interventions. Tailored approaches that consider the unique ways in which autistic males and females manage their emotions can help provide more effective support.

1.1.4 Emotion regulation

1.1.4.1 Emotions and temperament

Posner et al. (2009) highlight that the major method for investigating emotions recommends categorising them by specific neural structures and pathways, the theory of basic emotions. This theory posits that certain emotions are fundamental, biologically hardwired, and universally experienced across human cultures. These basic emotions include happiness, sadness, anger, fear, surprise, and disgust, and they are thought to arise from specific neural circuits and brain regions. Despite improving emotional knowledge, this theory fails to explain mood disorder co-occurrence and affective disorder neurological underpinnings in clinical psychology and psychiatry. It also conflicts with genetics and temperament research. Therefore, the authors propose that clinicians and researchers should focus on dimensional emotion models rather than basic emotion models of affective states.

One such model is a circumplex model of emotion developed by James Russell (1980). According to this concept, emotions can be mapped into a circular two-dimensional space that contains arousal and valence dimensions. The vertical axis represents arousal (arousal-sleepiness), and the horizontal axis represents valence (misery-pleasure). In this concept, the representation of emotional states can occur at any degree of valence and arousal or at a neutral level of either or both of these elements. For example, high arousal and pleasure would result in a state of excitement, while the opposite would be depression (high misery and sleepiness). High sleepiness and pleasure would result in a state of contentment/relax, while high arousal and misery would be described as distress.

The unique qualities of each person and the way they mature are integral components of emotional phenomena. One of such important individual differences associated with emotional experience is temperament. In psychology, "temperament" often refers to consistent individual differences in behaviour that are biologically based and relatively constant throughout life. As a result, one interpretation of temperament is that it is a set of hypothetical constructs that describe individual variances in reactivity and self-regulation (Rothbart & Bates, 2007). Else-Quest et al., (2006) suggest that a longitudinal study by Chess and Thomas (1977, 1980), also known as the New York Longitudinal Study, provided one of the first classifications on infants' temperament and significantly increased our understanding of temperament as a construct. However, it has been criticised for its lack of emphasis on the emotional components of temperament. Indeed, more recent research on temperament is directed at exploring how biological and cognitive processes and environmental processes interact and link with individuals' ability to self-regulate, well-being or social functioning (see Else-Quest et a., 2006; for review).

1.1.4.2 Emotion regulation concept and strategies

Emotion regulation (ER) is defined as the self-modulation of an individual's emotional state. It includes a broad set of cognitive and behavioural processes that can support adaptive and goal-directed behaviour (e.g., Mazefsky et al., 2013). Adaptive behaviour in psychology refers to practical, social, and conceptual skills that enable a person to cope and function in their environment. For example, to effectively cope with situational demands, avoid conflict with others, or get their needs met. Therefore, disruptive social or personal behaviours can be used to achieve a constructive outcome in certain situations or environments. However, these potentially initially adaptive behaviours may become maladaptive when used habitually (see Ike et al., 2020, for a review). Maladaptive behaviours, therefore, refer to behaviours, actions or choices that prevent someone from adapting, changing, or taking part in various aspects of life. These behaviours often alleviate or prevent stress initially but often affect social functioning due to their disruptive or avoidant nature,

leading to increased anxiety over time. Emotion regulation is a broad subject that refers to a wide range of automatic and deliberate, thus, both conscious and unconscious behavioural and cognitive processes.

Emotion regulation strategies include cognitive reappraisal, problem-solving, seeking social support, relaxation, acceptance, avoidance, distraction, rumination, venting, and expressive suppression. These strategies are often distinguished within one of the two 2-dimensional models. First is an outcome-oriented model where ER strategies are distinguished as adaptive and maladaptive (Aldao et al., 2010; Naragon-Gainey et al., 2017; Levin & Rawana, 2022). The second is a process-oriented model (Gross, 1998), where ER strategies are classified based on how the emotions are regulated cognitively or behaviourally. Gross's Process model of ER (Gross, 1998) categorises ER strategies based on the point at which they are applied during the emotion-generative process: 1. situation selection (e.g., approaching or avoiding specific situations); 2. situation modification (e.g., problem-solving); 3. attentional deployment (e.g., paying attention or distraction); 4. cognitive change (e.g., cognitive reappraisal); 5. response modulation (e.g., expressive suppression). Gross considered the first four antecedent-focused (meaning the regulation occurs before an emotional response is fully generated) and the last one response-focused (which occurs after the emotional response is generated). Each of the five points in the emotion generative process encompasses strategies that are often categorised as either adaptive (i.e., those that support individuals in achieving their personal goals and support their mental well-being) or maladaptive. For example, situation selection encompasses seeking social support (adaptive) and avoidance (maladaptive), while cognitive change includes cognitive reappraisal (adaptive) and rumination (maladaptive) (see Gross, 1998).

The most important evolutionary function of emotions is to support our understanding of the ongoing demands of our environment and to allow us an adaptive response to these demands (Barrett et al.,2007). To achieve that, each individual will have developed a specific preference for different emotion regulation strategies that highly depend on past experiences and skills and their temperament, thus, reactivity to emotion-eliciting situations. Additionally, to successfully regulate their emotions, one must be able to recognise/identify and understand their emotional reactions. Identifying and labelling one's emotions accurately, understanding the triggers and causes of these emotions, and having a range of strategies to cope with them all play important roles in effective emotion regulation.

1.1.4.3 Alexithymia

Alexithymia describes difficulty identifying and interpreting emotions in oneself and others (Kinnaird et al., 2019). Sifneos (1973) created the term alexithymia (literally "absence of words for emotion")

to characterise individuals who seemed to lack conceptual understanding of emotion, resulting in a reduced capacity to describe their feelings symbolically. The apparent absence of conceptual understanding of experienced emotional states leads to difficulty expressing emotion, imagining, and interacting with others and increases the possibility that emotion will be perceived as bodily symptoms (Rieffe et al., 2006). Individuals with alexithymia, even though they struggle with more nuanced differentiation of emotions, do still experience the core affect (pleasure and displeasure), and sometimes even greater than those without alexithymia as measured by physiological arousal to stimuli evoking emotions (Sanchez et al., 2001).

There has been a great deal of research focusing on the concept of alexithymia, indicating that it is more common in autistic individuals in comparison to the general population (Bloch et al., 2021; Fietz et al., 2018; Gormley et al., 2022; Ketelaars et al., 2016; Morie et al., 2019). Rates of alexithymia in autistic individuals compared to the general population are reported as 49.93% compared to 4.89%, respectively (Kinnaird et al., 2019). However, there are no reports of sex differences explored within this population, except a study by Ketelaars et al., (2016), who compared autistic females with typically developing females on vocal and visual emotion recognition tasks and found no differences between these two group in the task performance, despite higher rates of alexithymia as self-reported by the autistic females group. Additionally, Livingstone et al. (2022) provided some insight into sex differences in alexithymia in relation to autistic traits. Their cross-sectional studies included a large group (N = 1656) of typically developing young adults and measured autistic traits and alexithymia using questionnaires. The results showed that emotion processing, mainly a lower need for affect in males, was found to be a significant mediator of the relationship between sex and autistic traits, suggesting that it is an important factor in the expression of autistic traits within the general population. At the same time, alexithymia was not a strong mediator of the same relationship. This suggests that sex differences in alexithymia may be smaller than thought regarding autistic traits (Livingstone et al., 2022), highlighting the need for further exploration.

Moreover, alexithymia has been regularly related to various adverse mental and physical health effects. For example, alexithymia is associated with anxiety and depression (Van Der Cruijsen et al., 2019; Fietz et al., 2018; Grynberg et al., 2010) and eating disorders (Ridout et al., 2010), all of which were discussed earlier as more common in adolescent females. However, higher levels of alexithymia are consistently reported in males (see Levant, 2009, for a review). For example, Venta et al. (2013) reported ‘alexithymia’ rates of 68.43% for males and 31.58% for females in a group of adolescents (N=159, 66 females and 45 males) from an inpatient mental health unit. While it could be argued that males are inherently less emotionally expressive than females, as this is a popularly held assumption (Deng et al., 2016), it is interesting to note that infant boys are more emotionally reactive and expressive than infant girls in terms of their vocalisations and their displays of joy. These differences

are present for at least their first six months. However, at around the age of two, when language is usually learned, boys become less verbally expressive than girls. They also show fewer facial expressions than girls by age six (Levant et al., 2009). These findings seem to contradict each other, as the strong relation between alexithymia levels and the development of internalising issues would suggest these rates should be higher in females, who tend to have higher levels of internalising issues, as discussed above. However, some findings may help us understand better this phenomenon. For example, Prentice et al. (2022) point out that even though they are reported to have a better ability to recognise and label their emotions (lower levels of alexithymia), females have been shown to have worse interoception (processing of internal bodily sensations) sensitivity and accuracy than males (see Prentice et al., 2022, for more details). Interoception inaccuracy has also been associated with mental health conditions (e.g., low mood, elevated anxiety, and eating disorders) (e.g., Khalsa et al., 2018; Khalsa & Lapidus, 2016). In fact, females diagnosed with anxiety or depression have been found to report more somatic symptoms than males (Marcus et al., 2008). Finally, interoception has been found to affect emotional processing, and more accurate processing of bodily sensations was found to be associated with better emotional self-regulation (Weiss et al., 2014). At the same time, interoception sensitivity was found by Kever et al. (2015) to be related to the facilitation and implementation of the use of two ER strategies, namely cognitive reappraisal (adaptive) and suppression (maladaptive). The development of internalising issues is often linked with maladaptive coping styles and the frequent use of maladaptive ER strategies (see Aldao et al., 2010, for review).

1.1.4.4 Use of adaptive and maladaptive emotion regulation strategies

The frequent use of maladaptive emotion regulation (ER) strategies but also a low reliance on adaptive ER strategies or poor use of adaptive ER strategies is often found to be a risk factor for developing psychopathology (i.e., Garnefski et al., 2001; Aldao et al., 2010; Berking et al., 2008; Kraaij & Garnefski, 2012). Multiple studies have revealed that individuals who frequently use cognitive reappraisal have better mental health outcomes and lower rates of anxiety and depression, while the frequent use of suppression is often associated with increased prevalence of anxiety and depression (for a review, see Nolen-Hoeksema, 2012; Schafer et al., 2017). Higher rates of social anxiety have also been found in individuals who applied maladaptive ways of thinking and frequently used suppression (Dryman & Heimberg, 2018; O'Connor et al., 2014). Social anxiety disorder is often associated with cognitive processing biases like negative interpretation bias and heightened threat sensitivity (for review, see Morrison and Heimberg, 2013). Additionally, Blalock et al. (2016) found that individuals with social anxiety benefit more from reappraising their negative emotions than healthy controls, while in both groups, individuals who frequently used suppression for both negative

and positive emotions reported worse emotional experiences in general. The relationship between cognitive reappraisal, suppression and well-being has been widely investigated. It has revealed that, in general, cognitive reappraisal is more positively associated with well-being, while suppression of emotions is often positively associated with psychopathology (i.e., Aldao et al., 2010; Gross, 2015; Gross & John, 2003; Martins et al., 2016; Webb et al., 2012). The two most often investigated ER strategies related to mental health and well-being are cognitive reappraisal and expressive suppression.

1.1.4.5 The frequency of using cognitive reappraisal and expressive suppression in typical development and its relation to internalising disorders.

Cognitive reappraisal is an adaptive ER strategy that involves changing how one thinks about the emotion-eliciting stimulus to change the behavioural reaction to that stimulus. It is considered adaptive as it positively impacts one's understanding of the situation, shifts the focus to a more positive rationalisation for one's own behaviour and the behaviours of others, and is positively associated with well-being. For example, in a study conducted by Gross and John (2003), participants were instructed to either reappraise or suppress their emotions. The results showed that those who used reappraisal reported less negative affect and greater well-being than those who used suppression. A meta-analysis of 56 studies by Aldao et al. (2010) concluded that cognitive reappraisal was consistently associated with lower levels of anxiety and depression.

Cognitive reappraisal is related to activating and inhibiting the activity of different brain parts. For example, Ochsner et al. (2012) conducted a functional magnetic resonance imaging (fMRI) study and discovered that individuals who used cognitive reappraisal to manage their emotions showed increased activity in brain regions associated with positive emotions and reduced activity in regions associated with negative emotions. Additionally, there is evidence of structural differences in regions associated with ER in typically developing males and females and sex differences in brain activity associated with ER. For example, Vijayakumar et al. (2014) found that greater cortical thinning in females aged 12 to 16 years was associated with a more efficient use of cognitive reappraisal as an ER strategy at 19 years. Thus, greater lateral and prefrontal cortex thinning during adolescence was associated with superior cognitive reappraisal use in females alone.

In contrast to cognitive reappraisal, expressive suppression is an ER strategy considered maladaptive. Expressive suppression involves hiding the emotional reaction to the stimulus that caused that reaction in the first place. The expressive suppression of emotions is often positively associated with psychopathology (e.g., Aldao et al., 2010; Gross, 2015; Gross & John, 2003; Martins et al., 2016; Webb

et al., 2012). It is considered maladaptive as it is often not helpful in downregulating the intensity of the emotion itself. As expressive suppression is implemented after the emotional response is already generated within the ER process proposed by Gross (1988), it is rather ineffective in regulating the internal impact of the emotional stimuli (Li et al., 2017). While the use of expressive suppression in response to positive emotions decreases the experience of those emotions, the use of expressive suppression to manage negative emotions, such as anger or anxiety, has been shown to increase rather than decrease the specific individual experience of these emotions (i.e., Gross & Jazaieri, 2014; Gross & John, 2003). Interestingly, self-reported frequent use of expressive suppression has been associated with feelings of inauthenticity (Gross & John, 2003; English & John, 2012) and has been shown to have long-term negative effects on general well-being, especially life satisfaction and self-esteem (Gross & John, 2003; Brewer et al., 2016; Hu et al., 2014).

The development of internalising issues is often linked with maladaptive coping styles and the frequent use of maladaptive ER strategies. However, despite the general distinction between CR and ES as one of these strategies being adaptive and the second one maladaptive, ES was linked to a decrease in the impact of intolerance of uncertainty on worry (Khatibi et al., 2021). Thus, it can be an adaptive ER strategy in certain situations, for example, when one cannot control the situation. For instance, in a situation where immediate emotional expression might lead to negative consequences, suppressing emotions temporarily can help maintain social harmony or personal safety. Therefore, individual differences in implementing these two ER strategies within different contexts may indicate how well one can adapt to one's environment and how well one will regulate one's affect to pursue one's goals. The ability to switch between different ER strategies based on situational demands can be a marker of emotional adaptability. For example, while cognitive reappraisal might be beneficial in many situations, expressive suppression might be more effective in others, such as during a high-stakes professional presentation where outward emotional expression could undermine one’s credibility. Adapting to regulate emotions is crucial for mental health and goal attainment. Individuals who can flexibly use both adaptive and contextually appropriate ER strategies are likely to manage stress more effectively, maintain better mental health, and achieve their goals more successfully. This adaptability can prevent the development of internalising issues by providing more tools to cope with stress and emotional challenges. For individuals with autism, understanding and developing adaptive ER strategies is particularly important. Autistic individuals often face unique emotional and sensory challenges, making flexible ER strategies crucial to manage their emotions more effectively and navigating social environments more successfully.

1.1.4.6 ASD and cognitive rigidity: implications for emotion regulation

Cognitive reappraisal and cognitive flexibility are closely related ideas in psychology, especially regarding ER and adaptive coping mechanisms. Cognitive reappraisal (CR) is a demanding cognitive task requiring cognitive flexibility (Zaehringer et al., 2018). Individuals who use CR change their original emotional reaction by mentally reframing the problem. They move from their original emotional response to a usually more adaptive perception of the situation. This process requires the individual to be cognitively flexible enough to recognise their initial emotional response, question its accuracy, produce a fresh alternative interpretation, and then pick and implement this new interpretation.

According to multiple studies, CR is one of the most effective ER strategies for regulating emotional responses and coping with stress during various life events (see Riepenhausen et al., 2022, for a review). Every step of this complex procedure requires cognitive flexibility. Therefore, cognitive flexibility facilitates the efficient use of CR for emotion management (Gross & Thompson, 2007). However, past research showed that autistic individuals often face challenges in terms of flexibility (Geurts et al., 2009; Hollocks et al., 2022; Kissine, 2012). The lack of flexibility is a central component of core ASD symptoms, mainly restrictive and repetitive behaviours. Many individuals with ASD find changes in their schedules or expected events distressing and rely on structure and predictability. Thus, this rigid cognitive approach can hinder their ability to consider various interpretations of events or situations. People with ASD often struggle to take the perspectives of others into account and come up with alternative ways of thinking about a difficult or upsetting situation. As a result, they may be less able to spontaneously use CR, which can result in a prolonged impact of negative emotions in these problematic or upsetting situations, presenting as emotional dysregulation and increasing their anxiety levels. Wieckowski et al. (2020) compared a large sample of 722 (146 females) of psychiatrically hospitalised autistic children and adolescents (4-20 years) and found significantly higher emotion dysregulation in autistic females than males. Thus, they concluded that this result may suggest that due to the gender gap in the diagnosis of ASD and probable disparities in the presentation of autistic features in girls compared to males, there may be a delay in seeking help from psychiatric care services for females with ASD until they present with more severe behavioural impairments. Therefore, gaining a more thorough understanding of the varied manifestation of autistic features in males and females and detecting their interaction with emotion regulation and overall emotional well-being becomes critical in accurately recognising the specific manifestation of autism in females. The following section will summarise the main findings in the existing literature referring to different presentations of autistic traits in males and females.

1.1.5 Sex differences in ASD

In recent years, researchers have investigated differences between autistic males and females and often suggest that females with ASD may present with different ASD presentation than males with ASD (e.g., Mandy et al., 2012; Hiller et al., 2014; Howe et al., 2015; Lai et al., 2015; Hiller et al., 2016). This potentially means that a female-specific expression of autistic traits may differ from male-biased conceptualisations of ASD.

A meta-analysis by Edwards et al. (2023) showed that levels of stereotyped behaviours and restricted interests were significantly higher in autistic males compared to females. However, autistic females have been found to present with RRBs more frequently than males in some studies, especially in the area of insistence on sameness (Uljarevic et al., 2021). Hiller et al. (2014) reported that females with ASD, as observed at school by teachers, showed fewer restricted interests and that these interests were more gender-stereotyped, such as animals, rocks, shells, or books in comparison with males with ASD, who were more likely to demonstrate fixated interests in televisions, video games or wheeled toys. Special interests are a well-documented characteristic of autism (i.e. Anthony et al. 2013; Cho et al. 2017; Shattuck et al. 2007). Gould & Ashton Smith (2011) also suggest that females with ASD may present with more gender-stereotyped interests. However, they suggested the difference may be in the intensity of these interests compared to neurotypical females. These areas of intense focus can cover a wide range of topics, often becoming a significant part of the individual's life. Special interests provide a source of joy and comfort and can also be a coping mechanism for dealing with stress and uncertainty. For individuals with ASD, these interests are not merely hobbies but are pursued with a level of intensity and dedication that often is over and above that of neurotypical individuals. For females with ASD, the presentation of special interests can be influenced by social and cultural factors that shape gender-stereotyped interests. While neurotypical females might enjoy certain activities casually, females with ASD might engage in these same activities with extraordinary passion and detail. This can sometimes mask the presence of autism because their interests do not seem unusual in type, only in degree, contributing to issues with accurate diagnosis. Interestingly, the study by Gould and Ashton-Smith (2011) suggests that autistic males are generally more interested than females in collecting facts about non-social events and activities, while females tend to be more interested in gathering information about people.

Differences have also been reported in social and communication behaviours. For example, girls are more often reported to be able to integrate nonverbal and verbal behaviours, share conversations, and begin but not maintain friendships (e.g., Hiller et al., 2014; Head et al., 2014), compared with autistic males. Rieffe et al. (2021) found that autistic male adolescents were more likely to address the problem practically by offering to get a plaster for the injured person, while autistic female

adolescents were more likely, like neurotypical female adolescents, to offer emotional comfort to someone who had hurt themselves.

Therefore, one potential explanation for why girls with ASD are identified later than males is that they tend to have more social motivation than autistic males (Cook et al., 2018; Lacroix et al., 2022; Lawrence et al., 2020; Sedgewick et al., 2016; Song et al., 2021). Females with autism frequently report more and higher-quality friendships than males (Dean et al., 2017; Hiller et al., 2014; Sedgewick et al., 2016; Sedgewick et al., 2019). These more prosocial behaviours may lead to missed diagnoses in females with ASD. On the other hand, several studies indicate no differences in the social drive between autistic males and females, although they agree that both sexes engage in fewer social interactions than typically developing (TD) control groups (DaWalt et al., 2019; DaWalt et al., 2020; Shattuck et al., 2011). In their study, DaWalt et al. (2020) compared adolescent males and females (547 participants (76 females)) aged 14-21 years. They discovered that although there were no differences in the levels of autism symptoms between males and females in their ASD group, the difference in social impairment compared to peers of the same gender (by sex-normed standardised scores) was more pronounced for autistic females than males. Thus, they suggested that it may not be the differences in the levels of autistic traits between males and females alone that play a significant role in the social impairment observed in autistic individuals but rather how these traits interact with typical patterns of male and female social standards. This finding challenges the assumption that autism manifests identically across genders by highlighting that while the core symptoms of autism (autistic traits) might be similar in males and females, the social implications of these symptoms differ significantly. This suggests that the social environment and expectations play a crucial role in how autism is experienced and perceived differently by males and females.

Moreover, regardless of their diagnoses, females may have higher anxiety about social performance and acceptance than males due to the urge to build meaningful friendships and difficulties understanding and navigating social situations (see review by Rose and Rudolph, 2006). The reason why autistic females may have stronger social motivation despite their limitations in that area, however, is complicated and not fully understood. Sedgewick et al. (2019) found that adolescent autistic males and females differed in preferred activities when spending time with their friends. Males wanted to do things together, like playing games, while females spent more time talking with each other about various things. They also found that autistic girls, like their neurotypical peers, experienced more relational conflicts. At the same time, boys faced more overt difficulties with their friends, which had a less severe effect than the relational aggressions girls experienced (Sedgewick et al., 2019).

Therefore, multiple other factors may likely contribute to differences in the social functioning of autistic males and females. For example, some research suggests that females with ASD may possess

better cognitive flexibility, allowing them to adapt their behaviour in social situations more effectively (Bolte et al., 2011; Lehnhardt et al., 2016). As described earlier in this chapter, cognitive flexibility is the ability to shift one's thinking and adapt to new or changing situations. It involves the capacity to switch between different tasks, perspectives, or strategies and modify behaviour in response to the demands of the environment (see Sanders et al., 2008, for a review). Cognitive flexibility is an essential cognitive skill that underlies the successful use of an adaptive ER strategy cognitive reappraisal, which is often crucial for positive social interactions and adaptive behaviour. Another explanation may be that as social expectations for males and females may be different, females with ASD may engage in more masking or camouflaging behaviours than males (i.e., Halladay et al., 2015; Hull et al., 2017; Lai et al., 2017). They might be more able to learn social skills through observation and mimicry of what they think females should behave like due to social norms (Wing, 1981). Therefore, possible explanations for why females with ASD may be diagnosed later than males are that they might have a slightly different pattern of behaviours than males or develop strategies that could camouflage or mask what we traditionally think of as the signs of autism.

1.1.6 Camouflaging

Camouflaging, a term that encapsulates the effortful task of hiding or disguising one's true identity, thoughts, or feelings, is a strategy employed by individuals, both with and without autism, to navigate social interactions and build relationships. However, for individuals with autism spectrum disorder (ASD), camouflaging takes on a different meaning. It becomes a means to hide or disguise their social and communication difficulties, striving to appear more typical to others (Cook et al., 2021; Halladay et al., 2015; Hull et al., 2017; Lai et al., 2017).

Multiple studies suggest camouflaging is a common coping strategy used by autistic males and females. The higher rate of camouflaging by autistic individuals compared with non-autistic individuals may be due to a mismatch between their natural way of being and social expectations, which can lead to discrimination (Hull et al., 2017; Lai & Baron-Cohen, 2015; Mandy, 2019; Perry et al., 2022) and low self-esteem (Cooper et al., 2017). While camouflaging in ASD is associated with better social functioning (Hull et al., 2016), it can also be associated with increased stress and burnout (Gould et al., 2017). It is essential to understand how camouflaging, or hiding one's true self to fit in socially, relates to autism (Lai et al., 2020) and internalising issues (Bargiela et al., 2016; Mandy et al., 2012; Oswald et al., 2016).

The relationship between sex and gender and camouflaging in autistic individuals is debated (Fombonne, 2020; Lai et al., 2020; Pearson & Rose, 2021). However, it is often discussed in relation

to women and their superiority in using this coping mechanism and is often offered as a reason for missed or late diagnoses in this group (Duvekot et al., 2017; Shattuck et al., 2009; Whitlock et al., 2020). References to autistic camouflaging can be found early in the literature to describe or elucidate the gender gap in diagnosis, particularly among individuals without intellectual disabilities. Lorna Wing, for example, proposed in 1981 that clinical examinations might overlook some autistic females who do not have cognitive problems, possibly due to the finding that females generally have higher social and communication skills than males.

As discussed above, while males tend to present with more externalising behaviours that are more disruptive than behaviours presented by females, this could contribute to gender-based biases in identifying and referring individuals with autism, particularly within educational settings. The needs of autistic males might attract teachers' attention sooner and be viewed as more intrusive than those of females, who could be perceived as reserved or anxious (Hiller et al., 2014). These overt behaviours presented by males can sometimes lead to more direct support for emotion regulation, whereas the internal struggles of females may be overlooked. The internalising challenges females face may heighten their vulnerability to severe mental health conditions and reduce the likelihood of recognising their autism. The effort of maintaining a façade can be emotionally exhausting. Females who camouflage may find it harder to manage their emotions due to the depletion of emotional and cognitive resources needed for effective emotion regulation. Additionally, when females more prominently express the co-occurring internalising issues, these might overshadow the underlying autistic traits, leading to a diagnosis solely focused on the co-occurring condition, thus leaving the autism aspect undetected and unaddressed.

It is also essential to consider that autism is often viewed as a spectrum of traits that can be present in the general population (Robinson et al., 2016). Therefore, it is vital to investigate how camouflaging varies based on autism diagnosis and autistic traits in those without an autism diagnosis (Robinson et al., 2016; Hull et al., 2017) and how it is potentially linked to emotion regulation, alexithymia and internalising issues. At the same time, a better understanding of these associations in the general population can help us understand whether potential differences in the presentation of autistic traits are sex or maybe diagnosis-specific.

1.2 Summary and thesis aims

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder typically considered more common in males. There is growing recognition, however, that sex differences in the prevalence of ASD may have been overestimated. Females tend to be diagnosed later than males and are thought

to present with a slightly different profile of core and associated autistic traits. Anxiety and depression are more common in females and are becoming more obvious in adolescence. Moreover, these internalising issues are also more common in ASD, with similar sex differences.

Less adaptive emotion regulation, higher rates of alexithymia, and the use of camouflaging are all associated with both ASD and with poorer mental health, particularly anxiety and depression (Beck et al., 2020; Morie et al., 2019; Pandey & Choubey; 2010). Autistic individuals are four times more likely than neurotypicals to experience mental health issues over the course of their lives, and rates of these rise with intelligence and age within this population (Hollocks et al., 2019). Additionally, better executive functioning is associated with lower perceived social competence and global self-concept in autistic individuals (Vickerstaff et al., 2007; Zimmerman et al., 2017). A potential explanation for these findings relates to the nature of self-appraisals, whereby heightened awareness of social difficulties in past experiences may contribute to lower self-esteem in autistic individuals and their need to disguise their true selves in social interactions. Therefore, a better understanding of the relationship between emotion regulation, alexithymia, and camouflaging is essential in understating and addressing the mental health needs of autistic individuals, especially females.

The aim of this thesis, therefore, was to examine sex differences in the core profile of ASD. Given differences in emotion regulation reported in ASD and the association between emotion regulation and internalising conditions that commonly co-occur with ASD, this thesis proposes that emotion regulation may be a mechanism underpinning sex differences in the presentation of core and associated autistic traits in males and females. The original intention was to examine these issues within samples recruited through clinical pathways. Given difficulties with clinical recruitment due to the COVID-19 pandemic and multiple national lockdowns, which severely impacted clinical services, studies were also conducted using online samples of adults. Given that autism is a spectrum of traits that extends throughout the general population (Robinson et al., 2016), the stability of observed associations across clinical and non-clinical samples has also been considered.

The specific aims were:

1. To explore sex differences in the 'core' and associated features of ASD in adolescents and adults.
2. To examine sex differences in emotion regulation as a potential mechanism underpinning differences in the presentation of autistic traits in adolescents and adults.

3. To examine sex differences in alexithymia and its association with anxiety and depression in adults.
4. To explore the association between emotion regulation and camouflaging of autistic traits in adults.

Chapter 2: Sex Differences in the Core Profile of ASD

Chapter 2 focused on sex differences in the core profile of ASD, using both a clinical interview measure and questionnaires. This investigation included both adolescent clinical samples and studies with adults recruited online. It also allowed investigation of sex differences in the age of diagnosis.

Chapter 3: Emotion Regulation in ASD: Clinical Study

This chapter focuses on a clinical study and explores how adolescents regulate their emotions using an experimental paradigm, their ability to recognise emotions (alexithymia), and the association of the two with anxiety and depression. The findings contribute to the understanding of the complex relationship between emotion regulation, emotional recognition, and mental health outcomes in adolescents with and without autism diagnosis.

Chapter 4: Development of an Emotion Regulation Paradigm

Chapter 4 focuses on further investigation of emotion regulation in adults. It introduces an experimental paradigm, originally designed for neuroimaging but adapted for online use. As a measure of the efficacy of emotion regulation, this paradigm allowed for a more comprehensive investigation into ER, facilitating further exploration of its mechanisms. The findings of this chapter contribute to our understanding of the relationship between frequency and efficiency of using two ER strategies: cognitive reappraisal and expressive suppression.

Chapter 5: Association Between Emotion Regulation and ASD Traits

Building upon the measures developed in Chapter 4, Chapter 5 investigates associations between ER and both core and associated traits of ASD in adults. This investigation uncovers potential connections between the use of ER in a broader context and its relation to autistic traits and internalising issues,

particularly anxiety, social anxiety, and depression. The findings of this chapter contribute to our understanding of higher rates of internalising issues in females.

Chapter 6: Alexithymia, Anxiety, and Depression in Adults with ASD

Chapter 6 extends the scope by exploring the presence of alexithymia in adults, and its relationship with anxiety and depression. This chapter's findings add depth to the understanding of emotional experiences in individuals with and without ASD and how they might contribute to mental health challenges.

Chapter 7: Camouflaging and Emotion Regulation

The final chapter, Chapter 7, delves into the complicated interplay between camouflaging (masking one's autistic traits) and ER. By investigating this relationship, the chapter offers insights into how ER processes might be connected to individuals' strategies to navigate social contexts, shedding light on the complexities of autistic presentation in males and females.

Chapter 2 – Sex differences in autistic traits

As noted in Chapter 1, women tend to be diagnosed with ASD later than males, with higher levels of symptoms (Goin-Kochel et al., 2006; Russell et al., 2011; Shattuck et al., 2009). Although the diagnostic criteria are, by definition, the same for men and women, there is some evidence that the presentation of ASD may be different in men and women. This chapter will focus on the 'core' symptoms of ASD, starting first with the DSM-5 diagnostic criteria but also including measures frequently used to screen for ASD to explore whether there are differences within those in the core domains of impairment associated with ASD. Subsequent chapters will examine sex differences in associated features.

2.1 Sex differences in clinical profiles and late identification of girls with ASD

Diagnostic criteria for autism rely on behavioural descriptions of core autistic traits (APA, 2013). However, the most often used diagnostic measures for ASD were developed predominantly in male samples. In a recent review by Lebersfeld et al. (2021), both the Autism Diagnostic Observation Schedule (ADOS-2) and Autism Diagnostic Interview (ADI-R) have been found to have high diagnostic accuracy in research but were found less reliable in clinical settings, mainly due to risk of bias concerning patient selection (see Lebersfeld et al., 2021 for review).

Over the years, multiple screening measures for autistic traits have been developed, are freely available to the general public and are often used in research settings, with exciting findings showing some sex differences. For example, research on the Autism-Spectrum Quotient (AQ) has found a sex difference in autistic traits in nonclinical populations, with males scoring higher than females (Ruzich et al., 2015). However, this difference is not seen in clinical populations, which may account for the fact that these individuals are already diagnosed with ASD and, therefore, meet specific criteria. For example, one study of individuals with ASD found no sex differences in autistic symptoms on AQ measure, but females showed better functioning in daily living skills (Mandic-Maravic et al., 2015). On the other hand, another study by Ratto et al. (2018) comparing autistic traits and adaptive skills in school-aged youth diagnosed with ASD without co-occurring ID found that females with higher IQ were less likely to meet the criteria on the ADI-R measure. However, in the same study, according to parental reports utilising the Social Responsiveness Scale (SRS) and the Vineland-II measures, autistic females exhibited a higher degree of impairment compared to typically developing females, in contrast to autistic males who did not show such significant difference in impairment when compared

to typically developing males (Ratto et al., 2018). In essence, these findings imply that females meeting the criteria on gold-standard diagnostic measures tended to experience more pronounced challenges in real-world scenarios compared to autistic males. This may be potentially an effect of the different societal expectations for males and females, as discussed earlier in Chapter 1. Additionally, while there may be sex differences in the presentation of autistic traits, they are not consistently seen across different screening questionnaires and populations. Therefore, some autism screening measures may not effectively highlight sex differences, especially in populations already diagnosed with autism, possibly due to their reliance on standardised criteria that may not sufficiently capture the nuanced manifestations of autism in females, leading to potential underrepresentation or misinterpretation of the extent of impairment in autistic females compared to males.

Interesting findings were noted from the studies using the Broad Autism Phenotype Questionnaire (BAPQ). The BAPQ serves as a valuable tool in research on ASD due to its ability to identify and quantify traits associated with the broader autism phenotype (BAP) in relatives of individuals with ASD. Developed by Hurley et al. in 2007, the BAPQ comprises items that assess various social and communication behaviours commonly observed in individuals with ASD. By administering the BAPQ to family members of individuals with ASD, researchers explored the heritability and familial accumulation of autistic traits, shedding light on the genetic underpinnings of ASD. It is a reliable tool for identifying subgroups of parents within the ASD population (Sasson et al., 2013). It has also been used to detect sex differences, with fathers of children with ASD being rated as more "aloof" and mothers as more "rigid" (Seidman et al., 2012). However, the BAPQ's utility in clinical and research practice and its ability to detect sex differences in ASD populations have not been directly addressed in the literature. Further research is needed to determine the BAPQ's clinical utility and its reliability in detecting sex differences in ASD populations. Therefore, in this thesis, the idea that a better understanding of the broader autism phenotype could potentially highlight some sex differences in the clinical population will be further explored.

It is well established that females are less likely to receive a diagnosis with the same level of autistic traits as men when they are referred for a diagnosis (Goin-Kochel et al., 2006; Russell et al., 2011; Shattuck et al., 2009). Moreover, even when diagnosing using the current diagnostic criteria, women still typically only receive ASD diagnosis if they present with more severe autism symptoms or more co-occurring difficulties (e.g., Russell et al., 2011; Dworzynski et al., 2012). As mentioned above, according to a study by Ratto et al. (2018), females with higher IQs were less likely to meet the criteria for ASD diagnosis than males. These findings indicate that females may often go undiagnosed unless they also experience additional behavioural or cognitive difficulties, which suggests a double bias towards diagnosing males with autism. Specifically, there may be a bias against receiving an assessment, as some females are never referred for diagnostic assessment, as well as a bias against

meeting diagnostic criteria, as our understanding of the 'typical' female profile of ASD is limited by potential nosological and diagnostic preconceptions toward the more traditional, 'male' profile (Lai et al., 2015).

There is a consensus among social scientists that the female phenotype in autism may present different characteristics than the male one (e.g. Mandy et al., 2012; Hiller et al., 2014; Hull et al., 2020; Lai et al., 2015). However, quantitative broad construct-level analyses report no significant differences between autistic males and females. For example, a meta-analysis by Hull et al. (2017) found no significant differences in social and communication difficulties between autistic males and females. Another meta-analysis by Van Wijngaarden-Cremers et al. (2014) found no significant differences between autistic males and females in social interaction and communication across the sample and across groups of different ages, from children as young as infants to adults.

Based on preexisting diagnostic instruments like the ADOS and ADI-R, the aforementioned studies report broad construct-level social interaction and communication scores. To overcome limitations, Lai et al. (2015) suggest studying sex differences in autism through narrow constructs and behavioural examples of social communication and interaction to better understand the potential differences in the behavioural profiles of autistic males and females.

2.2 Sex differences in behavioural profiles of girls with ASD

As discussed in Chapter 1, current literature suggests differences in the behavioural profiles of autistic males and females. For example, autistic females seem more focused on social interactions and have a higher social motivation (e.g., Hiller et al., 2014; Head et al., 2014). This means they tend to report more/better friendship relations with their peers than autistic males. Females may also present with more typical and gender-stereotyped interests, such as animals, rocks, shells, or books, compared to males, who are more likely to demonstrate fixated interests in televisions, video games or wheeled toys (Hiller et al., 2014). Autistic females are often reported to have better communication skills than males (e.g., Lai et al., 2011; Rynkiewicz et al., 2016; Wood-Downie et al., 2021) and use non-verbal communication more frequently (Rynkiewicz et al., 2016; Tang et al., 2021). There are also reports of autistic females having greater imagination and more often engaging in role-play activities (Hiller et al., 2014; Lai et al., 2015), as well as significantly fewer stereotyped behaviours and restricted interests (see meta-analysis by Edwards et al., 2023). While there is a growing body of literature on gender differences in ASD, the research base is still limited, and the mechanisms responsible for females receiving their diagnoses later in life or not at all are still unclear. Therefore, it is essential to further investigate the unique behavioural presentation and characteristics of autistic females

compared to males to understand better the underlying causes and develop more accurate diagnostic criteria and interventions for ASD.

One possible explanation for the differences in behavioural profiles between autistic males and females is the presence of a unique female autism phenotype (as discussed in Chapter 1). However, there is an ongoing debate within the research community regarding the existence and nature of this phenotype. Many studies that included autistic females and explored sex differences were found to have uneven groups of males and females, with females being underrepresented. Moreover, large numbers of studies include female participants who are already diagnosed with autism, therefore, met current diagnostic criteria, and likely present with a more typical male-like profile. Thus, one argument is that females with intellectual disabilities (ID) should not be included in the search for subtle differences in the female autism phenotype, as cognitive impairments may overshadow any gender-specific characteristics. In contrast, others argue that females with intellectual disabilities should be included in the study of the female autism phenotype, as their inclusion provides a more comprehensive understanding of the range of these characteristics.

2.3 Aims and hypotheses

Given that autistic females with intellectual disability are likely to be diagnosed relatively early, this thesis aimed to explore potential factors related to delayed diagnosis in autistic females without co-occurring ID; as such, the clinical sample was recruited from adolescents going through diagnostic assessment. This approach allowed for the exploration of potentially less typical autistic traits in females, which might explain why they were not diagnosed earlier. Due to issues with recruitment resulting from disruption caused by the COVID-19 pandemic and subsequent lockdowns in the UK, two additional samples were collected online, including males and females over 18 years old, both with and without autism. This enabled comparison between autistic males and females and their typically developing peers matched for age and intelligence. The following research questions were investigated in this study:

RQ1. Do we see sex differences in the clinical and behavioural profiles of adolescent autistic males and females? It was hypothesised that males would be more likely to present with behaviours satisfying diagnostic criteria in the DSM-5 subdomains/domains.

RQ2. Are behaviours previously demonstrated to be the most highly discriminating for ASD (Carrington et al., 2014; Carrington et al., 2015) as common in autistic females as in autistic males? H2a) It was hypothesised that both autistic adolescents and adults would present with higher levels

of these highly discriminating behaviours compared to the non-ASD group. H2b) It was expected that fewer of these behaviours would be observed in autistic females than males across the three samples.

RQ3. Do we see sex differences in the screening questionnaires (AQ, BAPQ) for autistic traits in ASD and non-ASD populations? Based on the literature, it was hypothesised that there would be no differences between autistic males and females on the AQ measure (while the BAPQ was left open to exploration). In contrast, higher levels of autistic traits were expected to be found in non-ASD males compared to non-ASD females.

RQ4. Is there a sex difference in the age of diagnosis in the adult sample? Is there a significant relationship between levels of autistic traits and the age of diagnosis? H4a) Females were expected to report being diagnosed with ASD later than males (Goin-Kochel et al., 2006; Russell et al., 2011; Shattuck et al., 2009); H4b) It was hypothesised that individuals diagnosed earlier would have lower levels of autistic traits based on the paper of Mandy et al. (2018), suggesting that earlier support correlates with fewer difficulties later in life.

2.4 Methods

2.4.1 Participants

Sample 1

Participants in this sample, further referred to as a clinical study, were children and adolescents aged 10-18 years (further referred to as adolescents), and their parents were second informants on their children's behaviours. Autistic participants were recruited through clinical services. This was initially an established collaboration with Forward Thinking Birmingham (FTB) and expanded to include other pathways. Children referred to FTB for autism assessment or those already diagnosed with ASD but still under FTB care were identified as potential participants and provided information about the study. A total of 7 participants were recruited through this service. Participants for the ASD group were also recruited through schools, including Queens Alexandra's College and Limpsfield Grange School. A further 5 participants were recruited through these schools. A further six participants for the ASD group of the clinical study were recruited through advertisements on online platforms such as MQ Mental Health Research and social media groups. A total of 20 participants were recruited for the ASD group. However, one participant did not complete the study and was not included in the final sample. One further individual was excluded from the ASD group and included in the control group due to not receiving an ASD diagnosis after assessment at FTB.

The non-ASD group included age-matched individuals without ASD diagnosis recruited through local schools, advertisements and newsletters posted through Aston University, and online posts (53 participants were recruited for this group).

The total sample count for the clinical study was 71: 18 ASD participants (9 males and 9 females) and 53 non-ASD participants (25 males and 28 females) matched for age (ASD: M=14.11, SD=2.25; non-ASD: M=12.87, SD=2.1) and intelligence (IQ; ASD: M=112.94, SD=14.21; non-ASD: M=119.81, SD=11.32). All participants completed informed consent before participating, and each family was paid £25 in compensation for their time. This study was given a favourable ethical opinion by the Health Research Authority and the West Midlands – South Birmingham Research Ethics Committee (REC reference: 18/WM/0349).

Despite the initial plan for all data collection to be conducted in person, only 23 out of 71 participants were able to complete the study in a face-to-face setting with the researcher before the COVID-19 pandemic and UK lockdown began in March 2020. The study was then paused for 17 months, and the remaining 48 participants were recruited online and tested via Microsoft Teams/Zoom meetings after the study reopened in September 2021 (for non-ASD group) and from May 2022 (for clinical services – ASD group) up till January 2023 when data collection ended. This transition was carefully managed to ensure the integrity of the data. Participants completed informed consent and questionnaires collected in pen and paper form from participants who met with the researcher face-to-face and via Qualtrics (online survey software) from individuals participating online. Parents of autistic children completed additional interviews with the researcher (DISCO – see below for details), face-to-face before lockdown and via MS Teams/Zoom later. For a detailed list of measures collected from this sample, please see Table 1 below.

Sample 2

Participants from this sample, further referred to as online study 1, were recruited through Prolific, an online tool that connects researchers with a large database of trusted participants worldwide. The total sample consisted of 317 adults, fluent in English, with and without ASD diagnosis. Participants answered a question if they had an ASD diagnosis and were asked to provide the age at which they had been diagnosed with ASD. Only individuals who self-reported having received a clinical ASD diagnosis and scored above the 'clinical' threshold of ≥ 32 on the ASD screening measure Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001) were included in the ASD group. The control (non-ASD) group consisted of individuals without ASD diagnosis who scored ≤ 26 on the AQ scale.

The total number of participants included in this sample was 268: 108 ASD individuals (54 males; 54 females) and 160 non-ASD individuals (82 males; 78 females). The mean age of the two groups was not significantly different (ASD: M = 29.75, SD = 9.17; non-ASD: M = 27.74, SD = 8.75)). Before data

collection, Aston University's Health and Life Sciences Research Ethics Committee assessed and approved the study (REC reference number 1764). All participants accessed the study voluntarily through the Prolific website and were paid £11.25 for their input through Prolific. Participants completed the consent form and all questionnaires via Qualtrics and experimental tasks via Pavlovia online. Data for this study were collected from September to November 2021. For a detailed list of measures collected from this sample, please see Table 1 below.

Sample 3

Participants from this sample, further referred to as online study 2, were also recruited through the Prolific platform, and the inclusion criteria were the same as for sample 2. Participants who took part in the first online study were excluded from participating in this study (through Prolific settings). The total sample recruited for this study consisted of 320 participants. Again, only participants who confirmed having ASD diagnosis and reached the threshold (≥ 32) on ASD screening measure (AQ) were included in the ASD group, and those without ASD diagnosis and AQ scores ≤ 26 were included in the non-ASD group.

This sample's total number of included participants was 238: 106 ASD individuals (48 males, 58 females) and 132 non-ASD individuals (62 males, 70 females). As for Sample 2, the difference between the mean age of the two groups was significantly different (ASD: M=32.22, SD=9.05; non-ASD: M=37.55, SD=11.89; $t_{(236)}$=-3.82, p=.001). Before data collection, Aston University's Health and Life Sciences Research Ethics Committee assessed and approved the study (REC reference number: HLS21085). All participants accessed the study voluntarily through the Prolific website and were paid £10.50 for their input through Prolific. Participants completed the consent form and all questionnaires via Qualtrics and experimental tasks via Pavlovia online. Data for this study were collected in March 2023. For a detailed list of measures collected from this sample, please see Table 1 below.

Due to the data collection being conducted online for participants included in samples 2 and 3, no formal IQ check was performed for participants included in samples 2 and 3. However, it was assumed that individuals capable of registering with Prolific and using the platform to participate in the research were within the normal range of intellectual functioning. All participants reported having completed high school or secondary school, although it was not inquired whether they received any support during their schooling.

2.4.2 Measures

Table 1. Experimental tasks and questionnaires that participants from each sample completed

Sample 1 (age 10-18) N = 71 ASD = 18 (9 females) Non-ASD 53 (28 females) IQ: ASD (M=112.94) non-ASD (M=119.81)	**Sample 2 (age 18-64)** N = 268 ASD = 108 (54 females) non-ASD = 160 (78 females)	**Sample 3 (age 18-71)**N = 238 ASD = 106 (58 females) non-ASD = 132 (70 females)
CHILDREN (time ~ 2h) • Experimental Reactivity and Regulation Situation Task (adaptation from Samson et al., 2015a) • The Emotional Quotient Inventory (Youth Version) Brief Form (BarOn **EQ-i:YV**; Bar-On & Parker, 2000) • Hospital Anxiety and Depression Scale (**HADS**; Zigmond & Snaith, 1983) • Wechsler Abbreviated Scale of Intelligence – Second Edition (**WASI-II**, David Wechsler, 2011)	ADULTS (time ~ 1.5h) • Experimental Emotion Regulation Task (adaptation of a task by Pitskel et al. (2014)) • The Autism Spectrum Quotient (**AQ**_Adult; Baron-Cohen et al., 2001) • The Broad Autism Phenotype Questionnaire (**BAPQ**, Hurley et al., 2007) • Hospital Anxiety and Depression Scale (**HADS**; Zigmond & Snaith, 1983) • The Brief Fear of Negative Evaluation Scale (**BFNES**; Leary et al., 1983) • The Emotion Regulation Questionnaire (**ERQ**; Gross & John, 2003) • The Cognitive Emotion Regulation Questionnaire (**CERQ**; Garnefski et al. (2001) • The Behavioural Emotion Regulation Questionnaire (**BERQ** - Kraaij & Garnefski, 2019) • The Toronto Alexithymia Scale (**TAS-20**, Bagby, R. M., Parker, J. D. A. & Taylor, G. J. (1994)) (some participants only)	ADULTS (time ~ 1.5h) • Experimental Emotion Regulation Task (adaptation of a task by Pitskel et al. (2014)) • The Autism Spectrum Quotient (**AQ**_Adult; Baron-Cohen et al., 2001) • The Broad Autism Phenotype Questionnaire (**BAPQ**, Hurley et al., 2007) • The Signposting Questionnaire for Autism (**SQ-A** Adult; Livingstone et al., 2023; manuscript in preparation) • Hospital Anxiety and Depression Scale (**HADS**; Zigmond & Snaith, 1983) • The Brief Fear of Negative Evaluation Scale (**BFNES**; Leary et al., 1983) • The Emotion Regulation Questionnaire (**ERQ**; Gross & John, 2003) • The Cognitive Emotion Regulation Questionnaire (**CERQ**; Garnefski et al. (2001) • The Behavioural Emotion Regulation Questionnaire (**BERQ** - Kraaij & Garnefski, 2019) • The Toronto Alexithymia Scale (**TAS-20**, Bagby, R. M., Parker, J. D. A. & Taylor, G. J. (1994)) • The Camouflaging Autistic Traits Questionnaire (**CAT-Q**, Hull et al., 2019) • The Rosenberg Self-Esteem Scale (**RSE**, Rosenberg, M., 1965) • The Berkeley Expressivity Questionnaire (**BEQ**, Gross & John, 1995)
PARENTS (time ~ 30 min) • The Autism Spectrum Quotient Adolescent Version (**AQ**_Adolescent; Baron-Cohen et al., 2006) • Children's Alexithymia Measure (**CAM**; Way et al., 2010)		
PARENTS of ASD CHILDREN (time ~ 4-5h) Diagnostic Interview for Social and Communication Disorders (**DISCO**-11th revision); Wing et al., 2002)		

Diagnostic Interview for Social and Communication Disorders (DISCO-11th revision); Wing et al., 2002)

The DISCO is a 320-item semi-structured clinical interview that gathers information regarding the individual's development profile and behaviours. The interview is typically conducted with a parent or caregiver. It is a well-established clinical interview tool, which was not developed according to specific diagnostic criteria. Therefore, it provides a broader overview, from detailed developmental history to a profile of current strengths, needs and difficulties, than other tools currently used in clinical settings. The interview has good reliability and criterion validity (Leekam et al., 2002; Maljaars et al., 2012), as well as shown good stability of diagnosis over time (Anglim et al., 2022). The interview can be used to evaluate individual needs (see Wing et al., 2002 for details). While the DISCO interview was not developed according to specific diagnostic criteria, there are diagnostic algorithms that can be used to inform diagnosis as part of clinical practice or research. These algorithms have been developed according to official classification systems, such as ICD-10 (Leekam et al., 2002) and DSM-5 (Kent, Carrington et al., 2013), with the latter used in this study.

The DISCO DSM-5 algorithm is divided into two broad domains, which are further divided into subdomains. The first domain (domain A) measures social interaction and communication and has the following subdomains: 1) deficits in socio-emotional reciprocity; 2) deficits in non-verbal communication; 3) deficits in development, maintaining and understanding relationships. The second domain (domain B) measures restricted and repetitive patterns of behaviours and includes the following four subdomains: 1) stereotyped or repetitive motor movements, use of objects or speech; 2) insistence on sameness, inflexible adherence to routines, or ritualised patterns of verbal/non-verbal behaviour; 3) highly restricted fixated interests; 4) hyper or hypo reactivity to sensory input. In order to meet the criteria for a diagnosis of DSM-5 ASD, individuals must have impairments in all three of the Domain A subdomains and in two of the four Domain B subdomains. Finally, domain measuring evidence of impairment early in development was included (Domain C; for further detail, see Kent et al., 2013).

The Signposting Questionnaire for Autism (SQ-A Adult; Livingstone et al., 2023; manuscript in preparation)

The Signposting Questionnaire (SQ-A Adult) is an 18-item self-report questionnaire developed from the DISCO (Diagnostic Interview for Social and Communication Disorders), a 320-item semi-structured clinical interview (DISCO; Leekam et al., 2002). Carrington et al. (2014, 2015) originally identified a set of 14 interview items that best discriminated between individuals with and without an autism diagnosis. This 'signposting set' of interview items were converted to a parent-report questionnaire

format, which was validated with a sample of children (SQ-A Child; Jones et al., 2020). The version used in this study is a lifetime measure that has been developed to use first-person wording and adapted language preferred by autistic individuals to reflect their living experience (Livingstone et al., 2023; in preparation). This version has an additional 4 items from the DISCO included, which were particularly common in autistic individuals who were diagnosed in adulthood (Carrington et al., 2019).

This questionnaire was completed by Sample 3 only. In completing the questionnaire, participants answered statements like ("I seek comfort or help when in pain or distress" or "I have difficulty with making and keeping friendships") on a four-point response scale (definitely agree, slightly agree, slightly disagree, definitely disagree). The scale is converted into binary codes, which results in an SQ-A total score ranging from 0 to 18. Items are scored as present if they meet the DISCO criteria for a 'marked' impairment (for details of scoring, see Jones et al., 2020). Comparable to the short version of the Autism Spectrum Quotient (AQ-10; Allison et al., 2012), all SQ-A scores indicated good to exceptional internal reliability (0.83) and construct validity (Livingstone et al., 2023; manuscript in preparation).

The Autism Spectrum quotient (AQ_Adult; Baron-Cohen et al., 2001; AQ_Adolescent; Baron-Cohen et al., 2006)

The AQ is a 50-item questionnaire that measures traits associated with ASD. Initially developed as a self-report measure for adults, the AQ has been used to measure traits across the general population, with evidence of continuous variation of these traits in non-clinical samples, with higher scores – indicative of more traits – evident in those with a clinical diagnosis of ASD (Baron-Cohen et al., 2001). Every 10 questions of the scale cover five different areas: social skills (e.g., "I find social situations easy"), attention switching (e.g., "I find it easy to do more than one thing at once"), attention to detail (e.g., "I tend to notice details that others do not"), communication (e.g., "I enjoy social chit-chat"), and imagination (e.g., "I find making up stories easy"). The scale can differentiate between autistic adults and neurotypical adults (Woodbury-Smith et al., 2005) and has good test-retest reliability (Baron-Cohen et al., 2001). The adolescent version of this questionnaire for sample 1 was collected in the form of a parent report (see Appendix 1). While questionnaires from samples 2 and 3 were collected from adults as a self-report (see Appendix 2). The difference between the two versions is using the third-person pronouns (she/he, him/her) in the parent report.

The Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al., 2007)

The Broad Autism Phenotype (BAP) Questionnaire is a 36-item self-report tool designed to assess the presence of features associated with the "broad autism phenotype." The BAP questionnaire is often used in research settings to identify individuals who may have subclinical features of autism. The broad autism phenotype refers to a range of traits and behaviours similar to those seen in individuals with ASD but milder in intensity.

The BAPQ consists of a series of items that were divided into three subscales: Aloof Personality (e.g., "I enjoy being in social situations"), Pragmatic Language (e.g., "I find it hard to get my words out smoothly") and Rigid Personality (e.g., "People have to talk me into trying something new"). Respondents rate how well each statement applies to them on a five-point Likert scale. The aloof personality lacks interest in or enjoyment of social interaction, while the rigid personality lacks interest in change or difficulty adjusting to change. Pragmatic language problems are defined as deficiencies in the social aspects of language that lead to problems with effective communication or maintaining a flowing, reciprocal conversation (Hurley et al., 2007). Due to the specific nature of this research thesis, which was exploring sex differences in the profiles of individuals without intellectual disability, both with and without ASD diagnosis, BAPQ was included in both online studies to assess broad autistic traits across the samples to explore its ability for highlighting specific difficulties in each of the groups.

2.4.3 Procedure

Parents of ASD adolescents from the clinical study met with the researcher and completed the DISCO interview face-to-face or via MT/Zoom. All parents of the clinical sample children and control group children also completed the AQ_adolescent about their children either in pen and paper form or via Qualtrics (as explained earlier in this chapter).

Adult participants from samples 2 and 3 combined completed their questionnaires as self-reports via Qualtrics.

2.4.4 Analyses

All statistical analyses were conducted using IBM SPSS Statistics 26 software.

2.4.4.1 Comparison of sex differences in DISCO interview and signposting questionnaire

Due to the small sample size, the DISCO data were not assessed statistically and were explored descriptively rather than quantitatively. In accordance with the sub-domain and domain structure of the DSM-5 diagnostic criteria, represented by the DISCO algorithm mentioned earlier, the broad profile of male and female behaviour was investigated, following the analysis procedure by Carrington et al. (2019). The percentage of marked items within each sub-domain and domain of the algorithm was plotted and discussed first. Subsequently, the percentage of adolescents meeting the overall "cut-off" or threshold for each subdomain/domain was assessed in a plot and described.

Next, the adolescent behaviours were examined at the item level by extracting items corresponding to the signposting questionnaire (SQ-A). The percentage of individuals for whom each item was scored as ever having been present was plotted for the adolescents from the clinical study and for autistic and non-autistic adults from sample 3. Males and females were compared within each group.

2.4.4.2 Comparison of the levels of autistic traits within the AQ (AQ_Adolescents and AQ_adults) and BAPQ measures

The levels of autistic traits were compared between males and females within the autistic and typically developing groups in adolescents and adults separately.

Data distribution was assessed with the Shapiro-Wilk test or visual checks for larger samples. It is important to note that conducting normality checks using statistical methods might be inappropriate for large data samples, as they often exhibit non-normal distributions regardless of the underlying population distribution (Demir, 2022). Therefore, visual data checks were conducted using Q-Q plots, skewness, and kurtosis. To establish a normal univariate distribution, it is generally accepted that the asymmetry (skewness) and kurtosis values should fall within the range of -2 to +2, as George and Mallery (2010) suggested. Supporting this viewpoint, Hair et al. (2010) and Bryne (2010) have contended that data can be considered as normally distributed when the skewness value lies between -2 and +2 and the kurtosis value falls within the range of -7 to +7. This approach to normality checks of the data was carried out throughout this thesis.

To compare the total scores of autistic traits in males and females as collected by the AQ_adolescents and AQ_adults measures, bootstrapped parametric (t-test) or non-parametric test (Mann-Whitney) were run, depending on the data distribution. Potential sex differences in the individual five subscales of the AQ measures were explored with repeated measures ANOVA or non-parametric tests (Mann-Whitney) followed by one-way ANOVA post hoc tests when required.

The same statistical procedure was followed to compare the broad profiles of autistic traits in males and females as collected by the BAPQ in both online studies. Bootstrapped parametric (t-test) were run to compare males and females within the ASD and non-ASD groups. Potential sex differences in the individual three subscales of the BAPQ measure were explored with repeated measures ANOVA followed by one-way ANOVA post hoc tests when required.

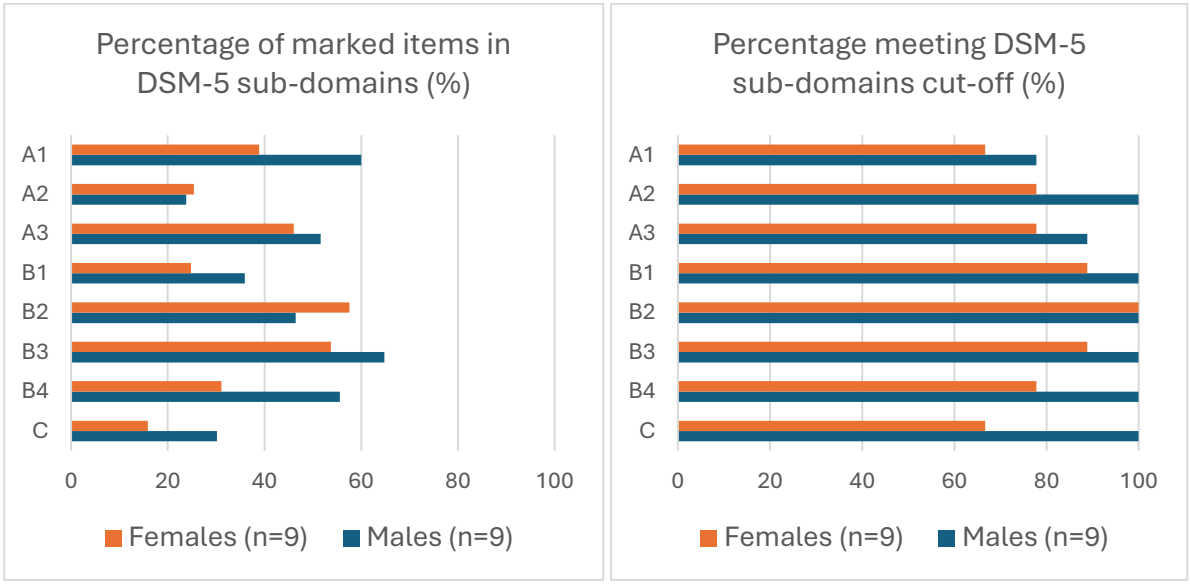
Independent sample mean scores comparisons were made to explore whether males and females within each sample's ages differed when they received their diagnosis. Then, bivariate correlations between the age of diagnosis and total scores of autistic traits measured on questionnaires (AQ, BAPQ, and SQ-A) were explored.

2.5 Results

2.5.1 DISCO and DSM-5 diagnostic criteria

The broad behavioural profile of male and female adolescents was investigated in accordance with the DSM-5 diagnostic criteria's sub-domain (Figure 1) and domain (Figure 2) structure, as represented by the DISCO algorithm.

Figure 1. DSM-5 sub-domains comparison for DISCO data from adolescent males and females

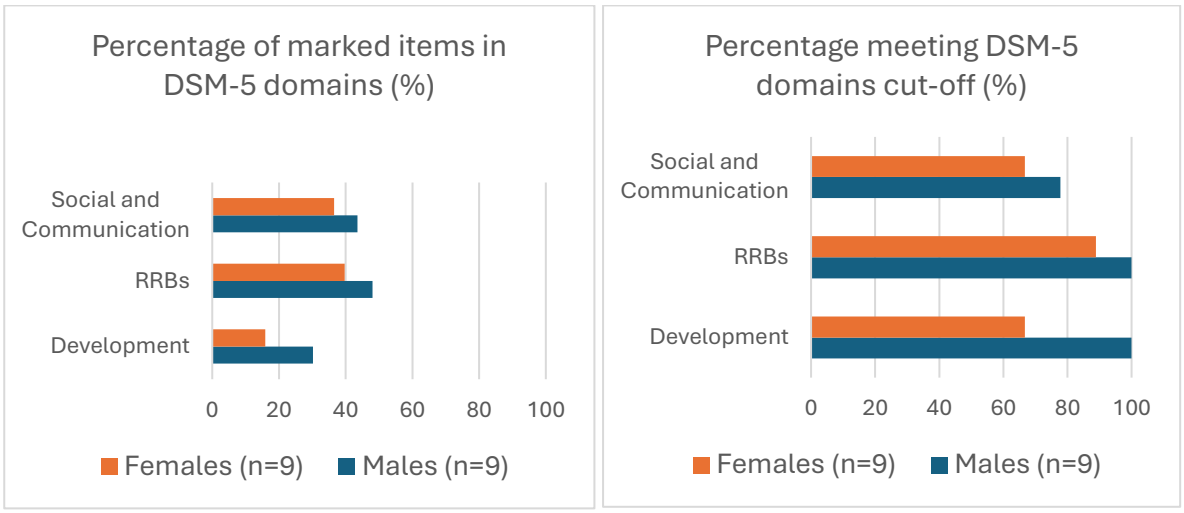


Note: The percentage of items of the DISCO DSM-5 algorithm marked as ever-present in each subdomain for males and females (left) and the percentage of adolescent males and females who met the subdomain thresholds on the DISCO DSM-5 algorithm (right). Subdomains: A1 - deficits in socio-emotional reciprocity, A2 - deficits in non-verbal communicative behaviours, A3 - deficits in developing, maintaining, and understanding relationships; B1 - stereotyped or repetitive motor movements, use of objects, or speech, B2 - insistence on sameness, inflexible adherence to routines or ritualised patterns of verbal or non-verbal behaviour, B3 - highly restricted, fixated interests abnormal in intensity or focus, B4 - hyper- or hypo-reactivity to sensory input or sensory interests, C – symptoms present in the early developmental period.

The profiles are suggestive of differences between autistic males and females, which was especially noticeable in the RRB domain. In Domain A, the subdomain in which males had the highest percentage of behaviours was deficits in socio-emotional reciprocity (A1), while for females, it was in the domain measuring difficulties in developing and maintaining relationships (A3). In Domain B, males had the highest percentage of behaviours relating to highly restricted, fixated interests (B3), while for females, it was the subdomain related to insistence on sameness, inflexibility in routines, and adherence to ritualised behaviours (B2). Overall, males presented with a higher percentage of marked behaviours than females in all DSM-5 sub-domains for ASD diagnosis, except for A2 (deficits in non-verbal communicative behaviours) and B2 (insistence on sameness, routines, or ritualised patterns of verbal and non-verbal behaviour). Subsequently, sub-domain B2 was the only one in which 100% of male and female participants scored above the clinical threshold. 100% of males have also reached cut-off scores in sub-domains A2, B1, B3, B4 and C, and less than 100% but still more than females in the remaining sub-domains A1 and A3.

Overall, females had a lower percentage of DISCO items marked as ever-present in all three DSM-5 domains compared to males, with early developmental issues being the ones with the fewest issues reported by parents (less than 20%) (see Figure 2). It was also the domain where both males and females had the highest probability of not meeting the clinical threshold. Only 66% of autistic female participants met the diagnostic algorithm "cut off" for the development domain, while all autistic male participants did. However, the C category within the DSM-5 relies on clinical judgment. It presumes the symptoms may have been masked or not in full manifestation before social demands exceeded an individual's limited capacity to cope.

Figure 2. DSM-5 domains comparison for DISCO data from adolescent males and females



Note: The percentage of items of the DISCO DSM-5 algorithm marked as ever-present in each domain for males and females (left) and the percentage of adolescent males and females who met the domain thresholds on the DISCO DSM-5 algorithm (right).

All males met the threshold for RRBs domain “cut-off” criteria. At the same time, one of the female participants was reported not to have enough marked issues in this domain, resulting in a total of 89% of females reaching the “cut-off” for this domain. Interestingly, only 77.7% of the males within the recruited sample met the social and communication domain “cut-off” criteria compared to 66% of females. However, upon a check of the two male participants who did not reach this domain cut-off, it was found that they were older teenagers (above the age of 16 years), both recruited not through clinical services and, therefore, diagnosed earlier in childhood, which might have affected how their parents perceived their developmental difficulties and current abilities in this domain.

2.5.2 DISCO and Signposting Questionnaire Item level analysis

Descriptive analyses were conducted based on the results of the signposting questionnaire collected in sample 3 (adults, online study), which allowed a comparison of males and females within both the ASD and non-ASD groups and items corresponding with SQ-A items extracted from the DISCO questionnaire from the clinical sample. Results for each of the 18 items from SQ-A are presented in Figure 3.

For the majority of SQ-A items, only a small percentage of the non-ASD group (sample 3 only) exhibited the behaviours measured; nevertheless, there were several items on which a slightly higher percentage of non-autistic participants scored, although still much lower than the ASD group. Notably, the items with slightly elevated percentages refer to aspects involving social interactions and preferences for specific interests and activities. This observation may be suggestive of a distinct trend that may reflect modern society's current tendencies. It is indeed possible that with the development of modern technology, social interactions and preferences for free time activities are also changing within society. There were no specific sex differences noted within the non-autistic group, except a slightly higher tendency for males to require prompting to interact with others and issues with seeking support when in pain or distress, which also may reflect common misconceptions of how typical men should behave.

The items for which the percentage of autistic adolescents exhibiting the behaviour was higher than autistic adults included collecting and arranging objects, seeking assistance during periods of discomfort, and recognising the emotions of others. The reverse pattern was seen for items measuring difficulties spontaneously joining others and a stronger feeling of distancing themselves from others. This variance may be suggestive of an increased desire to interact with peers more during adolescence.

In terms of sex differences between autistic adolescents and adults, some interesting changes within the pattern were observed and are described below. First, sex differences in the percentage of marked issues generally appeared more pronounced for adolescents than adults. Where there were apparent differences between males and females, these tended to be in the same direction for both adolescents and adults, with the exception of six items: share in happiness, one-sided approaches, difficulty with friendships, response to emotions, sharing interests, and arranging objects. Adolescent autistic males were reported (by their parents) to have a higher percentage of marked issues than adolescent autistic females on the first five items mentioned. In contrast, adolescent females were reported to have more issues with the 'arranging objects' item than adolescent males. The direction of these trends was reversed in the adult sample. In the adolescents' sample, more males than females exhibited behaviours on 10 of the items, but this pattern was only shown for two items in the adult sample; however, this should be interpreted with caution as the differences between males and females in the adult sample were much smaller.

Other interesting patterns were noted for individual items, for example, in the ability to share the happiness of others, where the percentage of autistic adolescent males encountering difficulties was higher than for adolescent females. Interestingly, this trend was reversed and much smaller within the adult group. A similar trend was also observed for sharing a wide range of interests with others, avoiding social interactions and challenges in forming and keeping friendships, as well as in choosing the same preferred activities.

Figure 3. Percentage of individuals with a 'marked' behaviour for each of the SQ-A items (non-ASD and ASD adults) and corresponding DISCO (ASD adolescents) items split by sex

*Note: * items are reverse scored.*

Additionally, a higher percentage of adolescent autistic females were inclined to arrange objects compared with adolescent males, a trend which was again reversed for adults. This may suggest that flexibility in this area may increase with age in autistic females in particular. More autistic females (adolescents and adults) had issues tolerating unwanted sounds, changes in the home environment, and collected objects compared with males, although these differences were relatively small (see Figure 3).

Finally, some interesting variances in the patterns were observed between autistic adolescent females and adult females. In particular, a higher percentage of adult autistic females reported difficulties joining others, making and keeping friendships, and being able to respond to the emotions of others and comforting others than adolescent autistic females. Again, this trend may be suggestive of differences potentially driven by the increased social motivation in adolescence, which may hinder these difficulties from being noticeable by others (DISCO was a parent report) and/or reflect better insight adult autistic females may have of their difficulties in these areas.

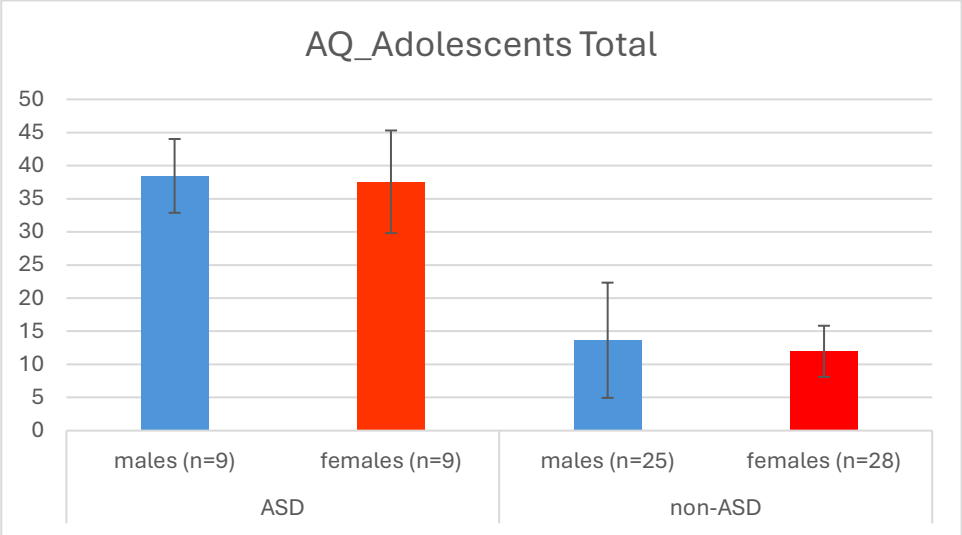
2.5.2 Sex differences as measured by questionnaires (AQ and BAPQ)

Adolescents (AQ_Adolescents)

The following results are from parent reports for the adolescents (10-18 years old) from clinical sample 1 (as described above) - a total of 71 participants (18 ASD (9 males and 9 females) and 53 non-ASD (25 males and 28 females)).

Data for the AQ total variable were not normally distributed ($W = .869$, $p < .00$). Thus, due to the small sample size, the Mann-Whiteny test was used to explore differences between males and females within both groups. Mean scores for group comparison are presented in Figure 4.

Figure 4. Mean scores for autistic traits (AQ_Adolescents), compared by group and sex

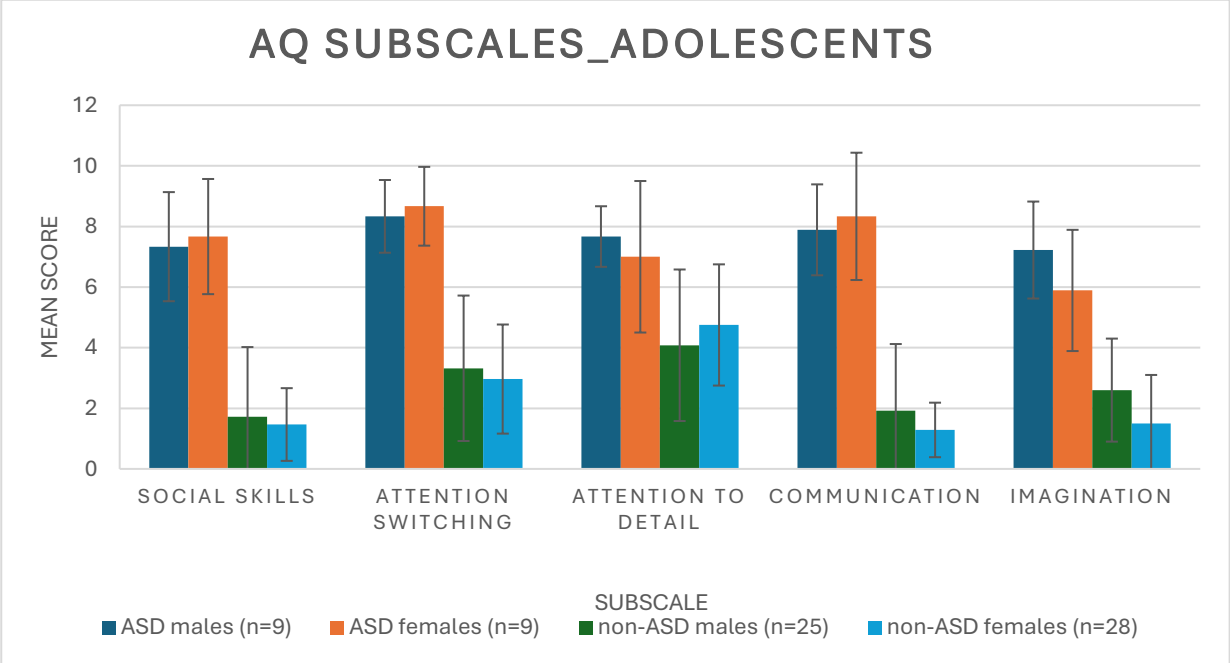


Note: Average total scores for each group with standard deviation error bars.

As expected, the ASD group had higher levels of autistic traits than the non-ASD group. The Mann-Whitney test was conducted to assess sex differences within the groups. No significant sex differences were found in the ASD (U = 39.5, p = .930) or non-ASD group (U = 3445, p = .922) groups.

The mean scores for each subscale were compared to explore potential sex differences between the two groups' individual subscales of the AQ measure, and the results are presented in Figure 5.

Figure 5. Mean scores for autistic traits by subscale (AQ_Adolescents) compared by group and sex



Note: Adolescents' mean scores for difficulties reported within each AQ subscale with standard deviation error bars

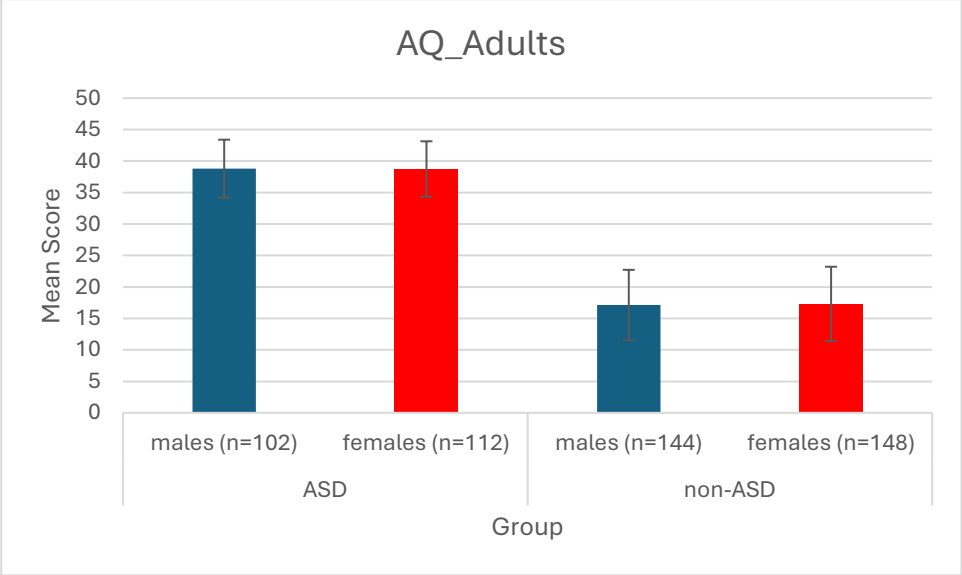
The scores were tested separately with the Mann-Whitney test for ASD and non-ASD groups. The results showed a significant difference between males and females in the imagination scale in the non-ASD group only (U = 200.5, p = .006). No other comparisons were significant (p > .05).

Adults (AQ_adults)

The following results are for the adults (self-reports) from online studies samples 2 and 3 combined with a total of 506 participants (214 ASD (102 males and 112 females), 292 non-ASD (148 females and 144 males)).

Due to the large sample sizes, the normality of the data for the AQ total score variable was assessed by Q-Q plots, skewness .037 and kurtosis -1.345 statistics, which falls within the range of -2 to +2 (George & Mallery, 2010). Mean scores for group comparison are presented in Figure 6.

Figure 6. Mean scores for autistic traits (AQ), compared by group and sex



Note: Adults from samples 2 and 3 combined mean scores for total difficulties reported within the AQ questionnaire with standard deviation error bars

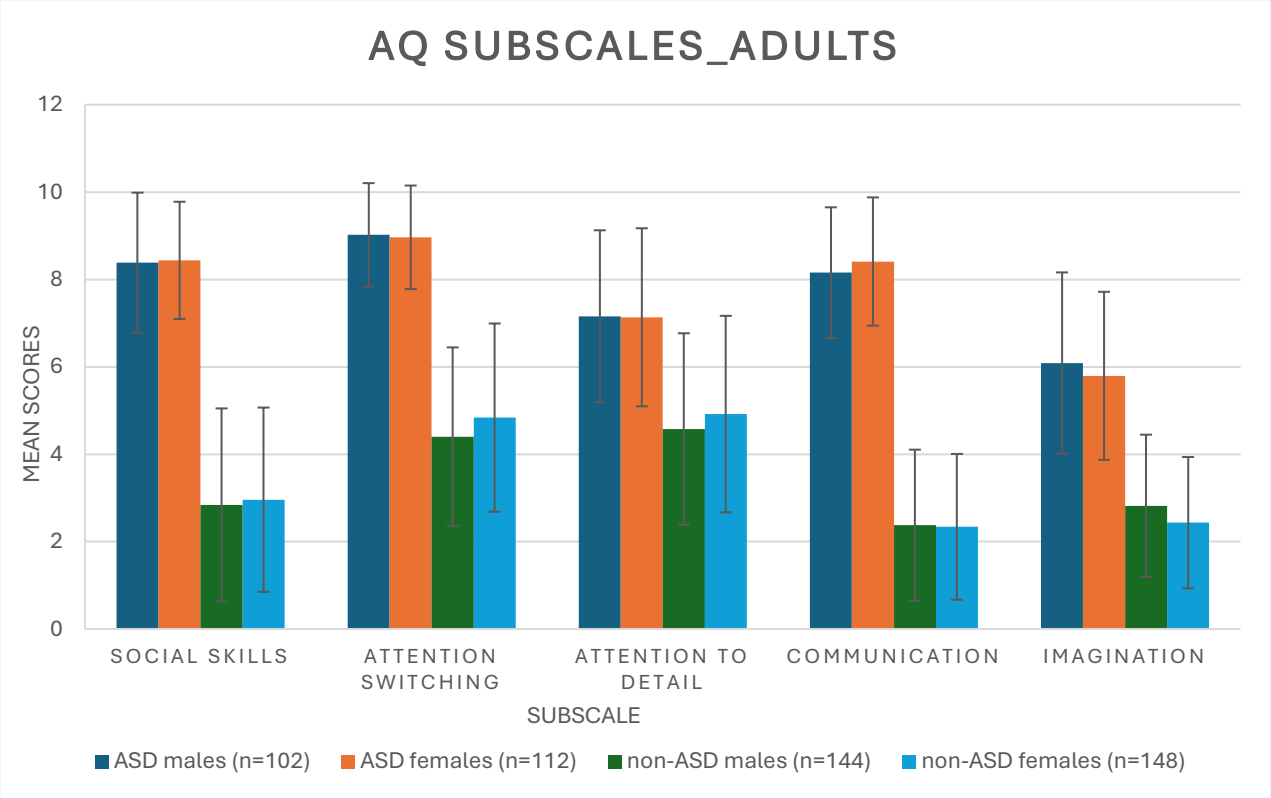
As expected, the ASD group had higher levels of autistic traits than the non-ASD group. Independent samples t-tests were run for the ASD and non-ASD groups separately to look for sex differences between them. No sex differences were found either in the ASD group ($t_{(212)}$ = .102, p = .919) or the non-ASD group ($t_{(290)}$ = -.285, p = .776).

Two repeated measure ANOVAs (2 sex (males vs females) x 5 subscales (social skills, attention switching, attention to detail, communication, imagination) for the ASD and non-ASD groups separately were run to explore the main effects of sex and subscale and potential interaction between

the two. Mauchly's test indicated that the assumption of sphericity had been violated (ASD: $\chi^2_{(9)}$ = 114.195, p < .001; non-ASD: $\chi^2_{(9)}$ = 94.211, p < .001); consequently, Greenhouse-Geisser statistics are reported.

The results show a significant main effect of the subscale, indicating that the mean scores for the five subscales differed significantly within both groups (ASD: $F_{(4, 683.1)}$ = 129.34, p<.001; non-ASD: $F_{(4, 1006.7)}$ = 122.079, p < .001). There was no significant main effect of sex found (ASD: $F_{(1, 212)}$ = .01, p=.919; non-ASD: $F_{(1, 290)}$ = .477, p = .490), but there was a significant interaction between the sex and subscale ($F_{(4, 1006.7)}$ = 2.493, p = .05), in the non-ASD group only. A sex-by-subscale interaction indicates significant variations in the general pattern of subscale mean scores between males and females in the non-ASD group. Therefore, post hoc, bootstrapped, one-way ANOVA was conducted to check the statistical significance of these differences. Additionally, the results are presented in Figure 7.

Figure 7. Mean scores for autistic traits by subscale (AQ_Adults), compared by group and sex



Note: Adults from samples 2 and 3 combined; mean scores for difficulties reported within each AQ subscale with standard deviation error bars

The results showed significant sex differences between non-autistic males and females within the imagination subscales only ($F_{(1,209)}$ = 4.46, p = .036), with males reporting more difficulties in this domain than females.

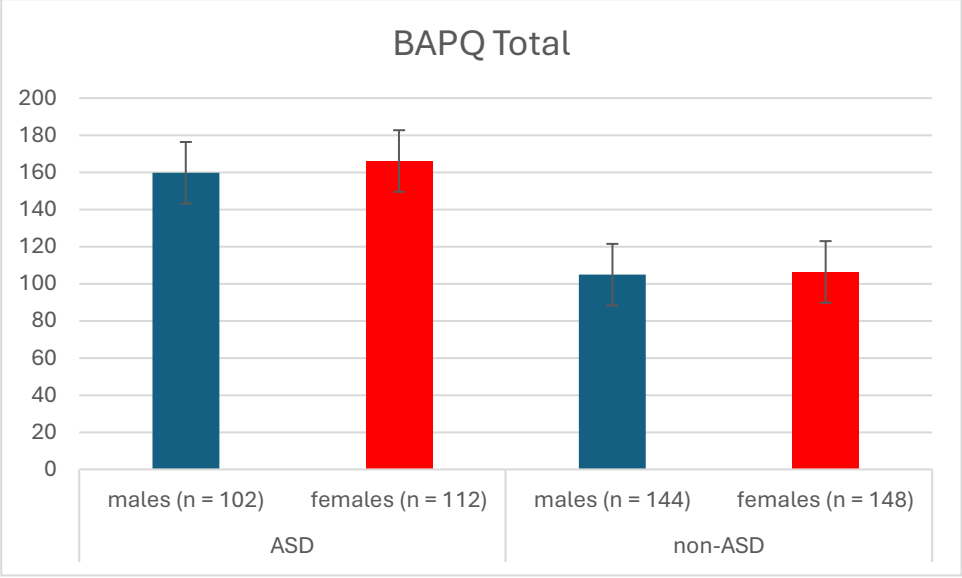
The overall results for AQ measures were similar in adult and adolescent samples; however, statistical analyses were not considered due to differences in the sample sizes and data collection methods (parents report vs. self-report).

Broad Autism Phenotype (BAPQ) adults only

The following results are for the adults (self-reports) from online studies samples 2 and 3 combined with a total of 506 participants (214 ASD (102 males and 112 females), 292 non-ASD (148 females and 144 males)).

The normality of the data for the BAPQ total score variable was assessed with skewness .06 and kurtosis -.97, which again falls within the range of -2 to +2 (George & Mallery, 2010). Mean scores for group comparison are presented in Figure 8.

Figure 8. Mean scores for broad autistic traits (BAPQ), compared by group and sex



Note: Adults from samples 2 and 3 combined mean scores for total difficulties reported within the BAPQ questionnaire with standard deviation error bars

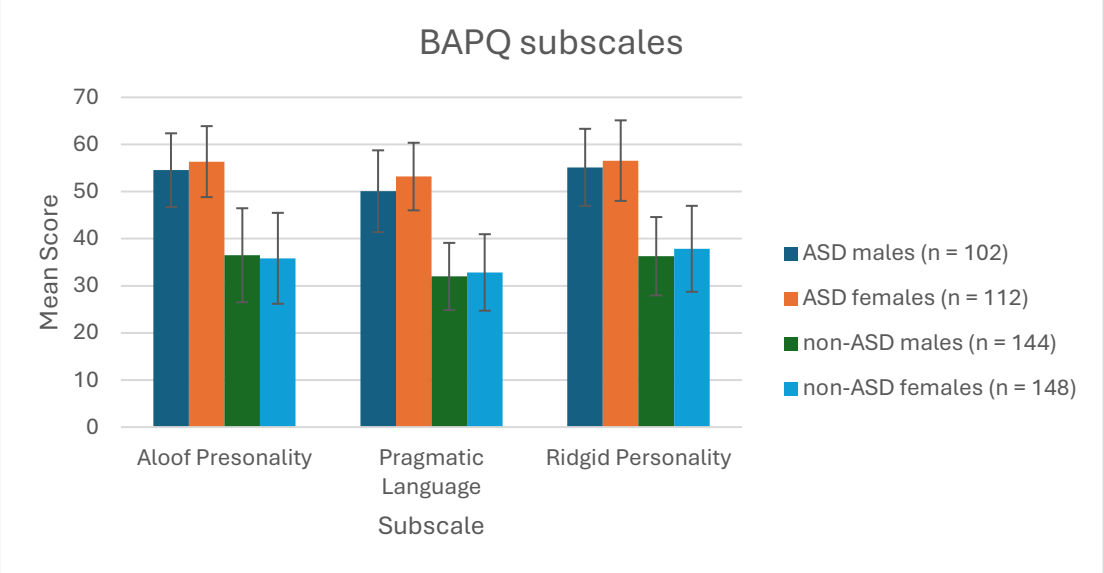
To compare sex differences within the groups, bootstrapped, independent samples t-tests were run for total scores of BAPQ in ASD and non-ASD groups separately. The results showed a significant difference between males and females within the ASD group only ($t_{(212)}$ = -2.424, p = .021), with females reporting more autistic traits than males. No significant sex differences were found in the non-ASD group ($t_{(290)}$ = -.596, p = .546).

Two repeated measure ANOVAs (2 sex (males vs females) x 3 subscales (aloof personality, pragmatic language, and ridged personality) for the ASD and non-ASD groups separately were run to explore the

main effects of sex and subscale and potential interaction between the two. Mauchly's test indicated that the assumption of sphericity was met (ASD: $\chi^2_{(2)} = 1.801$, $p = .406$; non-ASD: $\chi^2_{(2)} = 5.084$, $p = .079$).

The results show a significant main effect of the subscale, indicating that the mean scores for the three subscales differed significantly within both groups (ASD: $F_{(2, 424)} = 33.15$, $p<.001$; non-ASD: $F_{(2, 580)} = 44.36$, $p = < 001$). There was a significant main effect of sex found in the ASD group only (ASD: $F_{(1, 212)} = 5.87$, $p = .016$; non-ASD: $F_{(1, 290)} = .514$, $p = .474$), but there was no significant interaction between the sex and subscales (ASD: $F_{(2, 424)} = 1.188$, $p = .306$, non-ASD: $F_{(2, 580)} = 2.319$, $p = .100$), suggesting the differences between males' and females' totals scores within the three subscales were following the same patterns in each group (see Figure 9).

Figure 9. Mean scores for broad autistic traits by subscale (BAPQ), compared by group and sex



Note: Adults from samples 2 and 3 combined; mean scores for difficulties reported within each BAPQ subscale with standard deviation error bars

Post hoc one-way ANOVA was conducted to explore the main effect of sex within the ASD group. The results showed a significant difference between autistic males and females in the pragmatic language subscale only ($F_{(1,212)} = 8.209$, $p = .005$), with females experiencing more difficulties in that domain in comparison with males, which was the same as in the adolescent's sample.

2.5.3 Age of diagnosis and autistic traits

To explore differences in age at diagnosis between males and females, independent samples t-tests were conducted on samples 2 and 3 combined. The mean age of diagnosis was significantly higher in females (mean=23.04 years) than males (mean=18.57 years; $t_{(212)}=-2.44$, $p=.018$).

Bivariate, non-parametric correlations were conducted to explore the association between the age at diagnosis and levels of autistic traits measured by various screening questionnaires with all three samples separately. The non-parametric test was chosen to maintain consistency in the comparisons between the samples due to the small sample size of the clinical study sample. Results are presented in Table 2 for the whole sample and split by sex for comparison between males and females.

Table 2. Spearman's correlations for age of diagnosis and levels of autistic traits

Sample	Measure	Whole sample	ASD males	ASD females
Sample 1 (N=18)	AQ	-.338	.008	-.542
Sample 2 (N= 108)	AQ	**.298****	**.331***	.251
	BAPQ	**.218****	.254	.145
Sample 3 (N=106)	AQ	**.328****	**.394****	.258
	BAPQ	.278	.232	**.291***
	SQ-A	.043	.215	-.108

*Note: * p< .05; ** p< .01*

Higher levels of autistic traits as measured by AQ were positively (unlike hypothesised) correlated with the age of diagnosis in males with ASD from both online studies but not in females. This finding suggests that males diagnosed later in life self-reported higher levels of autistic symptoms at present. Only in sample 3 was a positive correlation between autistic traits as measured by BAPQ and age of diagnosis in autistic females. In the adolescents' sample, while the direction of the relationship between autistic traits and age of diagnosis was as hypothesised (negative), it was not significant.

2.6 Discussion

The DISCO data analyses were suggestive of slightly different behavioural profiles of autistic males and females, particularly in the RRB domain. In particular, males had the highest percentage of behaviours relating to highly restricted, fixated interests (B3), while for females, it was the subdomain related to insistence on sameness, inflexibility in routines, and adherence to ritualised behaviours (B2). Females presented with less marked behaviours except for the DSM-5 B2 subdomain. All males met the DSM-5 domain B cut-off criteria. At the same time, some females did not reach the cut-off within the domains B1 and B3. While in the current literature, autistic males are found to present

with higher levels of RRBs than females (Edwards et al., 2023; Uljarevic et al., 2022), some studies investigating sex differences in autism have reported that males and females with autism display more specific differences in RRBs. Males often exhibit more 'lower-order' RRBs, such as motor movements or sensory interests. In comparison, females might display more 'higher-order' RRBs, which can involve an intense focus on specific topics or routines (Lu et al., 2022). This study finding aligns with several recent studies reporting autistic females having more prominent 'higher-order' RRBs than males (Antezana et al., 2019; Wodka et al., 2022). Antezana et al. (2019) compared children and adolescents with autism aged 3-18 years old for sex differences in RRBs and found that boys showed increased stereotyped behaviours. At the same time, girls presented with higher levels of compulsiveness, insistence on sameness and restricted RRBs and interests. They suggested that the higher scores for these behaviours in girls with ASD may be attributed to the connections between insistence on sameness and executive function (e.g., cognitive flexibility) and internalising symptoms (Anthony et al., 2013; Factor et al., 2016; Uljarević et al., 2017). These differences could be influenced by internalising pathways that are potentially stronger in females (Antezana et al., 2019).

Interestingly, Wodka et al. (2022), in their study on children and adolescents with ASD aged 6-18 years old, showed that younger participants did not show increased RRBs with co-occurring conditions (ADHD or anxiety), but adolescent females did. Therefore, it is possible that increased levels of inflexible behaviours/need for routines specific to DSM-5 subdomain B2 in autistic adolescent females in this study are also related to their cognitive ability to interpret and respond adaptively to the everyday challenges in their environment and to the levels of anxiety they experience. Therefore, the next chapter will explore this idea in more detail.

The study explored and compared items from the signposting questionnaires (SQ-A) collected in adult sample 3 with corresponding items from the DISCO interview from the clinical sample. The non-ASD adults group presented with low levels of autistic behaviours, which supports the ability of SQ-A to discriminate between ASD and non-ASD individuals (Carrington et al., 2015). Additionally, patterns seen when comparing percentages of autistic traits reported by autistic adults and parents of autistic adolescents were intriguing. The percentage of marked issues was higher in adolescents than in adults. Sharing happiness, one-sided approaches, difficulty in friendship, emotional response, sharing interests, and arranging objects showed most sex differences. Adolescent autistic males had more problems in five items than females, but females scored higher in 'arranging objects', seeking assistance, and recognising others' emotions. The trend reversed in adults. Male adolescents showed more behaviours than females in 10 items compared to only 2 items in adults. Autistic adults faced greater difficulties spontaneously joining others and a stronger preference for distancing themselves from others. These differences may reflect a phenomenon called "chronogeneity", meaning diverse trajectories of autistic traits observed in this population over time (Georgiades et al., 2017), and

suggest that autistic females may experience more difficulties than males in adulthood. That could also hypothetically add to our understanding of the significant increase in the prevalence of diagnoses in adult females in the last two decades, as discussed in Chapter 1 (see Russell et al., 2022 for a review). Alternatively, the reverse trends in the severity of autistic difficulties in adult self-reports in comparison to parent reports of adolescents could be down to parents' bias in noticing these traits in boys more than in girls, or it could suggest that adult autistic females may have a better awareness of their difficulties. This might have been developed along their journey to receiving a diagnosis, reflecting deeper insight into the difficulties they had gained through "crying for help" and, finally, their acceptance of the traits following the diagnosis. Indeed, many autistic females report a sense of relief after receiving their diagnosis due to finally being able to understand the difficulties they experienced throughout their lives (see Leedham et al., (2020).

Nevertheless, some of these patterns are particularly interesting, especially those observed between autistic adolescent females and adult females, with the latter reporting more issues with joining others, making and keeping friendships, responding to others' emotions, and comforting others. This trend may be driven by increased social motivation in adolescence or reflect better insight adult autistic females may have of their difficulties in these areas, possibly due to a change in the perspective autistic females often report after receiving their diagnosis (Wilson et al., 2023).

As expected, drawing on the previous literature, AQ scores showed no significant sex differences in the ASD group in adolescent and adult samples. In the non-ASD group, however, sex differences were found in the imagination subscale for both adolescents and adults, with females presenting with fewer issues in this domain than males. These findings were in line with a large sample study by Grove et al. (2017) reporting similar results of no sex differences in the ASD group as measured by AQ-10 and few studies reporting marginal sex differences in autistic traits in the general population (English et al., 2021, also see Ruzich et al., 2015 for review). Furthermore, the absence of any observed gender disparities in this study using the AQ questionnaire may be attributed to its selection as the diagnostic confirmation screening tool. Thus, participants were classed into groups (ASD and non-ASD) based on their total scores and self-report of a formal diagnosis. Therefore, the outliers from both groups (non-diagnosed individuals with high AQ scores and diagnosed individuals with low AQ scores) were not included in analyses, likely contributing to lower variance in the compared samples.

Sex differences were found between males and females with autism in the BAPQ pragmatic language subscale, with females reporting more difficulties in this area. As BAPQ was measured in the two online studies, direct comparisons between adolescents and adults could not be made. However, it is noteworthy that in the DISCO subdomain A2 (deficits in non-verbal communication), adolescent autistic females had a slightly higher percentage of marked items than males. While structural language includes form (e.g., syntax, articulation, and phonology) and content (semantics), pragmatic

language relates to nonverbal communication, initiation and maintenance of conversation (Baird and Norbury et al., 2016). It is, therefore, a major component of successful social interactions.

These findings are especially interesting considering the higher social motivation discussed earlier, which has often been highlighted as a specific trait often observed in autistic females when compared with autistic males in multiple studies (Cook et al., 2018; Lacroix et al., 2022; Lawrence et al., 2020; Sedgewick et al., 2016; Song et al., 2021). It is possible that autistic females, especially those without ID, while trying to fit in with their peers and struggling with it, may, when able to reflect on these interactions, negatively self-perceive their competence in social situations. This, in return, may increase anxiety in those situations, which again may further hinder their ability to practice and improve their social skills, increasing their difficulties in that area in the form of the "vicious cycle", as discussed in Chapter 1. Further research could further explore these associations between levels of anxiety and self-perceived social competence in more detail in light of cognitive flexibility changes autistic females are going through over the transitions from childhood through adolescence to adulthood.

2.7 Strengths and limitations

The lack of sex differences in individuals already diagnosed with ASD is not surprising, considering that they have already met the threshold to receive an ASD diagnosis. This is a main issue with studies that have looked at sex differences in autistic traits in diagnosed samples. That is why the approach proposed within this thesis to compare individuals referred for diagnosis was intended to enable investigation of this matter from a different perspective, which is an inevitable strength of this study. However, the disruption to the procedure of data collection caused by the pandemic, as discussed at the beginning of this chapter, resulted in smaller than required sample sizes and is limiting the validity and reliability of these results. Therefore, the reader should take that under consideration when interpreting the results. Additionally, some of the participants in this ASD sample were not recruited through clinical services. Therefore, it was impossible to ensure that the diagnostic procedures they received in the past were held to the same standard as those recruited through the FTB. Within this clinical sample, two male participants did not present with difficulties in the A1 and A3 DSM-5 subdomains despite being already diagnosed with ASD; notably, these two participants were recruited not through clinical services and reported being diagnosed earlier in life. Therefore, they might have been diagnosed according to previous diagnostic criteria (e.g., DSM-4/ICD-10). In future

studies, recruiting participants purely through clinical services might be important for better consistency within the sample.

For the same reason (small clinical ASD sample size), exploratory statistical analyses on DISCO data were not conducted as planned. They were replaced by descriptive analyses, which may have been sensitive to the subjective bias of the researcher. However, a certain strength of all analyses presented in this chapter is that comparisons were made between approximately even groups of males and females in both ASD and non-ASD samples. This approach has been recommended in numerous studies (Carter et al., 2007; Craig et al., 2020; Hull et al., 2017; Jamison et al., 2017; Prosperi et al., 2021) as crucial to understanding better whether any sex differences are specific to the condition or just effect of gender socialisation typical for males or females.

One of this study's strengths is its novel approach to examining the broad autism phenotype traits within the already diagnosed population. It allowed for the exploration of more subtle autistic traits and highlighted the area of difficulties in pragmatic language as being one of the more pronounced in autistic females. As with any other problematic issues, a better awareness of the difficulty allows for more effective measures to be used to target the problem. Therefore, a better understanding of mechanisms allowing some autistic females to “fit in” with their peers may be crucial in expanding our understanding of potential reasons for females being diagnosed later. While exploring these mechanisms was beyond the scope of this chapter, some will be investigated in subsequent chapters of this thesis, beginning with emotion regulation and its relation to alexithymia and internalising issues like anxiety and depression.

Chapter 3 – Emotion regulation and use of cognitive reappraisal and its relation to alexithymia and internalising issues in TD and autistic adolescents

As outlined in the previous two chapters, autistic individuals are more likely to have internalising disorders such as anxiety and depression compared with their non-autistic peers (Bargiela et al., 2016; DaWalt et al., 2020; Uljarevic et al., 2020). Moreover, evidence suggests that girls presenting for diagnosis of Autism Spectrum Disorder (ASD) in adolescence and adulthood have higher rates of anxiety and depression than males presenting for diagnosis (Bargiela et al., 2016; Rynkiewicz & Łucka, 2018). One potential mechanism that could underpin sex differences in rates of anxiety and depression in the ASD population may be how they regulate their emotion. Furthermore, alexithymia may be a significant factor, as understanding emotions is essential to regulate them effectively. This chapter will examine ER in children and young people with ASD recruited through clinical services and in an age-matched control sample. First, sex and group differences in anxiety and depression will be examined to determine whether previously reported differences are replicated in these samples. Second, the spontaneous use of ER strategies and the efficacy of a strategy typically considered to be adaptive, cognitive reappraisal (CR), will be examined. Third, the association between ER and alexithymia (parent and child report) will be examined to explore how understanding emotions is related to the ability to use CR to regulate emotions. Finally, the associations between anxiety, depression, autistic traits, alexithymia, and CR will be explored.

3.1 Introduction

3.1.1 Emotion regulation in ASD

As discussed in Chapter 1, impaired emotion regulation has been described as an associated feature of ASD, with evidence of less frequent or ineffective use of adaptive strategies (e.g., Jahromi et al., 2012). In their study of emotion regulation in ASD, Bruggink et al. (2016) argued that participants' lack of insight into their own emotional functioning (alexithymia) may have hindered the use of adaptive emotion regulation strategies. By contrast, effective emotional insight was not thought to limit the use of maladaptive strategies. Numerous studies consistently report that autistic individuals tend to use maladaptive strategies for emotion regulation more frequently than typically developing individuals (Cai et al., 2018a; Cai et al., 2019; Ghanouni & Quirke, 2023; Jahromi et al., 2012; Nuske et al., 2017; Samson et al., 2015a; Samson et al., 2015b). These maladaptive strategies typically

include avoidance, expressive suppression, and venting (Cai et al., 2018a). In addition, it has been found that autistic individuals tend to experience negative emotions more frequently than their typically developing peers (Bos et al., 2018; Jahromi et al., 2012).

Impaired emotion regulation in ASD has been linked to behaviours such as intense reactions to situations or stimuli (so-called 'meltdowns'), as well as to symptoms of anxiety and low mood (e.g., Bruggink et al., 2016; for review, see Gotham et al., 2015). Impaired emotion regulation has also been associated with the core features of ASD, particularly with restricted and repetitive behaviours (Samson et al., 2015a). Moreover, Jahromi et al. (2013), in their study, which included 40 children (20 ASD and 20 TD), reported that children's emotional regulation predicted their prosocial peer engagement one year later. Emotion regulation, therefore, represents a potential mechanism that could at least partially explain the core and associated emotional and behavioural features of ASD.

3.1.2 Cognitive reappraisal's role in mental well-being in TD and ASD populations

As discussed in Chapter 1, cognitive reappraisal is one of the ER strategies considered adaptive, well-researched and found beneficial for the mental well-being of both ASD and non-ASD populations (Aldao et al., 2010; Gross & John, 2003; Haga et al., 2009; Maddox & White, 2015; Ochsner et al., 2012; Samson et al., 2015a; Samson et al., 2015b; Tamres et al., 2002). Reappraisal skills, which play a crucial role in cognitive-based psychotherapies, have been named a protective factor against the development of anxiety disorders (Gross, 1998) and are negatively associated with internalising issues like anxiety and depression (see Dryman & Heimberg, 2018 for a comprehensive review). However, several studies indicate that individuals on the autism spectrum use CR less frequently compared to the TD population (Cai et al., 2018b; Mazefsky et al., 2015; Samson et al.,2012; Samson et al., 2015a; Samson et al., 2015b). As discussed in Chapter 1, the successful use of CR requires certain levels of cognitive flexibility, which is often impaired in ASD. Some studies show that typically developing females have higher cognitive flexibility levels than males (Bardeen et al., 2013; Weiss et al., 2003), especially in stressful situations (Kalia et al., 2018; Shields et al., 2016). Similar results were found in the study done by Demetriou et al. (2021) where a comparison of autistic males and females without ID along with males and females from the control group, showed that females (with and without autism) had significantly better outcomes in assessments of processing speed, cognitive flexibility, verbal learning, memory, and semantic fluency. Regarding the differences in how typically developing males and females use CR, some studies suggest that females use this strategy more often than males

(Tamres et al., 2002; Noleen Hoeksema, 2012; for reviews). However, other research indicates no significant gender variations in its usage (Gross & John, 2003; Haga et al., 2009; Perchtold et al., 2019; Zlomke & Hahn, 2010). The conflicting results across studies may be influenced by factors such as individual differences (e.g., emotional reactivity, cognitive abilities, alexithymia) and situational or cultural circumstances. In society, females are often perceived as more emotionally expressive, which might explain their tendency to rely on CR to regulate emotions in specific situations more than males (McRae et al., 2008). However, regarding individuals with ASD, the research on sex differences in CR is limited. For instance, although Cai et al. (2018b) investigated the habitual use of CR through self-report measures among autistic individuals, they did not find any statistically significant sex differences.

Various studies in non-autistic samples found that socially anxious individuals tend to make more negative interpretations of social situations compared to their non-anxious peers, while their interpretations of non-social situations did not show significant differences (Huppert et al., 2003; Voncken et al., 2003; Wilson & Rapee, 2005; Miers et al., 2008). In autistic individuals, who often experience social difficulties, similar patterns of negative interpretations of social situations may occur. Due to challenges in understanding social cues and norms, they might be more inclined to interpret ambiguous everyday scenarios negatively, potentially leading to increased anxiety levels during social interactions and difficulties in navigating them effectively.

As previously discussed in Chapter 1, autistic females tend to have higher social motivation than autistic males. At the same time, they also need to overcome more challenges than males to fit in with the same gender peers due to different social dynamics in males' and females' social groups (Sedgewick et al., 2019), which may add to their difficulties in social interactions. Therefore, the use of cognitive reappraisal and its efficacy when used can also be dependent on the type of the experience (is it novel, or has an individual already had some previous similar experiences) and the situation (social vs non-social) in which it is applied to regulate emotional arousal.

3.1.3 Alexithymia's influence on emotion regulation in ASD

Another important factor that might impact how often and effectively individuals with ASD use cognitive reappraisal is, as mentioned earlier, difficulty in recognising emotional states (alexithymia). As discussed in Chapter 1, recognising and understanding one's emotional state is crucial to accurately interpreting it and successful reinterpretation. The prevalence of alexithymia in the ASD population ranges up to 59.2% compared to just 9.7% in neurotypical adults (Cai et al., 2020), and its impact on

emotional regulation and mental health outcomes in ASD and TD populations is a well-researched subject. For instance, Fietz et al. (2018) discovered that both alexithymia and autistic traits significantly predict anxiety and depression among university students with and without ASD. Similarly, Morie et al. (2019) found that alexithymia significantly predicted anxiety and depression in adult (18-65 years; 84% were females) autistic individuals without ID and that ER difficulties mediated this relationship. As they also found relatively high levels of anxiety and depression within their sample, they further concluded that therapeutic interventions targeting alexithymia could improve mood disorders within this population. Ketelaars et al. (2016) compared levels of alexithymia and difficulties in recognising emotions in autistic and non-autistic females without ID. The results reported higher levels of alexithymia in autistic females than in the control group. Additionally, they found that autistic females struggled more with identifying emotions from facial expressions than TD females. While this vital finding contributes to our understanding of the potential reasons for social difficulties autistic females experience, still more research is needed to understand potential sex differences in alexithymia prevalence in both TD and ASD populations and its association with higher rates of internalising disorders in females.

Both emotion regulation and alexithymia are linked to depression and anxiety (e.g., Morie et al., 2019; Preece et al., 2022; Shukla et al., 2021; Zhang et al., 2017). Research shows that alexithymia is a common trait in autism spectrum disorder (Berkovits, 2019; Bloch et al., 2021; Kinnaird, 2019; Morie et al., 2019; Ryan et al., 2021), and it is often linked with difficulties in emotion regulation (Bird et al., 2013; Gormley et al., 2022; Morie et al., 2019) as well as higher rates of co-occurrent anxiety and depression compared to neurotypical individuals (Morie et al., 2019). Alexithymia in ASD, like impaired ER, has been linked with core autistic traits like social and communication difficulties (Gormley et al., 2022; Oakley et al., 2022), as well as with behavioural dysregulation in this population (Goldsmith & Kelley, 2018; Mazefsky et al., 2012; Samson et al., 2015b; Zantinge et al., 2017). However, interventions that address behavioural issues in ASD often focus on teaching positive behaviours and social skills rather than addressing a limited understanding of one's emotional states and emotion regulation issues. Even though it is not possible to state the cause and effect in the complex associations between anxiety, alexithymia and impaired emotion regulation, it is important to explore this more broadly to help our understanding of the sex differences in the rates of internalising issues in typically developing and autistic adolescents (as discussed in Chapter 1). A better understanding of the emotion regulation strategies employed by males and females with and without ASD may provide further insight into the core and associated features characteristic of the female profile of ASD and highlight if any of these differences are condition or gender specific. This could then direct the search for gender-specific therapeutical interventions and improve the well-being of those affected by these difficulties.

3.2 Aims and hypotheses

The aim of this chapter was to explore whether differences in emotion regulation may underpin sex differences in anxiety and depression in individuals referred for diagnosis of ASD during adolescence.

The first aim, therefore, was to determine whether previously reported sex differences in anxiety and depression were present in this sample.

RQ1: Are there differences between sexes and groups in anxiety and depression levels among adolescents? Hypotheses: 1a) Females were expected to report higher levels of anxiety and depression compared to males; 1b) The group with ASD was expected to experience higher levels of anxiety and depression compared to the non-ASD group; 1c) There was an expectation that there would be no interaction between sex and group, as both groups were anticipated to show similar patterns of sex differences.

Anxiety and emotion regulation were then examined in the context of specific scenarios as part of an experimental paradigm, building on the work of Samson et al. (2015a). The results of their study found that individuals with ASD used CR less frequently than the non-ASD group. However, no significant group differences were found for other adaptive ER strategies, such as problem-solving, distraction and relaxation. Regarding maladaptive ER strategies, the ASD group employed suppression more frequently than the non-ASD group. No significant differences were found between groups for avoidance and venting. The ASD group had more "not codable" responses than the non-ASD group, while no differences were found for responses with no regulation. The paradigm used by Samson was extended in this study to include both non-social and social scenarios to compare potential sex and group differences in emotional reactivity (anxiety levels as measured by the task) in social and non-social contexts.

RQ2: Do autistic individuals and those without ASD experience different levels of anxiety (emotional reactivity) when thinking about potentially complex social and non-social scenarios? Are there any sex differences in that matter? Hypotheses: 2a) It was hypothesised that the ASD group would have higher anxiety ratings for social scenarios than the non-ASD group, while no difference was expected for non-social scenarios. 2b) Females within both groups were expected to have higher anxiety ratings than males in both scenario types.

RQ3: Are there sex and group differences in the spontaneous use of emotion regulation (ER) strategies among individuals with and without ASD? Hypothesis: Based on previous research

conducted by Samson et al. (2015a), it was anticipated that the same effects (as described above) would be found for the comparison of ASD and non-ASD groups. As there is limited prior research on this aspect, predictions regarding sex differences were not made, leaving room for exploration.

RQ4: Are there differences between sexes and groups in the ability to employ CR when instructed and its effectiveness in reducing anxiety levels? Hypotheses: 4a) It was expected that individuals with ASD would use CR less frequently and less efficiently than the non-ASD group. 4b) While females in both groups were expected to use CR more frequently when instructed because, as discussed earlier in this chapter, previous studies reported better cognitive flexibility, which was linked to successful use of CR in females (Bardeen et al., 2013; Demetriou et al., 2021). Therefore, it was expected females in both ASD and non-ASD groups may find positive reframing of the ambiguous scenarios easier. No specific predictions were made regarding expected sex differences in the efficiency of using this strategy for anxiety reduction.

Given associations between alexithymia and ER and mental health, a further research question related to sex and group differences in alexithymia (RQ5). Both parent and self-report measures were used to try to better understand a young person's understanding of emotions. Hypotheses: 5a) It was predicted that parent reports of alexithymia would align with children's self-reports of emotional intelligence across all four groups; 5b) It was hypothesised that the ASD group would have higher alexithymia/lower EI levels than the non-ASD group; 5c) It was expected to see higher levels of alexithymia/lower EI levels in males than females.

The final research question (RQ6) examined how traits of anxiety and depression were related to alexithymia, autistic traits and emotional regulation in adolescents. Hypotheses: 6a) The expectation was that internalising issues (anxiety and depression) would be positively correlated with autistic traits and would exhibit negative correlations with both parent- and self-reported emotional intelligence scores (inversed alexithymia). 6b) Additionally, it was anticipated that internalising issues would be negatively correlated with the frequency of spontaneous use of CR but positively correlated with the more effective use of this ER strategy (indicated by higher anxiety reduction scores).

3.3 Methods

3.3.1 Participants

The data analysed in this chapter are from the adolescents in Sample 1, as described in Chapter 2. This sample included 18 individuals with ASD (9 males, 9 females) recruited through ASD diagnostic pathways and 53 non-ASD (25 male, 28 female) participants recruited from the local community.

3.3.2 Ethical approval

This study was given a favourable ethical opinion by the Health Research Authority and the West Midlands – South Birmingham Research Ethics Committee (REC reference: 18/WM/0349).

3.3.3 Measures

Experimental Reactivity and Regulation Situation Task (adaptation from Samson et al., 2015a)

The ER task was adapted from Samson's Reactivity and Regulation Situation task (2015a). This task aimed to assess emotional reactivity and regulation in adolescents aged 10-18 years in ambiguous everyday situations. The original task was expanded from 16 to 30 sentences. The scenarios were divided into two categories: social and non-social. Each category had 15 scenarios. This division explored how individuals react to and regulate emotions in interpersonal (social) and non-interpersonal (non-social) contexts. Each scenario was formulated in the second person singular form ("you") and consisted of one or two sentences. The topics related to the potential situations that participants could experience at home, school, or everyday social interactions with friends and strangers.

To ensure accurate classification of scenarios as either social or non-social, the initial set of 34 sentences (17 in each category) was piloted with six adolescent volunteers. These volunteers were asked to rate how worried they would be in each situation on a scale from 1 (not worried at all) to 5 (very worried) and to categorise the scenarios as social or non-social based on their perception. Subsequently, the sentences were evaluated to determine their potential to induce mild anxiety, and four sentences with average ratings below 2.5 were excluded from the primary task and reserved for practice trials. The categorisation of sentences into social and non-social categories was represented using binary coding (0 for non-social and 1 for social). Sentences with total scores ranging from 4 to

6 or higher were classified as social, while those with total scores between 0 and 3 were considered non-social. See Appendix 3 for the list of all sentences used in the task.

The task consisted of two stages. Participants completed four practice trials before completing 30 experimental trials using novel scenarios. In stage 1, trials consisted of four steps. (1) Participants were shown a written scenario presented in the centre of a computer screen. (2) Participants were asked to read the scenario aloud, imagine themselves in that situation, and verbally "Describe the first thought that comes to your mind". They were asked to try not to overthink them but to report their initial thoughts and ideas as a measure of their immediate subjective responses. (3) Participants were then asked to use an emotion rating scale to indicate their level of anxiety, which ranged from 1 (not at all anxious) to 5 (very much anxious). (4) Finally, participants were asked, "What would you do to calm yourself down?". They were assured there were no right or wrong answers for this task to encourage them to share the most probable behaviour.

Following the completion of Stage 1, participants had the ambiguous nature of the presented situations explained; each situation could resolve in either a negative or positive outcome. Then, they were introduced to CR presented as "thinking differently" about these situations (See Appendix 4 for the complete CR instruction). They were given three examples of how CR could be used by the researcher. Next, they completed four practice trials to familiarise themselves with the new task procedure. In Stage 2, participants were then presented with all the scenarios they rated with 2 or more on the anxiety scale in Stage 1 and were asked to try to think of other, more positive explanations for these situations. Because participants were only shown scenarios that had previously caused them some anxiety (a score of 2 or more), the numbers differed across participants, although all first completed four practice trials. Each trial involved the following three steps: (1) The situation written in the centre of the screen, (2) The instruction prompt: "Can you think about this situation differently to make it less worrisome or scary", (3) The anxiety rating scale (1-5). The total duration of the task varied between 45 and 90 min, and participants were encouraged to take a short break between the two parts.

Participants' statements were coded by the researcher into nine categories based on the process model of ER (Gross, 1998, 2007), as in Samson et al. (2015a): avoidance, problem-solving, distraction, CR, suppression, venting, relaxation, no regulation, not codable answers (if the participant's response was unrelated to the question or unclear). These involved initial reactions and the reference to the behaviour or cognitive processing of the situation to calm themselves down. When a participant mentioned two distinct strategies, the first one was used for coding. For example, to differentiate between cognitive reappraisal and problem-solving, if the initial response involved reframing the situation, followed by actions to address the problem, it was classified as cognitive reappraisal.

Conversely, if the first response involved taking action to solve the problem, which was then positively reframed, it was categorised as problem-solving.

The Autism Spectrum Quotient Adolescent Version (AQ_Adolescent; Baron-Cohen et al., 2006) – parent report

The AQ is a 50-item questionnaire that measures traits associated with ASD. Please see Chapter 2 for details.

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

This brief measure was used to collect data about levels of anxiety and depression. The HADS is a 14-item, self-report measure, with seven items on each scale: anxiety (e.g., “I get a sort of frightened feeling like ‘butterflies’ in the stomach” and depression (e.g., “I can laugh and see the funny side of things”). Participants specify how often they experienced these feelings within the past week on a 4-point Likert-like scale (0-3), thus can score up to 21 points on each scale. The HADS anxiety and depression subscales consisted of 7 items each, and for this study, the values of Cronbach’s Alpha were $\alpha = .85$ and $\alpha = .84$, respectively.

Children’s Alexithymia Measure (CAM; Way et al., 2010) – parent report

The CAM is a parent report, a 14-item measure with a unidimensional factor structure to assess difficulties expressing feelings in children and adolescents. Respondents rate how often within the last three months they observed behaviours like “When asked about how he/she is feeling, instead talks about what he/she has been doing” or “Verbal expressions of feelings do not match non-verbal expressions of feelings” on a 4-point scale, ranging from "almost never" to "almost always". The score for each item is used to obtain a total score. Higher scores indicate increasing levels of behaviours associated with alexithymia. The CAM questionnaire has been found to have good internal reliability (Cronbach’s alpha of .92) in the study by Way et al., 2010.

The Emotional Quotient Inventory (Youth Version) Brief Form (BarOn EQ-i:YV; Bar-On & Parker, 2000)

The EQ-i:YV is a 12-item self-report measure of emotional intelligence (EI) developed by Bar-On and Parker (2000). Emotional intelligence is considered to be an inverse but strongly overlapping construct to alexithymia (Parker et al., 2001). The EQ-i:YV questionnaire was designed for children and

adolescents between 7 and 18 years old and is often used in research that is specific to minor participants. The measure has been found to have good test-retest reliabilities ranging from 0.84 for the intrapersonal scale to 0.89 for the total EI scales over a span of three weeks (Bar-On & Parker, 2000).

Participants are asked to respond to the statements that best describe how they feel, think, or behave in most situations on a four-point Likert scale, ranging from 1 ("very seldom true of me") to 4 ("very often true of me"). The total scores range from 12 to 48. They can be analysed as a total EI score or as separate 4 subscales: interpersonal (i.e., "It is easy to tell people how I feel"), intrapersonal (i.e., "I feel bad when other people have their feelings hurt"), stress management (reverse scored, i.e., "I get angry easily") and adaptability (i.e., " When answering hard questions, I try to think of many solutions"). Higher scores reflect higher levels of emotional insight and emotional competency, while low scores mean high levels of alexithymia.

While questionnaires assessing alexithymia tend to focus on difficulties in recognising emotions in oneself and others, emotional intelligence questionnaires emphasise skills and positive abilities in regulating emotions. Therefore, the measure of emotional intelligence was chosen to be presented to minor participants. This approach is more suitable for younger individuals, as it highlights their strengths and capabilities, fostering a more positive and supportive assessment experience.

Wechsler Abbreviated Scale of Intelligence – Second Edition (WASI-II, David Wechsler, 2011)

The Wechsler Abbreviated Scale of Intelligence Second Edition (WASI-II) offers a concise and dependable assessment of cognitive capacity suitable for clinical, educational, and research environments. The WASI-II includes four distinct subtests: Vocabulary and Similarities contribute to the Verbal Comprehension Index (VCI), while Block Design and Matrix Reasoning constitute the Perceptual Reasoning Index (PRI). Furthermore, the combination of all four subtests produces the Full-Scale IQ-4 Subtests (FSIQ-4), and the combination of Vocabulary and Matrix Reasoning forms the Full-Scale IQ-2 Subtests (FSIQ-2). The FSIQ-2 was used in this study because some participants completed the study remotely and were, therefore, unable to complete the block design tasks.

3.3.4 Procedure

Adolescents and their parents met with the researcher either face-to-face or via MT/Zoom, as discussed in Chapter 2. All participants completed consent forms either in pen-and-paper form or via Qualtrics. Young people completed the computer-based experimental task either on the researcher's laptop or via a shared screen during a video call; their answers were written down during assessment by the researcher and audio recorded to allow transcription and accurate coding. Adolescents also completed a cognitive assessment (WASI-II) and two short questionnaires, the HADS and the EQ:i-YV, again either in pen-and-paper form or via Qualtrics. At the same time, their parents completed the AQ_Adolescent and CAM questionnaires (either in pen-and-paper form or via Qualtrics).

3.3.5 Analyses

The a priori power analyses or this study have been calculated with the use of the G*Power 3.1.9.2 tool, concluding that if the null hypothesis is false (type II error), a total sample of size n = 109 would be required to have a 95% chance of correctly rejecting it (F tests - ANCOVA, Numerator degrees of freedom = 1, number of groups = 4, number of covariates = 1 (autistic traits), α err prob = 0.05, effect size $f^2(V) = 0.35$). Therefore, four groups of 30 participants were planned to be recruited for this study. Unfortunately, as explained in Chapter 2, this was not possible. Therefore, some changes in the plans for data analysis for this study have been made (i.e., autistic traits were omitted as a covariate due to participants being already assigned to groups based on the level of autistic traits), and some analyses were followed with the power analysis sensitivity calculation to determine what effect sizes the study was powered to detect. However, due to the smaller-than-planned sample sizes in the ASD group, statistical analyses related to sex differences in this group need to be interpreted with caution. ANOVA analyses were followed up with parametric (t-tests) or non-parametric tests to further explore significant main effects or interactions.

Mann-Whitney tests were used for the exploration of sex differences in anxiety and depression levels within the ASD and non-ASD groups.

Repeated measures ANOVA with bootstrapping was used to explore the between-subjects effects of group and sex and the within-subjects effect of emotional reactivity in social and non-social scenarios.

To examine which ER strategies were used spontaneously by participants, the frequency with which distinct strategies were reported in Stage 1 of the task were plotted for participants from all four groups and followed up with a comparative analysis of mean differences. The suitability of parametric or non-parametric tests, such as the t-test or the Mann-Whitney mean rank test, respectively, was assessed based on the results of normality checks.

To examine sex and group differences in the ability to generate CR and its efficacy for anxiety reduction, two variables were computed following the procedure used by Samson et al. (2015a). For every participant, the percentage of CR use following the prompt (stage 2) was calculated for all scenarios where they initially reported an impact (i.e., rated >1 in stage 1). Additionally, the effectiveness of CR was assessed by calculating the percentage reduction in anxiety after employing the cued reappraisal, contrasting it with the anxiety rating during the initial exposure (stage 1) in scenarios where they registered an effect (i.e., rated >1). In the rare cases where instead of an anxiety reduction, participants reported an increase in anxiety ratings after using CR in stage 2, the negative value was discarded, and the reduction for that trial was counted as 0. Data were plotted in a bar chart. Analysis of variance (ANOVA) was used to examine group (ASD vs non-ASD) and sex (males vs females) effects and potential interactions in CR frequency and efficacy percentage mean scores.

As mentioned earlier, emotional intelligence (EI) is considered to be an inverse but strongly overlapping construct to alexithymia (Parker et al., 2001). Therefore, to simplify further analyses and interpretation of the results, the alexithymia questionnaire (CAM) scores were reversed for both measures (EQ-iYV and CAM), reflecting the same EI construct. Then, bivariate non-parametric correlations, with bootstrapping, were run to assess the convergent validity between adolescents' EI levels and their parents' reports of inversed alexithymia levels (EI). This was followed by Mann-Whitney tests for group and sex within the groups comparisons on the two measures (CAM and EQ:i-YV).

Finally, to investigate the relationships between anxiety, depression, EI/alexithymia (self-reports and parent reports for comparison), and ER (use of CR), bivariate correlation analyses (e.g., Pearson or Spearman correlations) were used. The same analyses split by group and sex were run to compare the occurrence of these associations in the four groups.

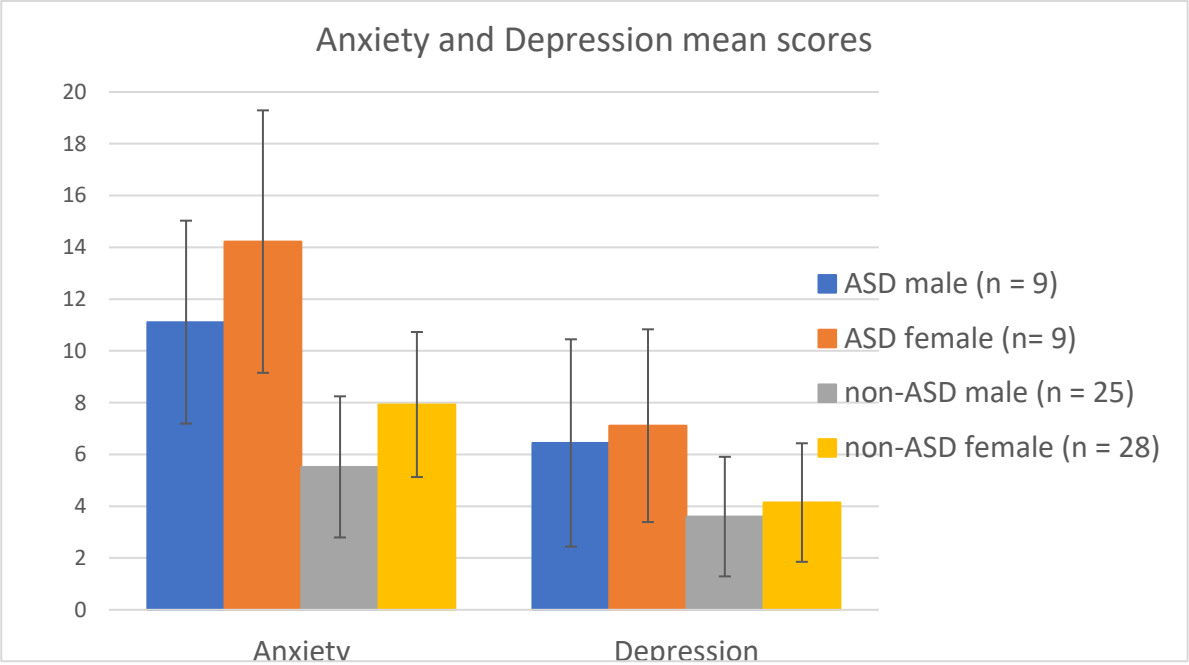
3.4 Results

3.4.1 Sex and group differences in anxiety and depression levels and their relation to alexithymia and ER

Normality checks for anxiety and depression mean scores revealed that data were not normally distributed (anxiety: W =.950, p = .007; depression: W= .922 p < .001). Indeed, for both variables, the distribution was essentially bimodal. Given previously reported group differences in these variables, the data were split by group, and the distribution was re-analysed. For each group, data for both anxiety and depression were normally distributed (anxiety: ASD W=.933, p=.217; non-ASD W=.982,

p=.614. Depression: ASD W=.912, p=.094; non-ASD W=.963, p=.097). Given the bimodal distribution and sample size, Mann-Whitney analyses were conducted to explore the potential effects of group and sex. Mean scores on the anxiety and depression subscales of the HADS are presented in Figure 1.

Figure 1. Mean scores for anxiety and depression levels split by group and sex



Note: Adolescents' mean scores for anxiety and depression levels as measured by the HADS questionnaire, with standard deviation error bars

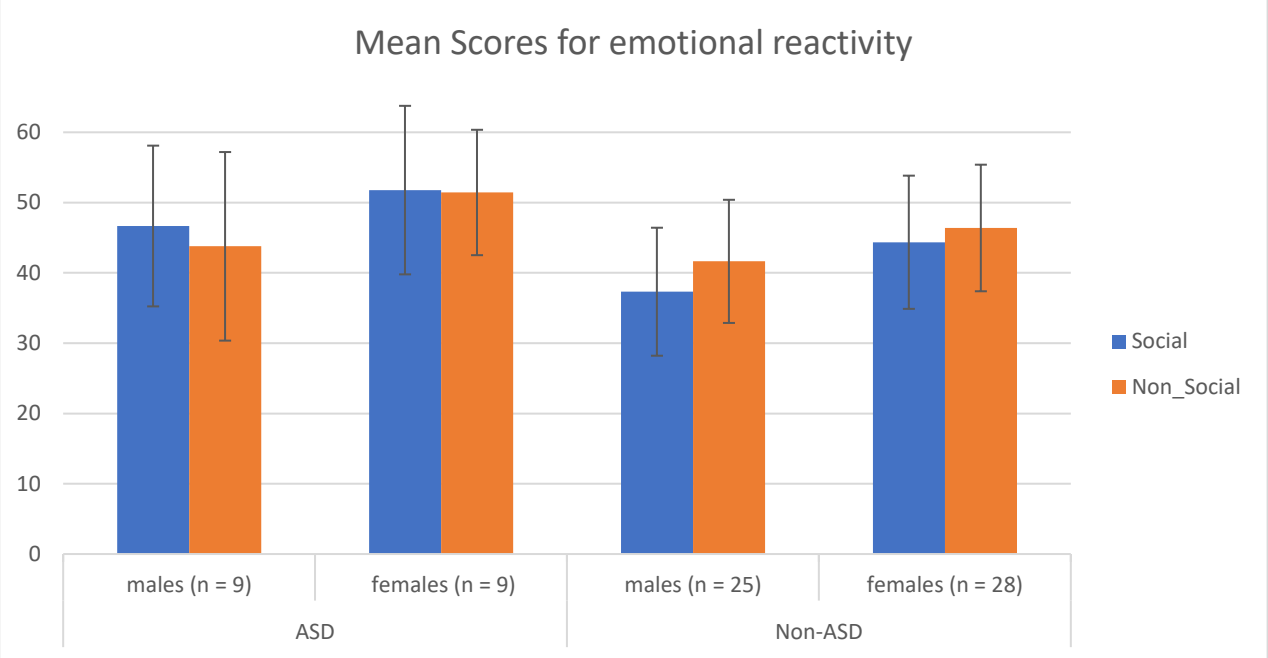
The ASD group scored significantly higher than the non-ASD group in both anxiety (U=146.5, p=<.001) and depression (U=231.0, p=.001). There were no sex differences found in the ASD group in anxiety and depression levels (U=24.0, p=.142; U=37.0, p=.754), respectively, suggesting that both males and females experienced similar levels of these internalising issues within this sample. In the non-ASD group, male and female participants also experienced similar levels of depression (U=302.5, p=.393). In contrast, there was a significant difference in anxiety levels, with females reporting higher levels than males (U=188.0, p=.004).

3.4.2 Sex and group differences in emotion regulation – experimental task

To assess group and sex differences in emotional reactivity within social and non-social scenarios, since the total sample size for this study was relatively small (N=71), the Shapiro-Wilk test was performed to determine the distribution of both variables for social and non-social anxiety ratings. The results show that both variables had normal distribution (W=.977, p=.23 and W=.982, p=.39) for

social and non-social scenarios, respectively. The emotional reactivity mean scores for the social and non-social scenarios within the four groups are presented in Figure 2.

Figure 2. Emotional reactivity means scores for social and non-social scenarios split by group and sex



Note: Adolescents' mean scores for subjective anxiety ratings reported for both social and non-social scenarios before spontaneous ER attempt, with standard deviation error bars

A 2x2x2 (2 scenarios (social vs non-social) x 2 groups (ASD vs non-ASD) x 2 sexes (males vs females)) repeated measures ANOVA with bootstrapping was used to explore the between-subjects effects of group and sex and the within-subjects effect of emotional reactivity in social and non-social scenarios.

Table 1. Results of repeated measures ANOVA analyses for emotional reactivity in social and non-social situations.

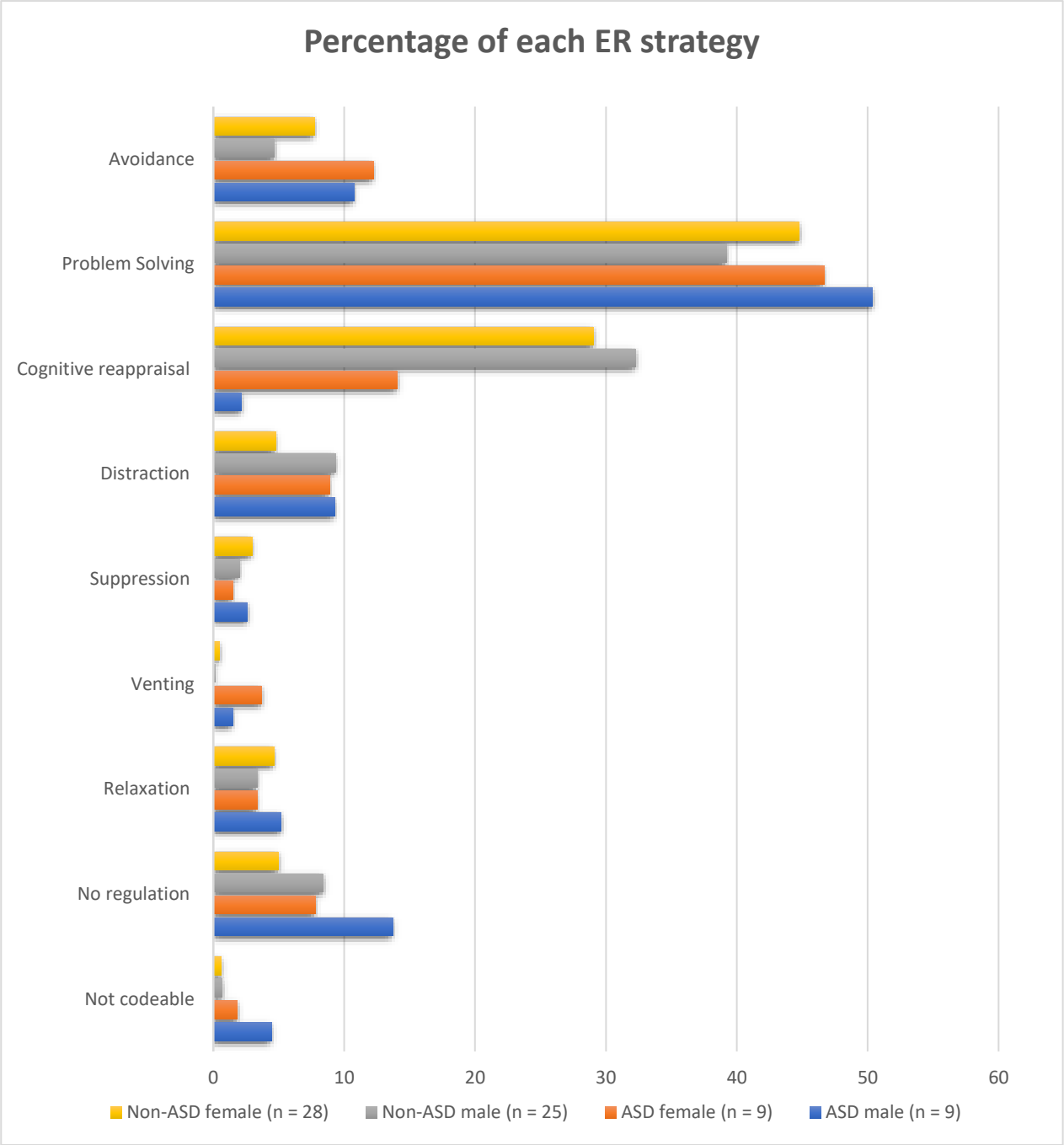
	Effects	*F*	*p*	*η2*
Within-subjects				
	Scenario	.699	.406	.010
	Scenario * Sex	.005	.943	.000
	Scenario * Group	**6.534**	**.013**	**.089**
	Scenario * Sex * Group	1.668	.201	.024
Between-subjects				
	Sex	**6.094**	**.016**	**.080**
	Group	**5.794**	**.019**	**.080**
	Sex*Group	.010	.921	.000

There were significant main effects of both group and sex, suggesting that the ASD group had greater reactivity than the non-ASD, and females had greater reactivity than males. Interestingly, there was no interaction between sex and group, suggesting that the sex difference identified above was consistent in both ASD and non-ASD groups. There was no significant main effect of scenario; however, there was a significant interaction between scenario and group. As depicted in Figure 2, the non-ASD group found the non-social scenarios to be more anxiety-provoking than the social scenarios. In the ASD group, this trend was reversed for males, but for females with ASD, both scenario types were equally anxiety-provoking. There was no significant interaction between scenario and group; however, post hoc power sensitivity analysis showed that with the α err prob = 0.05, Power (1-β err prob) = 0.95, total sample size 71, two measurements, and four groups, it could only detect large effect size f(U) = 0.506 with a critical F value of 2.74.

Post hoc independent sample t-tests with bootstrapping were run to explore sex and group effects further. As expected, the ASD group (M=49.22, SD=11.67) had higher emotional reactivity mean scores for social situations than the non-ASD group (M=41.04, SD=9.87), $t_{(69)}$=2.901, p=.005. There was no group difference within non-social situations $t_{(69)}$=1.29, p=.201 (M=47.61, SD=11.73; M=44.15, SD=9.12; for the ASD and non-ASD group, respectively). Overall, females had higher emotion reactivity mean scores than males for both social ($t_{(69)}$=-2.56, p=.013) and non-social scenarios ($t_{(69)}$=-2.38, p=.020). While there were no sex differences in emotional reactivity found in the ASD group, in the non-ASD group, the trend was the same as for the whole sample, with females having higher mean scores than males for social scenarios ($t_{(51)}$=-2.75, p=.008) but not significant for non-social scenarios ($t_{(51)}$=-1.94, p=.058).

To address the third research question of the groups that differed in the spontaneous use of ER strategies, a percentage of all strategies used spontaneously in the first part of the task was calculated, and the results split by group and sex are presented in Figure 3.

Figure 3. Preferences for spontaneous ER strategies use split by group and sex



Note: The percentage of each emotion regulation strategy used spontaneously by adolescents from all four groups in the first part of an experimental task used to regulate

Normality checks revealed that the data distribution within the nine tested variables, including eight ER strategies and one non-codable variable, were not normally distributed. Consequently, due to limited sample sizes and the deviation from normality within these variables, only non-parametric statistical tests were used to evaluate potential distinctions among groups and sexes. The Mann-Whitney means rank statistical test outcomes have been presented in Table 2.

Table 2. Mann-Whitney means rank test results for group and sex comparison

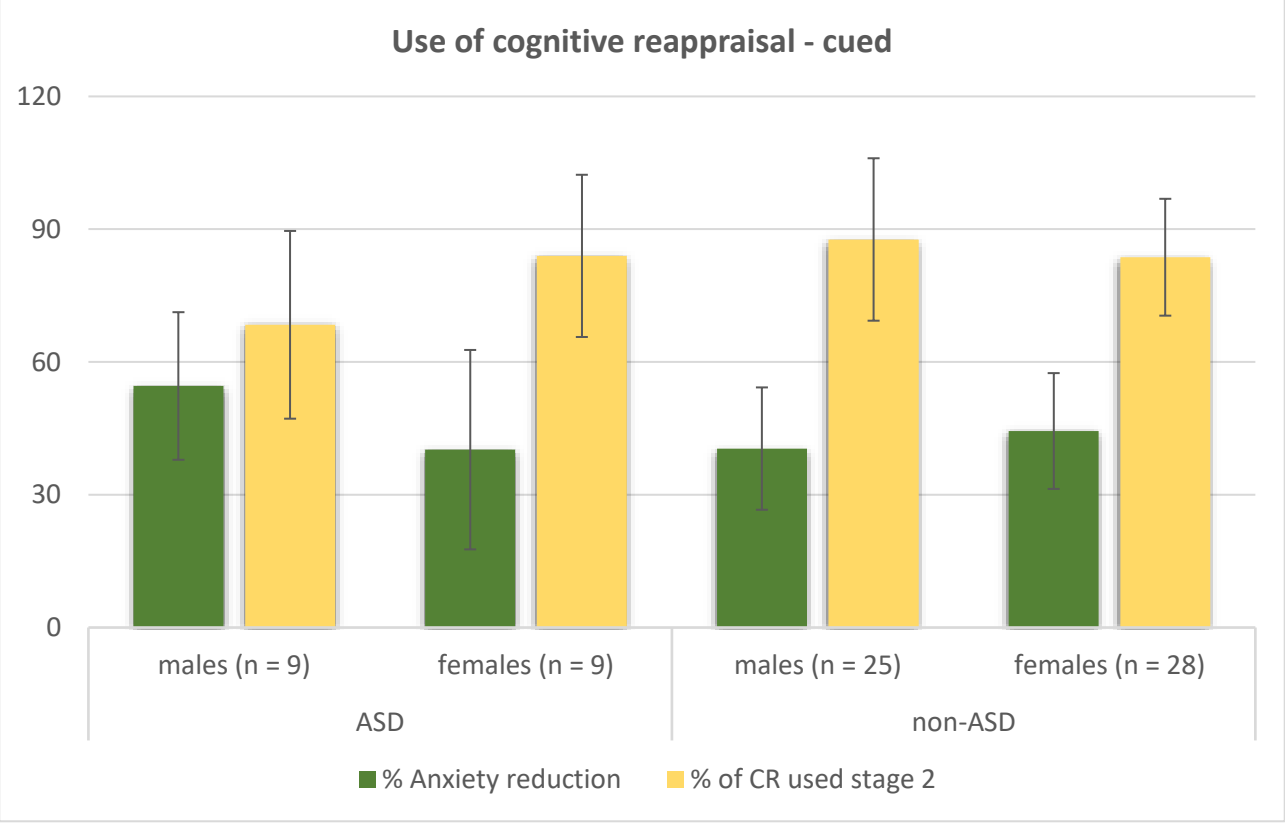
	ASD vs non-ASD		***ASD group males vs females***		***non-ASD group males vs females***	
/Statistics Strategy/	**U**	**p**	**U**	**p**	**U**	**p**
Cognitive Reappraisal	**118.0**	**0.000**	**3.0**	**0.001**	310.0	0.475
Avoidance	**306.0**	**0.021**	36.0	0.686	**224.5**	**0.022**
Problem-Solving	375.5	0.178	36.0	0.690	263.5	0.122
Distraction	386.0	0.217	37.0	0.751	**220.5**	**0.017**
Suppression	406.0	0.300	38.0	0.797	293.5	0.273
Venting	**302.5**	**0.001**	34.5	0.556	314.0	0.205
Relaxation	437.0	0.571	37.5	0.780	335.5	0.780
No Regulation	392.5	0.255	32.0	0.442	**235.0**	**0.037**
Not Codable	**253.5**	**0.000**	24.0	0.120	346.0	0.913

As expected, the ASD and non-ASD groups differed in using adaptive and maladaptive ER strategies, with the ASD group using maladaptive ER strategies (avoidance and venting) spontaneously more frequently than the non-ASD group. The non-ASD group used the CR spontaneously more frequently than the ASD group. Additionally, the prediction regarding non-codable answers was confirmed, and ASD individuals more often than the non-ASD group provided irrelevant answers. In contrast to the results of the study by Samson et al. (2015a), ASD and non-ASD participants within this sample did not differ in the spontaneous use of suppression. However, ASD participants reported more spontaneous use of avoidance and venting in comparison with the non-ASD group. Sex differences were only found in the ASD group in spontaneous use of CR, with females employing this strategy more frequently than males. In the non-ASD group, females used avoidance more frequently than males, while males used distraction and reported using no regulation more often than females.

To explore group and sex differences in the ability to generate CR when prompted and potential differences in its efficacy in reducing anxiety levels (RQ4), the percentage of trials when participants generated CR when cued and then a percentage of anxiety reduction scores were computed as described in the analyses section. A higher percentage of trials in which CR was used would indicate more frequent use of CR on instruction, while a higher percentage reduction in anxiety scores would indicate more effective use of CR. Due to the nature of the task, the data for frequency of CR use were

expected to deviate from normality, as perfect performance in applying CR in stage 2 would mean participants used it in 100% of the scenarios they read. Therefore, it would be left skewed by principle. To account for this deviation from normality, the data for the percentage of using CR in stage 2 of the task were transformed following a two-step transformation process as described by Templeton (2011). In the first step, a fractional rank of the percentage scores was computed, followed by the inverse cumulative distribution functions of the fractional rank, and the mean and standard deviation of the variable transformed. Following transformation, both variables were normally distributed (percentage frequency of CR: W = .975, p = .158; percentage anxiety reduction: W = .983, p = 454). The mean scores of computed variables for a percentage of trials when CR was used by participants in stage 2 and the percentage of reduction in anxiety scores are presented in Figure 4.

Figure 4. Comparison of frequency and efficacy of CR use, split into four groups



Note: The bars on the right in each group show how frequently participants in each group were able to produce cognitive reappraisal when cued to do so (part 2 of the experimental task). The bars on the left show the percentage of anxiety rating improvement compared with the first read.

Two univariate ANOVAs were conducted to examine the group and sex differences in the frequency and efficacy of using CR in stage 2 of the task. The results are presented in Table 3.

Table 3. ANOVA results for frequency and efficacy of CR use when cued

Variable	*Effects*	*F*	*p*	*η2*
Frequency of cued CR use				
	Sex	1.577	.214	.023
	Group	**4.248**	**.043**	**.060**
	Sex * Group	**4.524**	**.037**	**.063**
Reduction in anxiety by CR				
	Sex	1.576	.214	.023
	Group	1.431	.236	.021
	Sex*Group	**4.893**	**.030**	**.068**

There was a significant effect of the group for frequency of producing CR when prompted and a significant interaction between group and sex, but no main effect of sex. Therefore, as hypothesised and consistent with the results reported for the spontaneous use of ER strategies, the ASD group used CR in significantly fewer scenarios than the non-ASD group, even when specifically cued to do so (Figure 4).

While no significant effect of sex was found, meaning males and females could produce CR equally well, some slight differences in patterns across the two groups account for the significant sex-by-group interaction. Autistic females performed comparably to non-ASD males and females, while ASD males used CR less frequently than all other groups. The non-ASD group presented the opposite pattern, with males producing more CR when cued than females.

All groups benefited from CR at the same levels, as no significant effect of group or sex has been found for anxiety reduction with the use of CR. However, this variable had significant sex-by-group interaction, as autistic males reported a greater anxiety reduction than autistic females. At the same time, this pattern was reversed in the non-ASD group. While these trends are interesting and may potentially indicate that autistic females differ from autistic males in the ability and efficiency of using CR due to the small sample size of this group, these results should be interpreted with caution.

3.4.3 Alexithymia and emotional intelligence

To compare if children's (emotional intelligence (EQ:i-YV)) and parents' (alexithymia (CAM)) reports matched, bootstrapped non-parametric (due to small sample sizes), bivariate correlations split by group and sex were run. Results showed that the two measures were significantly correlated only in the autistic females' group (Spearman's correlation: r=-.690, p=.04). There was no agreement between parents' and children's responses in the remaining groups (p>.05).

Mann-Whitney tests were run to compare groups on both measures separately. Results showed significant group differences between ASD and non-ASD groups on CAM and EQ:i-YV measures (U=102, p<.001; U=94, p<.001; respectively), with ASD adolescents having higher levels of alexithymia according to parents' reports and lower levels of emotional intelligence (self-reports) than non-ASD adolescents. No sex differences were found in either ASD or non-ASD groups (p>.05).

3.4.4 Internalising issues and their relationship with autistic traits, alexithymia and emotion regulation

To explore relationships between traits of anxiety and depression and autistic traits, ER, and alexithymia, non-parametric bivariate correlations were conducted initially for the whole sample and then split by group and sex. Results are presented in Tables 4 and 5.

Table 4. Whole sample Spearman's rho correlation coefficients for anxiety and depression with autistic traits and ER

	Anxiety	Depression
Autistic Traits (AQ)	**.439****	**.318****
Self-report EI (EQ:i-YV)	**-.507****	**-.360****
Parents-report EI (CAM)	**-.331****	**-.527****
Spontaneous CR use	**-.316****	-.187
CR efficacy	.137	.009

*Note: **. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

As expected, in the whole sample analysis, anxiety and depression were positively correlated with autistic traits and negatively correlated with emotional intelligence measures, suggesting that participants with higher levels of autistic traits and alexithymia also presented with higher levels of anxiety and depression. Anxiety was also negatively correlated with spontaneous CR, suggesting that

more anxious individuals used this strategy during the task less often. No other significant correlations were found.

Table 5. Comparison of Spearman's rho correlation coefficients for anxiety and depression for both groups split by sex

	Anxiety				**Depression**			
	ASD		**non-ASD**		**ASD**		**non-ASD**	
	Males	**Females**	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
Autistic Traits (AQ)	0.051	-0.644	0.243	0.078	0.126	-0.383	0.301	-0.289
Self-report EI (EQ:i-YV)	0.254	0.445	**-.400***	**-.382***	0.393	0.231	**-.452***	-0.144
Parents-report EI (CAM)	-0.485	0.636	-0.297	0.205	-0.067	0.244	**-.479***	**-.381***
Spontaneous CR use	**-.672***	.255	-.005	-.123	-.511	-.124	.030	.068
CR efficacy	-0.136	0.586	-0.338	**.398***	-0.402	0.226	-0.288	0.265

*Note: **. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

When split by group and sex, no significant correlations were found in the ASD group except for spontaneous use of CR, which was negatively correlated with anxiety, specifically in this group. However, the lack of meaningful correlations in this group is highly likely caused by the small sample sizes of the individual groups. Thus, this finding should be treated with caution. In the non-ASD group, anxiety was negatively correlated with emotional intelligence measures in both males and females. Surprisingly, a positive correlation was found between the efficacy of CR and anxiety in non-ASD females only, suggesting the association between anxiety and efficacy of CR use was distinct for this group only. In the non-ASD group, depression was negatively correlated with both emotional intelligence measures in males, while in females, this correlation was distinct for parents' reports only.

This may suggest that individuals with higher depression symptoms also present with higher alexithymia levels. However, adolescent girls with higher depression levels may lack that insight into their difficulties with understanding their emotional states, while it seems more obvious to their parents.

3.5 Discussion

This study examined ER in children and young people with ASD recruited through clinical services with an age-matched control sample. The aim was to examine ER and alexithymia as potential mechanisms underpinning anxiety and depression, which are commonly co-occurring conditions with ASD and, anecdotally, are particularly prevalent in adolescent females referred for diagnosis of ASD (i.e., Bargiela et al., 2016; Belcher et al. 2023).

As hypothesised, anxiety and depression levels were higher in the ASD group in comparison with the non-ASD group. This finding is in accordance with current literature, as discussed in the introduction of this chapter, and unfortunately amplifies the need for answers on potential factors impacting that tendency. Females self-reported higher levels of anxiety than males in both groups, while levels of depression were almost equal (see Figure 1). However, statistical analyses showed that a significant difference in anxiety levels between males and females was found only in the non-ASD group, suggesting that both autistic males and females experienced similar levels of internalising issues within this sample.

The lack of sex differences, particularly in the ASD group, may reflect the limitation of this study's small sample size. The ASD group counted only 18 participants (9 males, 9 females), while the control group had 53 participants (25 males and 28 females). Alternatively, it could be potentially caused by the fact that the majority of girls in this group were currently taking medication to alleviate their anxiety symptoms. Seven out of the nine autistic girls participating in this study were currently taking serotonin reuptake inhibition (SSRI) medication prescribed for anxiety symptoms. Additionally, one of these girls was prescribed ADHD medication. Only two female participants from the ASD group were not using any medication at the time. In comparison, only two out of nine autistic boys were taking SSRI medication for anxiety symptoms. Additionally, four male participants from the ASD group were currently prescribed ADHD medication, with one of them taking both ADHD and SSRI medication. Another two male participants were prescribed medication to alleviate behavioural issues (antipsychotic and sedation type of meds). Again, only two male participants were not using any medication at the time. Therefore, it is possible that the fact that the majority of females in the ASD

group had already managed their anxiety pharmacologically hindered the sex differences expected based on previous research in this population. None of the control group children were reported to take any medication. Nevertheless, it was important to examine the potential role of ER and alexithymia in the presentation of anxiety and depression in ASD.

The spontaneous use of ER strategies and the efficacy of an adaptive strategy, CR, were examined, and comparisons between males and females within ASD and non-ASD samples were made in the context of experiencing anxiety in social and non-social situations. As expected, and in line with the higher rates of anxiety in females in their self-report scores (HADS) and also with current trends reported in the literature (Horwitz et al., 2023; Oswald et al., 2016), females had higher emotional reactivity (self-reported anxiety levels) than males for both social and non-social scenarios in the experimental task (see Figure 2). However, this difference was only statistically significant in the non-ASD group, possibly due to the same issues discussed earlier (small sample size of ASD group and/or use of medication). However, it is also possible that the ambiguous nature of the scenarios could increase anxiety in the ASD group. Individuals with autism with higher intelligence quotients are often reported as more anxious than autistic children with lower intelligence quotients and often experience heightened anxiety when faced with uncertain or unclear situations, as they may be more aware of their difficulties and find it challenging to predict outcomes or understand social nuances (see review by Mingins et al., 2021). This intolerance of uncertainty could have amplified their stress and discomfort when thinking about ambiguous scenarios and potentially overshadowed sex differences in this group. This hypothesis could be addressed by further research.

However, the study found a significant interaction between scenario type and group; the ASD group had significantly higher emotional reactivity mean scores for social situations than non-social, whereas this trend was reversed in the non-ASD group. Moreover, the ASD group's scores were significantly higher than the non-ASD group on the social scenarios, with no group difference within non-social situations. This finding suggests that ASD individuals experience higher anxiety levels in social contexts and potentially may relate to higher rates of social anxiety in this population, which has been reported as high as 50% in comparison with estimates of 7-13% in the general population (Maddox & White, 2015).

Interestingly, Dryman and Heimberg's (2018) systematic review of 104 studies on emotion regulation in social anxiety and depression within the typically developing population revealed that broader cognitive deficiencies might arise from attentional and memory biases linked to social anxiety. They suggested that socially anxious individuals struggle with more complex strategies for ER, like CR, since they spend so much of their mental energy on danger monitoring and social impression management. This suggests that socially anxious individuals are more likely to show stronger cognitive biases and may be at a greater risk of experiencing anxiety and depression because they are less likely to employ

more complex ER strategies like CR. Therefore, it is possible that a similar mechanism may impact the effectiveness of CR in autistic individuals.

The non-ASD group spontaneously used CR more than the ASD group, while the ASD group used more avoidance and venting than the non-ASD group, both considered maladaptive ER strategies. This finding was in line with a review by Cai et al. (2018a), who, on account of an examination of past research, concluded that autistic individuals tend to have difficulties regulating their own emotions and regularly self-report or show a less adaptive pattern of ER strategy use, then TD population. In contrast to the results of Samson et al. (2015a), no significant differences were found in the spontaneous use of suppression between the groups. Therefore, unlike expected, the ASD group did not report the potential for more frequent use of this ER strategy within this sample.

However, it is important to remember that the task required participants to reflect on the strategy they would most likely use to calm themselves down. Therefore, it is possible that given choice and time to think about it, they might have tried to choose the best strategy that would be "expected" of them. Interestingly, the only difference in the spontaneous use of CR was observed in the ASD group, where females spontaneously engaged CR significantly more frequently than males. This finding is suggestive of potential sex differences in how individuals with ASD might regulate their emotions. Females with ASD who are more adept at using CR may experience different social outcomes compared to males who may rely more on other, possibly less adaptive, emotion regulation strategies. However, due to the small sample size of the ASD group and the hypothetical nature of the experimental task, further research is needed to explore the potential impact on social functioning.

No sex differences were reported in the non-ASD group regarding the spontaneous frequency of CR use. However, in the non-ASD group, females spontaneously chose avoidance more often than males, whereas males reported the use of distraction and no regulation more often than females ($p < .005$). The gender-specific differences in emotion regulation strategies within the non-ASD group may highlight potential risk factors or protective factors for mental health outcomes. For example, if females in the non-ASD group tend to use avoidance more frequently than males, this could have implications for understanding and addressing anxiety or stress-related disorders in females. Conversely, if males tend to use distraction and no regulation more often, this may have implications for interventions targeting attentional control and impulse regulation. Overall, these findings point towards potential further research directions and are suggestive of the importance of considering gender-specific differences in emotion regulation across different populations regardless of whether they have ASD.

In terms of the ability to produce CR when cued, the results of this study replicated the findings of Samson et al. (2015a) in terms of differences between the ASD and non-ASD groups. There was a significant effect of the group for frequency of producing CR when prompted, with the non-ASD group doing so more frequently than the ASD group. All groups benefited from CR at the same levels when they implemented it, and no significant impact of group or sex was observed in terms of reducing anxiety through the application of CR. However, the ASD subgroups were smaller (n=9) than the non-ASD subgroups (n=25, n=28).

Nevertheless, there was a notable sex-by-group interaction for this variable, with autistic males seeing a more pronounced decrease in anxiety compared to autistic females. At the same time, this pattern was reversed in the non-ASD group. Considering that autistic females had the highest baseline reactivity for both social and non-social scenarios, even though they were able to use cognitive reappraisal when cued as often as non-ASD males and females and slightly more often than ASD males, their reports of anxiety reduction were lower than autistic males, suggesting the most considerable difference in the effectiveness of using CR was between non-ASD and ASD females. While this pattern is interesting, the difference between ASD and non-ASD females was insignificant ($p > .05$).

The absence of the main effects of sex in the ability to use cognitive reappraisal and its relation to ER as a mechanism underlying sex differences in the broader ASD profile suggests that both males and females reported similar capabilities to employ this emotion regulation strategy. However, further studies could explore sex differences in the practical use of cognitive reappraisal using larger samples and if the frequency and efficiency of using cognitive reappraisal. However, it is possible that these preliminary findings may imply that any observed sex differences in the broader ASD profile (including anxiety and depression) might not be directly explained by differences in cognitive reappraisal abilities. However, this doesn't rule out that other emotion regulation strategies or factors could contribute to sex differences in the ASD profile, which will be explored in further chapters.

Comparison of self and parent reports for alexithymia showed a significant association in the ASD females group only. However, due to the small sample sizes in this study, the lack of significant results should be taken with caution, as there was overall agreement in the directions of scores on both parents' and children's measures across all four groups. The majority of parents completing reports for their daughters were mothers, especially in the ASD group, where mothers in this study accompanied all girls. It is probable that they might have been closely attuned to their daughters' emotional problems, which might have driven a significant effect in this group only. Alternatively, this agreement may reflect the higher, already clinically diagnosed internalising issues in the group of autistic females; as discussed earlier, the majority of them were already receiving treatment for anxiety. A study by Cleridou et al. (2017) examined whether parent-child report agreement varies

based on presenting problems in a large UK sample of 16,754 participants (57% females). Using the Strengths and Difficulties Questionnaire (SDQ) for self-report and self-awareness, they found less agreement for internalising issues. Parents were more likely to identify externalising problems than internalising problems for their children. However, if the child was already diagnosed with depression or anxiety, the agreement between parent and child reports exceeded 70%.

As expected, the comparison of alexithymia/emotional intelligence levels between the groups showed that the ASD group had lower emotional intelligence as measured by the self-report and higher alexithymia symptoms as measured by the parent's reports than the non-ASD group. This finding supports the idea that individuals with ASD may have difficulty recognising and understanding their own emotions as well as expressing them effectively (Bloch et al., 2021; Gormley et al., 2022; Griffin et al., 2016; Morie et al., 2019). No sex differences within either the ASD or non-ASD groups were found. The absence of sex differences in alexithymia levels within ASD and non-ASD groups, at least in this study, may suggest that alexithymia might not be a direct mechanism driving the sex differences observed in anxiety, depression and the broader ASD profile. However, sex differences in anxiety and depression are well-documented (e.g., Altemus et al., 2014; Patalay & Fitzsimons, 2017), with females generally showing higher levels of these conditions than males. Alexithymia has been proposed as a potential contributing factor to these differences (e.g., Fietz et al., 2018; Morie et al., 2019). Thus, it is important to remember the small sample size of this study and cautiously interpret this lack of significant sex differences in alexithymia levels.

Anxiety and depression were positively correlated with core autistic features (measured using the AQ) and negatively correlated with emotional intelligence, suggesting that people with higher levels of autistic traits and alexithymia also had higher levels of anxiety and depression. Anxiety negatively correlated with spontaneous CR, suggesting that more anxious people used this ER strategy less often during the task. These results are similar to a study conducted by Goldsmith & Kelley (2018), done as a parent report on 145 children and adolescents with ASD (111 males), which showed that more effective ER, as defined by more use of reappraisal, predicted less severe ASD symptomatology and greater use of reappraisal predicted less severe social impairment. In the non-ASD group, depression was inversely correlated with both emotional intelligence measures in males, but the same was true for only parents' ratings in females. This could imply that adolescents with more depression also experience higher alexithymia symptoms. However, adolescent females may lack awareness of their issues and understanding of their emotional states, whereas it appears more evident to their parents.

3.6 Strengths and limitations

The current study has a few limitations. Therefore, it is essential to approach and interpret the results cautiously. First and foremost, using a smaller than planned sample (n=71 instead of 120) raises concerns about the reliability of the findings. A high likelihood exists that the study's statistical power was weakened due to the small number of participants, which would have resulted in an underestimation of the actual effects and a higher risk of errors. Therefore, the sample size may have been too small to accurately find the effects and/or generalise the limited significant findings to larger populations.

One notable limitation of this study is that coding experimental task responses into categories was not subjected to double rating. This lack of a second rater introduces the potential for bias. Consequently, any personal biases or inconsistencies in interpretation by the coder could affect the reliability and validity of the data. The absence of inter-rater reliability checks means that the findings might not be as robust or generalisable, as they could reflect subjective influences rather than objective categorisations. Addressing this limitation in future research by incorporating double rating or other reliability measures would enhance the accuracy and credibility of the results.

Additionally, due to the COVID-19 pandemic's disruption, data collection had to move from face-to-face interactions to online platforms (Microsoft Teams/ Zoom). This change might have introduced factors that could impact data quality. Factors such as home environments, distractions, and engagement levels during the task should be considered. Consequently, this altered data collection method may have influenced participants' emotional responses and overall interaction dynamics, potentially affecting the study's validity. Therefore, it is advisable to use caution when applying these findings to populations or drawing conclusions based solely on the observed effects. Further studies should address these limitations to enhance the reliability and generalizability of the results.

The absence of the main effects of sex in the ability to use cognitive reappraisal and in alexithymia levels potentially suggests that adolescent males and females have similar capabilities to recognise their emotions and can use cognitive reappraisal, ruling out these two factors as mechanisms underpinning higher rates of anxiety and depression in females as well as differences between autistic males and females. However, this finding may not be reliable due to the factors discussed above. Therefore, the search continues, and the next chapters will further explore broader emotion regulation strategies, including cognitive reappraisal and expressive suppression to start with, as well as internalising issues and alexithymia in subsequent chapters, as measured on a larger sample of autistic and typically developing adults from samples 2 and 3.

Despite its limitations, this study also had several significant strengths that enhance its overall value and contribution to the field. Notably, the novel approach of targeting a sample undergoing the diagnostic process allowed for the exploration of a more nuanced and subtle presentation of autistic difficulties, capturing a range of behaviours and experiences that might be overlooked in other contexts. Including parents in the study provided additional layers of information, enabling a comparison of answers that enriched the analysis and offered a more comprehensive understanding of the participants' experiences. Additionally, the study maintained equal sample sizes across groups, which, although small, ensured a balanced and fair comparison. The inclusion of a control group further strengthened the study by providing a baseline against which the experimental findings could be measured, thereby enhancing the value of the results.

Chapter 4 - Frequency vs. efficiency of using cognitive reappraisal and expressive suppression

This chapter will explore the use of cognitive reappraisal (CR) in more detail, along with one other ER strategy, expressive suppression (ES). This time, the comparisons will be made between autistic and typically developing adult males and females. Group and sex differences will be explored in terms of the frequency and efficacy of using CR and ES. As well as how the self-reported frequency of using the two strategies relates to the efficiency of using these strategies for directly regulating a specific emotion (disgust) in the experimental task.

4.1 Introduction

4.1.1 The frequency and efficiency of cognitive reappraisal and expressive suppression in typical development and its relation to internalising disorders

As discussed in Chapter 1, CR and ES are well-studied ER strategies due to their strong association with mental health and general well-being. CR is consistently associated with lower levels of anxiety and depression (see Aldao et al., 2010, for a meta-analysis review) and is therefore considered an adaptive ER strategy. While ES of emotions is often positively associated with internalising issues (i.e., Aldao et al., 2010; Gross, 2015; Gross & John, 2003; Martins et al., 2016; Webb et al., 2012) and have been demonstrated as having higher cognitive cost than CR, thus, this strategy is considered to be a maladaptive one, with rare exceptions, as discussed in Chapter 1.

Expressive suppression, which is often not helpful in downregulating the emotion's intensity, has been demonstrated to impair memory for social information (Richards & Gross, 2000). If expressive suppression impairs this memory, individuals who frequently use this strategy might struggle to recall important details about social interactions, such as names, events, or emotional cues. This can hinder their ability to connect with others, respond appropriately in social situations, and maintain relationships. In contrast, many studies have shown that reappraisal can lower emotional reactivity and reduce negative affect in unpleasant situations without significantly impairing the individual's physiological, cognitive, or social functioning. This is because cognitive reappraisal usually focuses on recognising the positive aspects of a situation (for reviews, see Gross, 2002; Gross & Thompson, 2007). For example, in a study conducted by Gross and John (2003), participants were instructed to either reappraise or suppress their emotions. The results showed that those who used reappraisal

also reported less negative affect and greater well-being than those who used suppression. However, Ford et al. (2022), in a study with neurotypical adults using daily diaries to record the frequency and success of using reappraisal under low and high-life-stress situations, found some interesting association between habitual use of reappraisal and depressive symptoms. The results showed that for those who habitually used reappraisal successfully, more frequent use of this strategy was associated with fewer depressive symptoms in the higher life stress condition. It was, though, associated with higher depressive symptoms in individuals who employed reappraisal less well. Therefore, the authors concluded that using cognitive reappraisal frequently but not successfully or being able to use it successfully but rarely would not provide the expected benefits of this ER strategy. A similar conclusion was proposed by De France et al. (2022), who investigated levels of reliance on cognitive reappraisal in 178 adolescents on subsequent depressive symptom development. Participants used a smartphone app to record the frequency of daily reappraisal use and their perception of its regulatory success over the course of two weeks. The results showed that the association between the frequency of cognitive reappraisal use, and depressive symptoms was moderated by perceptions of how successful the implementation of cognitive reappraisal was. Therefore, individual differences in efficiency, above the frequency of CR use, may be the main indicator of its benefits.

4.1.2 Sex differences in the frequency of using cognitive reappraisal and expressive suppression in typically developing populations

Several studies report that females use cognitive reappraisal more frequently than males (e.g., Tamres et al., 2002; Spaapen et al., 2014). However, several other studies did not find gender differences in the frequency of use of cognitive reappraisal (e.g., Gross and John, 2003; Haga et al., 2009; Zlomke & Hahn, 2010). With regards to suppression, the results seem to be more conclusive, and several studies showed that males tend to conceal the expression of emotions more often than females (e.g., Gross and John, 2003; Haga et al., 2009; Nolen-Hoeksema & Aldao, 2011; Tamres et al., 2002), even though they tend to be more emotionally expressive as toddlers (Levant et al., 2009), as discussed in Chapter 1. Therefore, this difference in the frequency of using ES between males and females may be due to socialisation and gender norms. Women may be more likely to express their emotions and receive social support from others, even if they suppress them. In contrast, men may face greater social stigma for expressing their emotions and may experience greater negative consequences for expressing them.

4.1.3 Use of cognitive reappraisal and expressive suppression in ASD and sex differences

Some differences have also been found in the frequency of using these two strategies between autistic individuals and the general population. For example, a study by Samson et al. (2012) found that autistic individuals reported using CR less frequently than non-autistic individuals. At the same time, there were no significant differences between the groups using ES in this study. However, a 2015(a) study by Samson et al. showed that autistic children and adolescents used CR less frequently and suppression more frequently than neurotypical peers. Another study found that autistic individuals reported using CR and ES less frequently than non-autistic individuals and that these differences were associated with higher anxiety levels in the autistic group (Cai et al., 2020). Overall, these findings suggest that autistic individuals may be less likely to use CR as an emotion regulation strategy, which may contribute to higher levels of anxiety in this group. However, research on sex differences in the use of emotion regulation strategies in individuals with autism spectrum disorder (ASD) is relatively limited, and findings are not conclusive. A study by Maddox and White (2015) compared males and females with ASD and found no significant sex differences in the use of CR or ES. However, another study found that adolescent girls with ASD reported using CR more frequently than adolescent boys with ASD, while there were no sex differences in the use of ES (Dean et al., 2017).

A considerable amount of literature has been published on the effectiveness of CR in improving mental health outcomes. Therefore, this ER strategy is often targeted for therapeutical interventions (see Webb et al., 2012; Aldao & Nolen-Hoeksema, 2012; for reviews). However, therapeutic interventions based on ER are not always equally successful for everyone. For example, cognitive-behavioural therapy has been found to provide long-term effects in reducing anxiety in typically developing youth (Kodal et al., 2018). Nevertheless, the results of a systematic review and meta-analysis by Wood et al. (2009) found no conclusive results in studies that included post-treatment follow-up studies of CBT effectiveness for anxiety reduction in autistic youths. Therefore, a better understanding of mechanisms affecting the efficacy of using CR in this group is needed to improve therapeutical interventions.

4.1.4 Aims and hypotheses

As discussed above, while many studies may have examined the use of CR as an intervention strategy, not many have directly measured the efficacy of using CR as a strategy for directly regulating a specific emotion. Therefore, the main aim of this chapter was to examine whether, if someone uses CR frequently, it would also mean that they can use that strategy effectively. The association between

frequency and efficiency was examined for CR and ES in autistic and non-autistic individuals. For measuring the efficiency of using CR and ES, an experimental paradigm was designed in which participants were presented with disgusting and neutral pictures (as a baseline) and encouraged to use either CR or ES to downregulate their emotions of disgust while looking at the pictures (a detailed description of the task procedure is presented below in the methods section). The paradigm was developed based on the original Pitskel et al. (2014) paradigm, and its initial form was intended to be used with the adolescent clinical sample in neuroimaging analyses (MRI and MEG). However, due to COVID-19 disruption (discussed in Chapters 1 & 2), it was further adapted for online use with adult samples. The experimental task results were analysed and compared to the results of the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) as a measure of frequency for ES and CR ER strategies.

Following the reports of higher rates of internalising disorders in the ASD population and the strong relation between frequent use of expressive suppression (ES) and low-frequency use of cognitive reappraisal (CR) and internalising issues discussed earlier, this study aimed to answer the following questions:

RQ1. Are there group and sex differences in the frequency of using ES and CR? Hypotheses: 1a) It was expected for autistic individuals to report more frequent use of ES than the non-ASD group and for the non-ASD group to report more frequent use of CR. 1b) Males in the non-ASD group would report more frequent use of ES than females, while no sex differences in self-reported frequency of using CR were expected. 1c) Due to limited research available in this field, it was hypothesised that patterns for frequency of using ES and CR by males and females in both groups will be the same.

RQ2. Are there group and sex differences in the efficiency of using ES and CR? Hypotheses: 2a) Disgust ratings should be lower for conditions where participants used either ES or CR to downregulate their emotion of disgust compared to the no-regulation conditions (baseline). 2b) Individuals with ASD would be less effective than non-ASD participants in regulating their emotions with ES and CR. 2c). Individuals who use ES or CR more frequently would also be more efficient using these ER strategies during the task. Therefore, it was hypothesised that males would be more effective in using ES than females during the task, while no differences were expected in the efficacy of using CR. 2d) The overall pattern of sex differences in the non-ASD and ASD groups will be the same.

RQ3. Does frequent use of ES and CR mean more efficient use of these two ER strategies? Hypothesis: 3) There was expected to be a positive association between the frequency and efficiency of using CR and ES.

4.2 Methods

4.2.1 Participants

Participants from sample 2, as described in Chapter 2, were included in this study. The total number of participants was 160 typically developing (non-ASD) individuals (82 males, 78 females) and 108 individuals with autism spectrum disorder diagnosis (ASD) (54 males, 54 females).

4.2.2 Ethical approval

Aston University's Health and Life Sciences Research Ethics Committee assessed and approved the study (REC reference number: 1764).

4.2.3 Measures

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003)

This 10-item self-report measure was used to collect data on the frequency of using cognitive reappraisal (CR) and expressive suppression (ES). Specifically, it measures the frequency with which individuals use these strategies. Six items measure CR (e.g., 'When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm'), and the remaining four items measure ES (e.g., 'I control my emotions by not expressing them'). Respondents rate each item on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (Strongly agree). This measure gives insight into how individuals control (thus, regulate and manage) their emotions.

Emotion Regulation Task

The emotion regulation task was developed as an adaptation of a task by Pitskel et al. (2014), who measured disgust ratings in response to images, looking at cognitive reappraisal to up and down-regulate emotional response. While Pitskel et al. (2014) assessed both up-regulation and down-regulation of the emotional response, the focus of the current study was the comparison of an adaptive ER strategy (cognitive reappraisal) with a maladaptive strategy (expressive suppression) in order to down-regulate the emotional response. This approach allowed for a direct comparison of the self-reported frequency of using these two ER strategies (as measured by questionnaires) with the efficacy of using the two ER strategies.

The task was designed for use in MEG and MRI scanners with adolescents from the clinical study sample. Several affective picture databases were considered, but disgusting pictures available in them were considered unsuitable for minor participants. Therefore, neutral pictures were selected from the International Affective Pictures System (Lang et al., 2008) and supplemented with an in-house set of images of mouldy food, skin conditions, broken nails and nasty toenails, faeces, parasites (ticks, bed bugs, etc.), people and animals vomiting, and dirty nappies.

A battery of 300 pictures (250 disgusting pictures and 50 neutral) was prepared in a Qualtrics survey. All pictures were assessed in a pilot study approved by Aston University's ethical committee. The purpose was to ensure the pictures were well balanced across each trial and presented with similar potential to elicit the emotion of disgust. 36 volunteers (13 males) aged 17 to 64 years completed the Qualtrics survey and provided responses with regards to how disgusted/grossed out these images made them feel on the 1–5-point Likert scale from "not grossed out at all" to "extremely grossed out". Data analysis showed that only three pictures selected for this database were rated with an average score of 4 or above. These pictures were removed from the data set as potentially too disgusting and not suitable for use in a study with minor participants. Additionally, the pictures with an average rating from 1.2 to 2 (61 images) were removed, as they may not have had enough potential to elicit the emotion of disgust. The database of selected pictures had 44 neutral pictures and 192 disgusting images. This task was then further adapted for online use with adults.

Stimuli were presented using PsychoPy (v.2021.2.3) Software. The task consisted of four conditions: participants were instructed to just "look" at neutral and disgusting pictures, or to either "pretend it is fake" (cognitive reappraisal condition), or "try not to react" (suppression condition). After each picture, they were asked to rate how disgusted they felt by the picture they had just seen on a scale of 1 ('not grossed out at all') to 4 ('very much grossed out'). Each trial consisted of a fixation, instruction ("look", "pretend it is fake", or "try not to react"), followed by a neutral or disgusting image, followed by a rating scale question and then a prompt to relax before the next trial. Participants completed an initial 12-trial practice session, which included three examples from each of the four conditions. For one trial in each condition, participants were asked a) if they regulated their emotions while looking at the picture and b) how they did that. This was included to ensure participants engaged in the practice trial session due to the online data collection mode. Once the practice was completed, participants moved on to the main paradigm, where they were presented with 64 randomised trials (16 per condition). The paradigm took approximately 15 minutes to complete.

4.2.4 Analyses

A univariate ANOVA was used to compare the frequency of using CR and ES (measured by the ERQ questionnaire), between males and females within both groups (ASD and non-ASD).

As measured by the experimental task, group and sex differences in disgust ratings were explored with the repeated measures ANOVA. To ensure that adult participants found the selected pictures appropriately disgusting, a 4x2x2 ANOVA was conducted, considering four task conditions (baseline neutral and baseline disgusting, with the two ER strategies conditions, ES and CR), two groups and two sexes. This analysis was crucial because the task's effectiveness depended on the participants experiencing a genuine sense of disgust. If the images did not elicit a strong disgust reaction, the task would lack the necessary emotional impact to evaluate the downregulation of disgust using the two selected emotion regulation (ER) strategies, cognitive reappraisal (CR) and expressive suppression (ES). By confirming that the images were sufficiently disgusting across all conditions, groups, and sexes, the study could reliably assess the efficacy of CR and ES in managing the participants' emotional responses.

Mean scores were calculated for disgust ratings in the four conditions to assess the efficiency of using both CR and ES in the experimental task. Subsequently, difference scores were calculated for each participant by subtracting the mean scores of each ER condition (ES and CR) from the mean scores of the baseline condition, where participants were required to look at disgusting images simply. For example, if participant's baseline condition mean score was 3.5, and their mean score for the CR condition was 2, then the reduction of the disgust experience (difference score) would be 1.5. However, if a participant had a baseline of 3.5, and their mean score for CR condition was 3, their difference score would be 0.5. Therefore, higher difference scores indicate a more effective use of that ER strategy. The difference scores were then explored for group and sex effects and potential interactions with a 2x2x2 (the two difference scores for ES and CR, two groups and two sexes) repeated measures ANOVA.

Bootstrapped, bivariate Pearson’s correlations were conducted on the whole sample to assess the association between the frequency with which participants used each ER strategy (using scores on the CR and ES subscales of the ERQ) and the efficacy with which those strategies were implemented during the task (difference scores).

4.3 Results

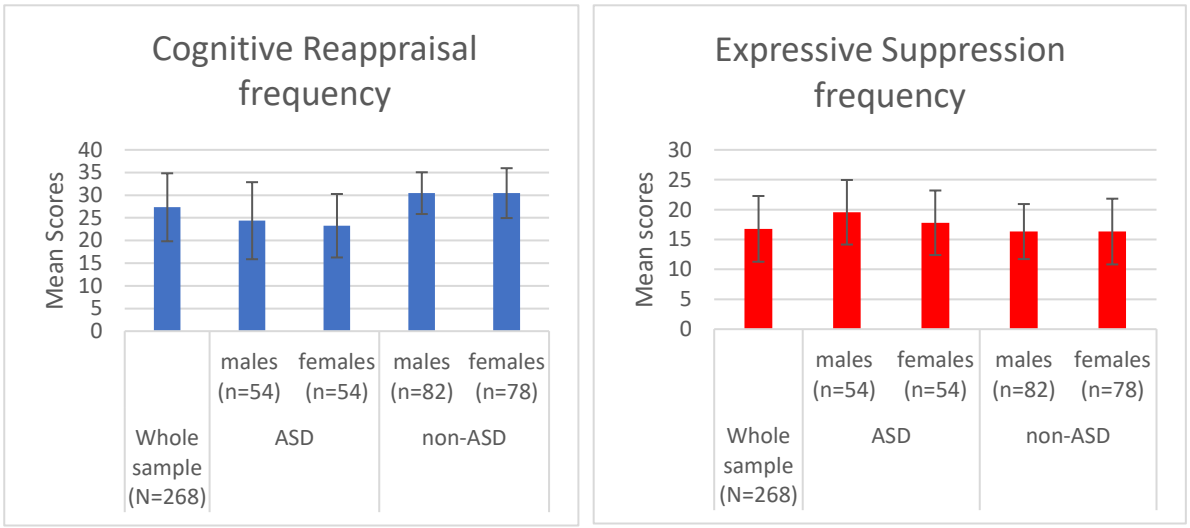
4.3.1 The frequency of using cognitive reappraisal and expressive suppression

As previously discussed, males are known to use ES more often than females, while there seem to be no differences in the use of CR between males and females. Thus, the first part of these analyses aimed to explore further these findings and investigate potential sex differences in the use of CR and ES in both ASD and non-ASD populations.

Descriptive analyses were run to determine means and standard deviations on both ERQ scales (ES and CR) for the four groups (see Figure 1) for participants from Study 2.

As can be seen in Figure 1, participants within all four groups reported using CR more frequently than ES. Males within both groups reported using both CR and ES more frequently than females, and as expected, the ASD group reported more frequent use of ES than the non-ASD group. The ERQ within the whole sample has shown good internal consistency with Cronbach's alpha of α = 0.74 for the suppression subscale (4 items) and α = 0.86 for the reappraisal subscale (6 items).

Figure 1. ERQ CR and ES total scores when split by group and sex



Note: Mean scores for the self-reported frequency of cognitive reappraisal (6 items) and expressive suppression (4 items) measured by ERQ, with standard deviation error bars.

Statistical analyses were conducted to explore these trends in the descriptive data. The skewness and kurtosis for the CR variable were found to be -.51 and -.099, respectively, and -.24 and -.49, respectively, for ES.

To examine potential differences in participants' self-reported use of CR and ES across sexes and groups (ASD vs. non-ASD), two bootstrapped univariate ANOVA analyses were performed. The between-subject factors included the group (ASD vs. non-ASD) and sex (males vs. females). These analyses aimed to determine whether there were significant variations in CR and ES usage between sexes and groups and to explore any potential interactions between these variables. The results are presented in Table 1. below.

Table 1. Results of univariate ANOVA analyses for frequency of using cognitive reappraisal and expressive suppression

Variable	*Effect*	*df*	*F*	*p*	*η2*
Cognitive reappraisal					
	Sex	1	2.374	.125	.009
	Group	1	**47.020**	**.000**	**.151**
	Sex * Group	1	.059	.808	.000
Expressive suppression					
	Sex	1	**7.167**	**.008**	**.026**
	Group	1	**24.39**	**.000**	**.085**
	Sex * Group	1	.001	.972	.000

As hypothesised, the ASD group reported significantly more frequent use of ES and less frequent use of CR than the non-ASD group. As expected, males reported more frequent use of ES than females. At the same time, there was no effect of sex found for the CR, suggesting the differences in frequency of using this ER strategy between males and females were not big enough to reach statistical significance.

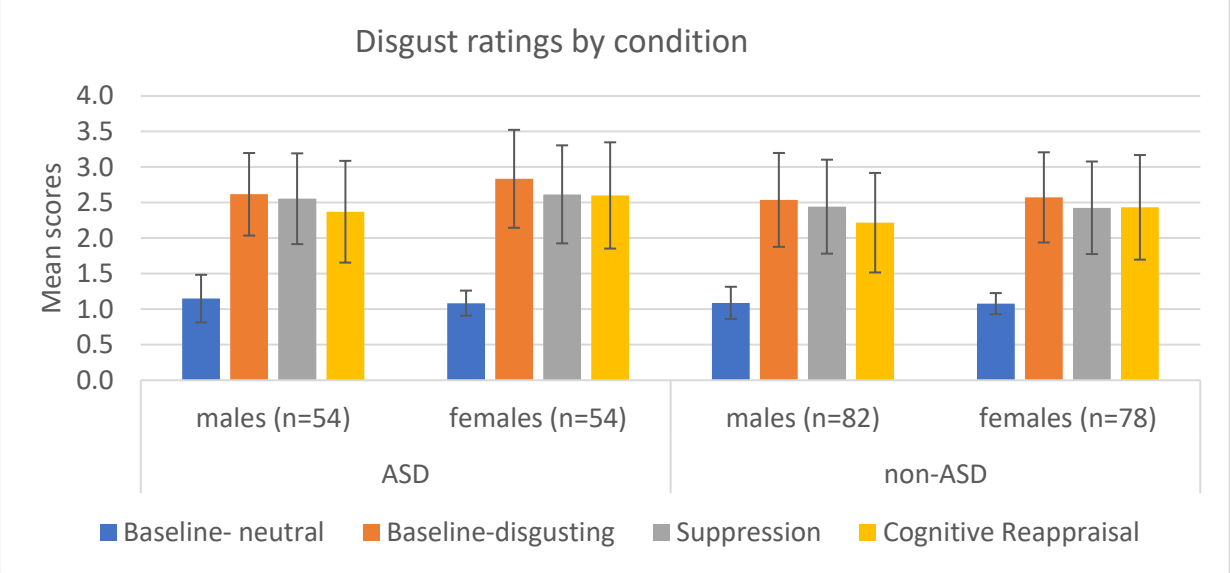
No significant interaction was found between sex and group in either CR or ES, which suggests that males and females within both groups presented with similar patterns, as males from both groups had slightly higher scores than females for both ER strategies (for reference, see Figure 1 above).

4.3.2 The efficiency of using cognitive reappraisal and expressive suppression

An experiment described in the methods section was used to measure how effectively participants can use CR and ES to downregulate their emotions. Participants were instructed to regulate their feelings of disgust with these two ER strategies. First, the task was analysed to ensure its validity.

Descriptive analyses on the four task conditions (Look disgusting, Look neutral, Expressive suppression, and Cognitive reappraisal) were run to determine total disgust rating scores per condition for each group, presented in Figure 2 below.

Figure 2. Disgust rating for the four task conditions for the whole sample and when split by sex and group



Note: Comparison of all 4 conditions disgust ratings

The lowest scores were reported for the Look neutral condition, whilst the Look disgusting condition had the highest scores. The two ER conditions, ES and CR, had lower disgust ratings than the Look disgusting condition within all four groups. However, the difference between the two ER condition disgust ratings was smaller between males and females in the non-ASD group than in the ASD group.

Statistical analyses were conducted to explore these trends in the descriptive data. A 4x2x2 repeated measures ANOVA was conducted to examine the effects of condition (look disgusting, look neutral, expressive suppression and CR), group (ASD vs. non-ASD), and sex (male vs. female). Mauchly's test indicated that the assumption of sphericity had been violated ($\chi^2_{(5)} = 167.637$, $p < .001$); consequently, Greenhouse-Geisser statistics are reported.

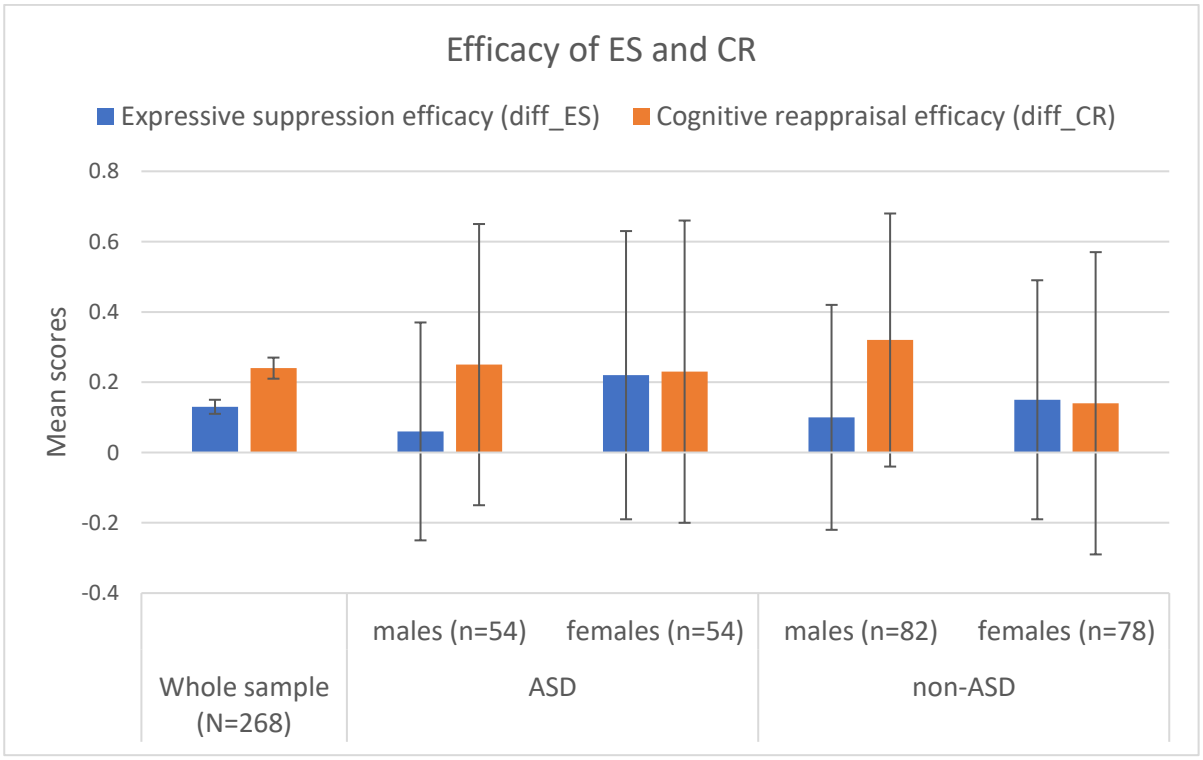
The results show a significant main effect of condition ($F_{(2.1,\ 553.03)} = 922.518$, $p<.001$), indicating that the mean scores for the four conditions differed significantly, and the participants reported notably

diverse levels of disgust while performing the task. There was a significant main effect of group ($F_{(1, 265)} = 4.28$, p=.039), but no interaction between the group and condition ($F_{(2.1, 553.03)} = 1.84$, p = .158), reflecting the higher disgust ratings across all conditions in the ASD group compared with the non-ASD group (see the Figure 2 above).

Although the main effect of sex was not significant ($F_{(1, 265)} = 1.806$, p = .18), there was a significant interaction between sex and condition ($F_{(2.09, 555.3)} = 5.96$, $p = .002$). The presence of a sex-by-condition interaction indicates that while there were no significant differences in the mean scores between whole sample females and males, there were variations in the general pattern of these differences within the two groups (ASD and non-ASD) that crossed over, which is why no significant overall effect of sex was observed. Again, there was no 3-way interaction found (condition by group by sex) ($F_{(2.1, 553.03)} = 1.132$, p = .325), which suggests that males and females within both groups presented similar patterns within all four conditions.

Differences between overall proficiency on the task and further group and sex differences were explored on two computed variables: the difference scores for ES (diff_ES) and CR (diff_CR), as described in the analysis section. A higher difference score means more effective use of the ER strategy. Descriptive statistics are presented in Figure 3 for the whole sample, broken down by group (ASD males, ASD females, non-ASD males, and non-ASD females).

Figure 3. Efficiency difference scores for CR and ES split by sex within ASD and non-ASD groups



Note: Mean scores with standard deviation error bars for the effectiveness of expressive suppression and cognitive reappraisal strategies for regulating emotion of disgust during experimental tasks.

Participants had higher difference scores for CR, which indicates they were more efficient with using that strategy to regulate their feelings of disgust during the task. There was more variety between CR and ES efficacy scores in ASD and non-ASD male groups than in ASD and non-ASD females. Males in both groups used CR more effectively than ES, while the difference between the ER strategies in ASD and non-ASD females was marginal. Therefore, the males' scores accounted for the higher difference scores in CR within the whole sample. Females were more efficient in regulating their emotion of disgust with ES than males within both ASD and non-ASD groups, as they had higher difference scores. In contrast, males were more efficient than females in downregulating their emotion of disgust with CR, which has already been indicated within the previous analyses.

A 2x2x2 repeated measures ANOVA with a within-subjects factor of condition (diff_ES vs diff_CR), and between subject factors of group (ASD vs non-ASD) and sex (males vs females) was conducted to investigate the effect of the condition and analyse if there are sex and group differences between the efficacy of using CR and expressive suppression in the experimental task.

Results showed a significant effect of condition ($F_{(1,265)} = 15.051$, $p < .001$). Therefore, participants were more effective in using CR than ES. There was no effect of group ($F_{(1,265)} = .141$, $p = .708$) and no group-by-condition interaction ($F_{(1,265)} = .039$, $p = .843$), as the pattern for both groups was the same. There was no group-by-sex interaction ($F_{(1,265)} = 3.166$, $p = .076$), thus, males and females had the overall pattern of efficiency of using both ES and CR similar. There was no significant effect of sex ($F_{(1,265)} = .009$, $p = .923$), but there was a significant sex-by-condition interaction ($F_{(1,265)} = 13.83$, $p < .001$); females had similar results for both conditions (see Figure 3) while males had higher difference scores for CR than ES, suggesting that for males, CR was a more efficient strategy than ES in regulating the emotion of disgust.

Independent samples t-tests were run, post hoc, to compare males and females in the ASD and non-ASD groups. Results showed a significant difference between ASD males and females in the efficacy of using ES ($t_{(106)} = -2.233$, $p = .028$), with females being more efficient than males. There was also a significant difference between non-ASD males and females in the efficacy of using CR ($t_{(158)} = 2.849$, $p = .005$), with males being more efficient than females in this group.

4.3.3 The relation between frequency and efficiency of using cognitive reappraisal and expressive suppression

Having examined both the frequency with which ER strategies are used and how efficient those strategies are in downregulating the emotion of disgust, the final step of these analyses was to examine the relationship between the self-reported frequency of using CR and ES and the efficacy of using these two ER strategies within the experimental task. This was important to answer whether the higher frequency of ES and/or CR use meant that participants were more efficient in using these ER strategies.

Bootstrapped, bivariate Pearson's correlations were conducted on the whole sample to assess the association between the frequency with which participants used each ER strategy (using scores on the CR and ES subscales of the ERQ) and the efficacy with which those strategies were implemented (using the difference scores calculated from the experimental paradigm). The results (Table 2) show a strong positive correlation between the efficacy of using CR and expressive suppression during the task. Thus, participants who effectively used CR were also effectively using ES. There was also a significant negative correlation between the frequency of use of ES and its efficacy on the task, which suggests that frequent use of expressive suppression does not increase the effectiveness of using this strategy. No other significant correlations were significant.

Table 2. Pearson correlation coefficients for CR and ES frequency and efficacy within the whole sample

	CR frequency	*ES frequency*	*CR efficacy*	*ES efficacy*
CR frequency		-0.010	0.043	-0.062
ES frequency	-0.010		-0.023	**-.203****
CR efficacy	0.043	-0.023		**.331****
ES efficacy	-0.062	**-.203****	**.331****	

*Note: * p < .05; ** p < .01 level*

Finally, the study aimed to provide a more nuanced understanding of how sex and ASD may affect the use and effectiveness of emotion regulation strategies. Thus, in the next step, the correlations between the frequency and efficacy of using CR and ES were explored for males and females within ASD and non-ASD groups separately, and the results of these are presented in Table 3 (see below).

Table 3. Pearson correlation coefficients for CR and ES frequency and efficacy for males and females within the ASD and non-ASD groups

GROUP		ES frequency	CR frequency	ES efficacy	CR efficacy
ASD females (n=54)	*ES frequency*	1.000	**.272***	-.174	.012
	CR frequency		1.000	-.070	.122
	ES efficacy			1.000	**.438****
	CR efficacy				1.000
ASD males (n=54)	*ES frequency*	1.000	.202	-.106	.131
	CR frequency		1.000	.077	-.007
	ES efficacy			1.000	.010
	CR efficacy				1.000
Non-ASD females (n=78)	*ES frequency*	1.000	.010	-.189	-.131
	CR frequency		1.000	-.132	.049
	ES efficacy			1.000	**.348****
	CR efficacy				1.000
Non-ASD males (n=82)	*ES frequency*	1.000	-.063	**-.324****	-.148
	CR frequency		1.000	-.026	-.018
	ES efficacy			1.000	**.505****
	CR efficacy				1.000

*Note: * p < .05; ** p < .01 level (2-tailed)*

The results of the above analyses showed a significant positive correlation between the efficacy of using ES and CR in all groups, apart from ASD males, suggesting that the association between these two ER strategies is different in this group. Finally, a significant negative correlation between the frequency and efficacy of ES was only found in the non-ASD male group, suggesting that this group drove the effect reported for the whole sample (Table 2).

4.4 Discussion

This chapter explored the self-reported frequency and efficacy of CR and ES use in an experimental task by autistic and typically developing adults. The findings indicate distinct patterns across the groups in both the frequency of use and effectiveness of these strategies, offering valuable insights into their practical applications and underlying mechanisms.

In terms of the frequency of using cognitive reappraisal (CR) and expressive suppression (ES) as hypothesised, it was found that autistic individuals reported using CR less often than the non-ASD group and ES more often than the non-ASD group. This finding aligns with the previous research, suggesting that individuals with ASD rely on use suppression more often than CR (e.g., Jahromi et al.,

2013; Samson et al., 2012; Samson et al., 2015a). The reduced use of CR among autistic individuals may be attributed to the inherent cognitive challenges associated with autism spectrum disorder. Cognitive reappraisal requires flexible thinking and the ability to shift perspectives, which can be particularly demanding for individuals with autism. These cognitive demands might explain why autistic individuals find it more difficult to employ CR as an emotion regulation strategy, leading to its lower reported use.

On the other hand, the increased reliance on ES among autistic individuals is notable. Expressive suppression involves the conscious inhibition of emotional expressions, which might be a more accessible strategy for autistic individuals who often experience heightened emotional reactivity and may struggle with social cues and interactions. By suppressing outward expressions of emotion, autistic individuals might attempt to conform to social norms and manage the immediate social consequences of their emotional responses. However, while this strategy might provide short-term social benefits, it is associated with increased physiological stress and potential long-term negative psychological effects, such as heightened anxiety and depression.

Autistic individuals found pictures presented within the experimental task more disgusting than the non-ASD group across all conditions. Additionally, females had higher disgust ratings than males when the task involved looking at disgusting pictures. This may suggest they experienced a stronger affect when completing the task. The heightened disgust sensitivity observed in autistic individuals could be attributed to the sensory processing differences commonly associated with autism. Autistic individuals often have heightened sensory perceptions, which can amplify their emotional responses to certain stimuli (Green et al., 2013; Wagner et al., 2021). In this context, the images used in the experimental task might have been particularly provocative (i.e. various food types, often mouldy), thus eliciting stronger disgust reactions due to these sensory sensitivities.

Regarding the gender differences in disgust ratings, observed findings align with existing literature suggesting that females generally report stronger emotional reactions to negative stimuli than males (see meta-analysis by Stevens & Hamann, 2012). This heightened sensitivity might be influenced by various factors, including biological, psychological, and social influences that shape emotional processing and expression differently in females and males.

ASD and non-ASD groups were equally effective in downregulating their emotion of disgust during the task. This is particularly interesting since the ASD group reported higher levels of disgust, yet no group effect was found, suggesting the difference scores were the same for both groups. This means that ASD participants within this sample were very efficient at regulating their emotions of disgust during the task. However, this result should be treated with caution, as the individuals who can volunteer for research online may be more able to succeed at this task and not be a representative

group of the ASD population. Those who participate in online studies might possess certain characteristics, such as higher cognitive functioning, better coping strategies, or greater motivation, which enable them to perform well on such tasks. Consequently, these findings might not generalise to all autistic individuals, particularly those who experience more severe symptoms or have less developed emotion regulation skills. In light of these considerations, while the results suggest that autistic individuals in this sample were efficient at regulating their disgust, further research is needed to explore emotion regulation in more naturalistic settings better to understand the variability and generalisability of these findings.

However, as discussed in Chapter 1, some studies report that autistic individuals, especially those without intellectual disability, frequently engage in camouflaging (and/or masking) of their autistic traits (Hull et al., 2017; Lai & Baron-Cohen, 2015; Mandy, 2019; Perry et al., 2022), therefore, it is possible that there is an association between efficient ER and this coping mechanism, as it will be explored later in this thesis.

The significant difference in the effectiveness of using CR between non-ASD males and females is in line with this study's finding regarding the more frequent use of this strategy reported by male participants. More frequent use of cognitive reappraisal within this sample reported by non-ASD males than non-ASD females could be reflected in males using CR more effectively during the task. On the other hand, the less frequent self-reported use of CR among non-ASD females from this sample might be related to observed less effective than males use of this strategy. Additionally, social and cultural expectations in early development may shape emotional expression differently for females, as discussed in Chapter 1, and potentially promote other emotion regulation strategies over CR. This disparity in socialisation and practice might explain why females, despite potentially having the capability to use CR, did not achieve the same level of effectiveness as males in this context.

However, unlike hypothesised within this study, no significant positive correlation was found between the frequency and efficiency of using CR, neither in the ASD males group nor in any other group. This lack of relationship between frequency and efficacy of CR can be caused by the low variety (1-4) of the disgust rating scores within the task, resulting in low variance within the difference scores. Additionally, the effectiveness of CR might be influenced by factors beyond mere frequency of use. For instance, the context in which CR is applied, the individual's cognitive flexibility, and their overall emotional intelligence could play crucial roles in determining how effective CR is in reducing negative emotions. These factors might vary among individuals, contributing to the lack of a straightforward relationship between CR frequency and efficacy.

Interestingly, a negative relationship was found between the frequency and efficacy of using ES in all groups. However, it was significant only in the non-ASD male group. Thus, a linear negative

relationship was found, suggesting that those individuals who reported frequent use of this strategy were less efficient when trying to reduce their emotions of disgust during the experimental task with this strategy. This finding potentially supports previous studies suggesting that ES has a limited ability to downregulate the internal experience of emotion (Gross, 2014; Gross & John, 2003; Li et al., 2017). If ES does not address the underlying emotional experience but rather masks it, it can result in the accumulation of unresolved emotional stress. Over time, this may reduce the strategy's effectiveness, as the underlying emotional arousal remains unaddressed.

However, autistic females were significantly more efficient at using ES than autistic males. Indeed, autistic females' difference scores were the highest of all four groups, showing this group's most effective use of this strategy, especially compared to ASD males. In the ASD males group, ES efficiency scores were the lowest, even though they self-reported using this ER strategy most frequently from all four groups. These findings highlight interesting gender differences within the ASD population concerning the use and effectiveness of ES as an emotion regulation strategy. The higher efficiency of ES among autistic females suggests that they might have developed more effective ways to employ this strategy, possibly due to different socialisation experiences or inherent gender differences in emotional processing and expression. They might be more adept at managing their emotional expressions to conform to social expectations, a skill that could translate into more efficient use of ES in experimental settings. Additionally, the effective use of suppression may at least partially explain why autistic females are often diagnosed later than males, as it may allow them to look unaffected in situations, which would be potentially diagnostic for males. This sex difference in the ASD group is particularly interesting, as it also is in opposition to what is usually reported for neurotypical males and females, that males are engaging in suppressing their emotions more, while females are using suppression less (e.g., Tamres et al., 2002; Zimmermann & Iwanski, 2014). Additionally, it may contribute to higher rates of internalising issues often reported in autistic females due to ES's potential cost on mental health, as discussed in Chapter 1. Therefore, the next chapter will explore how ER relates to internalising issues.

4.5 Strengths and limitations

This study had several noteworthy strengths. For example, a study was done on a large sample that included ASD and non-ASD individuals. By examining individuals with ASD and those without, the study facilitated a comprehensive analysis of potential differences in emotion regulation strategies between these two groups. It enabled comparisons between these groups and offered insights, showing that some sex differences in these analyses contrasted with sex differences in the general population. Including experimental tasks and self-report questionnaires strengthened the study's

methodology by using a multimodal approach to assess emotion regulation and allowed for comparing the frequency and efficacy of both ES and CR.

However, the study also had some limitations, mainly in terms of online data collection. Online studies often attract self-motivated participants with specific characteristics, potentially leading to a non-representative sample. Ensuring that participants provide genuine and thoughtful responses is harder online. The absence of direct supervision could lead to rushed or insincere answers, affecting the reliability of the collected data. Technical problems, such as slow internet connections or device malfunctions, could have affected participants' ability to fully engage with the study tasks. Participants accessed the study tasks on different devices with varying screen sizes, resolutions, and colour representations. This variability could have influenced their perception and interpretation of the tasks and subjective experience of the emotion of disgust. The presence of household noise interruptions during participants' engagement with the study tasks could have introduced unwanted distractions. Noise levels could vary widely among participants, affecting their concentration, task performance, and emotional responses. All these issues might have introduced additional sources of variability in the data. Finally, the emotion regulation task measuring the efficacy of using CR and ES was designed to be used within MEG and MRI scanners. Therefore, the rating scale used was limited to 4 points to match response devices used within both scanners. This lack of variation within the data was suspected to have significantly affected the results.

Chapter 5 - Internalising issues and its relation to ER

This chapter further explores sex differences in the dynamics between autistic traits, internalising problems, particularly anxiety, social anxiety, and depression and broader emotion regulation strategies in autistic and typically developing populations. Anxiety, depression, and social anxiety have variable prevalence rates across different populations. As discussed in Chapter 1, females experience higher rates of these internalising issues (Gotham et al., 2015; Hankin et al., 1998; May et al., 2014; Oswald et al., 2016). Moreover, those rates are even higher within autistic female populations when compared to typically developing girls (Jamison & Schuttler, 2015; Solomon et al., 2012) or autistic and typically developing males (Gotham et al., 2015; Solomon et al., 2012). This Chapter will examine sex and group differences in the frequency of using broader cognitive and behavioural adaptive and maladaptive ER strategies and rates of internalising issues in autistic and non-autistic adults. Finally, associations between internalising issues and emotion regulation will be explored, including the potential for predicting autistic traits and internalising issues from within the selected ER strategies.

5.1 Introduction

5.1.1 Broader ER measures in ASD and the general population – the use of adaptive and maladaptive ER strategies

As discussed in Chapter 1, emotion regulation (ER) is defined as the self-modulation of an individual's emotional state and includes a broad set of cognitive and behavioural processes that can support adaptive and goal-directed behaviour (e.g., Mazefsky et al., 2013). Therefore, the primary evolutionary role of emotions is to facilitate our comprehension of the ever-changing requirements of our surroundings, enabling us to respond adaptively to those demands (Barrett et al.,2007).

Multiple reports show that males and females rely on different emotion regulation strategies when dealing with difficult or stressful situations. For example, females are reported to use a significantly broader range of ER strategies spontaneously (e.g., Goubet & Chrysikou, 2019; Kwon et al., 2013; Nolen-Hoeksema & Jackson, 2001; Nolen-Hoeksema & Aldao, 2011; Tamres et al., 2002). In a recent study, Goubet & Chrysikou, (2019) found that females were more flexible in their emotion regulation choices. They also found that females significantly more often than males used specific ER strategies,

like problem-solving, seeking social support, emotional expression, and self-blame. On the other hand, males, more frequently than females, used suppression and acceptance (Goubet & Chrysikou, 2019). This study indicates that some sex differences may be apparent in the use of both behavioural and cognitive ER strategies, which may explain higher rates of internalising issues in females. While more frequent use of social support (behavioural adaptive ER strategy) might be potentially beneficial for females' well-being, the more frequent use of self-blame (cognitive maladaptive ER strategy) could potentially contribute to the development of internalising issues.

As discussed in previous chapters, the relationship between the two most often investigated ER strategies, cognitive reappraisal and suppression with well-being has been well-researched and has revealed that, in general, cognitive reappraisal is more positively associated with well-being, while suppression of emotions is often positively associated with internalising issues (i.e., Aldao et al., 2010; Gross, 2015; Gross & John, 2003; Martins et al., 2016; Webb et al., 2012). However, these are rarely considered along broader cognitive and behavioural ER strategies.

Autistic individuals often struggle with self-regulation of their emotional states, and atypical emotion regulation (ER), mainly reliance on more maladaptive ER strategies, has been identified in ASD (for review, see Cai et al. 2018a) and linked to higher levels of autistic traits (e.g., Jahromi et a., 2013; Samson et al., 2015a). Most studies to date compared the frequency of ER strategies used between individuals with ASD and typically developing individuals and found that individuals with ASD report and demonstrate less adaptive patterns (for review, see Cai et al. 2018a). For example, as previously discussed, individuals with ASD have been found to use expressive suppression more frequently and have been found to use cognitive reappraisal less often than typically developing individuals (Samson et al., 2012, 2015a). However, Bruggink et al. (2016) found that individuals with ASD do not make less use of cognitive emotion regulation strategies, but they report less use of broader adaptive cognitive emotion regulation strategies (e.g., positive reappraisal). Therefore, this finding highlights the importance of exploring ER beyond the simple usage frequency of particular strategies and considering the particular types (adaptive and maladaptive) of strategies used for ER. This wider perspective may present new insights into how the habitual use of broad ER interplays with internalising issues in autistic and typically developing individuals.

5.1.2 Internalising issues in autistic and typically developing populations

As discussed in Chapter 1, co-occurrent mental health issues are common in ASD (e.g., APA, 2013; Underwood et al., 2019), with social anxiety, depression and general anxiety being the ones most often reported (e.g., APA, 2013; Croen et al., 2015; Lugo-Marin et al., 2019; Underwood et al., 2019).

This pattern is especially noticeable in the group of autistic individuals without ID (Day et al., 2019; Nimmo-Smith et al., 2020). There is substantial evidence indicating that autistic females, particularly those without ID, are less likely to be identified during diagnostic processes than autistic males (Russell et al., 2011; Loomes et al., 2017) and are more often diagnosed with internalising disorders like anxiety or depression (e.g., Crick & Zahn-Waxler, 2003; May et al., 2014) prior to receiving their ASD diagnosis. Additionally, social and communication difficulties, characteristic traits of ASD, have been found to be an important risk factor for developing social anxiety in typically developing young people and those with autism (Pickard et al., 2017). Approximately 50% of individuals with autism present with social anxiety (Bellini, 2004; Maddox & White, 2015; Spain et al., 2016), which is a much higher proportion than the general population, 7-13% (NICE, 2013).

5.1.3 Internalising issues and its relation to emotion regulation

The development of internalising issues, like social anxiety, anxiety and depression, is often linked with ineffective ER and a predisposition to employing ER strategies considered to be maladaptive. The frequent use of maladaptive ER strategies but also a low reliance on or ineffective use of adaptive ER strategies is often found to be a risk factor for developing internalising issues (i.e., Garnefski et al., 2001; Aldao et al., 2010; Berking et al., 2008; Kraaij & Garnefski, 2012). Higher rates of social anxiety have been found in individuals who frequently used maladaptive cognitive ER strategies (maladaptive ways of thinking) and those who frequently used suppression (Dryman & Heimberg, 2018; O'Connor et al., 2014). Social anxiety disorder is often associated with cognitive processing biases like negative interpretation bias and heightened threat sensitivity (for review, see Morrison and Heimberg, 2013). Additionally, Blalock et al. (2016) found that individuals with social anxiety benefited more from reappraising their negative emotions than healthy controls, while in both groups, individuals who frequently used suppression for both negative and positive emotions reported worse emotional experiences in general.

As discussed in Chapter 1, ER strategies can be identified as cognitive and behavioural on the process-oriented model and as adaptive and maladaptive on the outcome-oriented model Gross, 1998). However, researchers less often explore behavioural ER strategies than cognitive ER strategies. Augustine and Hemenover (2009), in their meta-analysis of emotion regulation across a variety of populations, including healthy adults and individuals with psychiatric disorders, found that behavioural strategies were more effective at improving affect ($d_+ = 0.54$) than cognitive strategies ($d_+ = 0.33$). Interestingly, some behavioural ER strategies found to be maladaptive in the general population may have the opposite effect in the ASD population. For example, avoidant ER strategies are considered maladaptive and consistently shown to be positive predictors of anxiety and

depression in the general population (Aldao et al., 2010; Ottenbreit et al., 2014). However, Pouw et al. (2013) found that avoidant coping strategies were negatively associated with depression in young boys with and without autism diagnosis. That correlation was stronger in the ASD boys in comparison with non-ASD boys, where avoidant coping was found to be significantly associated with less depressive symptoms. By contrast, Rieffe et al. (2014), in their study on the predictability of depressive symptoms in autistic and TD children and adolescents, collected data over three time points, each separated by intervals of nine months, and found that in both ASD and non-ASD children and adolescents, an increase in avoidant strategies contributed to fewer depressive symptoms over time. The difference between the results of these studies may be related to the fact that Rieffe et al. (2014) study included both male and female participants. Therefore, the association was significant in the non-ASD group, too.

As previously discussed in Chapter 1, typically developing adolescent boys are the group that shows the lowest increase in anxiety and depression levels compared with childhood. Therefore, the use of avoidant ER strategies may be adaptive for individuals who experience higher levels of these issues (young people with ASD and potentially also typically developing and adolescent females), at least in the short to medium-term use (Cai et al. 2018a). However, more research is needed to determine the potential adaptive or maladaptive long-term effects of these strategies in both ASD and non-ASD groups, as well as establish whether there is a correlation with gender.

5.1.4 Predictors of autistic traits and internalising issues

One possible long-term issue related to the frequent use of maladaptive ER strategies (such as avoidance and rumination) may be social isolation/peer exclusion, which may increase social difficulties in the ASD population and contribute to the higher rates of internalising issues in this group. Therefore, it is important to understand better what factors could help highlight potential vulnerabilities in autistic and neurotypical children to prevent the development of these issues.

Emotion regulation has been considered in predicting internalising issues along with sex/gender. For example, a study by Perchtold et al. (2019) done with 126 typically developing university students (67 females, 59 males) although found no sex differences in participants' ability to use cognitive reappraisal, its more frequent use was associated with fewer depressive symptoms, in typically developing males only, this relationship was not observed in females. This result may suggest that the association between ER and mental health may be different in males and females, highlighting the importance of considering sex differences in the development and implementation of interventions targeting emotional well-being.

Females tend to engage more in rumination and catastrophising (maladaptive cognitive ER strategies) but also significantly more often report using positive refocusing (cognitive adaptive ER strategy) to cope with difficult situations (Garnefski et al., 2004). While frequent use of adaptive cognitive emotion regulation strategies is found to be a protective factor against psychopathology, habitual use of maladaptive ways of thinking has quite the opposite effect. For example, Martin and Dahlen (2005) examined the association between cognitive ER strategies and anxiety, depression, stress, and anger and found that independent of respondent gender, self-blame, rumination, catastrophising and low positive reappraisal were the strongest predictors for these issues. Martins et al. (2016) reported similar results in a more recent study. Higher anxiety levels were predicted by more use of catastrophising, rumination, self-blame, and less refocus on planning, while depression was associated with self-blame and catastrophising.

Poor ER can exacerbate social misunderstandings and communication breakdowns, as discussed in Chapter 1, which in turn may reinforce autistic traits and affect opportunities for further development of adaptive ER skills and may contribute to an increase in internalising issues. Again, all these mechanisms seem to be intertwined in the form of a vicious cycle, with ER being a mechanism that could be potentially used for clinical interventions. Therefore, a better understanding of ER patterns that are associated with autistic traits and internalising issues is crucial for developing targeted interventions that can enhance emotional well-being, reduce co-occurring mental health problems, and improve overall functioning and quality of life.

5.2 Study aims and hypotheses

This study aimed to explore sex and group differences in the frequency of using broader cognitive and behavioural adaptive and maladaptive ER strategies and rates of internalising issues as well as predictors for autistic traits and internalising issues from within these ER strategies.

RQ 1: Are there sex and group differences in the frequency of use of cognitive and behavioural adaptive and maladaptive ER strategies? Hypotheses: 1a) Females would report using maladaptive cognitive ER strategies and adaptive behavioural ER strategies more frequently than males; 1b) Individuals with ASD would report more frequent use of both cognitive and behavioural maladaptive ER strategies than the non-ASD group, while non-ASD individuals will report more frequent use of both cognitive and behavioural adaptive ER strategies than the ASD group.

RQ 2: Are there sex differences in the levels of internalising issues within both ASD and non-ASD groups, and if the levels of internalising issues are higher within the ASD group in comparison to the non-ASD group? Hypotheses: 2a) Males in both groups would report lower rates of anxiety and depression than females; 2b) The rates of both anxiety and depression were expected to be higher in the ASD group compared to the non-ASD group.

RQ 3: Are internalising issues related to the frequency of use of cognitive and behavioural adaptive and maladaptive ER (including the two specific ER strategies discussed in Chapter 4 – cognitive reappraisal and expressive suppression)? Hypotheses: 3a) Frequent use of adaptive cognitive and behavioural ER strategies would negatively correlate with internalising issues. In contrast, frequent use of maladaptive ER strategies would positively correlate with internalising issues; 3b) The frequent use of ES would positively correlate with internalising issues across the entire sample.

RQ4: Are sex and ER significant predictors of autistic traits and internalising issues? Are the same predictors significant in non-ASD and ASD populations? Hypotheses: 4a) Sex was expected to be a significant predictor of internalising issues of anxiety, depression, and social anxiety, but not autistic traits on its own, due to limitations of the screening measure discussed in Chapter 1; 4b) It was hypothesised that introducing ER to the models would improve models significantly relative to sex on its own and may change the importance of sex in the autistic traits models. CR was expected to be negatively associated with the dependent variables, indicating that individuals who use it more frequently likely have lower levels of autistic traits, anxiety, depression, and social anxiety. In contrast, ES was expected to be positively associated with all four dependent variables, indicating that individuals who tend to suppress their emotions more frequently would likely have higher internalising symptoms or autistic traits; 4c and d) The Introduction of broader cognitive (in step 3) and behavioural (in step 4) adaptive and maladaptive subscales was expected to change the variance explained in the model significantly. Again, it was hypothesised that the adaptive cognitive and behavioural subscales from CERQ and BERQ would have a significant negative association with the dependent variables. In contrast, the cognitive and behavioural maladaptive subscales would significantly positively predict the dependent variables.

5.3 Methods

5.3.1 Participants

Sample 2 participants were included in this chapter's analyses. The total sample count was 268 individuals ASD 108 (54 males; 54 females), non-ASD 160 (82 males, 78 females), as described in Chapter 2.

5.3.2 Ethical approval

The Aston University School of Health and Life Sciences Research Ethics Committee gave this study a favourable ethical opinion.

5.3.3 Measures

The Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al. (2001)

The CERQ consists of 36 items measuring nine 4-item dimensions, five of which are adaptive and four maladaptive. The adaptive strategies measured are: acceptance (e.g., 'I think that I have to accept the situation'), positive refocusing (e.g., 'I think of something nice instead of what has happened), refocus on planning (e.g., 'I think about how to change the situation'), positive reappraisal (e.g. 'I think that the situation also has its positive sides'), and putting into perspective (e.g., 'I tell myself that there are worse things in life'). The maladaptive strategies measured are self-blame (e.g., 'I feel that I am the one to blame for it'), blaming others (e.g., 'I feel that others are responsible for what has happened'), rumination (e.g., 'I often think about how I feel about what I have experienced), and catastrophising (e.g., 'I keep thinking about how terrible it is what I have experienced'). Participants were asked to rate from 1 (almost never) to 5 (almost always) how often they behave in a way described by each item in situations when they feel unhappy or stressed. Higher subscale scores indicate greater use of a specific cognitive strategy. All subscales have demonstrated good internal consistencies (Garnefski et al., 2002), and Cronbach's α values ranged from 0.72 (acceptance) to 0.85 (self-blame). The computed subscales of adaptive (20 items) and maladaptive (16 items) cognitive ER strategies within this study sample have shown good reliability with Cronbach's Alpha values of $\alpha = .85$ and $\alpha = .80$, respectively.

The Behavioural Emotion Regulation Questionnaire (BERQ - Kraaij & Garnefski, 2019)

The BERQ consists of 20 items measuring five dimensions/strategies, three of which are adaptive and two maladaptive. Each dimension consists of 4 items. Adaptive strategies are: seeking distraction (e.g., 'I engage in other, unrelated activities'), actively approaching (e.g., 'I try to do something about it'), and seeking social support (e.g., 'I ask someone for advice'). Maladaptive are: ignoring (e.g., 'I behave as if nothing is going on') and withdrawal (e.g., 'I avoid other people'). Respondents rate on a 5-point Likert scale (from 1 (almost never) to 5 (almost always)) how often they behave as described when confronted with negative or unpleasant events. Higher total subscale scores indicate greater use of a specific cognitive strategy. The BERQ is a relatively new questionnaire, but its Cronbach's α values were high, ranging from 0.86 (seeking distraction) to 0.93 (withdrawal) (Kraaij & Garnefski, 2019). Again, within this study sample, the combined adaptive behavioural ER scales (12 items) and maladaptive scales (8 items) had shown a good reliability Cronbach's Alpha value of α = .79 and α = .84, respectively.

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

This brief measure was used to collect data about significant levels of anxiety and depression. The HADS is a 14-item, self-report measure, with seven items on each scale: anxiety (e.g., "I get a sort of frightened feeling like 'butterflies' in the stomach" and depression (e.g., "I can laugh and see the funny side of things"). Participants specify how often they experienced these feelings within the past week on a 4-point Likert-like scale (0-3), thus can score up to 21 points on each scale. The HADS anxiety and depression subscales consisted of 7 items each, and for this study, the values of Cronbach's Alpha were α = .85 and α = .84, respectively.

The Brief Fear of Negative Evaluation Scale (BFNES; Leary et al., 1983)

The BNFES is a 12-item self-report measure that assesses fear of negative evaluation, a characteristic feature of social anxiety. This measure uses a 5-point Likert-type rating scale, ranging from 1 (not at all characteristic of me) to 5 (extremely characteristic of me). The statements are designed to capture the extent to which individuals are worried about being evaluated negatively by others and how much they try to avoid such situations (e.g., "I am afraid that people will find fault with me"). The BFNES is a brief, reliable, and valid measure of fear of negative evaluation that can provide valuable information about an individual's social anxiety and related symptoms. The Cronbach's Alpha for the BNFES survey (12 items) in this study sample was α = .93.

The Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001)

The AQ is a 50-item questionnaire that measures traits associated with ASD. Please see Chapter 2 for details.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003)

This 10-item self-report measure was used to collect data on cognitive reappraisal (CR) and expressive suppression (ES). Please see Chapter 4 for details.

5.3.4 Analyses

Total scores for adaptive and maladaptive cognitive and behavioural subscales of both CERQ (Garnefski et al., 2001) and BERQ (Kraaij & Garnefski, 2019) questionnaires were computed for each participant.

4 x 2 x 2 Repeated measures ANOVA was used to explore subscale (CERQ: adaptive vs maladaptive, BERQ: adaptive vs maladaptive), group, and sex effects, as well as their interactions. Post hoc independent sample t-tests were run to explore significant effects.

To investigate the differences in self-reported internalising issues measures (BFNES and HADS), a bootstrapped multivariate analysis of variance (MANOVA) was conducted to examine the effects of group (ASD vs. non-ASD) and sex (males vs. females). This was followed by tests to explore any between-subject effects found (t-test or Mann-Whitney, depending on data distribution).

Bivariate, bootstrapped Pearson correlations were used to assess the relationship between ER and internalising issues within the whole sample and when split by group and sex.

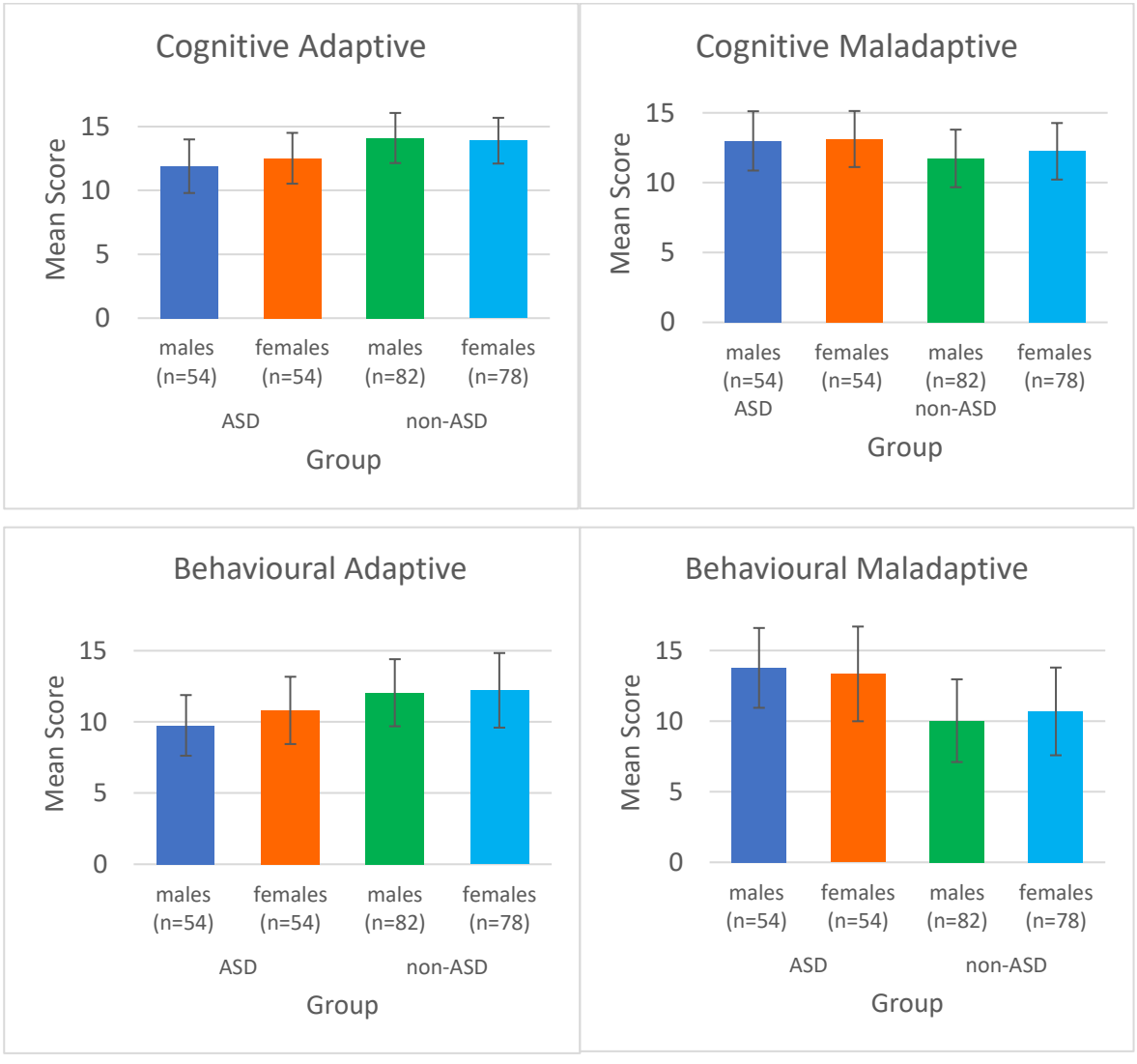
The analyses were concluded with eight hierarchical regressions to explore sex and emotion regulation as potential predictors for autistic traits and internalising issues with ASD and non-ASD groups separately.

5.4 Results

5.4.1 Frequency of use of cognitive and behavioural adaptive and maladaptive ER strategies

The distribution of data was assessed and confirmed through Q-Q plots, skewness, and kurtosis, as described in the analysis methods section of Chapter 2. The normality of data distribution was considered satisfied for all questionnaires analysed in this chapter. The means of total scores for CERQ and BERQ adaptive and maladaptive subscales split by group and sex are presented in Figure 1.

Figure 1. Interactions between group and sex for means of total scores for all four subscales (CERQ adaptive and maladaptive and BERQ adaptive and maladaptive)



A 4x2x2 Repeated measures ANOVA with a within-subjects factor of condition (4 subscales: cognitive adaptive, cognitive maladaptive, behavioural adaptive and behavioural maladaptive), and between subject factors of group (ASD vs non-ASD) and sex (males vs females) was conducted. Mauchly's test indicated that the assumption of sphericity had been violated ($\chi^2_{(5)} = 141.5$, $p < .001$); consequently, Greenhouse-Geisser statistics are reported in Table 1.

Table 1. Repeated Measures Analysis of Variance Results

	Effects	*SS*	*df*	*F*	*p*	*η2*
Between subjects						
	Sex	25.44	1	**4.800**	**.029**	**.018**
	Group	6.19	1	1.167	.281	.004
	Sex * Group	.27	1	.051	.821	.000
	Error	1399.055	264			
Within subjects						
	Subscale	507.097	2.177	**28.557**	**.000**	**.098**
	Subscale * Sex	9.053	2.177	.510	.616	.002
	Subscale * Group	1154.540	2.177	**65.018**	**.000**	**.198**
	Subscale * Sex * Group	44.695	2.177	2.517	.077	.009
	Error	4687.920	574.839			

Note: SS indicates the sum of squares, df indicates degrees of freedom, F and p-values with Greenhouse-Geisser correction, η2 indicates eta-squared,

There was a significant effect of subscale, and the effect of sex was significant, but there was no significant sex-by-subscale interaction.

The effect of group was not significant, but there was a significant effect of sex and significant interaction between subscale and the group, as seen in Figure 1. Therefore, independent sample t-tests were run to explore these effects.

There were no sex differences found within the four subscales in either ASD or non-ASD groups, except for behavioural adaptive ER strategies in the ASD group, where females reported significantly more frequent use of these strategies ($t_{(106)} = -2.44$, $p = 0.16$).

Comparison of both ASD and non-ASD groups on each of the subscales showed significant results for all four variables: (cognitive adaptive $t_{(266)} = -7.384$, $p < .001$; cognitive maladaptive $t_{(266)} = 4.195$, $p <$

.001; behavioural adaptive $t_{(266)}$ = -6.162, p < .001; behavioural maladaptive $t_{(266)}$ = 8.430, p < .001). The directions of these differences were as hypothesised with ASD reporting more frequent use of maladaptive ER strategies and less frequent use of adaptive ER strategies than the non-ASD group (See Figure 1).

These results align with previous research findings and our hypothesis that individuals with ASD rely more on maladaptive than adaptive ER strategies when downregulating their emotions. There was no 3-way interaction found (condition by group by sex), which suggests that males and females within both groups presented with similar patterns for all four subscales, which is in line with what has been observed within Figure 1.

5.4.2 Internalising issues

As noted earlier, individuals with ASD are more likely to rely on maladaptive emotion regulation strategies, which may contribute to their increased risk of developing internalising issues, including anxiety, social anxiety, and depression. The present findings regarding using cognitive and behavioural ER strategies in individuals with ASD and the non-ASD group have important implications for our understanding of the relationship between emotion regulation and internalising issues in different populations.

Following these results, further analyses will investigate sex and group differences within this sample in internalising issues rates and their relation to emotion regulation. Specifically, it was explored whether there the differences in the use of cognitive and behavioural adaptive and maladaptive strategies between males and females in the ASD and non-ASD groups, related to the reported internalising issues symptoms.

Figure 2. Means of social anxiety split by group and sex

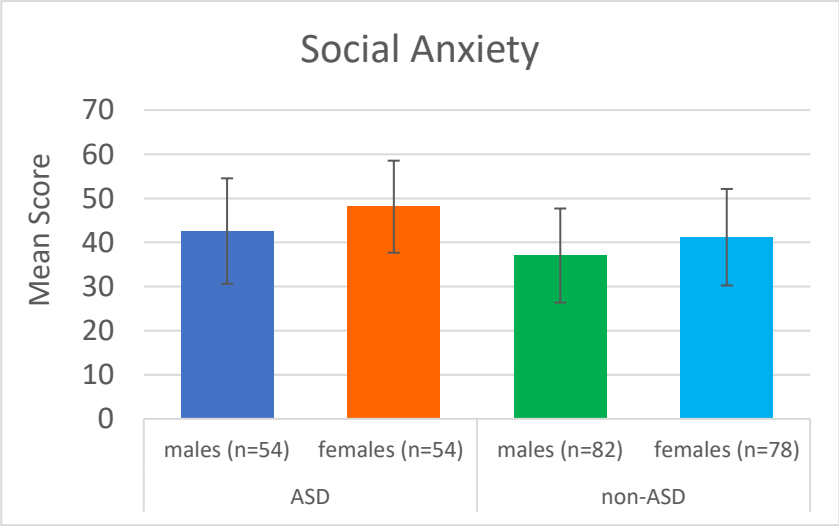


Figure 3. Means of anxiety split by group and sex

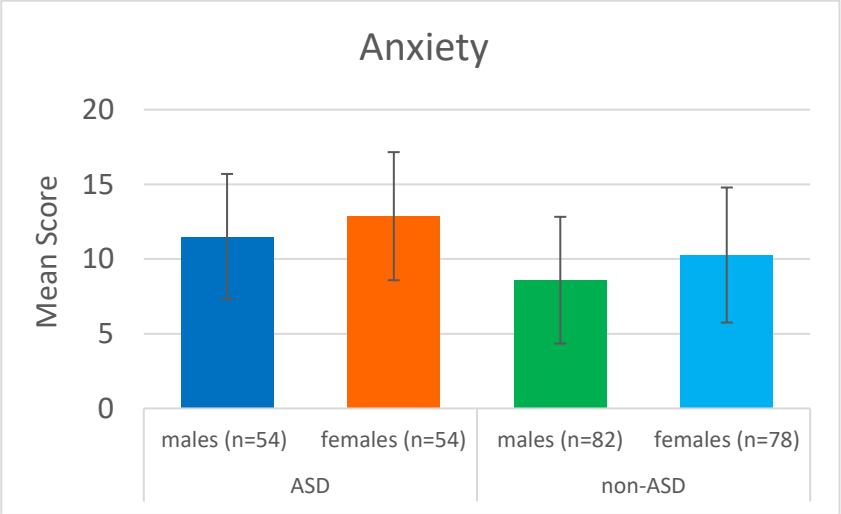
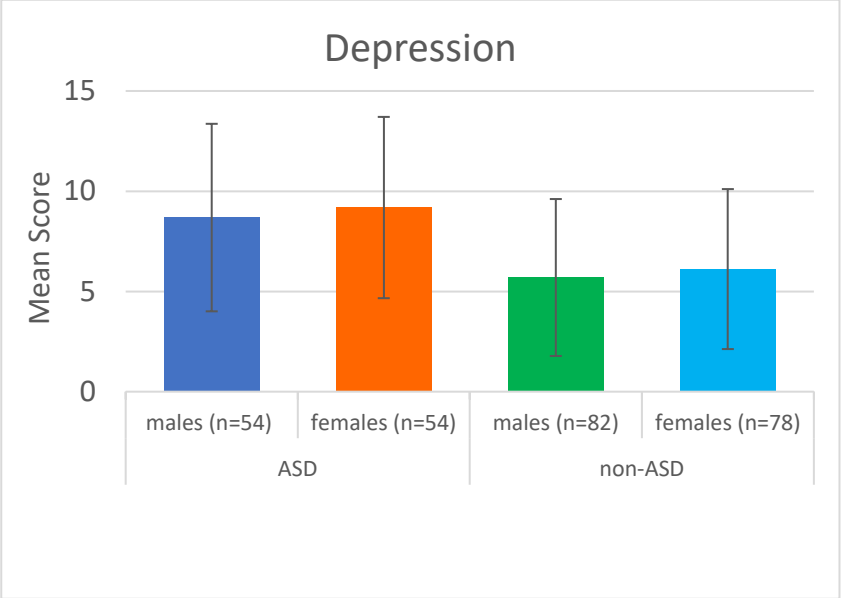


Figure 4. Means of depression split by group and sex



A 2x2x3 (group (ASD vs. non-ASD) x sex (males vs. females) x 3 measures) multivariate analysis of variance (MANOVA) with bootstrapping was conducted to examine sex and group differences in the self-reported level for anxiety, depression, and social anxiety within the whole sample. Pearson correlations were performed between the dependent variables to test the required correlation assumption for this test. All three variables (anxiety, social anxiety, and depression) were found to be highly correlated ($p < .001$), and no multicollinearity was found (all coefficients < 0.6). There were significant main effects of group ($F_{(1, 265)} = 15.285$, $p < .001$) and sex ($F_{(1, 265)} = 5.114$, $p= .002$) but no group-by-sex interaction ($F_{(1, 265)} = .209$, $p = .89$) was found. Indeed, it can be seen in Figures 2,3 & 4, that patterns for scores for males and females are the same within both groups across all three dependent variables. The univariate comparisons revealed significant differences between males and females in social anxiety and anxiety only, but not depression. In contrast, group differences were

found within all three dependent variables (Table 2). Males and females within both groups presented similar patterns of mean scores within all three dependent variables, as seen in Figures 2-4. Thus, the group-by-sex interaction effect was not significant. Results for all between-subjects effects for each variable are presented in Table 2.

Independent sample t-tests were run to check sex differences within all three variables in both groups separately. In the ASD group, females had higher than males scores in social anxiety only ($t_{(106)}$ = -2.56, p = .012), while there was no sex difference in the anxiety and depression scores (p > .05). In the non-ASD group females had higher scores than males in both anxiety and social anxiety ($t_{(158)}$ = -2.431, p = .030; $t_{(158)}$ = -2.433, p = .019) respectively, while there was no sex differences found in depression (p > .05).

Table 2. Internalising Issues MANOVA between-subjects effects

Variable	***Effect***	***SS***	***df***	***F***	***p***	***η2***
Social anxiety	Sex	1508.055	1	**12.537**	**.000**	**.045**
Anxiety		150.330	1	**8.036**	**.005**	**.030**
Depression		13.648	1	.765	.383	.003
Social anxiety	Group	2503.053	1	**20.808**	**.000**	**.073**
Anxiety		490.289	1	**26.208**	**.000**	**.090**
Depression		591.787	1	**33.162**	**.000**	**.112**
Social anxiety	Sex * Group	29.957	1	.249	.618	.001
Anxiety		1.584	1	.085	.771	.000
Depression		.102	1	.006	.940	.000

5.4.3 Relationship between internalising issues and emotion regulation

To address the third research question, bootstrapped, bivariate Pearson correlations were conducted on the whole sample to assess the association between internalising issues and emotion regulation measures (ERQ, CERQ, BERQ). The results of Pearson coefficients are shown in Table 3.

Table 3. Correlation Matrix for internalising issues and emotion regulation for the whole sample (n=268)

	SA	A	D	CR	ES	CA	CM	BA	BM
Social Anxiety (SA)	1.000								
Anxiety (A)	**.476****	1.000							
Depression (D)	**.287****	**.598****	1.000						
Cognitive Reappraisal (CR)	**-.217****	**-.207****	**-.303****	1.000					
Expressive Suppression (ES)	.098	**.211****	**.267****	-.010	1.000				
Cognitive Adaptive (CA)	**-.170****	**-.279****	**-.476****	**.537****	**-.128***	1.000			
Cognitive Maladaptive (CM)	**.366****	**.524****	**.415****	**-.150***	**.142***	**-.205****	1.000		
Behavioural Adaptive (BA)	-.117	**-.203****	**-.433****	**.353****	**-.395****	**.457****	**-.161****	1.000	
Behavioural Maladaptive (BM)	**.309****	**.414****	**.446****	**-.271****	**.493****	**-.301****	**.332****	**-.444****	1.000

Note: **. Correlation is significant at the 0.01 level; *. Correlation is significant at the 0.05 level;

The results show that all three internalising issues variables were strongly negatively correlated with cognitive reappraisal (as measured by ERQ), suggesting that less frequent use of this strategy is associated with higher rates of internalising issues, which is in line with previous research. Anxiety and depression were also strongly positively correlated with frequent use of expressive suppression (as measured by ERQ), suggesting that frequent use of this ER strategy is associated with higher rates of internalising issues, which is also in line with previous research.

There was a negative correlation between the joined subscale of cognitive adaptive ER strategies and a positive correlation between cognitive and behavioural maladaptive ER strategies and all three internalising issues measures. Adaptive behavioural ER strategies were negatively correlated with anxiety and depression but not social anxiety. Overall, these results align with previous research, highlighting the importance of adaptive ER strategies in reducing internalising issues and symptoms.

In the next step, correlations between the internalising issues measures and emotion regulation measures were explored for males and females within ASD and non-ASD groups, to allow for investigation of sex differences. The results are presented in Table 4 below.

Table 4. Correlation Matrix for internalising issues and emotion regulation for males and females within ASD and non-ASD groups

ASD		**SA**	**A**	**D**	**CR**	**ES**	**CA**	**CM**	**BA**	**BM**
FEMALES	***Social Anxiety (SA)***	1.0								
	Anxiety (A)	**.275***	1.0							
	Depression (D)	.205	**.611****	1.0						
	Cognitive Reappraisal (CR)	-.056	.100	-.133	1.0					
	Expressive Suppression (ES)	-.033	-.049	-.038	**.272***	1.0				
	Cognitive Adaptive (CA)	-.161	**-.372****	**-.466****	**.442****	.234	1.0			
	Cognitive Maladaptive (CM)	**.294***	**.341***	**.333***	-.034	-.157	-.199	1.0		
	Behavioural Adaptive (BA)	-.048	-.089	**-.397****	**.371****	-.224	**.436****	-.139	1.0	
	Behavioural Maladaptive (BM)	.195	.214	.169	-.170	**.417****	-.174	.050	**-.431****	1.0
ASD		**SA**	**A**	**D**	**CR**	**ES**	**CA**	**CM**	**BA**	**BM**
MALES	***Social Anxiety (SA)***	1.0								
	Anxiety (A)	**.304***	1.0							
	Depression (D)	.068	**.380****	1.0						
	Cognitive Reappraisal (CR)	-.014	.033	-.149	1.0					
	Expressive Suppression (ES)	.096	**.337***	**.346***	.202	1.0				
	Cognitive Adaptive (CA)	.186	-.199	**-.497****	**.433****	-.073	1.0			
	Cognitive Maladaptive (CM)	-.008	.201	.245	-.004	.142	-.208	1.0		
	Behavioural Adaptive (BA)	-.003	**-.352****	**-.597****	.232	**-.384****	**.308***	-.185	1.0	
	Behavioural Maladaptive (BM)	**.347***	.255	.207	.025	**.490****	.070	.179	**-.269***	1.0

NON-ASD		SA	A	D	CR	ES	CA	CM	BA	BM
FEMALES	***Social Anxiety (SA)***	1.0								
	Anxiety (A)	**.498****	1.0							
	Depression (D)	.194	**.637****	1.0						
	Cognitive Reappraisal (CR)	**-.243***	-.199	**-.228***	1.0					
	Expressive Suppression (ES)	.062	.164	.149	.010	1.0				
	Cognitive Adaptive (CA)	-.108	-.110	**-.360****	**.384****	-.053	1.0			
	Cognitive Maladaptive (CM)	**.325****	**.579****	**.503****	-.200	**.272***	-.200	1.0		
	Behavioural Adaptive (BA)	-.091	**-.225***	**-.259***	**.271***	**-.314****	**.340****	**-.225***	1.0	
	Behavioural Maladaptive (BM)	.123	**.388****	**.562****	-.210	**.384****	**-.249***	**.403****	**-.507****	1.0
NON-ASD		**SA**	**A**	**D**	**CR**	**ES**	**CA**	**CM**	**BA**	**BM**
MALES	***Social Anxiety (SA)***	1.0								
	Anxiety (A)	.484**	1.0							
	Depression (D)	**.363****	**.569****	1.0						
	Cognitive Reappraisal (CR)	-.111	**-.232***	**-.278***	1.0					
	Expressive Suppression (ES)	.101	**.229***	**.344****	-.063	1.0				
	Cognitive Adaptive (CA)	-.213	-.129	**-.303****	**.590****	-.091	1.0			
	Cognitive Maladaptive (CM)	**.553****	**.658****	**.346****	.056	.044	.078	1.0		
	Behavioural Adaptive (BA)	-.047	.076	**-.315****	.212	**-.350****	**.366****	.149	1.0	
	Behavioural Maladaptive (BM)	**.251***	**.388****	**.401****	-.064	**.489****	-.128	**.285****	-.127	1.0

*Note: ** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level*

In the ASD group, social anxiety was positively correlated with cognitive maladaptive ER strategies in females, while in males, it was positively correlated with behavioural maladaptive ER strategies only. As expected, anxiety was negatively correlated with cognitive adaptive and positively correlated with

cognitive maladaptive ER strategies in ASD females, although interestingly, no significant correlations were observed for the ERQ. The pattern was different in ASD males, however, no significant correlations were observed for cognitive ER strategies, but the anxiety was positively correlated with ES and negatively correlated with behavioural adaptive ER strategies. Depression was negatively correlated with cognitive and behavioural adaptive ER strategies in both ASD males and females, while in ASD females, it was also positively correlated with cognitive maladaptive ER strategies.

In the non-ASD group, the correlation patterns were more like the whole sample pattern. Social anxiety was negatively correlated with CR and positively correlated with cognitive maladaptive ER strategies in females. In contrast, it positively correlated with cognitive and behavioural maladaptive ER strategies in males. Anxiety was positively correlated with both cognitive and behavioural maladaptive ER strategies in males and females. At the same time, it was also negatively correlated with behavioural adaptive ER strategies in non-ASD females only. Finally, depression was negatively correlated with CR and broader cognitive and behavioural adaptive ER strategies and positively correlated with both cognitive and behavioural maladaptive ER strategies in males and females. Additionally, in non-ASD males, depression was also positively correlated with ES.

These findings indicate that understanding the role of emotion regulation strategies is crucial when investigating the association between internalising issues and emotional functioning, especially in individuals with ASD. The correlations observed in this study highlight the potential significance of group differences in emotion regulation for individuals with ASD. Additionally, these correlations show different patterns of associations in ASD vs. non-ASD (and males vs. females). Therefore, the next Section will explore predictors of autistic traits and internalising issues specifically related to emotion regulation within ASD and non-ASD separately, including sex as a factor.

5.4.4 Predictors of autistic traits and internalising issues – hierarchical regressions

The next part of this chapter explored the possible factors contributing to the manifestation of autistic traits and internalising issues. To this end, eight hierarchical regression analyses were conducted to investigate whether certain emotion regulation strategies, such as frequency and efficacy (as described in Chapter 4) of using cognitive reappraisal and expressive suppression, as well as the broad cognitive and behavioural adaptive and maladaptive strategies, could predict autistic traits and internalising issues including anxiety, depression, and social anxiety.

As the factors that may affect the manifestation of these traits and internalising issues can vary between clinical and non-clinical groups, separate analyses for the ASD and non-ASD groups were performed. Sex was included as a primary independent variable, entered separately and independently in the first step of each analysis, allowing for a direct comparison between the ASD and non-ASD groups.

Before conducting regression models, the assumptions were checked and confirmed. Multicollinearity was checked and found to be within acceptable range, all correlations were significantly lower than the 0.7 suggested as the threshold by Tabachnick and Fidell (2014). The highest correlations were between AQ total mean scores and BERQ maladaptive variable ($r = .53$, $p < .001$), Anxiety mean scores and CERQ maladaptive ($r = .51$, $p < .001$), BERQ maladaptive and ERQ ES scores ($r = .49$, $p < .001$) and between CERQ adaptive scores and ERQ CR scores ($r = .52$, $p < .001$). Efficacy difference scores for the CR (diff_CR) and ES (diff_ES) (see Chapter 4) were rarely correlated with other variables and, thus, were not included as predictors within those analyses. For each of the models conducted, Cook's distance values were all below 1, as Cook (1977) recommended, confirming that there were no influential outliers in the samples. Additionally, Durbin-Watson test statistics were checked to test for correlations between errors and all values were found to be between 1 and 3, meaning that the residuals were uncorrelated (Durbin and Watson, 1951).

5.4.4.1 Predictors of autistic traits in the ASD group

The first model examined predictors of autistic traits (see Table 5 for the entire model) in the ASD group. The level of autistic traits was dependent, and sex was entered in step 1 as an independent variable. In the first step of the analysis for the ASD group, the model did not reach statistical significance ($F_{(1,106)} = .155$; $p > .05$) and accounted for only 0.01% of the variance in autistic traits. After the inclusion of the ERQ subscales in step 2, the model was significantly improved ($F change_{(2,104)} = 3.807$, $p = .025$), accounting for an additional 6.8% (R^2 Change) of the variance. Cognitive reappraisal was a significant negative predictor for autistic traits ($t = -2.597$, $p = .01$, $\beta = -.253$) when controlling for sex and expressive suppression. No other variables were significant in this step.

The introduction of cognitive adaptive and maladaptive variables into the model in step 3 explained a further 5.4% of the variance and the model significantly improved ($F change_{(2, 102)} = 3.16$, $p = .047$). When controlling for all other variables, only the use of adaptive cognitive emotion regulation strategies was significantly associated with autistic traits ($t = -2.86$, $p = .031$, $\beta = -.233$), with the CR scale of the ERQ no longer reaching significance.

In the final step, adaptive and maladaptive behavioural scales were included, explaining only an additional 1.8% of the variance. The change was not significant, however, the model remained significant ($F change_{(2, 100)} = 1.071$, $p = .347$). Neither behavioural scale significantly predicted autistic traits when all other variables were controlled, although the CERQ adaptive variable remained significant ($t = -2.095$, $p = .039$, $\beta = -.233$). To summarise, sex is not a good predictor for autistic traits in the ASD population, while emotion regulation accounts for 14% of the variance. The cognitive adaptive ER strategies were the strongest negative predictor from within the variables tested by this model. Moreover, the frequency of using cognitive reappraisal (as measured by the ERQ questionnaire) was a significant negative predictor until broader adaptive cognitive ER measures were included in the model. While behavioural ER measures were not significant in predicting autistic traits at all.

5.4.4.2 Predictors of autistic traits in the non-ASD group

The second model examined predictors of autistic traits (see Table 5 for the full model) in the non-ASD group. Again, AQ total was the dependent variable, and sex was entered in step 1 as an independent variable. The model did not reach statistical significance in the first step ($F_{(1,158)} = .021$; $p > .05$), and sex accounted for 0% of the variance in autistic traits in the non-ASD group.

After the inclusion of the ERQ subscales in step 2 the model became significant ($F change_{(2,156)} = 4.93$, $p = .008$), accounting for an additional 5.9% (R^2 change) of the variance. In contrast to the ASD group, expressive suppression, rather than cognitive reappraisal, was a significant positive predictor of autistic traits ($t = 2.931$, $p = .004$, $\beta = .231$) when controlling for sex and cognitive reappraisal. No other variables were significant in this step. Introducing cognitive adaptive and maladaptive variables into the model explained 5% of the variance and significantly improved the model ($F change_{(2,154)} = 4.33$, $p = .015$). When all other variables were controlled for the expressive suppression remained a significant, positive predictor of autistic traits ($t = 2.445$, $p = .016$, $\beta = .192$), along with cognitive maladaptive ER strategies ($t = 2.346$, $p = .02$, $\beta = .183$). In the final step, adaptive and maladaptive behavioural scales were included again, resulting in an additional explanation of 4.1% of the variance, giving a total of 15.1% of the variance in autistic traits explained by emotion regulation strategies in the non-ASD group. Unlike the ASD group, including behaviour strategies significantly improved the model ($F change_{(2, 152)} = 3.66$, $p = .028$). Moreover, when all other variables were controlled for, the only predictor that remained significant for autistic traits was the BERQ maladaptive variable ($t = 2.548$, $p = .012$, $\beta = .231$).

To summarise, sex is not a good predictor for autistic traits in the non-ASD population, while emotion regulation accounts for 15.1% of the variance. Moreover, the frequency of using expressive suppression (measured by the ERQ questionnaire) was a significant predictor even when broader maladaptive cognitive ER measures were included in the model. While behavioural ER measures were not significant in predicting autistic traits in the ASD group, for the non-ASD population, the high frequency of using behavioural maladaptive emotion regulation strategies was the strongest predictor from within the variables tested by this model.

Table 5. Hierarchical regression model for predictors of autistic traits in the ASD and non-ASD group

Autistic Traits	**ASD (N=108)**					**Non-ASD (N=160)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.001					.000				
Sex			-.352	.895	-.038			.131	.912	.011
Step 2	**.070**	**.068**				**.060**	**.059**			
Sex			-.297	-.032	-.032			.456	.910	.040
ERQ CR			**-.150**	**.058**	**-.253**			-.078	.073	-.084
ERQ ES			.126	.083	.149			**.259**	**.088**	**.231**
Step 3	**.124**	**.054**				**.110**	**.050**			
Sex			.068	.886	.007			.144	.900	.013
ERQ CR			-.089	.063	-.150			.004	.081	.004
ERQ ES			.121	.082	.143			**.215**	**.088**	**.192**
CERQ adaptive			**-.525**	**.240**	**-.233**			-.472	.266	-.154
CERQ			.157	214	.070			**.512**	**.218**	**.183**
Step 5	.142	.018				**.151**	**.041**			
Sex			.087	.900	.009			-.183	.895	-.016
ERQ CR			-.071	.066	-.119			.020	.080	.022
ERQ ES			.053	.097	.063			.103	.097	.092
CERQ adaptive			**-.523**	**.250**	**-.233**			-.358	.272	-.117
CERQ			.117	216	.052			.340	.226	.121
BERQ adaptive			-.015	.235	-.007			-.086	.200	-.037
BERQ			.232	.163	.155			**.438**	**.172**	**.231**

5.4.4.3 Predictors of social anxiety in the ASD group

The next model investigated potential factors associated with social anxiety in the ASD group using the same, variables of interest (see Table 6 for the complete model details). Social anxiety was the dependent variable, with sex as an independent variable in the first step. Analysis done for the ASD group showed the first step was significant ($F_{(1,106)} = 6.534$; $p = .012$), with sex being a significant predictor for social anxiety ($p = .012$), accounting for 5.8% of the variance. The inclusion of the ERQ subscales in step 2 did not significantly improve the model ($F\textit{change}_{(2,104)} = .153$, $p = .858$), accounting for only 0.3% (R^2 change) additional variance. No variables were significant at this step except for sex, which remained significant ($p = .012$). Introducing cognitive adaptive and maladaptive variables into the model again did not improve its significance ($F\textit{change}_{(2, 102)} = 1.180$, $p = .312$) and explained only a further 2.1% of the variance. Again, no variables except for sex ($p = .024$) were significant.

Including adaptive and maladaptive behavioural scales in the fourth and final step significantly improved the model ($F\textit{change}_{(2, 100)} = 4.020$, $p = .021$), explaining an additional 6.8% of the variance. Sex remained a significant factor ($p = .028$) along with behavioural maladaptive ER strategies ($t = 2.835$, $p = .006$, $\beta = .308$), a positive predictor of social anxiety in the ASD group. In summary, the regression analysis revealed that being female (sex) strongly predicts social anxiety in the ASD group. The only other variable that significantly predicted social anxiety in this group was the use of behavioural maladaptive ER strategies.

5.4.4.4 Predictors of social anxiety in the non-ASD group

The next analysis was done for the non-ASD group for social anxiety as an independent variable (see Table 6 for the full model). As previously, in the first step of the model, sex was introduced as the sole dependent variable. This initial model was significant ($F_{(1,158)} = 5.921$; $p = .016$). Thus, being female (sex) was a significant predictor for social anxiety in the non-ASD group and explained 3.6% of the variance in the independent variable. In step 2, after the ERQ subscales inclusion, the model change was significant ($F\textit{change}_{(2,156)} = 3.167$, $p = .045$), accounting for an additional 3.8% of the variance. Sex remained significant ($p = .023$), along with cognitive reappraisal ($t = -2.301$, $p = .023$, $\beta = -.179$), which was found to be a negative predictor for social anxiety. The introduction of cognitive adaptive and maladaptive variables in step three explained a further 17.7% of the variance and improved the model significantly ($F\textit{change}_{(2, 154)} = 18.217$, $p < .001$).

After controlling for all other variables, cognitive maladaptive ER strategies were found to be a positive significant predictor of social anxiety ($t = 5.925$, $p < .001$, $\beta = .423$); unlike in the ASD group, sex was no longer significant when the cognitive ER strategies were included in the model. Both adaptive and maladaptive behavioural scales were included in the final step, however, no additional

variance was explained ($F change_{(2,152)}$ = .013, p = .987), giving a total of 25.1% of the variance in social anxiety explained by sex and ER strategies in the non-ASD group. After controlling for sex and the frequency of employing cognitive reappraisal and expressive suppression, the non-ASD group's analysis revealed that the only significant predictor for social anxiety was the cognitive maladaptive ER strategies (t = 5.549, p < .001, β = .420).

To summarise, in the non-ASD group, only cognitive maladaptive ER strategies were a significant predictor. Additionally, cognitive reappraisal was found to be a negative predictor for social anxiety in the non-ASD group, whereas no such predictor was identified in the ASD group. In both groups, sex was a significant predictor for social anxiety in the initial step of the regression models. In the ASD group, sex remained a significant predictor throughout the model's steps. In contrast, in the non-ASD group, sex was no longer a significant predictor after controlling for other variables in the third step of the model.

Table 6. Hierarchical regression model for predictors of social anxiety in the ASD group and non-ASD group

Social Anxiety	**ASD (N=108)**					**Non-ASD (N=160)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	**.058**					**.036**				
Sex			**5.519**	**2.159**	**.241**			**4.155**	**1.708**	**.190**
Step 2	.061	.003				**.074**	**.038**			
Sex			**5.616**	**2.207**	**.245**			**3.950**	**1.723**	**.181**
ERQ CR			-.060	.144	-.041			**-.317**	**.138**	**-.179**
ERQ ES			.094	.208	.045			.163	.167	.076
Step 3	.082	.021				**.251**	**.177**			
Sex			**5.154**	**2.252**	**.225**			2.615	1.575	.120
ERQ CR			-.113	.160	-.077			-.181	.142	-.102
ERQ ES			.098	.208	.047			.003	.154	.002
CERQ adaptive			.491	.611	.088			-.532	.465	-.091
CERQ			.790	.544	.141			**2.261**	**.382**	**.423**
Step 5	**.150**	**.068**				.251	.000			
Sex			**4.960**	**2.225**	**.217**			2.585	1.602	.118
ERQ CR			-.056	.163	-.038			-.182	.144	-.103
ERQ ES			-.169	.241	-.080			.002	.175	.001
CERQ adaptive			.380	.617	.068			-.542	.487	-.093
CERQ			.641	.535	.115			**2.244**	**.404**	**.420**
BERQ adaptive			.345	.581	.069			.046	.359	.010
BERQ			**1.144**	**.404**	**.308**			.037	.308	.010

5.4.4.5 Predictors of anxiety in the ASD group

The third model examined generalised anxiety (see Table 7 for the full model) in the ASD group. Anxiety score measured by the HADS scale was the dependent variable, and sex was entered in step 1 as an independent variable. In the first step of the analysis for the ASD group, the model did not reach statistical significance ($F_{(1,106)} = .2.817$; $p > .05$) and accounted for 2.6% of the variance in the dependent variable. The inclusion of the ERQ subscales in step 2 did not significantly improve the model ($F\textit{change}_{(2,104)} = 1.12$, $p > .05$), accounting for an additional 2.1% (R^2 Change) of the variance.

No variables were significant at this step. The introduction of cognitive adaptive and maladaptive variables into the model improved it significantly ($F\textit{change}_{(2, 102)} = 9.78$, $p < .001$) and explained a further 15.3% of the variance. At this stage, sex significantly predicted anxiety ($p = .011$), along with both cognitive adaptive ($t = -3.235$, $p = .002$, $\beta = -.330$) and maladaptive ($t = 2.237$, $p = .027$, $\beta = .203$) ER strategies. In the final step, both adaptive and maladaptive behavioural scales were included, resulting in an additional explanation of 3% of the variance, giving 23% of the variance in anxiety explained by sex and emotion regulation strategies in the ASD group. The change was not significant ($F\textit{change}_{(2,100)} = 1.972$, $p >.05$).

When controlling for all other variables, sex remained a significant predictor of anxiety in the ASD group ($p = .008$). Frequency of using cognitive reappraisal ($t = 2.189$, $p = .031$, $\beta = .230$) became a significant predictor of anxiety along with the cognitive adaptive scale ($t = -2.983$, $p = .004$, $\beta = -.314$). The directions of these associations suggest that frequent use of cognitive reappraisal (adaptive) along with the less frequent use of other broader cognitive, adaptive ER strategies as measured by the CERQ questionnaire along with sex are the strongest predictors of anxiety in the ASD group from within variables tested within this model.

5.4.4.6 Predictors of anxiety in the non-ASD group

The fourth model examined predictors of anxiety (see Table 7 for the full model) in the non-ASD group. Unlike in the ASD group, the inclusion of sex in the first step of the model explained a significant proportion of the variance in anxiety (3.6%; $F_{(1,158)} = 5.908$; $p > .05$). Therefore, being female is a strong predictor of anxiety in the non-ASD group. In step 2, the inclusion of the ERQ subscales in the model significantly improved it ($F_{change\ (2,156)} = 6.89$, $p < .001$), accounting for an additional 7.8% of the variance. Sex remained significant ($p = .012$) in this step. And both cognitive reappraisal ($t = -2.729$, $p = .007$, $\beta = -.207$) and expressive suppression ($t = 2.464$, $p = .015$, $\beta = .188$) significantly predicted anxiety. Moreover, these were both in the expected directions, with CR negatively and ES positively associated with anxiety.

The introduction of cognitive adaptive and maladaptive variables into the model explained a further 32.4% of the variance, and significantly improved the model ($F_{change\ (2,\ 154)} = 44.492$, $p < .001$). Although sex and ES were no longer significant, the frequency of using cognitive reappraisal remained significant ($t = -2.289$, $p = .023$, $\beta = -.159$), along with cognitive maladaptive ER strategies ($t = 9.432$, $p < .001$, $\beta = .584$).

Both adaptive and maladaptive behavioural scales were included in the final step, resulting in an additional explanation of 2.1% of the variance, giving a total of 46% of the variance in generalised anxiety explained by sex and emotion regulation strategies in the non-ASD group. This change was not significant, however, the model remained significant ($F_{change\ (2,\ 152)} = 3.02$, $p = .052$). In the final step, the strongest negative predictor for anxiety was cognitive reappraisal ($t = -2.228$, $p = .027$, $\beta = -.154$) and significant positive predictors were frequent use of cognitive ($t = 8.304$, $p < .001$, $\beta = .534$) and behavioural ($t = 2.446$, $p = .016$, $\beta = .177$) maladaptive ER strategies.

To summarise, unlike in the ASD group, sex alone was a significant predictor of anxiety in the non-ASD group. It remained significant, along with infrequent cognitive reappraisal and frequent expressive suppression. However, it was no longer significant when broader cognitive and behavioural ER strategies were controlled for within the model. Interestingly, although the CR scale from the ERQ remained significant in all steps of the model, the broader maladaptive scales rather than the adaptive scales appeared to best predict anxiety.

Table 7. Hierarchical regression model for predictors of anxiety in the ASD group and non-ASD group

Anxiety	**ASD (N=108)**					**Non-ASD (N=160)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.026					**.036**				
Sex			1.370	.816	.161			**1.684**	**.693**	**.190**
Step 2	.046	.021				**.114**	**.078**			
Sex			1.575	.827	.185			**1.737**	**.683**	**.196**
ERQ CR			.017	.054	.031			**-.149**	**.055**	**-.207**
ERQ ES			.105	.078	.134			**.166**	**.066**	**.188**
Step 3	**.200**	**.153**				**.439**	**.324**			
Sex			**2.023**	**.782**	**.238**			.998	.553	.112
ERQ CR			.098	.056	.180			**-.114**	**.050**	**-.159**
ERQ ES			.098	.072	.126			.081	.054	.093
CERQ adaptive			**-.686**	**.212**	**-.330**			-.015	.163	-.006
CERQ maladaptive			**.422**	**.189**	**.203**			**1.264**	**.134**	**.584**
Step 5	.230	.030				.460	.021			
Sex			**2.121**	**.787**	**.249**			.800	.552	.090
ERQ CR			**.126**	**.058**	**.230**			**-.111**	**.050**	**-.154**
ERQ ES			.009	.085	.011			.036	.060	.041
CERQ adaptive			**-.652**	**218**	**-.314**			.001	.168	.000
CERQ maladaptive			.368	.189	.177			**1.157**	**.139**	**.534**
BERQ adaptive			-.126	.206	-.068			.087	.124	.049
BERQ maladaptive			.247	.143	.179			**.259**	**.106**	**.177**

5.4.4.7 Predictors of depression in the ASD group

The seventh model investigated potential factors associated with depression using our variables of interest, namely sex and frequency of use of emotion regulation strategies (see Table 8 for the full model). The mean score for the depression subscale of the HADS questionnaire was used as the dependent variable, with sex being included as an independent variable at the beginning. In the first step of the analysis for the ASD group, the model did not reach statistical significance ($F_{(1,106)} = .319$; $p > .05$) and accounted for 0.3% of the variance in the dependent variable. The inclusion of the ERQ subscales in step 2 significantly improved the model ($F\textit{change}_{(2,104)} = 3.200$, $p = .045$), accounting for an additional 5.8% (R^2 change) of the variance in depression.

When all other variables were controlled, expressive suppression was a positive predictor of depression, although this effect was marginal ($t = 2.045$, $p = .043$, $\beta = .202$). In step three, the introduction of cognitive adaptive and maladaptive variables into the model improved it significantly ($F\textit{change}_{(2, 102)} = 18.309$, $p < .001$) and explained a further 24.8% of the variance. When controlling for sex and cognitive reappraisal in this step, the expressive suppression remained a positive significant predictor for depression ($t = 2.215$, $p = .029$, $\beta = .190$) along with maladaptive cognitive ER strategies ($t = 2.279$, $p = .025$, $\beta = .192$). In contrast, cognitive adaptive ER strategies were a negative predictor ($t = -4.973$, $p < .001$, $\beta = -.472$) for depression.

The fourth and final step included both adaptive and maladaptive behavioural ER strategies, which explained a further 8.1% of the variance, giving a total of 39% of the variance in depression explained by sex and emotion regulation strategies in the ASD group. This change was significant ($F\textit{change}_{(2, 100)} = 6.666$, $p = .002$). In this step, sex became a significant predictor for depression ($p = .014$), while the frequent use of expressive suppression and maladaptive cognitive ER strategies were no longer significant predictors. Cognitive adaptive ER strategies remained a significant negative predictor for depression ($t = -4.067$, $p < .001$, $\beta = -.381$), and behavioural adaptive ER strategies became a negative significant predictor ($t = -3.563$, $p = .001$, $\beta = -.351$).

In summary, after accounting for the impact of behavioural emotion regulation (ER) strategies in the model, the analysis reveals that sex significantly predicts depression among individuals with ASD. However, the most remarkable finding is that, among the factors investigated, the less frequent use of cognitive and behavioural adaptive ER strategies rather than the more frequent use of maladaptive ER strategies were the best predictors of depression in this group.

5.4.4.8 Predictors of depression in the non-ASD group

The same analysis was done for the non-ASD group (see Table 8 for the model details) for depression as an independent variable. In the first step of the model, sex was introduced as a sole dependent variable. This initial model was insignificant ($F_{(1,158)} = .452$; $p = .502$), explaining only 0.3% of the variance in the independent variable. In step 2, the inclusion of the ERQ subscales improved the model significantly ($F_{change\ (2,156)} = 10.367$, $p < .001$), accounting for an additional 11.7% of the variance. Accounting for sex, cognitive reappraisal becomes a significant negative predictor for depression ($t = -3.255$, $p = .001$, $\beta = -.246$) as well as expressive suppression a positive predictor for depression ($t = 3.117$, $p = .002$, $\beta = .238$).

The introduction of cognitive adaptive and maladaptive variables into the model explained a further 18.7% of the variance and improved the model significantly ($F_{change\ (2,\ 102)} = 20.705$, $p < .001$). After controlling for sex and the frequency of using cognitive reappraisal, expressive suppression remains a significant positive predictor of depression ($t = 2.316$, $p = .022$, $\beta = .160$), along with cognitive maladaptive ER strategies ($t = 5.508$, $p < .001$, $\beta = .379$). In contrast, cognitive adaptive ER strategies were a negative predictor for depression ($t = -3.316$, $p = 001$, $\beta = -.254$).

Again, adaptive and maladaptive behavioural scales were included in the final step, resulting in an additional explanation of 7.5% of the variance, giving 38.2% of the variance in depression explained by sex and emotion regulation strategies in the non-ASD group. The change was significant ($F_{change\ (2,\ 100)} = 9.270$, $p < .001$). After controlling for sex and the frequency of utilising cognitive reappraisal and expressive suppression, the non-ASD group's analysis revealed that the most significant predictors for depression were the infrequent use of cognitive adaptive ER strategies ($t = -2.589$, $p = .011$, $\beta = -.196$), frequent use of cognitive maladaptive ER strategies ($t = 4.361$, $p < .001$, $\beta = .300$), and behavioural maladaptive ER strategies ($t = 3.878$, $p < .001$, $\beta = .300$).

To summarise, in the non-ASD group, after accounting for sex and the frequency of using cognitive reappraisal and expressive suppression, the infrequent use of cognitive adaptive ER strategies, frequent use of cognitive maladaptive ER strategies, and behavioural maladaptive ER strategies were the most significant predictors of depression.

Table 8. Hierarchical regression model for predictors of depression in the ASD group and non-ASD group

Depression	**ASD (N=108)**					**Non-ASD (N=160)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.003					.003				
Sex			.500	.885	.055			.420	.625	.053
Step 2	**.061**	**.058**				**.120**	**.117**			
Sex			.676	.880	.074			.494	.604	.063
ERQ CR			-.111	.057	-.188			**-.157**	**.048**	**-.246**
ERQ ES			**.170**	**.083**	**.202**			**.183**	**.059**	**.238**
Step 3	**.309**	**.248**				**.306**	**.187**			
Sex			1.391	.779	.152			.054	.545	.007
ERQ CR			.013	.055	.022			-.061	.049	-.095
ERQ ES			**.159**	**.072**	**.190**			**.123**	**053**	**.160**
CERQ adaptive			**-.1.051**	**.211**	**-.472**			**-.534**	**.161**	**-.254**
CERQ maladaptive			**.429**	**.188**	**.192**			**.728**	**.132**	**.379**
Step 5	**.390**	**.081**				**.382**	**.075**			
Sex			**1.878**	**.751**	**.206**			-.236	.524	-.030
ERQ CR			.067	.055	.114			-.044	.047	-.068
ERQ ES			.046	.081	.054			.015	.057	.020
CERQ adaptive			**-.848**	**.208**	**-.381**			**-.413**	**.047**	**-.196**
CERQ maladaptive			.348	.181	.156			**.577**	**.132**	**.300**
BERQ adaptive			**-.699**	**.196**	**-.351**			-.132	.117	-.083
BERQ maladaptive			.010	.136	.007			**.391**	**.101**	**.300**

5.5 Discussion

This study examined sex and group differences in the frequency of broader cognitive and behavioural adaptive and maladaptive ER strategies, rates of internalising issues, and predictors for autistic traits and internalising issues from these ER strategies.

5.5.1 The frequency of broader cognitive and behavioural adaptive and maladaptive ER strategies

As expected, the ASD group reported more frequent use of both cognitive and behavioural maladaptive than adaptive ER strategies, in comparison with the non-ASD group, who reported more frequent use of adaptive cognitive and behavioural ER strategies. These results for using adaptive and maladaptive cognitive and behavioural ER strategies align with previous research findings (e.g., Bruggink et al., 2016; Cai et al., 2018a; Samson et al., 2012,2015a). Therefore, these findings add to the evidence base and emphasise the need to develop and implement therapies that teach and reinforce adaptive cognitive and behavioural strategies. Techniques from cognitive-behavioural therapy, mindfulness, and social skills training could be particularly beneficial.

Sex differences were found within the ASD group only, with ASD females reporting significantly more frequent use of behavioural adaptive ER strategies than ASD males. This finding is especially interesting, as it potentially explains the mechanism allowing autistic females to engage in more social interactions often reported in this group (e.g., Hiller et al., 2014; Head et al., 2014). On the other hand, it may also mean that practice makes improvement, and due to having more frequent social interactions, autistic females are reporting more frequent use of behavioural adaptive ER strategies than males. However, the reliance on self-reported data can introduce bias. Individuals may underreport or overreport certain behaviours based on social desirability or lack of self-awareness. The interplay between gender, ASD, and ER strategies is complex and influenced by multiple factors, including upbringing, environment, and individual differences. Therefore, more research is needed to understand the root causes of these sex differences in ER strategies within the ASD population. Longitudinal studies could help determine whether these differences persist over time and how they impact long-term outcomes. Exploring whether these findings hold true across different cultures and age groups can provide a more comprehensive understanding of ER in ASD.

5.5.2 Rates of internalising issues

As anticipated, significantly higher rates of internalising issues were found in the ASD group compared to the non-ASD group, which confirms previous research demonstrating that individuals with ASD are more prone to experiencing anxiety, depression, and social anxiety (e.g., APA, 2013; Croen et al., 2015; Hollocks et al., 2019; Lugo-Marin et al., 2019; Simonoff et al., 2008; Underwood et al., 2019). The consistency of these findings across multiple studies underscores the robustness of the association between ASD and internalising issues. Therefore, this result highlights the vulnerability of autistic individuals to emotional difficulties. Notably, this study exclusively included individuals with ASD without ID, suggesting that they may be aware of their difficulties in this domain, which could contribute to increased anxiety and low mood levels (Wing, 1981). However, autistic individuals with ID may also be particularly vulnerable to internalising problems such as anxiety and depression. These issues often manifest differently than the general population, making them harder to identify. Emotional distress in this population may be expressed through behaviours such as increased irritability, aggression, self-injury, or withdrawal rather than the typical verbal expressions of anxiety or sadness. Contributing factors include communication barriers, which make it difficult for individuals to express their emotional state, leading to most likely underreporting of these issues in current literature or misinterpretation of their symptoms.

One of the primary challenges in addressing these issues is the lack of reliable assessment measures. Existing tools for identifying internalising problems are often not designed or validated for use with autistic individuals with ID, limiting their reliability and validity in this population. Many standard measures rely on self-reporting or responses to verbal prompts, which are not feasible for non-verbal or those individuals with limited communication abilities. While behavioural assessments can provide some insights, they may not fully capture the internal emotional experiences of individuals. Behaviours observed in these assessments can be misinterpreted or attributed to autism-related characteristics rather than underlying emotional problems. The need for specialised assessment tools that can accommodate this population's cognitive and communicative limitations is critical. Tools that incorporate observational methods, caregiver reports, and alternative communication strategies are essential. See a review and meta-analysis by Mingins et al. (2021) for more details regarding this matter. Therefore, further investigation is required to explore the link between cognitive abilities and self-awareness of anxiety and depression and its potential effects on emotion regulation, self-esteem and overall well-being.

As expected, the results for sex differences in the overall sample showed that females reported significantly higher rates of anxiety and social anxiety than males, which is in line with literature

highlighting these issues in the general population (e.g., Hollocks et al., 2018; Patalay & Fitzsimons, 2017) and ASD (e.g., Crick & Zahn-Waxler, 2003; May et al., 2014). At the same time, there was no significant difference in reported levels of depression between the sexes.

Sex differences when groups split according to the diagnosis were consistent for social anxiety only. Females in both the ASD and non-ASD groups had higher rates of social anxiety than males. This may imply that regardless of diagnosis, females tend to experience more social anxiety compared to males. This finding could prompt further investigation into potential societal, cultural, or biological factors contributing to this difference. In the non-ASD group, females had higher anxiety scores than males, while there were no sex differences found in depression within either the ASD or non-ASD group.

The finding relating to the higher rates of anxiety in females aligns with the existing evidence base and may have implications for clinical practice, suggesting there should be more emphasis on early detection of anxiety to prevent the escalation of these issues into more severe mental health problems. Additionally, it may be particularly important for choices of potential therapeutical interventions. For instance, therapeutic approaches such as cognitive-behavioural therapy can be tailored to focus more on anxiety management techniques for female patients

Additionally, the absence of significant sex differences in depression levels is noteworthy. It suggests that while anxiety and social anxiety may be more prevalent in females, depression may affect males and females more equally. A potential explanation for these equal levels of depression reported by males and females may be that when openly asked, in the lab or clinical settings, males may deny experiencing low mood symptoms because of the feeling of shame or embarrassment that may come from unrealistic masculinity beliefs, as discussed in Chapter 1. However, as the questionnaires completed by participants were self-report questionnaires that were completed online, freely, in a safe, home environment, it may be possible that the equal levels of depression between genders may highlight another important problem that males may be less likely to admit it in the face-to-face research or clinical settings when struggling with depression. At the same time, it is well established that males are more likely to commit suicide in comparison to females (see Bennett et al., 2023).

Further research can address the potential underreporting of depression by males by employing a variety of innovative and sensitive methods, for example, the use of technology. By creating an environment that encourages honest reporting, utilising diverse and indirect assessment tools, and promoting mental health awareness, researchers can gain a more accurate understanding of depression levels among males regardless of their ASD diagnosis. This potentially could help to uncover the true extent of depression in males and develop interventions that effectively address

their mental health needs, ultimately contributing to a reduction in the higher rates of suicide observed in this population.

5.5.3 Association between ER strategies and rates of internalising issues

As expected, the results showed that using cognitive reappraisal less often was associated with more internalising problems, while using expressive suppression more often was linked to higher rates of anxiety and depression. This confirms the results reported within the literature (i.e., Aldao et al., 2010; Gross, 2015; Gross & John, 2003; Martins et al., 2016; Webb et al., 2012). As hypothesised, cognitive and behavioural maladaptive ER strategies positively correlated with all internalising issues. While cognitive adaptive ER strategies had negative correlations with all internalising issues, behavioural adaptive ER strategies were not negatively correlated with social anxiety. This finding again aligns with previous research findings that frequent use of maladaptive ER strategies but also a low reliance on or ineffective use of adaptive ER strategies is often found to be a risk factor for developing internalising issues (i.e., Garnefski et al., 2001; Aldao et al., 2010; Berking et al., 2008; Kraaij & Garnefski, 2012).

The most noteworthy finding here was the lack of a negative correlation between behavioural adaptive ER strategies and social anxiety. The behavioural ER strategies included in the adaptive dimension of BERQ were seeking distraction, actively approaching and seeking social support. For individuals with high levels of social anxiety, the typical adaptive ER strategies might not be sufficient, even if they use them frequently to form that linear negative association. For example, while seeking social support is generally beneficial, individuals with social anxiety might find it challenging to reach out due to their fear of judgment or rejection. Similarly, distraction techniques might not effectively alleviate the intense anticipatory anxiety associated with upcoming social events. Social anxiety might be influenced by a multitude of factors, including genetic predispositions, environmental influences, and past experiences. Behavioural adaptive ER strategies, while beneficial for managing emotions generally, might not directly address the specific fears and cognitions associated with social anxiety.

As expected, correlations between ER and internalising issues within the four groups were following the trends observed within the whole sample, with rare exceptions. The most significant difference was observed between behavioural adaptive and maladaptive ER strategies and internalising issues. Maladaptive behavioural ER strategies were not associated with internalising issues in both ASD males and females, except for social anxiety in males. This lack of clear association between maladaptive behavioural ER strategies and internalising issues may suggest that some of these

strategies could be considered adaptive in these two groups, as suggested earlier in this chapter regarding avoidant ER strategies (Pouw et al., 2013; Rieffe et al., 2014). Behavioural adaptive strategies were negatively associated with depression across the four groups and with anxiety in non-ASD females and ASD males group only, again suggesting a different pattern for autistic females in comparison with males.

5.5.4 Predictors of autistic traits

Individual differences in the use of different ER strategies are potentially a critical predictor for the diverse presentations of autistic traits, anxiety, depression, and social anxiety in both ASD and non-ASD populations. As discussed earlier, difficulties in ER are closely linked to higher levels of anxiety, depression and social anxiety. In individuals with ASD, emotion regulation difficulties are intertwined with core symptoms such as social communication challenges and repetitive behaviours (i.e. Mazefsky & White, 2014), and these difficulties contribute significantly to co-occurring conditions like anxiety and depression (White et al., 2009). There is significant variability in the ER strategies used by individuals within both ASD and non-ASD populations, potentially leading to different presentations of autistic traits and mental health outcomes (Gross & John, 2003). Studies have shown that the use of adaptive ER strategies is associated with better psychological well-being and social functioning, while the use of maladaptive strategies is linked to worse outcomes (Samson et al., 2015a). Interventions focusing on improving ER skills, such as cognitive-behavioural therapy and mindfulness-based interventions, have proven effective in reducing symptoms of anxiety, depression, and social anxiety in both ASD and non-ASD populations (Reaven et al., 2012). Therefore, the results of the exploration of predictors for autistic traits and internalising issues within this chapter are particularly interesting as they have the potential to increase our understanding and address individual differences in ER through targeted interventions that can significantly improve mental health and social functioning outcomes, highlighting the importance of personalised approaches to intervention.

The results of the first hierarchical regression model investigating ER and sex as predictors of autistic traits in the ASD population showed that sex was not a reliable predictor of autistic traits in this group. This suggests that sex does not reliably predict the severity or type of autistic traits when controlling for diagnostic criteria in this sample, which was limited to individuals without ID. Therefore, this finding cannot be generalised. However, a recent meta-analysis has also found that, while there may be some differences in specific areas, such as social communication and repetitive behaviours, these differences are not consistent enough to use sex as a reliable predictor for ASD (Lai et al., 2015).

Phenotypic variability, genetic factors, and environmental influences may all contribute to the unreliability of sex as a predictor of autistic traits in the ASD population. However, the use of emotion regulation strategies was found to account for a significant portion of the variance in autistic traits. Specifically, the low frequency of using adaptive cognitive emotion regulation strategies was the strongest predictor among the variables tested in the model. Furthermore, results suggested that CR, as measured by the ERQ questionnaire, was a significant predictor of autistic traits until more comprehensive measures of adaptive cognitive ER were included in the model. This finding highlights the importance of considering a broader range of adaptive cognitive ER strategies when examining their relationship with autistic traits. Finally, within this model, no significant relationship between behavioural ER measures and autistic traits was found. However, it's important to note that the study only examined a limited set of ER measures, and further research is needed to fully understand the relationship between behavioural ER strategies and autistic traits in the ASD population.

The second model investigated ER and sex as predictors of autistic traits in the non-ASD group. As in the ASD group, sex was not a significant predictor for autistic traits in the non-ASD population, consistent with previous research (Mandy et al., 2012; Lai et al., 2013; Hull et al., 2017). Emotion regulation was a significant predictor of autistic traits, accounting for 15.1% of the variance in the non-ASD group. Interestingly, the use of ES was found to be a significant predictor of autistic traits, even when broader maladaptive cognitive ER measures were included in the model. This may suggest that non-ASD individuals who frequently suppress their emotions may present with more autistic traits.

In contrast to the ASD group, maladaptive behavioural ER strategies were found to be a significant positive predictor of autistic traits in the non-ASD population. This highlights the importance of examining cognitive and behavioural ER strategies in understanding the presentation of autistic traits in non-ASD populations. Maladaptive ER strategies may exacerbate or mimic certain autistic traits, potentially leading to higher scores on measures of autistic traits in the non-ASD population. These strategies may also reflect underlying difficulties in processing and regulating emotions, which are common features of both autism and various psychological disorders. Overall, these findings suggest that targeting maladaptive ER strategies may be an important area for intervention in non-ASD populations.

5.5.5 Predictors of social anxiety

In individuals with ASD, sex emerged as a significant positive predictor of social anxiety, even when considering various emotion regulation (ER) strategies. Therefore, being a female was found to predict social anxiety in this group. This finding is particularly interesting in light of the frequent accounts for higher social motivation in autistic females. Notably, frequent use of behavioural maladaptive ER strategies (withdrawal and ignoring) alongside sex was a significant predictor of social anxiety in the ASD group. This may suggest that autistic individuals, when relying more on these behavioural maladaptive ER strategies, may experience higher rates of social anxiety, potentially due to fewer opportunities to practice their social skills. The combination of high social motivation and high social anxiety can lead to a negative feedback loop. Autistic females may continually strive for social connection but find themselves hindered by anxiety and the use of behavioural maladaptive ER strategies, reinforcing their social difficulties and anxiety. Further research is needed to confirm and understand this mechanism better. However, it is possible that the ER could be a good point in breaking this vicious cycle within clinical interventions. The model accounted for only 15% of the variance in the ASD group, highlighting the complexity of this issue influenced potentially by other factors, which were not included in this analysis, like genetics, environment, and self-esteem.

In the non-ASD group, sex initially predicted social anxiety, but its significance diminished when broader cognitive and behavioural ER strategies were included. Cognitive maladaptive ER strategies emerged as the most significant predictor, which aligns with the findings regarding cognitive processing biases as reported in the review by Morrison and Heimberg, (2013). Cognitive maladaptive ER strategies, such as rumination and catastrophising, involve persistent, negative thinking patterns that exacerbate emotional distress. Morrison and Heimberg (2013) discuss how these cognitive biases contribute to the maintenance of anxiety disorders by reinforcing negative thought patterns and emotional responses. As discussed earlier in this chapter, frequent use of suppression (behavioural maladaptive ER strategy) has been shown to be associated with social anxiety in typical development (Dryman & Heimberg, 2018; O'Connor et al., 2014). However, this finding was not observed in this study, suggesting that this ER strategy may not be a good predictor for social anxiety. Therefore, it is possible that it may be social anxiety that is driving more frequent use of expressive suppression and not the other way around. However, this reverse causality was not examined in the current study, highlighting the need for future research to explore these dynamics more comprehensively.

5.5.6 Predictors of anxiety

The exploration of potential predictors of anxiety, as measured by the HADS subscale, showed that in the ASD group, sex was not a significant predictor on its own. This was consistent with the findings of t-tests done to compare if the differences in anxiety levels between males and females within ASD and non-ASD groups were significant, as even though the ASD females had higher self-reported scores for anxiety within this sample, the difference when compared with ASD males was not significant ($p > .05$). Interestingly, while sex alone didn't significantly predict anxiety, it became significant when adaptive and maladaptive cognitive ER strategies were introduced. However, when adaptive and maladaptive behavioural ER strategies were included, the strongest predictors of anxiety in the ASD group were being female, less use of broader adaptive cognitive strategies, and, interestingly, frequent use of cognitive reappraisal.

This finding is particularly interesting, as a similar result was discussed in Chapter 3 regarding adolescent autistic females regarding the effectiveness of CR use to reduce anxiety in this group. Autistic adolescent females, even though they were able to produce cognitive reappraisal when prompted during the experimental task at a similar rate as non-ASD males and females, had the least pronounced reduction in anxiety; that is, this strategy seemed less efficient in this group. It was then hypothesised in the discussion of Chapter 3 that this pattern might have been related to the higher emotional reactivity adolescent autistic females presented with at the beginning of the task.

However, the finding in the current chapter that CR was a significant positive predictor of anxiety in the ASD group along with the sex (being female) and less frequent use of broader adaptive cognitive ER strategies, supports the idea that frequent use of CR reappraisal might be a less adaptive (or efficient) ER strategy in this population. While cognitive-behavioural therapy is often used and found effective within the ASD population (Wood et al., 2009; Reaven et al., 2012), it is important to investigate further what other factors may influence if CR as an ER strategy is an adaptive or maladaptive ER strategy for autistic females. As mentioned earlier, multiple factors like cognitive biases and negative interpretations are associated with heightened threat sensitivity (for review, see Morrison and Heimberg, 2013). Therefore, further research could explore the interaction between cognitive reappraisal and these cognitive biases in autistic females, particularly focusing on how these factors influence the effectiveness of CR as an ER strategy and contribute to either alleviating or exacerbating social anxiety and other related symptoms. This could help tailor interventions more precisely to the needs of autistic females, improving their emotional and social outcomes.

In contrast to the ASD group, where the final model explained only 23% of the variance in anxiety, in the non-ASD group, sex and ER explained a total of 46% of the variance in anxiety. For the non-ASD group, being female was a significant predictor of anxiety on its own. ER strategies' introduction sustained sex's significance alongside infrequent cognitive reappraisal use and frequent expressive suppression. However, when broader cognitive and behavioural ER strategies were included in the model, sex was no longer a significant predictor. In this group, the significant variables that predicted anxiety were as expected (less frequent use of CR and more frequent use of maladaptive ER strategies), suggesting that our understanding of the associations between adaptive and maladaptive ER strategies and higher rates of internalising issues may be coming from past research done prominently on typically developing populations. The results of these analyses suggest that these associations may present differently in the ASD population. However, further studies are necessary to confirm and validate this finding.

5.5.7 Predictors of depression

Sex was not a significant predictor of depression in the ASD group until ER was considered. It became significant with frequent use of ES and remained significant after accounting for the impact of the broader cognitive and behavioural emotion regulation (ER) strategies within the model. This finding suggests that while sex may play a role in the development of depression in individuals with ASD, it may only be significant in the context of emotion regulation. In other words, the impact of sex on depression may be mediated using certain emotion regulation strategies. Specifically, the frequent use of ES, which involves inhibiting or hiding one's emotions, may be particularly detrimental for individuals with ASD, especially for those who also struggle with depression.

However, the most remarkable finding was that, among the factors investigated, the infrequent use of both cognitive and behavioural adaptive ER strategies was the strongest and most consistent predictor of depression in this group, which again aligns with the literature discussed earlier (i.e., Garnefski et al., 2001; Aldao et al., 2010; Berking et al., 2008; Kraaij & Garnefski, 2012).

Moreover, the fact that infrequent use of both cognitive and behavioural adaptive ER strategies is the strongest predictor of depression in this population highlights the critical importance of addressing emotion regulation in interventions aimed at preventing or treating depression in individuals with ASD. This finding is consistent with previous research suggesting that cognitive-behavioural therapy and other interventions that target emotion regulation can be effective in reducing depression symptoms in individuals with ASD (Mazefsky et al., 2013).

The analysis conducted on the non-ASD group showed that sex alone was not a significant predictor of depression in this population and that the introduction of the ER strategies did not change its significance as a predictor in contrast to the ASD group. Less frequent use of CR and frequent use of suppression were significant predictors until broader cognitive and behavioural adaptive and maladaptive ER strategies were included in the model. After controlling for sex and the frequency of using CR and ES, the analysis revealed that the most significant predictors for depression in the non-ASD group were the infrequent use of cognitive adaptive ER strategies, frequent use of cognitive maladaptive ER strategies, and behavioural maladaptive ER strategies.

Overall, these findings suggest that emotion regulation strategies play a significant role in predicting depression in both individuals with and without ASD. Furthermore, the infrequent use of cognitive and behavioural adaptive ER strategies consistently emerged as the strongest predictor of depression across both groups. These findings highlight the importance of developing interventions that target emotion regulation, particularly cognitive and behavioural adaptive strategies, for individuals with and without ASD who experience depression symptoms. At the same time, supporting the efficacy of cognitive-behavioural therapy and similar therapeutic interventions in treating depression, these approaches can be tailored to enhance adaptive ER strategies, thereby addressing the unique emotional regulation challenges faced by both ASD and non-ASD populations.

5.6 Strengths and limitations

This study had multiple strengths. First, it is a rare study that attempted to characterise the role of gender within both cognitive and behavioural ER strategies and internalising issues. Examining potential gender differences within this study contributed to understanding how these factors interact and vary across populations. Additionally, considering both adaptive and maladaptive ER strategies provided a more comprehensive understanding of how different emotional regulation approaches relate to internalising issues. The inclusion of both ASD and non-ASD populations enabled a comparison between these groups and offered insights into potential differences in ER strategies and their associations with internalising issues. Therefore, shedding light on the potential mechanisms underlying these issues is an important step in planning therapeutical interventions. Finally, consideration of both cognitive and behavioural aspects of ER strategies provides a more nuanced understanding of how different facets of ER relate to internalising issues. This comprehensive approach allows for a deeper exploration of the connections between ER and internalising issues.

On the other hand, one notable constraint of this study was its reliance on an online questionnaire, which limited the inclusion to only those adults who had access and the ability to complete the survey. Additionally, individuals struggling with internalising issues like social anxiety, anxiety and depression may be less likely to take part in online surveys. Therefore, this factor could affect variability within this study sample. Further studies, which would include clinical samples of individuals diagnosed with social anxiety disorder, generalised anxiety disorder and depression that would look at their ER habits, would be advisable. Finally, the measure of alexithymia was not included in this study, which is inevitably a great limitation and will be addressed in the next chapter.

Chapter 6 - Alexithymia and its relation to ER and internalising issues

In Chapter 6, the focus shifts to explore alexithymia in adults with and without ASD, including how it is linked to autistic traits and internalising issues. This approach will allow for a better understanding of findings relating to emotion regulation discussed in the previous chapter. Sex differences within alexithymia levels will be investigated in both ASD and non-ASD groups, as well as associations between alexithymia, internalising issues and ER. Finally, it will explore whether alexithymia is a good predictor of autistic traits and internalising issues over and above ER, as discussed in Chapter 5.

6.1 Introduction

6.1.1 Relationship between alexithymia and emotion regulation in ASD and typical development

As discussed in Chapter 1, alexithymia is characterised by a lack of conceptual understanding of emotional states. This makes expressing emotions, imagining, and interacting with others hard. It also makes it more likely that emotions will be seen as physical symptoms (Rieffe et al., 2006). The relationship between alexithymia and emotion regulation has been a topic of interest in psychology and related fields. It has been associated with impaired emotional regulation and increased risk for mood disorders, depression, anxiety, and stress (Cruijsen et al., 2019; Fietz et al., 2018; Grynberg et al., 2010).

Numerous research studies focus on the relationship between alexithymia, emotional regulation, and mental health outcomes, particularly in individuals with autism spectrum disorder (ASD) or high-functioning autism. This may be caused by the high prevalence of alexithymia in this population, ranging up to 59.2%, compared to 9.7% in neurotypical adults (Cai et al., 2020). For example, Laloyaux et al. (2015) examined differences in emotion regulation strategies between individuals with and without alexithymia. They showed that individuals with alexithymia used more suppression and less reappraisal in emotion regulation. Another study by Fietz, Valencia and Silani (2018) found that both alexithymia and autistic traits were predictors of depression and anxiety in university students with and without ASD, while Morie et al. (2019) found that alexithymia was a significant predictor of mood disorders in individuals with high-functioning autism, and emotion regulation mediated this relationship. While all these studies investigated the relationship between alexithymia and different

aspects of mental health in relation to emotion regulation, none of these studies investigated sex differences, leaving a gap which may be crucial for our understanding of discussed within this thesis differences in emotion regulation and the presentation of core and associated autistic traits in males and females.

Ketelaars et al. (2016) conducted a study to investigate whether autistic females without ID have difficulties with emotion recognition and whether they show signs of alexithymia. The study included 20 autistic females and 20 typically developing females, matched for age, intelligence, and education. The results showed that females with ASD performed worse on recognising emotions from facial expressions and had more difficulties identifying and describing their emotions than typically developing females. Therefore, they presented with higher levels of alexithymia than the control group. The findings suggest that females with ASD struggle to recognise and describe emotions, which may contribute to their social and communication deficits. However, as the study did not include males, it is not known whether the same would be true for autistic and typically developing males. While social and communication difficulties are core traits of autism, alexithymia may significantly contribute to sex differences in the presentation of these traits, as well as in co-occurring internalising issues and emotion regulation styles. However, further research is necessary to understand the potential sex differences in the prevalence of alexithymia in both the typically developing and ASD populations and its association with the higher rates of internalising disorders observed in females.

6.1.2 Alexithymia and internalising issues

As discussed in Chapter 1, autistic individuals are four times more likely than neurotypicals to experience mental health issues over the course of their lives, and rates of these rise with intelligence and age within this population (Hollocks et al., 2019). This elevated risk highlights the need for targeted interventions that address not just the core symptoms of autism but also the factors that contribute to mental health problems. Alexithymia, characterised by difficulties in identifying and describing emotions, is prevalent in individuals with ASD and is strongly associated with poorer mental health outcomes, particularly anxiety and depression (Beck et al., 2020; Morie et al., 2019; Pandey & Choubey, 2010).

In 2019, Morie and colleagues examined how autistic traits, ER difficulties, and alexithymia affect depressive symptoms in individuals with ASD (N = 64, 17 males, 47 females) using an online questionnaire. They found no direct association between autism traits and depression in their mediation analyses. However, they found an indirect effect between alexithymia and poor emotion

regulation skills. Therefore, they suggested that higher rates of alexithymia in this population could increase its vulnerability to developing depression. This study is particularly interesting due to the large number of females in their sample, which could be detrimental to these findings, however, comparisons between males and females were not made in this study. While alexithymia is associated with anxiety and depression (Van Der Cruijsen et al., 2019; Fietz et al., 2018; Grynberg et al., 2010) and eating disorders (Ridout et al., 2010), all of which are more common in females, higher levels of alexithymia are consistently reported in males (Levant, 2009) regardless of diagnosis. This discrepancy may be important in understanding potential differences in emotion regulation between sexes. Specifically, males with higher levels of alexithymia may struggle to identify and describe their emotions, leading to different or less effective emotion regulation strategies than females. In contrast, although females may experience higher rates of anxiety, depression, and eating disorders, their emotion regulation strategies might be influenced by other factors, such as heightened emotional awareness and expression, over and above the presence of alexithymia.

Consequently, when exploring group and sex differences in emotion regulation (ER) styles within the ASD and non-ASD populations, it becomes imperative to include the influence of alexithymia. Without considering the role of alexithymia, our comprehension of the nuanced interplay between ER styles, group distinctions, and potential gender differences would be incomplete.

6.2 Aims and hypotheses

Thus, the main aim of this chapter is to explore the relations between alexithymia, emotion regulation in relation to autistic traits and internalising issues within ASD and non-ASD populations, as well as explore if these differ between males and females. Again, by taking a between-group and dimensional approach, this study hopes to provide further insights into potential intervention strategies for individuals who struggle with emotion regulation and understanding their emotional states, regardless of whether they are diagnosed with autism.

RQ1: Are there sex differences in the self-reported levels of alexithymia in the typically developing population, and are these same patterns observed in the ASD population? Hypotheses: 1a) Based on previous research, it was hypothesised that the ASD group would have higher rates of alexithymia than the non-ASD group; 1b) Regarding sex differences, despite limited research in this area, males were expected to report higher rates of alexithymia across ASD and non-ASD samples.

RQ2: Are levels of alexithymia associated with the frequency and efficiency of using emotion regulation and levels of internalising issues, and are these the same in males and females within ASD and non-ASD groups? Hypotheses: 2a) It was hypothesised that high levels of alexithymia would be negatively associated with the frequent use of adaptive cognitive and behavioural ER strategies, including cognitive reappraisal, and positively associated with maladaptive cognitive and behavioural ER strategies, including expressive suppression; 2b) It was hypothesised that alexithymia would be negatively associated with the efficiency of using both cognitive reappraisal and expressive suppression; H2c) It was hypothesised that alexithymia would be positively associated with autistic traits and internalising issues.

RQ3: To what extent does alexithymia, beyond sex differences, predict levels of autistic traits, social anxiety, anxiety and depression, and how do subsequent emotion regulation strategies contribute to these mental health outcomes in individuals with and without ASD? Hypotheses: 3a) Alexithymia will significantly predict higher levels of autistic traits and internalising issues beyond the effects of sex differences; H3b) After controlling for sex, alexithymia, and emotion regulation (adaptive and maladaptive strategies), higher levels of maladaptive ER strategies would be positively associated with higher levels of autistic traits and all three internalising issues in both groups. In contrast, adaptive ER strategies would be negatively associated with the dependent variables.

6.3 Methods

6.3.1 Participants

Sample 3 - 238 participants, ASD 106 (58 females, 48 males), non-ASD 132 (68 females, 62 males). Please see Chapter 2 for details.

6.3.2 Ethical approval

Aston University's Health and Life Sciences Research Ethics Committee assessed and approved the study (REC reference number: HLS21085).

6.3.3 Measures

The Toronto Alexithymia Scale (TAS-20, Bagby, R. M., Parker, J. D. A. & Taylor, G. J. (1994))

The TAS-20 consists of 20 items, with three subscales: difficulty identifying feelings (e.g., “When I am upset, I don’t know if I am sad, frightened, or angry”), difficulty describing feelings (e.g., “It is difficult for me to find the right word for my feelings”), and externally oriented thinking (e.g., “I prefer to just let things happen rather than to understand why they turned out that way”). Respondents rate the extent to which each item applies to them on a 5-point scale, ranging from "strongly disagree" to "strongly agree." The TAS-20 has been found to have good psychometric properties, including good reliability and validity (Cronbach’s alpha = 0.81) (Bagby et al., 1994). It has been used in various research studies to investigate the relationship between alexithymia and a range of psychological disorders, including anxiety, depression, and eating disorders. The total alexithymia score is the sum of responses to all 20 items, whereas the score for each subscale factor is the sum of responses to items comprising that subscale. The TAS-20 uses cutoff scoring: equal to or below 51 = non-alexithymia, and equal to or above 61 = alexithymia. Possible alexithymia scores range from 52 to 60.

The Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001)

The AQ is a 50-item questionnaire that measures traits associated with ASD. Please see Chapter 2 for details.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003)

This 10-item self-report measure collected cognitive reappraisal (CR) and expressive suppression (ES) data. Please see Chapter 5 for details.

The Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al. (2001)

The CERQ consists of 36 items measuring nine 4-item dimensions, five of which are adaptive and four maladaptive. Please see Chapter 5 for details.

The Behavioural Emotion Regulation Questionnaire (BERQ - Kraaij and Garnefski, 2019)

The BERQ consists of 20 items measuring five dimensions/strategies, three of which are adaptive and two maladaptive. Please see Chapter 5 for details.

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is a 14-item self-report measure used to collect data about significant levels of anxiety and depression, with seven items on each scale. Please see Chapter 5 for details.

The Brief Fear of Negative Evaluation Scale (BFNES; Leary et al., 1983)

The BNFES is a 12-item self-report measure that assesses fear of negative evaluation, a characteristic feature of social anxiety. Please see Chapter 5 for details.

Experimental task difference scores – Difference scores from the second task analyses (completed by the same participants, sample 3) were used in analyses as a measure of the efficiency of using cognitive reappraisal and expressive suppression to regulate the emotion of disgust. Please see Chapter 4 for details on how these were calculated.

6.3.4 Analyses

The normality of the data was assessed and confirmed, as previously described in Chapter 2. To examine sex differences in the self-reported levels of alexithymia in the non-ASD and ASD populations, a univariate ANOVA was conducted (RQ1). Bivariate correlation analyses with bootstrapping were used to investigate the relationship between alexithymia, emotion regulation efficiency (experimental task) and frequency measures (ERQ, CERQ, BERQ), and internalising issues measures (HADS, BNFES).

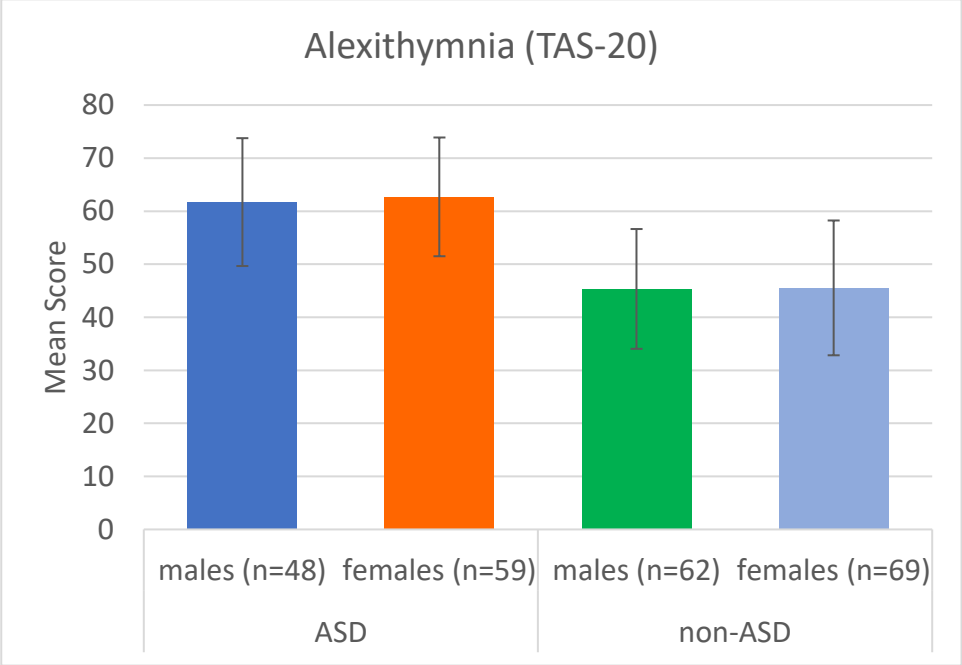
Finally, eight hierarchical multiple regressions were conducted to determine the association between a selected set of predictors (sex, alexithymia and ER) for autistic traits, anxiety, depression, and social anxiety. For each model, sex was entered in the first step to control for its effects, based on the main aim of this study, which was to investigate potential sex differences in both the ASD and non-ASD groups. Alexithymia was introduced to the model in the second step to explore to what extent alexithymia, beyond sex/gender, is a valid predictor of autistic traits and internalising issues, followed by CR and ES (ERQ measure) in the third step. In the fourth step, the cognitive adaptive and maladaptive subscales from CERQ were integrated into the model, followed by the behavioural adaptive and maladaptive subscales from BERQ in the fifth step.

6.4 Results

6.4.1 Sex and group differences in the alexithymia levels

Descriptive analyses were run to determine means and standard deviations for alexithymia total scores for the four groups (see Figure 1) for participants from Sample 3. As can be seen in Figure 1, ASD participants reported higher levels of alexithymia than the non-ASD group. At the same time, the patterns for males and females were similar in both groups.

Figure 1. Shows interactions between group and sex for means of total scores for alexithymia



To address the first research question for this chapter, a bootstrapped, univariate ANOVA was run to explore sex and group differences in the alexithymia levels within this sample and the potential interaction of the two. The results are presented in Table 1.

Table 1. Results of univariate ANOVA analyses for alexithymia

Variable	Effect	MS	df	F	p	η2
Alexithymia (TAS-20)						
	Sex	29.419	1	.207	.650	.001
	Group	16073.202	1	**113.113**	**.000**	**.326**
	Sex * Group	2.823	1	.020	.888	.000

As hypothesised, the ASD group reported significantly higher levels of alexithymia. However, no significant differences were found between males and females in either group, and the patterns of alexithymia scores for males and females were the same within both groups. Thus, there was no significant interaction.

6.4.2 Sex and group differences in the association between alexithymia, emotion regulation and internalising issues

A bivariate Pearson correlation with bootstrapping was run to explore the association between alexithymia, ER, autistic traits and internalising issues levels. The results are presented in Table 2.

Table 2. The whole sample Pearson correlation coefficients for alexithymia

	ALEXITHYMIA
FREQUENCY COGNITIVE REAPPRAISAL	**-.230****
FREQUENCY EXPRESSIVE SUPPRESSION	**.407****
EFFICIENCY COGNITIVE REAPPRAISAL	-0.040
EFFICIENCY EXPRESSIVE SUPPRESSION	**-.144***
ADAPTIVE COGNITIVE ER STRATEGIES	**-.271****
ADAPTIVE BEHAVIOURAL ER STRATEGIES	**-.312****
MALADAPTIVE COGNITIVE ER STRATEGIES	**.285****
MALADAPTIVE BEHAVIOURAL ER STRATEGIES	**.617****
AUTISTIC TRAITS	**.662****
ANXIETY	**.488****
DEPRESSION	**.464****
SOCIAL ANXIETY	**.308****

*Note:**. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

The results for the whole sample showed that, as expected, alexithymia was positively correlated with maladaptive ER strategies, including frequency of ES use, and negatively correlated with adaptive ER strategies, including frequency of using CR. Therefore, individuals who reported better insight into their emotional experiences also reported more frequent use of adaptive ways of regulating their emotions. While those who reported more difficulties in that area also reported reliance on maladaptive patterns of controlling their affects. Alexithymia was also negatively associated with the

efficiency of using CR and ES. However, this relation was only significant for ES. This finding suggests that individuals with limited insight into their emotional experiences were also less efficient at regulating their emotions during the experimental task (described in Chapter 4). Finally, alexithymia was positively associated with autistic traits and all three internalising issues.

To examine sex differences in these associations within both groups, the same analyses were run for males and females separately. The results are presented in Table 3.

Table 3. Comparison of Pearson correlation coefficients for alexithymia for both groups split by sex

	ASD		***non-ASD***	
	males	***females***	***males***	***females***
		Alexithymia		
Frequency Cognitive Reappraisal	-0.230	-0.012	-0.102	-0.205
Frequency Expressive Suppression	**.308***	0.138	**.404****	**.457****
Efficacy Cognitive Reappraisal	-0.036	0.004	-0.089	0.046
Efficacy Expressive Suppression	-0.126	-0.124	-0.023	-0.076
Adaptive Cognitive ER strategies	-0.053	0.016	-0.115	-0.205
Adaptive Behavioural ER strategies	-0.205	-0.202	-0.097	**-.287***
Maladaptive Cognitive ER strategies	**.312***	-0.132	**.332****	**.439****
Maladaptive Behavioural ER strategies	**.408****	**.394****	**.560****	**.471****
Autistic Traits	0.214	**.332***	**.479****	**.455****
Anxiety	**.459****	**.304***	**.462****	**.376****
Depression	**.431****	0.235	**.336****	**.340****
Social Anxiety	**.300***	0.003	**.273***	**.317****

*Note: **. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

The comparison shows slightly different patterns of association of alexithymia with the selected measures across the groups. The observed patterns in the ASD females group displayed the most noticeable distinction while remaining more like those observed in the analyses of the entire sample for non-ASD males and females and ASD males. However, autistic traits were positively correlated with alexithymia in males and females in the non-ASD group and ASD females group. At the same time, this association did not reach statistical significance in the ASD males group. Therefore, autistic males may present with autistic traits regardless of their levels of alexithymia, while for the other three groups, including ASD females, this association was more pronounced. Interestingly, a positive

association between alexithymia and depression and social anxiety was found for all three groups except for ASD females, which may suggest that they may experience both these difficulties regardless of their ability to understand their emotional experiences.

6.4.3 Predictors of autistic traits and internalising issues, when accounted for alexithymia

In the next step, the analyses focused on assessing if alexithymia is a significant predictor for autistic traits and anxiety, depression, and social anxiety in both ASD and non-ASD groups. Eight hierarchical regressions were run with sex and alexithymia included in the two consecutive steps, followed by the ES and CR subscales of the ERQ in step three, adaptive and maladaptive cognitive ER strategies in step four, and adaptive and maladaptive behavioural ER strategies in the fifth step. The assumptions for hierarchical regressions were confirmed in the same way as described in Chapter 5.

6.4.3.1 Predictors of autistic traits

Similarly to the results presented in Chapter 5 (from sample 2), sex was not a significant predictor for autistic traits in either group in sample 3. However, when alexithymia was added to the model, it was a significant positive predictor of autistic traits in both ASD and non-ASD groups, and its inclusion in the second step improved both models significantly (ASD: $F change_{(1,103)} = 11.344$, $p = .001$; non-ASD: $F change_{(1,129)} = 37.493$, $p < .001$). Surprisingly, it was the only significant predictor of autistic traits in ASD. In Step 2, the inclusion of alexithymia accounted for an additional 9.9% on its own, compared with the 14.2% accounted for by the whole model in the previous chapter. In the final step, the overall model explained 13.6% of the total variance in autistic traits in the ASD group, similar to the sample 2 results as discussed in Chapter 5 (14.2%).

In contrast, in the non-ASD group, while alexithymia remained a significant predictor of autistic traits throughout, the inclusion of the ERQ subscales significantly improved the model. Moreover, ES and behavioural maladaptive ER strategies also significantly predicted variance in autistic traits, even when controlling for alexithymia, which aligned with the findings from the sample 2 analysis (see Chapter 5).

In the non-ASD group, alexithymia and ER explained 34% of the variance in autistic traits, a noticeable increase from the previous result reported in Chapter 5 for this group (15.1%). But most strikingly, including alexithymia in Step 2, the variance the model explained 22.8% has already exceeded the total variance accounted for in the previous model. This suggests that alexithymia on its own is a strong predictor for autistic traits in the non-ASD group.

Table 4. Hierarchical regression model for predictors of autistic traits in the ASD and non-ASD group

Autistic Traits	**ASD (N=106)**					**Non-ASD (N=132)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.001					.003				
Sex			.259	.850	.030			.613	1.014	.053
Step 2	**.100**	**.099**				**.228**	**.225**			
Sex			.149	.811	.017			.502	.896	.043
Alexithymia			**.118**	**.035**	**.315**			**.227**	**.037**	**.474**
Step 3	.104	.004				**.285**	**.057**			
Sex			.209	.845	.024			1.205	.940	.104
Alexithymia			**.113**	**.036**	**.302**			**.176**	**.041**	**.368**
ERQ CR			.001	.058	.001			.046	.069	.052
ERQ ES			.045	.071	.061			**.303**	**.099**	**.267**
Step 4	.120	.016				.314	.029			
Sex			.036	.859	.004			.815	.946	.070
Alexithymia			**.115**	**.036**	**.308**			**.135**	**.044**	**.282**
ERQ CR			.031	.069	.052			.061	.077	.070
ERQ ES			.048	.071	.066			**.335**	**.101**	**.296**
CERQ adaptive			-.205	.190	-.125			-.112	.238	-
CERQ maladaptive			-.151	.173	-.084			**.528**	**.238**	**.186**
Step 5	.136	.016				.340	.026			
Sex			.061	.860	.007			.837	.935	.072
Alexithymia			**.106**	**.039**	**.284**			**.111**	**.046**	**.231**
ERQ CR			.030	.069	.051			.095	.078	.108
ERQ ES			.044	.088	.060			**.231**	**.113**	**.204**
CERQ adaptive			-.298	.210	-.182			-.081	.260	-
CERQ maladaptive			-.176	.175	-.098			.346	.250	.122
BERQ adaptive			.201	.217	.113			-.166	.211	-
BERQ maladaptive			.160	.156	.121			**.373**	**.179**	**.200**

6.4.3.2 Predictors of social anxiety

In the ASD group, sex was not a good predictor for social anxiety, and surprisingly, neither was alexithymia. When controlling for sex, alexithymia, and ER, the maladaptive cognitive ER strategies were the strongest positive predictor of social anxiety and accounted for 43.8% of the variance in the ASD group. This is in contrast to previous sample analyses (Chapter 5), where sex and maladaptive behavioural ER strategies were the most potent positive predictors in this group, and the total variance explained was only 15%.

Sex (being a female) was a strong positive predictor of social anxiety in the non-ASD group only within this sample, in contrast to the results of the previous sample analysis, where this factor was significant in both groups. Alexithymia was a strong positive predictor of social anxiety only in the non-ASD group until broader cognitive ER strategies were included in the model. At last, in the non-ASD group, being female and cognitive maladaptive ER strategies were the strongest predictors of social anxiety, which aligned with the previous sample analysis. The total variance of social anxiety explained by sex, alexithymia and ER in the non-ASD group was 32.6%, an increase compared to results from the previous chapter, which was 25.1%. See Table 5 for a full model comparison.

Table 5. Hierarchical regression model for predictors of social anxiety in the ASD and non-ASD group

Social Anxiety	**ASD (N=106)**					**Non-ASD (N=132)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.022					**.103**				
Sex			3.831	2.50	.149			**7.994**	**2.06**	**.321**
Step 2	.044	.022				**.174**	**.071**			
Sex			3.678	2.48	.143			**7.859**	**1.99**	**.316**
Alexithymia			.164	.107	.148			**.274**	**.082**	**.266**
Step 3	**.126**	**.082**				.182	.008			
Sex			2.199	2.48	.085			**7.542**	**2.16**	**.303**
Alexithymia			.107	.107	.097			**.305**	**.094**	**.296**
ERQ CR			**-.508**	**.171**	**-**			-.090	.159	-.047
ERQ ES			.225	.210	.103			-.214	.227	-.088
Step 4	**.423**	**.297**				**.313**	**.131**			
Sex			2.235	2.06	.087			**5.668**	**2.03**	**.228**
Alexithymia			.091	.088	.082			.133	.095	.129
ERQ CR			-.270	.165	-.153			.082	.166	.043
ERQ ES			.221	.172	.102			-.139	.218	-.057
CERQ adaptive			-.379	.457	-.078			**-1.174**	**.512**	**-.198**
CERQ maladaptive			**2.916**	**.417**	**.544**			**2.173**	**.512**	**.356**
Step 5	.438	.016				.326	.013			
Sex			2.266	2.06	.088			**5.701**	**2.03**	**.229**
Alexithymia			.044	.094	.039			.097	.099	.094
ERQ CR			-.263	.165	-.149			.133	.169	.070
ERQ ES			.108	.210	.050			-.300	.245	-.123
CERQ adaptive			-.489	.504	-.100			**-1.107**	**.565**	**-.187**
CERQ maladaptive			**2.812**	**.421**	**.525**			**1.897**	**.543**	**.311**
BERQ adaptive			.175	.521	.033			-.285	.457	-.059
BERQ maladaptive			.605	.373	.153			.556	.388	.138

6.4.3.3 Predictors of anxiety

In the ASD group, sex was not a significant predictor of anxiety. Including alexithymia in the second step improved the model significantly ($F change_{(1,103)} = 17.135$, $p < .001$) in the ASD group. Alexithymia was a strong predictor of anxiety throughout all steps, along with maladaptive cognitive and behavioural ER strategies. Compared with the previous sample analysis (see Chapter 5), the most stand-out difference is that when accounted for, sex, alexithymia and ER, the strongest predictors of anxiety in the ASD group were alexithymia and maladaptive cognitive and even the maladaptive behavioural ER strategies, which were not a significant predictor in the sample 2 ASD group in Chapter 5, where the model was done without alexithymia.

In the non-ASD group, being a female was a significant predictor of anxiety ($F_{(1,130)} = 3.754$, $p = .05$) along with alexithymia, which improved the model significantly ($F change_{(1,129)} = 26.300$, $p < .001$). Interestingly, sex was a significant predictor for anxiety until broader cognitive ER strategies were included in the model, while alexithymia was no longer a significant predictor for anxiety in the non-ASD group after behavioural adaptive and maladaptive ER strategies were added.

The final models explained 33.2% of the total variance in anxiety in the ASD group and 31.3% in the non-ASD group, which shows an increase in the explained variance compared with the previous sample analyses, 25.1% and 23%, respectively. See Table 6 for a full model comparison.

Table 6. Hierarchical regression model for predictors of anxiety in the ASD and non-ASD group

Anxiety	**ASD (N=106)**					**Non-ASD (N=132)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.000					**.028**				
Sex			.196	.965	.020			**1.400**	**.723**	**.168**
Step 2	**.143**	**.143**				**.193**	**.165**			
Sex			.047	.898	.005			**1.332**	**.661**	**.159**
Alexithymia			**.160**	**.039**	**.378**			**.140**	**.027**	**.406**
Step 3	.159	.016				.195	.002			
Sex			-.279	.929	-.028			**1.442**	**.721**	**.172**
Alexithymia			**.158**	**.040**	**.372**			**.136**	**.031**	**.394**
ERQ CR			-.084	.064	-.124			-.027	.053	-.042
ERQ ES			-.027	.078	-.032			.009	.075	.011
Step 4	**.291**	**.132**				**.299**	**.104**			
Sex			-.051	.874	-.005			.996	.690	.119
Alexithymia			**.152**	**.037**	**.358**			**.079**	**.032**	**.229**
ERQ CR			-.077	.070	-.114			-.046	.056	-.073
ERQ ES			-.031	.073	-.038			.078	.074	.095
CERQ adaptive			.190	.193	.102			.115	.174	.058
CERQ			**.749**	**.176**	**.366**			**.741**	**.174**	**.362**
Step 5	.332	.041				.313	.014			
Sex			-.029	.858	-.003			1.007	.689	.120
Alexithymia			**.123**	**.039**	**.291**			.065	.034	.189
ERQ CR			-.073	.069	-.108			-.036	.057	-.057
ERQ ES			-.097	.087	-.116			.057	.083	.070
CERQ adaptive			.113	.210	.061			.035	.192	.018
CERQ			**.685**	**.175**	**.335**			**.678**	**.184**	**.331**
BERQ adaptive			.132	.217	.065			.103	.155	.063
BERQ			**.372**	**.155**	**.247**			.182	.132	.135

6.4.3.4 Predictors of depression

In the ASD group, sex on its own was not a significant predictor of depression. Including alexithymia in the second step improved the model significantly in the ASD group ($F change_{(1,103)} = 12.134$, $p = .001$), and alexithymia was a strong predictor of depression until behavioural ER strategies were accounted for in the last step. Interestingly, in the ASD group, sex became a negative significant predictor of depression when ER regulation strategies (CR and ES) were accounted for in step 3. Being male (negative predictor) was a significant predictor for depression in the ASD group, along with alexithymia and ER regulation till the end. In the last step, only sex was a significant negative predictor of depression, along with adaptive and maladaptive behavioural ER strategies.

While in the non-ASD group, sex was not a significant predictor of depression. Including alexithymia in the second step improved the model significantly ($F change_{(1,129)} = 18.312$, $p < .001$). The strongest predictors for depression were ES and maladaptive cognitive ER strategies. Alexithymia, sex, and ER explained the total of 42% in the total variance of depression in the ASD group, which was noted as an increase from the previous sample analyses (39%). In contrast, in the non-ASD group, the total variance in depression explained by this model was 29.6%, thus less than the results reported in Chapter 5 for the non-ASD group, 38.2%. See Table 7 for a full model comparison.

Table 7. Hierarchical regression model for predictors of depression in the ASD and non-ASD group

Depression	**ASD (N=106)**					**Non-ASD (N=132)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.015					.010				
Sex			-1.109	.881	-.123			-.716	.610	-.102
Step 2	**.119**	**.104**				**.133**	**.123**			
Sex			-1.226	.838	-.136			-.765	.573	-.109
Alexithymia			**.126**	**.036**	**.322**			**.102**	**.024**	**.351**
Step 3	**.264**	**.145**				**.178**	**.045**			
Sex			**-1.685**	**.799**	**-.186**			-.154	.609	-.022
Alexithymia			**.092**	**.034**	**.236**			**.070**	**.026**	**.243**
ERQ CR			**-.203**	**.055**	**-.327**			-.072	.045	-.135
ERQ ES			**.192**	**.067**	**.251**			**.138**	**.064**	**.202**
Step 4	**.352**	**.088**				**.272**	**.094**			
Sex			**-2.005**	**.769**	**-.222**			-.518	.588	-.074
Alexithymia			**.093**	**.033**	**.238**			.024	.028	.085
ERQ CR			-.095	.062	-.153			-.084	.048	-.158
ERQ ES			**.197**	**.064**	**.258**			**.191**	**.063**	**.280**
CERQ adaptive			**-.470**	**.170**	**-.275**			.072	.148	.043
CERQ maladaptive			**.334**	**.155**	**.178**			**.593**	**.148**	**.346**
Step 5	**.427**	**.076**				.296	.024			
Sex			**-2.053**	**.731**	**-.227**			-.507	.583	-.072
Alexithymia			.058	.033	.149			.009	.028	.032
ERQ CR			-.083	.059	-.134			-.074	.049	-.139
ERQ ES			.045	.074	.058			**.171**	**.070**	**.249**
CERQ adaptive			-.276	.179	-.162			-.021	.162	-.013
CERQ maladaptive			.276	.149	.147			**.525**	**.156**	**.306**
BERQ adaptive			**-.513**	**.185**	**-.275**			.123	.131	.090
BERQ maladaptive			**.282**	**.132**	**.204**			.198	.111	.175

6.5 Discussion

As expected, ASD participants reported higher levels of alexithymia than the non-ASD group. Research consistently shows that alexithymia is more prevalent in individuals with ASD than in the general population. For instance, studies estimate that around 50% of autistic individuals present with high levels of alexithymia, compared to about 10% in the general population (Cai et al., 2020). This high co-occurrence suggests that alexithymia may be a significant factor in the emotional and social difficulties experienced by those with ASD.

While alexithymia is more common in individuals with ASD, it is considered a separate construct. Not all individuals with ASD have alexithymia, and vice versa. This distinction is crucial for appreciating the diversity within the ASD population and for tailoring interventions accordingly. Alexithymia appears to exacerbate the social and emotional challenges associated with ASD. For example, individuals with both ASD and alexithymia often face more severe difficulties in empathy, emotional regulation, and social communication than those with ASD alone (Bird & Cook, 2013; Oakley et al., 2016; Milosavljevic et al., 2016). Research indicates that alexithymia may contribute more to these challenges than the core traits of ASD themselves (Cook et al., 2013; Kinnaird et al., 2019; Mazefsky & White, 2014; Milosavljevic et al., 2016).

The finding of no sex differences in the alexithymia levels in both ASD and non-ASD groups was surprising. While it is more commonly seen that there are no sex differences in alexithymia levels within clinical samples compared to the general population, the literature regularly reports higher levels of alexithymia in men. Refer to Levant et al., 2006 and 2009 for a comprehensive review. However, the absence of sex differences in alexithymia levels within both ASD and non-ASD groups may indicate that alexithymia might be a universal characteristic in terms of sex, particularly in the context of autistic trait levels. It also underscores the importance of understanding alexithymia as a distinct phenomenon that transcends typical sex-related patterns of emotional processing.

Autistic traits were positively linked with alexithymia in both the non-ASD males and females and ASD female groups but not in ASD males. Therefore, autistic males may exhibit autistic symptoms regardless of their levels of alexithymia, but this link is more prominent in the other groups, suggesting that ASD females, who have better abilities to recognise their emotions, could present with fewer autistic traits. Furthermore, this finding highlights the importance of considering sex differences when diagnosing and treating ASD. The traditional diagnostic criteria and therapeutic approaches have often been based on male presentations of autism, potentially leading to underdiagnosis or misdiagnosis in females. Understanding that ASD females may exhibit fewer

autistic traits when they have better emotional recognition abilities suggests a need for more tailored diagnostic criteria that account for these differences. This means that diagnosing clinicians should be aware of how alexithymia can influence the presentation of autistic traits in males and females. Additionally, therapeutic approaches for ASD females might benefit from incorporating strategies to improve emotional awareness and expression, which could help reduce the severity of autistic symptoms. On the other hand, interventions for ASD males might need to focus more on the core characteristics of ASD, as their autistic traits may be less influenced by their levels of alexithymia.

Interestingly, the positive association between alexithymia and depression and social anxiety was found for all three groups except for ASD females, which may suggest that difficulties in understanding emotions are not central to the occurrence of depression/social anxiety in this group. The general association between alexithymia and both depression and social anxiety across most groups aligns with existing literature that links difficulties in emotional processing with higher rates of these mental health issues (Beck et al., 2020; Morie et al., 2019; Pandey & Choubey, 2010). Alexithymia, characterised by an inability to identify and describe emotions, can hinder effective emotional regulation, leading to increased vulnerability to depression and social anxiety. This is understandable as individuals who struggle to understand their own emotions might find it more challenging to cope with stressors and social interactions, which are often triggers for depression and social anxiety. However, the lack of this association in ASD females may suggest a distinct psychological profile within this subgroup. It is possible that, for ASD females, depression and social anxiety may not stem primarily from their difficulties in understanding and processing emotions.

This finding is important because it highlights the possibility that other factors might play a more central role in the development of depression and social anxiety in ASD females. Therefore, independently of alexithymia, these other factors, like, for example, self-esteem, social expectations, experiences of social exclusion, or heightened sensitivity to social rejection and/or camouflaging of autistic traits, can contribute to mental health issues in autistic females without ID, as already mentioned in Chapter 1. Additionally, this result highlights the importance of considering sex differences in both research and treatment of mental health issues within the ASD population. Historically, much of the research on ASD has focused on males, leading to a potential oversight of the unique experiences of females with ASD. Therefore, recognising that the mental health profile of ASD females may differ from both non-ASD individuals and ASD males underscores the need for inclusive and sex-specific therapeutical and research approaches. Exploring the broader psychosocial context in which ASD individuals live could shed light on the factors influencing their mental health and our understanding of sex differences in that area. Research can examine the impact of family dynamics, social support, and community engagement on emotional well-being and mental health,

as well as the role of educational and occupational environments in mitigating or exacerbating mental health challenges.

Alexithymia, when included in all four models along with sex, explained between 2%-22% of the variance in dependent variables with higher percentage values in the non-ASD group. In the non-ASD group, the higher percentage of variance explained by alexithymia suggests that emotional processing difficulties are a more substantial factor in influencing dependent variables such as mental health outcomes, social functioning, or quality of life. Alternatively, in the ASD group, the lower percentage of variance explained by alexithymia may suggest a more complex interplay of factors influencing the dependent variables. While alexithymia is certainly relevant, other core characteristics of ASD, such as social communication difficulties, repetitive behaviours, and sensory sensitivities, may likely play a more dominant role in shaping outcomes. This finding supports the need for multifaceted approaches to understanding and addressing the needs of individuals with ASD. It suggests that while addressing alexithymia is important, it should be part of a broader strategy that also targets other core and co-occurring features of ASD.

Alexithymia was found to be a significant predictor of both autistic traits and internalising issues within both the ASD and non-ASD groups, except for social anxiety in the ASD group. Therefore, alexithymia appears to influence the manifestation of autistic traits and internalising problems such as depression and general anxiety in both groups. This indicates that emotional processing difficulties are a common factor contributing to these issues, in both autistic and non-autistic samples. In the general population, individuals with higher levels of alexithymia may experience more pronounced autistic-like traits and internalising problems, possibly because their inability to understand and express emotions may lead to increased psychological distress and social difficulties. In the ASD population, the significant prediction of autistic traits and internalising issues by alexithymia may highlight the additional burden that emotional processing difficulties impose on autistic individuals. For people with ASD, who already face many challenges in social communication and behaviour, the presence of alexithymia can exacerbate these difficulties and may potentially lead to greater internal distress and more pronounced autistic traits. This suggests that addressing alexithymia in therapeutic settings could potentially alleviate some of the broader challenges associated with ASD, improving the overall functioning and well-being of autistic individuals.

However, the exception of social anxiety in the ASD group is particularly noteworthy. Unlike other internalising issues, social anxiety in individuals with ASD was not significantly predicted by alexithymia. This finding implies that the factors contributing to social anxiety in ASD are distinct and perhaps more complex than in the general population. Social anxiety in ASD may be more directly related to core features of the disorder, such as difficulties with social communication, sensory sensitivities, and possibly negative past social experiences rather than emotional processing deficits

per se. This finding suggests that interventions for social anxiety in the ASD population might need to focus more on improving social skills, enhancing social support, and addressing specific anxiety triggers rather than solely focusing on emotional awareness and expression.

Finally, it is important to notice similarities and differences in the ER strategies, highlighted between hierarchical regressions done within this and previous chapter, remembering that both analyses were conducted with different sample participants (sample 2 in Chapter 5 and sample 3 in this chapter). Including alexithymia in the analyses done on sample 3, while explaining additional variance in the models, did not overshadow the significance of emotion regulation and its predictive role for autistic traits and internalising issues across both groups. Most of the outcomes were consistent with the results of the hierarchical regression done on sample 2 in the previous chapter. This consistency suggests that ER strategies maintain their significant predictive power for autistic traits and internalising issues, however, there were some notable exceptions.

In the model predicting anxiety, an interesting difference emerged regarding maladaptive ER strategies in the ASD group. With alexithymia included, cognitive and behavioural maladaptive ER strategies became a strong positive predictor for anxiety (along with alexithymia) in the ASD group, whereas these strategies were not a significant predictor in the ASD group in Chapter 5's model without alexithymia, where infrequent use of cognitive adaptive and frequent use of cognitive reappraisal, along with sex were the strongest predictors. This shift in predictive factors may suggest several potential reasons. First, alexithymia might amplify the impact of maladaptive ER strategies in individuals with ASD. Autistic individuals with alexithymia struggle to identify and describe their emotions, which may lead them to rely more heavily on maladaptive strategies, such as avoidance, withdrawal, or rumination. These strategies are typically ineffective at reducing anxiety and can actually increase it, particularly when individuals are unable to process their emotions effectively. Therefore, when alexithymia is included in the model, it highlights the significant role these maladaptive strategies may play in contributing to anxiety. Second, including alexithymia may overshadow the effects of cognitive adaptive strategies and cognitive reappraisal that were significant in the previous model. Alexithymia may potentially be so influential that it changes the relative importance of other predictors. When alexithymia is not accounted for, the ability to use cognitive adaptive strategies and frequent reappraisal might appear more critical because they are among the few available tools individuals use to manage anxiety. However, when alexithymia is considered, it becomes clear that emotional processing difficulties are a more central issue, shifting the focus to how maladaptive strategies are employed when adaptive ones fail. Third, the inclusion of alexithymia might indicate a more complex interaction between ER strategies and anxiety. For individuals with ASD, the presence of alexithymia might mean that even when they attempt to use adaptive cognitive strategies, their effectiveness is undermined by their fundamental difficulties with emotion

processing. This could explain why maladaptive strategies emerge as significant predictors when alexithymia is included: autistic individuals might default to maladaptive behaviours because their cognitive strategies are not effectively mitigating their anxiety.

Additionally, in the ASD group, sex became a significant negative predictor of depression when ER strategies (cognitive reappraisal and expressive suppression) were accounted for in step 3. Being male was a significant predictor of depression, unlike in the previous chapter (sample 2), where being female in the ASD group was a significant predictor of higher depression levels. This shift implies that when accounting for ER strategies and alexithymia, males in the ASD group may present with higher levels of depression. In the final step, only sex (being male) remained a significant negative predictor of depression, along with maladaptive cognitive and behavioural ER strategies, highlighting the complex interplay of these factors. Again, several potential reasons for this difference need to be considered. Firstly, including ER strategies and alexithymia may reveal underlying emotional regulation difficulties that are more pronounced in males with ASD. For example, autistic males might struggle more with identifying and expressing emotions, a characteristic of alexithymia, which could exacerbate depression when these difficulties are considered. Secondly, males may be more likely to use maladaptive ER strategies, such as suppression or avoidance, which are ineffective and can contribute to higher levels of depression. Thirdly, the previous model might have underestimated the complexity of emotional regulation and potential sex differences in autistic individuals in that matter. Without considering alexithymia, the role of ER strategies might have seemed more critical for females. However, once alexithymia is included, it becomes clear that males who struggle with both emotion identification and regulation may be at a higher risk for depression, highlighting the importance of these factors in understanding their mental health. Moreover, the shift to males being significant predictors of depression when ER strategies and alexithymia are considered may suggest that sex may play a more significant role in the development of depression within the ASD population. This indicates that gender differences in emotional regulation and processing are crucial factors to consider.

Finally, changes in societal conditions, interventions, or cultural shifts over time may influence the relationship between variables explored by hierarchical regression models. It is essential to state that sample 2 (discussed in Chapter 5) engaged in the research during the global pandemic times (Covid-19), which has been a stressful time for most people and its impact on the general well-being of the population and increased rates of internalising issues like anxiety, depression and social anxiety has been widely researched (Dettmann et al., 2023 for a review). These time effects could lead to differences in the explained variance between the two samples. Furthermore, including an additional predictor in the second sample may introduce interaction effects or complex relationships among the

variables. These interactions can alter the overall variance explained by the model and potentially result in a decrease compared to the first sample.

Future research should continue to explore these dynamics, particularly the differential impact of alexithymia and ER strategies on anxiety and depression across ASD and non-ASD groups. Longitudinal studies could provide insights into how these relationships evolve over time and the long-term effectiveness of various interventions. Additionally, examining other internalising issues and their relationship with alexithymia and ER strategies can provide a more comprehensive understanding of the emotional and psychological challenges faced by individuals with and without ASD.

6.6 Strengths and Limitations

This study inevitably increased our understanding of alexithymia's role in the sex and group differences observed in previous studies in both ER and internalising issues. One of the primary strengths of this study is the inclusion of multiple factors, such as ER strategies, alexithymia, and sex differences, which provides a nuanced understanding of predictors for autistic traits, social anxiety, depression and anxiety in both ASD and non-ASD groups. Another strength is the detailed regression analysis used to explore the predictive roles of these various factors. This method allows for a clearer understanding of how each variable contributes to mental health outcomes, particularly the role of alexithymia and ER strategies. The study's focus on sex and group differences is also crucial, as it helps identify potential gender-specific challenges and inform targeted interventions. Moreover, by considering multiple types of ER strategies, both cognitive and behavioural, the study provides a comprehensive view of their impact on mental health.

However, the study has some limitations. For example, it employs a cross-sectional design, which limits the ability to draw causal inferences. Longitudinal studies would be necessary to determine how alexithymia and ER strategies influence the development of depression and anxiety over time. Relying on online questionnaires may restrict participation, potentially affecting sample variability. Moreover, those struggling with internalising issues might be less inclined to partake in online surveys. Additionally, comparisons of the hierarchical regressions that resulted from this chapter and the previous chapter were only attempted using descriptive and not statistical analyses. Therefore, while the differences in patterns observed are interesting, future research could address this limitation on larger and more diverse samples that might allow the inclusion of non-binary participants. Therefore, the results of these comparisons should be treated with caution.

Chapter 7 – Camouflaging of autistic traits, in relation to emotional expressivity and self-esteem

As discussed in Chapter 1, females with ASD, especially those without intellectual disabilities (ID), are typically diagnosed later – if at all and experience higher rates of co-occurrent internalising issues (like anxiety, depression, and social anxiety), which has also been noted in this thesis. As discussed in Chapter 2, however, this research has identified limited significant sex differences in the presentation of autistic traits between males and females in these samples. However, some notable differences were found in the frequency and efficiency of using emotion regulation by males and females with and without ASD. This would suggest that potentially different coping mechanisms rather than specific autistic traits might be accountable for the fact that females with ASD are less often identified during diagnostic processes.

7.1 Introduction

7.1.1 Camouflaging and its association with mental health

As discussed in Chapter 1, camouflaging is the effortful task of hiding or disguising one's true identity, thoughts, or feelings to navigate social interactions and build relationships. For individuals with autism spectrum disorder (ASD), camouflaging is particularly significant as it involves concealing social and communication difficulties to appear more “typical” to others (Halladay et al., 2015; Hull et al., 2017; Lai et al., 2017). Therefore, camouflaging is considered a coping mechanism frequently reported by autistic people that allows them to hide the visible expressions of autistic traits. As it often works well in certain environments, like schools or workplaces, it may be considered an adaptive mechanism that allows individuals to pursue their goals successfully. This temporary alignment with societal expectations can, in that moment, boost self-esteem by providing a sense of accomplishment and societal approval.

However, previous research shows that camouflaging comes at a significant cost to autistic individuals as it is often exhausting and associated with feelings of stress, anxiety, sadness, and identity confusion

(Bargiela et al., 2016; Hull et al., 2017; Tierney et al., 2016). Studies show that camouflaging is associated with higher rates of anxiety, depression, and suicidality among autistic individuals (Cage & Troxell-Whitman, 2019; Cassidy et al., 2018; Livingston et al., 2019). Therefore, it may be one factor that makes autistic people more vulnerable to mental health problems and low self-esteem development in the long run, as autistic individuals who often rely on camouflaging report feeling that their true selves are invalid or unacceptable, which can severely undermine self-esteem (Hull et al., 2017). Moreover, camouflaging can delay or prevent diagnosis and appropriate support, further exacerbating feelings of inadequacy and low self-worth (Bargiela et al., 2016).

Studies suggest that effective emotion regulation can mitigate some of the negative psychological impacts of camouflaging (Tierney et al., 2016; Hull et al., 2017). While emotion regulation and camouflaging are both strategies people use to manage their behaviours and emotions, it is important to specify these are two separate constructs that serve different purposes and operate in distinct ways. Emotion regulation is aimed at managing individuals' internal emotional state for their own well-being, focusing on how they feel inside. On the other hand, camouflaging is about changing one's external behaviour to meet social norms and focuses on how the individual appears to others. Therefore, while everyone may engage in camouflaging to a certain degree, it is more specific to people who feel their natural behaviours might not be socially accepted.

References to autistic camouflaging have already been used to explain the gender gap in diagnosis in 1981 by Lorna Wing, who proposed that clinical examinations might overlook some autistic females without cognitive problems due to camouflaging and females presenting as having higher social and communication skills. Since then, camouflaging has been studied mainly by narrative interviews and accounts of autistic individuals until recently, when the Camouflaging Autistic Traits Questionnaire (CAT-Q) was developed by Hull and colleagues (2019), allowing for quantitative exploration of the construct. This questionnaire includes three subscales that measure different aspects of camouflaging behaviours: compensation, masking and assimilation. Compensation describes behaviours individuals use to compensate for their social difficulties. Examples include copying body language or facial expressions and explicitly researching social interaction rules to blend in better socially. Masking behaviours are aimed at hiding autistic traits and presenting a less autistic persona. It includes actions such as monitoring one's facial expressions to appear relaxed and being acutely aware of the impression they make on others. Finally, behaviours used to fit in with others without revealing discomfort allow assimilation. This involves putting on an act or creating a new persona, essentially 'performing' rather than being themselves to be accepted socially (See Cook et al., 2021 for a detailed review of camouflaging strategies).

7.1.2 Sex differences in camouflaging behaviours

As previously discussed in Chapter 1, the relationship between sex and gender and camouflaging in autistic individuals is debated (Fombonne, 2020; Lai et al., 2021; Pearson & Rose, 2021). It is often suggested that women are better at using camouflaging as a coping mechanism, which can lead to missed or late diagnoses in this group (Duvekot et al., 2017; Shattuck et al., 2009; Whitlock et al., 2020). Interestingly, previous research indicated that the associations between camouflaging and negative mental health outcomes were more pronounced in autistic men compared to autistic women (Lai et al., 2017). One possible reason for this could be differences in social expectations and support systems for men and women. Women are often socialised to be more socially aware and skilled at navigating complex social interactions, which might make camouflaging a more familiar and practised behaviour for them. Consequently, women may develop more effective strategies for camouflaging, thereby reducing the immediate mental health impacts. In contrast, men may not have the same social conditioning or support to develop these skills, potentially leading to greater stress and mental health challenges when they attempt to camouflage. Additionally, societal expectations of men to be less emotionally expressive could increase the internal stress experienced when trying to mask their autistic traits.

Multiple studies exploring sex differences in autistic individuals point towards the idea of camouflaging autistic traits as a potential factor contributing to different presentations of autism in females. Autistic females often report using compensatory behaviours to mask their social communication needs. For example, they may stay in close proximity to other girls so they can appear as part of a social group without being fully integrated. This contrasts with autistic males, who are more likely to wander alone and thus are more conspicuous and receive more support (Dean et al., 2017; Kasari et al., 2016; Myles et al., 2019). Autistic females often report consciously camouflaging to avoid appearing different, avoid bullying and make friends, and they may develop strategies, scripts, or personas for social situations through research or observation (Bargiela et al., 2016; Cook et al., 2018; Cridland et al., 2014; Hull et al., 2017, 2019, 2020; Logsden, 2010; Milner et al., 2019; Tierney et al., 2016). Additionally, they might automatically mimic others, such as copying body language and accents, to fit in (Bargiela et al., 2016; Hull et al., 2017).

It is also essential to recognise that autism is often considered a spectrum of traits that can be present across the general population (Robinson et al., 2016). While current evidence consistently shows that autistic individuals report camouflaging more frequently than matched control samples (Hull et al., 2019), not all autistic individuals engage in camouflaging behaviours, and often individual differences

like sex/gender, and the levels of autistic traits are considered as factors contributing to these variations (Cook et al., 2021). Thus, it is important to explore how camouflaging differs based on autism diagnosis and the presence of autistic traits in those without a diagnosis (Robinson et al., 2016; Hull et al., 2017). Additionally, it is important to examine if the potential links between camouflaging and factors such as emotion regulation, alexithymia, and internalising issues vary for males and females. Understanding these associations in the general population can help determine whether differences in the presentation of autistic traits are specific to sex or diagnosis.

7.2 Aims and hypotheses

Therefore, this study will investigate how camouflaging tendencies in males and females with and without ASD relate to emotion regulation, alexithymia, emotional expressivity, and internalising issues while also assessing its potential impact on their self-esteem. The study seeks to investigate whether there are sex differences in camouflaging behaviours among individuals with and without ASD to help us understand if both sexes equally frequently apply this coping mechanism within these groups. By incorporating measures of internalising issues, the study aims to comprehensively understand the interplay between camouflaging tendencies, psychological well-being, and sex differences in individuals with and without ASD.

Therefore, the specific research questions this study addresses are:

RQ1. Are there sex differences in self-reported camouflaging behaviours scores between adult males and females with and without ASD? Hypotheses: 1a) As discussed in Chapter 1, previous research suggests that camouflaging behaviours may be more prevalent in females than males, regardless of ASD diagnosis. Therefore, it was expected that females, both with and without ASD, would report higher levels of camouflaging behaviours than males; 1b) Camouflaging is more often reported in individuals with ASD. Thus, it was expected that individuals with ASD would report higher levels of camouflaging behaviours than non-ASD individuals, irrespective of their sex.

RQ2. Is camouflaging associated with autistic traits, internalising issues, self-esteem, emotional expressivity, and alexithymia? Are these associations the same across the groups? Hypotheses: 2a) Camouflaging was expected to be positively related to autistic traits and internalising issues within the whole sample. When split by sex and group, positive associations between all three internalising issues measures were expected to be found, especially in the ASD females group; 2b) Camouflaging was expected to show a negative association with self-esteem within the whole sample, and again, it was presumed this relation would be sustained in both ASD males and females due to low self-esteem

issues frequently reported in this population, as discussed in Chapter 1; 2c) It was hypothesised that camouflaging would negatively correlate with emotional expressivity; 2d) Finally, camouflaging was expected to show a positive correlation with alexithymia, and this association was expected to be more pronounced in ASD males and females. As discussed in Chapter 6, males and females with ASD reported higher levels of alexithymia within this sample than the non-ASD group.

RQ3. Is camouflaging and self-esteem particularly associated with all adaptive or maladaptive cognitive and behavioural ER strategies measured by CERQ, BERQ and ERQ questionnaires? Are these relationships different for males and females with and without ASD? Hypotheses: 3a) For the whole sample analysis, camouflaging was expected to be negatively associated with adaptive cognitive ER strategies and positively associated with maladaptive cognitive ER strategies. In contrast, high self-esteem would have the opposite pattern. Specifically, it was predicted that in the whole sample, camouflaging would be positively associated, and high self-esteem negatively associated with two of the three adaptive behavioural ER strategies (actively approaching and seeking social support), withdrawal (behavioural maladaptive ER strategy), and expressive suppression; 3b) Due to limited research investigating sex differences in the relation between camouflaging, self-esteem and emotion regulation, forming any specific hypotheses for associations between these variables was challenging. However, it was hypothesised that the positive correlation between camouflaging and behavioural adaptive strategies (actively approaching and seeking social support), as well as camouflaging and rumination, would be observed in females. At the same time, a positive association between withdrawal and camouflaging was expected to be found in males. Sex differences in associations with self-esteem were left open to exploration.

RQ4. Are sex, autistic traits, self-esteem, alexithymia, internalising issues (social anxiety, anxiety, and depression), and these identified ER strategies associated with camouflaging good predictors for camouflaging behaviours? Are the same predictors significant in ASD and non-ASD groups? Hypotheses: 4a) Sex was expected to be significantly associated with the dependent variable and predict essential variance in camouflaging. It was also expected that consecutive steps, including autistic traits, self-esteem, alexithymia, internalising issues, and emotion regulation strategies, would improve each model in both groups and predict further variance in camouflaging; 4b) It was hypothesised that from within internalising issues (social anxiety, anxiety, and depression), social anxiety would be the strongest predictor for camouflaging within both groups; 4c) It was hypothesised that from emotion regulation strategies, expressive suppression and rumination would be the strongest predictors of camouflaging within both groups.

7.3 Methods

7.3.1 Participants

Sample 3 - 238 participants, ASD 106 (58 females, 48 males), non-ASD 132 (70 females, 62 males). Please see Chapter 2 for details.

7.3.2 Ethical approval

Aston University's Health and Life Sciences Research Ethics Committee assessed and approved the study (REC reference number: HLS21085).

7.3.3 Measures

The Camouflaging Autistic Traits Questionnaire (CAT-Q, Hull et al., 2019)

The CAT-Q questionnaire comprises 25 items that encompass various forms of camouflaging behaviours. Respondents use a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7), to indicate their agreement with each statement. The total score on the questionnaire ranges from 25 to 175, with higher scores indicating a greater degree of camouflaging behaviour. The total camouflaging score is a sum of three subscales: Compensation (9 items, i.e., "I have developed a script to follow in social situations"), Masking (8 items, i.e., "I adjust my body language or facial expressions so that I appear relaxed"), and Assimilation (8 items, i.e., "When in social situations, I try to find ways to avoid interacting with others"). The total scale of the CAT-Q demonstrated high internal consistency with a Cronbach's alpha coefficient of 0.94; additionally, the Assimilation factor (α=0.92), Compensation factor (α=0.91), and Masking factor (α=0.85) all showed good internal consistency (Hull et al., 2019).

The Rosenberg Self-Esteem Scale (RSE, Rosenberg, M., 1965)

The scale consists of 10 items designed to assess an individual's overall perception of themselves by capturing positive and negative feelings about the self. The scale is considered to measure a single underlying dimension (i.e., "I feel that I have a number of good qualities" and "I wish I could have more respect for myself" (reverse scored)). Participants respond to each item using a 4-point Likert scale, ranging from "strongly agree" to "strongly disagree."

The Berkeley Expressivity Questionnaire (BEQ, Gross & John, 1995)

The emotional expressivity scale consists of 16 items designed to measure an individual's expression of emotions. The scale is divided into three facets: Negative Expressivity (i.e., “People often do not know what I am feeling”), Positive Expressivity (i.e., “I am an emotionally expressive person”), and Impulse Strength (i.e., “I am sometimes unable to hide my feelings, even though I would like to”). Participants respond to each item using a 7-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

The Toronto Alexithymia Scale (TAS-20, Bagby, R. M., Parker, J. D. A. & Taylor, G. J., 1994)

The TAS-20 consists of 20 items, with three subscales: difficulty identifying feelings, difficulty describing feelings, and externally oriented thinking. Please see Chapter 6 for details.

The Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001)

The AQ is a 50-item questionnaire that measures traits associated with ASD. Please see Chapter 2 for details.

The Broad Autism Phenotype Questionnaire (BAPQ, Hurley et al., 2007)

The Broad Autism Phenotype (BAP) Questionnaire is a 36-item self-report questionnaire that refers to a range of traits and behaviours often presented by autistic individuals but milder in intensity. Please see Chapter 2 for details.

The Signposting Questionnaire for Autism (SQ-A Adult; Livingstone et al., 2023; manuscript in preparation)

The Signposting Questionnaire (SQ-A Adult) is an 18-item self-report questionnaire developed from the DISCO (Diagnostic Interview for Social and Communication Disorders; Leekam et al., 2002). Please see Chapter 2 for details.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003)

This 10-item self-report measure collected cognitive reappraisal (CR) and expressive suppression (ES) data. Please see Chapter 5 for details.

The Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001)

The CERQ consists of 36 items measuring nine 4-item dimensions, five of which are adaptive and four maladaptive. Please see Chapter 5 for details.

The Behavioural Emotion Regulation Questionnaire (BERQ - Kraaij and Garnefski, 2019)

The BERQ consists of 20 items measuring five dimensions/strategies, three of which are adaptive and two maladaptive. Please see Chapter 5 for details.

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is a 14-item self-report measure used to collect data about significant levels of anxiety and depression, with seven items on each scale. Please see Chapter 5 for details.

The Brief Fear of Negative Evaluation Scale (BFNES; Leary et al., 1983)

The BNFES is a 12-item self-report measure that assesses fear of negative evaluation, a characteristic feature of social anxiety. Please see Chapter 5 for details.

7.3.4 Analyses

The normality of the data was assessed and confirmed, as previously described in Chapter 2. To examine sex differences in camouflaging scores in the non-ASD and ASD populations, a bootstrapped univariate ANOVA was conducted. A multivariate ANOVA followed to assess sex and group differences for the three CAT-Q questionnaire subscales.

Bivariate correlation analyses with bootstrapping were performed to investigate the relationship between camouflaging, internalising issues, and alexithymia and between camouflaging and emotion regulation. Pearson's correlations test was reported for associations within the whole sample, then split by sex and groups to explore these relations within each group.

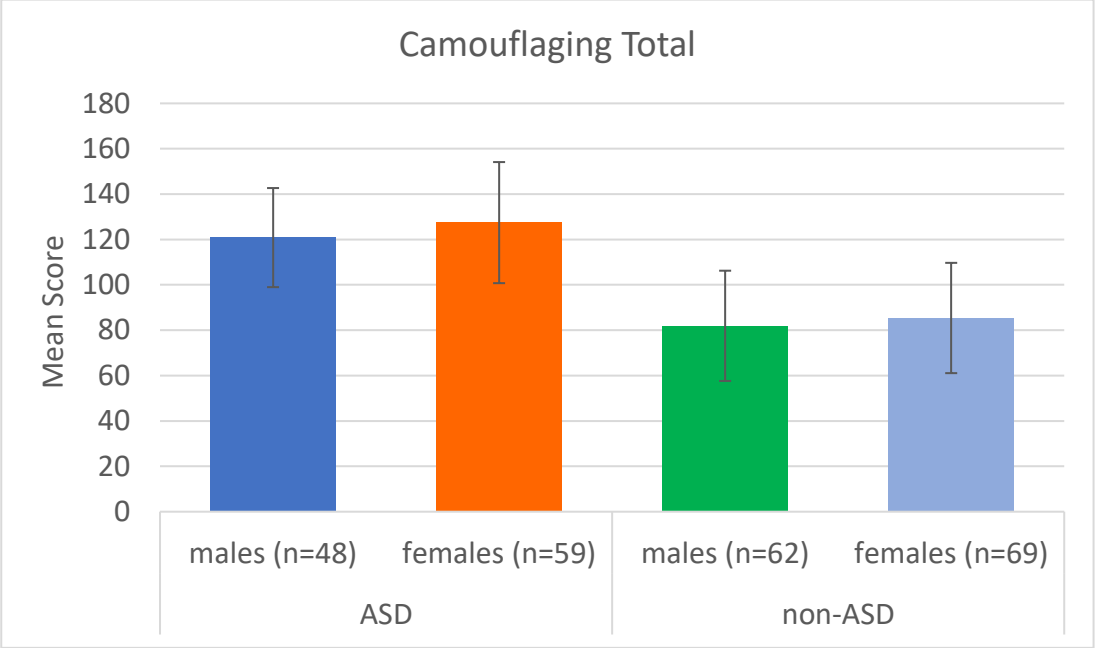
As a next step, hierarchical regression was conducted to explore what percentage of the variance in camouflaging can be explained by sex, autistic traits, self-esteem, alexithymia, and emotion regulation.

7.4 Results

7.4.1 Sex differences in self-reported camouflaging behaviours scores

Figure 1 presents participants' mean scores on the CAT-Q. Individuals with ASD reported higher levels of camouflaging behaviours than those in the non-ASD group. In both groups, females reported slightly higher levels of camouflaging than males.

Figure 1. Shows interactions between group and sex for means of total scores for camouflaging



To investigate the initial research question of this chapter, which involves examining differences in camouflaging levels based on sex and group association within the sample and exploring the potential interaction between these factors, a bootstrapped, univariate ANOVA was conducted. The findings from this analysis are displayed in Table 1.

Table 1. Results of univariate ANOVA analyses for camouflaging

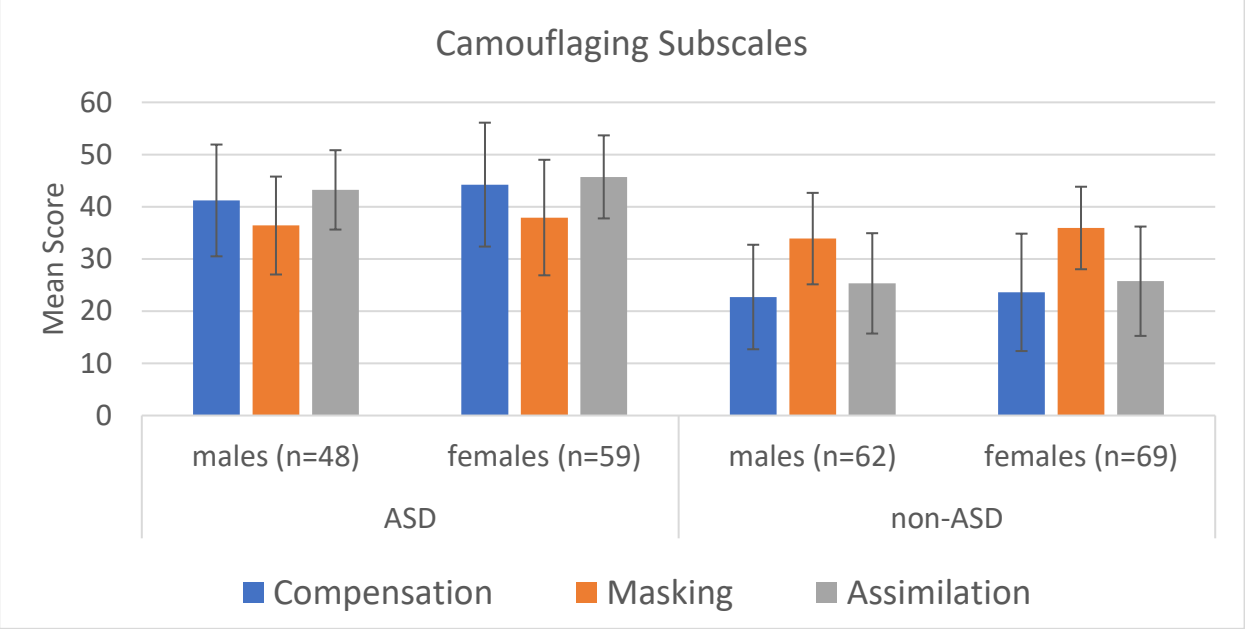
	MS	df	F	p	η2
Sex	1684.79	1	2.83	.094	.012
Group	96222.27	1	**161.46**	**.000**	**.408**
Sex * Group	167.24	1	.281	.597	.001

As expected, the ASD group exhibited significantly higher levels of camouflaging. However, there were no significant differences between males and females in either group, and the patterns of

camouflaging scores for males and females were consistent within both groups. As a result, no significant interaction was observed.

The subsequent analysis aimed to compare male and female scores within both groups in the three camouflaging measure subscales (compensation, masking, and assimilation). Mean scores for the four groups in each subscale are presented in Figure 2.

Figure 2. Shows means and standard deviations for total scores for camouflaging subscales split by group and sex



All three variables (compensation, masking, and assimilation) represented different aspects of the camouflaging variable and were found to be highly correlated (Pearson's correlation coefficients for compensation and masking r=.536, compensation and assimilation r=.754, masking and assimilation r=.397, $p < .001$ for all) and conform to the parametric assumptions. Thus, a 2x2x3 (group (ASD vs non-ASD) x sex (males vs females) x 3 subscales) MANOVA with bootstrapping was conducted to examine sex and group differences in the camouflaging subscales within the whole sample.

The results showed a significant multivariate effect of group, Wilks' lambda (Λ) = .374, ($F_{(3, 232)}$ = 129.703, $p < .001$, η2 = .626), but no effect of sex (Λ = .988, $F_{(3, 232)}$ = .954, p= .415, η2 = .012) or group-by-sex interaction (Λ = .993, $F_{(3, 232)}$ = .516, p = .672 η2 = .007) were found. The test of between-subjects effects within each dependent variable revealed significant differences between ASD and non-ASD groups in compensation and assimilation scores. In contrast, the masking scores difference did not reach significance levels. Both groups' males and females presented similar mean score patterns within all three dependent variables, as seen in Figure 2. Thus, no significant sex differences

were found in any camouflaging subscales. Results for all between-subjects effects are presented in Table 2.

Table 2. Camouflaging subscales scores MANOVA between-subjects effects

Variable	*Effect*	*SS*	*df*	*F*	*Sig.*	*η2*
Compensation	Sex	224.747	1	1.863	.174	.008
Masking		185.101	1	2.149	.144	.009
Assimilation		154.991	1	1.865	.173	.008
Compensation	Group	22367.564	1	**185.366**	**.000**	**.442**
Masking		295.019	1	3.425	.065	.014
Assimilation		20581.674	1	**247.601**	**.000**	**.514**
Compensation	Sex * Group	67.036	1	.556	.457	.002
Masking		3.508	1	.041	.840	.000
Assimilation		43.792	1	.527	.469	.002

In the next step, independent sample t-tests were run to check if ASD females had significantly higher scores on masking and compensation subscales than males and if any differences between males and females were in the non-ASD group. While females within both ASD and non-ASD groups had slightly higher scores on all three camouflaging subscales, independent sample t-test results showed none of these were significant—see Table 3.

Table 3. T-test results comparing ASD and non-ASD males and females on three camouflaging subscales

Subscale	*Group*	*M*	*SD*	*df*	*t*	*p*
	ASD					
Compensation	**Male (n=48)**	41.21	10.70	104	-1.37	0.174
	Female (n=58)	44.24	11.88			
Masking	**Male**	36.40	9.38	104	-0.76	0.450
	Female	37.93	11.15			
Assimilation	**Male**	43.23	7.60	104	-1.646	0.103
	Female	45.72	7.90			
	Non-ASD					
Compensation	**Male (n=62)**	22.71	10.01	130	-0.478	0.633
	Female (n=70)	23.60	11.22			
Masking	**Male**	33.90	8.76	130	-1.400	0.164
	Female	35.93	7.85			
Assimilation	**Male**	25.32	9.61	130	-0.435	0.665
	Female	26.10	10.46			

7.4.2 Association of camouflaging with autistic traits, internalising issues, self-esteem, emotional expressivity, and alexithymia

Bivariate bootstrapped Pearson correlations were conducted to examine associations between camouflaging and autistic traits, internalising issues, self-esteem, emotional expressivity, and alexithymia.

As expected, when examining scores from the whole sample (Table 4), camouflaging was significantly and positively associated with autistic traits as measured by all three questionnaires and internalising issues. This suggests that core/associated traits of ASD are associated with camouflaging regardless of diagnosis. Similarly, camouflaging was significantly positively associated with impulse strength and alexithymia. In contrast, camouflaging was negatively correlated with high self-esteem and positive expressivity, while there was no clear association with negative expressivity.

Table 4. The whole sample Pearson correlation coefficients for camouflaging

	CAMOUFLAGING
AUTISTIC TRAITS (AQ)	**.716****
AUTISTIC TRAITS (BAPQ)	**.751****
AUTISTIC TRAITS (SQ-A)	**.642****
SOCIAL ANXIETY (BFNES)	**.488****
ANXIETY (HADS)	**.401****
DEPRESSION (HADS)	**.349****
POSITIVE EXPRESSIVITY (BEQ)	**-.283****
NEGATIVE EXPRESSIVITY (BEQ)	-.026
IMPULSE STRENGTH (BEQ)	**.158***
SELF-ESTEEM (RSE)	**-.481****
ALEXITHYMIA (TAS-20)	**.536****

***. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

The same analyses were run for all four groups separately to assess if the same trends would be observed for males and females within both groups.

Table 5. Comparison of Pearson correlation coefficients for camouflaging for both groups split by sex

	CAMOUFLAGING			
	ASD		non-ASD	
	males	females	males	females
AUTISTIC TRAITS (AQ)	-.035	.254	**.577****	**.613****
AUTISTIC TRAITS (BAPQ)	.197	.177	**.788****	**.739****
AUTISTIC TRAITS (SQ-A)	.065	.150	**.407****	**.640****
SOCIAL ANXIETY (BFNES)	**.492****	**.434****	**.489****	**.408****
ANXIETY (HADS)	.175	.210	**.407****	**.275***
DEPRESSION (HADS)	.244	-.079	**.382****	.214
POSITIVE EXPRESSIVITY (BEQ)	.228	-.109	-.177	-.196
NEGATIVE EXPRESSIVITY (BEQ)	.088	-.182	.080	.002
IMPULSE STRENGTH (BEQ)	**.333***	.038	.100	.184
SELF-ESTEEM (RSE)	**-.341***	-.093	**-.364****	**-.281***
ALEXITHYMIA (TAS-20)	-.088	-.052	**.463****	**.582****

***. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

In the non-ASD group, associations with camouflaging seem to reflect the whole sample pattern with the exclusion of expressivity measures in both groups and depression in non-ASD females. The picture in the ASD group, however, was strikingly different. In contrast to the hypotheses, camouflaging in the ASD females group was only significantly correlated with social anxiety. For ASD males, camouflaging was positively correlated with both social anxiety and impulse strength and negatively correlated with high self-esteem.

7.4.3 Association of camouflaging and self-esteem with adaptive and maladaptive cognitive and behavioural ER strategies

Further analyses explored associations between emotion regulation and camouflaging, and self-esteem. Results are presented in Table 6.

Table 6. The whole sample Pearson correlation coefficients for camouflaging, self-esteem and ER

	Camouflaging	Self-Esteem
Cognitive Reappraisal (ERQ)	**-.130***	**.335****
Expressive Suppression (ERQ)	**.359****	**-.334****
Self-blame (CERQ)	**.377****	**-.494****
Rumination (CERQ)	**.277****	**-.220****
Catastrophising (CERQ)	**.255****	**-.363****
Blaming others (CERQ)	.124	**-.190****
Acceptance (CERQ)	.067	-.013
Positive refocussing (CERQ)	**-.243****	**.281****
Refocus on planning (CERQ)	**-.169****	**.312****
Positive Reappraisal (CERQ)	**-.259****	**.492****
Putting into perspective (CERQ)	**-.159***	**.194****
Withdrawal (BERQ)	**.623****	**-.602****
Ignoring (BERQ)	**.246****	**-.240****
Seeking distraction (BERQ)	.020	.027
Actively approaching (BERQ)	**-.307****	**.488****
Seeking Social Support (BERQ)	**-.172****	**.171****

Note: **. Correlation is significant at the 0.01 level; *. Correlation is significant at the 0.05 level.

The directions of all relationships were as hypothesised. Camouflaging was negatively associated with adaptive ER strategies (cognitive and behavioural), except for acceptance and seeking distraction, and positively associated with cognitive and behavioural maladaptive ER strategies, excluding blaming others. High self-esteem was negatively correlated with maladaptive ER strategies and positively correlated with adaptive ones, except for acceptance and seeking distraction.

The same analyses were run for males and females in ASD and non-ASD groups to investigate sex differences in those associations. Results are presented in Table 7.

Table 7. Comparison of Pearson correlation coefficients split by group and sex for camouflaging and emotion regulation, and self-esteem and emotion regulation

	CAMOUFLAGING				SELF-ESTEEM			
	ASD		non-ASD		ASD		non-ASD	
ER STRATEGIES	males	females	males	females	males	females	males	females
COGNITIVE REAPPRAISAL (ERQ)	-0.224	0.217	-0.080	0.035	**.382****	**.292***	**.270***	0.199
EXPRESSIVE SUPPRESSION (ERQ)	0.210	0.231	**.359****	**.309****	**-.314***	**-.336****	-0.237	-0.107
SELF-BLAME (CERQ)	**.342***	**.386****	**.251***	**.315****	**-.526****	**-.530****	**-.433****	**-.403****
RUMINATION (CERQ)	0.238	**.361****	**.255***	**.369****	-0.278	**-.277***	-0.231	-0.113
CATASTROPHISING (CERQ)	**.457****	0.024	**.379****	0.193	**-.404****	**-.327***	**-.487****	-0.213
BLAMING OTHERS (CERQ)	-0.087	0.102	0.144	0.019	-0.130	-0.216	-0.109	-0.135
ACCEPTANCE (CERQ)	0.042	0.173	-0.149	**.296***	0.172	0.013	0.065	**-.304***
POSITIVE REFOCUSSING (CERQ)	**-.380****	0.032	-0.141	-0.060	**.304***	0.207	0.186	0.092
REFOCUS ON PLANNING (CERQ)	-0.057	0.250	0.067	-0.225	**.288***	0.118	**.257***	0.206
POSITIVE REAPPRAISAL (CERQ)	0.008	0.199	0.015	-0.046	**.502****	**.389****	**.307***	**.286***
PUTTING INTO PERSPECTIVE (CERQ)	-0.095	**.286***	-0.221	-0.050	0.183	-0.054	0.211	0.081
WITHDRAWAL (BERQ)	0.279	**.380****	**.470****	**.375****	**-.657****	**-.293***	**-.513****	**-.358****
IGNORING (BERQ)	0.266	0.209	0.190	0.203	-0.152	-0.064	-0.238	**-.351****
SEEKING DISTRACTION (BERQ)	-0.137	0.114	0.089	-0.026	0.005	0.150	0.093	-0.077
ACTIVELY APPROACHING (BERQ)	-0.129	0.080	-0.238	-0.115	**.561****	**.279***	**.498****	**.247***
SEEKING SOCIAL SUPPORT (BERQ)	0.069	-0.166	-0.174	-0.117	0.075	0.229	0.205	-0.038

***. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.*

Again, the directions of the significant associations reflected those discussed for the whole sample, apart from camouflaging and acceptance showing a positive correlation in the non-ASD females' group and camouflaging and putting into perspective also showing a positive correlation in the ASD females group.

7.4.4 Predictors for camouflaging behaviours

Lastly, two hierarchical regressions were conducted to look at predictors of camouflaging behaviours in ASD and non-ASD groups. Results are presented in Table 8.

Table 8. Comparison for predictors of camouflaging in the ASD and non-ASD groups

Camouflaging	**ASD (N=106)**					**Non-ASD (N=132)**				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 1	.020					.006				
Sex			7.063	4.803	.143			3.679	4.229	.076
Step 2	.039	.019				**.358**	**.352**			
Sex			6.861	4.782	.139			2.157	3.416	.045
Autistic Traits			.783	.552	.137			**2.483**	**.295**	**.594**
Step 3	**.077**	**.038**				**.383**	**.025**			
Sex			6.727	4.711	.136			1.998	3.364	.041
Autistic Traits			.763	.543	.134			**2.288**	**.303**	**.548**
Self-esteem			**-.693**	**.340**	**-.194**			**-.695**	**.309**	**-.163**
Step 4	.100	.023				**.440**	**.057**			
Sex			6.954	4.678	.141			2.153	3.216	.045
Autistic Traits			1.050	.569	.184			**1.820**	**.317**	**.436**
Self-esteem			**-.788**	**.342**	**-.221**			-.316	.313	-.074
Alexithymia			-.345	.216	-.161			**.579**	**.160**	**.289**
Step 5	**.276**	**.176**				**.492**	**.052**			
Sex			3.401	4.373	.069			-1.995	3.478	-.041
Autistic Traits			.970	.519	.170			**1.605**	**.313**	**.384**
Self-esteem			.019	.420	.005			.331	.386	.078
Alexithymia			**-.450**	**.212**	**-.211**			**.587**	**.157**	**.293**
Social Anxiety			**.854**	**.197**	**.445**			**.572**	**.164**	**.294**
Anxiety			.667	.566	.133			.019	.591	.003
Depression			-.389	.647	-.071			.084	.649	.012

Camouflaging	ASD (N=106)					Non-ASD (N=132)				
	R2Δ	R2Δ Change	B	SEB	β	R2Δ	R2Δ Change	B	SEB	β
Step 6	**.371**	**.095**				.504	.012			
Sex			4.263	4.308	.086			-1.600	3.581	-.033
Autistic Traits			.652	.519	.114			**1.480**	**.341**	**.354**
Self-esteem			.636	.452	.178			.298	.414	.070
Alexithymia			**-.562**	**.212**	**-.263**			**.506**	**.173**	**.253**
Social Anxiety			**.636**	**.231**	**.331**			**.475**	**.183**	**.245**
Anxiety			.890	.568	.177			-.052	.606	-.009
Depression			-.736	.709	-.135			-.073	.676	-.011
Suppression			**.995**	**.402**	**.238**			.368	.395	.078
Self-blame			.807	.848	.110			.279	.552	.042
Rumination			.271	.833	.037			.685	.666	.088
Catastrophising			.354	.734	.049			.194	.625	.024
Withdrawal			1.223	.681	.195			.158	.531	.025

In the first step, sex was introduced to the model to examine whether there were any inherent gender-based differences in the dependent variable (camouflaging). However, being a female was not found to be a significant predictor either in ASD or in the non-ASD group. Sex explained 2% of the variance in the camouflaging in the ASD group, and only 0.6% in the non-ASD group, and neither model was significant ($F_{(1,104)}$ = 2.162, p = .144; $F_{(1,130)}$ = .757, p =.386 respectively). Sex did not significantly predict camouflaging for either group in any of the subsequent steps.

Autistic traits (measured by AQ) were a positive predictor of camouflaging in the non-ASD group only and, when added, improved the model significantly in the non-ASD group only ($F change_{(1,129)}$ = 70.816, p <.001), accounting for an additional 35.2% of the variance in camouflaging. Moreover, autistic traits significantly predicted variance in camouflaging for the non-ASD group in all subsequent steps when other variables were controlled for. In contrast, autistic traits did not significantly improve the model when first added to the ASD group ($F change_{(1,103)}$ = 2.015, p =.159) and explained only an additional 1.9% of the variance in the dependent variable. Moreover, it did not significantly predict variance in camouflaging in any subsequent step. Including self-esteem in the third step improved both models significantly (ASD: $F change_{(1,102)}$ = 4.159, p = .044; non-ASD: $F change_{(1,128)}$= 5.073, p = .026), the model in the ASD group has now become significant. In step four, the inclusion of self-esteem explained further 3.8% of the variance in camouflaging in the ASD group, but this change was not significant (ASD: $F change_{(1,101)}$ = 2.549, p = .113).

The inclusion of alexithymia significantly improved the model in the non-ASD group only, and it explained a further 5.8% of the variance in camouflaging ($F change_{(1, 127)}$ = 13.052, p <.001). When all other variables were controlled, both alexithymia and autistic traits were significant in this step, but

self-esteem no longer significantly predicted variance in camouflaging when alexithymia was included in the model. In contrast to the non-ASD group and also contrary to the hypotheses, including alexithymia did not significantly improve the model for the ASD group ($F change_{(1, 101)} = 2.549$, $p = .113$) and explained only an additional 2.3% of the variance in camouflaging. When all other variables were controlled, self-esteem remained significant in the ASD group.

The addition of internalising issues in step five improved both models significantly. It explained further 17.6% of the variance in camouflaging ($F change_{(3,98)} = 7.979$, $p < .001$) in the ASD group and 5.2% of the variance ($F change_{(3,124)} = 4.215$, $p = .007$) in the non-ASD group. Of these three internalising variables, only social anxiety significantly predicted camouflaging when all other variables were controlled (ASD: $t_{(106)}=4.33$, $p <.001$; non-ASD: $t_{(132)} = 3.48$, $p = .001$), while autistic traits and alexithymia also remained significant. As in the previous step, alexithymia also significantly predicted variance in camouflaging in the ASD group, and it was also significant in the non-ASD group for the first time ($t_{(132)} = -2.13$, $p = .036$), while self-esteem was no longer significant ($p > .05$).

Finally, the inclusion of highly correlated with camouflaging ER strategies (suppression, self-blame, rumination, catastrophising and withdrawal) significantly improved the model in the ASD group only ($F change_{(5,93)}= 2.798$, $p = .021$), accounting for an additional 9.5% of the variance. While alexithymia and social anxiety both remained significant predictors of camouflaging when all other variables were controlled for, of the ER strategies, only suppression significantly predicted variance in camouflaging ($t_{(106)}=2.47$, $p = .015$). In contrast, including the ER strategies did not significantly improve the model for the non-ASD group ($F change_{(5, 119)} = .596$, $p = .703$), although autistic traits, alexithymia, and social anxiety remained significant. All predictors explained 37.1% of the total variance in camouflaging in the ASD group and 50.4% in the non-ASD group. Interestingly, in the ASD group, alexithymia was found to be a negative predictor of camouflaging, along with social anxiety and suppression, which were the positive significant predictors. While in the non-ASD group, alexithymia, along with autistic traits and social anxiety, were the most significant positive predictors of camouflaging.

7.5 Discussion

7.5.1 Sex differences in self-reported camouflaging behaviours scores and its association with internalising issues

The research examined camouflaging behaviours in individuals with ASD compared to a non-ASD control group. The results showed that the ASD group exhibited significantly higher levels of camouflaging. Further examination of the different camouflaging subscales showed significant differences between ASD and non-ASD groups in compensation and assimilation scores but not in masking scores. There was no significant interaction between group and sex. The patterns of camouflaging scores were similar between males and females within both groups, indicating no significant sex differences in any camouflaging subscales.

The ASD group reported higher levels of camouflaging, which aligns with current literature. Previous research has shown that individuals with ASD tend to engage in higher levels of camouflaging, which involves masking their autistic traits to fit into social situations better (Halladay et al., 2015; Hull et al., 2017; Lai et al., 2017). This finding highlights the importance of understanding the social pressures and challenges faced by individuals with autism. It indicates that autistic individuals may feel a strong need to conform to social norms and expectations, which can be both emotionally exhausting and stressful. Furthermore, this finding has important implications for the diagnosis and support of individuals with ASD. Since camouflaging can mask the observable symptoms of autism, it may lead to underdiagnosis or misdiagnosis, as suggested in previous studies discussed in this chapter. Therefore, clinicians need to be aware of camouflaging behaviours and should consider them during the diagnostic process to ensure that individuals receive appropriate support and intervention. Additionally, recognising high levels of camouflaging in the ASD group can inform the development of more effective support systems and therapeutic approaches. Individualised support strategies can be planned to address the specific needs of autistic individuals who rely on camouflaging in their social interactions, helping them to manage the stress associated with these behaviours. Better awareness of their own motivation for engaging in camouflaging behaviours may support authentic social interactions that are less reliant on masking their true selves.

The absence of significant differences in camouflaging behaviours between males and females within ASD and non-ASD groups from this sample is also an important finding. Previous studies have shown mixed results regarding sex differences in camouflaging. Some studies have suggested that females with ASD might camouflage more than males (Duvekot et al., 2017; Hull et al., 2017 & 2019; Shattuck

et al., 2009; Whitlock et al., 2020), while others have found no significant differences (Fombonne, 2020; Lai et al., 2020; Pearson & Rose, 2021). The current study's results align with the latter, indicating that camouflaging behaviours may not be influenced significantly by sex/gender but may be associated with other factors (McQuaid et al., 2022). The lack of a significant group-by-sex interaction suggests that the effect of ASD on camouflaging did not vary between males and females within this sample. This finding contradicts previous research that suggested potential group-specific effects in camouflaging (Hull et al., 2020; Milner et al., 2023). The finding of no significant sex difference in camouflaging levels suggests that camouflaging should be considered during diagnostic approaches for both males and females, ensuring that neither gender is overlooked or misdiagnosed due to stereotypes. Unfortunately, it is often a limitation of autism research that due to the heterogeneity of the autistic community, multiple factors may affect disparities in result findings. For example, lack of representativeness in study samples may limit the extent to which findings can be generalised to the wide range of people on the autism spectrum. Variations in sample size and composition, measurement tools, and cultural and societal factors might influence how camouflaging is perceived and reported. Additionally, publication bias is an important factor, where studies finding significant differences are more likely to be published, which may further skew the literature.

The significant differences between ASD and non-ASD groups in compensation and assimilation scores indicate that individuals with ASD are more likely to employ these camouflaging strategies compared to the non-ASD group. This finding aligns with the broader understanding of how individuals with ASD navigate social interactions. By compensating and assimilating, they attempt to manage the challenges posed by their condition in environments that often do not accommodate their needs. Such behaviours indicate the substantial effort required of autistic people to cope with social norms and expectations. The heightened levels of these strategies in the ASD group point to the adaptive yet clearly effortful nature of these behaviours.

On the other hand, the absence of significant group and sex differences in masking scores suggests that masking behaviours, which involve hiding or suppressing autistic traits to appear more neurotypical, are employed at similar levels across both ASD and non-ASD groups and between males and females within this sample. This finding is somewhat unexpected, given the general assumption that individuals with ASD, particularly females, might engage more in masking to blend in socially. The lack of variation may imply that masking, as a specific form of camouflaging, might be a common social strategy not exclusively heightened in individuals with autism or influenced by gender within this context. However, this finding contradicts the results of a study by Hull et al. (2020), which reported that females with ASD tended to have higher scores on the assimilation and masking subscales of the CAT-Q compared to ASD males yet found no such difference in the non-ASD sample. Considering the mentioned study had a larger sample size, it is possible that the sample size of this

study was not large enough to detect the subtle sex difference in the masking subscale in the ASD group.

As expected, camouflaging was positively associated with autistic traits (Table 2). Camouflaging was linked to the core and associated traits of autism regardless of diagnosis (ASD). As expected, camouflaging also correlated positively with alexithymia, negatively with high self-esteem and positive expressivity, and but not with negative expressivity. The relationships in the non-ASD group matched the overall trend, except for expressivity measures across both genders and depression among non-ASD females. However, the ASD group's results were surprising. Contrary to expectations, ASD female camouflaging scores were only associated with social anxiety. Higher camouflaging scores in ASD males were related to higher scores of social anxiety and lower self-esteem. This finding aligns with previous research indicating that the associations between camouflaging and negative mental health outcomes were more pronounced in autistic males compared to autistic females (Lai et al., 2017). The lack of correlations between camouflaging and autistic traits in the ASD group is surprising. However, it could be potentially caused by a lower variance of autistic traits in this group. All participants were adults without ID. Alternatively, it can suggest a lower variance in camouflaging in this group.

7.5.2 Predictors for camouflaging behaviours

Sex was not found to be a significant predictor of camouflaging in either the ASD or non-ASD groups. Autistic traits showed a positive association with camouflaging, specifically in the non-ASD group, suggesting that these traits contribute to such behaviours. Self-esteem's inclusion improved both models' significance, particularly for the ASD group. In contrast, alexithymia's impact varied: it significantly influenced camouflaging in the non-ASD group throughout, but it became significant in the ASD group only when internalising issues were accounted for. Internalising issues were significant predictors of camouflaging.

In the ASD group, social anxiety stood out as a crucial factor, along with autistic traits and alexithymia. The importance of social anxiety in predicting camouflaging behaviours is not surprising and is debated as a main motivation for engaging in this behaviour – to fit in with neurotypical peers. For the non-ASD group, autistic traits, alexithymia, and social anxiety retained significance. However, the most noteworthy difference between both groups from this point was that alexithymia in the ASD group was a negative predictor of camouflaging, while in the non-ASD group, it was a positive predictor of camouflaging. This finding may suggest that autistic individuals who have a better

understanding of their emotional states may engage in camouflaging more frequently than those who have higher levels of alexithymia.

At the same time, higher levels of alexithymia would be a good predictor of camouflaging behaviours in the non-ASD group. Therefore, it is possible that our current understanding of the association between alexithymia and camouflaging needs to be more nuanced and context specific.

The literature provides some context for these findings. Research by Bird and Cook (2013) explores the interplay between alexithymia and social cognition, suggesting that understanding and processing emotions is crucial for effective social interaction. Additionally, Livingston and Happé (2017) discuss how emotional self-awareness influences the ability to camouflage in social situations, emphasising the variability in camouflaging behaviours based on individual emotional competencies. Therefore, individuals with ASD who have lower levels of alexithymia – and therefore a greater ability to identify and articulate their emotions – might be more adept at recognising social cues and understanding the expectations of social interactions. This enhanced emotional awareness could enable them to engage in camouflaging behaviours more effectively, as they might better navigate and manage their social environment. Conversely, autistic individuals with higher levels of alexithymia may find it more challenging to engage in camouflaging due to their difficulties in understanding and processing their own emotions, as well as interpreting the emotions and social signals of others. In contrast, higher levels of alexithymia predicting increased camouflaging behaviours in the non-ASD group could indicate that non-autistic individuals who struggle with identifying and expressing their emotions might rely more on camouflaging to fit into social situations. These individuals might use camouflaging as a compensatory mechanism to mask their emotional confusion and comply with expected social norms.

Therefore, this study's finding suggests that the role of alexithymia in camouflaging is complex and may vary significantly between ASD and non-ASD populations. However, this nuanced understanding can inform more tailored approaches in both clinical practice and social support. For example, interventions for individuals with ASD might focus on enhancing emotional awareness and social skills to reduce the reliance on camouflaging, while support for non-ASD individuals with high alexithymia might aim at improving emotional processing to mitigate the need for extensive camouflaging.

The introduction of ER strategies, notably suppression, yielded intriguing findings for the ASD group, contributing to understanding camouflaging. As expected, suppression was a significant predictor of camouflaging, but only in the ASD group. This finding may suggest that ASD and non-ASD individuals use suppression for different reasons. For individuals with ASD, suppression might be employed to mitigate the feelings associated with deliberate efforts to reduce the visibility of behaviours or traits that are perceived as socially undesirable or atypical. This conscious inhibition may help them

navigate social interactions more smoothly, reduce negative social feedback, and avoid stigmatisation. This ER strategy may be used when, for example, they are urged to engage in stimming behaviour to reduce stress or sensory overload, yet they expect others will not accept it in their current environment. Therefore, they may need to regulate the emotion of potential disappointment, while at the same time, they may camouflage and engage in some substitute behaviour. In contrast, non-ASD individuals might not rely on suppression in the same way or to the same extent because their natural behaviours and responses are generally more aligned with societal norms. When neurotypical individuals engage in suppression, it is often for context-specific reasons, such as adhering to professional standards or maintaining politeness in social settings. These instances of suppression are typically less about masking an underlying condition and more about situational appropriateness. However, further research is necessary to explore this theory.

All predictors considered in the analysis collectively accounted for 37.1% and 50.4% of the total variance in camouflaging in the ASD and non-ASD groups, respectively. It is worth noticing that the nature of predictors differed between the groups, underscoring the complex interplay of factors in influencing camouflaging behaviours. This suggests that motives for camouflaging may be different for ASD and non-ASD individuals. The differing motives for camouflaging between ASD and non-ASD individuals reflect the distinct social and emotional challenges faced by each group. For those with ASD, camouflaging is more about managing the discrepancies between their neurodiverse traits and the neurotypical world, whereas, for non-ASD individuals, it may be more about overcoming specific emotional processing difficulties to maintain social harmony. However, to expand on this idea, further research is needed to explore this in more detail.

7.6 Strengths and limitations

This study had multiple strengths, with the main one being its comprehensive approach by examining various factors, including autistic traits, self-esteem, alexithymia, internalising issues, and emotion regulation strategies. This approach allowed for a more holistic understanding of the complex phenomenon of camouflaging. Additionally, by including both ASD and non-ASD groups, the study facilitated a comparative analysis, offering insights into the unique predictors of camouflaging in these populations. The study's exploration of the associations between camouflaging and all other variables, including emotion regulation strategies, provides a piece of new knowledge on how these factors collectively contribute to camouflaging behaviours and highlights potential differences in motivation behind using these behaviours in ASD and non-ASD populations.

However, there are also limitations to this study. As in previous studies, online surveys might have introduced selection bias, as individuals with more severe internalising issues may have been less likely to participate. This could affect the reliability of the findings. The study relied on self-report measures, which may be subject to biases and inaccuracies. Objective assessments or clinical evaluations could provide a more reliable perspective. The study involved specific populations, such as adults without ID, therefore, the findings may not reflect trends within the whole ASD population.

Chapter 8 – General Discussion

8.1 Introduction

The aim of this thesis was to examine sex differences in the core profile of ASD. Given differences in emotion regulation reported in ASD and the association between emotion regulation and internalising conditions that commonly co-occur with ASD, this thesis explored whether emotion regulation may be a mechanism underpinning sex differences in the presentation of core and associated autistic traits in males and females.

Chapter 1 provided an overview of the literature related to this aim. It highlighted how autism spectrum disorder (ASD) is considered to be a complex disorder diagnosed mostly by behavioural observations and often self-reports. It explored the transition to the DSM-5's unified diagnostic approach and emphasised gender inequalities in diagnosis rates, with females frequently being underdiagnosed. Co-occurring disorders with ASD, such as depression and anxiety, were considered, underlining the significance of early detection and intervention. The review also investigated the increased prevalence of anxiety and depression in females, particularly throughout adolescence, citing hormonal changes and social problems as contributory factors.

Adolescence has been identified as a critical period distinguished by pubertal onset and emerging independence, during which individuals navigate complicated social dynamics. This phase was interlinked with Emotional Regulation (ER), which is necessary for adaptive behaviour. Adolescents with ASD may experience additional social difficulties and elevated emotional states, requiring appropriate ER measures. As a result, this developmental stage is commonly cited as the time when young autistic people without intellectual disabilities are identified.

The research review focused on the importance of ER methods used in adolescence and their impact on mental health outcomes. It highlighted the difference between adaptive (e.g., cognitive reappraisal) and maladaptive (e.g., expressive suppression) ER techniques, stressing their link to psychopathology and well-being. Cognitive reappraisal, or reframing emotional responses, has emerged as an adaptive method associated with improved mental health outcomes. Conversely, expressive suppression, which involves hiding emotional reactions, has been linked to increased psychopathology and decreased well-being. The review also examined the significance of alexithymia, the difficulties in identifying emotional states in oneself and others, and cognitive flexibility in effective ER, particularly when using cognitive reappraisal. However, autistic people frequently demonstrate cognitive rigidity, which may limit their capacity to adopt adaptive ER strategies flexibly. This cognitive rigidity, which is a characteristic autistic trait, makes contemplating alternative

interpretations of events difficult, and it may contribute to emotional dysregulation. As a result, it was suggested that while attempting to comprehend ER in autistic individuals, broader cognitive and behavioural ER techniques should be considered, especially since some research findings indicated differences in the outcomes of associations between maladaptive ER strategies and internalising issues, which were discovered to be in opposing directions in the ASD and non-ASD groups.

Notably, previous studies have identified sex differences in the rates of co-occurring internalising disorders, which have been linked to ER styles. Furthermore, it was stated that females are enduring delays in receiving support due to potential disparities in symptom presentation. According to the studies described, autistic females may have more gender-stereotyped interests and fewer RRBs than males. Furthermore, it was shown that autistic females may exhibit more prosocial behaviours and have higher-quality friendships, potentially leading to missed diagnoses due to a perceived higher degree of social functioning. However, some research showed that there were no variations in social motivation between autistic males and females, emphasising the complexities of gender dynamics in ASD presentation. Furthermore, social expectations and norms were considered factors that may affect the presentation of autistic traits differently in men and women. As a result, it was highlighted how females with ASD may use camouflaging or masking behaviours to adapt to societal standards, complicating proper identification and potentially increasing internalising difficulties. Camouflaging can be emotionally exhausting and deplete the resources required for successful emotion regulation while hindering diagnosis and treatments. In the conclusion of this literature review, a better understanding of the variations in mechanisms that influence the presentation of autistic features in males and females, such as emotional awareness or lack of it (alexithymia), emotion regulation, factors predicting the development of internalising difficulties, and emotional well-being, has emerged as critical elements for accurate identification and targeted interventions.

8.2 Main findings

This study aimed to expand our understanding of differences between autistic males and females in search of potential factors explaining why autistic females are often diagnosed later than males and present with higher rates of internalising issues.

While there were limited sex differences found in Chapter 2 with the use of screening questionnaire measures (AQ), sex differences were observed between males and females with autism on the BAPQ pragmatic language subscale, with females reporting more difficulties in this area. Since the BAPQ was assessed in two separate online studies, direct comparisons between adolescents and adults

were impossible. However, it is noteworthy that in the DISCO subdomain A2 (deficits in non-verbal communication), adolescent autistic females had a slightly higher percentage of marked items than males. While structural language encompasses form (e.g., syntax, articulation, and phonology) and content (semantics), pragmatic language pertains to nonverbal communication and the initiation and maintenance of conversation (Baird and Norbury et al., 2016). Additionally, some interesting patterns of sex variations were found in comparing behavioural profiles between autistic adolescents and adults using items selected from the DISCO interview that matched the items from the Signposting Questionnaire (SQ-A). These differences may suggest that adolescent females may struggle in different areas than males. It has also highlighted that these may change as they get older due to the patterns found being reversed in the adult samples.

In Chapter 3, the clinical study done on adolescent participants confirmed higher rates of anxiety and depression in the autistic group than in their respective control groups. However, no sex differences were found between levels of these internalising issues in autistic males and females. While in the non-ASD group, females had higher anxiety levels than males. The ASD group had higher emotional reactivity in social situations than in non-social situations, as measured by the experimental task, highlighting elevated social anxiety in this group. Additionally, there were group and sex differences found in the spontaneous use of cognitive reappraisal (adaptive ER strategy), with the ASD group using this strategy less when compared to the non-ASD group and autistic males using it less than autistic females. In fact, autistic females used cognitive reappraisal spontaneously nearly as frequently as the non-ASD group. This ability could be one factor contributing to autistic females coping better than males in those early years and is one of the most interesting findings discussed in this thesis.

In Chapter 4, it was found that adult autistic females were more proficient at using suppression during experimental tasks than autistic males. Again, this finding may contribute to our understanding of why females are often diagnosed later due to their ability to suppress their affect more efficiently. This finding is particularly interesting, as it deviates from gender differences reported in the literature for typically developing males and females, consistently reporting that males rely on suppression more than females when regulating their emotions.

Chapter 5 looked at broader cognitive and behavioural ER strategies and internalising issues. The results of this study revealed significant differences in the use of behavioural ER strategies between autistic and typically developing individuals. Notably, the ASD group reported more frequent use of behavioural maladaptive ER strategies, such as withdrawal and ignoring, compared to the non-ASD group. This suggests that individuals with ASD may tend to rely on avoidance and disengagement behaviours to regulate their emotions.

Interestingly, sex differences were observed within the ASD group specifically. ASD females reported significantly higher behavioural adaptive ER strategies use than ASD males. Again, this finding is significant for understanding potential factors contributing to delayed diagnoses in this group. This finding is intriguing as it might explain the stronger motivation for social interaction often reported in autistic females, as the use of adaptive strategies may allow them to perform better than autistic males in social situations.

The next study discussed in Chapter 6 explored sex differences in alexithymia. The main finding was that the positive association between alexithymia, depression and social anxiety was found for all three groups except for ASD females, which may suggest that difficulties in understanding emotions may affect autistic females differently than others and/or are potentially not central to the higher rates of depression/social anxiety reported in this group.

In the last study, Chapter 7, which investigated sex differences in camouflaging, contrary to expectations, higher camouflaging scores were associated with higher levels of social anxiety in autistic females. This suggests that, for autistic females, the primary link between camouflaging and internal experiences is likely related to social anxiety. On the other hand, in autistic males, higher camouflaging scores were also related to higher levels of social anxiety and lower self-esteem. This difference between the relationships of camouflaging with internal factors in autistic males and females highlights potential gender-specific differences in the motivations and outcomes of camouflaging behaviours, like lower self-esteem in males or higher social anxiety in females. It suggests that for autistic females, camouflaging might have different consequences, which also may explain why previous research reports females using camouflaging more often than males. Even though there was no significant difference found within this study's sample in the frequency of using camouflaging by males and females, potentially for autistic males, frequent use of camouflaging as being related to lower self-esteem may be a significant factor that discourages them from using it as often as females, as reported in other studies (i.e. Perry et al., 2022; Ratto et al., 2018; Rynkiewicz et al., 2016; Schuck et al., 2019).

While sex was not a good predictor of camouflaging in either ASD or non-ASD groups, autistic traits were positively associated with camouflaging, particularly in the non-ASD group, indicating that these traits contribute to such behaviours. Including self-esteem improved the models' significance, especially for the ASD group. However, the most interesting finding was that alexithymia's impact varied: it was a significant positive predictor of camouflaging in the non-ASD group regardless of other variables accounted for in the model. In contrast, it was a negative predictor in the ASD group but only became significant when internalising issues were considered. Internalising issues were significant predictors of camouflaging, with social anxiety being particularly crucial in the ASD group alongside autistic traits and alexithymia (lower levels in this group). Interestingly, while higher

alexithymia levels predict camouflaging in the non-ASD group, autistic individuals who better understand their emotional states may camouflage more frequently.

8.3 Implications of these findings

Sex Differences in the 'Core' and Associated Features of ASD in Adolescents and Adults:

The study revealed that while there were limited sex differences using the screening questionnaire measure (AQ), some interesting differences were found in the BAPQ. Notable differences in patterns of behaviours emerged from a comparison of behavioural profiles derived from the DISCO interview items matched with the Signposting Questionnaire (SQ-A). Adolescent females showed struggles in different areas than males, and these patterns reversed in adults, potentially suggesting that autistic traits may become more apparent in autistic females when they transition to adulthood. This finding is very interesting and worth further exploration as to potential causes of this finding. As discussed in Chapter 2, it could suggest fluctuations in trajectories of how these behaviours may present over a lifetime period in males and females (developmental changes). Alternatively, it could reflect better awareness of one's own skills and limitations, which can be better understood and accepted by autistic females after they receive the diagnosis and, therefore, reported more openly in adulthood. Alternatively, it could also reflect that a lack of early support may lead to more difficulties later in life

Sex Differences in Emotion Regulation as a Potential Mechanism Underpinning Differences in the Presentation of Autistic Traits:

Autistic females demonstrated a more frequent spontaneous use of cognitive reappraisal compared to autistic males, potentially aiding them in managing social interactions more effectively and masking autistic traits. This ability to use adaptive emotion regulation (ER) strategies might contribute to the delayed diagnosis of autistic females, as their behaviours may not align with typical ASD presentations. Additionally, adult autistic females' proficiency in using suppression more effectively than males could explain why females often go undiagnosed for longer periods. These findings suggest that sex differences in ER strategies play a crucial role in the presentation and detection of autistic traits, with females potentially using these strategies to navigate social environments more adeptly.

Chapter 5 examined cognitive and behavioural emotion regulation (ER) strategies and internalising issues, revealing significant differences in the use of behavioural ER strategies between autistic and

typically developing individuals. The study found that the ASD group reported more frequent use of maladaptive behavioural ER strategies, such as withdrawal and ignoring, compared to the non-ASD group, suggesting a tendency among individuals with ASD to rely on avoidance and disengagement behaviours to regulate emotions. This finding adds to our understanding of sensory difficulties autistic individuals often struggle with and highlights the importance of understanding their need to seek solitude and space, especially when they experience intense emotional states.

Additionally, within the ASD group, females reported significantly higher use of adaptive behavioural ER strategies than males, a finding that is again important for understanding potential factors contributing to delayed diagnoses in females. This higher use of adaptive strategies might explain the stronger motivation for social interaction often observed in autistic females, as these strategies may enable them to perform better in social situations than autistic males.

Sex Differences in Alexithymia and Its Association with Anxiety and Depression in Adults:

The study has supported a link between alexithymia and internalising issues, mainly depression and social anxiety, in all groups except for ASD females. This indicates that alexithymia may affect autistic females differently, suggesting that their challenges in understanding emotions may not be the main factor contributing to their higher rates of depression and social anxiety. This difference emphasises the importance of understanding and addressing alexithymia-related emotional issues in a way that is specific to each gender within the autistic community.

Additionally, the study found that alexithymia had a negative association with camouflaging in the ASD group, but a positive relationship between alexithymia and camouflaging was found in the non-ASD group, highlighting the complex role of alexithymia in emotional and social functioning across different populations. However, for individuals presenting for autism assessment, clinicians might increase their differential diagnosis rates when keeping in mind that better emotional awareness (less alexithymia) is more likely to enable the individual to camouflage their autistic traits.

Association Between Emotion Regulation and Camouflaging of Autistic Traits in Adults:

The study revealed that higher camouflaging scores were linked to higher social anxiety in autistic females, whereas in autistic males, camouflaging was related to both social anxiety and lower self-esteem. This indicates that the motivations and psychological costs of camouflaging may differ between sexes. For autistic females, camouflaging may primarily serve as a mechanism to manage social anxiety, while for males, the lower self-esteem associated with camouflaging might discourage its use and/or increase their vulnerability to the development of internalising issues.

Finding that self-esteem and alexithymia were significant factors in predicting camouflaging behaviours further underscores the intricate relationship between emotion regulation and camouflaging. These findings suggest that interventions aimed at improving emotional awareness and self-esteem could potentially reduce the reliance on camouflaging, especially in the ASD population. However, as this better emotional awareness may also be a potential factor that may increase camouflaging behaviour, it seems crucial to support such interventions with social skills training and mindfulness practice to increase self-acceptance and self-esteem in autistic individuals and prevent that from happening. Therefore, it calls for carefully planning individualised therapeutical approaches in this population. Additionally, this association between emotional awareness and camouflaging in autistic individuals highlights inequalities in everyday functioning for autistic and non-autistic individuals and calls for action to increase awareness of the general population of this mechanism and better understanding and tolerance for autistic behaviours, that could reduce their need to camouflage these. Therefore, this finding may be especially helpful in developing interventions that may improve the quality of life for autistic individuals.

8.4 Further research

Based on the findings and discussions provided, there are several key areas for further research that have the potential to significantly enhance our understanding of sex differences in autism spectrum disorder (ASD), emotion regulation (ER), alexithymia, and camouflaging behaviours. These research areas are crucial for advancing our knowledge and hold promise for developing more effective interventions and support strategies for individuals on the autism spectrum.

One important direction is conducting longitudinal studies to understand how sex differences in ASD traits and behaviours evolve over time. These studies could track autistic individuals from adolescence into adulthood, observing changes in core and associated features, with a particular focus on differences between males and females. Researchers could use a combination of structured interviews and self-report questionnaires to gather comprehensive data over multiple time points.

Another crucial area is investigating the role of cognitive flexibility and threat sensitivity in ER and the presentation and management of autistic traits, particularly in females. Future research should explore the spontaneous and deliberate use of ER strategies, such as cognitive reappraisal and suppression, in larger and more diverse samples. Experimental tasks in a lab setting combined with self-report measures could assess real-time ER strategy use and its impact on social functioning and

assess if cognitive flexibility and sensitivity to threat affect the choice of ER strategies across different contexts (e.g., social vs. non-social) to provide deeper insights.

Additionally, further investigation of the better efficiency of autistic females at using suppression as an ER strategy in a more controlled experimental setting is necessary. Further research could clarify if more efficient use of suppression is a functional behaviour for autistic females and allows additional processing time, which is often required by autistic individuals with learning disabilities. However, it may be as important for individuals without ID to consider the situation and implement certain skills and strategies, and females may be more adept at that.

Understanding the complex role of alexithymia in emotional health and social functioning in ASD is also essential. Researchers should examine the differential impact of alexithymia on anxiety, depression, and camouflaging behaviours, specifically in autistic females versus males. Studies could use physiological measures, such as heart rate variability and self-reports, to capture subjective and objective aspects of alexithymia and emotional processing.

Another significant research direction is identifying the motivations behind camouflaging and its psychological costs, with a focus on sex differences. Qualitative methods, such as in-depth interviews, can explore personal experiences of camouflaging in autistic individuals, supplemented with quantitative measures of social anxiety, self-esteem, and other relevant psychological factors. Longitudinal designs could help understand the long-term consequences of camouflaging on mental health. Further investigation of the relationship between expressive suppression and camouflaging in the form of lab-based comparative studies between ASD and non-ASD populations is also important for understanding the similarities and differences between ER and camouflaging behaviours.

Developing and testing interventions tailored to the unique needs of autistic males and females is vital. Intervention studies should design and evaluate programs to improve emotional awareness and ER strategies and reduce camouflaging behaviours. For instance, mindfulness-based interventions or cognitive-behavioural therapy could be adapted to enhance emotional processing and social skills. These interventions should be tested in randomised controlled trials to assess their efficacy objectively across different sexes and age groups.

8.5 Conclusion

While most research focuses on problems and difficulties, this study aimed to examine the differences between autistic males and females from a slightly different perspective. Aside from comparing the core and associated traits of autism, therefore, difficulties, like higher rates of anxiety, depression and social anxiety in autistic males and females in comparison to non-autistic control groups. The focus of this thesis was on investigating what mechanisms or abilities may be potential factors that allow autistic females to cope for longer periods of time before they present with clinically significant symptoms. Emotion regulation was the main area explored for potential factors, along with alexithymia and camouflaging. The studies discussed in this thesis significantly expand our understanding of these phenomena, supporting emotion regulation and emotional awareness as mechanisms likely affecting differing presentation of autistic traits due to its association with increased camouflaging behaviour. It is therefore concluded that the delay in diagnosis in the population of autistic females is most likely related to these abilities discussed above. Further research is needed, though, to replicate these findings and expand our understanding of each one of these.

Most sex differences found within this thesis were diagnosis-specific rather than gender-specific. Therefore, the author recommends that emotion recognition and emotion regulation abilities, along with camouflaging behaviours, should be considered during diagnostic procedures, especially when assessing females referred for autism diagnosis due to their potential to compensate for difficulties that might be observed in other environments.

While social anxiety in the ASD group was the main predictor for camouflaging, it has transpired throughout this thesis that the social context is an area that needs a better understanding. Therefore, increasing societal awareness of the presentations, struggles and needs of autistic people is one of the most important directions that can help improve their quality of life, and the author of this thesis hopes the work put into completing these studies may add to that cause.

REFERENCES:

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical psychology review*, *30*(2), 217-237.

Allison, C., Auyeung, B., & Baron-Cohen, S. (2012). Toward brief “red flags” for autism screening: the short autism spectrum quotient and the short quantitative checklist in 1,000 cases and 3,000 controls. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(2), 202-212.

Altemus, M., Sarvaiya, N., & Epperson, C. N. (2014). Sex differences in anxiety and depression clinical perspectives. *Frontiers in neuroendocrinology*, *35*(3), 320-330.

American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders (4th edn), Text Revision. Washington, DC: American Psychiatric Association (APA).

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.)., 50-59. (APA)

Angel, L., Ailey, S. H., Delaney, K. R., & Mohr, L. (2023). Presentation of depressive symptoms in autism spectrum disorders. *Western Journal of Nursing Research*, *45*(9), 854-861.

Anglim, M., Conway, E. V., Barry, M., Kashif, M., Ackermann, P., Moran, A., ... & Guerin, S. (2022). An initial examination of the psychometric properties of the Diagnostic Instrument for Social and Communication Disorders (DISCO-11) in a clinical sample of children with a diagnosis of Autism spectrum disorder. *Irish Journal of Psychological Medicine*, *39*(3), 251-260.

Antezana, L., Factor, R. S., Condy, E. E., Strege, M. V., Scarpa, A., & Richey, J. A. (2019). Gender differences in restricted and repetitive behaviors and interests in youth with autism. *Autism Research*, *12*(2), 274-283.

Anthony, L. G., Kenworthy, L., Yerys, B. E., Jankowski, K. F., James, J. D., Harms, M. B., ... & Wallace, G. L. (2013). Interests in high-functioning autism are more intense, interfering, and idiosyncratic than those in neurotypical development. *Development and psychopathology*, *25*(3), 643-652.

Autism and Developmental Disabilities Monitoring Network Surveillance Year 2010 Principal Investigators. (2014). Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *Morbidity and Mortality Weekly Report: Surveillance Summaries*, *63*(2), 1-21.

Augustine, A. A., & Hemenover, S. H. (2009). On the relative effectiveness of affect regulation strategies: A meta-analysis. Cognition and Emotion, 23(6), 1181-1220.

Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia Scale—I. Item selection and cross-validation of the factor structure. *Journal of psychosomatic research*, *38*(1), 23-32.

Baird, G., & Norbury, C. F. (2016). Social (pragmatic) communication disorders and autism spectrum disorder. *Archives of Disease in Childhood*, *101*(8), 745-751.

Blalock, D. V., Kashdan, T. B., & Farmer, A. S. (2016). Trait and daily emotion regulation in social anxiety disorder. *Cognitive Therapy and Research*, *40*, 416-425.

Bancroft, Kathrine, Amanda Batten, Sarah Lambert, and Tom Madders. "The way we are." *Autism* (2012).

Bardeen, J. R., Stevens, E. N., Murdock, K. W., & Lovejoy, M. C. (2013). A preliminary investigation of sex differences in associations between emotion regulation difficulties and higher-order cognitive abilities. *Personality and Individual Differences*, *55*(1), 70-75.

Bargiela, S., Steward, R., & Mandy, W. (2016). The experiences of late-diagnosed women with autism spectrum conditions: An investigation of the female autism phenotype. *Journal of autism and developmental disorders*, *46*, 3281-3294.

Bar-On, R., & Parker, J. D. A. (2000). *BarOn emotional quotient inventory: Youth version*. Toronto: Multi-Health system, Incorporated.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, malesand females, scientists and mathematicians. *Journal of autism and developmental disorders*, *31*, 5-17.

Baron-Cohen, S., Hoekstra, R. A., Knickmeyer, R., & Wheelwright, S. (2006). The autism-spectrum quotient (AQ)—adolescent version. *Journal of autism and developmental disorders*, *36*, 343-350.

Barrett, L. F., Mesquita, B., Ochsner, K. N., & Gross, J. J. (2007). The experience of emotion. *Annu. Rev. Psychol.*, *58*, 373-403.

Beck, J. S., Lundwall, R. A., Gabrielsen, T., Cox, J. C., & South, M. (2020). Looking good but feeling bad:“Camouflaging” behaviors and mental health in women with autistic traits. *Autism*, *24*(4), 809-821.

Begeer, S., Mandell, D., Wijnker-Holmes, B., Venderbosch, S., Rem, D., Stekelenburg, F., & Koot, H. M. (2013). Sex differences in the timing of identification among children and adults with autism spectrum disorders. *Journal of autism and developmental disorders*, *43*, 1151-1156.

Belcher, H. L., Morein-Zamir, S., Stagg, S. D., & Ford, R. M. (2023). Shining a light on a hidden population: Social functioning and mental health in women reporting autistic traits but lacking diagnosis. *Journal of autism and developmental disorders*, *53*(8), 3118-3132.

Bellini, S. (2004). Social skill deficits and anxiety in high-functioning adolescents with autism spectrum disorders. *Focus on autism and other developmental disabilities*, *19*(2), 78-86.

Bennett, S., Robb, K. A., Zortea, T. C., Dickson, A., Richardson, C., & O'Connor, R. C. (2023). Male suicide risk and recovery factors: A systematic review and qualitative metasynthesis of two decades of research. *Psychological Bulletin*, *149*(7-8), 371.

Berking, M., Orth, U., Wupperman, P., Meier, L. L., & Caspar, F. (2008). Prospective effects of emotion-regulation skills on emotional adjustment. *Journal of counseling psychology*, *55*(4), 485.

Berkovits, L., Eisenhower, A., & Blacher, J. (2017). Emotion regulation in young children with autism spectrum disorders. *Journal of autism and developmental disorders*, *47*, 68-79.

Bird, G., & Cook, R. (2013). Mixed emotions: the contribution of alexithymia to the emotional symptoms of autism. *Translational psychiatry*, *3*(7), e285-e285.

Brereton, A. V., Tonge, B. J., & Einfeld, S. L. (2006). Psychopathology in children and adolescents with autism compared to young people with intellectual disability. *Journal of autism and developmental disorders*, *36*, 863-870.

Blakemore, S. J., & Mills, K. L. (2014). Is adolescence a sensitive period for sociocultural processing?. *Annual review of psychology*, *65*, 187-207.

Bloch, C., Burghof, L., Lehnhardt, F. G., Vogeley, K., & Falter-Wagner, C. (2021). Alexithymia traits outweigh autism traits in the explanation of depression in adults with autism. *Scientific reports*, *11*(1), 2258.

Bölte, S., Duketis, E., Poustka, F., & Holtmann, M. (2011). Sex differences in cognitive domains and their clinical correlates in higher-functioning autism spectrum disorders. *Autism*, *15*(4), 497-511.

Bos, M. G., Diamantopoulou, S., Stockmann, L., Begeer, S., & Rieffe, C. (2018). Emotion control predicts internalizing and externalizing behavior problems in boys with and without an autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *48*, 2727-2739.

Brereton, A. V., Tonge, B. J., & Einfeld, S. L. (2006). Psychopathology in children and adolescents with autism compared to young people with intellectual disability. *Journal of autism and developmental disorders*, *36*, 863-870.

Brewer, N. T., DeFrank, J. T., & Gilkey, M. B. (2016). Anticipated regret and health behavior: A meta-analysis. *Health Psychology*, *35*(11), 1264.

Bruggink, A., Huisman, S., Vuijk, R., Kraaij, V., & Garnefski, N. (2016). Cognitive emotion regulation, anxiety and depression in adults with autism spectrum disorder. *Research in autism spectrum disorders*, *22*, 34-44.

Bryne, B. M. (2010) Structural Equation Modelling with AMOS: Basic Concepts, Applications and Programming, (2nd ed.), Routledge, Taylor and Francis Group, New York.

Burgin, C. J., Brown, L. H., Royal, A., Silvia, P. J., Barrantes-Vidal, N., & Kwapil, T. R. (2012). Being with others and feeling happy: Emotional expressivity in everyday life. *Personality and Individual Differences*, *53*(3), 185-190.

Cage, E., & Troxell-Whitman, Z. (2019). Understanding the reasons, contexts and costs of camouflaging for autistic adults. *Journal of autism and developmental disorders*, *49*(5), 1899-1911.Livingstone

Cai, R. Y., Richdale, A. L., Uljarević, M., Dissanayake, C., & Samson, A. C. (2018a). Emotion regulation in autism spectrum disorder: Where we are and where we need to go. *Autism Research*, *11*(7), 962-978.

Cai, R. Y., Richdale, A. L., Foley, K. R., Trollor, J., & Uljarević, M. (2018b). Brief report: Cross-sectional interactions between expressive suppression and cognitive reappraisal and its relationship with depressive symptoms in autism spectrum disorder. *Research in Autism Spectrum Disorders*, *45*, 1-8.

Cai, R. Y., Richdale, A. L., Dissanayake, C., Trollor, J., & Uljarević, M. (2019). Emotion regulation in autism: Reappraisal and suppression interactions. *Autism*, *23*(3), 737-749.

Cai, R. Y., Richdale, A. L., Dissanayake, C., & Uljarević, M. (2020). How does emotion regulation strategy use and psychological wellbeing predict mood in adults with and without autism spectrum disorder? A naturalistic assessment. *Journal of autism and developmental disorders*, *50*, 1786-1799.

Carrington, S. J., Kent, R. G., Maljaars, J., Le Couteur, A., Gould, J., Wing, L., ... & Leekam, S. R. (2014). DSM-5 autism spectrum disorder: In search of essential behaviours for diagnosis. *Research in Autism Spectrum Disorders*, *8*(6), 701-715.

Carrington, S., Leekam, S., Kent, R., Maljaars, J., Gould, J., Wing, L., ... & Noens, I. (2015). Signposting for diagnosis of autism spectrum disorder using the diagnostic interview for social and communication disorders (DISCO). *Research in Autism Spectrum Disorders*, *9*, 45-52.

Carrington, S. J., Barrett, S. L., Sivagamasundari, U., Fretwell, C., Noens, I., Maljaars, J., & Leekam, S. R. (2019). Describing the profile of diagnostic features in autistic adults using an abbreviated version of the Diagnostic Interview for Social and Communication Disorders (DISCO-Abbreviated). *Journal of autism and developmental disorders*, *49*, 5036-5046.

Carter, A. S., Black, D. O., Tewani, S., Connolly, C. E., Kadlec, M. B., & Tager-Flusberg, H. (2007). Sex differences in toddlers with autism spectrum disorders. *Journal of autism and developmental disorders*, *37*, 86-97.

Cassidy, S., Bradley, L., Shaw, R., & Baron-Cohen, S. (2018). Risk markers for suicidality in autistic adults. *Molecular autism*, *9*, 1-14.

CDC (2014) Autism and Developmental Disabilities Monitoring Network Surveillance Year 2010 Principal Investigators. Prevalence of autism spectrum disorder among children aged 8 years - Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2010.

Cho, I. Y., Jelinkova, K., Schuetze, M., Vinette, S. A., Rahman, S., McCrimmon, A., ... & Bray, S. (2017). Circumscribed interests in adolescents with Autism Spectrum Disorder: A look beyond trains, planes, and clocks. *PloS one*, *12*(11), e0187414.

Christensen, D. L. (2016). Prevalence and characteristics of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2012. *MMWR. Surveillance summaries*, *65*.

Cleridou, K., Patalay, P., & Martin, P. (2017). Does parent–child agreement vary based on presenting problems? Results from a UK clinical sample. *Child and adolescent psychiatry and mental health*, *11*, 1-11.

Cook, R. D. (1977). Detection of influential observation in linear regression. *Technometrics*, *19*(1), 15-18.

Cook, R., Brewer, R., Shah, P., & Bird, G. (2013). Alexithymia, not autism, predicts poor recognition of emotional facial expressions. *Psychological science*, *24*(5), 723-732.

Cook, A., Ogden, J., & Winstone, N. (2018). Friendship motivations, challenges and the role of masking for girls with autism in contrasting school settings. *European Journal of Special Needs Education*, *33*(3), 302-315.

Cook, J., Hull, L., Crane, L., & Mandy, W. (2021). Camouflaging in autism: A systematic review. *Clinical psychology review*, *89*, 102080.

Cooper, K., Smith, L. G., & Russell, A. (2017). Social identity, self-esteem, and mental health in autism. *European Journal of Social Psychology*, *47*(7), 844-854.

Craig, F., Crippa, A., De Giacomo, A., Ruggiero, M., Rizzato, V., Lorenzo, A., ... & Trabacca, A. (2020). Differences in developmental functioning profiles between male and female preschoolers children with autism spectrum disorder. *Autism research*, *13*(9), 1537-1547.

Crick, N. R., & ZAHN–WAXLER, C. A. R. O. L. Y. N. (2003).. *Development and psychopathology*, *15*(3), 719-742.

Cridland, E. K., Jones, S. C., Caputi, P., & Magee, C. A. (2014). Being a girl in a boys' world: Investigating the experiences of girls with autism spectrum disorders during adolescence. *Journal of autism and developmental disorders*, *44*, 1261-1274.

Croen, L. A., Zerbo, O., Qian, Y., Massolo, M. L., Rich, S., Sidney, S., & Kripke, C. (2015). The health status of adults on the autism spectrum. *Autism*, *19*(7), 814-823.

DaWalt, L. S., Usher, L. V., Greenberg, J. S., & Mailick, M. R. (2019). Friendships and social participation as markers of quality of life of adolescents and adults with fragile X syndrome and autism. *Autism*, *23*(2), 383-393.

DaWalt, L. S., Taylor, J. L., Bishop, S., Hall, L. J., Steinbrenner, J. D., Kraemer, B., ... & Odom, S. L. (2020). Sex differences in social participation of high school students with autism spectrum disorder. *Autism Research*, *13*(12), 2155-2163.

Day, T. C., McNaughton, K. A., Naples, A. J., & McPartland, J. C. (2019). Self-reported social impairments predict depressive disorder in adults with autism spectrum disorder. *Autism*, *24*(2), 297-306.

De France, K., Hicks, O., & Hollenstein, T. (2022). Understanding the association between reappraisal use and depressive symptoms during adolescence: the moderating influence of regulatory success. *Cognition and Emotion*, *36*(4), 758-766.

De Giambattista, C., Ventura, P., Trerotoli, P., Margari, F., & Margari, L. (2021). Sex differences in autism spectrum disorder: focus on high functioning children and adolescents. *Frontiers in psychiatry*, *12*, 539835.

Dean, M., Harwood, R., & Kasari, C. (2017). The art of camouflage: Gender differences in the social behaviors of girls and boys with autism spectrum disorder. *Autism*, *21*(6), 678-689.

Demetriou, E. A., Pepper, K. L., Park, S. H., Pellicano, L., Song, Y. J. C., Naismith, S. L., ... & Guastella, A. J. (2021). Autism spectrum disorder: An examination of sex differences in neuropsychological and self-report measures of executive and non-executive cognitive function. *Autism*, *25*(8), 2223-2237.

Demir, S. (2022). Comparison of normality tests in terms of sample sizes under different skewness and Kurtosis coefficients. *International Journal of Assessment Tools in Education*, *9*(2), 397-409.

Deng, Y., Chang, L., Yang, M., Huo, M., & Zhou, R. (2016). Gender differences in emotional response: Inconsistency between experience and expressivity. *PloS one*, *11*(6), e0158666.

Dettmann, L. M., Adams, S., & Taylor, G. (2022). Investigating the prevalence of anxiety and depression during the first COVID-19 lockdown in the United Kingdom: Systematic review and meta-analyses. *British Journal of Clinical Psychology*, *61*(3), 757-780.

Dillon, E. F., Kanne, S., Landa, R. J., Annett, R., Bernier, R., Bradley, C., ... & SPARK consortium Ericka L. Wodka. (2021). Sex differences in autism: Examining intrinsic and extrinsic factors in children and adolescents enrolled in a national ASD cohort. *Journal of Autism and Developmental Disorders*, 1-14.

Dryman, M. T., & Heimberg, R. G. (2018). Emotion regulation in social anxiety and depression: A systematic review of expressive suppression and cognitive reappraisal. *Clinical psychology review*, *65*, 17-42.

Dubbin, J., & Watson, G. S. (1951). Testing for serial correlation in least squares regression. II. *Biometrika*, *38*, 159-178.

Duvekot, J., van der Ende, J., Verhulst, F. C., Slappendel, G., van Daalen, E., Maras, A., & Greaves-Lord, K. (2017). Factors influencing the probability of a diagnosis of autism spectrum disorder in girls versus boys. *Autism*, *21*(6), 646-658.

Dworzynski, K., Ronald, A., Bolton, P., & Happé, F. (2012). How different are girls and boys above and below the diagnostic threshold for autism spectrum disorders?. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(8), 788-797.

Edwards, H., Wright, S., Sargeant, C., Cortese, S., & Wood-Downie, H. (2023). Research Review: A systematic review and meta-analysis of sex differences in narrow constructs of restricted and repetitive behaviours and interests in autistic children, adolescents, and adults. *Journal of Child Psychology and Psychiatry*, *65*(1), 4-17.

Else-Quest, N. M., Hyde, J. S., Goldsmith, H. H., & Van Hulle, C. A. (2006). Gender differences in temperament: a meta-analysis. *Psychological bulletin*, *132*(1), 33.

English, M. C., Gignac, G. E., Visser, T. A., Whitehouse, A. J., Enns, J. T., & Maybery, M. T. (2021). The Comprehensive Autistic Trait Inventory (CATI): Development and validation of a new measure of autistic traits in the general population. *Molecular autism*, *12*(1), 37.

Factor, R. S., Condy, E. E., Farley, J. P., & Scarpa, A. (2016). Brief report: Insistence on sameness, anxiety, and social motivation in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *46*, 2548-2554.

Fietz, J., Valencia, N., & Silani, G. (2018). Alexithymia and autistic traits as possible predictors for traits related to depression, anxiety, and stress: A multivariate statistical approach. *Journal of evaluation in clinical practice*, *24*(4), 901-908.

Fombonne, E., Quirke, S., & Hagen, A. (2009). Prevalence and interpretation of recent trends in rates of pervasive developmental disorders. *McGill Journal of Medicine: MJM*, *12*(2).

Fombonne, E. (2020). Camouflage and autism. *Journal of Child Psychology and Psychiatry*, *61*(7), 735-738.

Forbes, E. E., & Dahl, R. E. (2010). Pubertal development and behavior: hormonal activation of social and motivational tendencies. *Brain and cognition*, *72*(1), 66-72.

Ford, J. H., Kim, S. Y., Kark, S. M., Daley, R. T., Payne, J. D., & Kensinger, E. A. (2022). Distinct stress-related changes in intrinsic amygdala connectivity predict subsequent positive and negative memory performance. *European Journal of Neuroscience*, *56*(6), 4744-4765.

Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Personality and Individual differences*, *30*(8), 1311-1327.

Garnefski, N., Legerstee, J., Kraaij, V., van Den Kommer, T., & Teerds, J. A. N. (2002). Cognitive coping strategies and symptoms of depression and anxiety: A comparison between adolescents and adults. *Journal of adolescence*, *25*(6), 603-611.

Garnefski, N., Teerds, J., Kraaij, V., Legerstee, J., & van Den Kommer, T. (2004). Cognitive emotion regulation strategies and depressive symptoms: Differences between males and females. *Personality and individual differences*, *36*(2), 267-276.

Ghanouni, P., & Quirke, S. (2023). Resilience and coping strategies in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *53*(1), 456-467.

George, D., & Mallery, P. (2010). SPSS for Windows Step by Step: A Simple Guide and Reference 18.0 Update.

Georgiades, S., Bishop, S. L., & Frazier, T. (2017). Editorial Perspective: Longitudinal research in autism–introducing the concept of 'chronogeneity'. *Journal of Child Psychology and Psychiatry*, *58*(5), 634-636.

Geurts, H. M., Corbett, B., & Solomon, M. (2009). The paradox of cognitive flexibility in autism. *Trends in cognitive sciences*, *13*(2), 74-82.

Goin-Kochel, R. P., Mackintosh, V. H., & Myers, B. J. (2006). How many doctors does it take to make an autism spectrum diagnosis?. *Autism*, *10*(5), 439-451.

Goldsmith, S. F., & Kelley, E. (2018). Associations between emotion regulation and social impairment in children and adolescents with autism spectrum disorder. *Journal of autism and developmental disorders*, *48*, 2164-2173.

Gormley, E., Ryan, C., & McCusker, C. (2022). Alexithymia is associated with emotion dysregulation in young people with autism spectrum disorder. *Journal of Developmental and Physical Disabilities*, *34*(1), 171-186.

Gotham, K., Marvin, A. R., Taylor, J. L., Warren, Z., Anderson, C. M., Law, P. A., ... & Lipkin, P. H. (2015). Characterizing the daily life, needs, and priorities of adults with autism spectrum disorder from Interactive Autism Network data. *Autism*, *19*(7), 794-804.

Goubet, K. E., & Chrysikou, E. G. (2019). Emotion regulation flexibility: Gender differences in context sensitivity and repertoire. *Frontiers in psychology*, *10*, 935.

Gould, J., & Ashton-Smith, J. (2011). Missed diagnosis or misdiagnosis? Girls and women on the autism spectrum. *Good Autism Practice (GAP)*, *12*(1), 34-41.

Green, S. A., Rudie, J. D., Colich, N. L., Wood, J. J., Shirinyan, D., Hernandez, L., ... & Bookheimer, S. Y. (2013). Overreactive brain responses to sensory stimuli in youth with autism spectrum disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, *52*(11), 1158-1172.

Griffin, C., Lombardo, M. V., & Auyeung, B. (2016). Alexithymia in children with and without autism spectrum disorders. *Autism research*, *9*(7), 773-780.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of general psychology*, *2*(3), 271-299.

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281-291.

Gross, J. J. (2014). Emotion regulation: Conceptual and empirical foundations. *Handbook of emotion regulation*, *2*, 3-20.

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological inquiry*, *26*(1), 1-26.

Gross, J. J., & Jazaieri, H. (2014). Emotion, emotion regulation, and psychopathology: An affective science perspective. *Clinical psychological science*, *2*(4), 387-401.

Gross, J. J., & John, O. P. (1995). Berkeley expressivity questionnaire. *Journal of Personality and Social Psychology*.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of personality and social psychology*, *85*(2), 348.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), Handbook of emotion regulation (pp. 3–24). New York: Guilford Press.

Grove, R., Hoekstra, R. A., Wierda, M., & Begeer, S. (2017). Exploring sex differences in autistic traits: A factor analytic study of adults with autism. *Autism*, *21*(6), 760-768.

Grynberg, D., Luminet, O., Corneille, O., Grèzes, J., & Berthoz, S. (2010). Alexithymia in the interpersonal domain: A general deficit of empathy?. *Personality and individual differences*, *49*(8), 845-850.

Haga, S. M., Kraft, P., & Corby, E. K. (2009). Emotion regulation: Antecedents and well-being outcomes of cognitive reappraisal and expressive suppression in cross-cultural samples. *Journal of happiness studies*, *10*, 271-291.

Hair, J.F., W.C. Black, B.J. Babin, and R.E. Anderson (2010) Multivariate Data Analysis, 7th edition, Upper Saddle River, NJ: Prentice Hall.

Halladay, A. K., Bishop, S., Constantino, J. N., Daniels, A. M., Koenig, K., Palmer, K., ... & Szatmari, P. (2015). Sex and gender differences in autism spectrum disorder: summarizing evidence gaps and identifying emerging areas of priority. *Molecular autism*, *6*, 1-5.

Hankin, B. L., Abramson, L. Y., Moffitt, T. E., Silva, P. A., McGee, R., & Angell, K. E. (1998). Development of depression from preadolescence to young adulthood: emerging gender differences in a 10-year longitudinal study. *Journal of abnormal psychology*, *107*(1), 128.

Hattier, M. A., Matson, J. L., Tureck, K., & Horovitz, M. (2011). The effects of gender and age on repetitive and/or restricted behaviors and interests in adults with autism spectrum disorders and intellectual disability. *Research in developmental disabilities*, *32*(6), 2346-2351.

Head, A. M., McGillivray, J. A., & Stokes, M. A. (2014). Gender differences in emotionality and sociability in children with autism spectrum disorders. *Molecular autism*, *5*, 1-9.

Hiller, R. M., Young, R. L., & Weber, N. (2014). Sex differences in autism spectrum disorder based on DSM-5 criteria: evidence from clinician and teacher reporting. *Journal of abnormal child psychology*, *42*, 1381-1393.

Hiller, R. M., Young, R. L., & Weber, N. (2016). Sex differences in pre-diagnosis concerns for children later diagnosed with autism spectrum disorder. *Autism*, *20*(1), 75-84.

Hirota, T., & King, B. H. (2023). Autism spectrum disorder: A review. *Jama*, *329*(2), 157-168.

Hollocks, M. J., Lerh, J. W., Magiati, I., Meiser-Stedman, R., & Brugha, T. S. (2019). Anxiety and depression in adults with autism spectrum disorder: A systematic review and meta-analysis. *Psychological medicine*, *49*(4), 559-572.

Hollocks, M. J., Charman, T., Baird, G., Lord, C., Pickles, A., & Simonoff, E. (2022). Exploring the impact of adolescent cognitive inflexibility on emotional and behavioural problems experienced by autistic adults. *Autism*, *26*(5), 1229-1241.

Holtmann, M., Bölte, S., & Poustka, F. (2007). Autism spectrum disorders: Sex differences in autistic behaviour domains and coexisting psychopathology. *Developmental Medicine & Child Neurology*, *49*(5), 361-366.

Horwitz, E., Vos, M., De Bildt, A., Greaves-Lord, K., Rommelse, N., Schoevers, R., & Hartman, C. (2023). Sex differences in the course of autistic and co-occurring psychopathological symptoms in adolescents with and without autism spectrum disorder. *Autism*, *27*(6), 1716-1729.

Howe, Y. J., O'Rourke, J. A., Yatchmink, Y., Viscidi, E. W., Jones, R. N., & Morrow, E. M. (2015). Female autism phenotypes investigated at different levels of language and developmental abilities. *Journal of autism and developmental disorders*, *45*, 3537-3549.

Hu, T., Zhang, D., Wang, J., Mistry, R., Ran, G., & Wang, X. (2014). Relation between emotion regulation and mental health: A meta-analysis review. *Psychological reports*, *114*(2), 341-362.

Hull, L., Mandy, W., Lai, M. C., Baron-Cohen, S., Allison, C., Smith, P., & Petrides, K. V. (2019). Development and validation of the camouflaging autistic traits questionnaire (CAT-Q). *Journal of autism and developmental disorders*, *49*, 819-833.

Hull, L., Mandy, W., & Petrides, K. V. (2016/17). Behavioural and cognitive sex/gender differences in autism spectrum condition and typically developing males and females. *Autism*, *21*(6), 706-727. *Epub 2016 Dec 14.*

Hull, L., Petrides, K. V., Allison, C., Smith, P., Baron-Cohen, S., Lai, M. C., & Mandy, W. (2017). "Putting on my best normal": Social camouflaging in adults with autism spectrum conditions. *Journal of autism and developmental disorders*, *47*, 2519-2534.

Hull, L., Mandy, W., Lai, M. C., Baron-Cohen, S., Allison, C., Smith, P., & Petrides, K. V. (2019). Development and validation of the camouflaging autistic traits questionnaire (CAT-Q). *Journal of autism and developmental disorders*, *49*, 819-833.

Hull, L., Mandy, W., & Petrides, K. V. (2017). Behavioural and cognitive sex/gender differences in autism spectrum condition and typically developing males and females. *Autism*, *21*(6), 706-727.

Hull, L., Petrides, K. V., & Mandy, W. (2020). The female autism phenotype and camouflaging: A narrative review. *Review Journal of Autism and Developmental Disorders*, *7*, 306-317.

Huppert, J. D., Foa, E. B., Furr, J. M., Filip, J. C., & Mathews, A. (2003). Interpretation bias in social anxiety: A dimensional perspective. *Cognitive Therapy and Research*, *27*, 569-577.

Hurley, R. S., Losh, M., Parlier, M., Reznick, J. S., & Piven, J. (2007). The broad autism phenotype questionnaire. *Journal of autism and developmental disorders*, *37*, 1679-1690.

Ike, K. G., de Boer, S. F., Buwalda, B., & Kas, M. J. (2020). Social withdrawal: an initially adaptive behavior that becomes maladaptive when expressed excessively. *Neuroscience & Biobehavioral Reviews*, *116*, 251-267.

Jamison, R., Bishop, S. L., Huerta, M., & Halladay, A. K. (2017). The clinician perspective on sex differences in autism spectrum disorders. *Autism*, *21*(6), 772-784.

Jamison, T. R., & Schuttler, J. O. (2015). Examining social competence, self-perception, quality of life, and internalizing and externalizing symptoms in adolescent females with and without autism spectrum disorder: a quantitative design including between-groups and correlational analyses. *Molecular autism*, *6*, 1-16.

Jahromi, L. B., Bryce, C. I., & Swanson, J. (2013). The importance of self-regulation for the school and peer engagement of children with high-functioning autism. *Research in Autism Spectrum Disorders*, *7*(2), 235-246.

Jahromi, L. B., Meek, S. E., & Ober-Reynolds, S. (2012). Emotion regulation in the context of frustration in children with high functioning autism and their typical peers. *Journal of Child Psychology and Psychiatry*, *53*(12), 1250-1258.

Jones, C. R., Barrett, S. L., Bite, I., Legzdina, M., Arina, K., Higgins, A., ... & Leekam, S. R. (2020). Development of the Signposting Questionnaire for Autism (SQ-A): measurement comparison with the 10-item Autism Spectrum Quotient-Child and the Strengths and Difficulties Questionnaire in the UK and Latvia. *Molecular Autism*, *11*, 1-14.

Joshi, G., Petty, C., Wozniak, J., Henin, A., Fried, R., Galdo, M., ... & Biederman, J. (2010). The heavy burden of psychiatric comorbidity in youth with autism spectrum disorders: A large comparative study of a psychiatrically referred population. *Journal of autism and developmental disorders*, *40*, 1361-1370.

Kalia, V., Vishwanath, K., Knauft, K., Vellen, B. V. D., Luebbe, A., & Williams, A. (2018). Acute stress attenuates cognitive flexibility in males only: An fNIRS examination. *Frontiers in psychology*, *9*, 2084.

Kasari, C., Dean, M., Kretzmann, M., Shih, W., Orlich, F., Whitney, R., ... & King, B. (2016). Children with autism spectrum disorder and social skills groups at school: A randomized trial comparing intervention approach and peer composition. *Journal of Child Psychology and Psychiatry*, *57*(2), 171-179.

G. Kent, R., J. Carrington, S., Le Couteur, A., Gould, J., Wing, L., Maljaars, J., ... & R. Leekam, S. (2013). Diagnosing Autism Spectrum Disorder: who will get a DSM-5 diagnosis?. *Journal of Child Psychology and Psychiatry*, *54*(11), 1242-1250.

Kent, R., & Simonoff, E. (2017). Prevalence of anxiety in autism spectrum disorders. *Anxiety in children and adolescents with autism spectrum disorder*, 5-32.

Kempermann, G. (2011). Seven principles in the regulation of adult neurogenesis. *European Journal of Neuroscience*, *33*(6), 1018-1024.

Ketelaars, M. P., Mol, A., Swaab, H., & van Rijn, S. (2016). Emotion recognition and alexithymia in high functioning females with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *21*, 51-60.

Kever, A., Pollatos, O., Vermeulen, N., & Grynberg, D. (2015). Interoceptive sensitivity facilitates both antecedent-and response-focused emotion regulation strategies. *Personality and Individual Differences*, *87*, 20-23.

Khalsa, S. S., & Lapidus, R. C. (2016). Can interoception improve the pragmatic search for biomarkers in psychiatry?. *Frontiers in psychiatry*, *7*, 187423.

Khalsa, S. S., Adolphs, R., Cameron, O. G., Critchley, H. D., Davenport, P. W., Feinstein, J. S., ... & Zucker, N. (2018). Interoception and mental health: a roadmap. *Biological psychiatry: cognitive neuroscience and neuroimaging*, *3*(6), 501-513.

Khatibi, A., Sharpe, L., Dehghani, M., Ghalibaf, E., Hosseinchi, P., Mazidi, M., ... & Ghadiri, T. (2021). Suppression may improve adaptation to worry when facing uncertainty: Studying COVID-19 pandemic. *Frontiers in Psychiatry*, *12*, 778375.

Kinnaird, E., Stewart, C., & Tchanturia, K. (2019). Investigating alexithymia in autism: A systematic review and meta-analysis. *European Psychiatry*, *55*, 80-89.

Kirkovski, M., Enticott, P. G., & Fitzgerald, P. B. (2013). A review of the role of female gender in autism spectrum disorders. *Journal of autism and developmental disorders*, *43*, 2584-2603.

Kissine, M. (2012). Pragmatics, cognitive flexibility and autism spectrum disorders. *Mind & language*, *27*(1), 1-28.

Kodal, A., Fjermestad, K., Bjelland, I., Gjestad, R., Öst, L. G., Bjaastad, J. F., ... & Wergeland, G. J. (2018). Long-term effectiveness of cognitive behavioral therapy for youth with anxiety disorders. *Journal of anxiety disorders*, *53*, 58-67.

Kraaij, V., & Garnefski, N. (2012). Coping and depressive symptoms in adolescents with a chronic medical condition: A search for intervention targets. *Journal of Adolescence*, *35*(6), 1593-1600.

Kraaij, V., & Garnefski, N. (2019). The behavioral emotion regulation questionnaire: development, psychometric properties and relationships with emotional problems and the cognitive emotion regulation questionnaire. *Personality and Individual Differences*, *137*, 56-61.

Kreiser, N. L., & White, S. W. (2014). ASD in females: are we overstating the gender difference in diagnosis?. *Clinical child and family psychology review*, *17*, 67-84.

Kwon, H., Yoon, K. L., Joormann, J., & Kwon, J. H. (2013). Cultural and gender differences in emotion regulation: Relation to depression. *Cognition & emotion*, *27*(5), 769-782.

Lacroix, A., Dutheil, F., Logemann, A., Cserjesi, R., Peyrin, C., Biro, B., ... & Mermillod, M. (2022). Flexibility in autism during unpredictable shifts of socio-emotional stimuli: Investigation of group and sex differences. *Autism*, *26*(7), 1681-1697.

Lai, M. C., & Baron-Cohen, S. (2015). Identifying the lost generation of adults with autism spectrum conditions. *The Lancet Psychiatry*, *2*(11), 1013-1027.

Lai, M. C., Hull, L., Mandy, W., Chakrabarti, B., Nordahl, C. W., Lombardo, M. V., ... & Livingston, L. A. (2021). Commentary:'Camouflaging'in autistic people–reflection on Fombonne (2020). *Journal of Child Psychology and Psychiatry*, *62*(8).

Lai, M. C., Lombardo, M. V., Suckling, J., Ruigrok, A. N., Chakrabarti, B., Ecker, C., ... & Baron-Cohen, S. (2013). Biological sex affects the neurobiology of autism. *Brain*, *136*(9), 2799-2815.

Lai, M. C., Lombardo, M. V., Ruigrok, A. N., Chakrabarti, B., Auyeung, B., Szatmari, P., ... & MRC AIMS Consortium. (2017). Quantifying and exploring camouflaging in men and women with autism. *Autism*, *21*(6), 690-702.

Lai, M. C., & Szatmari, P. (2020). Sex and gender impacts on the behavioural presentation and recognition of autism. *Current Opinion in Psychiatry*, *33*(2), 117-123.

Laloyaux, J., Fantini, C., Lemaire, M., Luminet, O., & Larøi, F. (2015). Evidence of contrasting patterns for suppression and reappraisal emotion regulation strategies in alexithymia. *The Journal of nervous and mental disease*, *203*(9), 709-717.

Lang, P. J., Bradley, MM., & Cuthbert, B. N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8. Gainesville: University of Florida.

Lawrence, K. E., Hernandez, L. M., Eilbott, J., Jack, A., Aylward, E., Gaab, N., ... & Dapretto, M. (2020). Neural responsivity to social rewards in autistic female youth. *Translational psychiatry*, *10*(1), 178.

Leader, G., & Mannion, A. (2016). Gastrointestinal disorders. *Comorbid conditions among children with autism spectrum disorders*, 257-281.

Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and social psychology bulletin*, *9*(3), 371-375.

Lebersfeld, J. B., Swanson, M., Clesi, C. D., & O'Kelley, S. E. (2021). Systematic review and meta-analysis of the clinical utility of the ADOS-2 and the ADI-R in diagnosing autism spectrum disorders in children. *Journal of Autism and Developmental Disorders*, 1-14.

Leedham, A., Thompson, A. R., Smith, R., & Freeth, M. (2020). 'I was exhausted trying to figure it out': The experiences of females receiving an autism diagnosis in middle to late adulthood. *Autism*, *24*(1), 135-146.

Leekam, S. R., Libby, S. J., Wing, L., Gould, J., & Taylor, C. (2002). The Diagnostic Interview for Social and Communication Disorders: algorithms for ICD-10 childhood autism and Wing and Gould autistic spectrum disorder. *Journal of Child Psychology and Psychiatry*, *43*(3), 327-342.

Lehnhardt, F. G., Falter, C. M., Gawronski, A., Pfeiffer, K., Tepest, R., Franklin, J., & Vogeley, K. (2016). Sex-related cognitive profile in autism spectrum disorders diagnosed late in life: implications for the female autistic phenotype. *Journal of autism and developmental disorders*, *46*, 139-154.

Levant, N., Thom, C., & Wallis, D. J. (2010). Emotion recognition and alexithymia in females with non-clinical disordered eating. *Eating behaviors*, *11*(1), 1-5.

Levant, R. F., Good, G. E., Cook, S. W., O'Neil, J. M., Smalley, K. B., Owen, K., & Richmond, K. (2006). The normative Male Alexithymia Scale: Measurement of a gender-linked syndrome. *Psychology of Men & Masculinity*, *7*(4), 212.

Levant, R. F., Hall, R. J., Williams, C. M., & Hasan, N. T. (2009). Gender differences in alexithymia. *Psychology of men & masculinity*, *10*(3), 190.

Levin, R. L., & Rawana, J. S. (2022). Exploring two models of emotion regulation: how strategy use, abilities, and flexibility relate to well-being and mental illness. *Anxiety, Stress, & Coping*, *35*(6), 623-636.

Li, P., Wang, W., Fan, C., Zhu, C., Li, S., Zhang, Z., ... & Luo, W. (2017). Distraction and expressive suppression strategies in regulation of high-and low-intensity negative emotions. *Scientific reports*, *7*(1), 13062.

Livingston, L. A., & Happé, F. (2017). Conceptualising compensation in neurodevelopmental disorders: Reflections from autism spectrum disorder. *Neuroscience & Biobehavioral Reviews*, *80*, 729-742.

Livingston, L. A., Waldren, L. H., Walton, E., & Shah, P. (2022). Emotion processing differences mediate the link between sex and autistic traits in young adulthood. *JCPP advances*, *2*(3), e12096.

Livingston, L.A., Davies, G., Shah, P., Layinka, O., Leekam, S.R., & Jones, C. R. G*.,* (2023/24) *(in preparation)* Initial Development of the Signposting Questionnaire for Autistic Adults (SQ-A Adult).

Livingston, L. A., Shah, P., & Happé, F. (2019). Compensatory strategies below the behavioural surface in autism: A qualitative study. *The Lancet Psychiatry*, *6*(9), 766-777.

Logsden, L. (2010). *The experiences of adolescence for females with asperger's disorder*. Alliant International University, San Francisco Bay.

Loomes, R., Hull, L., & Mandy, W. P. L. (2017). What is the male-to-female ratio in autism spectrum disorder? A systematic review and meta-analysis. *Journal of the American Academy of Child & Adolescent Psychiatry*, *56*(6), 466-474.

Lu, J., Wang, Z., Liang, Y., & Yao, P. (2022). Rethinking autism: the impact of maternal risk factors on autism development. *American journal of translational research*, *14*(2), 1136.

Lugo-Marin, J., Magan-Maganto, M., Rivero-Santana, A., Cuellar-Pompa, L., Alviani, M., Jenaro-Rio, C., ... & Canal-Bedia, R. (2019). Prevalence of psychiatric disorders in adults with autism spectrum disorder: A systematic review and meta-analysis. *Research in Autism Spectrum Disorders*, *59*, 22-33.

Maddox, B. B., & White, S. W. (2015). Comorbid social anxiety disorder in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*, 3949-3960.

Maenner, M. J. (2020). Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *MMWR. Surveillance Summaries*, *69*.

Maenner, M. J., Warren, Z., Williams, A. R., Amoakohene, E., Bakian, A. V., Bilder, D. A., ... & Shaw, K. A. (2023). Prevalence and characteristics of autism spectrum disorder among children aged 8 years—Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2020. *MMWR Surveillance Summaries*, *72*(2), 1.

Maljaars, J., Noens, I., Scholte, E., & van Berckelaer-Onnes, I. (2012). Evaluation of the criterion and convergent validity of the Diagnostic Interview for Social and Communication Disorders in young and low-functioning children. *Autism*, *16*(5), 487-497.

Mandic-Maravic, V., Pejovic-Milovancevic, M., Mitkovic-Voncina, M., Kostic, M., Aleksic-Hil, O., Radosavljev-Kircanski, J., ... & Lecic-Tosevski, D. (2015). Sex differences in autism spectrum disorders: does sex moderate the pathway from clinical symptoms to adaptive behavior?. *Scientific reports*, *5*(1), 10418.

Mandy, W. (2019). Social camouflaging in autism: Is it time to lose the mask?. *Autism*, *23*(8), 1879-1881.

Mandy, W., Chilvers, R., Chowdhury, U., Salter, G., Seigal, A., & Skuse, D. (2012). Sex differences in autism spectrum disorder: evidence from a large sample of children and adolescents. *Journal of autism and developmental disorders*, *42*, 1304-1313.

Mandy, W., Pellicano, L., St Pourcain, B., Skuse, D., & Heron, J. (2018). The development of autistic social traits across childhood and adolescence in males and females. *Journal of Child Psychology and Psychiatry*, *59*(11), 1143-1151.

Marcus, S. M., Kerber, K. B., Rush, A. J., Wisniewski, S. R., Nierenberg, A., Balasubramani, G. K., ... & Trivedi, M. H. (2008). Sex differences in depression symptoms in treatment-seeking adults: confirmatory analyses from the Sequenced Treatment Alternatives to Relieve Depression study. *Comprehensive psychiatry*, *49*(3), 238-246.

Martel, M. M. (2013). Sexual selection and sex differences in the prevalence of childhood externalizing and adolescent internalizing disorders. *Psychological bulletin*, *139*(6), 1221.

Martin, R. C., & Dahlen, E. R. (2005). Cognitive emotion regulation in the prediction of depression, anxiety, stress, and anger. *Personality and individual differences*, *39*(7), 1249-1260.

Martins, E., Freire, M., & Ferreira-Santos, F. (2016). Examination of adaptive and maladaptive cognitive emotion regulation strategies as transdiagnostic processes: associations with diverse psychological symptoms in college students.

Mazefsky, C. A., Herrington, J., Siegel, M., Scarpa, A., Maddox, B. B., Scahill, L., & White, S. W. (2013). The role of emotion regulation in autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *52*(7), 679-688.

Mazefsky, C. A., Pelphrey, K. A., & Dahl, R. E. (2012). The need for a broader approach to emotion regulation research in autism. *Child development perspectives*, *6*(1), 92-97.

Mazefsky, C. A., & White, S. W. (2014). Emotion regulation: Concepts & practice in autism spectrum disorder. *Child and Adolescent Psychiatric Clinics*, *23*(1), 15-24.

Mazefsky, C. A. (2015). Emotion regulation and emotional distress in autism spectrum disorder: Foundations and considerations for future research. *Journal of autism and developmental disorders*, *45*, 3405-3408.

May, T., Cornish, K., & Rinehart, N. (2014). Does gender matter? A one year follow-up of autistic, attention and anxiety symptoms in high-functioning children with autism spectrum disorder. *Journal of autism and developmental disorders*, *44*, 1077-1086.

May, T., Cornish, K., & Rinehart, N. J. (2015). Mechanisms of anxiety related attentional biases in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*, 3339-3350.

May, T., Cornish, K., & Rinehart, N. J. (2016). Gender profiles of behavioral attention in children with autism spectrum disorder. *Journal of attention disorders*, *20*(7), 627-635.

Mayes, S. D., Calhoun, S. L., Waschbusch, D. A., & Baweja, R. (2017). Autism and reactive attachment/disinhibited social engagement disorders: Co-occurrence and differentiation. *Clinical child psychology and psychiatry*, *22*(4), 620-631.

McCrimmon, A. W., & Smith, A. D. (2013). Review of the Wechsler abbreviated scale of intelligence (WASI-II).

McQuaid, G. A., Lee, N. R., & Wallace, G. L. (2022). Camouflaging in autism spectrum disorder: Examining the roles of sex, gender identity, and diagnostic timing. *Autism*, *26*(2), 552-559.

McRae, K., Ochsner, K. N., Mauss, I. B., Gabrieli, J. J., & Gross, J. J. (2008). Gender differences in emotion regulation: An fMRI study of cognitive reappraisal. *Group processes & intergroup relations*, *11*(2), 143-162.

Miers, A. C., Blöte, A. W., Bögels, S. M., & Westenberg, P. M. (2008). Interpretation bias and social anxiety in adolescents. *Journal of anxiety disorders*, *22*(8), 1462-1471.

Milner, V., Colvert, E., Mandy, W., & Happé, F. (2023). A comparison of self-report and discrepancy measures of camouflaging: Exploring sex differences in diagnosed autistic versus high autistic trait young adults. *Autism Research*, *16*(3), 580-590.

Milner, V., McIntosh, H., Colvert, E., & Happé, F. (2019). A qualitative exploration of the female experience of autism spectrum disorder (ASD). *Journal of autism and developmental disorders*, *49*, 2389-2402.

Milosavljevic, B., Carter Leno, V., Simonoff, E., Baird, G., Pickles, A., Jones, C. R., Erskine, C., Charman, T. & Happé, F. (2016). Alexithymia in adolescents with autism spectrum disorder: Its relationship to internalising difficulties, sensory modulation and social cognition. *Journal of autism and developmental disorders*, *46*, 1354-1367.

Mingins, J. E., Tarver, J., Waite, J., Jones, C., & Surtees, A. D. (2021). Anxiety and intellectual functioning in autistic children: A systematic review and meta-analysis. *Autism*, *25*(1), 18-32.

Morie, K. P., Jackson, S., Zhai, Z. W., Potenza, M. N., & Dritschel, B. (2019). Mood disorders in high-functioning autism: The importance of alexithymia and emotional regulation. *Journal of Autism and Developmental Disorders*, *49*, 2935-2945.

Morrison, A. S., & Heimberg, R. G. (2013). Social anxiety and social anxiety disorder. *Annual review of clinical psychology*, *9*(1), 249-274.

Myles, O., Boyle, C., & Richards, A. (2019). The social experiences and sense of belonging in adolescent females with autism in mainstream school. *Educational and Child Psychology*.

Naragon-Gainey, K., McMahon, T. P., & Chacko, T. P. (2017). The structure of common emotion regulation strategies: A meta-analytic examination. *Psychological bulletin*, *143*(4), 384.

Nasca, B. C., Lopata, C., Donnelly, J. P., Rodgers, J. D., & Thomeer, M. L. (2020). Sex differences in externalizing and internalizing symptoms of children with ASD. *Journal of autism and developmental disorders*, *50*, 3245-3252.

National Collaborating Centre for Mental Health, & Britain, G. (2013). Social anxiety disorder: recognition, assessment and treatment. British Psychological Society. (NICE, 2013).

Nimmo-Smith, V., Heuvelman, H., Dalman, C., Lundberg, M., Idring, S., Carpenter, P., ... & Rai, D. (2020). Anxiety disorders in adults with autism spectrum disorder: A population-based study. *Journal of autism and developmental disorders*, *50*, 308-318.

Nolen-Hoeksema, S. (2012). Emotion regulation and psychopathology: The role of gender. *Annual review of clinical psychology*, *8*, 161-187.

Nolen-Hoeksema, S., & Aldao, A. (2011). Gender and age differences in emotion regulation strategies and their relationship to depressive symptoms. *Personality and individual differences*, *51*(6), 704-708.

Nolen-Hoeksema, S., & Jackson, B. (2001). Mediators of the gender difference in rumination. *Psychology of women quarterly*, *25*(1), 37-47.

Nuske, H. J., Hedley, D., Woollacott, A., Thomson, P., Macari, S., & Dissanayake, C. (2017). Developmental delays in emotion regulation strategies in preschoolers with autism. *Autism Research*, *10*(11), 1808-1822.

Oakley, B. F., Brewer, R., Bird, G., & Catmur, C. (2016). Theory of mind is not theory of emotion: A cautionary note on the Reading the Mind in the Eyes Test. *Journal of abnormal psychology*, *125*(6), 818.

Oakley, B. F., Jones, E. J., Crawley, D., Charman, T., Buitelaar, J., Tillmann, J., ... & Loth, E. (2022). Alexithymia in autism: cross-sectional and longitudinal associations with social-communication difficulties, anxiety and depression symptoms. *Psychological medicine*, *52*(8), 1458-1470.

O'Connor, E. J., Staiger, P. K., Kambouropoulos, N., & Smillie, L. D. (2014). Pathways to social anxiety: The role of reinforcement sensitivities and emotion regulation. *Psychiatry Research*, *220*(3), 915-920.

Ochsner, K. N., Silvers, J. A., & Buhle, J. T. (2012). Functional imaging studies of emotion regulation: a synthetic review and evolving model of the cognitive control of emotion. *Annals of the new York Academy of Sciences*, *1251*(1), E1-E24.

Oswald, T. M., Winter-Messiers, M. A., Gibson, B., Schmidt, A. M., Herr, C. M., & Solomon, M. (2016). Sex differences in internalizing problems during adolescence in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *46*, 624-636.

Ottenbreit, N. D., Dobson, K. S., & Quigley, L. (2014). An examination of avoidance in major depression in comparison to social anxiety disorder. *Behaviour Research and Therapy*, *56*, 82-90.

Pandey, R., & Choubey, A. K. (2010). Emotion and health: An overview. *SIS Journal of Projective Psychology & Mental Health*, *17*(2).

Parker, J. D., Taylor, G. J., & Bagby, R. M. (2001). The relationship between emotional intelligence and alexithymia. *Personality and Individual differences*, *30*(1), 107-115.

Patalay P & Fitzsimons E. (2017). Mental ill-health among children of the new century: trends across childhood with a focus on age 14. September 2017.Centre for Longitudinal Studies: London.

Pearson, A., & Rose, K. (2021). A conceptual analysis of autistic masking: Understanding the narrative of stigma and the illusion of choice. *Autism in Adulthood*, *3*(1), 52-60.

Perchtold, C. M., Papousek, I., Fink, A., Weber, H., Rominger, C., & Weiss, E. M. (2019). Gender differences in generating cognitive reappraisals for threatening situations: Reappraisal capacity shields against depressive symptoms in men, but not women. *Frontiers in Psychology*, 553.

Perry, E., Mandy, W., Hull, L., & Cage, E. (2022). Understanding camouflaging as a response to autism-related stigma: A social identity theory approach. *Journal of autism and developmental disorders*, *52*(2), 800-810.

Pickard, H., Rijsdijk, F., Happé, F., & Mandy, W. (2017). Are social and communication difficulties a risk factor for the development of social anxiety?. *Journal of the American Academy of Child & Adolescent Psychiatry*, *56*(4), 344-351.

Pitskel, N. B., Bolling, D. Z., Kaiser, M. D., Pelphrey, K. A., & Crowley, M. J. (2014). Neural systems for cognitive reappraisal in children and adolescents with autism spectrum disorder. *Developmental cognitive neuroscience*, *10*, 117-128.

Posner, J., Russell, J. A., Gerber, A., Gorman, D., Colibazzi, T., Yu, S., ... & Peterson, B. S. (2009). The neurophysiological bases of emotion: An fMRI study of the affective circumplex using emotion-denoting words. *Human brain mapping*, *30*(3), 883-895.

Postorino, V., Fatta, L. M., De Peppo, L., Giovagnoli, G., Armando, M., Vicari, S., & Mazzone, L. (2015). Longitudinal comparison between male and female preschool children with autism spectrum disorder. *Journal of autism and developmental disorders*, *45*, 2046-2055.

Pouw, L. B., Rieffe, C., Stockmann, L., & Gadow, K. D. (2013). The link between emotion regulation, social functioning, and depression in boys with ASD. *Research in Autism Spectrum Disorders*, *7*(4), 549-556.

Preece, D. A., Mehta, A., Becerra, R., Chen, W., Allan, A., Robinson, K., ... & Gross, J. J. (2022). Why is alexithymia a risk factor for affective disorder symptoms? The role of emotion regulation. *Journal of Affective Disorders*, *296*, 337-341.

Prentice, F., Hobson, H., Spooner, R., & Murphy, J. (2022). Gender differences in interoceptive accuracy and emotional ability: An explanation for incompatible findings. *Neuroscience & Biobehavioral Reviews*, *141*, 104808.

Prosperi, M., Turi, M., Guerrera, S., Napoli, E., Tancredi, R., Igliozzi, R., ... & Vicari, S. (2021). Sex differences in autism spectrum disorder: an investigation on core symptoms and psychiatric comorbidity in preschoolers. *Frontiers in integrative neuroscience*, *14*, 594082.

Ratto, A. B., Kenworthy, L., Yerys, B. E., Bascom, J., Wieckowski, A. T., White, S. W., ... & Anthony, L. G. (2018). What about the girls? Sex-based differences in autistic traits and adaptive skills. *Journal of autism and developmental disorders*, *48*, 1698-1711.

Reaven, J., Blakeley-Smith, A., Culhane-Shelburne, K., & Hepburn, S. (2012). Group cognitive behavior therapy for children with high-functioning autism spectrum disorders and anxiety: A randomized trial. *Journal of Child Psychology and Psychiatry*, *53*(4), 410-419.

Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: the cognitive costs of keeping one's cool. *Journal of personality and social psychology*, *79*(3), 410.

Rieffe, C., Oosterveld, P., & Terwogt, M. M. (2006). An alexithymia questionnaire for children: Factorial and concurrent validation results. *Personality and individual differences*, *40*(1), 123-133.

Rieffe, C., De Bruine, M., De Rooij, M., & Stockmann, L. (2014). Approach and avoidant emotion regulation prevent depressive symptoms in children with an Autism Spectrum Disorder. *International Journal of Developmental Neuroscience*, *39*, 37-43.

Rieffe, C., O'Connor, R., Bülow, A., Willems, D., Hull, L., Sedgewick, F., ... & Blijd-Hoogewys, E. (2021). Quantity and quality of empathic responding by autistic and non-autistic adolescent girls and boys. *Autism*, *25*(1), 199-209.

Riepenhausen, A., Wackerhagen, C., Reppmann, Z. C., Deter, H. C., Kalisch, R., Veer, I. M., & Walter, H. (2022). Positive cognitive reappraisal in stress resilience, mental health, and well-being: A comprehensive systematic review. *Emotion Review*, *14*(4), 310-331.

Robinson, E. B., Lichtenstein, P., Anckarsäter, H., Happé, F., & Ronald, A. (2013). Examining and interpreting the female protective effect against autistic behavior. *Proceedings of the National Academy of Sciences*, *110*(13), 5258-5262.

Robinson, E. B., St Pourcain, B., Anttila, V., Kosmicki, J. A., Bulik-Sullivan, B., Grove, J., ... & Daly, M. J. (2016). Genetic risk for autism spectrum disorders and neuropsychiatric variation in the general population. *Nature genetics*, *48*(5), 552-555.

Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological bulletin*, *132*(1), 98.

Rosenberg, M. (1965). Rosenberg self-esteem scale (RSE). *Acceptance and commitment therapy. Measures package*, *61*(52), 18.

Rothbart, M. K., & Bates, J. E. (2007). Temperament. *Handbook of child psychology*, *3*.

Russell, J. A. (1980). A circumplex model of affect. *Journal of personality and social psychology*, *39*(6), 1161.

Russell, G., Steer, C., & Golding, J. (2011). Social and demographic factors that influence the diagnosis of autistic spectrum disorders. *Social psychiatry and psychiatric epidemiology*, *46*, 1283-1293.

Russell, G., Stapley, S., Newlove-Delgado, T., Salmon, A., White, R., Warren, F., ... & Ford, T. (2022). Time trends in autism diagnosis over 20 years: a UK population-based cohort study. *Journal of Child Psychology and Psychiatry*, *63*(6), 674-682.

Rutherford, M., McKenzie, K., Johnson, T., Catchpole, C., O'Hare, A., McClure, I., ... & Murray, A. (2016). Gender ratio in a clinical population sample, age of diagnosis and duration of assessment in children and adults with autism spectrum disorder. *Autism*, *20*(5), 628-634.

Ruzich, E., Allison, C., Smith, P., Watson, P., Auyeung, B., Ring, H., & Baron-Cohen, S. (2015). Measuring autistic traits in the general population: a systematic review of the Autism-Spectrum Quotient (AQ) in a nonclinical population sample of 6,900 typical adult males and females. *Molecular autism*, *6*, 1-12.

Ryan, C., Cogan, S., & Phillips, A. (2021). Objective and Subjective Measurement of Alexithymia in Adults with Autism. *Journal of Autism and Developmental Disorders*, *51*(6), 2019-2028.

Rynkiewicz, A., Schuller, B., Marchi, E., Piana, S., Camurri, A., Lassalle, A., & Baron-Cohen, S. (2016). An investigation of the 'female camouflage effect'in autism using a computerized ADOS-2 and a test of sex/gender differences. *Molecular autism*, *7*, 1-8.

Rynkiewicz, A., & Łucka, I. (2018). Autism spectrum disorder (ASD) in girls. Co-occurring psychopathology. Sex differences in clinical manifestation. *Psychiatria Polska*, *52*(4), 629-639.

Sánchez, F. M., Soria, B. O., & García, M. A. (2001). Subjective and autonomic stress responses in alexithymia. *Psicothema*, *13*(1), 57-62.

Sanders, J., Johnson, K. A., Garavan, H., Gill, M., & Gallagher, L. (2008). A review of neuropsychological and neuroimaging research in autistic spectrum disorders: Attention, inhibition and cognitive flexibility. *Research in autism spectrum disorders*, *2*(1), 1-16.

Samson, A. C., Huber, O., & Gross, J. J. (2012). Emotion regulation in Asperger's syndrome and high-functioning autism. *Emotion*, *12*(4), 659.

Samson, A. C., Hardan, A. Y., Podell, R. W., Phillips, J. M., & Gross, J. J. (2015a). Emotion regulation in children and adolescents with autism spectrum disorder. *Autism Research*, *8*(1), 9-18.

Samson, A. C., Wells, W. M., Phillips, J. M., Hardan, A. Y., & Gross, J. J. (2015b). Emotion regulation in autism spectrum disorder: evidence from parent interviews and children's daily diaries. *Journal of Child Psychology and Psychiatry*, *56*(8), 903-913.

Spaapen, D. L., Waters, F., Brummer, L., Stopa, L., & Bucks, R. S. (2014). The emotion regulation questionnaire: validation of the ERQ-9 in two community samples. Psychological assessment, 26(1), 46.

Sasson, N. J., Lam, K. S., Childress, D., Parlier, M., Daniels, J. L., & Piven, J. (2013). The Broad Autism Phenotype Questionnaire: Prevalence and Diagnostic Classification. *Autism Research*, *6*(2), 134-143.

Schuck, R. K., Flores, R. E., & Fung, L. K. (2019). Brief report: Sex/gender differences in symptomology and camouflaging in adults with autism spectrum disorder. *Journal of autism and developmental disorders*, *49*, 2597-2604.

Sedgewick, F., Hill, V., Yates, R., Pickering, L., & Pellicano, E. (2016). Gender differences in the social motivation and friendship experiences of autistic and non-autistic adolescents. *Journal of autism and developmental disorders*, *46*, 1297-1306.

Sedgewick, F., Hill, V., & Pellicano, E. (2019). 'It's different for girls': Gender differences in the friendships and conflict of autistic and neurotypical adolescents. *Autism*, *23*(5), 1119-1132.

Seidman, I., Yirmiya, N., Milshtein, S., Ebstein, R. P., & Levi, S. (2012). The Broad Autism Phenotype Questionnaire: mothers versus fathers of children with an autism spectrum disorder. *Journal of autism and developmental disorders*, *42*, 837-846.

Shattuck, P. T., Seltzer, M. M., Greenberg, J. S., Orsmond, G. I., Bolt, D., Kring, S., ... & Lord, C. (2007). Change in autism symptoms and maladaptive behaviors in adolescents and adults with an autism spectrum disorder. *Journal of autism and developmental disorders*, *37*, 1735-1747.

Shattuck, P. T., Durkin, M., Maenner, M., Newschaffer, C., Mandell, D. S., Wiggins, L., ... & Cuniff, C. (2009). Timing of identification among children with an autism spectrum disorder: findings from a population-based surveillance study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *48*(5), 474-483.

Shattuck, P. T., Orsmond, G. I., Wagner, M., & Cooper, B. P. (2011). Participation in social activities among adolescents with an autism spectrum disorder. *PloS one*, *6*(11), e27176.

Shields, G. S., Sazma, M. A., & Yonelinas, A. P. (2016). The effects of acute stress on core executive functions: A meta-analysis and comparison with cortisol. *Neuroscience & Biobehavioral Reviews*, *68*, 651-668.

Shukla, M., & Pandey, R. (2021). Identifying the transdiagnostic and unique domains of emotion regulation difficulties in subclinical conditions of anxiety and co-occurring anxiety-depression. *Current Psychology*, *40*, 2896-2909.

Sifneos, P. E. (1973). The prevalence of 'alexithymic'characteristics in psychosomatic patients. *Psychotherapy and psychosomatics*, *22*(2-6), 255-262.

Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., & Baird, G. (2008). Psychiatric disorders in children with autism spectrum disorders: prevalence, comorbidity, and associated factors in a population-derived sample. *Journal of the American Academy of Child & Adolescent Psychiatry*, *47*(8), 921-929.

Solomon, M., Miller, M., Taylor, S. L., Hinshaw, S. P., & Carter, C. S. (2012). Autism symptoms and internalizing psychopathology in girls and boys with autism spectrum disorders. *Journal of autism and developmental disorders*, *42*, 48-59.

Song, A., Cola, M., Plate, S., Petrulla, V., Yankowitz, L., Pandey, J., ... & Parish-Morris, J. (2021). Natural language markers of social phenotype in girls with autism. *Journal of Child Psychology and Psychiatry*, *62*(8), 949-960.

Spain, D., Happé, F., Johnston, P., Campbell, M., Sin, J., Daly, E., ... & MRC Aims Consortium. (2016). Social anxiety in adult males with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *32*, 13-23.

Spence, S. J., & Schneider, M. T. (2009). The role of epilepsy and epileptiform EEGs in autism spectrum disorders. *Pediatric research*, *65*(6), 599-606.

Stevens, J. S., & Hamann, S. (2012). Sex differences in brain activation to emotional stimuli: a meta-analysis of neuroimaging studies. *Neuropsychologia*, *50*(7), 1578-1593.

Stevens, T., Peng, L., & Barnard-Brak, L. (2016). The comorbidity of ADHD in children diagnosed with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *31*, 11-18.

Szatmari, P., Liu, X. Q., Goldberg, J., Zwaigenbaum, L., Paterson, A. D., Woodbury-Smith, M., ... & Thompson, A. (2012). Sex differences in repetitive stereotyped behaviors in autism: implications for genetic liability. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics*, *159*(1), 5-12.

Tabanchnick, B.G., & Fidell, L.S. (2014). Using multivariate statistics (6thed.). Boston; Pearson Education, Limited.

Tang, J. W., Li, J. W., Baulderstone, D., & Jeyaseelan, D. (2021). Presenting age and features of females diagnosed with autism spectrum disorder. *Journal of Paediatrics and Child Health*, *57*(8), 1182-1189.

Tang, X., Hua, Z., Xing, J., Yi, L., Ji, Z., Zhao, L., ... & Liu, J. (2023). Verbal fluency as a predictor of autism spectrum disorder diagnosis and co-occurring attention-deficit/hyperactivity disorder symptoms. *Reading and Writing*, *36*(6), 1461-1485.

Tamres, L. K., Janicki, D., & Helgeson, V. S. (2002). Sex differences in coping behavior: A meta-analytic review and an examination of relative coping. *Personality and social psychology review*, *6*(1), 2-30.

Templeton, G. F. (2011). A two-step approach for transforming continuous variables to normal: implications and recommendations for IS research. *Communications of the association for information systems*, *28*(1), 4.

Thomas, A., & Chess, S. (1977). Temperament and development. Oxford, England: Brunner/Mazel.

Thomas, A., & Chess, S. (1980). The dynamics of psychological development. New York: Brunner/Mazel.

Tierney, S., Burns, J., & Kilbey, E. (2016). Looking behind the mask: Social coping strategies of girls on the autistic spectrum. *Research in Autism Spectrum Disorders*, *23*, 73-83.

Uljarević, M., Richdale, A. L., Evans, D. W., Cai, R. Y., & Leekam, S. R. (2017). Interrelationship between insistence on sameness, effortful control and anxiety in adolescents and young adults with autism spectrum disorder (ASD). *Molecular autism*, *8*, 1-6.

Uljarević, M., Hedley, D., Rose-Foley, K., Magiati, I., Cai, R. Y., Dissanayake, C., ... & Trollor, J. (2020). Anxiety and depression from adolescence to old age in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *50*, 3155-3165.

Uljarević, M., Jo, B., Frazier, T. W., Scahill, L., Youngstrom, E. A., & Hardan, A. Y. (2021). Using the big data approach to clarify the structure of restricted and repetitive behaviors across the most commonly used autism spectrum disorder measures. *Molecular Autism*, *12*(1), 39.

Uljarević, M., Carrington, S. J., Hardan, A. Y., & Leekam, S. R. (2022). Subdomains of restricted and repetitive behaviors within autism: Exploratory structural equation modeling using the diagnostic interview for social and communication disorders. *Autism Research*, *15*(5), 861-869.

Underwood, J. F., Kendall, K. M., Berrett, J., Lewis, C., Anney, R., Van den Bree, M. B., & Hall, J. (2019). Autism spectrum disorder diagnosis in adults: Phenotype and genotype findings from a clinically derived cohort. *The British Journal of Psychiatry*, *215*(5), 647-653.

Van Der Cruijsen, R., Murphy, J., & Bird, G. (2019). Alexithymic traits can explain the association between puberty and symptoms of depression and anxiety in adolescent females. *PloS one*, *14*(1), e0210519.

Van Wijngaarden-Cremers, P. J., van Eeten, E., Groen, W. B., Van Deurzen, P. A., Oosterling, I. J., & Van der Gaag, R. J. (2014). Gender and age differences in the core triad of impairments in autism spectrum disorders: a systematic review and meta-analysis. *Journal of autism and developmental disorders*, *44*, 627-635.

Venta, A., Hart, J., & Sharp, C. (2013). The relation between experiential avoidance, alexithymia and emotion regulation in inpatient adolescents. *Clinical child psychology and psychiatry*, *18*(3), 398-410.

Vickerstaff, S., Heriot, S., Wong, M., Lopes, A., & Dossetor, D. (2007). Intellectual ability, self-perceived social competence, and depressive symptomatology in children with high-functioning autistic spectrum disorders. *Journal of autism and developmental disorders*, *37*, 1647-1664.

Vijayakumar, N., Whittle, S., Yücel, M., Dennison, M., Simmons, J., & Allen, N. B. (2014). Thinning of the lateral prefrontal cortex during adolescence predicts emotion regulation in females. *Social cognitive and affective neuroscience*, *9*(11), 1845-1854.

Voncken, M. J., Bögels, S. M., & de Vries, K. (2003). Interpretation and judgmental biases in social phobia. *Behaviour research and therapy*, *41*(12), 1481-1488.

Wagner, J., Grigor, J., Abdullah, A., Cannon, P., Wilkin, J., Robertson, P., & Szymkowiak, A. (2021). The relationship between tendency to attend to detail, sensory sensitivity, and affective response to food cues–A registered report. *International Journal of Psychophysiology*, *166*, 50-60.

Way, I. F., Applegate, B., Cai, X., Franck, L. K., Black-Pond, C., Yelsma, P., ... & Muliett, M. (2010). Children's Alexithymia Measure (CAM): A new instrument for screening difficulties with emotional expression. *Journal of Child & Adolescent Trauma*, *3*, 303-318.

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: a meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological bulletin*, *138*(4), 775.

Wechsler, D. (2011). Wechsler abbreviated scale of intelligence-(WASI-II). San Antonio, TX: NCS Pearson. *Open Access This article is licensed under a Creative Commons Attribution*, *4*.

Weiss, E. M., Kemmler, G., Deisenhammer, E. A., Fleischhacker, W. W., & Delazer, M. (2003). Sex differences in cognitive functions. *Personality and individual differences*, *35*(4), 863-875.

Weiss, S., Sack, M., Henningsen, P., & Pollatos, O. (2014). On the interaction of self-regulation, interoception and pain perception. *Psychopathology*, *47*(6), 377-382.

Werling, D. M., & Geschwind, D. H. (2013). Sex differences in autism spectrum disorders. *Current opinion in neurology*, *26*(2), 146-153.

White, S. W., Oswald, D., Ollendick, T., & Scahill, L. (2009). Anxiety in children and adolescents with autism spectrum disorders. *Clinical psychology review*, *29*(3), 216-229.

White, S. W., Ollendick, T. H., & Bray, B. C. (2011). College students on the autism spectrum: Prevalence and associated problems. *Autism*, *15*(6), 683-701.

Whitlock, A., Fulton, K., Lai, M. C., Pellicano, E., & Mandy, W. (2020). Recognition of girls on the autism spectrum by primary school educators: An experimental study. *Autism Research*, *13*(8), 1358-1372.

Wieckowski, A. T., Luallin, S., Pan, Z., Righi, G., Gabriels, R. L., & Mazefsky, C. (2020). Gender differences in emotion dysregulation in an autism inpatient psychiatric sample. *Autism Research*, *13*(8), 1343-1348.

Willner, C. J., Hoffmann, J. D., Bailey, C. S., Harrison, A. P., Garcia, B., Ng, Z. J., ... & Brackett, M. A. (2022). The development of cognitive reappraisal from early childhood through adolescence: A systematic review and methodological recommendations. *Frontiers in Psychology*, *13*, 3412.

Wilson, J. K., & Rapee, R. M. (2005). The interpretation of negative social events in social phobia: Changes during treatment and relationship to outcome. *Behaviour research and therapy*, *43*(3), 373-389.

Wilson, R. B., Thompson, A. R., Rowse, G., Smith, R., Dugdale, A. S., & Freeth, M. (2023). Autistic women's experiences of self-compassion after receiving their diagnosis in adulthood. *Autism*, *27*(5), 1336-1347.

Wing, L. (1981). Sex ratios in early childhood autism and related conditions. *Psychiatry research*, *5*(2), 129-137.

Wing, L. (1992). Manifestations of social problems in high-functioning autistic people. In *High-functioning individuals with autism* (pp. 129-142). Boston, MA: Springer US.

Wing, L., Leekam, S. R., Libby, S. J., Gould, J., & Larcombe, M. (2002). The diagnostic interview for social and communication disorders: Background, inter-rater reliability and clinical use. *Journal of child psychology and psychiatry*, *43*(3), 307-325.

Wodka, E. L., Parish-Morris, J., Annett, R. D., Carpenter, L., Dillon, E., Michaelson, J., ... & Kanne, S. (2022). Co-occurring attention-deficit/hyperactivity disorder and anxiety disorders differentially affect males and females with autism. *The Clinical Neuropsychologist*, *36*(5), 1069-1093.

Wood, J. J., Drahota, A., Sze, K., Har, K., Chiu, A., & Langer, D. A. (2009). Cognitive behavioral therapy for anxiety in children with autism spectrum disorders: A randomized, controlled trial. *Journal of Child Psychology and Psychiatry*, *50*(3), 224-234.

Woodbury-Smith, M. R., Robinson, J., Wheelwright, S., & Baron-Cohen, S. (2005). Screening adults for Asperger syndrome using the AQ: A preliminary study of its diagnostic validity in clinical practice. *Journal of autism and developmental disorders*, *35*, 331-335.

Wood-Downie, H., Wong, B., Kovshoff, H., Mandy, W., Hull, L., & Hadwin, J. A. (2021). Sex/gender differences in camouflaging in children and adolescents with autism. *Journal of Autism and Developmental Disorders*, *51*, 1353-1364.

World Health Organization. (1993). *The ICD-10 classification of mental and behavioural disorders: diagnostic criteria for research* (Vol. 2). World Health Organization.

Zaboski, B. A., & Storch, E. A. (2018). Comorbid autism spectrum disorder and anxiety disorders: a brief review. *Future neurology*, *13*(1), 31-37.

Zaehringer, J., Falquez, R., Schubert, A. L., Nees, F., & Barnow, S. (2018). Neural correlates of reappraisal considering working memory capacity and cognitive flexibility. *Brain Imaging and Behavior*, *12*, 1529-1543.

Zantinge, G., van Rijn, S., Stockmann, L., & Swaab, H. (2017). Physiological arousal and emotion regulation strategies in young children with autism spectrum disorders. *Journal of autism and developmental disorders*, *47*, 2648-2657.

Zhang, H., Qing, F. A. N., Yan, S. U. N., Jianyin, Q. I. U., & Lisheng, S. O. N. G. (2017). A study of the characteristics of alexithymia and emotion regulation in patients with depression. *Shanghai archives of psychiatry*, *29*(2), 95.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica*, *67*(6), 361-370.

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International journal of behavioral development*, *38*(2), 182-194.

Zimmerman, D., Ownsworth, T., O'Donovan, A., Roberts, J., & Gullo, M. J. (2017). Associations between executive functions and mental health outcomes for adults with autism spectrum disorder. *Psychiatry Research*, *253*, 360-363.

Zlomke, K. R., & Hahn, K. S. (2010). Cognitive emotion regulation strategies: Gender differences and associations to worry. *Personality and individual Differences*, *48*(4), 408-413.

Zwaigenbaum, L., Bryson, S. E., Szatmari, P., Brian, J., Smith, I. M., Roberts, W., ... & Roncadin, C. (2012). Sex differences in children with autism spectrum disorder identified within a high-risk infant cohort. *Journal of autism and developmental disorders*, *42*, 25

Appendices

Appendix 1 – AQ_Adolescents Parent Report

The Adolescent Autism Spectrum Quotient (AQ)

SPECIMEN, FOR RESEARCH USE ONLY.

For full details, please see:

S. Baron-Cohen, R. Hoekstra, R. Knickmeyer, S. Wheelwright, (2006)

The Autism Spectrum Quotient (AQ) – Adolescent Version

Journal of Autism and Developmental Disorders.

Name:..... Sex:.....

Today's Date.....

HOW TO FILL OUT THE QUESTIONNAIRE

Below is a list of statements about your child. Please read each statement very carefully and rate how strongly you agree or disagree by selecting the appropriate option opposite each question.

DO NOT MISS ANY STATEMENT OUT

Examples

E1. S/he is willing to take risks.	definitely agree	slightly agree (circled)	slightly disagree	definitely disagree

E2. S/he likes playing board games.	definitely agree / slightly agree / slightly disagree / definitely disagree (circled)
E3. S/he finds learning to play musical instruments easy.	definitely agree / slightly agree (circled) / slightly disagree / definitely disagree
E4. S/he is fascinated by other cultures.	definitely agree / slightly agree / slightly disagree (circled) / definitely disagree

	Definitely Agree	**Slightly Agree**	**Slightly Disagree**	**Definitely Disagree**
1. S/he prefers to do things with others rather than on her/his own.				
2. S/he prefers to do things the same way over and over again.				
3. If s/he tries to imagine something, s/he finds it very easy to create a picture in her/his mind.				
4. S/he frequently gets so strongly absorbed in one thing that s/he loses sight of other things.				
5. S/he often notices small sounds when others do not.				
6. S/he usually notices car number plates or similar strings of information.				
7. Other people frequently tell her/him that what s/he has said is impolite, even though s/he thinks it is polite.				
8. When s/he is reading a story, s/he can easily imagine what the characters might look like.				
9. S/he is fascinated by dates.				
10. In a social group, s/he can easily keep track of several different people's conversations.				
11. S/he finds social situations easy.				

	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
12. S/he tends to notice details that others do not.				
13. S/he would rather go to a library than a party.				
14. S/he finds making up stories easy.				
15. S/he finds her/himself drawn more strongly to people than to things.				
16. S/he tends to have very strong interests, which s/he gets upset about if s/he can't pursue.				
17. S/he enjoys social chit-chat.				
18. When s/he talks, it isn't always easy for others to get a word in edgeways.				
19. S/he is fascinated by numbers.				
20. When s/he is reading a story, s/he finds it difficult to work out the characters' intentions.				
21. S/he doesn't particularly enjoy reading fiction.				
22. S/he finds it hard to make new friends.				
23. S/he notices patterns in things all the time.				
24. S/he would rather go to the theatre than a museum.				
25. It does not upset him/her if his/her daily routine is disturbed.				
26. S/he frequently finds that s/he doesn't know how to keep a conversation going.				
27. S/he finds it easy to "read between the lines" when someone is talking to her/him.				
28. S/he usually concentrates more on the whole picture, rather than the small details.				
29. S/he is not very good at remembering phone numbers.				

	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
30. S/he doesn't usually notice small changes in a situation, or a person's appearance.				
31. S/he knows how to tell if someone listening to him/her is getting bored.				
32. S/he finds it easy to do more than one thing at once.				
33. When s/he talks on the phone, s/he is not sure when it's her/his turn to speak.				
34. S/he enjoys doing things spontaneously.				
35. S/he is often the last to understand the point of a joke.				
36. S/he finds it easy to work out what someone is thinking or feeling just by looking at their face.				
37. If there is an interruption, s/he can switch back to what s/he was doing very quickly.				
38. S/he is good at social chit-chat.				
39. People often tell her/him that s/he keeps going on and on about the same thing.				
40. When s/he was younger, s/he used to enjoy playing games involving pretending with other children.				
41. S/he likes to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.)				
42. S/he finds it difficult to imagine what it would be like to be someone else.				
43. S/he likes to plan any activities s/he participates in carefully.				
44. S/he enjoys social occasions.				
45. S/he finds it difficult to work out people's intentions.				
46. New situations make him/her anxious.				

	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
47. S/he enjoys meeting new people.				
48. S/he is a good diplomat.				
49. S/he is not very good at remembering people's date of birth.				
50. S/he finds it very to easy to play games with children that involve pretending.				

Appendix 2 – AQ Adults as a Self-Report

The Adult Autism Spectrum Quotient (AQ)

Ages 16+

How to fill out the questionnaire

Below are a list of statements. Please read each statement very carefully and rate how strongly you agree or disagree with it by selecting your answer.

1. I prefer to do things with others rather than on my own.	definitely agree	slightly agree	slightly disagree	definitely disagree
2. I prefer to do things the same way over and over again.	definitely agree	slightly agree	slightly disagree	definitely disagree
3. If I try to imagine something, I find it very easy to create a picture in my mind.	definitely agree	slightly agree	slightly disagree	definitely disagree
4. I frequently get so strongly absorbed in one thing that I lose sight of other things.	definitely agree	slightly agree	slightly disagree	definitely disagree
5. I often notice small sounds when others do not.	definitely agree	slightly agree	slightly disagree	definitely disagree
6. I usually notice car number plates or similar strings of information.	definitely agree	slightly agree	slightly disagree	definitely disagree

7. Other people frequently tell me that what I've said is impolite, even though I think it is polite.	definitely agree	slightly agree	slightly disagree	definitely disagree
8. When I'm reading a story, I can easily imagine what the characters might look like.	definitely agree	slightly agree	slightly disagree	definitely disagree
9. I am fascinated by dates.	definitely agree	slightly agree	slightly disagree	definitely disagree
10. In a social group, I can easily keep track of several different people's conversations.	definitely agree	slightly agree	slightly disagree	definitely disagree
11. I find social situations easy.	definitely agree	slightly agree	slightly disagree	definitely disagree
12. I tend to notice details that others do not.	definitely agree	slightly agree	slightly disagree	definitely disagree
13. I would rather go to a library than a party.	definitely agree	slightly agree	slightly disagree	definitely disagree
14. I find making up stories easy.	definitely agree	slightly agree	slightly disagree	definitely disagree
15. I find myself drawn more strongly to people than to things.	definitely agree	slightly agree	slightly disagree	definitely disagree

16. I tend to have very strong interests which I get upset about if I can't pursue.	definitely agree	slightly agree	slightly disagree	definitely disagree
17. I enjoy social chit-chat.	definitely agree	slightly agree	slightly disagree	definitely disagree
18. When I talk, it isn't always easy for others to get a word in edgeways.	definitely agree	slightly agree	slightly disagree	definitely disagree
19. I am fascinated by numbers.	definitely agree	slightly agree	slightly disagree	definitely disagree
20. When I'm reading a story, I find it difficult to work out the characters' intentions.	definitely agree	slightly agree	slightly disagree	definitely disagree
21. I don't particularly enjoy reading fiction.	definitely agree	slightly agree	slightly disagree	definitely disagree
22. I find it hard to make new friends.	definitely agree	slightly agree	slightly disagree	definitely disagree
23. I notice patterns in things all the time.	definitely agree	slightly agree	slightly disagree	definitely disagree
24. I would rather go to the theatre than a museum.	definitely agree	slightly agree	slightly disagree	definitely disagree

25. It does not upset me if my daily routine is disturbed.	definitely agree	slightly agree	slightly disagree	definitely disagree
26. I frequently find that I don't know how to keep a conversation going.	definitely agree	slightly agree	slightly disagree	definitely disagree
27. I find it easy to "read between the lines" when someone is talking to me.	definitely agree	slightly agree	slightly disagree	definitely disagree
28. I usually concentrate more on the whole picture, rather than the small details.	definitely agree	slightly agree	slightly disagree	definitely disagree
29. I am not very good at remembering phone numbers.	definitely agree	slightly agree	slightly disagree	definitely disagree
30. I don't usually notice small changes in a situation, or a person's appearance.	definitely agree	slightly agree	slightly disagree	definitely disagree
31. I know how to tell if someone listening to me is getting bored.	definitely agree	slightly agree	slightly disagree	definitely disagree
32. I find it easy to do more than one thing at once.	definitely agree	slightly agree	slightly disagree	definitely disagree
33. When I talk on the phone, I'm not sure when it's my turn to speak.	definitely agree	slightly agree	slightly disagree	definitely disagree
34. I enjoy doing things spontaneously.	definitely	slightly	slightly	definitely

	agree	agree	disagree	disagree
35. I am often the last to understand the point of a joke.	definitely agree	slightly agree	slightly disagree	definitely disagree
36. I find it easy to work out what someone is thinking or feeling just by looking at their face.	definitely agree	slightly agree	slightly disagree	definitely disagree
37. If there is an interruption, I can switch back to what I was doing very quickly.	definitely agree	slightly agree	slightly disagree	definitely disagree
38. I am good at social chit-chat.	definitely agree	slightly agree	slightly disagree	definitely disagree
39. People often tell me that I keep going on and on about the same thing.	definitely agree	slightly agree	slightly disagree	definitely disagree
40. When I was young, I used to enjoy playing games involving pretending with other children.	definitely agree	slightly agree	slightly disagree	definitely disagree
41. I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).	definitely agree	slightly agree	slightly disagree	definitely disagree
42. I find it difficult to imagine what it would be like to be someone else.	definitely agree	slightly agree	slightly disagree	definitely disagree
43. I like to plan any activities I participate in carefully.	definitely	slightly	slightly	definitely

	agree	agree	disagree	disagree
44. I enjoy social occasions.	definitely agree	slightly agree	slightly disagree	definitely disagree
45. I find it difficult to work out people's intentions.	definitely agree	slightly agree	slightly disagree	definitely disagree
46. New situations make me anxious.	definitely agree	slightly agree	slightly disagree	definitely disagree
47. I enjoy meeting new people.	definitely agree	slightly agree	slightly disagree	definitely disagree
48. I am a good diplomat.	definitely agree	slightly agree	slightly disagree	definitely disagree
49. I am not very good at remembering people's date of birth.	definitely agree	slightly agree	slightly disagree	definitely disagree
50. I find it very easy to play games with children that involve pretending.	definitely agree	slightly agree	slightly disagree	definitely disagree

Appendix 3 – Reactivity and Regulation Situation Task

List of All Sentences Used in the Task

Reactivity and Regulation Situation Task.

	Scenario	type
1	**You see a bunch of your friends hanging around and you want to join them. When you come closer you hear them laughing.**	social
2	**Your friend was supposed to meet you in the park but he/she is late.**	social
3	**Your teacher asks to see you after class.**	social
4	**Your friend has invited you to their birthday party, but when you get there you realise you don't know anybody else.**	social
5	**You are getting ready to go out. Your friends call to cancel just as you're finished getting ready.**	social
6	**You see some girls from school in town. They stop talking and look at you.**	social
7	**You have finished an exam and are talking about the answers with your friends. They all get the same answer to a question, but you did not.**	social
8	**You are about to buy an ice cream and there is a long queue of people waiting behind you, but you can't find your money.**	social
9	**You went for a school trip and your friend says they have posted a picture of you which you do not like on social media.**	social
10	**You are working with your classmates on a group project and it is your turn to present results to the whole class.**	social
11	**You sent a text message to a boy/girl you like, but they did not reply.**	social
12	**You told your best friend a secret and you have just found out that they told the whole class.**	social
13	**You hear a knock on the door and when you open it, you see a person you do not know.**	social
14	**It is the first day of school and everyone in the class has to stand up and say who they are. It is your turn to stand up.**	social

15	**Your parents tell you they want to talk to you about something important.**	social
16	**You are walking in the street and a car slows down next to you.**	non-social
17	**Your homework is due in tomorrow but your computer has just crashed and lost all of your work.**	non-social
18	**You are trying to buy some tickets online before they sell-out, but the website has crashed.**	non-social
19	**You are at home alone and you realise you lost your phone somewhere.**	non-social
20	**Your teacher returns a test and says that your score was surprising.**	non-social
21	**You lose a signed photo of your favourite actor or singer.**	non-social
22	**You wake up at night and hear a noise in the hallway.**	non-social
23	**On the way to school your stomach starts to feel weird.**	non-social
24	**Your teacher has just given you your test to complete and you start reading the questions.**	non-social
25	**You forgot to bring your homework to school.**	non-social
26	**You are home alone and all of the lights just went out.**	non-social
27	**You have just come home from school and no-one is home. You do not have your key with you and your phone battery is flat.**	non-social
28	**You have just remembered that you have a test tomorrow and you have not done any revision yet.**	non-social
29	**You need to return a book to the library but you can't find it anywhere.**	non-social
30	**Your teacher wants to talk with your parents.**	non-social

Practice Trials

	type
You enter a store and the employee stares at you.	social
Your friend gives you their phone. You drop it by accident and break the screen.	social
You have a ketchup stain on your new t-shirt. You tried to clean it but it is not coming off.	non-social
You have a birthday party today and you have a massive spot on your chin.	non-social

Appendix 4 - Reactivity and Regulation Situation Task Complete CR Instruction

Cognitive reappraisal

Now, first of all, let me tell you that you did great with the first part of the task. In the second part of this task, I would like you to have another look at some of those sentences and try to think differently about them. We can sometimes change how we feel (our emotions) by changing how we think about what is happening to us. For example, if someone bumps into you on the school corridor, you may think about it in two ways: they did it on purpose, or they did it by accident. If you think they did it on purpose, you may feel angry (even if they have said sorry), but if you think it was an accident, you might not. Another example could be when the teacher returns your homework, and you see there is a mistake circled out on it by the teacher. You may get angry or embarrassed because you made a mistake and feel bad about it, or you could think that everyone makes mistakes and mistakes help you learn.

OR ADDITIONAL IF NEEDED: Today, you are feeling sick, but that means that you get to stay at home and do things that you don't usually get to do on a school day.

So now, I would like you to read some of the sentences from the first task again and think of another, more positive explanation for these situations. It is a little bit like trying to turn something that seems unpleasant or bad into something good.

Appendix 5 – Broad Autism Phenotype Questionnaire

Broad Autism Phenotype Questionnaire

Hurley, R. S., Losh, M., Parlier, M., Reznick, J. S., & Piven, J. (2007). The broad autism phenotype questionnaire. *Journal of autism and developmental disorders*, *37*, 1679-1690.

You are about to fill out a series of statements related to personality and lifestyle. For each question, select the answer that best describes how often that statement applies to you. Many of these questions ask about your interactions with other people. Please think about the way you are with most people rather than special relationships you may have with spouses or significant others, children, siblings, and parents. Everyone changes over time, which can make it hard to fill out questions about personality. Think about the way you have been the majority of your adult life, rather than the way you were as a teenager, or times you may have felt different than normal. You must answer each question and give only one answer per question. If you are confused, please give it your best guess.

*** Casual interactions with acquaintances rather than special relationships such as close friends or family.

1. I like being around other people
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

2. I find it hard to get my words out smoothly
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

3. I am comfortable with unexpected changes in plans
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

4. It's hard for me to avoid getting sidetracked in conversation
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

5. I would rather talk to people to get information than to socialize
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

6. People have to talk me into trying something new
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

7. I am "in-tune" with the other person during conversation***
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

8. I have to warm myself up to the idea of visiting an unfamiliar place
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

9. I enjoy being in social situations
   1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

10. My voice has a flat or monotone sound to it
    1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

11. I feel disconnected or "out of sync" in conversations with others***

1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

12. People find it easy to approach me***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

13. I feel a strong need for sameness from day to day
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

14. People ask me to repeat things I've said because they don't understand
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

15. I am flexible about how things should be done
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

16. I look forward to situations where I can meet new people
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

17. I have been told that I talk too much about certain topics
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

18. When I make conversation it is just to be polite***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

19. I look forward to trying new things
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

20. I speak too loudly or softly
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

21. I can tell when someone is not interested in what I am saying***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

22. I have a hard time dealing with changes in my routine
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

23. I am good at making small talk***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

24. I act very set in my ways
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

25. I feel like I am really connecting with other people
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

26. People get frustrated by my unwillingness to bend
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

27. Conversation bores me***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

28. I am warm and friendly in my interactions with others***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

29. I leave long pauses in conversation
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

30. I alter my daily routine by trying something different

1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

31. I prefer to be alone rather than with others
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

32. I lose track of my original point when talking to people
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

33. I like to closely follow a routine while working
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

34. I can tell when it is time to change topics in conversation ***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

35. I keep doing things the way I know, even if another way might be better
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

36. I enjoy chatting with people ***
1 -Very rarely 2-Rarely 3-Occasionally 4-Somewhat often 5-Often 6-Very Often

Appendix 6 – Emotion Regulation Questionnaire

Emotion Regulation Questionnaire

Instructions and Items: We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1 Strongly disagree

2

3

4 Neutral

5

6

7 Strongly agree

1. ____ When I want to feel more *positive* emotion (such as joy or amusement), I *change what I'm thinking about*.

2. ____ I keep my emotions to myself.
3. ____ When I want to feel less *negative* emotion (such as sadness or anger), I *change*

what I'm thinking about.

4. ____When I am feeling *positive* emotions, I am careful not to express them.

5. ____When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm.

6. ____ I control my emotions by *not expressing them*.
7. ____When I want to feel more *positive* emotion, I *change the way I'm thinking* about

the situation.

8. ____ I control my emotions by *changing the way I think* about the situation I'm in.

9. ____When I am feeling *negative* emotions, I make sure not to express them.

10. ____When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation.

Appendix 7 – The Cognitive Emotion Regulation Questionnaire

The Cognitive Emotion Regulation Questionnaire(CERQ)

Instruction:
Emotion regulation is the ability to modulate – that is, change and alter one's emotional experiences. Emotion regulation is differentiated from suppression, i.e. 'bottling up' one's emotions, and is also different from catharsis, where one expresses or vents their emotions. This questionnaire assesses how well you regulate emotions through a range of cognitive processes such as positive reappraisal (rethinking the emotion-causing event more positively), acceptance, rumination and self-blame. State how often you think in the following manner when experiencing strong threatening or stressful life events.

	Almost never	Rarely	Occasionally	Frequently	Almost always
1. I feel that I am the one to blame for it.					
2. I feel that I am the one who is responsible for what has happened.					
3. I think about the mistakes I have made in this matter.					
4. I think that basically the cause my lie within myself.					
5. I think that I have to accept that this has happened.					
6. I think that I have to accept the situation.					
7. I think that I cannot change anything about it.					
8. I think I must learn to live with it.					
9. I often think about how I feel about what I have experienced.					
10. I am preoccupied with what I think and feel about what I have experienced.					
11. I want to understand why I feel the way I do about what I have experienced.					
12. I dwell upon the feelings the situation has evoked in me.					
13. I think of nicer things that what I have experienced.					
14. I think of pleasant things that have nothing to do with it.					
15. I think of something nice instead of what has happened.					
16. I think about pleasant experiences.					
17. I think about what I can do best.					

18. I think about how I can best cope with the situation.					
19. I think about how to change the situation.					
20. I think about a plan of what I can do best.					
21. I think I can learn something from the situation.					
22. I think that I can become a stronger person as a result of what has happened.					
23. I think that the situation also has its positive sides.					
24. I look for the positive sides to the matter.					
25. I think that it could have all been much worse.					
26. I think that other people go through much worse experiences.					
27. I think that it hasn't been too bad compared to other things.					
28. I tell myself that there are worse things in life.					
29. I often think that what I have experienced is much worse than what others have experienced.					
30. I keep thinking about how terrible it is what I have experienced.					
31. I often think that what I have experienced is the worst that can happen to a person.					
32. I continually think how horrible the situation has been.					
33. I feel that others are to blame for it.					
34. I feel that others are responsible for what has happened.					
35. I think about the mistakes others have made in this matter.					
36. I feel that basically the cause lies with others.					

Scoring

Almost never = 1, Rarely = 2, Occasionally = 3, Frequently = 4, Almost always = 5

Total self-blame = Average items 1 – 4

Total acceptance = Average items 5 – 8

Total rumination = Average items 9 – 12

Total positive refocusing = Average items 13 – 16

Total refocus on planning = Average items 17 – 20

Total positive reappraisal = Average items 21 – 24

Total putting into perspective = Average items 25 – 28

Total catastrophizing = Average items 29 – 32

Total blaming others = Average items 33 – 36

Appendix 8 – Hospital Anxiety and Depression Scale

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.

Don't take too long over your replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like 'butterflies' in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book or radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:

Total score: Depression (D) _____ Anxiety (A) _____

0-7 = Normal

8-10 = Borderline abnormal (borderline case)

11-21 = Abnormal (case)

Appendix 9 – Children's Alexithymia Measure

The Children's Alexithymia Measure (CAM) is designed to be completed by a parent or other caregiver who has known the child for some time. The CAM was developed in a study of caregivers of children ages 5-17 (Way, Applegate, Cai, Kimball-Franck, Black-Pond, Yelsma, Roberts, Hyter, & Muliett, 2010).

The concept of alexithymia has been defined various ways. Simply stated, it is a lack of words for feelings (Buchanan, Waterhouse, & West, 1980); more complexly stated, it is defined as having "difficulty identifying and describing feelings, difficulty distinguishing between feelings and bodily sensations, a lack of imaginative ability, and a focus on the external world rather than internal feelings" (Nemiah & Sifneos, 1970; Nemiah, Freyberger, & Sifneos, 1976; Marty & de M'Uzan, 1963, as cited in Hendryx, Haviland, & Shaw, 1991, pp. 227-228). The *Children's Alexithymia Measure* has a unidimensional factor structure and measures difficulties expressing feelings.

Scoring directions: Add the score for each item, to obtain a total score.

Interpretation: Higher scores indicate increasing levels of behaviors associated with alexithymia.

The authors intend the CAM to be administered and interpreted by clinicians as a screening instrument to help guide treatment. It is expected that clinicians will use clinical judgment in interpreting CAM scores.

The reference for the CAM is:

Way, I., Applegate, B., Cai, X., Kimball-Franck, L., Black-Pond, C., Yelsma, P., Roberts, E., Hyter, Y., & Muliett, M. (2010). Children's Alexithymia Measure (CAM): A new instrument for screening difficulties with emotional expression. *Journal of Child and Adolescent Trauma, 3,* 303-318.

The *Children's Alexithymia Measure* (CAM) research project was funded by the Substance Abuse and Mental Health Services Administration (SAMHSA #5 U79 SM56207) through a grant awarded to the Southwest Michigan Children's Trauma Assessment Center (Western Michigan University) as a part of the National Child Traumatic Stress Initiative's Collaborative Response to Traumatized Children. This instrument was developed by the authors and does not necessarily represent the views of SAMHSA or the NCTSN.

For additional questions about the administration, use, and scoring of the CAM please contact Dr. Ineke Way, School of Social Work, Western Michigan University, Kalamazoo, MI 49008 ineke.way@wmich.edu

Children's Alexithymia Measure (CAM)

Child's Name: _____ **Date:** _____

Birth Date: _____ **Gender:** _____

Completed by: _____ **Relationship to Child:** _____

Instructions: During the past three months, how often have you observed each of the following behaviors in _____(*enter child's first name*). To assist you, it may be helpful to think of typical children of a similar age.

Please note: in this questionnaire, the words *feelings* and *emotions* have the same meaning.

	Almost never	Sometimes	Often	Almost always
1. When asked about how he/she is feeling, instead talks about what he/she has been doing	0	1	2	3
2. Has difficulty saying he/she feels sad even though he/she looks sad	0	1	2	3
3. Talks about unimportant things/topics instead of sharing his/her feelings	0	1	2	3
4. Has long periods of little or no emotional expression, interrupted by bursts of emotional expression	0	1	2	3
5. Has difficulty saying he/she is happy even though he/she looks happy	0	1	2	3
6. Physically removes self from situations when asked to talk about feelings	0	1	2	3
7. Makes up unrelated stories when asked about his/her feelings	0	1	2	3
8. Verbal expressions of feelings do not match non-verbal expressions of feelings	0	1	2	3
9. Changes the topic of conversation when asked about his/her feelings	0	1	2	3
10. Has difficulty naming his/her positive feelings (such as joy, happiness, excitement)	0	1	2	3
11. Says "forget it" or "leave me alone" when asked about his/her feelings	0	1	2	3
12. Has trouble finding words or getting words out when talking about his/her own feelings	0	1	2	3
13. Uses few words (may just say "good" / "bad") to describe most of his/her feelings	0	1	2	3
14. Says "I don't know" when asked why he/she is upset	0	1	2	3

Way, I., Applegate, B., Cai, X., Kimball-Franck, L., Black-Pond, C., Yelsma, P., Roberts, E., Hyter, Y., & Muliett, M. (2010).

Appendix 10 – Brief Fear of Negative Evaluation Scale

Brief Fear of Negative Evaluation Scale
Leary (1983)

Read each of the following statements carefully and indicate how characteristic it is of you according to the following scale:

1 = Not at all characteristic of me
2 = Slightly characteristic of me
3 = Moderately characteristic of me
4 = Very characteristic of me
5 = Extremely characteristic of me

_____ 1. I worry about what other people will think of me even when I know it doesn't make any difference.
_____ 2. I am unconcerned even if I know people are forming an unfavorable impression of me.
_____ 3. I am frequently afraid of other people noticing my shortcomings.
_____ 4. I rarely worry about what kind of impression I am making on someone.
_____ 5. I am afraid others will not approve of me.
_____ 6. I am afraid that people will find fault with me.
_____ 7. Other people's opinions of me do not bother me.
_____ 8. When I am talking to someone, I worry about what they may be thinking about me.
_____ 9. I am usually worried about what kind of impression I make.
_____ 10. If I know someone is judging me, it has little effect on me.
_____ 11. Sometimes I think I am too concerned with what other people think of me.
_____ 12. I often worry that I will say or do the wrong things.

REF: Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and Social Psychology Bulletin, 9*, 371-376.

Appendix 11 – Camouflaging Autistic Traits Questionnaire

Camouflaging Autistic Traits Questionnaire (CAT-Q)

Instruction: Please read each statement below and choose the answer that best fits your experiences during social interactions.

		Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1	When I am interacting with someone, I deliberately copy their body language or facial expressions.	1	2	3	4	5	6	7
2	I monitor my body language or facial expressions so that I appear relaxed.	1	2	3	4	5	6	7
3	I rarely feel the need to put on an act in order to get through a social situation.	7	6	5	4	3	2	1
4	I have developed a script to follow in social situations.	1	2	3	4	5	6	7
5	I will repeat phrases that I have heard others say in the exact same way that I first heard them.	1	2	3	4	5	6	7
6	I adjust my body language or facial expressions so that I appear interested by the person I am interacting with.	1	2	3	4	5	6	7
7	In social situations, I feel like I'm 'performing' rather than being myself.	1	2	3	4	5	6	7
8	In my own social interactions, I use behaviours that I have learned from watching other people interacting.	1	2	3	4	5	6	7
9	I always think about the impression I make on other people.	1	2	3	4	5	6	7
10	I need the support of other people in order to socialise.	1	2	3	4	5	6	7
11	I practice my facial expressions and body language to make sure they look natural.	1	2	3	4	5	6	7
12	I don't feel the need to make eye contact with other people if I don't want to.	7	6	5	4	3	2	1
13	I have to force myself to interact with people when I am in social situations.	1	2	3	4	5	6	7
14	I have tried to improve my understanding of social skills by watching other people.	1	2	3	4	5	6	7
15	I monitor my body language or facial expressions so that I appear interested by the person I am interacting with.	1	2	3	4	5	6	7
16	When in social situations, I try to find ways to avoid interacting with others.	1	2	3	4	5	6	7

		Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
17	I have researched the rules of social interactions to improve my own social skills.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18	I am always aware of the impression I make on other people.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19	I feel free to be myself when I am with other people.	**7**	**6**	**5**	**4**	**3**	**2**	**1**
20	I learn how people use their bodies and faces to interact by watching television or films, or by reading fiction.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
21	I adjust my body language or facial expressions so that I appear relaxed.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
22	When talking to other people, I feel like the conversation flows naturally.	**7**	**6**	**5**	**4**	**3**	**2**	**1**
23	I have spent time learning social skills from television shows and films, and try to use these in my interactions.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
24	In social interactions, I do not pay attention to what my face or body are doing.	**7**	**6**	**5**	**4**	**3**	**2**	**1**
25	In social situations, I feel like I am pretending to be 'normal'.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Reference:

Hull, L., Mandy, W., Lai, M.-C., Baron-Cohen, S., Allison, C., Smith, P., & Petrides, K. V. (2019). Development and Validation of the Camouflaging Autistic Traits Questionnaire (CAT-Q). Journal of Autism and Developmental Disorders, 49(3), 819–833. https://doi.org/10.1007/s10803-018-3792-6

Appendix 12 – Rosenberg Self-Esteem Scale (RSE)

Author: Morris Rosenberg

The purpose of the 10 item RSE scale is to measure self-esteem. Originally the measure was designed to measure the self-esteem of high school students. However, since its development, the scale has been used with a variety of groups including adults, with norms available for many of those groups.

Scoring: As the RSE is a Guttman scale, scoring can be a little complicated. Scoring involves a method of combined ratings. Low self-esteem responses are "disagree" or "strongly disagree" on items 1, 3, 4, 7, 10, and "strongly agree" or "agree" on items 2, 5, 6, 8, 9. Two or three out of three correct responses to items 3, 7, and 9 are scored as one item. One or two out of two correct responses for items 4 and 5 are considered as a single item; items 1,8, and 10 are scored as individual items; and combined correct responses (one or two out of two) to items 2 and 6 are considered to be a single item. The scale can also be scored by totalling the individual 4 point items after reverse-scoring the negatively worded items.
Reliability: The RSE demonstrates a Guttman scale coefficient of reproducibility of .92, indicating excellent internal consistency. Test-retest reliability over a period of 2 weeks reveals correlations of .85 and .88, indicating excellent stability.
Validity: Demonstrates concurrent, predictive and construct validity using known groups. The RSE correlates significantly with other measures of self-esteem, including the Coopersmith Self-Esteem Inventory. In addition, the RSE correlates in the predicted direction with measures of depression and anxiety.
Reference: Rosenberg, M. (1979). *Conceiving the Self.* New York: Basic Books.

Instruction:
Please record the appropriate answer for each item, depending on whether you Strongly agree, agree, disagree, or strongly disagree with it.

1 = Strongly agree
2 = Agree
3 = Disagree
4 = Strongly disagree

_____ 1. On the whole, I am satisfied with myself.
_____ 2. At times I think I am no good at all.
_____ 3. I feel that I have a number of good qualities.
_____ 4. I am able to do things as well as most other people.
_____ 5. I feel 1do not have much to be proud of.
_____ 6. I certainly feel useless at times.
_____ 7. I feel that I'm a person of worth.
_____ 8. I wish I could have more respect for myself.
_____ 9. All in all, I am inclined to think that I am a failure.
_____ 10. I take a positive attitude toward myself.

Appendix 13 – Berkeley Expressivity Questionnaire

Berkeley Expressivity Questionnaire
The Berkeley Expressivity Questionnaire assesses three facets of emotional expressivity: negative expressivity, positive expressivity, and impulse strength.
Its citation is:
Gross, J.J., & John, O.P. (1997). Revealing feelings: Facets of emotional expressivity in self-reports, peer ratings, and behavior. Journal of Personality and Social Psychology, 72, 435-448.
Other references include:
Gross, J.J. (2000). The Berkeley Expressivity Questionnaire. In J. Maltby, C.A. Lewis, & A.P. Hill (Eds.), Commissioned reviews on 300 psychological tests (pp. 465-467). Lampeter, Wales: Edwin Mellen Press.
Gross, J.J., & John, O.P. (1998). Mapping the domain of expressivity: Multi-method evidence for a hierarchical model. Journal of Personality and Social Psychology, 74, 170-191.
Gross, J.J., John, O.P., & Richards, J.M. (2000). The dissociation of emotion expression from emotion experience: A personality perspective. Personality and Social Psychology Bulletin, 26, 712-726.

****

For each statement below, please indicate your agreement or disagreement. Do so by filling in the blank in front of each item with the appropriate number from the following rating scale:

1	2	3	4	5	6	7
strongly disagree			**neutral**			**strongly agree**

____ 1. Whenever I feel positive emotions, people can easily see exactly what I am feeling.
____ 2. I sometimes cry during sad movies.
____ 3. People often do not know what I am feeling.
____ 4. I laugh out loud when someone tells me a joke that I think is funny.
____ 5. It is difficult for me to hide my fear.
____ 6. When I'm happy, my feelings show.
____ 7. My body reacts very strongly to emotional situations.
____ 8. I've learned it is better to suppress my anger than to show it.
____ 9. No matter how nervous or upset I am, I tend to keep a calm exterior.
____10. I am an emotionally expressive person.
____11. I have strong emotions.
____12. I am sometimes unable to hide my feelings, even though I would like to.
____13. Whenever I feel negative emotions, people can easily see exactly what I am feeling.
____14. There have been times when I have not been able to stop crying even though I tried to stop.
____15. I experience my emotions very strongly.
____16. What I'm feeling is written all over my face.

Scoring(take from http://psychology.stanford.edu/~psyphy/resources.html**):**
Items 3, 8, and 9 are reverse scored.
Items 3, 5, 8, 9, 13, 16 make up the Negative Emotionality facet
Items 1, 4, 6, 10 make up the Positive Emotionality facet
Items 2, 7, 11, 12, 14, 15 make up the Impulse Strength facet.
Scoring is kept continuous. Researchers can either keep the 3 facets as separate scores or can combine them together to form an overall Emotional Expressivity scale.