

Why do autistic women develop restrictive eating disorders?

Exploring social risk factors

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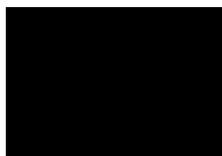
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Overview

This thesis seeks to understand why women with Autism Spectrum Disorder ('autism') are more likely to develop restrictive eating disorders ('REDs'). Part 1 is a conceptual introduction exploring the wider topic. To start, I introduce key terms and explore current understanding of autism among females, including the notion of 'social camouflaging'; the masking of autistic traits and imitation of social behaviours, common among autistic women. Next, I discuss issues around prevalence and diagnosis of autism among those with REDs and the experience of eating disorder treatment for autistic individuals. Finally, a comprehensive review of the literature, outlining the multiple factors which might increase the likelihood of autistic women developing REDs, is presented. Part 2 documents an empirical study investigating the specific role of social risk factors for autistic women with REDs. It is hypothesised that difficulties gaining acceptance from others increases the likelihood of autistic women to perceive themselves as inferior. Moreover, that autistic women who attempt to 'fit in' through social camouflaging, are more vulnerable to such risk factors. Two groups of autistic women, with and without REDs, are compared on measures of social comparison, submissive behaviour, fear of negative evaluation and social camouflaging. Autistic women with REDs are found to compare themselves as significantly more inferior than autistic women without REDs. The clinical implications of the findings are discussed. Part 3 of the thesis is a critical appraisal which describes personal reflections on the research process, the impact of the COVID-19 pandemic and suggestions for future research.

Impact Statement

Over a third of women in treatment for restrictive eating disorders (REDs) such as anorexia nervosa, also meet criteria for Autism Spectrum Disorder ('autism'). Despite this, current treatment guidelines, such as the National Institute of Clinical Excellence (NICE, 2017) do not include, or indeed acknowledge, autism within their recommendations. Consequently, eating disorder (ED) services in the UK currently fail their autistic clients (Kinnaird et al., 2019), who have lower recovery rates (Tchanturia et al., 2016) and worse treatment outcomes (Nazar et al., 2018). Autistic women report difficulty accessing ED treatment, a lack of recognition of their autism within ED services and poor relationships with healthcare professionals (Kinnaird et al., 2019). Furthermore, ED clinicians feel less confident supporting autistic individuals, due to a lack of clear guidance (Kinnaird, Norton & Tchanturia, 2017). At the very least, autistic individuals require evidence-based care pathways that are tailored to their specific needs, for an equal chance of recovery.

It is therefore vital that commissioners and clinicians have access to a scientific evidence-base to inform how ED services can support autistic individuals effectively. This thesis falls under 'The Study of Eating Disorders in Autistic Females (SEDAF)', a wider project carried out by UCL and Cardiff University. SEDAF is a two-staged mixed methods study which seeks to (i) generate new understanding about REDs amongst autistic women and (ii) identify how services can adapt to become more accessible to their autistic clients. Stage one involved interviews with autistic women with anorexia, carers and healthcare professionals which informed the first data-driven model of autism-specific mechanisms underlying REDs (Brede et al., 2020). The second stage seeks to test this model and draw conclusions about specific risk and maintenance factors underlying REDs among autistic individuals. This increased

knowledge will enable the selection and implementation of treatments that target causal and maintaining factors specific to autistic individuals.

Therefore this study exploring social risk factors, alongside the wider SEDAF project, will benefit academia, healthcare professionals and autistic service-users. The research will advance the current literature by directly testing hypotheses about the mechanisms underlying REDs among autistic women. Dissemination of this evidence will occur through academic journals, healthcare conferences and direct feedback to NHS services. In turn, this will improve how ED services engage, assess and treat their autistic patients with REDs. In the long term, this could promote development and research of novel specialist autism interventions for REDs. Most importantly, this increased understanding of REDs among autistic individuals will improve the clinical outcomes and treatment experiences for women with autism accessing ED services.

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Part 1: Literature Review

Why do autistic women develop restrictive eating disorders?

Exploring autism-specific mechanisms

Introduction

Autism Spectrum Disorder ('autism') is considerably over-represented among those with Restrictive Eating Disorders (REDs) such as Anorexia Nervosa ('anorexia'). Around 20-35% of women with anorexia meet criteria for autism (Westwood & Tchanturia, 2017) and these women typically have the worst treatment outcomes (Kinnaird et al., 2019). When accounting for other restrictive eating disorders (REDs), rates of autism among ED patients are likely to be even higher. Despite this, many autistic women find their autism remains undiagnosed (Bargiela, Steward & Mandy, 2016) and ED services often fail to adapt interventions to meet the unique needs of autistic women (Kinnaird, 2019). Consequently, those on the autistic spectrum can end up as 'revolving door' patients within inpatient facilities. Without the guidance of evidence-based research, professionals lack the knowledge, skills and confidence to effectively support autistic individuals with EDs (Kinnaird, Norton & Tchanturia, 2017). As a result, autistic women are at risk of being misdiagnosed and mistreated within ED services.

As such, a scientific evidence base for how autism-specific factors contribute to REDs is needed. This improved understanding can guide appropriate assessment and treatment, resulting in improved recovery rates for autistic individuals. In recent years, research has confirmed high co-occurrence between autism and REDs and begun to explore potential underlying mechanisms. One possibility is that autistic individuals, particularly females, struggle socially and this increases their risk of REDs, for which social difficulties are a well-established aetiological factor (Cardi et al., 2018).

This chapter will outline the evidence base pertaining to core concepts of the topic. Literature was identified via an online search in which key terms were entered into major electronic

databases and emerging data were scanned and organised by topic relevance. Here, I will first explore autism, attending to issues around diagnosis, gender and co-occurring mental health problems, which all contribute to our understanding of restrictive eating disorders in autistic females. I will then discuss RED diagnoses, with particular focus on Anorexia Nervosa and Avoidant Restrictive Food Intake Disorder (ARFID), and the concept of body image disturbance. The challenges of identifying autism among ED patients will be highlighted, before describing current ED treatment experiences of autistic individuals. I will then explore the multiple autism-specific variables, which may increase the likelihood of some autistic women experiencing REDs.

Finally, I will focus on the topic of the current research project; how social difficulties might contribute to high rates of REDs among autistic women. Specifically, I will hypothesise that social communication impairments negatively impact autistic women's ability to form relationships, contributing to adverse social experiences such as bullying, exclusion and isolation. Consequently, autistic women may be especially vulnerable to social processes that have been shown to play a role in REDs. These include viewing oneself as inferior, demonstrated by unfavourable social comparisons and submissive behaviour, and fearing negative judgements. I propose these risk factors may be particularly relevant for autistic women facing the challenges of navigating a neuro-typical social world.

Autism Spectrum Disorder

Autism is a neurodevelopmental condition emerging in infancy that impacts the way an individual perceives and interacts with the world. Autism exists across a spectrum with huge variability across its presentation (Rea, LaMotte & Burrell, 2018). Autistic individuals

display differences in social interaction and communication styles as well as restricted or repetitive behaviours and sensory sensitivities (American Psychiatric Association, 2013). Approximately 1% of the population meet criteria for autism (Scott, 2002) with a 3-1 ratio of male to female prevalence (Loomes, Hull & Mandy, 2017). Typically, autism is diagnosed in early childhood; however, females are more likely to be diagnosed in later life (Rea, 2018). Until 2013, autism was considered to manifest as a “triad of impairment” with difficulties in reciprocal social interaction, communication deficits and repetitive interests or behaviours as the three defining features. However, updates in the DSM-5 (APA, 2013) saw changes to a two dimensional diagnostic criteria; social communication and repetitive behaviour, with sensory interests grouped with the latter. These diagnostic changes mean fewer autism symptoms are required for diagnosis (Kulage, Smaldone and Cohn, 2014). Overall, autism diagnoses are increasing, which may relate to changes in diagnostic criteria, increased public awareness or a growing understanding of how autism presents in females (Arvidsson et al., 2018).

Autism Diagnosis and the Female Phenotype. The notion of female specific autism and the related consequences of delayed autism diagnosis are important considerations for REDs among autistic women. Historically, autism was considered a predominantly male syndrome, resulting in diagnostic criteria and assessment tools largely based on male behavioural features (Lai, 2015). Consequently, current assessment tools such as the Autism Diagnostic Observation Schedule (ADOS) may not effectively identify female autism traits, particularly if diagnosing clinicians are less attuned to female characteristics, which might be more subtle (Lai et al., 2015). Indeed, females showing the same levels of autistic traits as males are less likely to receive a diagnosis (Dworzynski et al., 2012) and require more severe autistic features to be diagnosed (Russel et al., 2010). In fact, autistic women may be treated

under mental health services for many years without their autism being identified (Bargiela, Steward & Mandy, 2016).

The 'female phenotype' refers to a female manifestation of autism where, despite core autistic features remaining, there are subtle yet significant differences to a typical male presentation (Mandy et al. 2012). Characteristics of female autism include fewer repetitive, stereotyped behaviours (Mandy, 2012), more 'gender typical' special interests such as pop music or animals (Lai, 2015) and higher internalising problems such as anxiety and depression over externalising problems such as hyperactivity or conduct problems (Oswald et al. 2016). Moreover, autistic females are more likely to self-monitor and adapt their social behaviours in accordance with others, a process known as 'social camouflaging' (SC). Currently, it is difficult to tease apart whether these differences relate to sex (biologically driven) or gender (culturally driven) and the extent to which these interact (Lai et al., 2015). Most likely, both sex and gender contribute to specific features of the 'female phenotype', which result in some autistic women appearing less typically autistic and contribute to delays in receiving autism diagnosis (Lai et al. 2015).

Social Camouflaging in Autistic Females. Social Camouflaging (SC) refers to the masking of autistic characteristics and the use of strategies to make one appear more socially able (Hull et al., 2017). Camouflaging behaviours are used more consistently by females (Hull et al., 2020; Lai et al., 2017) and have been associated with higher intellectual ability (Livingston, Shah, Milner & Happé, 2020). SC strategies include making more eye contact or mimicking phrases and gestures (Lai, 2017). One explanation is that SC reflects the early socialisation of girls to modify their behaviour to meet societal expectations, leading to higher observation and mimicking of peers (Gould and Ashton-Smith, 2011). Such imitation

enables a degree of external social effectiveness by disguising observable impairments and thereby reducing the likelihood of autism identification (Allely, 2019). SC is therefore highly relevant to the misdiagnosis of female autism. Bargiela, Steward & Mandy (2016) propose autistic females who are more socially motivated, invest in more SC behaviours and have higher internalising difficulties, are less likely to receive a diagnosis. In addition, the misconceptions of relevant professionals, including teachers and healthcare professionals, about whether females can be autistic and how this presents, reduces the likelihood of females accessing services.

Whilst camouflaging may enable a degree of apparent social ‘success’, it is associated with adverse consequences. SC is reported to be mentally, physically and emotionally exhausting for autistic adults, negatively affecting one’s identity and self-esteem (Hull et al, 2017).

Indeed, late-diagnosed autistic women describe how engaging in SC in order to ‘fit in’ with peers left them exhausted with the burden of ‘pretending’ and contributed to confusion about their true self (Bargiela, 2016). Moreover, many women linked attempts to appear non-autistic directly to mental health difficulties and for some, to being manipulated and abused by others (Baldwin and Costley, 2016). Evidently, many autistic women make active attempts to hide their autism, at the cost of misdiagnosis and their own mental health.

Autism and Mental Health Difficulties. Mental health problems are strikingly high among autistic people; around 77% report experiencing a comorbid psychiatric disorder in their lifetime, irrespective of intellectual ability (Lever & Geurts, 2016; Mannion & Leader, 2013). Systematic reviews and meta-analyses report consistently high rates of psychiatric comorbidities which impair the quality of life of autistic adults (Lugo-Marin et al.; 2019, Lai

et al., 2019). Although co-occurring mental health problems are comparatively higher among autistic individuals than the general population, accessing professional support is challenging (Crane et al., 2019). Reported barriers include a lack of or delayed access to services, treatment not tailored to autism needs and expectations for self-management without accounting for autistic challenges. Moreover, autistic individuals report feeling uncomfortable disclosing mental health problems and face stigma among healthcare professionals (Crane, 2019). Nicolaidis et al. (2015) highlight multiple autism-specific factors that can influence healthcare interactions and suggest changes in professionals' attitudes, skills and behaviours are needed to promote a respectful and effective autism friendly environment.

Approximately 85% of autistic women identify as having a mental health problem yet around a third do not access professional support (Baldwin & Costley, 2016). In line with evidence regarding SC, some young autistic females connect psychological difficulties to the pressures of acting 'normal' in a neuro-typical world (Crane et al., 2019). One woman quoted "*the reason that so many people with autism develop mental health conditions is because of the way that we are treated. From early childhood, autistic kids are excluded, frowned upon and made to feel unnatural. We are constantly pressured to be more 'normal' ... and grow up being excluded, bullied, and pressured to be something that [we] are not*" (Crane, 2019). Such negative social experiences, the pressure to be 'normal' and the effect of missed or delayed diagnosis are all likely to impact on the psychological wellbeing of autistic women.

Overall, noteworthy gender differences exist between autistic males and females. SC is a key characteristic of the female phenotype and may contribute to delays in autism diagnosis and psychological difficulties. Consequently, mental health problems are commonplace among

autistic women. This is most likely associated with pressures to conform to a neuro-typical society, which fails to recognise the specific needs of autistic females. Moreover, autistic women face barriers accessing professional support, often due to associated stigma and inadequate treatment.

Eating Disorders

Eating Disorder Diagnoses. I will now discuss ED diagnoses, with particular attention to restrictive eating disorders (REDs), outlining how recent diagnostic changes within the DSM-5 (APA, 2013) may be relevant for autistic individuals. Eating disorders are characterised by psychological disturbances around eating, food and often body image, which have severe negative physical and psychological consequences (National Health Service, 2018). Anorexia Nervosa is characterised by restriction of intake relative to requirements, markedly low body weight and a fear about or persistent behaviour to avoid gaining weight. This is accompanied by a lack of recognition for the seriousness of low weight and disturbance in the way one's weight or shape is experienced (APA, 2013). Prevalence rates of anorexia are around 0.3% across all age groups and approximately 90% are female (NICE, 2019). Anorexia has the highest mortality rate among any psychiatric disorder, owing to associated medical complications and high suicide rates, with a relapse rate of up to 52% (Khalsa, Portnoff, McCurdy-McKinnon & Feusner, 2017). For those who do fully recover, longstanding physical and psychosocial problems are common.

Bulimia Nervosa (BN) is characterised by eating a large quantity of food in a discrete period of time whilst experiencing a loss of control, followed by compensatory behaviours, which might include purging or excessive exercise (APA, 2013). Whilst restriction of intake may

occur as part of a BN presentation, I will not be including this diagnosis hereafter, as it is not typically considered a restrictive ED nor included in autism related research. However, the clinical reality that many individuals experience more than one ED diagnoses over time (Cooper & Dalle Grave, 2017) suggests consideration for BN in future ED research with autistic individuals would be valuable.

As with autism, the diagnostic criteria for EDs saw noteworthy changes in the updated DSM-5 (APA, 2013), which may have particular relevance for the less 'typical' ED presentations among autistic individuals. Firstly, the language of the criteria for anorexia changed in subtle but significant ways. The word "refusal" was replaced with "restriction", and the requirement of displaying "fear" about weight gain was removed. These linguistic alterations are potentially important for autistic individuals who may not overtly display or acknowledge a fear of weight gain, but nevertheless may be restricting their intake. Secondly, the catchall category of Eating Disorder Not Otherwise Specified (EDNOS) was removed. Historically, this was the most commonly diagnosed ED and included a wide variety of atypical and subclinical ED presentations (Call, Walsh & Attia, 2013). However, with the removal of a low weight cut off and amenorrhea, these presentations are now captured within an anorexia or atypical anorexia diagnosis. Atypical anorexia might fit for some autistic women, where extreme rigidity or obsession about numbers, calories and exercise is more important than losing weight (Lai & Baron-Cohen, 2015).

Finally, Avoidant Restrictive Food Intake Disorder (ARFID) was added to the DSM-5, replacing the Feeding Disorder of Infancy and Early Childhood in the DSM-IV. ARFID describes restriction or avoidance of eating in the absence of body image disturbance. Instead, food avoidance occurs due to lack of interest in or aversion to the sensory properties

of food or the feared negative consequences of eating, such as choking (APA, 2013). ARFID patients are often significantly underweight, nutritionally deficient or dependent on enteral feeding and supplements, with marked interference with psychosocial functioning. ARFID can occur throughout the lifespan, often with a chronic presentation, typically diagnosed in childhood. ARFID occurs equally across genders in infancy and early childhood, but later becomes more prevalent in boys (Coglan & Otasowie, 2019). Retrospective studies among adolescents have found ARFID patients tended to be male, younger, have longer illness duration and experience coexisting anxiety or medical complications (Fisher et al., 2014; Forman et al., 2014).

ARFID appears to be particularly common among autistic individuals. One study compared adolescents with ARFID to those with anorexia and Bulimia Nervosa and found significantly higher rates of pervasive developmental disorder, a form of autism, in the ARFID patient group (Nicely et al, 2014). Given that ARFID is typically seen in young males with higher autistic traits, one could suggest females with ARFID may be at risk of misdiagnosis, with females more likely to receive an anorexia diagnosis and males with ARFID, a pattern often observed in clinical practice but not yet formally researched. Evidently, careful assessment of EDs in autistic individuals is necessary (Shea, 2016).

Body Image Disturbance. Body image disturbance is a key feature of many EDs and refers to one's perception of and attitude towards one's body shape and size (National Eating Disorders Association, 2018). Body image comprises both how you see and feel about your body; cognitive-perceptual and affective components coexist and interact (Preston & Ehrsson, 2014; Riva, 2014). In the general population, females typically exhibit poorer body image than males (Brierley et al., 2016) however this may reflect a reporting bias given that

most studies utilise female samples within ED research. Body image disturbance plays a significant role in the initiation, persistence and relapse of anorexia (Glashouwer et al., 2019), with some arguing anorexia should be re-conceptualised as a ‘body image disorder’ (Phillipou, Castle & Rossell, 2018). Positive attitudes towards an extreme desired low weight are fundamental to body image disturbance in anorexia (Mölbart et al., 2018), with individuals commonly drawing on their weight or shape for self-evaluation (APA, 2013). In contrast, restrictive eating among ARFID patients is not driven by weight or shape concerns (Zimmerman & Fisher, 2017).

It is currently unclear to what extent body image disturbance plays a role in the development of REDs in autistic women. Body image research in the autism field is far less established than for EDs. Interestingly, healthy autistic individuals’ self-estimates of body size have found to be significantly less accurate than neuro-typical controls (Asada et al., 2018) and autistic traits are a significant predictor of momentary negative body image; the immediate affective evaluation of one’s body (Krumm, Ferraro & Ingvalson, 2018). Moreover, autistic traits such as weak central coherence and interoceptive awareness, both described later, have been suggested to increase negative body evaluations among autistic individuals (Krumm, 2018). This has been supported by case studies of young autistic men with co-morbid body-dysmorphic disorder, where autistic features including detailed processing and egocentrism are proposed to contribute to distorted body image (Vasudeva & Hollander, 2017). Together, these studies suggest whilst body image disturbance is not a prominent feature of autism, it is possible that autism-specific factors may increase the likelihood of autistic individuals misperceiving their body size, thereby increasing risk for body image disturbance. However, evidence in this area is currently limited and it is also possible that body image disturbance is a symptom that characterises non-autistic REDs from autistic presentations.

Identifying Autistic Traits in Eating Disorders.

Establishing true prevalence of autism among ED patients is a complex task. First, perceived autistic traits such as rigidity and social impairments may arise from the effects of starvation or psychiatric disorders including anxiety, depression and OCD; all highly prevalent within EDs (Mandy & Tchanturia, 2015). As such, high scores on autism measures run the risk of over-reporting autistic traits within ED populations and studies have cautioned about the construct validity of describing such traits as autistic in females with current anorexia (Hiller & Pellicano, 2013). One study scored women who were currently unwell with anorexia, those that had recovered and those with no experience of anorexia on the former and updated ADOS-2 algorithms (Sedgewick et al., 2019). They found under both algorithms, more acutely unwell patients were identified as meeting autism criteria, suggesting observation of autistic behaviours may reflect illness severity.

However, whilst important to acknowledge the potential effects of acute anorexia, a wealth of evidence suggests despite this, around 20-30% of anorexia patients do in fact meet criteria for autism. Comparisons between females with current anorexia to recovered, healthy controls found both unwell and recovered groups demonstrated impairments in social function, suggesting impairments persist beyond recovery (Bentz et al., 2017). Similarly, longitudinal research found autistic traits were stable over time following recovery (Anckarsäter et al., 2012) and studies investigating pre-morbid AN have found autistic traits to be present before illness onset (Mandy & Tchanturia, 2015; Vagni et al., 2016). Furthermore, studies using gold-standard assessment tools such as the ADOS-2 alongside parental reports via the

Developmental, Dimensional and Diagnostic Interview (3Di), support the over-representation of autism in anorexia patients (Westwood et al., 2018, Mandy & Tchanturia, 2015).

Investigating the updated ADOS-2 algorithm, Sedgewick (2019) concluded that the new ADOS-2 is an effective measure of autism in women with current and recovered anorexia, reporting a significantly higher proportion of women with anorexia meeting criteria for autism, which persists beyond illness recovery. Together, this evidence supports the prevalence of ‘true’ diagnosable autism among anorexia patients, rather than a state of anxiety or malnutrition.

Given the majority of these studies include anorexia patients only, it is important to acknowledge that autistic traits may also be over-represented in patients with ARFID. There is a lack of research into autistic traits among ARFID patients, likely due to the paucity of ARFID research more generally, perhaps owing to its relatively recent inclusion within the DSM-5. However, one can speculate in light of the high overlap between REDS and autism (Shea, 2016), that if autistic traits were investigated among ARFID patients, equally high rates of autism would exist. Furthermore, considering the reverse, of EDs in autistic individuals, one study investigated disordered eating in adolescents and young adults with autism and found abnormal eating behaviours, including food refusal, selective eating and eating of non-food objects (known as ‘Pica’) were over-represented in autistic adults and that these behaviours were often treatment resistant (Rastam, 2008). However, whilst some studies have investigated eating behaviours in autism, presented below, more research is needed into the existence of diagnosable eating disorders in autistic adults. Overall, despite complexities in identifying autism in ED populations, autism is undoubtedly over-represented in this patient group.

Eating Disorder Treatment for Autistic Patients.

Despite an already comparatively poor prognosis for ED patients, those on the autistic spectrum experience consistently more negative care pathways. Co-morbid autism has been associated with more severe and chronic anorexia (Spek, 2015), greater treatment augmentation and lower recovery rates (Stewart et al., 2017). Moreover, autistic patients have poorer functioning post treatment with regards to mental state, psychosexual and socio-economic functioning (Nielsen, 2015; Nazar et al., 2018). Due to the high risk associated with anorexia, involuntary treatment interventions including restraint, involuntary re-feeding and enforced admissions are commonplace. Co-morbid autism increases the use of involuntary practices, medication and admission rate and length; all of which are associated with higher mortality (Clausen et al., 2018). Whilst this may relate to autistic patients typically presenting with more severe anorexic symptoms at admission (Tchanturia, 2019), autistic individuals consequently experience negative and enforced treatment pathways. Whilst such practices serve to mitigate risk, the experience of involuntary treatment can be traumatising for patients and damage relationships with healthcare professionals and services (Kinner et al., 2017).

Autistic patients who experience less severe courses of anorexia may still face multiple obstacles within ED services. Autistic women who have accessed ED services report typically negative perceptions of treatment and describe unique challenges (Kinnaird, Norton & Tchanturia, 2019). These include difficulty accessing services, a lack of recognition from

the ED service of autism specific factors, poor relationships with healthcare professionals, sensory difficulties and premature discharge from services. Clinicians working with this client group also experience challenges; reporting a lack of confidence and evidence based guidelines on necessary treatment adaptations for autistic ED patients (Kinnaird et al., 2017). Autistic individuals therefore require treatments that are non-traumatising, evidence based and tailored to their specific needs. Moreover, commissioners and clinicians require understanding about how REDs develop and maintain in autistic individuals so that healthcare provision can be adapted accordingly.

To date, a number of studies have investigated potentially relevant clinical features, which might account for the association between autism and REDs. In the following section, I will outline these mechanisms alongside current research to explore how and why autistic individuals might be more likely to develop eating disorders.

Autism Specific Risk Factors for Restrictive Eating Disorders

Here I will explore the role of autism-specific mechanisms which might underlie REDs among autistic women, introducing possible hypotheses for risk and maintenance factors, summarised in Table 1. REDs are multifaceted disorders with a number of potential biopsychosocial developmental and maintenance factors (Stice, 2002). However, there appear to be certain variables that are especially relevant for autistic women. These, described below, include eating behaviours, sensory processing, cognitive profiles and social-emotional processing. Finally, I will explore how negative social experiences and difficulty forming relationships might increase autistic women's vulnerability to developing REDs. Most research in this area has focused on anorexia, however where possible, consideration for atypical anorexia and ARFID is included.

Table 1: Summary of evidence regarding autism-specific risk factors for restrictive eating disorders

Topic	Summary	Key References
Eating behaviours	Feeding and eating difficulties are common among autistic children. High levels of disordered eating behaviours exist among autistic women without eating disorders. Women with anorexia display similar eating behaviours to healthy autistic women.	Sharp et al., 2013 Spek et al., 2019 Karjalainen et al., 2019
Sensory processing	The majority of autistic adults experience atypical sensory processing. Atypical sensory processing increases food refusal among autistic children. Women with anorexia experience altered taste and olfactory processing.	Crane et al., 2009 Chistol et al., 2018 Kinnaird, Stewart & Tchanturia et al., 2019
Interoception	Poor interoceptive awareness increases risk of restrictive eating disorders. Autistic individuals demonstrate atypical interoceptive processing. Atypical interoception may contribute to eating disorders via sensory, cognitive and emotional mechanisms.	Fassino, 2004 DuBois et al., 2016 Barrett, 2004; Badoud & Tsakiris, 2017; Cane et al., 2009
Cognitive profiles	Women with anorexia demonstrate similar cognitive styles to autistic women, including cognitive inflexibility and poor central coherence. Comorbidities and starvation may impact on cognitive performance among women with anorexia.	Westwood, Mandy & Tchanturia, 2017; Lang et al., 2014 Oldershaw et al., 2011; Westwood, 2017
Alexithymia	Emotional processing difficulties are associated with greater clinical need among autistic individuals. Alexithymia is common among women with restrictive anorexia and reduces social reciprocity.	Kinnaird, Stewart & Tchanturia, 2011 Brewer et al., 2014; Westwood, 2017
Social cognition	Women with anorexia demonstrate similar theory of mind abilities and empathy profiles as autistic individuals. Facial emotion recognition (FER) abilities are impaired among autistic individuals and those with acute anorexia. Co-morbid autism reduces FER abilities in recovered individuals.	Postorino, 2017; Kerr-Gaffney et al., 2019 Loth et al., 2018; Caglar-Nazali et al., 2014; Dinkler et al., 2019
Relationships and social exclusion	Autistic females experience difficulty gaining acceptance and forming relationships. Women with restrictive eating disorders report similar relationship difficulties.	Baldwin & Costley, 2016 Cardi, Tchanturia & Treasure, 2018

Social anxiety	Social anxiety is commonplace among autistic women and is a key developmental and maintenance factor for restrictive eating disorders.	Joshi et al., 2012; Arcelus, 2013; Cardi et al., 2018
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Eating Behaviours

Atypical eating behaviours among autistic individuals might be one reason why they are more vulnerable to developing disordered eating. REDs by their very nature involve unusual eating patterns; a characteristic typically observed among autistic individuals from a young age. A meta-analysis of feeding and eating difficulties in children found autistic children are five times more likely to experience a feeding disturbance and over half of autistic children are selective eaters; characterised by high food refusal and limited food repertoire (Sharp et al., 2013). The Swedish Eating Assessment for Autism Spectrum Disorders (SWEAA, Karlsson et al. 2013) has been used to investigate eating behaviours among autistic adults. The SWEAA measures specific autistic eating behaviours including perception, motor control, purchase of food, eating behaviour, mealtime surroundings, social situation at meal times and other behaviours associated with disturbed eating and hunger/satiety.

One study using the SWEAA to explore eating behaviours among autistic adults found high levels of disordered eating among females (Spek, Rijnsoever, Laarhoven & Kiep, 2019). Autistic women reported significantly more eating problems than female controls in all SWEAA subscales; reporting higher sensory sensitivity, more eating rituals and substantial burden experienced with the pressures of eating socially. Autistic women scored significantly higher on eating disorder behaviours, with a medium effect size, than controls. The authors describe “worrying” levels of eating problems across female participants and suggest a hypothesis that eating difficulties in childhood persist into adulthood and contribute to poorer

functioning in autistic women. Such evidence suggests autism specific eating behaviours may contribute to the development of REDs in later life.

The SWEAA has also been used to investigate autistic eating behaviours in an ED sample, comparing young women with anorexia to matched autistic and healthy controls (Karjalainen, Rastam, Paulson-Karlsson & Wentz, 2019). ED participants scored higher overall than autistic individuals on the SWEAA, suggesting high overlap in eating behaviours across autism and anorexia. Moreover, typical autistic eating behaviours persisted in weight restored individuals with anorexia, indicating such behaviours may co-occur in anorexia post recovery and are not necessarily a reflection of ill-state. Surprisingly, items pertaining to selective eating habits e.g. due to food texture, were more common in anorexia than autistic participants. This finding is tentatively explained by high levels of obsessive-compulsiveness and a need for control commonly observed in anorexia patients. The authors speculate that autism specific eating behaviours may exist pre-morbidly in anorexia and present a potential risk factor to ED development.

Evidently, high overlap exists in eating behaviours typically considered ‘autistic’ or ‘eating disordered’. One possibility is that autistic eating and feeding difficulties persist into adulthood and increase risk of eating disorder pathology. If so, childhood eating and feeding interventions may act as an important buffer to ED development for women in later life.

Further investigation is warranted into atypical eating behaviours in autistic women to understand how this might relate to the development and maintenance of REDs.

Sensory Processing

Differences in sensory processing, a core feature of autism, might offer another explanation as to why autistic women experience higher levels of REDs. Specifically, autistic women may experience the sensory properties of eating differently to non-autistic adults and therefore might be more likely to restrict or avoid certain foods. Sensory differences in autism include hypersensitivity (heightened reactivity), hyposensitivity (under reactivity) and general sensory overload across sensory systems (Robertson & Baron-Cohen, 2017). Up to 94% of autistic adults experience extreme levels of atypical sensory processing in at least one domain (Crane, Goddard & Pring, 2009). Moreover, autistic females report that sensory sensitivities can be their most overwhelming and debilitating autistic feature (Milner, McIntosh, Colvert & Happé, 2019), typically reporting higher sensory reactivity than autistic males (Lai, 2015).

In autistic children, atypical sensory processing has been associated with selective eating and feeding problems (Cermak et al. 2010; Suarez, 2012), often owing to the sight, smell, texture or taste of food (Whiteley, Rodgers & Shattock, 2000). In fact, atypical oral sensory processing increases rates of food refusal in autistic children (Chistol et al., 2018). This appears to be related to the role of food texture on food acceptance in children (Hubbard et al., 2014). In light of how atypical childhood eating behaviours may contribute to adulthood disordered eating, sensory related food refusal in childhood might be an important consideration for eating difficulties in autistic adults. Indeed, autistic sensory sensitivities have been identified as a key predisposing factor to the development of ARFID, both in children and adults (Coglan & Otasowie, 2019).

Sensory processing has attracted growing interest within the ED literature; particularly with regards to taste and smell. Food restriction in anorexia has been hypothesised to relate to atypical taste responses. Specifically, anorexia patients perceive food tastes as less pleasant (Szalay et al, 2010) and experience restriction as more rewarding than food (Kaye et al., 2013). Evidence for these altered taste and reward pathways has been supported by neuroimaging research (Keating et al., 2012). Research into taste sensitivity, how accurately and intensely one identifies taste stimuli, has yielded conflicting evidence. In a recent systematic review, Kinnaird, Stewart & Tchanturia (2018) concluded that overall, individuals with anorexia experience reduced taste sensitivity which improves with recovery, however highlight significant variability in findings across studies.

Research with anorexia patients into olfactory processing – the sense of smell – yields similarly complex findings. Tonacci et al. (2019) highlight the importance of considering autistic features when interpreting olfactory processing in anorexia. In their study, whilst no difference was found between the olfactory function of girls with anorexia and healthy controls, the researchers found a significant correlation between olfactory performance and autistic features, supporting previous findings of olfactory differences in autism (Tonacci et al., 2017). Thus, autistic women with atypical sensory processing who experience food textures, tastes or smells differently might be more vulnerable to experiencing REDs.

Interoception

In light of wider sensory differences, atypical interoceptive abilities might also account for higher levels of disordered eating among autistic women. Interoception refers to the detection and processing of internal signals such as hunger and satiety. Poor interoceptive awareness,

the inability to detect internal bodily cues, is a key developmental and maintenance factor for REDs (Fassino, 2004). Females with anorexia demonstrate reduced interoceptive sensitivity and awareness compared with healthy controls (Pollatos, 2008). Whilst research into autistic interoceptive abilities consistently reports atypical processing, the exact degree and direction of this processing is unclear (DuBois et al., 2016). Whilst some studies indicate increased interoceptive abilities overall (Schauder, 2015), those using self-report methodologies demonstrate a small bias towards hypo-reactivity to processing of internal signals.

Furthermore, fMRI studies show hypo-reactivity in studies investigating socioemotional processes and hyper-reactivity for studies focusing on internal processing, suggesting there are also differences across types of interoceptive processing. Interestingly, the ability to feel hunger was significantly worse in women with anorexia compared with autistic controls, as measured by the SWEAA (Karjalainen et al., 2019). Overall, whilst autistic individuals certainly have differences in interoceptive processing, further research is required to determine the direction of this sensory difference, and how this might relate to restrictive eating patterns.

Interestingly, interoception not only contributes to ED pathology through the processing of hunger and satiety, but also impacts experience of emotions, empathy and body image. Internal feedback from visceral experiences contributes to the comprehension and communication of our own emotional states (Barrett, 2004) and to our understanding about the emotional states of others (Fukushima, Terasawa & Umeda, 2011). Moreover, there appears to be a causal link between interoceptive processing and body image; whereby reduced interoceptive awareness may increase risk for body-image dissatisfaction in healthy individuals and increases severity of body-image disturbance in ED patients (Badoud & Tsakiris, 2017). This relationship appears to have a neurological underpinning whereby the

insula is involved in cortical representations of interoceptive signals, our awareness of these signals and our body image representation. In support, evidence suggests functioning of the insular cortex is altered among anorexia patients (Badoud & Tsakiris, 2017). Moreover, increased sensitivity to internal sensations is associated with higher body image disturbance and avoidance of sensory experiences in women with anorexia (Cane, Goddard & Pring, 2009). Therefore, atypical interoceptive processing in autistic women may contribute to REDs through multiple sensory, cognitive and emotional mechanisms.

Cognitive Profiles

Similarities in the cognitive profiles of autistic individuals and ED patients might also explain why autistic women are more likely to develop REDs. Two autism-specific cognitive features, cognitive inflexibility and weak central coherence, appear to be important mechanisms in the development and persistence of REDs in autistic women. Cognitive inflexibility refers to difficulty switching from one idea or task to another, a tendency for rigid and concrete problem solving, or using non-flexible and repetitive responses (Roberts et al, 2007). Weak central coherence involves attending to detailed, localised information at the expense of wider, contextual information during processing, impairing one's ability to integrate information and 'see the bigger picture'. Both traits have been consistently observed among ED patients.

Cognitive inflexibility has been conceptualised as an impairment in 'set shifting', empirically demonstrated through the Wisconsin Card Sorting Test (WCST; Heaton et al., 1993); a task requiring individuals to flexibly respond to changes in card sorting rules. In a systematic review and meta-analysis comparing set shifting profiles, as measured by the WCST, autistic

women and those with anorexia performed significantly worse than ‘healthy’ controls, with no significant effect of diagnosis. Interestingly, autistic children performed worse than children with anorexia. Although a non-significant difference, this suggests cognitive inflexibility is more severe in adults with anorexia; possibly a reflection of illness duration. One study investigated within-disorder differences by comparing elevated, sub-clinical or no autistic features in anorexia patients on the ADOS-2 and found higher autistic traits were associated with poorer set-shifting abilities (Westwood, Mandy & Tchanturia, 2017). These studies suggest both women with anorexia and autism experience rigid cognitive styles and that this is particularly true for women with higher autistic traits. We might therefore hypothesise that autistic women are especially susceptible to the inflexible, rule driven behaviour commonly observed in REDs such as anorexia.

Weak central coherence was first proposed by Frith (1989) to explain common autistic traits including obsessional interests, specialised abilities and preference for sameness. A large review of empirical studies of coherence supports a bias towards local processing in autism, which appears to be independent of theory of mind deficits and executive dysfunction (Happé & Frith, 2006). Similarly, a systematic review and meta-analyses of central coherence in EDs demonstrated superior local processing and impaired global processing in individuals with anorexia (Lang et al., 2014). Westwood’s (2017) study comparing within-disorder differences of anorexia patients found no significant difference between those with high, low or no autistic traits on a central coherence task. The authors contextualise this finding in a female only sample, drawing attention to research, which suggests females typically display a less detailed-focused cognitive profile than males (Bolte et al., 2011). Thus, the autistic tendency to process localised information and have difficulty ‘seeing the bigger picture’ is also observed among women with REDs such as anorexia.

However, there may be potential underlying variables to these neuro-cognitive differences in women with anorexia. Oldershaw et al. (2011) draw our attention to state vs trait cognitive deficits in their study of cognitive profiles in ED patients, noting participants were acutely unwell and underweight and thus cognitive impairments may well be compounded by starvation. Furthermore, perfectionism and obsessive-compulsive tendencies are highlighted as potentially underlying cognitive rigidity. Indeed, Westwood (2017) highlights the need to control for psychiatric comorbidities such as depression and obsessive compulsive disorder (APA, 2013), which may impact on neuropsychological performance.

Nevertheless, autistic cognitive traits including cognitive inflexibility and poor central coherence are common among ED patients. Consequently, cognitive interventions, such as Cognitive Remediation Therapy (CRT) have become increasingly popular within ED treatment. CRT targets cognitive inflexibility by addressing anorexic thinking styles and detail focus whilst encouraging active practise of more flexible thinking on issues outside of their ED (Tchanturia, 2014). Moreover, the Maudsley Model of Anorexia Nervosa Treatment for Adults (Schmidt, Wade & Treasure, 2014) includes a treatment module specifically targeting cognitive inflexibility, which has demonstrated comparable effectiveness to individual CBT and specialist supportive clinical management (Schmidt et al., 2015). Such interventions may be especially relevant for autistic women, for whom such cognitive traits may be particularly relevant to their ED pathology.

Alexithymia

Difficulties processing emotions might be another important mechanism that increases the risk of REDs in autistic women. Alexithymia refers to the inability to identify, describe and

express one's own emotional state (Nemiah et al., 1976) and has been associated with a variety of psychopathologies, including EDs. Alexithymia affects an estimated 40-50% of autistic individuals (Berthoz & Hill, 2005). It appears to underlie particular autistic features including difficulties making eye contact, recognising facial and vocal emotional expression (Bird & Cook, 2013), empathic responses (Bird et al., 2010) and levels of social interaction and isolation (Gerber et al., 2019). A recent systematic review and meta-analysis found that alexithymia was common, but not universal, among the autistic population. It concluded that rather than a core autistic feature, there are a subgroup of autistic individuals who experience greater emotional processing difficulties, and that these individuals have specific clinical needs (Kinnaird, Stewart & Tchanturia, 2019). Interestingly, alexithymia is also a common phenomenon among ED patients and is particularly pronounced for those with restrictive anorexia (Westwood et al., 2017). For ARFID patients, it is suggested that alexithymia may be an important means of internalising distress, which may be particularly relevant for autistic patients (Coglan & Otasowie, 2019). Evidence from longitudinal research suggests alexithymia negatively predicts ED prognosis, independent of symptom severity and depressive symptoms (Speranza, 2007). However, this particular study did not consider autism and it is therefore possible that those individuals with higher alexithymia and poorer ED outcomes were also autistic.

Alexithymia appears to be associated with higher levels of internalised mental health difficulties among autistic women. Alexithymia has been found to mediate the association between autism and mood and anxiety disorders, suggesting interventions targeting alexithymia might be especially useful for autistic individuals with mental health problems (Morie et al., 2019). Moreover, young autistic adults' difficulties describing changes in their emotional states contributed to challenges in noticing and describing their own mental health

problems (Crane et al., 2019). This suggests alexithymia may present a further obstacle to recognising and accessing professional support for mental health difficulties among autistic women.

Alexithymia in autistic women might also play a role in REDs through the negative impact on social interactions, specifically via the ability to recognise emotions in others. Indeed, alexithymia has been suggested to be at the core of emotional reciprocity for autistic individuals (Bird & Cook, 2013). One study compared levels of alexithymia and emotion recognition abilities between high-functioning autistic females and matched controls (Ketelaars et al., 2016). Autistic women demonstrated higher levels of alexithymia, but no differences in visual or vocal emotion recognition was found overall. However, autistic women with higher levels of alexithymia found identifying low intensity emotions more difficult, suggesting challenges in processing one's own emotions may also impair the identification of more subtle emotions in others. This has important implications for how autistic women might empathise and relate to others, posing a potential barrier to positive social interactions. Interestingly, a similar mechanism has been proposed for ED patients, with ability to recognise facial emotions predicted by the level of alexithymia, rather than ED symptomology (Brewer et al., 2015). This supports the hypothesis that autistic women with high levels of alexithymia might be especially vulnerable to REDs, through negative impacts on social reciprocity, described further below.

Social Cognition

Impairments in social cognition offer another potential mechanism through which REDs develop and persist in autistic women. Social cognition refers to the cognitive processes

underlying social interaction (Brothers, 2002). Here, three areas of social cognition are outlined; theory of mind, empathy and facial emotion recognition. These are all found to be impaired among autistic individuals and appear to play a role in REDs (Zucker et al., 2007). It is likely these impairments contribute to difficulties forming relationships among autistic women, a well-known risk factor for REDs (Cardi et al., 2018).

Theory of Mind. Baron-Cohen's (1985) well-established theory argues that poor social cognition, specifically impaired Theory of Mind (TOM), is fundamental to autism. TOM, or mentalising, requires us to recognise another's mind; their thoughts, emotions and imagination as separate from our own, in order for us to understand their intentions (Baron-Cohen, 1995). Poor TOM is a well-documented phenomenon among autistic individuals, particularly among children, where clear developmental stages of TOM have been demonstrated. By four years, neuro-typical children perform significantly better than autistic children on false belief tasks requiring understanding of the mental states of others (Wellman & Bartsch, 1994; Wellman et al., 2001). However, older autistic children appear to perform equally well once their language ability improves (Fisher, Happé & Dunn, 2005), suggesting that language plays a pivotal role in TOM performance, particularly for high functioning individuals. Over the years, our understanding and tests of TOM have advanced to include more sophisticated TOM abilities such as inferring second order false beliefs or understanding sarcasm and irony. Whilst some studies of advanced TOM in high functioning autistic individuals have demonstrated impairments (Kleinman, Marciano, & Ault, 2001), others have not found evidence for such difficulties (Spek, Scholte & Van Berckelaer-Onnes, 2010; Scheeren et al., 2013). Possibly, language abilities enable high functioning autistic adults to demonstrate advanced mentalising abilities during tests, but may struggle to apply this understanding in everyday interactions.

Mentalising abilities have also been researched among ED patients. Systematic review and meta-analysis of studies investigating TOM abilities concluded that overall, ED patients demonstrate poor understanding of the mental states of others (Caglar-Nazali et al., 2014). Similar reviews have found these deficits to be a specific feature of anorexia, with more pronounced difficulties evident in more acutely unwell patients (Bora & Köse, 2016). Moreover, a sample of acutely unwell female adolescents with anorexia were found to have comparable TOM abilities to an autistic control group (Postorino et al., 2017). Whilst these findings indicate impaired TOM among anorexia patients, state vs. trait considerations are particularly relevant for this domain, as TOM abilities reduce with the effects of illness severity.

Concluding that women with anorexia entirely lack TOM is a potential oversight. A recent study found no quantitative differences in TOM abilities between women with anorexia, with and without autistic features, compared to healthy controls (Sedgewick, 2019). Notably, the authors of this study acknowledge limitations in the male established TOM measures used, which may not demonstrate more subtle TOM deficits in females. Indeed, evidence suggests both autistic and neuro-typical young girls demonstrate better TOM ability than males (Walker, 2005) suggesting TOM impairments may not be as obvious in women.

Nevertheless, the authors suggest that rather than a complete absence of TOM, women with anorexia, particularly those with autistic features, may experience issues such as negative interpretation bias, which interacts with TOM ability. Indeed, those with anorexia and autistic features in this study were more likely to interpret ambiguous social situations negatively, misidentify emotions and label more negative than positive emotions. Moreover, a study examining the TOM profiles of autistic individuals and anorexia patients concluded autistic individuals have more pronounced TOM impairments than those with anorexia, particularly

with regards to the comprehension of other's emotions; 'emotional TOM' (Leppanen et al., 2018). Therefore, autistic women evidently experience some challenges understanding the minds, and specifically emotions, of others.

Whilst women with anorexia may not struggle to the same degree with TOM, they appear to experience greater interpretation bias in response to emotional cues. Possibly, these biases are especially pertinent for autistic women, who already experience some difficulty recognising and labelling others' emotions. Impaired TOM, particularly emotional TOM, is therefore another potential mechanism in how REDs develop in autistic women.

Empathy. The ability to mentalise enables us to make sense of others' emotional states, to feel these emotions ourselves and respond in prosocial ways. Empathy refers to emotional perspective taking; making sense of another's emotions (cognitive empathy) and sharing in and responding appropriately to them (affective empathy) (Singer, 2006). Empathy is the 'glue' of the social world; enabling relationships and connections with others (Baron-Cohen & Wheelwright, 2004). Autism has previously been conceptualised as an extreme 'male brain', characterised largely by empathizing deficits (Baron-Cohen et al., 2010). Within autism theory, this extends the TOM hypothesis by considering the capacity of autistic individuals to respond to another's emotional state (Baron-Cohen, 2002). However, growing evidence suggests rather than a lack of empathy all together, autistic individuals may have difficulty in the cognitive, rather than the affective, empathy domain (Mazza et al., 2014).

The suggestion autistic individuals lack empathy altogether is too simplistic. Whilst cognitive empathy, related to TOM capacity, may be reduced, this is not necessarily true for affective

empathy. During experimental empathy inducing situations, autistic individuals have demonstrated similar levels of emotional arousal and appropriate social responses to neuro-typical peers (Dziobek et al, 2008). Interestingly, the same appears to be true among ED patients. A systematic review and meta-analysis of cognitive and affective empathy in eating disorders found individuals with anorexia consistently demonstrate impaired cognitive empathy, yet have similar levels of total and affective empathy as healthy controls (Kerr-Gaffney, Harrison & Tchanturia, 2019). This review concludes the empathy profile among those with EDs is similar to that found among autistic individuals. It suggests those with autism and anorexia may share a specific impairment in cognitive empathy; how to identify and understand other's emotions, rather than lacking in empathy all together. Even so, difficulties empathising with others on a cognitive level is likely to impair the ability to form successful relationships, an impairment in social cognition, which appears to be especially relevant to REDs.

Facial Emotion Recognition. Facial emotion recognition (FER) is a social cognitive process, which describes the ability to identify and label emotion states from facial expressions. Deficits in FER have been consistently demonstrated in autistic individuals (Loth et al., 2018, Uljarevic & Hamilton, 2013). Similarly, slower and less accurate facial emotion identification has been demonstrated among women with anorexia (Jansch, Harmer & Cooper, 2009), whilst other studies have not demonstrated such impairments (Gramaglia et al., 2016). Overall, a meta-analysis reported a small effect size for impairments in FER in acutely unwell individuals with AN (Caglar-Nazali et al., 2014). Interestingly, adolescents with anorexia have been shown to be more accurate than healthy controls at facial fear recognition and more accurate than depressed patients in identifying other negative facial emotions (Sfarlea et al., 2017). Attentional processing biases towards negative faces may

shed light on such findings, given that anorexia patients typically demonstrate increased threat sensitivity and an attentional bias towards rejecting faces (Cardi et al., 2013; 2014). Possibly, autistic women who have experienced negative social responses may share a similar threat based processing bias. This, along with FER deficits may mean these difficulties are especially pertinent for autistic women, impairing social relationships and increasing risk for REDs.

Once again, phase of illness and the presence of autistic traits appear to be important considerations for FER abilities among ED patients. Comparisons between women who had long-term recovered from anorexia with matched controls, demonstrate no differences in FER accuracy, however comorbid autism reduces FER abilities in those with recovered anorexia (Dinkler et al., 2019). Overall, these findings suggest whilst acutely unwell anorexia patients may have reduced FER, these differences tend to disappear in recovery. However, high autistic traits may leave ED patients more vulnerable to social impairments through reduced FER abilities. Therefore, autistic women who have poor FER abilities and have experienced negative social experiences might be particularly vulnerable to developing REDs. Overall, social cognitive processes, including TOM, empathy, and facial emotion recognition may all play a role in REDs for autistic women.

Relationships and Social Exclusion

As a result of socio-cognitive impairments, autistic individuals struggle to relate to others and may experience negative and rejecting social interactions. Such difficulties forming relationships can lead to social ostracism, isolation and loneliness (Henault, 2005; Jobe &

White, 2007). Consequently, autistic women may perceive themselves as inferior and fear the negative evaluations of others; two well-established pathways into REDs (Cardi, 2018).

This hypothesis assumes autistic women are negatively impacted by such exclusion, contradicting former autism theories and stereotypes, which suggest autistic individuals prefer solitude over social connection (Chevallier et al., 2012). However, the idea that this fundamental human desire is absent among all autistic people is a misconception which, if accepted, risks neglecting their social needs (Jaswal & Akhtar, 2019). Instead, research suggests autistic individuals, especially females, equally desire friendships, romantic relationships and marriage (Henault, 2005; Newport & Newport, 2002) and prefer direct interactions such as talking with friends over solitary activities (Kuo et al., 2011). Whilst social motivation varies across individuals, social communication impairments, rather than a preference for aloneness, leads to social withdrawal amongst autistic individuals (Henault, 2005; Attwood, 2007). Moreover, high social motivation does not equate to successful relationships among those with high autistic traits (Jobe & White, 2007), suggesting even if autistic individuals are motivated towards relationships, they may lack the skills and understanding to maintain them (Stokes & Kaur, 2005). Autistic individuals can therefore be simultaneously socially motivated and socially impaired.

Despite wanting to connect with others, autistic individuals have difficulty gaining social acceptance throughout their lives. Autistic children experience higher rates of bullying, report more loneliness and struggle to initiate and maintain friendships (Bauminger & Kasari, 2000; Bauminger, Shulman & Agam, 2003). In one study, 50% of autistic women related their worst experiences of education to being teased and bullied (Baldwin & Costley, 2016). For autistic adolescents, social interactions are reported as the most significant challenge

(Church, Alisanski & Amanullah, 2000), with many reporting themselves on the periphery of peer social networks (Locke et al., 2010). Interestingly, fMRI evidence suggests autistic individuals are emotionally impacted by peer rejection, self-reporting equivalent levels of distress as non-autistic peers to social rejection, despite reduced brain activity in areas associated with distress (Masten et al., 2011). Whilst neural processing of social exclusion may differ among autistic individuals, their awareness and concern about rejection does not.

For autistic women, relational difficulties persist. In one study, over a third of autistic women reported feeling lonely, isolated or excluded (Baldwin & Costley, 2016). Interestingly, females in this study were less socially engaged than males and reported feeling more content in their own company. However, the women also described high demand and burden associated with social interaction, suggesting socialising is more emotionally taxing for women than men, possibly accounting for less frequent social interaction in this study. This is perhaps not surprising given evidence about the negative impact of social camouflaging described earlier. Moreover, social challenges such as difficulty understanding friendship expectations, fear of rejection and safety in online over real life interactions were common among late-diagnosed autistic women (Bargiela, Steward & Mandy, 2016). Evidently, relationship difficulties and social exclusion are experienced by many autistic females throughout their life.

Social exclusion is a key risk factor for most adult psychological difficulties, particularly EDs (Fung, 2016). Social experiences are important in the development and maintenance of ED psychopathology (Cardi et al., 2018). Similar to autistic individuals, those with anorexia spend more time engaged in solitary activities and less time socialising (Krug, Penelo & Fernandez, 2013), have smaller social networks (Tiller et al., 1997) and report more loneliness

(Cardi et al., 2018). Indeed, “isolation” was the one word chosen to describe anorexia in an individual account of the illness (McKnight & Boughton, 2009). Friendship difficulties and anxiety about friendships are common prior to the onset of anorexia, with many reporting a distancing from friends as a consequence of the illness (Westwood et al., 2016). Moreover, bullying and friendship difficulties are found to predict ED symptoms (Copeland, 2015). Interestingly, the friendship experiences of women with anorexia are strikingly similar to those of autistic women, with both experiencing a limited social network, lack of personal contact and difficulty understanding friendships (Doris et al., 2014)

For ED patients, social difficulties occur prior to illness onset, during the course of the ED and as a consequence of the illness (Cardi, Tchanturia & Treasure, 2018). Pre-morbidly, anorexia patients recall themselves as shy and anxious about fitting in, with a perceived inferiority to peers. During illness, socio-cognitive impairments compound social difficulties and negatively impact the individual’s social network (Cardi, 2018). Exploring potential mechanisms underlying this, the authors suggest interpersonal difficulties predispose ED symptoms via negative affect, suggesting EDs represent attempts to ‘fit in’ and compensate distress associated with social isolation. In a follow up study, further social mechanisms including submissiveness, related to perceiving oneself as inferior, and fear of negative evaluation, were found to predict ED symptoms (Cardi et al., 2018). Interestingly, this association was mediated by perceived lack of social competence, which may be especially relevant for autistic women who might be more aware of their social impairments.

Evidently, both autistic individuals and those with EDs experience social difficulties from a young age. These include bullying, friendship problems, social exclusion. It appears, for autistic individuals, difficulty navigating a complex social world and a sense of ‘not fitting in’ can lead to mental health difficulties and loneliness. Given that for many ED patients,

anorexia may represent an attempt at gaining social acceptance and overcoming social isolation, it is possible this is especially true for autistic women.

Social Anxiety

Given the difficult social experiences described above, it is perhaps unsurprising that social anxiety is common among autistic women. Social anxiety is fundamentally a fear of scrutiny by others (APA, 2013). In the general population, women are more likely than men to experience social anxiety, typically with a more severe clinical presentation (Asher & Aderka, 2018). Around 50% of autistic individuals report experiencing social anxiety (Spain et al., 2016). High social anxiety among autistic individuals appears to relate directly to inherent social communication difficulties and their impact on social experiences (Spain et al., 2018). However, as outlined previously, anxiety among autistic individuals occurs in a context of a neuro-typical society and the demands this places on autistic individuals to behave and interact in certain ways. In one study, 80% of autistic adults felt strongly that their social anxiety related to a lack of acceptance and understanding from people they interacted with regularly (Beardon & Edmond, 2007). Moreover, it is suggested that high functioning autistic women are at increased pressure to ‘conform’ to non-autistic social norms thereby more likely to feel socially anxious (Joshi et al., 2012). Moreover, given typical experiences of social exclusion described above, social anxiety is understandable, particularly for autistic women who may be more aware of their social impairments.

Within EDs, social anxiety is the most common co-morbid anxiety disorder among anorexia patients and is associated with more severe ED psychopathology (Kerr-Gaffney, Harrison & Tchanturia, 2018). Indeed, fear of negative evaluation is a key developmental and

maintenance factor for anorexia (Arcelus, 2013; Cardi, 2018) and predicts drive for thinness and restraint (Levinson & Rodebaugh, 2012). To some degree, the close relationship between social anxiety and anorexia can be understood within a wider societal context, particularly within western cultures where appearance and thinness are highly valued (Diedrichs, 2016). The ‘thin ideal’ is a term used to describe the internalisation of societal expectations, thereby influencing behaviour and contributing to disordered eating (Thompson & Stice, 2001). Within this context, shame has been proposed as a mediator between social anxiety and EDs, supported by anorexia patients demonstrating significantly higher scores on measures of internalised shame than healthy controls (Grabhorn et al., 2006). One idea is that societal pressures lead women with anorexia to perceive themselves as inferior, experience shame and develop disordered eating in an attempt to increase their social rank (Troop, Allan, Treasure & Katzman, 2003). Indeed, internalised shame has been associated with social comparison and submissive behaviour, both risk factors for anorexia (Cardi et al., 2018). Thus, social anxiety among ED patients may exist within a wider societal context and may connect to perceptions of low social rank.

High occurrence of social anxiety among autistic women is therefore likely to be an important mechanism in the development of REDs. For autistic women, social anxiety appears to relate to the pressures of fitting into a neuro-typical social world, from which they may be rejected or excluded from. For many ED patients, social anxiety plays a pivotal role in ED psychopathology and appears to be mediated to some degree by the role of shame and perceived inferiority. Therefore, one hypothesis is that due to relational difficulties and social marginalisation, autistic women might be especially vulnerable to viewing themselves as of lower social rank, making negative comparisons and demonstrating submissive behaviour.

Social anxiety might therefore increase risk for REDs developing among autistic women and contribute to ED symptoms.

Conclusion

In conclusion, autism is over-represented in women with REDs and autistic women have the lowest recovery rates and experience the most adverse treatment pathways. Services require an evidence based understanding of how autism-specific factors contribute to REDs. There is substantial literature pointing to a multitude of contributory factors towards autistic women developing REDs and experiencing typically longer and more severe REDs. Although presented sequentially in this chapter, these concepts likely integrate and interact to create a complex picture of how autism mechanisms contribute to ED symptomology.

Importantly, socio-cognitive impairments contribute to autistic women experiencing difficulty relating to others. Consequently, autistic women struggle throughout their lifetime to form relationships and experience higher levels of social exclusion and social anxiety than their neuro-typical peers. The social pressures placed on autistic females to conform to neuro-typical social norms appears to further exacerbate these social difficulties and often results in isolation and loneliness. Similar social difficulties appear to be relevant for women with REDs. For women with anorexia, experiencing themselves as inferior to others and fearing negative evaluation appears to predict ED severity and results in social withdrawal, further exacerbating ED pathology. Therefore, adverse social experiences faced by autistic women might be one contributing factor to the high overlap between autism and REDs.

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Part 2: Empirical Paper

Why do autistic women develop restrictive eating disorders?

Exploring social risk factors

Abstract

A high proportion of women with restrictive eating disorders (REDs) are also autistic and there is evidence that autism-specific mechanisms underlie this relationship. This study explored the role of social risk factors for REDs among autistic women. Specifically, whether perceptions of low social rank demonstrated by unfavourable social comparisons, submissive behaviour and fearing negative evaluation (FNE) increased risk of REDs for autistic women. Further, whether autistic women with REDs were especially concerned with gaining social acceptance and would demonstrate higher levels of social camouflaging. Two groups of autistic women; with (N= 22) and without (N= 28) REDs, were compared on measures of social comparison, submissive behaviour, FNE and social camouflaging. Autistic women with REDS were significantly more likely to compare themselves negatively to others; to perceive themselves as of lower social rank, as not belonging and as less socially attractive. Those with REDs also demonstrated higher FNE. There were no significant differences in submissive behaviour or social camouflaging. Clinical implications of the findings are discussed.

Introduction

Around a third of women in treatment for anorexia nervosa (AN) also meet criteria for Autism Spectrum Disorder, ‘autism’ (Westwood, Mandy & Tchanturia, 2017). Despite this, eating disorder (ED) services often fail to meet the specific needs of autistic individuals (Kinnaird et al., 2019) and clinicians lack evidence-based guidance for how to adapt interventions for those on the autism spectrum (Kinnaird et al., 2017). Consequently, autistic individuals experience adverse treatment pathways and worse recovery rates than non-autistic ED patients (Kinnaird, 2019; Tchanturia et al., 2016). An evidence-based understanding of how EDs develop and persist among autistic individuals is therefore required. This will help guide the direction of future research and inform how clinical interventions could be adapted to improve ED outcomes and service provision for autistic individuals.

Restrictive Eating Disorders (REDs) include 1) Anorexia Nervosa (‘anorexia’), and 2) Avoidant Restrictive Food Intake Disorder (ARFID). Anorexia is characterised by fear of weight gain, body image disturbance, restricted intake and significantly low body weight. By contrast ARFID is characterised by restrictive eating due to the sensory properties or feared consequences of food, without body image disturbance (American Psychiatric Association, 2013). Autism is a neuro-developmental condition, characterised by social communication impairments, restricted, repetitive patterns of behaviour and differences in sensory processing (APA, 2013). Autism is more common among males than females (Loomes, Hull and Mandy, 2017), whilst for REDs the reverse is true. The term ‘autism’ is used here to capture all previous and associated diagnostic labels which fall under autism spectrum conditions, to include Autism Spectrum Disorder (APA, 2013), Asperger’s Syndrome and Pervasive Developmental Delay.

There is strong evidence that autistic girls and women are at heightened risk of developing REDs. Studies suggest around 20-35% of women with anorexia are also autistic (Westwood, 2017) compared with less than 1% of women in the general population (Loomes et al. 2017). Some evidence suggests autistic traits observed in those with anorexia may reflect obsessive tendencies or a state of starvation (Bora & Köse, 2016). However, research investigating pre-morbid autistic traits among anorexia patients (Mandy & Tchanturia, 2015; Vagni et al., 2016), studies using gold-standard autism assessment tools (Westwood et al., 2017) and those with weight-restored individuals (Anckarsäter et al., 2012) all suggest genuine autism is over-represented among those with REDs. Further, longitudinal evidence has shown that childhood autistic traits increase risk of subsequent adolescent disordered eating (Solmi et al., 2020).

Despite these high rates of autism, exact mechanisms through which autism gives rise to REDs are not yet established. Since the association was first documented (Gilberg, 1985), a number of comparisons have been made between autism and anorexia, generating interesting hypothesis about why autism is over-represented among RED patients. Studies demonstrating similarities in cognitive rigidity and detailed processing (Westwood, Mandy & Tchanturia, 2017) suggest an inflexible cognitive profile might contribute to obsessional and rule driven behaviour observed in AN. Other studies have highlighted similarities in socio-cognitive functioning (Zucker et al., 2007) such as impairments in the ability to mentalise (Leppanen et al., 2018) and empathise (Kerr-Gaffney, Harrison & Tchanturia, 2020) with others. These studies indicate autistic social communication difficulties might increase risk of REDs, for example through their negative impact on relationships (Henault, 2005). However, until now there has been no direct testing of these ideas to explain how these autism-specific

mechanisms might contribute to the development and persistence of REDs among autistic women.

Interviews with autistic women with anorexia offer insights into autism-specific REDs and highlight key differences from the experience and presentation of non-autistic REDs.

(Kinnaird, 2019; Brede, 2020). For example, food restriction driven by rigidity and a need for control rather than weight concerns (Kinnaird, 2019). Such evidence supports the idea that certain autism-specific factors may underlie REDs among autistic individuals. The first data-based model identifying such mechanisms has recently been proposed (Brede et al., 2020).

Generated from interviews with autistic women with REDs, their parents and healthcare professionals, the model suggests disordered eating among autistic women serves as a coping mechanism for dealing with autism-related difficulties. These include sensory sensitivities, emotional processing, cognitive rigidity and social interactions, among others. These difficulties contribute to restrictive eating directly and via indirect pathways, through negative emotional consequences, mental health difficulties and a negative sense of self. Outcomes of restrictive eating include numbing down of emotional or sensory experiences and introducing calmness through predictability and control, thereby creating maintaining feedback loops by reducing impact of initial autistic difficulties.

Therefore, whilst a number of potential bio-psycho-social factors underlie disordered eating (Szmukler, Dare & Treasure, 1995), it seems there are specific characteristics of autism which engender certain experiences that increase the likelihood of autistic individuals developing REDs (Brede, 2020). This paper will focus on one such risk factor; the effects of adverse social experiences. Specifically, it is hypothesised that social communication impairments and associated negative social experiences such as rejection and exclusion may

increase autistic women's vulnerability to established risk factors for REDs. These include viewing themselves as inferior and fearing the negative evaluations of others. Moreover, this might be particularly true for autistic women who are more aware of their social differences and concerned with gaining social acceptance.

Core socio-cognitive features of autism contribute to relationship difficulties, social isolation and loneliness among autistic individuals (Jobe & White, 2007). Interpersonal adversity such as childhood bullying (Bauminger & Kasari, 2000), social exclusion and fewer friendships are common among autistic children and adolescents (Kasari et al., 2011; Kuo et al., 2013). Autistic teenagers typically exist on the periphery of social groups (Locke et al., 2010), during a time when differences in social skills become increasingly evident (Howlin, 2003). Moreover, social ostracism has an equally negative emotional impact on the self-esteem and sense of belonging for autistic individuals as for typically developing peers (Sebastian, Blakemore & Charman, 2009). Among adults, autistic women report poorer relationship experiences and experience higher vulnerability to exploitation than non-autistic women, which they relate to their difficulties interpreting social situations (Sedgewick, Crane, Hill & Pellicano, 2019).

In the wider ED literature, social difficulties are central to a number of explanations of REDs (Raykos et al., 2017; Treasure & Schmidt, 2013). Indeed, social difficulties are evident pre-morbidly, during and following illness duration (Cardi, Tchanturia & Treasure, 2018a). Children who develop AN spend more time engaged in solitary activities and less time socialising, a pattern which persists into adulthood (Krug, Penelo & Fernandez, 2013). Moreover, early experiences of negative evaluation such as childhood bullying (Copeland et al., 2015), friendship difficulties (Westwood et al., 2016) and derogatory "fat talk" (Sharpe et

al., 2013) have all been documented in the development and maintenance of AN. Among adolescents, poor acceptance by peers and a lack of friendship intimacy has been found to predict restrictive eating (Gerner & Wilson, 2005). Furthermore, AN patients show an increased sensitivity to the threat of social rejection; demonstrated by an attentional bias towards rejecting faces and away from accepting faces, a bias that is associated with adverse childhood social experiences (Cardi, Metteo, Corfield & Treasure, 2013). Qualitative reports from adults with AN report that social difficulties both pre-dated and occurred during their ED, and directly associated such difficulties with the development of their REDs (Cardi, 2018a). Conversely, the construct of social connectedness; that is, feelings of belonging and identification with others, is associated with fewer eating disorder symptoms among ED patients (Nunez, 2019).

A number of possible mechanisms have been proposed for how social difficulties contribute to REDs. One suggestion is that REDs serve to manage negative affect associated with adverse social experiences, or that REDs are attempts to 'fit in' and compensate social exclusion and feelings of inferiority (Cardi et al., 2018b). Further, submissive behaviour and fear of negative evaluation have been found to predict ED symptoms (Cardi, 2018b).

Evidently, social difficulties are an important risk factor in the development of REDs and autistic women may be especially vulnerable to such difficulties. This paper seeks to further explore the underlying mechanisms for how social difficulties might increase risk of REDs among autistic women. It is hypothesised that social communication impairments and experiences of social rejection and exclusion leave some autistic women vulnerable to i) perceiving themselves as inferior to others and ii) fearing the negative judgments of others. Moreover, it is suggested that these women will also be more concerned with gaining social

acceptance and will therefore iii) engage in behavioural attempts to fit in with others, known as ‘social camouflaging’.

Perceived Inferiority

Developing a sense of inferiority in comparison to others is one way through which early negative social experiences might predispose autistic individuals to REDs (Cardi, 2018a).

Perceived inferiority; viewing oneself as socially undesirable and of low social rank has been suggested to underlie a number of psychological disorders, including REDs (Gilbert, 2000; Troop & Baker, 2008). Evolutionary psychology attempts to explain psychopathology in the context of social hierarchy and survival (Gilbert, 1992; Gilbert, 2000). Social rank theory suggests difficulties arise when individuals are or perceive themselves to be of lower social standing in relation to others (Stevens & Price, 2000). A systematic review and meta-analysis of the social processes involved in EDs found a belief that one was socially inferior to others was evident among ED patients with a large effect size (Caglar-Nazali et al., 2014).

Indicators of perceived inferiority include high social comparison, an adaptive mechanism to assess one’s hierarchical position within a group (Price and Sloman, 1987) and submissive behaviour, a behavioural pattern of conflict avoidance in order to maintain group acceptance (Gillbert & Allen, 1998).

There appears to be a specific role of social rank perceptions in predicting ED symptoms (Troop & Baker, 2008). Among college students, disordered eating attitudes are associated with judgments of inferiority and a striving to gain social acceptance (Bellew et al., 2006). AN patients demonstrate significantly higher social comparisons and submissive behaviour than healthy controls (Kalayci et al., 2019; Cardi et al., 2014), and perceived inferiority is

associated with ED severity (Troop et al., 2003). Those recovered from AN continue to demonstrate similar patterns of low social rank, which have been shown to mediate the relationship between childhood interpersonal adversity and AN (Connan et al., 2007). Further, experimental evidence demonstrates hypersensitivity towards social rank related cues among AN patients (Cardi, 2014). Such evidence suggests viewing oneself as inferior to others is a key factor in the development of REDS. Interestingly, unfavourable social comparisons have been associated with depressive symptoms among autistic adolescents (Hedley & Young, 2006), suggesting rank processes may also be an important risk factor for REDS among autistic individuals.

Fear of Negative Evaluation

Fear of negative evaluation (FNE) is a fundamental cognitive component of social anxiety and refers to fear of scrutiny by others (APA, 2013). Among college students, heightened negative evaluation fears are significantly associated with restrictive eating attitudes, suggesting restriction may serve to increase status among peers (Gilbert & Meyer, 2005). FNE is a key developmental and maintenance factor of anorexia (Arcelus, 2013; Cardi, 2018b) and predicts drive for thinness and restraint (Levinson & Rodebaugh, 2012). Moreover, social anxiety is the most common anxiety disorder among anorexia patients and is associated with more severe ED psychopathology (Kerr-Gaffney, Harrison & Tchanturia, 2018). Due to theory of mind deficits, autistic individuals might be misconceived as not experiencing such socio-evaluative concerns (Capriola, et al., 2017). However, evidence suggests autistic teens equally fear negative judgments as typically developing peers (Bauminger et al. 2003; White and Schry, 2011). Moreover, autistic adolescents report themselves to be less socially competent and less approved by peers than typically

developing controls (Williamson et al., 2008). This suggests autistic individuals both make social comparisons and consider the judgments that other's make of them. Moreover, few differences have been found in FNE between adolescents and adults with and without autism (Capriola et al., 2017).

FNE appears to be a trans-diagnostic feature across all EDs, however more significantly associated with EDs characterised by weight and shape concerns and less associated with ARFID (Trompeter et al., 2019). This is in line with evidence suggesting a strong positive correlation between FNE and body image concerns (Levinson, 2012), with a stronger association among girls (Trompeter, 2018). This raises the question as to whether FNE will be as relevant for autistic individuals whose ED might be less driven by body image concerns. However, FNE among autistic individuals might relate to more general evaluations of the self rather than one's weight or shape specifically. In support, FNE predicted attentional biases towards social threat cues among autistic adolescents (White, Maddox & Panneton, 2015). Moreover, FNE among autistic individuals may well be grounded in personal experiences of negative responses and social rejection (Capriola, 2017). Research suggests neuro-typical children and adults make quick negative judgments about autistic individuals which are associated with reduced interaction (Sasson et al., 2017). As such, autistic individuals may well pick up on negative social responses towards them and consequently fear how others might perceive them.

Social Camouflaging

Some autistic women more than others might be especially burdened by difficult social experiences and feel a greater pressure to gain social acceptance. Autistic females are

typically more socially motivated than males (Sedgewick et al., 2016) and equally desire friendships and romantic relationships as non-autistic women (Henault; 2005, Attwood; 2007), yet many experience social exclusion throughout their life. Some autistic women may attempt to overcome this by actively changing their behaviour in order to fit in, a process known as ‘social camouflaging’ (SC). SC has been defined as the masking of autistic characteristics and the imitation of social behaviours to appear more socially competent (Hull et al., 2017). Such behaviours are more common among autistic women than men (Hull et al., 2019) and are highly psychologically taxing (Hull, 2017). Women who SC are typically more motivated towards social engagement and consequently tend to be those whose autism goes unrecognised (Bargiela, Steward & Mandy, 2016). Indeed, late-diagnosed autistic women report the pressure to ‘conform’ to non-autistic social standards negatively impacts on their emotional wellbeing and sense of identity (Bargiela, 2016). It has been suggested camouflaging might mediate the relationship between a lack of acceptance and mental health difficulties (Cage, Di Monaco & Newell, 2018). Moreover, autistic individuals report camouflaging as a necessary strategy to avoid rejection, mistreatment and social ostracism (Mandy, 2019). Therefore, autistic women who camouflage may be especially vulnerable to the effects of adverse social experiences and experience an increased pressure to gain acceptance from others.

Aim of the Current Study

There appear to be specific social risk factors for REDs which might be especially relevant for autistic individuals. Given the high levels of ostracism many autistic women face, it is possible some may learn to perceive themselves as inferior to others. Further, experiences of overt social rejection, for example through bullying, may contribute to fears about scrutiny

from others. Moreover, autistic women who experience greater pressure to ‘fit in’ and make active attempts to gain social acceptance may be especially prone to the negative impact of such experiences. This study initially set out to compare three participant groups; autistic women with and without REDs to non-autistic women with REDs. However, due to the COVID-19 pandemic the study was suspended before a non-autistic comparison group had been recruited.

This study therefore aims to explore further the role of social risk factors among autistic individuals by comparing autistic women with and without REDs on measures of social comparison, submissive behaviour and FNE. It is hypothesised that, compared to autistic women without REDs, autistic women with REDs will demonstrate: (i) higher levels of perceived inferiority, demonstrated by increased negative social comparisons and submissive behaviours; (ii) higher fears of negative evaluation and; (iii) more social camouflaging behaviours.

Method

Social Context

Data was collected for this study between August 2019 and March 2020, therefore partly coinciding with the global COVID-19 outbreak in 2020. In response to government enforced lockdown measures, the project was suspended on 23rd March 2020. Data collection from NHS ED services had just begun at this time. Consequently, the current study describes a comparison between two groups of autistic women, with and without REDS and does not include a non-autistic RED group as initially planned. Additionally, the number of

participants included is lower than originally anticipated. The impact of the COVID-19 pandemic on the study is discussed further later.

Participants

At the time of lockdown, data had been collected from 50 autistic women, with and without REDS. The current sample size is reflective of the impact of the COVID-19 pandemic and not indicative of former power calculations. Prior to the pandemic, the study had sought to recruit a total of 135 participants. Given the novel research design in comparing three participant groups, it was not possible to estimate group difference effect sizes from existing literature. Therefore, a sample size of 45 women in each group was chosen to power the study to $\geq 80\%$ with a two tailed alpha at .05. This would allow for the detection of medium-to-large effect sizes (Cohen's $d \geq .6$) and ensure clinical sensitivity. However, unfortunately this was not possible due to early termination of data collection.

Participants were recruited via an existing database of autistic women who had previously engaged in autism related research, from NHS autism and ED services across London, Surrey and Cardiff and through social media. Eligibility criteria required participants to be 1) female, 2) over 18 years, 3) have been formally diagnosed with autism (including autism spectrum disorder, autism, Asperger's syndrome, high functioning autism and pervasive developmental disorder), 4) without an intellectual disability. If recruited for the RED group, women who were suspected to be on the autism spectrum by their ED team were also accepted and autism diagnosis was investigated by the research team (see below). Women in the RED group were required to be currently living with a RED (including anorexia nervosa, atypical anorexia or ARFID). Participants were assigned groups based on the presence of a clinically diagnosed

RED, of which there were twenty two participants with a RED. Of note, autistic women without REDs had significantly higher levels of education and employment. Characteristics of the sample are reported below (*Table 1*).

Table 1: Descriptive characteristics of the sample

		RED + ASD (N=22)	ASD only (N=28)	P value
Age in years: Mean, SD, (range)		36.18, 12.87 (20-61 years)	37.91, 10.82 (20-59 years)	.608
Ethnicity: Frequency, (%)				.118
	White British	18 (81.82%)	19 (67.86%)	
	Black Caribbean	1 (4.55%)	2 (7.14%)	
	White Black Caribbean	1 (4.55%)	0	
	White other	2 (9.09%)	4 (14.29%)	
	Chinese	0	1 (3.57%)	
	Vietnamese	0	1 (3.57%)	
	Hispanic	0	1 (3.57%)	
Highest Education Level: Frequency, (%)				.024*
	GCSE level or equivalent	1 (4.55%)	1 (3.70%)	
	A Level or equivalent	5 (22.73%)	2 (7.41%)	
	Diploma/Foundation level degree or equivalent	6 (27.28%)	1 (3.70%)	
	Degree level or equivalent	6 (27.27%)	12 (44.44%)	
	Masters level or equivalent	3 (13.64%)	10 (37.04%)	
	PhD level or equivalent	1 (4.55%)	0	
	Other	0	1 (3.70%)	
Current Employment: Frequency, (%)				.042*
	Voluntary work	6 (27.27%)	2 (7.14%)	
	Part time paid work	2 (9.09%)	17 (60.71%)	
	Full time paid work	1 (4.55%)	5 (17.86%)	
	Not working, looking for work	3 (13.64%)	1 (3.57%)	
	Not working, not looking for work	8 (36.36%)	2 (7.14%)	
	Other	6 (27.27%)	1 (3.57%)	
Current Education: Frequency, (%)				.737
	Full time education	3 (13.64%)	2 (7.14%)	
	Part time education	2 (9.09%)	4 (14.29%)	

Not currently in education	16 (72.72%)	21 (75.0%)
Interrupted study	1 (4.55%)	1 (3.57%)

Significance cut off: *p-value= <.05

Ethics

Full ethical approval was gained by UCL and NHS Research Ethics Committee. See Appendix 1.

Procedure

This study was part of wider research investigating potential autism-specific mechanisms underlying REDs, which required participants to complete a large battery of experimental tasks and questionnaires (*Table 2*). Participants met with either myself or one of two PhD students in London or Cardiff, at a university building or in their home, for two to three hours. Once written consent was obtained (Appendix 2), participants' weight and height were measured and a background questionnaire was completed. The Autism Diagnostic Observation Schedule, module 4 (ADOS-4, Lord et al., 2000), a gold-standard observational autism assessment, was then administered and filmed for coding purposes, with participants' consent.

Experimental tasks and questionnaires were then administered in a randomised order. The online platform 'Qualtrics' was used to randomise the order of tasks and record data. Participants could log onto Qualtrics from home to complete any remaining questionnaires that had not been completed in session. Once participants had completed all measures, they were sent an online £30 Amazon voucher as a reward for participating.

Table 2: Full list of all questionnaires and experimental tasks completed by participants

Experimental tasks	Autism Diagnostic Observation Schedule- Module 4	(ADOS-4; Lord, Rutter, DiLavore, & Risi, 2000)
	Picture-based Implicit Association Task	(Greenwald et al., 1998; Ahern, Bennett & Hetherington, 2008)
	Questionnaire-based Implicit Association Task	(Greenwald et al., 1998; Yovel & Friedman, 2013)
	Interoceptive accuracy task ('heartbeat tracking task')	(Schandry, 1981; Murphy et al., 2018)
	Taste sensitivity task ('taste strips task')	(Burghart, Messtechnik, Germany; Landis et al., 2009)
	Test of Premorbid Functioning – UK edition	(TOPF; Wechsler, 2011)
Questionnaire Measures	Adult Repetitive Behaviours Questionnaire	(RBQ-2A; Barrett, Uljaverić, Baker, Richdale, Jones & Leekam, 2015)
	Body Shape Questionnaire	(BSQ; Cooper, Taylor, Cooper & Fairburn, 1987)
	Brief Fear of Negative Evaluation Scale	(BFNE; Leary, 1983)
	Glasgow Sensory Questionnaire	(Robertson & Simmons 2013)
	Interoception Sensory Questionnaire	(ISQ; Fiene, Ireland & Brownlow, 2018)
	Intolerance of Uncertainty Scale	(IUS-12, Carleton et al. 2007)
	Pride in Eating Pathology Scale	(PEP-S; Fajja, Fox, Tierney, Peters & Gooding, 2017)
	Ritvo Autism Asperger Diagnostic Scale –14	(RAADS-14; Eriksson, Andersen & Bejerot, 2013)
	Social Attitudes Towards Appearance Scale	(SATAQ-3; Thompson, van den Berg, Roehrig, Guarda & Heinberg, 2004)
	Social Phobia Inventory	(SPIN; Connor et al, 2000)
	Submissive Behaviour Scale	(SBS; Allan & Gillbert, 1997)
	SWedish Eating Assessment for Autism spectrum disorders	(SWEAA; Karlsson, L., Råstam, M., & Wentz, E. 2013)
	The Camouflaging Autistic Traits Questionnaire	(CAT-Q; Hull et al., 2018)
	The Eating Disorder Examination-Questionnaire	(EDE-Q; Fairburn & Beglin, 1994)
	The Hospital Anxiety and Depression Scale	(HADS; Zigmond & Snaith, 1983)
	The Social Comparison Scale	(SCS; Allan & Gillbert, 1995)
	Toronto Alexithymia Scale	(TAS-20; (Bagby, Taylor, & Parker, 1994)

Measures

Measures directly relating to the clinical characteristics of the sample and research hypotheses will be described.

Autism. Autism was confirmed through self-report and direct observational measures. The Ritvo Autism Asperger Diagnostic Scale –14 (RAADS-14; Eriksson, Andersen & Bejerot, 2013) is a 14-item NICE-recommended screening questionnaire for autism, specifically designed to map onto DSM-5 symptoms (APA, 2013), with excellent internal consistency ($\alpha = 0.9$). At a cut-off score of 14 or above, the RAADS-14 reached a sensitivity of 97% and a specificity of 95% when including a general population comparison group, and a specificity of 46 - 64% when including other psychiatric outpatients (Eriksson, 2013).

The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord, Rutter, DiLavore, & Risi, 2000) is a standardised, semi-structured observational assessment of autism. It is widely used in clinical practice and offers the best validated direct observational measure (NICE 2012). The ADOS-2 consists of four modules; module 4, designed for use with verbally fluent adolescents and adults, was used. Scoring occurs through a standardised, diagnostic algorithm, which maps on to DSM-5 diagnostic criteria (Hus, Gotham & Lord, 2014). Two sub-scores; ‘Social Affect’ and ‘Restricted and Repetitive Behaviours’ and a total score are used to confirm diagnosis. The Module 4 algorithm has demonstrated high sensitivity (90.5%) and specificity (82.2%) (Hus & Lord, 2014), particularly to symptoms displayed by females and adults (Pugliese et al., 2015). ADOS-2 assessments were filmed and double coded within the research team to improve reliability of scores.

Eating Disorders. The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) consists of thirty-two items assessing core ED symptomology. It is a self-report measure based on the Eating Disorder Examination interview (Fairburn & Cooper, 1993). Items are rated using a seven point forced-choice scale, with higher scores reflecting either greater severity or frequency. The EDE-Q has four subscales: Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern and produces an overall global score. Internal consistency has been established for the global score ($\alpha = .90$) and all four subscales; Restraint ($\alpha = .70$), Eating Concern ($\alpha = 0.73$), Shape Concern ($\alpha = 0.83$) and Weight Concern ($\alpha = 0.72$), (Peterson et al., 2007).

Depression and Anxiety. The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a brief self-report questionnaire comprising fourteen questions relating to anxiety (HADS-A) and depression (HADS-D). This measure has excellent psychometric properties; Cronbach's alpha for HADS-A varies from .68 to .93 (mean $\alpha = .83$) and for HADS-D from .67 to .90 (mean $\alpha = .82$). It has been found to successfully assess symptom severity and identify cases of anxiety disorders and depression in somatic, psychiatric and primary care patients and in the general population (Bjelland, Dahl, Haug, & Neckelmann, 2002). The HADS was selected due to its focus on non-physical symptoms, to minimise potential overlap with autistic features.

The Social Phobia Inventory (SPIN; Connor et al, 2000) is a 17-item well validated measure of social anxiety disorder. Symptom domains of fear, avoidance and physiological arousal are assessed via a 5-point rating scale of how "bothered" respondents have felt, rating from 0 (not at all) to 4 (extremely). Good psychometric properties of test-retest reliability, internal consistency ($\alpha = 0.94$) and validity have been demonstrated for this measure (Connor, 2000).

Perceived inferiority. Two measures of perceived inferiority were used; social comparison and submissive behaviour; both have been used to measure social rank within ED populations (e.g. Troop, 2003). The Social Comparison Scale (SCS; Allan & Gillbert, 1995) measures perceived social standing in relation to others. It is an 11-item rating scale of bipolar constructs, for example “Inferior-Superior”, through which global comparisons between the self and others are rated along a ten-point scale (Appendix 3). Low scores below 60 indicate self-perceptions of low social rank and feelings of inferiority. Previous factor analysis has identified three components of social comparison measured by this scale, involving comparison of (i) rank, (ii) group fit ‘belongingness’ and (iii) attractiveness. This scale has good internal reliability, with Cronbach alphas (α) of .96 and .91 for clinical and student populations respectively (Allan and Gilbert, 1995). High internal consistency was also observed for the current sample ($\alpha = 0.93$).

The Submissive Behaviour Scale (SBS; Allan & Gillbert, 1997) is a 16-item questionnaire through which submissive behaviours, for example “I continue to apologise for minor mistakes”, are rated on a 5-point frequency scale ranging from 0 (never) to 4 (always). The scale has good internal reliability ($\alpha = .88$) in student and patient populations. Some items on the SBS were considered to highly correspond to features of autism, for example “I avoid direct eye contact”. Following consultation with an expert in the autism field, three items (item 11, item 13 and item 14) were considered too closely related to autistic features and were therefore removed to create an alternative scale. Analysis was run using both the original (Appendix 3) and amended scale and findings were broadly similar for both versions of the scale (Table 4). High internal consistency for the current sample was found for both the original ($\alpha = .89$) and amended ($\alpha = .88$) scales. Results reported below refer to the amended scale.

Fear of Negative Evaluation. The Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983) measures the specific construct of fearing one is being judged unfavourably by others. It is a 12-item self-report measure (Appendix 3) which asks respondents to rate how “characteristic” each statement is for them from 1 (not at all) to 5 (extremely). The BFNE has demonstrated strong construct validity and high internal reliability for both non-clinical ($\alpha=.90$) and the current sample ($\alpha=.74$).

Social Camouflaging. The Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al., 2019) is a measure of social camouflaging behaviours developed from autistic women’s own reports of their camouflaging experiences (Appendix 3). Respondents rate 25 statements which describe typical social camouflaging behaviours that ‘best fit’ their own social interactions on a scale from 1 (strongly disagree) to 7 (strongly agree). Higher scores on the measure reflect greater camouflaging. The measure has demonstrated internal consistency ($\alpha = 0.94$) and test–retest reliability ($r = 0.77$). High internal reliability was also observed for the current sample ($\alpha = 0.91$).

Analysis

Hypotheses were tested using IBM SPSS Statistics 24.0 software (SPSS, Chicago, IL, USA) to carry out a series of independent samples T-tests. Firstly, groups were compared on clinical measures of autism, REDs and depression and anxiety. Then, mean scores on measures of inferiority and FNE were compared. Linear regression was then used to explore the role of anxiety and depression on any significant findings of group difference. These regressions were carried out in two blocks; the first replicated the t-test whereby group was entered as a categorical predictor variable, whilst the second block included total scores on

the HADS depression and anxiety subscales and the SPIN, to control for the effects of general anxiety, depression and social anxiety (Appendix 4).

Results

Clinical Characteristics

With regards to autism diagnosis, 63% of autistic women with REDS had a diagnosis of Autism Spectrum Disorder (ASD) and 22% with Asperger Syndrome (AS), whilst for autistic women without REDs, 53% had a diagnosis of ASD and 46% with AS. Within the RED group, two women had not yet received formal autism diagnosis and one had a diagnosis of Pervasive Developmental Delay Not Otherwise Specified. Within the RED group, 81.6% (40 of 49) met criteria for autism using the updated ADOS-2 algorithm (Hus & Lord, 2014), which included the two participants without a formal autism diagnosis. However, based on scores on the ADOS, RAADS and observations during the assessment, all participants were considered to meet criteria for autism by the research team. As is shown in Table 3, there were no significant differences found between autistic women with and without REDs with regards to total ADOS-2 scores $t(46) = 1.62$, $p = .112$, $d = 0.47$, or on subscales of Restricted and Repetitive Behaviours, $t(46) = 0.42$, $p = .967$, $d = 0.01$, or Social Affect, $t(46) = 1.96$, $p = .056$, $d = 0.57$. However, there was a non-significant trend towards autistic women with REDs scoring higher on the Social Affect subscale. On the self-report measure of autistic traits, autistic women with REDs scored significantly higher on overall RAADS scores $t(48) = 2.63$, $p = .011$; $d = 0.76$, however there were no significant differences across subscales on this measure.

With regards to eating disorders, significantly more autistic women with REDs reported childhood feeding or eating concerns $t(48) = 2.98, p = .004; d = 0.86$. Nevertheless, nearly half of autistic women without REDs also reported some childhood eating difficulties. As expected, autistic women with REDs had a significantly lower Body Mass Index (BMI) than those without REDs, $t(46) = -6.17, p = <.000, d = 1.90$. Autistic women with REDs demonstrated significantly higher current ED symptomology, as measured by global EDEQ scores $t(48) = 3.94, p = <.001; d = 1.09$, and scored significantly higher on all subscales. Autistic women with REDs also demonstrated higher levels of depression $t(48) = 3.12, p = .003; d = 0.88$ and anxiety $t(48) = 3.01, p = .004; d = 0.85$ as measured by the HAADs and social anxiety $t(47) = 2.14, p = .037; d = 0.62$, as measured by the SPIN. For autistic women with REDs,

With regards to anxiety scores on the HADS, 81.82% (18 of 22) of autistic women with REDs scored within the clinical range, and 9.09% (2 of 22) within the borderline and 9.09% (2 of 22) within 'normal' range. For those without REDs, 57.14% (16 of 28) scored within the clinical range for anxiety, 21.43% (6 of 28) within the borderline and 21.43% (6 of 28) within 'normal' range. With regards to depression, 50% (11 of 28) of autistic women with REDs scored within the clinical range on the HADS, with 18.18% (4 of 28) scoring within the borderline range and 31.82% (7 of 28) within 'normal' range. By contrast, only 17.86% (5 of 28) of autistic women without REDs scored within the clinical range for depression, 14.29% (4 of 28) within the borderline range and 67.86% (19 of 28) within the normal range.

There were no significant correlations found between BMI and autism as measured by the ADOS ($r = -.06, p = .714$) or RAADS ($r = .12, p = .419$), with EDEQ scores ($r = -.23, p = .124$) or social anxiety as measured by the SPIN ($r = .184, p = .216$). However, a significant negative

correlation was found between BMI and depression ($r = -.360$, $p = .012$) and anxiety ($r = -.329$, $p = .022$) as measured by the HADS. Further, BMI did not correlate significantly with social comparison ($r = .12$, $p = .401$), submissive behaviour ($r = -.20$, $p = .170$), fear of negative evaluation ($r = -.12$, $p = .436$) or social camouflaging ($r = .27$, $p = .068$). All clinical characteristics of the sample are displayed in *Table 3*.

Table 3: Clinical characteristics of sample

		RED + ASD (N=22) M, SD	ASD only (N=28) M, SD	P value
Body Mass Index (Mean, SD)		18.77, 3.05 (N=20) ^a	28.21, 6.32	.000**
Age of autism diagnosis (Mean, SD)		33.4, 13.37	34.24, 12.12	.823
Ritvo Autism Asperger Diagnostic Scale –14 (Mean, SD)	Total	36.86, 4.34	32.79, 6.16	.011*
	Metalizing deficits	19.14, 2.95	16.75, 3.63	.16
	Social anxiety	9.59, 8.50	2.20, 2.17	.086
	Sensory reactivity	8.14, 1.28	7.54, 2.12	.247
Autism Diagnostic Observation Schedule- Module 4 (Mean, SD)	Total	13.27, 4.92	11.04, 4.62 (N=26) ^b	.112
	Social Affect	10.14, 4.24	7.92, 3.59	.056
	RRB	3.14, 1.46	3.12, 1.93	.967
Eating Disorder Diagnosis Frequency, (%)	Anorexia Nervosa	17 (77.3%)	0	
	Atypical Anorexia	2 (9.1%)	0	
	ARFID	3 (13.6%)	0	
Childhood eating concerns identified Frequency, (%)		18 (81.82%)	12 (42.86%)	.004*
Eating Disorder Examination Questionnaire (Mean, SD)	Global score	3.13, 1.73	1.55, 1.11	.001**
	Restraint	3.02, 2.00	1.47, 1.56	.005*
	Eating concern	2.65, 1.60	0.82, 0.99	.000**
	Shape concern	3.60, 1.98	2.00, 1.41	.003*
	Weight concern	3.28, 2.03	1.89, 1.30	.009*
Hospital Anxiety and Depression Scale (Mean, SD)	Anxiety	14.77, 4.93	10.89, 4.18	.004*
	Depression	10.00, 5.18	5.75, 4.49	.003*
Social Phobia Inventory (Mean, SD)		43.81, 14.77 (N=21)*	34.89, 14.15	.037*

Note^a: Two participants in RED group declined recording of weight

Note^b: ADOS scores from two participants unavailable due to impact of COVID-19

Significance cut off: *p-value= <.05, **p-value = <.001

Hypothesis 1: Perceived inferiority

Perceived inferiority was investigated via measures of social comparison (SCS) and submissive behaviour (SBS). With regards to social comparison, autistic women with REDs rated themselves as significantly more inferior overall than autistic women without REDs, $t(48) = -4.723, p < .001; d = 1.37$. When individual factors were compared, autistic women with REDs rated themselves as of significantly lower social rank $t(48) = -4.475, p > .001; d = 1.27$, compared themselves as 'belonging' significantly less $t(48) = -3.30, p = .002; d = 0.98$, and rated themselves as significantly less socially attractive $t(48) = -4.237, p < .001; d = 1.23$, than women without REDs. Scores below 60 on this measure indicate an unfavourable comparison and perceived inferiority, suggesting autistic women without REDs also perceived themselves as inferior, yet to a lesser extent than those with REDs (*Table 4*). Linear regression demonstrated this significant difference remained when controlling for anxiety and depression scores on the HADS and SPIN, $F(1, 48) = 22.307, p < .001$, with an R^2 of .32 (Appendix 4). Whilst SCS scores were significantly associated with REDs, social comparison was not significantly correlated with anxiety ($r = -.26, p = .069$), depression ($r = -.08, p = .561$) or social anxiety ($r = .21, p = .142$).

There were no significant differences found in submissive behaviours between autistic women with and without REDs $t(48) = 1.274, p = .209; d = 0.36$.

Hypothesis 2: Fear of Negative Evaluation

The BFNE was used to measure fear of negative evaluation. Although no significant difference was found between self-reported fears of negative evaluation by autistic women

with and without REDs, there was a trend towards autistic women with REDs to report higher FNE, with a medium effect size $t(48)=1.927$, $p=.060$; $d= 0.55$.

Hypothesis 3: Social Camouflaging

Social camouflaging behaviours were measured using the CAT-Q. No significant differences were found between autistic women with and without REDs on levels of social camouflaging $t(48)= .523$, $p= .603$; $d= 0.149$.

Table 4: Mean scores (M) and Standard Deviations (SD) for measures relating to hypotheses

		RED + ASD (N=22)	ASD only (N=28)	P value	Cohen's d
Perceived Inferiority	Social Comparison Scale (SCS) Total (M, SD)	29.09, 12.35	48.29, 15.59	.000**	1.37
	SCS Social Rank (M, SD)	15.95, 7.77	25.29, 6.95	.000**	1.27
	SCS Group Fit (M, SD)	5.59, 2.46	9.57, 5.21	.002*	0.98
	SCS Attractiveness (M, SD)	7.55, 3.88	13.43, 5.53	.000**	1.23
	Submissive Behaviour Scale (M, SD)	39.45, 11.92	34.39, 10.08	.110	0.36
Fear of Negative Evaluation	Brief Fear of Negative Evaluation Scale (M, SD)	39.68, 6.23	36.00, 7.06	.060	0.55
Social Camouflaging	Camouflaging Autistic Traits Questionnaire (M, SD)	128.23, 22.96	124.89, 21.90	.603	0.149

**Significance cut off: p value <0.05, **Significant cut off: p value <0.001*

Discussion

This study aimed to explore whether established social risk factors for REDs, specifically social rank processes including inferior social comparisons, submissive behaviour and fear of negative evaluation (FNE), were important in the development of REDs among autistic

women. Furthermore, whether higher levels of social camouflaging (SC) would be found among autistic women with REDS compared to those without. Although the original study was designed to compare three participant groups, the impact of the COVID-19 pandemic meant only two groups of women were successfully recruited; autistic women with and without REDs. Overall, compared to autistic women without REDs, those with REDS made more negative social comparisons across domains of social rank, group membership and attractiveness, even after controlling for levels of depression and anxiety. Autistic women with REDS also demonstrated higher levels of FNE, although this finding was not significant. There were no significant differences between groups on levels of submissive or social camouflaging (SC) behaviours.

Evidently, social rank processes are important in the development of REDS among autistic women. These findings suggest autistic women with REDs are significantly more likely to perceive themselves as inferior, an outsider to the group and less desirable to others. This appears to be specifically related to REDs, rather than just due to high levels of anxiety or depression. Whilst it is not possible to conclude that negative social comparisons cause REDS, evidently a perception of oneself as inferior to others is an important mechanism for autism-specific REDs. These findings suggest there is an important difference in how autistic women respond to common experiences of social exclusion and rejection (Baldwin & Costley, 2016). Possibly, some autistic women more than others learn to compare themselves negatively to others as a result of these experiences and develop an inferior sense of self. Many individuals with eating disorders recall themselves as inferior prior to onset and during illness (Cardi, 2018), which persists post recovery (Connan et al., 2007). It is therefore possible that for some autistic women, difficulties gaining social acceptance contributes to

negative social comparisons and a perceived sense of inferiority, a risk factor which appears to be specific to REDs, rather than for mental health difficulties more generally.

Whilst unfavourable social comparisons are often associated with the presence of submissive behaviour among ED patients (Connan, 2007), this was not the case for autistic women with REDS. Submissive behaviour has been found to independently predict AN among non-autistic ED patients (Troop & Baker, 2008), therefore it is interesting this relationship was not found among autistic individuals. However, it appears both groups of autistic women demonstrated relatively high levels of submissive behaviour, when compared to previous studies which have compared ED samples to healthy controls (Connan, 2007). Possibly, autistic women generally have a tendency to behave submissively and this is not necessarily specific to REDs. This might be understood in the context of high mental health difficulties among autistic women, given that submissive tendencies are evident across a broad range of psychopathology (Johnson, Leedom & Multadie, 2012). Many autistic women have associated their mental health problems with difficulties ‘fitting in’ (Crane, 2019), suggesting submissive behaviour may be one way of maintaining group acceptance. Moreover, autistic women report narratives of passive responses to peer rejection, noting such experiences have left them “desperate” for acceptance (Bargiela, Steward & Mandy, 2016) Indeed, one woman described a tendency to “please, appease and apologise” in order to feel included (Bargiela, 2016, p. 3287). Therefore, whilst submissive behaviour among autistic women may well relate to perceptions of low social rank and high levels of psychopathology (Gilbert & Allen, 1998), it appears it is not submissive behaviour alone that is important for REDs among autistic women.

Whilst a significant difference between groups in FNE was not found, autistic women with REDs demonstrated higher fears about how they were perceived by others. This fits within the wider ED literature which has found FNE to occur across ED diagnoses (Arcelus, 2013; Cardi, 2018). This might suggest that some autistic women more than others demonstrate greater sensitivity to social rejection and that these women are more likely to develop REDs. In support, high FNE among autistic adolescents has been found to predict attentional bias towards negative facial expressions such as anger and disgust (White, Maddox & Panneton, 2015). Interestingly, a similar pattern of threat based facial processing has been found in non-autistic individuals with REDs (Cardi et al., 2013). However, there may be an important difference in the FNE demonstrated by autistic and non-autistic women with REDs. For autistic women, FNE might be a response to multiple experiences of genuine negative judgments and rejection from others (Capriola, 2017), particularly given their social communication difficulties (Bellini, 2004). For non-autistic ED patients, FNE might more reflect a more perceived or predicted fear of rejection, as with cognitions evident in those with social anxiety (APA, 2013). The finding that higher FNE was found among autistic women with REDs indicates it would be helpful to explore social anxiety more generally, as well as potential qualitative differences in FNE between autistic and non-autistic individuals with REDs in future research.

It was hypothesised autistic women who develop REDs are those who are most concerned with gaining social approval and hence attempt to 'fit in' through social camouflaging (SC). However, it appears autistic women with REDs are no more likely to engage in SC behaviours than those without REDs. As with submissiveness, both groups demonstrated high SC behaviours, confirming increased levels of SC found among autistic women more generally (Hull et al., 2020). Importantly, autistic women who participated in this study

volunteered to meet face to face with a researcher they had never met. This might indicate a more socially motivated sample, who therefore typically use more camouflaging strategies (Bargiela, Steward & Mandy, 2016). Moreover, the majority of women in our sample were diagnosed with autism in adulthood, suggesting they might have engaged in SC throughout their lives, resulting in less obvious social communication impairments and delayed autism diagnosis (Bargiela, 2016).

With regards to the characteristics of the sample, it is interesting to note that nine individuals did not meet criteria on the ADOS-2 when administered by the research team. Rather than indicating that these women were not autistic, this more likely reflects problems with the ADOS-2 in identifying autism among women. Given that the ADOS was originally validated in a majority male sample (Lord et al., 2000), that females showing comparable autistic traits to males are less likely to receive diagnosis (Dworzynski et al., 2012) and require more severe features to be diagnosed (Russel et al., 2010), it is suggested the ADOS-2 may not be sensitive enough to identify more subtle characteristics of female autism (Lai et al., 2015). Interestingly, autistic women with REDs had higher scores on the Social Affect subscale and lower scores on the Restricted and Repetitive Behaviours subscale of the ADOS, suggesting REDs might also be associated with higher social communication impairments. This raises the question about whether higher social communication impairments are due to the effects of REDs, for example through starvation (Bora & Kose, 2016), or whether it is autistic women with this particular autism profile of poorer social functioning, that are more likely to develop REDs. Evidence demonstrating the stability of social impairments post recovery from REDs (Nazar et al., 2018) suggests the latter may be true.

Nevertheless, high social communication impairments among autistic women with REDs are likely to negatively impact on their social network (Henault, 2005) and increase vulnerability to social risk factors described in this study. One possibility is that autistic women with higher social communication difficulties struggle more within their social groups and therefore face higher levels of rejection and exclusion. This may increase the likelihood of perceiving oneself as of lower social rank, an outsider and less socially attractive, and thereby leaving autistic women vulnerable to REDs. If this were the case, perceived inferiority might be an important moderating variable between social communication difficulties and REDs. However, further investigation is warranted to understand the exact direction of these associations.

Strengths and Limitations

One strength of the current study was its use of the ADOS-2, a gold-standard autism assessment tool (Hus & Lord, 2014). Many studies investigating the presence of autism among those with REDs have used brief, self-report measures such as the Autism-spectrum Quotient (Baron-Cohen et al., 2001) and do not include direct observational assessment (Vagni et al., 2016; Bentz et al., 2017). The advantage of using both self-report and direct observational methods meant we were able to confirm autism diagnosis for research purposes, even for women who had not yet been diagnosed clinically.

A key limitation of the current study is the impact of the COVID-19 pandemic on recruitment and the final sample. The sample size was smaller, with a larger disparity between groups than anticipated, likely reducing the power of findings. Moreover, it was not possible to compare outcome variables to a non-autistic RED group. This meant it was not possible to infer the degree to which perceived inferiority is specifically, and potentially more so,

relevant for autistic women with REDs, compared to those without autism. Negative comparisons and perceived inferiority increase risk for REDs generally (Cardi, 2018; Troop, 2003), however without a non-autistic comparison group it is unclear whether autistic women with REDs make significantly worse social comparisons, than those without autism. Possibly, frequent rejection and ostracism faced by autistic women increases their tendency to compare themselves negatively to others. Therefore, a lack of non-autistic RED group hindered our ability to draw conclusions about the autism-specificity of social rank processes underlying REDs.

A further limitation is that causation cannot be inferred from the current research findings. Although a negative social comparison to others certainly appears to be a specific factor that is important for REDs among autistic women, it is not possible to conclude whether this a cause or effect of REDs. Indeed, it is possible the very experience of having a RED leaves one feeling inferior to others. Particularly when considering the often severe and enduring presentation (Wonderlich et al., 2020) and significant psycho-social impact REDs have on an individual's life (Nazar et al., 2018). However, literature suggests a number of social difficulties, including childhood bullying (Copeland et al., 2015) poor acceptance from peers (Gerner & Wilson, 2016) and a sense of oneself as inferior to others (Cardi et al., 2018a) are present before illness onset. Moreover, direct accounts from autistic women with REDs have related early social difficulties to their own restrictive eating (Brede, 2020). Thus, it is plausible such experiences would contribute to perceptions of inferiority prior to illness onset, rather than reflecting a consequence of REDs.

Finally, data was not collected regarding length or stage of eating disorder from our RED group. Given that acute stage of illness can impair social cognition (Caglar-Nazali et al.,

2014) and length of illness duration reduces social networks (Westwood et al., 2016) among those with anorexia, it would have been helpful to investigate the effect of state of illness on the current findings. Indeed, it is possible those with a longer illness duration may have experienced greater social exclusion and therefore might have compared themselves more negatively to others, which warrants further investigation.

Clinical Implications

This study highlights potential avenues for clinical intervention. Firstly, supporting autistic females to integrate within their social groups, in order to increase their sense of social status, belongingness and desirability to others, would be valuable. A strong evidence base exists for the effectiveness of social skills training interventions for autistic young people, including females (McVey et al., 2017), although evidence with adults is less well established (Ashman et al., 2017). Nevertheless, an intervention which equips autistic women to feel accepted by others would benefit.

However, evidence suggests autistic adults' social fears often relate to real, rather than perceived, negative judgments (Capriola, 2017) and many autistic adults relate their social anxiety to a lack of acceptance and understanding from neuro-typical others (Beardon & Edmond, 2007). Therefore, healthcare interventions should be cautious not to locate the 'problem' within the autistic individual. Indeed, autistic women already experience a pressure to 'conform' and interventions which reinforce this message through individual change may be unhelpful. An alternative way of supporting autistic women to feel less inferior would be to educate neuro-typical individuals to promote inclusion and positive interaction with autistic individuals. Such interventions may occur in educational or work place settings, where social exclusion of autistic females might occur. Furthermore, qualitative evidence

from autistic adults highlights the benefits of social interaction with other autistic people, including experiencing a sense of belonging and understanding (Crompton, Fletcher-Watson & Ropar, 2019). Opportunities for informal peer support and social interaction with other autistic individuals may also be beneficial.

Future Directions

Firstly, given the sample limitations described above, it will be helpful to re-start data collection once COVID-19 related restrictions have been lifted. This will enable a more highly powered sample and may result in significant findings, for example significantly higher FNE in autistic women with REDs, which was a non-significant trend in this study. Moreover, data collection from a non-autistic RED comparison group, to investigate the degree to which perceived inferiority and FNE are autism-specific risk factors for REDs.

Further, it would be helpful for future studies to investigate a potential pathway to test the hypothesis that negative social experiences engender a sense of perceived inferiority and increase risk for REDs among autistic women. In order to understand this further, it would be helpful to examine the relationship between negative social experiences and an inferior sense of self. Research with non-autistic samples suggests such a relationship does occur; childhood bullying (Copeland et al., 2015) and lack of acceptance from peers (Gerner & Wilson, 2005) have been found to predict RED symptoms. However, whether this is true for autistic females is yet to be established. Additionally, qualitative methodology, exploring how social communication difficulties and negative social experiences contribute to an inferior sense of self, would enable a more in-depth understanding of social rank processes underlying REDs among autistic women.

Longitudinal research, which tracked the course of adverse social experiences faced by autistic females throughout different life periods and the impact this has on one's sense of self would offer a rich understanding of the relationship between social exclusion and social rank. However, perhaps a more feasible methodology would be to investigate this relationship across samples at different ages. Adolescence, a developmental period characterised by increased importance of peer relationships is also a common time for REDs to be diagnosed (Reijonen et al., 2003), suggesting perceived inferiority may be especially relevant during teenage years.

Finally, it would also be useful to investigate potential moderating variables in the relationship between perceived inferiority and REDs among autistic women. A significant indirect pathway from difficulties socialising to RED symptoms via self-esteem has been found among non-autistic individuals with REDs (Raykos, McEvoy & Fursland, 2017), suggesting self-esteem would be a useful avenue to explore. In addition, internalised shame, related to a perception of low social rank, has been associated with perceived inferiority among ED patients (Troop, 2003; Cardi, 2018b). Exploring the role of shame in negative social comparisons among autistic women with REDs might therefore also warrant further investigation.

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Part 3: Critical Appraisal
Reflections on the Research

Introduction

This section provides a critical reflection on the project. Firstly, I will reflect on the process of carrying out the research; from choosing the topic and forming my hypotheses, to collecting data and making sense of findings. I will then discuss the impact of the COVID-19 pandemic on the study and finally, will suggest further directions for future research.

Reflections on the Research Process

Choosing the project

My own clinical experience prior to training highlighted the need to improve eating disorder (ED) services for autistic individuals and sparked my interest in choosing this project.

Working in a child and adolescent ED service, I observed a high number of young people who were, or the team suspected to be, autistic. Typically, these young people spent longer in the service and were more likely to require inpatient admission. I recall multiple dilemmas arising when working with autistic individuals; was this young person's exercise routine to lose weight or an autism-related ritual? How much should we expect this young person to increase their food repertoire? Is their avoidance of dairy to do with texture or is it really about fear of weight gain? Diagnosing and formulating an autistic individual's ED was always complex. I observed how a gender bias (Murray et al., 2017) would play out in these discussions; disordered eating among boys was often quickly labelled as 'autistic', whilst girls were viewed as downplaying ED related cognitions. On one occasion, autism assessment was disregarded on the basis that a teenage girl had friends in school. I feel

confident looking back now, that many more young people attending the service would have met criteria for autism than we were aware. Furthermore, I believe that understanding how autism presents differently in females as well as having clear guidance around how best to support autistic individuals clinically, would have led to more positive treatment experiences for the autistic young people accessing the service.

Currently, National Institute of Clinical Excellence (NICE, 2017) guidance does not include, or indeed acknowledge, autism within recommendations for the assessment and treatment of EDs. Consequently, as a team that prided itself on delivering NICE recommended evidence-based interventions, no such intervention, which specifically accounted for autistic differences, was available to offer young people on the autism spectrum. As a result, standard interventions, such as Family Based Treatment (Lock & Le Grange, 2005) were offered as first line interventions, despite the fact they appeared to be less effective for autistic young people. When I saw this project, I was therefore not only interested to find out about why autistic individuals are at increased risk of EDs, but I was also motivated by the clinical need for the research. I felt confident this research would generate new understandings, which could help inform possible treatment recommendations for ED teams to offer autistic individuals. As such, I hoped to contribute to a much-needed evidence base, which could support ED services to engage with autistic individuals differently.

Designing the Project and Forming Hypotheses

Forming my hypotheses was a dynamic process, informed by direct accounts of autistic women with REDs and the wider literature. This research project is part of a wider study called ‘Study of Eating Disorders in Autistic Females’ (SEDAF). SEDAFA is a collaborated

study between UCL and Cardiff University, funded by the charity 'Autistica'. It comprises a two-staged project. Firstly, qualitative interviews with autistic women with anorexia, their carers and healthcare professionals, informed a data-driven model to understand the development and maintenance of restrictive eating disorders (REDs) among autistic women (Brede, 2020). Secondly, a quantitative stage sought to test this model through comparison of three groups; autistic women with and without REDs and non-autistic women with REDs, on measures relating to autism-specific factors identified within the model. I joined the SEDAF study shortly after data-collection for stage one, so had the opportunity to listen to some of the recorded interviews. I was interested to hear that many of my own observations at the ED service, for example autistic individuals avoiding foods due to the sensory properties, were common experiences shared by the interviewees. I was also struck by the number of women who spoke about harsh social experiences such as being teased, or excluded from peer groups, both in school and adulthood. Interestingly, many of these autistic women felt that these experiences played an important role in the development of their ED. For example, one participant, whilst describing a lack of friends in school noted, "popular girls were sporty" and following this logic, lost weight to increase her social status. Listening to these interviews therefore sparked my interest in exploring the role of how these challenging social experiences might contribute to the development of REDs for autistic women.

Analysis of the interviews indicated that social difficulties, particularly a lack of acceptance from others, was an important factor to consider in how REDs develop and persist among autistic women. Searching the literature, I found there were a number of similarities in the adverse social experiences faced by those with autism and REDs. Exploring social difficulties faced by individuals with anorexia and the potential mechanisms underlying these (Cardi et

al., 2018a, 2018b), I found evolutionary ideas of REDs, which attempt to explain disordered eating in terms of social hierarchy and survival, particularly interesting. Reading about the role of social rank processes in psychopathology, I discovered that low social rank status among animals has been associated with behavioural patterns similar to anorexia in humans (Treasure & Owen, 1996). For example, ‘thin sow syndrome’, in which pigs who experience defeat in competition for social hierarchy reduce their food intake and develop a preference for blander foods, even when other foods are available. Indeed, within the animal world there are many examples whereby animals at the bottom of the ‘pecking order’ demonstrate submissiveness in a bid to maintain group acceptance. Within evolutionary ideas, REDs have been conceptualised as a way of counteracting feelings of inferiority and increasing social status in order to gain acceptance (Troop et al., 2003). This may be especially true within western cultures, where appearance and thinness are highly valued (Diedrichs, 2016) resulting in internalised societal expectations increasing likelihood of disordered eating (Thompson & Stice, 2001). In my own clinical work, I find exploring survival-based, evolutionary ideas and related animal examples helpful in providing a compassionate and non-blaming understanding to human behaviour and psychological difficulties. I was therefore keen to investigate these ideas further and consider how they might relate to autistic individuals.

The literature concerning the social experiences of autistic women supported what many women had reported during interviews; as an autistic female, ‘fitting in’ can be difficult. Indeed, I was saddened to read about how many autistic women feel socially excluded throughout their lives and experience a pressure to conform in order to gain acceptance from others (Bargiela, Steward & Mandy, 2016; Baldwin & Costley, 2016). Moreover, the shockingly high number of women that face bullying, exploitation and abuse (Bargiela,

2016). This led me to reflect on how autistic women might perceive themselves in relation to others; whether such experiences left autistic women comparing themselves negatively or developing a sense of inferiority in some way. Indeed, negative social comparisons have shown to play a role in depression among autistic adolescents (Hedley & Young, 2006) suggesting social rank processes might be a worthwhile path of investigation for autism-specific REDs.

Following an initial literature search, the process of generating my hypotheses and choosing measures developed throughout the course of the project. My initial research proposal planned to investigate social rank processes, via measures of social comparison and submissive behaviour (Troop, 2003). In addition, I planned to measure social anxiety using the Social Phobia Inventory (SPIN, Connor et al., 2000) and Brief Fear of Negative Evaluation Scale (BFNE, Leary, 1983), and attitudes towards friendships using the Friendship Questionnaire (FQ; Baron-Cohen & Wheelwright, 2003). However, whilst planning data collection, it became clear we were asking participants to complete a considerably high number of tasks and measures. This led me to reflect on the dilemma between 'ideal' research methodology and ensuring ethical practice. Ultimately, we decided to remove some measures to reduce burden on participants. From my own measures, I decided to remove the FQ. Whilst I felt confident friendship difficulties were relevant to REDs among autistic women, I felt it was a broad topic, which would not be well captured by the FQ alone. Moreover, as some research exists in the similar friendship experiences between those with autism and anorexia (Doris, Westwood, Mandy & Tchanturia, 2014), I felt investigating social rank processes offered a more novel pathway of investigation.

In addition, I later changed my hypothesis about social anxiety to fear of negative evaluation (FNE) more specifically. This followed discussion about how best to describe the demographic and clinical characteristics of the sample, during which it was decided the SPIN would be better used as a measure to describe and control for social anxiety levels within the sample. Interestingly, evidence suggests that it is FNE specifically, rather than general social anxiety symptoms, that is important in REDs (Arcelus, 2013; Cardi, 2018b). Moreover, FNE conceptually seemed a more closely related concept to perceived inferiority. Finally, the CAT-Q was added to the project later, following data collection, prompted by discussion with my supervisor about how social camouflaging might reflect one way in which autistic women cope with or counteract experiences of social exclusion. Indeed, social camouflaging is frequently cited as a way of managing the threat of social exclusion or attack by autistic individuals (Mandy, 2019). My hypotheses therefore developed systematically and changed throughout the course of the project. This challenged my preconceptions about the fluidity of the research process and my previous assumption that initial research hypotheses are fixed from the start.

Carrying out the Research

Meeting with autistic participants directly developed my understanding of the challenges and practicalities of data collection and of how autism presents in females. Firstly, I experienced first-hand the challenge of collecting large amounts of quantitative data face-to-face. Many of the autistic women I met were interested in the SEDAF study and were keen to share experiences of their own eating habits, their journeys in receiving autism diagnosis and the different challenges they had faced along the way. I found some participants were keen to share a large amount of information, which I was not necessarily able to capture as part of the

study. Helpfully, questions within Module 4 of the ADOS-2 provided opportunity to ask some open questions and hear about participant's experiences, for example with work or relationships. However, this is a structured observational assessment and requires a different set of skills to administer than a therapeutic conversation; therefore, discussions were limited somewhat by the structure of the assessment. Indeed, on occasion I found myself actively resisting the urge to ask follow up questions and find out more about participant's experiences or offer reflections. I found myself faced with a dilemma of wanting to allow time and space for participants to tell their story, whilst also managing time boundaries of an already long participant session. Moreover, I was conscious to ensure regular breaks were offered to participants, further increasing session length. Particularly after a day on placement, I found myself 'switching hats' between therapist and researcher, which often required me to take a more directive stance. This presented as a challenge when some participants felt strongly that their additional information would benefit the project. Consequently, I have reflected on the limitations for participants engaging in quantitative research, where the methods of investigation have been pre-determined and the rich details of personal experiences are not necessarily sought out, or indeed recorded.

Secondly, through meeting a number of autistic women, my awareness and understanding about female autism has changed. Prior to meeting with participants, I felt I had a relatively good understanding of how autism presents differently in females from my clinical training and the reading I had done around the 'female phenotype'. However, meeting with participants in this study, challenged my pre-conceptions about female autism. In particular, I was struck by the huge variability in how autism presents itself in adult women and how often autistic traits are not immediately noticeable. Indeed, for a number of participants, had our meeting occurred in a different context, I may not have considered that they were on the

autism spectrum straight away. On reflection, I believe this was largely due to their apparent social abilities, from making eye contact to initiating conversation on the way to the research room. Whilst these may be learned social skills, and might reflect social camouflaging behaviours more than genuine social abilities, it led me to reflect on the effect such social nuances can have on how neuro-typical adults interact with and respond to autistic women. Indeed, I wonder whether many autistic women are quickly labelled as ‘odd’ or ‘different’, without an understanding or appreciation for their differences. One participant spoke about fellow colleagues becoming frustrated by her need to order the office in a particular way and I wondered how many of her colleagues were aware she was autistic. Meeting with participants deepened my understanding of how successful social camouflaging behaviours can be at masking autism during everyday interactions (Bargiela et al., 2016). Moreover, it helped me to appreciate the burden placed on autistic women with always having to ‘pretend’ and be someone they are not, in order to meet the expectations of a neuro-typical society (Mandy, 2019). One participant I met quoted a poem called ‘Alone’ by Edgar Allan Poe, to describe her experience as an autistic woman. This quote, more than any academic reading I have done, helped me to understand her experience. *“I have not been as others were, I have not seen as others saw”*.

Research Findings

One interesting finding which was not discussed within the empirical paper was the high rates of feeding or eating difficulties within the sample overall. Whilst the autistic women without REDs did not have a clinically diagnosed eating disorder, it was striking that nearly half of participants reported childhood eating difficulties. Moreover, a high number of participants across both groups reported both past and present unusual relationships with food. Although

scores on the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994) were significantly different between groups, there were some participants without REDs who scored surprisingly high on the EDEQ. In part, this might relate to the fact many of the autistic women without REDs had volunteered to participate after hearing about the project either through their NHS service, autistic organisations or social media. Therefore, autistic women who participated may have been especially drawn to the project if they had personal experience of eating difficulties. Nevertheless, atypical eating patterns are evidently commonplace among autistic women. Indeed, many of the women cited an unusual relationship with food, such as ‘picky’ eating or limited food repertoires, when first making contact with the research team, even if they did not have a diagnosed RED. This fits within the wider literature suggesting a considerably high number of autistic children experience feeding and eating difficulties (Sharp et al., 2013) and evidence which demonstrates high levels of disordered eating among autistic women without REDs (Spek, Rijnsoever, Laarhoven & Kiep, 2019). A broader investigation of how atypical eating patterns develop and persist might be an interesting direction for study, in order to understand what moves disordered eating to eating disorders among autistic females.

Impact of COVID-19

Perhaps the most significant challenge faced during this research project was the impact of the COVID-19 pandemic on data collection. One important variable in the impact of COVID-19 was the delay we experienced gaining full NHS ethical approval. Although we gained ethical approval from UCL in May 2019, we did not have NHS ethical approval until November 2019. I was surprised by the length and detail required to obtain NHS ethics and it is something I will certainly hold in mind when planning future research projects.

Unfortunately, just as data collection was due to begin within NHS services, the lockdown

was announced and all research across the NHS was temporarily stopped. Whilst of course it would not have been possible to justify continuing meeting with vulnerable adults, who were likely to have been low weight, it was unfortunate that this meant we no longer had a non-autistic RED comparison group. The lack of this participant group not only changed the design of the study but also meant we were not able to draw conclusions about the degree to which an inferior sense of self is a risk factor for autistic women specifically. As such, we were not able to make inferences about whether autistic women with REDs, more so than non-autistic women, engage in negative social comparisons, due to the multiple adverse social experiences they face. However, I am also thankful that enough data had been collected from the two autism groups to warrant meaningful analysis. This has led me to reflect on the importance of being proactive when carrying out research in order to start data collection as early as possible. Whilst no one could have planned for a global pandemic mid-study, it certainly benefited us to have engaged potential participants and NHS services at an early stage in the research process.

In addition, the COVID-19 pandemic altered the context through which I wrote up this thesis. Firstly, I was separated physically from the research setting and a PhD student with whom I was working closely with on the project. This brought about challenges in the handling and storage of confidential data, which needed to be stored and password protected in non-identifiable worksheets. Secondly, the lockdown also meant both my clinical and research commitments were carried out from home. Whilst the early termination of data collection meant I had more time to write up the project, it also required me to navigate new ways of working and learn to create my own time boundaries between clinical work, research and time off. This experience has led me to reflect on how much I value working as part of a research team and being able to meet with colleagues and participants face to face.

Personally, the most enjoyable and motivating aspect of carrying out the research project was meeting autistic women from a variety of backgrounds and hearing about their diverse range of experiences. This is something I will certainly consider for any future research involvement.

Future Directions

The current study used a female only sample and similar lines of investigation among males will be an important next step. Whilst REDs are over-represented among females, evidence of a diagnostic bias against males has been documented (Murray et al., 2017), an opposite pattern to that found for diagnosis of autism (Lai et al., 2015). Despite some of the earliest documented cases of anorexia being male (Wooldridge, 2016), the requirement for ‘amenorrhea’ to be present for diagnosis of anorexia was only removed in the most recent version of the DSM-5 (APA, 2013). In the UK, evidence suggests males make up around 30% of ED patients (Nicholls, Lynn & Viner, 2011) with ARFID diagnoses more common among males than females (Eddy et al., 2014).

Therefore, it is highly likely a number of males accessing ED services are also autistic and equally in need of specialised, evidence-based interventions. Moreover, emerging evidence about ‘bigorexia’, a form of muscle dysphoria typically observed among males suggests a pre-occupation about the inadequacy of one’s body shape contributes to significant distress and social avoidance (Mosley, 2009). It is reasonable to assume that high social comparison alongside fears about other’s negative judgments are likely to play a role in such difficulties. Moreover, an interesting case study documenting an autistic man with co-morbid body dysmorphic disorder highlights how autistic traits might serve to maintain such difficulties (Vasudeva & Hollander, 2017). Indeed, from my own clinical experience, many of the boys

we saw in the ED service had an autism diagnosis. Therefore, just as females require our attention and careful consideration within the autism field, it is important not to neglect males within the growing body of literature on autism and REDs.

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Appendices

Appendix 1: NHS Health Research Authority Ethical Approval Letter



Dr John Fox
School of Psychology
70 Park Place
Cardiff
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Email: Wales.REC6@wales.nhs.uk

15 November 2019

Dear Dr Fox

**HRA and Health and Care
Research Wales (HCRW)
Approval Letter**

Study title:	The influence of social communication styles and cognitive profiles on restrictive eating disorders in women
IRAS project ID:	259480
Protocol number:	1743-19
REC reference:	19/WA/0303
Sponsor	Research and Innovation Services, Cardiff University

I am pleased to confirm that [HRA and Health and Care Research Wales \(HCRW\) Approval](#) has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, [in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.](#)

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?

HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report (including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see [IRAS Help](#) for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?

HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to [obtain local agreement](#) in accordance with their procedures.

What are my notification responsibilities during the study?

The standard conditions document "[After Ethical Review – guidance for sponsors and investigators](#)", issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The [HRA website](#) also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?

Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is 259480. Please quote this on all correspondence.

Yours sincerely,
Ann Parry

Email: Wales.REC6@wales.nhs.uk

Copy to: *Helen Falconer*

Appendix 2: Participant Information Sheet and Consent Form



LONDON'S GLOBAL UNIVERSITY



Participant Information Sheet for Autistic Women

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of Study: The influence of social communication styles and cognitive profiles on restricted eating disorders in women

Department: Research Department of Clinical, Educational and Health Psychology, UCL / School of Psychology, Cardiff University

Name and Contact Details of the Researchers: Janina Brede (janina.brede@ucl.ac.uk) / Charli Babb (babbc@cardiff.ac.uk) / Hannah Baker (ucjuhdb@ucl.ac.uk)

Name and Contact Details of the Principal Researchers: William Mandy (w.mandy@ucl.ac.uk) / John Fox (foxj10@cardiff.ac.uk)

You are being invited to take part in a research project being led by Cardiff University and run in conjunction with researchers at UCL. This study is being carried out in order to fulfil an educational qualification. It is important that you understand exactly what participation will involve and why the research is being done. Please take your time to read this information sheet and discuss it with others if you wish. If anything is not clear, please do not hesitate to ask one of us. Take time to decide whether or not you wish to take part.

1. What is the project's purpose?

The purpose of this project is to gain a better understanding of restrictive eating disorders in autistic individuals. It is estimated that at least 8,000 autistic women suffer with anorexia nervosa in the UK and evidence suggests these women tend to have lower recovery rates than non-autistic women. There is currently a lack of research into eating difficulties in autistic women, which means that eating disorder services lack sufficient understanding and treatment options for this client group.

This project aims to understand what might make autistic women more vulnerable to developing eating disorders and how these difficulties are maintained. Last year, we interviewed a number of autistic women with anorexia, their parents/carers and healthcare professionals to help us understand eating difficulties in autistic women. In the current study, we are hoping to explore this further by understanding how autistic women with eating disorders, autistic women without eating disorders and non-autistic women with eating disorders vary on a number of different measures. With this understanding, we hope to inform eating disorders services on how to become more accessible and beneficial for autistic women.

2. Why have I been chosen?

In order to understand how autism specifically relates to restrictive eating difficulties, it is helpful for us to look at both autistic women with eating disorders and those without. If you would like to take part in this study, you should meet the following inclusion criteria: (1) female; (2) aged over 18 years; (3) formally diagnosed with autism spectrum disorder (including autism spectrum disorder, autism, Asperger's syndrome, high functioning autism, and pervasive developmental disorder) and; (4) you are not formally diagnosed and/or currently living with an eating disorder. You must also have the capacity to consent to take part. If you meet the inclusion criteria and decide you want to take part, you will be completing the same measures as the other women participating in the study.

3. Do I have to take part?

It is completely up to you whether you take part. If you do decide to take part, you will be given this information sheet to keep and will be asked to sign a consent form. You can withdraw from the study at any time without

giving a reason and without it affecting any reimbursements for time and travel that you are entitled to. If you decide to withdraw, you will be asked what you wish to happen to the data you have provided up to that point.

4. What will happen if I decide to take part?

If you decide to take part, you will meet with one of the researchers for around 2.5 hours. We will aim to meet with you at a time and place that is convenient for you. We will go through the study information again and ask you to sign a consent form. Then you will be asked to complete a number of tasks and questionnaires. You will also be asked to provide other details about yourself, such as information about your mental health history and we will measure your weight and height. Some people can find it uncomfortable to be weighed, therefore if you would prefer to do this at home or go on the scales backwards so that you do not see your weight, you can. With your permission, the researchers may also need to access your medical records to review information related to your autism diagnosis.

Two of the tasks will be sensory activities related to taste and your ability to monitor your heartbeat. The taste task will not involve eating food, but will involve tasting small pieces of taste test paper. The other two tasks will be computer tasks. There will also be a set of tasks and interview questions to confirm the presence of high autistic traits for research purposes, unless your scores are available from a previous assessment. This will last for 30 minutes. We routinely video-record these assessments, but you can opt out of being recorded if you wish. The researcher will explain what you need to do before you start and answer any questions or concerns you may have.

There will also be a total of 18 questionnaires to complete; some will be short and some may take more time. You will be asked to complete all of the questionnaires fully, however you can take your time completing them and you can take a break at any time. You will have the option to complete them during the face-to-face session while the researcher is present or on your own after the meeting. Some of the questionnaires will be about interaction styles and thinking profiles, some about your eating habits and some will be about other things such as your relationships with others. Some of the questions might seem strange or may not feel relevant to you; however it is helpful if you can answer all of the questions as best you can. If you are not sure about the meaning or relevance of a question, you can ask the researcher to explain at any time.

Some of the measures screen for eating disordered behaviours, autistic traits, anxiety and depression. You can decide whether you would like to be informed of your scores on these measures, as this may indicate that you are experiencing a mental health difficulty. If you choose to be informed, the researcher will give you feedback after you have taken part in the study about what your scores might mean and give you advice about accessing further support.

If you decide to take part, we will also ask you if you would be happy for us to conduct a structured interview with someone who has known you well since childhood, for example a family member, to gather some more information about what you were like when you were younger. We would be asking them questions about your current and childhood social communication style and interests. It is up to you whether you want to provide us with contact details of a family member for this purpose, and they do not have to talk to us if they do not want to. If you have someone who might be willing to talk to us, we will take their contact details and arrange to talk to them either in person or over the phone. This would take 30 minutes of their time.

If for any reason you find the meeting distressing or uncomfortable, you can stop at any time. When you have completed all measures, you will be debriefed and receive further information about ways to access support if you feel you might need it. You will be offered a £30 voucher to thank you for your time and we will reimburse your travel expenses on the production of a receipt, e.g. a bus or train ticket, if you are traveling to meet with us.

5. What will happen after the study?

You will be asked whether you would like to be contacted about opportunities to be involved in future research or to receive a copy of the research report resulting from this study. This is completely voluntary, and you would be appropriately compensated for any further input. Should you wish to be involved, your contact details will be stored securely and separately from other data.

6. What will happen with my data/the answers I give?

If you consent to take part in the study, your data (the answers you gave on the questionnaires and tasks) will be stored on a Cardiff University database anonymously so your responses will not be identifiable. You can choose to withdraw your data at any time, and you do not have to give a reason. Leaving the study early will not affect any NHS care you receive either now or in the future. If you do choose to leave the study at any point, you can decide if you would like us to keep any data (completed questionnaires etc.) you have provided up until the point you left the study and we may still include this data in the final analysis.

7. What are the possible disadvantages and risks of taking part?

The meeting with the researcher is quite a long process, so you may feel fatigued after. Some of the questions on the questionnaires may bring up some sensitive topics, which you may find uncomfortable or upsetting to think about. We understand these may be distressing so we encourage you to let us know if it feels like too much.

If you chose to find out your scores on the questionnaires you complete, there may be a chance that your scores indicate you are experiencing mental health difficulties such as anxiety, depression or eating difficulties. This might be upsetting or worrying for you. If this is the case, you can talk to the researcher. Although we will not be able to make a diagnosis based on the questionnaires or provide clinical advice, we can provide guidance on where to access further support. If you would prefer not to know about your scores on the questionnaires, this is okay too.

Some people find the sensory-related tasks (e.g. to do with taste) uncomfortable. If at any point you feel uncomfortable during these tasks and want to stop, you can just let the researcher know. You can do this verbally or we can agree at the start how you would like to show us when you do not want to answer a question (e.g. hand signal).

8. What are the possible benefits of taking part?

While there are no other immediate benefits for those participating in the project, it is hoped that this work will help to inform future research and clinical practice so that eating disorders services and other mental health services will become more accessible particularly for autistic individuals. You will be offered a £30 voucher as a thank you for taking part.

9. What if something goes wrong?

If you are unhappy or dissatisfied about any aspects of your participation, we encourage you to let us know, so we can try to resolve any concerns and find a solution. If you wish to raise a complaint, you should contact one of the Principal Researchers, Will Mandy or John Fox (contact details above). However, if you feel your complaint has not been handled to your satisfaction, you can contact the Secretary of the School of Psychology Ethics Committee at Cardiff University (Mark Jones, call: 029 2087 4568, or email: psychethics@cardiff.ac.uk).

10. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be kept strictly confidential. All data is stored without any identifying details under secure conditions at Cardiff University. You will not be able to be identified in any ensuing reports or publications.

11. Limits to confidentiality

Please note that assurances on confidentiality will be strictly adhered to unless evidence of potential harm or danger to you or someone else is uncovered. In such cases the researchers may be obliged to contact relevant statutory bodies/agencies. Before meeting with the researcher, we will routinely ask everyone for their GP contact details. If you tell us that you or someone else is at risk or being harmed we will need to disclose this information to your GP and may ask for your permission to share the information with responsible services. If this is not necessary, we will return your GPs contact details to you after the interview and will not record this information.

12. What will happen to the results of the research project?

We plan to distribute the findings via publications in peer reviewed academic journals, social media, including a blog, and conference presentations. We also plan to publish tailored reports to share our findings with the autism community and clinical professionals. The results will also be published as part of two PhD theses, one at Cardiff University and one at UCL, and as part of a Professional Doctorate in Clinical Psychology (DClinPsy) qualification at UCL. The research team will ensure that all responses are anonymised, so that you cannot be identified. The researchers in this project are all involved with a range of clinical training activities and will circulate relevant findings to directly and rapidly improve clinical practice (e.g. within mental health services). You will have the option to be sent a summary of the research and be contacted at the end of the study to discuss the findings of the study with the researchers. You may also contact the researchers and ask for copies of any publications if you wish to read them.

13. Data Protection Privacy Notice

Cardiff University is the Sponsor for the study based in the UK. We will be using information from you and your medical records in order to undertake this study and will act as the data controller for this study. This means that we are responsible for looking after your information and using it properly. Cardiff University will keep research data provided by you for 15 years after the study has finished. Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally-identifiable information possible. You can find out more about how we use your information at: <https://www.cardiff.ac.uk/public-information/policies-and-procedures/data-protection> or by contacting the Cardiff University Data Protection Officer at: inforequest@cardiff.ac.uk.

The NHS will collect information from you and your medical records for this research study in accordance with our instructions. The NHS will use your name, NHS number and contact details to contact you about the research study, and make sure that relevant information about the study is recorded for your care, and to oversee the quality of the study. Individuals from Cardiff University, UCL and regulatory organisations may look at your medical and research records to check the accuracy of the research study. The NHS will pass these details to Cardiff University and UCL along with the information collected from you and your medical records. The only people in Cardiff University and UCL who will have access to information that identifies you will be the people conducting the research or those who need to contact you about the study or audit the data collection process.

You can opt to receive information about future relevant Cardiff University and/or UCL studies on the consent form. If this is the case, your contact details will be stored securely at Cardiff University and UCL and deleted after 5 years.

14. Who is organising and funding the research?

Cardiff University is the Sponsor for the study. The study is part of a larger project and has been organised by the research team at Cardiff University and UCL. The research has been reviewed and given a favourable opinion by an independent group of people on an NHS Research Ethics Committee (Wales REC 6). The research has also been reviewed by the Health Research Authority. The research is part funded by Autistica – a charity that funds and

campaigns for research to increase our understanding of autism, improve diagnosis and develop evidence-based interventions.

15. Contact for further information

Should you have any questions about the study, please find our contact details below:

Charli Babb (researcher)
CUCHDS Building
School of Psychology
Cardiff University
Park Place
Cardiff CF10 3AT
babbc@cardiff.ac.uk

Janina Brede (researcher)
University College London
Department for Clinical, Educational
and Health Psychology
1–19 Torrington Place
London WC1E 7HB
janina.brede@ucl.ac.uk

Hannah Baker (researcher)
University College London
Department for Clinical, Educational and
Health Psychology
1–19 Torrington Place
London WC1E 7HB
ucjuhdb@ucl.ac.uk

Thank you for reading this information sheet and for considering to take part in this research study.



LONDON'S GLOBAL UNIVERSITY



Consent Form for Autistic Women with a Restrictive Eating Disorder

Please complete this form after you have read the Information sheet and listened to an explanation about the research.

Title of Study: The influence of social communication styles and cognitive profiles on restrictive eating disorders in women

Department: Research Department of Clinical, Educational and Health Psychology, UCL / School of Psychology, Cardiff University

Name and Contact Details of the Researchers: Janina Brede (janina.brede@ucl.ac.uk) / Charli Babb (babbc@cardiff.ac.uk) / Hannah Baker (ucjuhdb@ucl.ac.uk)

Name and Contact Details of the Principal Researchers: William Mandy (w.mandy@ucl.ac.uk) / John Fox (foxj10@cardiff.ac.uk)

Name and Contact Details of the UCL Data Protection Officer: Lee Shailer (data-protection@ucl.ac.uk)

Thank you for considering taking part in this research. The person organising the research (Janina Brede, Charli Babb, or Hannah Baker) must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in.

I confirm that I understand that by initialling each box below, I am consenting to this element of the study. I understand that it will be assumed that un-initialled boxes mean that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element that I may be deemed ineligible for the study.

Participant Statements:

Tick Box

<ul style="list-style-type: none"> I confirm that I have read and understood the Information Sheet for the above study. I have had an opportunity to consider the information and what will be expected of me. I have also had the opportunity to ask questions which have been answered to my satisfaction. 	
<ul style="list-style-type: none"> I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and without my medical care or legal rights being affected. 	
<ul style="list-style-type: none"> I understand that if I decide to withdraw, any personal data I have provided up to that point may still be used in the study, unless I request otherwise. 	
<ul style="list-style-type: none"> I consent to my answers and personal information being used for the purposes of this research study only, as explained to me in the Information Sheet. I understand that such information will be handled in accordance with all applicable data protection legislation. 	
<ul style="list-style-type: none"> I understand that all personal information will remain confidential and that all efforts will be made to ensure I cannot be identified. I understand that my data gathered in this study will be stored anonymously and securely. It will not be possible to identify me in any publications. 	
<ul style="list-style-type: none"> I understand the potential risks of participating as outlined in the Information Sheet, and the support that will be available to me should I become distressed during the course of the research. 	
<ul style="list-style-type: none"> I understand the direct and indirect benefits of participating as outlined in the Information Sheet. 	
<ul style="list-style-type: none"> I understand that the data will not be made available to any commercial organisations but is solely the responsibility of the researchers undertaking this study. 	
<ul style="list-style-type: none"> I understand that I will be offered full compensation for time spent in the study even if I choose to withdraw. 	

<ul style="list-style-type: none"> I understand that in order to process any expenses, my details may be shared with the Cardiff University or UCL Finance Department. 	
<ul style="list-style-type: none"> I understand that the information I have submitted will be published as a report and I wish to receive a copy of it. YES/NO 	
<ul style="list-style-type: none"> I confirm that I understand the inclusion criteria as detailed in the Information Sheet and explained to me by the researcher, and that I fit into this inclusion criteria. 	
<ul style="list-style-type: none"> I am aware of who I should contact if I wish to lodge a complaint as outlined in the Information Sheet. 	
<ul style="list-style-type: none"> I understand I will be asked to provide the details of my GP at the start of the study, but that my GP will only be contacted if deemed necessary by the researchers. 	
<ul style="list-style-type: none"> I voluntarily agree to take part in this study. 	

If you would like your contact details to be retained so that you can be contacted in the future by UCL researchers who would like to invite you to participate in follow up studies to this project, or in future studies of a similar nature, please tick the appropriate box below.

Yes, I would be happy to be contacted in this way.	
No, I would not like to be contacted.	

Some of the measures used in this study screen for autistic traits, eating disordered behaviours, anxiety and depression. Please indicate whether you would like to be given more information about your scores on these measures. If you choose to be informed, the researcher will give you feedback about what your scores might mean and give you advice about accessing further support. Please tick the appropriate box below.

Yes, I would like to be informed about my scores on mental health measures.	
<ul style="list-style-type: none"> I understand by choosing to receive feedback about my scores that the researchers will not be able to diagnose or provide clinical advice and intervention related to mental health issues. 	
No, I would not like to be informed about my scores on mental health measures.	

We would like to video record one of the assessments, which is conducted to confirm the presence of autistic traits for research purposes. Video recordings will be stored securely and will only be used for the purpose of this study. Please indicate whether you agree to be video recorded by ticking the appropriate box below.

Yes, I am happy for part of the assessment to be video recorded.	
No, I would not like to be video recorded.	

We would also like to conduct a structured interview with someone who has known you well since childhood to gather some more information about what you were like when you were younger. Please indicate whether you agree for an informant to be contacted by ticking the appropriate box below and providing their contact details.

Yes, I am happy for my informant to be contacted.	
No, I would not like to provide any informant details.	

Informant name: _____
 Informant relationship: _____
 Informant contact details: _____

 Name of participant Date Signature

 Researcher Date Signature

Appendix 3: Outcome Variable Measures

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.

From: Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and Social Psychology Bulletin*, 9, 371-376.



THE SUBMISSIVE BEHAVIOUR SCALE

Below are a series of statements which describe how people act and feel about social situations. Circle the number to the right of the statements which best describes the degree to which a statement is true for you.

Please use the following scale:

0 = NEVER 1 = RARELY 2 = SOMETIMES 3 = MOSTLY 4 = ALWAYS

- | | | | | | |
|-----------------------------------------------------------------------------------------------|---|---|---|---|---|
| 1. I agree that I am wrong even though I know I'm not | 0 | 1 | 2 | 3 | 4 |
| 2. I do things because other people are doing them, rather than because I want to | 0 | 1 | 2 | 3 | 4 |
| 3. I would walk out of a shop without questioning, knowing that I had been short changed | 0 | 1 | 2 | 3 | 4 |
| 4. I let others criticise me or put me down without defending myself | 0 | 1 | 2 | 3 | 4 |
| 5. I do what is expected of me even when I don't want to | 0 | 1 | 2 | 3 | 4 |
| 6. If I try to speak and others continue, I shut up | 0 | 1 | 2 | 3 | 4 |
| 7. I continue to apologise for minor mistakes | 0 | 1 | 2 | 3 | 4 |
| 8. I listen quietly if people in authority say unpleasant things about me | 0 | 1 | 2 | 3 | 4 |
| 9. I am not able to tell my friends when I am angry with them | 0 | 1 | 2 | 3 | 4 |
| 10. At meetings and gatherings, I let others monopolise the conversation | 0 | 1 | 2 | 3 | 4 |
| 11. I don't like people to look straight at me when they are talking | 0 | 1 | 2 | 3 | 4 |
| 12. I say 'thank you' enthusiastically and repeatedly when someone does a small favour for me | 0 | 1 | 2 | 3 | 4 |
| 13. I avoid direct eye contact | 0 | 1 | 2 | 3 | 4 |
| 14. I avoid starting conversations at social gatherings | 0 | 1 | 2 | 3 | 4 |
| 15. I blush when people stare at me | 0 | 1 | 2 | 3 | 4 |
| 16. I pretend I am ill when declining an invitation | 0 | 1 | 2 | 3 | 4 |



SOCIAL COMPARISON SCALE

Please circle a number at a point which best describes the way in which you see yourself in comparison to others.

For example:

Short 1 2 3 4 5 6 7 8 9 10 Tall

If you put a mark at 3 this means you see yourself as shorter than others; if you put a mark at 5 (middle) about average; and a mark at 7 somewhat taller.

If you understand the above instructions, please proceed. Circle one number on each line according to how you see yourself in relationship to others.

In relationship to others I feel:

Inferior	1	2	3	4	5	6	7	8	9	10	Superior
Incompetent	1	2	3	4	5	6	7	8	9	10	More competent
Unlikeable	1	2	3	4	5	6	7	8	9	10	More likeable
Left out	1	2	3	4	5	6	7	8	9	10	Accepted
Different	1	2	3	4	5	6	7	8	9	10	Same
Untalented	1	2	3	4	5	6	7	8	9	10	More talented
Weaker	1	2	3	4	5	6	7	8	9	10	Stronger
Unconfident	1	2	3	4	5	6	7	8	9	10	More confident
Undesirable	1	2	3	4	5	6	7	8	9	10	More desirable
Unattractive	1	2	3	4	5	6	7	8	9	10	More attractive
An outsider	1	2	3	4	5	6	7	8	9	10	An insider

Camouflaging Autistic Traits Questionnaire (CAT-Q)

Please read each statement below and choose the answer that best fits your experiences during social interactions.

			Neither			
Strongly		Somewhat	Agree nor	Somewhat		Strongly
Disagree	Disagree	Disagree	Disagree	Agree	Agree	Agree
(1)	(2)	(3)	(4)	(5)	(6)	(7)

1. When I am interacting with someone, I deliberately copy their body language or facial expressions	
2. I monitor my body language or facial expressions so that I appear relaxed	
3. I rarely feel the need to put on an act in order to get through a social situation*	
4. I have developed a script to follow in social situations (for example, a list of questions or topics of conversation)	
5. I will repeat phrases that I have heard others say in the exact same way that I first heard them	
6. I adjust my body language or facial expressions so that I appear interested by the person I am interacting with	
7. In social situations, I feel like I'm 'performing' rather than being myself	
8. In my own social interactions, I use behaviours that I have learned from watching other people interacting	
9. I always think about the impression I make on other people	
10. I need the support of other people in order to socialise	
11. I practice my facial expressions and body language to make sure they look natural	
12. I don't feel the need to make eye contact with other people if I don't want to*	
13. I have to force myself to interact with people when I am in social situations	
14. I have tried to improve my understanding of social skills by watching other people	
15. I monitor my body language or facial expressions so that I appear interested by the person I am interacting with	
16. When in social situations, I try to find ways to avoid interacting with others	
17. I have researched the rules of social interactions (for example, by studying psychology or reading books on human behaviour) to improve my own social skills	

18. I am always aware of the impression I make on other people	
19. I feel free to be myself when I am with other people*	
20. I learn how people use their bodies and faces to interact by watching television or films, or by reading fiction	
21. I adjust my body language or facial expressions so that I appear relaxed	
22. When talking to other people, I feel like the conversation flows naturally*	
23. I have spent time learning social skills from television shows and films, and try to use these in my interactions	
24. In social interactions, I do not pay attention to what my face or body are doing*	
25. In social situations, I feel like I am pretending to be 'normal'	

Appendix 4: Linear Regression Table

Table 1: Linear Regression controlling for anxiety and depression on Social Comparison Scale

		B	SE (b)	β	t	P value	VIF	R²	R² Change
Block 1	Constant	28.62	3.13		9.15	.000**			
	Group	19.67	4.14	.57	4.75	.000**	1.00	.32	.32
Block 2	Constant	64.67	6.50		9.96	.000**			
	Group	10.30	3.60	.30	2.87	.006	1.31		
	HADS_D	-.72	.35	-.22	-2.09	.043	1.33		
	HADS_A	-.50	.43	-.14	-1.16	.252	1.79		
	SPIN	-.49	.130	-.43	-3.78	.000**	1.523	.64	.31

Note^a: Hospital Anxiety and Depression Scale (HADS), HADS_D = Depression subscale, HADS_A = Anxiety Subscale.

Note^b: Social Phobia Inventory (SPIN)

** p<.001