Impact of camouflaging on females with autism

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Impact of Camouflaging on Females with Autism

By

Cortney Janicki-Menzie

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Abstract

Females with autism spectrum disorder are an underrepresented group in the autism literature that is in need of greater understanding. Growing evidence suggests that autistic females have a unique clinical presentation of symptoms and they are more frequently camouflaging their autism characteristics to fit in with peers. While support for social camouflaging theory builds, little attention has been paid to the effects of camouflaging on outcomes for females with autism. The current study proposes that females with autism will demonstrate greater use of camouflaging behaviors and that camouflaging behaviors will predict adverse outcomes for these women. Specific outcomes addressed in the proposed study will include mental health, quality of life, and substance use. Camouflaging behaviors and their outcomes will be compared among autistic females, autistic males, and typically developing females and males.

*Keywords:* gender differences, female, camouflaging, autism spectrum disorder
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Introduction

It has been widely established that girls and women are less frequently diagnosed with autism spectrum disorder than boys and men. The Centers for Disease Control and Prevention recently updated their prevalence statistics on autism spectrum disorder, finding that the United States prevalence rate currently stands at 1 in 54 people (Maenner et al., 2020). Although gender differences in prevalence rates of autism spectrum disorder vary, on average, the prevalence of autism spectrum disorder is 4.3 times higher in males than in females (Maenner et al., 2020). Yet, declaring that there are four times more males with autism spectrum disorder than females appears to be an inaccurate representation of prevalence by sex/gender. When comparing males and females who are severely impacted by their autism symptoms, the ratio is closer to 1.33-2 males for every one female (Baio et al., 2018). Determining the ratio of males to females with less severely impactful autism symptoms has been more complicated, however. The prevalence ratio of autism spectrum disorder in males and females less severely impacted by their autism symptoms has been found to be between 6-8:1 (Fombonne, 2003). Many studies have looked at the biological and environmental underpinnings of autism spectrum disorder to understand this discrepancy, yet results identify multiple mechanisms, leading to largely inconclusive findings (Ferri et al., 2018). However, sex differences between male and female prevalence of autism spectrum disorder, as well as sex differences in symptom severity, remain a constant finding (Wilson et al., 2016).

The female protective effect theory (FPE) indicates that males have greater genetic variability, and this variability exposes them to increased incidence of autism spectrum disorder. Conversely, females have less variability, and a decreased incidence of autism spectrum disorder (Ferri et al., 2018; Werling & Geschwind, 2013). FPE potentially explains why males are
diagnosed with autism spectrum disorder at a much higher rate than females. Additionally, FPE argues a liability-threshold model for females, indicating that, because of their lower rate of incidence, females would require a much higher genetic load for autism spectrum disorder to manifest (Dworzynski et al., 2012; Ferri et al., 2018). The liability-threshold model of FPE may explain greater autism spectrum disorder symptom severity observed in females and why the prevalence rates of autism spectrum disorder in autistic males and autistic females more severely impacted by their autism symptoms are less discrepant.

Sex hormone differences are also considered in the higher prevalence of autism spectrum disorder in males. Researchers have argued that fetal testosterone plays a role the development of autism spectrum disorder (Ferri et al., 2018). Since males have more testosterone than females, this theory supports the imbalance of diagnoses between sexes. Multiple animal studies have looked at fetal testosterone’s effect on the development of autism spectrum disorder (see Ferri et al., 2018). Some human studies have also been conducted and have shown moderate effect sizes on the relationship between hormonal variations and later autism diagnoses (Hu et al., 2009; Sarachana et al., 2011), indicating that fetal testosterone may impact the development of autism spectrum disorder. Overall, there is some support that fetal testosterone plays a role in autism spectrum disorder-related behaviors, but this area requires further study (Ferri et al., 2018). A literature review by Lai and colleagues (2017) discussed the mixed findings of neuroimaging studies on gender differences in autism spectrum disorder. There appears to be some evidence that the brains of autistic males and autistic females differ from their same-sex peers; however autistic males’ and autistic females’ brains show similar patterns.

The literature on biological explanations for sex differences in autism spectrum disorder suggest that males have a greater risk of developing autism spectrum disorder than females due
to brain differences as well as genetic and hormonal vulnerability. Biological underpinnings, however, do not complete the picture that explains sex differences in the prevalence of autism spectrum disorder, given the variability of male to female prevalence based on symptom severity (Baio et al., 2018; Fombonne, 2003). Additionally, biological differences in the brain can be linked to environmental experience (Lai et al., 2017), so findings from neuroimaging may not only be capturing innate differences between autistic males and autistic females. Furthermore, females are diagnosed later in life than males, especially when less severely impacted (Baio et al., 2018; Begeer et al., 2013). Given these differences in sex ratios at the symptom severity level, explanations for sex differences in autism spectrum disorder prevalence should extend beyond the biological.

Males have dominated research samples that have contributed to the understanding of autism spectrum disorder. Males outnumbered females in the development of the *Autism Diagnostic Interview – Revised* (Rutter et al., 2003) and the Autism Diagnostic Observation Schedule – Generic (Lord et al., 1994) by approximately 3:1 (Koenig & Tsatsanis, 2005). While these ratios are similar to the prevalence ratios of autism spectrum disorder, the two gold-standard diagnostic assessment tools do not provide analyses on sex differences in symptom presentation. The school-age version of the *Social Responsiveness Scale, Second Edition* (*SRS*-2) is the only popular screening instrument that takes gender differences into account and provides separate clinical cutoff scores for school-aged males and females (Constantino & Gruber, 2012). In the school-age *SRS*-2, females require lower symptom endorsement than males to meet threshold for clinically significant autism symptoms. Even as conceptualizations of autism spectrum disorder have changed from the early observations of Kanner and Asperger, present day research continues to include an overriding majority of autistic males in assessment and
treatment samples (Watkins et al., 2014). Fewer females are potentially diagnosed with autism spectrum disorder because our understanding of autism is based primarily on observing males.

Females with autism spectrum disorder exist, yet the current literature struggles to identify the autistic female presentation. It is possible that biological factors contribute to the difference in prevalence rates in males and females with autism spectrum disorder, but it is also possible that we do not understand autistic females because they have not been significantly included research. Cheslack-Postava and Jordan-Young (2012) postulated that societal gender norms and human tendency to interact differently with different genders (e.g., a mother speaks more conversationally to her infant daughter than her infant son) have contributed to the gender discrepancy in prevalence of autism spectrum disorder and a diagnostic bias to view autism spectrum disorder as a male disorder. Thus, it is imperative to examine gender differences in autistic males and females to elucidate similarities and differences between the two groups. In recent years, research has shifted focus to females with autism to better understand differences in symptom presentation that may be contributing to the discrepancy in prevalence and age of diagnosis between males and females.

**Previous literature on gender differences in presentation and social development**

As described in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013), the presentation of autism spectrum disorder consists of deficits in social communication and the presence of restricted or repetitive behaviors and/or interests. Social communication deficits consist of difficulties with social-emotional reciprocity; nonverbal communication; and developing, maintaining, and understanding social relationships (American Psychiatric Association, 2013). Individuals with autism spectrum disorder have difficulties with back-and-forth conversations and sharing their
interests and emotions with others. They show diminished production of nonverbal communication (e.g., eye contact, gestures) and/or diminished understanding of nonverbal communication in others (e.g., interpreting facial expressions). These individuals can also struggle to form meaningful relationships with others (e.g., making friends). Restricted/repetitive patterns of behavior, interests, or activities cover a number of different behaviors. These include stereotyped speech or motor movements (e.g., stereotypies, echolalia), behavioral inflexibility (e.g., difficulty transitioning between activities), restricted and intense interests, and hyper- or hyporeactivity to sensory stimuli. To meet DSM-5 criteria for autism spectrum disorder, an individual must have all social communication deficits and at least two of the four restricted/repetitive behavior criteria (American Psychiatric Association, 2013). Additionally, social communication deficits and restricted/repetitive behaviors are specified on a 1 to 3 level of severity scale, where Level 1 requires support and a Level 3 requires very substantial support (American Psychiatric Association, 2013).

A growing body of research suggests that there is a difference in symptom presentation between males and females with autism. Females with autism spectrum disorder have long been viewed as, overall, more impaired than males with autism spectrum disorder. Current CDC estimates found that 40% of females with autism spectrum disorder have a co-occurring intellectual disability, compared to 32% of males with autism spectrum disorder (Maenner et al., 2020). Previous studies have supported the CDC’s findings that females with autism have lower IQ scores (Giarelli et al., 2010). The literature also found greater social-communication deficits in females with autism spectrum disorder (Kirkovski et al., 2013), but fewer observed restricted/repetitive behaviors and interests than males with autism (Allely, 2019). Higher-functioning females with autism spectrum disorder are also diagnosed later in life than higher-
functioning males with autism spectrum disorder (Baio et al., 2018). New research has suggested that females with autism spectrum disorder are not necessarily more impaired than their male counterparts, but rather their difference in symptom presentation has made it difficult to capture what autism looks like in females (Grove et al., 2017). Thus, the more impaired a female is, the easier she is to detect, whereas a less impaired female may go undetected.

Looking at gender differences in typical development can elucidate gender differences observed in autistic males and females. Research on gender differences in social development has tended to focus on peer socialization. From an early age, boys and girls can be observed playing differently with their peers. In preschool, boys engage in more physical activities, while girls engage in more interpersonal and social play (Martin et al., 2013). Both males and females also consistently choose to play and form peer relationships with group members of the same sex (Maccoby, 2002; Martin et al., 2013). The selection of same-sex peer relationships has been largely attributed to sex homophily, similarity in activity engagement, and, to a lesser extent, peer influence. Though children begin to interact more often with opposite sex peers as they get older, same sex peer relationships remain the majority of their friendships (Martin et al., 2013).

Female friendships are notable for their smaller group size and propensity for intimacy and reciprocity among group members (Goodwin, 2002; Maccoby, 2002). In his meta-analysis on sex differences in friendships, Hall (2011) found that females expect their friendships to include symmetrical reciprocity, communion, and solidarity, while males expect their friendships to include a sense of agency. Because of the importance placed on reciprocity in friendships among girls, female friendships are more exclusive and are prone to conflict (Underwood, 2007; Vaquera & Kao, 2008). The literature points to another major difference in how boys and girls develop socially: how they approach social difficulties in peer relationships. Typically
developing boys do not engage in conflict as often as typically developing girls, but when they do, they use overt strategies (e.g., physical aggression) to handle conflict, while girls engage in more covert strategies, such as relational aggression, as a form of conflict resolution (e.g., spreading rumors; Maccoby, 2002; Underwood, 2007).

For many years, researchers have thought that individuals with autism spectrum disorder were uninterested in developing social relationships (Kanner, 1943). While some evidence supports the notion that individuals with autism are less interested in social relationships, new findings suggest that this not true of all individuals with autism spectrum disorder. Instead, some individuals with autism are interested in social relationships, but lack the skills and understanding necessary to navigate these relationships (Bauminger & Kasari, 2000), such as understanding social rules and social cues that dictate play and peer relationships (Chamberlain et al., 2007; Kasari et al., 2011). Children with autism consistently find themselves on the periphery of friendships and social networks (Kasari et al., 2011). When asked to assess engagement in social relationships with classmates, participants rated children with autism as less likely than typically developing peers to be preferred and accepted in social groups (Chamberlain et al., 2007; Kasari et al., 2011; Rotheram-Fuller et al., 2010). Dean and colleagues (2014) found that some children with autism successfully engaged and did so primarily within same-sex social groups.

Evidence suggests that females consistently show greater social skills than males (e.g., De Goede et al., 2009). Typically developing females not only have more social skills, but also are also more adept at using these skills (De Goede et al., 2009); and research has begun to demonstrate these same gender differences in social skills in the autism spectrum disorder population. An important study by Head and colleagues (2014) measured level of social skill
ability among typically developing females, typically developing males, autistic females, and autistic males between 10 to 16 years in age. A significant difference was found overall between typically developing children and children with autism spectrum disorder. Typically developing females had the highest rated social skills and males with autism spectrum disorder had the lowest rated social skills. Interestingly, there was no significant difference between females with autism spectrum disorder and typically developing males. That is, females with autism spectrum disorder demonstrated similar social skills abilities to typically developing males. While the sample sizes of Head and colleagues’ study (2014) were on the smaller side (i.e., 25 participants per group), matched participants were included in the study, which permitted comparisons to be made across gender and diagnosis. This is something missing from many other studies on social development and autism spectrum disorder.

In addition to gender differences in social skills, autistic males and autistic females exhibit different play skills as well. Boys with autism spectrum disorder are observed to have fewer friendships than their typically developing peers and are often found playing by themselves. Additionally, the play of boys with autism spectrum disorder is object-oriented, rather than relational (Dean et al., 2014). When females with autism spectrum disorder have been observed separately from males, they reportedly engaged in interpersonal relationships (Foggo & Webster, 2017). Observed females with autism spectrum disorder generally have better play skills than their autistic male peers (Kirkovski et al., 2013). Multiple studies have found different aspects of play behavior that autistic girls engage in and do better at than autistic boys. Knickmeyer and colleagues (2008) found that females with autism spectrum disorder engaged in imaginative play, which is a type of play not often observed in autistic males. Females with autism spectrum disorder were also more likely to engage in female-typical play, which requires
social involvement (e.g., peer engagement, emotionality, etc; Knickmeyer et al., 2008). Males with autism spectrum disorder, however, do not choose to engage in play that requires peer engagement or understanding (Knickmeyer et al., 2008). Furthermore, the restricted interests of females with autism spectrum disorder may lend themselves to more social play. Females with autism spectrum disorder often have a restricted interest of being around others, and thus, their interests appear as typical play and social in intent, regardless of whether these females actually understand the social meaning of their play (Knickmeyer et al., 2008). Additionally, boys with autism spectrum disorder were more likely to be overtly excluded from social groups, while autistic girls were not explicitly excluded from their typically developing female peers, but rather were overlooked (Dean et al., 2014).

Children with autism spectrum disorder mirror the homophily found in typical children’s play (Dean et al., 2014). While this appears positive on the surface, autistic children struggle to socialize with their peers. Both autistic females and autistic males find themselves on the edge of social circles (Kasari et al., 2011) and autistic males experience overt rejection from peers while autistic females’ rejection is more subtle (Underwood, 2007). Of course, overt rejection can be distressing, but covert rejection experienced by females may be more confusing. Females with autism spectrum disorder, like typically developing females, outpace their male diagnostic counterparts in social skills (Head et al., 2014). Autistic females’ social skills are even on par with the skills of typically developing males. While this is a strength of autistic females, it important to remember that autistic females’ social skills are still significantly lower than the group with whom they are more likely to initiate social interaction: typically developing females (Head et al., 2014). As autistic females choose to navigate through same-sex peer groups, they are attempting to socialize with typically developing peers that are more socially advanced than
they are, and who do not explicitly communicate their disinterest in socializing, potentially making autistic females’ social world more difficult.

**Emotional development**

Although not a core feature of autism spectrum disorder, poor emotional control is frequently cited as a distressing factor in the lives of individuals with autism spectrum disorder and their families (Mazefsky et al., 2013). Despite emotion regulation being a clinically important factor, it is an understudied area of autism research. Two studies led by Samson have examined emotion regulation strategies in individuals with autism spectrum disorder and in typically developing individuals (Samson et al., 2015; Samson et al., 2012). When examining how less severely impacted autistic children and adolescents compared to age- and gender-matched typically developing children and adolescents, autistic participants and typically developing participants did not differ in their level of reactivity to potentially threatening stimuli, but autistic children were less likely to engage in cognitive reappraisal to regulate their emotions (Samson et al., 2015). Additionally, when prompted to use a cognitive reappraisal strategy, autistic children had more difficulty implementing the strategy, but reported benefit from using it once they were able to generate their own reappraisals (Samson et al., 2015). The results from this study are similar to Samson and colleagues’ (2012) study with autistic adults. That is, autistic adults used cognitive reappraisal as an emotion regulation strategy less often and felt less able to implement such strategies than typically developing adults. The researchers also found that autistic adults had more difficulty labeling emotions and more often used suppression as an emotion regulation strategy than typically developing adults. These two studies shed light on an understudied, but clinically well-documented relationship between emotion regulation and autism spectrum disorder. However, the results are limited to only high-functioning autistic
individually and reports on difficulties with emotion regulation extend to both high-functioning and lower-functioning autistic individuals (Mazefsky et al., 2013). It should be noted that Samson and colleagues’ (2012) study on emotion regulation in adulthood has a strength in gender representation. As the research on emotion regulation in this population is already lacking, there is even less support for any potential gender differences on this topic. However, both the autistic and typically developing samples in the Samson study were 59% female. While the groups were small, overall (i.e., 27 participants per group), a nearly even distribution of males and females in the samples promote greater generalizability of the findings across genders.

Multiple theories of emotional development point to social context as being an important indicator of emotion recognition (Brody, 1985). Theory of mind research looks at individuals’ ability to understand the perspective and mental states of others (Baron-Cohen, 2001). Emotional development is largely researched as the recognition of others’ emotions rather than the recognition of one’s own emotions. This requires individuals to be examined on their orienting and emotion recognition toward social stimuli, whether it is looking at a picture of a face or at a face of an actual person in front of them. In this sense, emotional development is inherently social. Even when measuring individuals’ personal emotional development, the consequences of that development are social. For example, a study on effortful control, a characteristic of emotion regulation, followed children from 22 months to 33 months of age (Kochanska et al, 2000). Longitudinally, the study participants improved significantly in their effortful control, which can be conceptualized as their ability to suppress a dominant response in order to perform a subdomain (and more appropriate) response. Better effortful control was linked to better regulation of angry and happy emotions and to increased behavioral restraint, which all impacted these children’s social quality (Kochanska et al., 2000). Effortful control requires social skills.
that may not be developed well enough in individuals with autism, and in turn, the quality of their social relationships suffers. Emotional intensity has also been shown to influence autistic individuals’ level of social engagement. When responding to joint attention (a social task), young children with autism were more likely to respond when the examiner made intense/exaggerated emotional facial expressions (Franchini et al., 2017). Very overt forms of socialization are necessary for individuals with autism to understand social stimuli and respond to cues.

**Autistic females in context**

It is especially important to consider the relationship between social and emotional development when examining females with autism spectrum disorder. The social context of autistic girls and women is different from that of autistic boys and men. As such, they face different pressures that may be influencing their autism presentation. In semi-structured interviews with autistic females between the ages of 23 to 30 years old who were diagnosed later in life, these women discussed gender biases that they experienced as a minority group within the autism spectrum population (Bargiela et al., 2016). They also shared experiences, such as having to pretend to be normal during everyday activities and feeling societal pressure to behave more femininely, which may have contributed to their delayed diagnosis. In some studies, adolescent females with autism spectrum disorder were rated as having greater social communication impairments than autistic males (Holtmann et al., 2007; Ratto et al., 2018). It was postulated that higher parent-reported symptom severity for females was linked to higher parental expectations for social skills, given that females generally have more advanced social skills than males (Holtmann, et al, 2007).

The social camouflaging theory is an emerging theory in autism research that supports the phenomenon of under-representation of females with autism spectrum disorder and why
autistic females may appear more socially and emotionally advanced than autistic males. Social camouflaging encompasses multiple coping strategies used to hide one’s social difficulties, such as masking and compensating (Hull et al., 2017). An example of masking includes hiding one’s autism spectrum disorder characteristics (e.g., relating to others, performing self-stimulatory behaviors). Compensating encompasses intensive monitoring of oneself in order to perform socially appropriate behavior (e.g., forcing oneself to maintain eye contact with others). When Hull and colleagues (2017) interviewed adults with autism spectrum disorder, they found that respondents reported overcompensating by over-emphasizing facial expressions and body language. Social camouflaging is seen in both males and females with autism spectrum disorder; however, affected females have higher camouflaging scores than affected males, and females have been observed to camouflage their symptoms more often than males (Lai et al., 2017). Societal expectations potentially impact autistic females’ higher rates of camouflaging. Thus, females with autism spectrum disorder feel the need to camouflage more, but it is to their own disadvantage. As females have become adept at camouflaging, they may risk being overlooked and under-diagnosed (Gould & Ashton-Smith, 2013).

**Potential impact of camouflaging**

While social camouflaging may appear beneficial and adaptive to females with autism spectrum disorder in the immediate context, it can have long-term detrimental implications. Females – typically developing or autistic – are at an increased risk of having anxiety and depression, especially during adolescence (Bolognini et al., 1996; Green et al., 1996). People with autism spectrum disorder are also at an increased risk of developing co-occurring psychopathology (Simonoff et al., 2008; Skokauskas & Gallagher, 2012). Females with autism spectrum disorder are an especially vulnerable population given this compounding risk. Both
typically developing and autistic boys more commonly display externalizing psychopathology, leading to increased referral for treatment; whereas typically developing and autistic females commonly display internalizing symptoms, which may go unnoticed (Green et al., 1996; Lai et al., 2017).

Evidence suggests that girls with autism spectrum disorder stand out because they reportedly feel isolated from both typically developing and autistic peers (Cridland et al., 2014). While females with autism spectrum disorder show social skills similar to those of typically developing males, their skills still fall short of typically developing female peers (Dean et al., 2014). Thus, social skills deficits in females with autism spectrum disorder are still debilitating for this group. Typically developing females handle conflict more covertly, which can be challenging for autistic females to understand. Core deficits of autism spectrum disorder include difficulties relating to others and difficulties with nonverbal communication (American Psychiatric Association, 2013). With this in mind, autistic females struggle with the nuances needed for female social relationships (Cridland et al., 2014).

Social difficulties have been linked to adverse outcomes for individuals with autism spectrum disorder. Not only are individuals with autism more likely to experience higher levels of depression and anxiety, but their risk for comorbid mood disorders also increases with age (Ghaziuddin et al., 2002; Gillott & Standen, 2007; Sterling et al., 2008). Additionally, individuals with autism spectrum disorder report poor quality of life in both childhood and adulthood. For children with autism spectrum disorder, severity of behavior problems was negatively correlated with quality of life (Kuhlthau et al., 2013), while level of adaptive functioning was positively correlated (Tilford et al., 2012). In adults, adaptive functioning was not significantly correlated with quality of life (Kamp-Becker et al., 2010; Saldana et al., 2009);
however, behavior problems were negatively correlated with quality of life in this group as well (Gerber et al., 2008; Gerber et al., 2011). Access to and engagement in leisure activities and employment status were positively correlated with autistic adults’ quality of life (Garcia-Villamisaret et al., 2002). Chiang and Wineman’s (2014) review of the literature on quality of life for individuals with autism spectrum disorder noted a lack of research on gender differences in quality of life for this population, particularly with autistic adults. Jamison and Schuttler’s (2015) study found that adolescent girls with autism spectrum disorder reported lower social competence, lower self-worth, lower quality of life, and higher levels of internalizing and externalizing issues. Mason and colleagues (2018) found that, compared to autistic adult males, autistic adult females reported higher social quality of life. More research needs to be done on how females with autism spectrum disorder may experience a differing quality of life from their male counterparts.

Little research has focused on the relationship between autism spectrum disorder and substance use, though prevalence rates suggest a low co-occurrence compared to those with other psychiatric issues (Mandell et al., 2012; Santosh & Mijovic, 2006). Screening for substance use does not frequently occur as part of routine assessments for autism spectrum disorder, despite substance use screenings occurring frequently for other mental health issues (Palmquist et al., 2014). Nevertheless, co-occurrence is still a reality, and there is room for research to expand on this issue. Studies have found that individuals with autism spectrum disorder engage in substance use to be more social (Kronenberget al., 2015) and to cope with anxiety (Lalanne et al., 2015). Risk for substance use in the autism population appears to increase when an individual with autism is also diagnosed with attention-deficit/hyperactivity disorder (Butwicka et al., 2016). As research on the relationship between substance use and autism is limited, gender differences have
not yet been explored. While, in the general population, females use substances less frequently than males, females who do use substances have a higher prevalence of co-occurring mood disorders and are potentially using substances as a way of self-medicating (Brady & Randall, 1999). These findings suggest that autistic females’ use of substances is an important area to address.

Current study

Females with autism spectrum disorder represent a minority group that, for too long, has been understudied in research. Studies specifically targeting research questions related to autistic females make up only 15% of the literature (Watkins et al., 2014), so our understanding of unique female presentation is limited. As females are diagnosed with autism spectrum disorder less frequently than males, much of the past research has had predominantly male samples or has excluded females from studies all together (Kirkovski et al., 2013). Because of this lack of representation in the literature, it has been difficult to provide empirical evidence to anecdotal claims that autistic females are qualitatively different from autistic males. In recent years, there has been a concerted effort to address this gap in the literature.

Autistic females consistently show better social and emotional development than autistic males, but continue to face difficulties when socializing with their peers. Therefore, instead of only using the social successes and difficulties of autistic males as a measure of autism spectrum disorder in females, autistic females should also be compared to the successes and difficulties of typically developing females. A shift in comparison would be especially beneficial for females with autism spectrum disorder because children predominantly develop and maintain same-sex peer relationships that carryover into adulthood (Dean, 2014; Maccoby, 2002). Autistic females’ social skills deficits and underdeveloped emotion recognition are most prominent when
compared to typically developing females and are at their greatest need for intervention. Research is beginning to shift in understanding that there are gender differences in autism presentation, and our benchmarks for social deficits should be compared not only by diagnosis, but also by gender (Dean et al., 2014).

The current study purports that camouflaging has a negative impact on the lives of autistic females, and it will investigate the use of camouflaging behaviors in autistic women compared to autistic men and typically developing women. The study will then further explore how the use of camouflaging behaviors may impact autistic women’s lives, specifically mental health, quality of life, and substance use. Understanding of camouflaging is only beginning and further work needs to be done on outcomes related to these behaviors. Despite growing evidence of gender differences in social presentation and expectations, prevalence of mental health disorders, and quality of life issues, there is a lack of research on outcomes for autistic females (Green et al., 1996, Jamison & Schuttler, 2015, Lai et al., 2017). Autistic females report an increased pressure to camouflage their autistic characteristics (Bargiela et al, 2016). Though autistic females exhibit better social skills than autistic males, they work harder socially than autistic males (i.e., camouflage more; Lai et al., 2017). The additional work they are putting in and the increased pressure they feel to fit in may be a major contributor to their higher rates of mood disorders (Bolognini et al., 1996). In this study, it is proposed that women with autism have a compounded risk of adverse outcomes, due to being both a person with a developmental disability and being a woman. Specifically, the current study hypothesizes:

Hypothesis 1: Women with autism spectrum disorder will report greater use of camouflaging behaviors than males with autism spectrum disorder
Hypothesis 2: Women with autism spectrum disorder will report greater use of camouflaging behaviors than typically developing women

Hypothesis 3: Camouflaging behaviors will predict lower quality of life, higher mental health issues, and higher substance use

Hypothesis 4: Gender and diagnosis will contribute unique variance to camouflaging behaviors’ predicted impact on quality of life, mental health, and substance use

Methods

Recruitment

Participants included adults 18 years of age and older. Due to the goals of the study, participant recruitment focused on individuals with autism spectrum disorder and typically developing females and males. All recruitment posts explained the nature of the study and included a link to complete the survey. Recruitment for individuals with autism spectrum disorder utilized mailing lists and resources through a statewide network of community-based autism centers across New York State, mailing lists gathered through collaboration with a national autism research project, and through online resources to expand recruitment across the nation. Autistic participants were given the option to enter a raffle for gift cards as compensation for participating in the study.

The online survey was available to typically developing females and males through an undergraduate research pool and through Amazon Mechanical Turk (MTurk). Undergraduate students had the option to choose the present study’s survey from many study options available at the university, and there was no requirement to complete any specific survey within the undergraduate research pool. Participants recruited via the undergraduate research pool received course credit upon completion of the online survey. Because university students consist largely
of a limited age range, MTurk, an online marketplace that researchers and businesses utilize to recruit participants at a low cost, was utilized to recruit a broader age range of typically developing females and males as well. Recruited participants from MTurk responded to a post detailing the nature of the study as well as a link to complete the survey. As part of MTurk policies, MTurk participants received negligible compensation (i.e., $1.00) for their participation. See Appendix A for recruitment materials.

The sample included males and females with autism spectrum disorder and typically developing females and males. A minimum sample of 73 participants per group was necessary to detect medium-sized differences (partial $\eta^2 = 0.5$), according to a power analysis conducted using G*Power (Faul et al., 2007). Inclusion criteria for the present study are as follows:

1. Participants were a minimum of 18 years of age.

2. Participants identified gender as either cisgender man or cisgender woman.

   Transgender, nonbinary, and gender nonconforming participants were able to complete the survey, but excluded from primary analyses, due to small group sample size.

3. Male and female participants in the autism spectrum disorder groups self-disclosed an autism spectrum disorder diagnosis in the demographic questionnaire and had a self-reported score above threshold on a measure of autism symptomatology (i.e., SRS-2 T score at or above 60 for both males and females). Male and female participants in autism spectrum disorder groups who self-disclosed a diagnosis, but did not meet threshold on the autism symptomatology measure (i.e., SRS-2 T score 59 or below) were excluded from primary analyses.
4. Typically developing females and males did not self-disclose an autism spectrum disorder diagnosis and had a self-reported score below threshold on a measure of autism symptomatology (i.e., SRS-2 T score 59 or below). Typically developing participants who did not disclose an autism spectrum disorder diagnosis, but scored at or above threshold on a measure of autism symptomatology (i.e., SRS-2 T score at or above 60) were excluded from primary analyses.

Those who demonstrated a clinically significant presentation of autism characteristics without an official self-disclosed autism diagnosis or who self-disclosed a diagnosis without demonstrating a clinically significant presentation were excluded from primary analyses due to difference in reporting and an inability to confirm diagnosis through evaluative means in the present study.

**Participants**

There were 374 participants that completed the online survey. Of those participants, 164 self-identified as having an autism spectrum disorder and scored at or above threshold on the measure of autistic symptomatology (88 autistic females, 76 autistic males). Two-hundred ten participants (144 females, 66 males) did not self-identify as having an autism diagnosis and scored below threshold on the measure of autistic symptomatology. The mean age of all participants was 32.75 years ($SD = 14.40$). The average age for autistic females was 37.22 years ($SD = 12.57$). Autistic males were 41.26 years old ($SD = 14.93$) on average. Typically developing females were an average of 26.61 years old ($SD = 13.19$) and typically developing males were an average age of 30.51 years old ($SD = 11.76$). There was a statistically significant difference in participant age between groups ($F(3,371) = 25.02, p < .000$). Chi-square tests revealed that there were not significant differences in ethnicity ($p = .238$), race ($p = .052$), and
mental health diagnosis ($p = .897$) across groups. However, these analyses did reveal significant differences in education ($p < .00$) and employment status ($p < .00$). See Appendix B Table 1 for demographic information and questionnaire.

One hundred eighty-nine participants were excluded from the study for having conflicting information regarding diagnosis and score on the autism symptomatology measure. That is, those who identified as having autism, but did not score at or above threshold for autism symptomatology were excluded from analyses. Those who identified as not having autism, but scored at or above threshold were also excluded from analyses. Sixty excluded females that self-identified as autistic had a mean age of 35.96 years ($SD = 13.72$). There were sixty-six males that self-identified as autistic, and the mean age for this group was 34.85 years ($SD = 12.80$). Twenty-eight females who did not self-identify as autistic, but endorsed significant autism symptomatology were excluded from the study ($M_{age} = 36.55; SD = 11.62$). There were 35 excluded males who did not self-identify as autistic, but endorsed significant autism symptomatology ($M_{age} = 34.50, SD = 8.89$).

**Measures**

All participants completed an online survey that included several measures to assess autism symptomatology, camouflaging behaviors, mental health, quality of life, and substance use.

**Autism symptomatology.** The *Social Responsiveness Scale, Second Edition (SRS-2;* Constantino & Gruber, 2012) is a standardized 65-item, Likert-scale measure that assesses the severity of social impairment and restricted/repetitive behaviors associated with autism spectrum disorder. The *SRS*-2 measures several domains of autism symptomatology including social awareness (i.e., ability to pick up on social cues), social cognition (i.e., ability to interpret social
cues once picked up), social communication (i.e., expressive social communication), social motivation (i.e., motivation to engage in social behavior), and restricted/repetitive interests or behaviors. Unlike the school-age version of the SRS-2, the adult version does not include separate clinical cutoff scores for males and females, as nonsignificant gender differences were found during standardization of the adult form. All participants completed the adult self-report version of the SRS-2 and rated their symptoms on a scale of 1 (not true) to 4 (almost always true). Higher ratings indicate a greater severity of autism symptomatology. An SRS-2 T-score less than or equal to 59 indicates falling within normal limits, a T-score between 60 and 65 indicates falling in the mild range of symptoms, a T-score between 66 and 75 indicates falling in the moderate range, and a T-score greater than or equal to 76 indicates falling in the severe range of symptoms. Mild autism symptomatology, as indicated in the SRS-2, is observed in high-functioning individuals with autism spectrum disorder. The SRS-2 has shown acceptable convergent validity with the Autism Diagnostic Observation Schedule (Lord et al., 2003) and the Autism Diagnostic Interview – Revised (Rutter et al., 2003).

**Camouflaging behaviors.** The use of camouflaging behaviors was measured using the Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al., 2018). The CAT-Q is a 25-item self-report measure validated on adults with autism spectrum disorder. Raters indicated how much they agree with an item from strongly disagree (1) to strongly agree (7). The CAT-Q measures overall camouflaging behavior and three subdomains of camouflaging: compensation, masking, and assimilation. Compensation is described as learning and displaying new behaviors in order to make up for autism-related difficulties (e.g., deliberately copying the behaviors of someone else during a social interaction). The display of behaviors that hide autistic characteristics is considered masking (e.g., monitoring one’s body language to appear relaxed).
Assimilation is the display of behaviors that aid in fitting in with peers (e.g., feeling like one is ‘performing’ rather than being genuine). The CAT-Q was validated on both autistic adults (ages 18 to 75 years) and non-autistic adults (ages 16 to 82 years). During development and validation of the measure, the CAT-Q demonstrated acceptable internal consistency (α = 0.94) and preliminary test-retest reliability (r = 0.77).

**Mental Health.** The Beck inventories were used to measure participants’ depression and anxiety. The *Beck Anxiety Inventory* (BAI; Beck & Steer, 1993) is a 21-item self-report measure on the severity of anxious symptoms. Participants rated their anxious symptoms on a Likert scale from 0 (*not at all*) to 3 (*severely*). Level of anxiety is determined by a total item score. A total item score of 21 and under indicates a low level of anxiety. Scores between 22 and 35 are considered moderate, and scores 36 and above are considered “potentially concerning levels of anxiety.” The BAI is considered a reliable and valid anxiety measure (Beck & Steer, 1993). Previous studies have found that the BAI has high internal consistency (α = 0.92) and test-retest reliability (r = 0.75; Beck, Epstein, Brown, & Steer, 1988).

The presence of depressive symptoms will be assessed using the *Beck Depression Inventory, Second Edition* (BDI-II; Beck et al., 1996). The BDI-II is a 21-item self-report questionnaire on the severity of depressive symptoms. Participants rated the presence and severity of depressive symptoms on a Likert scale from 0 to 3, where a 0 rating indicates an absence of the depressive symptom in question and a 3 rating indicates a severe presence of the symptom. The severity level of depressive symptoms is determined by a total rating score. Severity scores from 0 to 13 are considered minimal, scores from 14 to 19 are considered mild, scores from 20 to 28 are considered moderate, and scores from 29 to 63 are considered severe. The BDI-II demonstrated high internal consistency (α = .92) and test-retest reliability (r = 0.93).
The *BDI-II* has been used frequently in research with autistic individuals. Gotham and colleagues (2015) endorsed the *BDI-II* as a reliable measure of depression in the autism spectrum disorder population, and Cassidy and colleagues (2018) demonstrated robust support for its use with this population.

**Quality of life.** All participants completed an abbreviated version of the *World Health Organization Quality of Life* instrument (*WHOQOL-BREF*; World Health Organization Quality of Life Group, 1998) to measure quality of life across four domains: physical health, psychological, social relationships, and environment. It is a 26-item self-report questionnaire. Participants rate quality of life on a Likert scale from 1 (*very dissatisfied*) to 5 (*very satisfied*). The *WHOQOL-BREF* was validated cross-culturally and has demonstrated good internal consistency and test-retest reliability (Skevington et al., 2004).

**Substance use.** The World Health Organization (WHO) Alcohol, Smoking, and Substance Involvement Screening Test (*ASSIST*; World Health Organization, 2010) Version 3.1 was used to screen for substance use. The *ASSIST V3.1* contains 8 overarching questions about history of substance use and targets 10 types of substances. Participants indicated their use of substance(s) with a *yes* or *no* and rate how often they use substance(s) and how the substance has impacted their life across various domains (e.g., financial, health, etc.) on a Likert scale from 0 (*never*) to 6 (*daily or almost daily*). A risk score was calculated for each substance. For alcohol, a score from 0 to 10 is considered *lower risk*, a score from 11 to 26 is considered *moderate risk*, and a score of 27 and above is considered *high risk*. For all other substances, a score from 0 to 3 is considered *lower risk*, a score from 4 to 26 is considered *moderate risk*, and a score of 27 and above is considered *high risk*. Demonstrated internal consistency (Cronbach’s alpha) for the majority of *ASSIST* domains was greater than 0.80 (World Health Organization, 2010).


**Procedure**

Upon recruitment, all participants self-selected to complete an online survey. Male and female participants with autism spectrum disorder accessed the online survey through a link provided in recruitment emails and through social media posts. Typically developing participants recruited through the undergraduate research pool were given access to the online survey after becoming a registered member of the undergraduate research pool, while typically developing participants recruited through MTurk were given access to the link via MTurk’s online platform. The online survey was designed to take no longer than 20 minutes to complete.

All participants consented to participation at the beginning of the survey. Participants reported on age, gender identity, race, ethnicity, state in which they currently reside, education level, employment status, and mental health diagnoses through multiple choice and open-response question formats in the demographic questionnaire. All participants then completed self-report measures on autism symptomatology, camouflaging, mental health, quality of life, and substance use. At the end of the survey, participants were presented with a debriefing page that provided a list of resources for mental health issues, life stressors, social skills, and evaluations for developmental disabilities (see Appendix D).

**Data Analysis**

Distributions of study variables for assumptions of normality were examined. Due to study variables’ non-normal distributions, data were transformed using Box-Cox transformations (Osborne, 2010). Transformation of camouflaging, mental health, quality of life, and substance use variables yielded significantly improved variable distributions. Analysis of survey data included the use of analysis of variance (ANOVA) to examine group differences across outcomes. Autistic females were compared to autistic males, typically developing females, and
typically developing males on camouflaging, mental health, quality of life, and substance use.

Overall scores were assessed for the CAT-Q, BAI, and BDI-II, while domain-level scores were assessed for the WHOQOL-BREF, and ASSIST scores). Frequency information was used to describe the demographic information of the sample. In addition to understanding group differences across outcomes, data analysis included multiple regression to determine how gender, diagnosis, and camouflaging scores predicted outcome scores on mental health, quality of life, and substance use. Each of these independent variables was added to the regression model to explain unique variance in predicting outcome scores.

Results

Scores across camouflaging, mental health, quality of life, and substance use measures were compared by diagnosis (i.e., autism spectrum disorder and typically developing) and gender (cisgender male and cisgender female).

Camouflaging

It was hypothesized that autistic females would display significantly higher rates of camouflaging behaviors than autistic males and typically developing females. The CAT-Q rates camouflaging behavior on a scale of 1 (strongly disagree) to 7 (strongly agree). Autistic females reported a mean rating of 5.28 (SD = .96) and autistic males reported a mean rating of 4.64 (SD = 1.10) for camouflaging behavior. Typically developing females endorsed an average camouflaging rating of 3.29 (SD = 1.05) and typically developing males endorsed an average camouflaging rating of 3.68 (SD = 1.29). See Appendix D Table 2 for descriptive statistics.

Between-subjects t-tests revealed that autistic females reported significantly more camouflaging behaviors than both autistic males (t(162) = -3.94, p < .000) and typically developing females (t(231) = 14.32, p < .000). Though not part of the study’s hypotheses, post-
Hoc analysis revealed that autistic females also reported significantly higher camouflaging scores than typically developing males ($t(152) = 9.366, p < .000$). See Appendix D Table 3 for results.

A two-way analysis of variance (ANOVA) was conducted on camouflaging behavior to examine main effects and interactions for gender (cisgender female or cisgender male) and diagnosis (autism spectrum disorder or typically developing). The ANOVA results revealed a significant main effect for diagnosis ($F(1) = 164.45, p < .000, \eta^2 = .31$) and a nonsignificant effect for gender ($F(1) = .96, p = .33, \eta^2 = .003$). Results also revealed a significant interaction between gender and diagnosis ($F(1) = 20.18, p < .000, \eta^2 = .052$). An analysis of covariance (ANCOVA) was also performed to control for significant demographic differences between groups, such as age, education level, and employment status. The ANCOVA results revealed that there continued to be a significant main effect for diagnosis ($F(1) = 166.84, p < .000, \eta^2 = .32$), a nonsignificant main effect for gender ($F(1) = 2.17, p = .14, \eta^2 = .006$), and a significant interaction between gender and diagnosis ($F(1) = 13.32, p < .000, \eta^2 = .036$) when covariates were controlled. The results of the t-tests and two-way ANOVA support the study’s hypotheses that autistic females endorse significantly higher camouflaging behaviors than autistic males and typically developing females. Having an autism spectrum disorder and identifying one’s gender as female resulted in significantly higher rates of camouflaging. See Appendix D Tables 3 and 4 for results.

**Multiple regression**

To understand the impact camouflaging may have on outcomes, several multiple linear regressions were performed. A Bonferroni correction was implemented for measures that were analyzed at the domain level, such as the *WHOQOL-BREF* and the *ASSIST V 3.1* to address the risk of an inflated p value with multiple comparisons done at once. In addition, the study sought
to understand how one’s gender identity and diagnosis contributed unique variance to camouflaging behaviors’ predicted impact on outcomes. Thus, gender and diagnosis were examined in addition to camouflaging behaviors in the multiple regressions. When examining multiple regression models, multiple statistics and assumptions were analyzed (Field, 2013). The $R^2$ statistic was analyzed to determine percentage of variance in scores explained by the model. Then coefficients were examined to determine significant unique variance of each predictor variable. These were determined by exploring beta, p values, and semi-partial correlations. Models were inspected for multicollinearity between predictor variables, designated by a correlation between predictor variables of .7 or greater. In addition, regression and residual plots were inspected for assumptions of linearity of data and homoscedasticity.

**Mental health.** For mental health concerns, the BAI and the BDI-II evaluate overall endorsement of anxious and depressive symptoms. For the BAI, scores below 21 indicate a low level of anxiety, scores between 22 and 35 indicate moderate levels of anxiety, and scores 36 and higher indicate potentially concerning levels of anxiety. Autistic females and autistic males reported potentially concerning levels of anxiety ($M_{ASDfemale} = 44.18, SD = 12.84; M_{ASDmale} = 44.50, SD = 14.07$). Typically developing females and typically developing males reported moderate levels of anxiety ($M_{TDfemale} = 34.65, SD = 12.59; M_{TDmale} = 33.79, SD = 14.51$). See Appendix D Table 2 for descriptive statistics.

To analyze the significance of the anxiety scores between groups, a two-way analysis of variance (ANOVA) was conducted, examining main effects and interactions for gender (cisgender female or cisgender male) and diagnosis (autism spectrum disorder or typically developing). The ANOVA results revealed a significant main effect for diagnosis ($F(1) = 63.03, p < .000, \eta^2 = .15$) and a nonsignificant effect for gender ($F(1) = .42, p = .52, \eta^2 = .001$).
Results also revealed a significant interaction between gender and diagnosis \((F(1) = 20.18, p < .000, \eta^2 = .052)\). These analyses were then repeated with an analysis of covariance (ANCOVA) to control for significant group differences. When controlling for age, education level, and employment status, there continued to be a significant main effect for diagnosis \((F(1) = 14.84, p < .000, \eta^2 = .08)\) and a nonsignificant effect for gender \((F(1) = .90, p = .35, \eta^2 = .005)\), but there was not a significant interaction between gender and diagnosis \((F(1) = .21, p = .65, \eta^2 = .001)\). These results suggest that both autistic females and autistic males experience similar concerning levels of anxiety, which are significantly greater than the moderate levels of anxiety endorsed by typically developing females and typically developing males.

A multiple linear regression was calculated to predict anxious symptoms based on camouflaging, gender, and diagnosis. A significant regression equation was found \((F(3,371) = 42.04, p < .000)\), with an \(R^2\) of .25. The \(R^2\) value indicates that the three predictors of interest, camouflaging score, diagnosis, and gender, explained 25% of the variance in the overall model. Camouflaging \((t(1) = 7.26, p < .000, sr^2 = .11)\) and diagnosis \((t(1) = -2.73, p = .01, sr^2 = .015)\) contributed significant unique variance to the model, while gender did not \((t(1) = .459 p = .647, sr^2 < .00)\). Camouflaging behavior predicted 11% of unique variance in anxiety scores and diagnosis predicted 1.5% unique variance in anxiety scores. Overall, the model predicted 25% of variance in anxiety scores. This model suggests that camouflaging one’s social deficits and being autistic predict endorsement of anxious symptoms. See Appendix D Table 5 for results.

For the BDI-II, total scores between 0 and 13 indicate minimal endorsement of depressive symptoms, scores from 14 to 19 indicate mild endorsement, scores from 20 to 28 indicate moderate endorsement, and scores from 29 to 63 indicate severe endorsement. Autistic females and autistic males endorsed moderate depressive symptoms \((M_{ASDfemale} = 23.86, SD = 11.76)\);
Typically developing females endorsed mild depressive symptoms ($M = 14.24, SD = 11.80$) and typically developing males minimally endorsed depressive symptoms ($M = 11.29, SD = 12.14$). See Appendix D Table 2 for descriptive statistics.

Investigation into the significance of differences between groups on reported depression scores was conducted using a two-way analysis of variance (ANOVA) that examined main effects and interactions for gender (cisgender female or cisgender male) and diagnosis (autism spectrum disorder or typically developing). The ANOVA results revealed a significant main effect for diagnosis ($F(1) = 78.98, p < .000, \eta^2 = .18$) and a nonsignificant effect for gender ($F(1) = 2.43, p = .12, \eta^2 = .007$). Similar main effects were found when performing an analysis of covariance (ANCOVA) to control for significant group differences in age, education level, and employment status ($F_{\text{diagnosis}}(1) = 10.17, p = .002, \eta^2 = .06$) and a nonsignificant effect for gender ($F_{\text{gender}}(1) = 1.39, p = .24, \eta^2 = .01$). These results reveal that autistic individuals endorse significantly higher rates of depression than typically developing individuals. See Appendix D Table 4 for results.

To predict depressive symptoms, a multiple linear regression was calculated based on camouflaging, gender, and diagnosis. The overall model was statistically significant ($F(3,371) = 47.75, p < .000), R^2 = .28). Based on the R^2 value, the inclusion of all three predictors (i.e., camouflaging score, diagnosis, and gender) explained 28% of variation in scores in the overall model. Camouflaging ($t(1) = 7.33, p < .000, sr^2 = .104$) and diagnosis ($t(1) = -3.44, p = .001, sr^2 = .023$) contributed significant unique variance to the model, while gender did not ($t(1) = 1.45 p = .147, sr^2 < .00$). Camouflaging behavior predicted 10.4% of unique variance in anxiety scores and diagnosis predicted 2.3% unique variance in anxiety scores. Overall, the model predicted
28% of variance in depression scores. The model demonstrated that being autistic and camouflaging one’s autistic characteristics predict the endorsement of depressive symptoms. See Appendix D Table 5 for results.

**Quality of life.** The WHOOQL-BREF measures quality of life across four domains: physical health, psychological health, social relationships, and environment. Participants rated how satisfied they were in each domain on a scale of 1 to 5. Domain scores were computed to be directly comparable to the full version of the *World Health Organization Quality of Life Assessment* (World Health Organization, 1998), domain scores ranged from 4 to 20. In each domain, higher scores indicate higher satisfaction, and thus, a higher quality of life. For the domain of physical health, autistic females had a mean score of 12.48 ($SD = 2.78$), autistic males had a mean score of 13.29 ($SD = 2.51$), typically developing females had a mean score of 15.12 ($SD = 2.62$), and typically developing males had a mean score of 15.14 ($SD = 2.56$). For psychological health, autistic females reported a mean score of 11.10 ($SD = 3.13$), autistic males reported a mean score of 11.04 ($SD = 3.17$), typically developing females reported a mean score of 13.55 ($SD = 3.41$), and typically developing males reported a mean score of 14.35 ($SD = 2.89$). For social relationships, autistic females had a mean score of 12.61 ($SD = 3.80$), autistic males had a mean score of 11.21 ($SD = 4.60$), typically developing females had a mean score of 13.92 ($SD = 3.55$), and typically developing males had a mean score of 15.13 ($SD = 2.95$). For satisfaction with environment, autistic females reported a mean score of 13.78 ($SD = 3.15$), autistic males reported a mean score of 13.98 ($SD = 3.13$), typically developing females reported a mean score of 15.08 ($SD = 3.02$), and typically developing males reported a mean score of 14.91 ($SD = 2.54$). See Appendix D Table 2 for descriptive statistics.
To analyze the significance of the quality of life scores between groups, a two-way analysis of variance (ANOVA) was conducted for each quality of life domain, examining main effects and interactions for gender (cisgender female or cisgender male) and diagnosis (autism spectrum disorder or typically developing). Because multiple pairwise comparisons were made for domain-level analysis, a Bonferroni correction was used to adjust for an inflated p-value. For this group of analyses, the adjusted p-value for significance was less than .0125. The ANOVA results revealed significant main effects for diagnosis and nonsignificant effects for gender on the following domains: physical health ($F_{\text{diagnosis}}(1) = 62.66, p < .000, \eta^2 = .15; F_{\text{gender}}(1) = 2.17, p = .14, \eta^2 = .01$), psychological health ($F_{\text{diagnosis}}(1) = 68.87, p < .000, \eta^2 = .16; F_{\text{gender}}(1) = 1.22, p = .27, \eta^2 = .003$), and environment ($F_{\text{diagnosis}}(1) = 63.43, p = .001, \eta^2 = .03; F_{\text{gender}}(1) = .004, p = .95, \eta^2 < .000$). Results also revealed a significant interaction between diagnosis and gender for social quality of life domain ($F(1) = 10.47, p = .001, \eta^2 = .03$). When these analyses were repeated using an analysis of covariance (ANCOVA) to control for significant group differences in age, education level, and employment status, there was a difference in significant findings. The ANCOVA revealed significant main effects for diagnosis and nonsignificant effects for gender on the following domains: psychological health ($F_{\text{diagnosis}}(1) = 13.66, p = .000, \eta^2 = .07; F_{\text{gender}}(1) = .001, p = .97, \eta^2 < .00$) and social quality of life ($F_{\text{diagnosis}}(1) = 7.88, p < .006, \eta^2 = .04; F_{\text{gender}}(1) = .036, p = .55, \eta^2 < .002$). The main effects for physical health and environmental quality of life were nonsignificant when controlling for covariates. These results suggest that autistic individuals experience a lower quality of life than typically developing individuals, specifically in the domains of psychological health and social quality of life. See Appendix D Table 4 for results.
A multiple linear regression was performed to examine how each quality of life domain was predicted based on camouflaging, gender, and diagnosis.

For quality of physical health, the overall model was statistically significant \((F(3, 370) = 36.48, p < .000, R^2 = .23)\). Camouflaging \((t(1) = -5.73, p < .000, sr^2 = .07)\) and diagnosis \((t(1) = 3.81, p < .000, sr^2 = .03)\) contributed significant unique variance to the model, while gender did not \((t(1) = -1.24, p = .217, sr^2 < .00)\). Camouflaging behavior predicted 7% of unique variance in anxiety scores and diagnosis predicted 3% unique variance in anxiety scores. Overall, the model predicted 23% of variance in anxiety scores. Though their contributions are small, being autistic and camouflaging social deficits significantly predicted lower quality of physical health. See Appendix D Table 5 for results.

Upon examining quality of psychological health, the overall model was statistically significant \((F(3, 369) = 30.01, p < .000, R^2 = .19)\). Camouflaging \((t(1) = -4.39, p < .000, sr^2 = .063)\) and diagnosis \((t(1) = 4.29, p < .000, sr^2 = .04)\) contributed significant unique variance to the model, while gender did not \((t(1) = -1.01, p = .314, sr^2 < .00)\). Camouflaging behavior predicted 6.3% of unique variance in anxiety scores and diagnosis predicted 4% unique variance in anxiety scores. Overall, the model predicted 19% of variance in psychological health scores. Like the results from the physical health model, being autistic and camouflaging one’s autistic characteristics predicted lower quality of psychological health. See Appendix D Table 5 for results.

The overall model for quality of social relationships was significant \((F(3, 371) = 12.96, p < .000, R^2 = .095)\). Significance of the overall model demonstrated that the combination of the three predictor variables of interest (i.e., camouflaging scores, diagnosis, and gender) explained 9.5% of the variance in quality of social relationship scores. Only diagnosis contributed a
significant 3.6% of unique variance of to the model \((t(1) = 3.83, p < .000, sr^2 = .036)\), while camouflaging scores’ \((t(1) = -1.68, p = .09, sr^2 = .007)\) and gender’s \((t(1) = .20, p = .85, sr^2 = .0001)\) unique variance scores were nonsignificant. Diagnosis appears to be the strongest predictor of quality of social relationships, according to this model. See Appendix D Table 5 for results.

For environmental quality of life, the overall model was significant \((F(3,371) = 9.15, p < .000), R^2 = .069\). The combination of camouflaging scores, diagnosis, and gender explained 6.9% of variance in the overall model. When examined separately, reported camouflaging score’s unique variance of 3.5% was the only predictor of significance \((t(1) = -3.65, p < .000, sr^2 = .036)\). The unique variances of diagnosis \((t(1) = .91, p = .36, sr^2 = .002)\) and gender \((t(1) = .101, p = .92, sr^2 < .000)\) were nonsignificant. How much one camouflaged their social deficits predicted satisfaction with one’s environment. See Appendix D Table 5 for results.

**Substance use.** The ASSIST V3.0 examines history and risk level of substance use across 10 different substances. A risk score was calculated based on participants’ ratings of their use of substances and how that use impacted their lives across various domains. In general, higher scores indicated higher risk of substance use. For alcohol, scores from 0 to 10 are considered a lower risk, scores from 11 to 26 are considered a moderate risk, and scores of 27 and higher are considered a high risk. For all other substances, scores from 0 to 3 are considered a lower risk, scores from 4 to 26 are considered a moderate risk, and scores of 27 and higher are considered a high risk. For tobacco use, autistic females \((M = 3.20, SD = 8.55)\) and typically developing females \((M = 3.19, SD = 6.46)\) fell into the lower risk range, while autistic males \((M = 4.58, SD = 9.51)\) and typically developing males \((M = 8.20, SD = 12.80)\) fell into the moderate risk range. For cannabis use, autistic females \((M = 2.94, SD = 5.36)\) fell into the lower risk range,
while autistic males ($M = 4.66, SD = 8.63$), typically developing females ($M = 6.90, SD = 9.53$), and typically developing males ($M = 6.84, SD = 10.33$) fell into the moderate risk range. A two-way ANOVA compared these scores across groups, using an adjusted significant $p$-value of <.005. Of these results, a two-way ANOVA demonstrated that the difference in tobacco scores between gender and diagnostic groups was not significant ($F_{\text{diagnosis}}(1) = 6.71, p = .01, \eta^2 = .02$; $F_{\text{gender}}(1) = 1.76, p = .19, \eta^2 = .01$), and the difference in cannabis scores was significant between diagnostic groups, but not between genders ($F_{\text{diagnosis}}(1) = 10.30, p = .001, \eta^2 = .03$; $F_{\text{gender}}(1) = .09, p = .77, \eta^2 < .000$). An analysis of covariance (ANCOVA) was then performed to control for potential covarying demographic group differences, such as age, education level, and employment status. The ANCOVA performed revealed that the differences in tobacco scores and cannabis scores were not significant between genders and diagnostic groups ($F_{\text{diagnosisxtobacco}}(1) = 5.37, p = .02, \eta^2 = .03$; $F_{\text{genderxtobacco}}(1) = .022, p = .88, \eta^2 < .000$; $F_{\text{diagnosisxcannabis}}(1) = 1.50, p = .22, \eta^2 = .01$; $F_{\text{genderxcannabis}}(1) = .38, p = .54, \eta^2 = .002$). See Appendix D Table 4 for results.

All participants reported a lower risk of alcohol use ($M_{\text{ASDfemale}} = 4.27, SD = 6.82$; $M_{\text{ASDmale}} = 7.62, SD = 9.99$; $M_{\text{TDFemale}} = 8.37, SD = 8.20$; $M_{\text{TDMale}} = 9.39, SD = 11.22$). All participants reported a lower risk of cocaine use ($M_{\text{ASDfemale}} = 1.05, SD = 5.06$; $M_{\text{ASDmale}} = 2.36$, $SD = 7.68$); $M_{\text{TDFemale}} = 1.30, SD = 4.75$; $M_{\text{TDMale}} = 3.03, SD = 7.75$). All participants reported a lower risk of amphetamine use ($M_{\text{ASDfemale}} = 1.13, SD = 4.80$; $M_{\text{ASDmale}} = 2.57, SD = 7.86$); $M_{\text{TDFemale}} = 0.84, SD = 4.01$; $M_{\text{TDMale}} = 3.23, SD = 8.11$). All participants reported a lower risk of inhalant use ($M_{\text{ASDfemale}} = 0.89, SD = 4.67$; $M_{\text{ASDmale}} = 2.18, SD = 7.64$); $M_{\text{TDFemale}} = 0.38, SD = 2.81$; $M_{\text{TDMale}} = 3.14, SD = 8.26$). All participants reported a lower risk of sedative use ($M_{\text{ASDfemale}} = 2.01, SD = 6.91$; $M_{\text{ASDmale}} = 3.64, SD = 8.79$); $M_{\text{TDFemale}} = 1.01, SD = 4.01$; $M_{\text{TDMale}} = 3.29, SD = \ldots$
7.91). All participants reported a lower risk of hallucinogen use ($M_{ASDfemale} = 1.38, SD = 5.43$; $M_{ASDmale} = 2.71, SD = 7.82$; $M_{TDfemale} = 1.08, SD = 3.72$; $M_{TDmale} = 3.53, SD = 8.74$). All participants reported a lower risk of opioid use ($M_{ASDfemale} = 1.78, SD = 5.99$; $M_{ASDmale} = 2.57, SD = 8.45$; $M_{TDfemale} = 0.56, SD = 3.23$; $M_{TDmale} = 3.24, SD = 8.18$). All participants also reported a lower risk of other substance use (e.g., stimulants) that was not better categorized by the above-mentioned substances ($M_{ASDfemale} = 1.67, SD = 6.72$; $M_{ASDmale} = 2.16, SD = 7.54$; $M_{TDfemale} = 0.06, SD = 0.41$; $M_{TDmale} = 1.79, SD = 6.49$). Because the incidence of use across these substances was low for all participants groups, examining significant differences between groups would not yield clinically meaningful results. See Appendix D Table 2 for descriptive statistics.

Multiple linear regressions were performed for each substance reported, using camouflaging, gender, and diagnosis as predictor variables. Low reported use across substances complicated regression analyses. Despite Box-Cox transformations of data, substance use scores continued to display heteroscedasticity. Thus, interpretation of multiple regressions for substance use should be met with caution, as generalizability of results is limited (Field, 2013). The overall models for use of hallucinogens ($F(3,371) = 2.55, p = .055, R^2 = .020$) and cocaine ($F(3,371) = 2.31, p = .076, R^2 = .018$) were not significant. The overall models for use of tobacco ($F(3,371) = 3.77, p = .01, R^2 = .03$), alcohol ($F(3,371) = 6.86, p < .000, R^2 = .053$), cannabis ($F(3,371) = 5.95, p = .001, R^2 = .046$), amphetamines ($F(3,371) = 3.64, p = .013, R^2 = .029$), inhalants ($F(3,371) = 7.97, p < .000, R^2 = .061$), sedatives ($F(3,371) = 4.46, p = .004, R^2 = .035$), opioids ($F(3,371) = 4.67, p = .003, R^2 = .036$), and other substances ($F(3,371) = 3.57, p = .014, R^2 = .028$) were significant. See Appendix D Table 5 for results.

In addition to examination of overall models, the unique variance of each predictor variable was also analyzed. In the overall model for tobacco use, the combination of
camouflaging scores, diagnosis, and gender explained 3% of variation in tobacco scores.

Additionally, diagnosis (t(1) = 3.20, p = .001, sr^2 = .032) and camouflaging scores (t(1) = 2.04, p = .04, sr^2 = .011) contributed significant unique variance of 2.7% and 1.1%, respectively, while the unique variance of gender (t(1) = -1.46, p = .15, sr^2 = .005) was not significant. Though its explanation of variance is limited, being typically developing and having higher camouflaging scores predicted higher tobacco use. The combination of the three predictor variables for the overall model of alcohol use explained 5.3% of variation in alcohol scores, and diagnosis significantly contributed 5% of unique variance (t(1) = 4.40, p < .000, sr^2 = .05). Unique variances of camouflaging scores (t(1) = 1.75 p = .08, sr^2 = .008) and gender (t(1) = -1.13, p = .26, sr^2 = .003) were not significant. For alcohol use, being in the typically developing participant group was a significant predictor of increased use. The three predictor variables explained 4.6% of variation in cannabis use scores. Diagnosis significantly contributed 4.6% of unique variance (t(1) = 4.21, p < .000, sr^2 = .045) and camouflaging scores (t(1) = 2.32 p = .02, sr^2 = .014) contributed 1.4% of unique variance. Gender (t(1) = -.337, p = .74, sr^2 < .000) did not contribute significant unique variance to the model. Cannabis use was predicted by one’s diagnosis and camouflaging scores. Camouflaging scores, diagnosis, and gender explained 2.9% of variation in amphetamine scores in the overall regression model. When analyzing unique variances, camouflaging scores (t(1) = 2.25, p = .03, sr^2 = .013) and gender (t(1) = -2.49, p = .01, sr^2 = .016) contributed significant unique variance. Camouflaging scores contributed 1.3% unique variance and gender contributed 1.6% unique variance. Gender and camouflaging scores were strongest predictors of amphetamine use. The three predictor variables explained 6.1% of inhalant use, and all three predictors contributed significant unique variance. Camouflaging scores contributed 2.8% of unique variance (t(1) = 3.31, p = .001, sr^2 = .028), diagnosis
contributed 1.6% of unique variance (t(1) = 2.50, p = .013, sr² = .016), and gender contributed 3.5% of unique variance (t(1) = -3.72 p < .000, sr² = .035) of inhalant use. The predictor variables explained 3.5% of variance in sedative use. Both gender and camouflaging scores contributed significant unique variance to the model. Gender (t(1) = -2.77, p = .006, sr² = .020) contributed 2% of unique variance and camouflaging scores (t(1) = 2.44, p = .015, sr² = .016) contributed 1.6% of unique variance. Diagnosis (t(1) = 1.34, p = .182, sr² = .005) did not contribute significant unique variance to the model of sedative use. Gender and camouflaging scores were strongest predictors of sedative use in model. In the overall model, camouflaging scores, diagnosis, and gender explained 2.9% of variance in opioid use. Camouflaging scores significantly contributed 2.5% of unique variance (t(1) = 3.07, p = .002, sr² = .025) and gender significantly contributed 1.1% of unique variance (t(1) = -2.06, p = .04, sr² = .011). Diagnosis (t(1) = 1.33, p = .186, sr² = .005) did not contribute significant unique variance to the model of opioid use. Camouflaging scores and gender were strongest predictors of opioid use. Predictor variables in the overall model explained 2.8% of use of other substances. Only camouflaging scores contributed a significant unique variance (1.2%; (t(1) = 2.12, p = .035, sr² = .012). Unique variance of diagnosis (t(1) = =.182, p = .856, sr² < .000) and gender (t(1) = -1.58, p = .115, sr² = .007) were nonsignificant. Camouflaging scores were the strongest predictor of use of other substances. See Appendix D Table 5 for results.

Significance of predictor variables differed by type of substance. However, as stated previously, interpretations of these results are limited given overall low reporting of substance use. While gender, diagnosis, and camouflaging scores predicted substance use scores, overall substance use across all participants was low, and predictions of use between groups may not be clinically meaningful.
Summary of multiple regressions. The linear multiple regressions performed revealed that camouflaging and diagnosis contributed unique variance to models for anxiety, depression, quality of physical health, and quality of psychological health. Separately, diagnosis contributed unique variance to quality of social relationships and camouflaging contributed unique variance to quality of environment. Camouflaging, diagnosis, and gender contributed unique variance to substance use, but differed across substances. These predictor variables did not significantly predict use of hallucinogens or cocaine. Of note, gender contributed significant unique variance to models of substance use amphetamine, inhalants, sedatives, and opioids, which is different from gender’s lack of contribution to other outcome variables in the study. However, when substance use varied between groups (e.g., tobacco and cannabis use), the differences were found to be nonsignificant. For all other substance, reported use across groups was in the low range. Thus, models that predict substance use may be statistically significant, but not clinically meaningful, according to ASSIST V3.0 cut-off scores. Results partially support the study’s hypotheses that camouflaging behaviors and diagnosis predict outcomes, but results also do not support the study’s hypothesis that gender would predict outcomes. Furthermore, camouflaging behaviors and diagnosis did not predict all outcomes, as hypothesized.

Discussion

Previous literature suggests that autistic females may be at greater risk for mental health concerns and have a lower quality of life (Bolognini et al., 1996; Green et al., 1996; Simonoff et al., 2008, Skokauskas & Gallagher, 2012; Sterling et al. 2008). In addition, growing research has found that people with autism engage in some level of substance use, especially as a means to fit in with others (Kronenberg et al., 2015). To address the discrepancy in prevalence rates between males and females, researchers have looked to camouflaging theory as a potential explanation
(Hull et al., 2017). In qualitative interviews, autistic females reported experiencing stress and pressure to relate better with others and appear more neurotypical (Bargiela et al., 2016). Furthermore, clinical observations of autistic females indicate a unique presentation of autism characteristics (Grove et al., 2017; Head et al., 2014). The pressure to fit in that autistic females face and general differences in displays of autistic characteristic have contributed to the development of camouflaging theory (Hull et al., 2017). Growing evidence suggests that autistic females, particularly less severely impacted autistic females, camouflage their social deficits (Lai et al., 2017). As camouflaging theory is a relatively new theory on the symptom presentation of autistic females, research has primarily focused on identifying this phenomenon. Little research has yet to explore the consequences of camouflaging behavior.

Given that previous literature has found both that autistic females experience increasing rates of mental health issues and lower quality of life and that they endorse camouflaging their autistic characteristics, the present study investigated the relationship between these phenomena. Specifically, the present study examined how camouflaging behavior may impact the mental health, quality of life, and level of substance use for autistic females. Autistic females’ reported levels among these outcomes, and they were compared to autistic males and typically developing females. It was hypothesized that autistic females would display more camouflaging behaviors than autistic males and typically developing females and that being a camouflaging autistic female would predict poorer outcomes for mental health, quality of life, and substance use.

Results indicated that autistic females endorsed displaying significantly more camouflaging behaviors than autistic males and typically developing females. The combination of being female and having an autism spectrum disorder diagnosis led to a greater occurrence of camouflaging one’s social communication deficits, as there was a significant interaction for gender and
diagnosis in the analysis of variance performed. These findings support two hypotheses of the present study as well as previous research that has demonstrated that autistic females camouflage their social deficits more than autistic males and typically developing females. Yet, when multiple regressions sought to understand how camouflaging social deficits may impact autistic females’ lives, models revealed that gender did not play a significant role in predicting life outcomes. Instead, the presence of elevated camouflaging behaviors and having an autism diagnosis were the most predictive factors, particularly for symptoms of anxiety, depression, physical health, and psychological health. Interestingly, the presence of camouflaging behaviors and a diagnosis of autism spectrum disorder did not predict differences in the quality of social relationships, quality of environmental needs being met, or risk of substance use. These results supported the study’s hypothesis that camouflaging behaviors and diagnosis would be significant predictors of outcomes for participants, but the results did not support the study’s hypothesis that gender would also be a significant predictor of outcomes. That is, being both autistic and female did not elevate risk of mental health concerns or poorer quality of life.

While the results do not support that gender plays a significant role in adverse outcomes, the data show that camouflaging and diagnosis play a large role these outcomes. Results from the t-tests performed demonstrated that autistic females had significantly higher rates of camouflaging than all other groups in the study. Camouflaging was demonstrated to impact symptoms of anxiety and depression, as well as some aspects of quality of life. Given that autistic females display significant camouflaging behaviors, they continue to be at risk of anxiety and depression.

Though autistic females appear to be at greatest risk, just having an autism diagnosis is a significant risk factor as well. Autistic males also endorsed camouflaging their social communication deficits, high levels of anxious symptoms, and moderate levels of depressive
symptoms. It is important to note that camouflaging impacts the lives of autistic males in a similar way to autistic females. The results of the present study provide novel information on how camouflaging one’s autism characteristics is related to poorer mental health and quality of life outcomes, adding to the growing body of literature on camouflaging theory.

The results of the present study suggest that research and services for autistic individuals need to focus greater attention to the domains of mental health and quality of life. It is imperative that researchers continue to explore how camouflaging plays a role in the mental health and quality of life of autistic individuals. Camouflaging reduces others’ ability to perceive autistic characteristics, which may make an autistic person’s life more stressful or make it more difficult for others to detect when an autistic person needs additional support. In semi-structured interviews with parents of autistic children, parents endorsed multiple stressors regarding access to mental health care for their autistic child, among which included finding providers competent to treat children with autism and co-occurring disorders (Brookman-Frazee et al., 2012). This trend continues into adulthood for autistic individuals, as indicated by the results from Maddox and colleagues’ study (2020). There is a lack of mental health providers equipped to treat individuals with autism spectrum disorder experiencing significant anxiety and depression. Results from the current study support the argument for the need of greater access to mental health care for autistic people and for better training of mental health providers to develop competency among this population. Autism researchers are beginning to address this need by partnering with Project Extension for Community Healthcare Outcomes (Project ECHO) to reach a wide network of healthcare and mental health providers who have autistic patients (see Mazurek et al., 2016 for an example), but more work needs to be done.

Limitations
The current study is presented with limitations. The first limitation is the lack of assessment used to determine an autism spectrum disorder diagnosis. To maximize participant recruitment, the study was presented in an online survey format, which streamlined completion of measures and allowed for a larger geographic sampling. Gold-standard procedures for diagnosing autism spectrum disorder typically include a conducting a comprehensive battery of standardized assessments. However, because the study was conducted in an online format, it was not feasible to conduct this type of diagnostic assessment to confirm an autism diagnosis in those who self-reported one or to ensure that those who self-reported as neurotypical did not meet diagnostic criteria for autism spectrum disorder. Furthermore, the present study did not evaluate cognitive functioning of participants. Autism spectrum disorder and intellectual disability frequently co-occur (Maenner et al., 2020), so conducting a cognitive assessment would have strengthened comparability between autistic and typically developing groups in the study. To address these limitations, the current study collected both self-reported confirmation or denial of an autism spectrum disorder and responses to the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012). As described previously, the SRS-2 shows acceptable convergent validity with gold-standard diagnostic assessment measures for autism spectrum disorder. There is currently no well-established cognitive screener for intellectual disability that can be presented in an online format, so the present study presumed that participants who provided complete data demonstrated at least average cognitive ability.

The present study examined responses from autistic and typically developing adults. The decision to collect data on adults was largely impacted by the Camouflaging Autistic Traits Questionnaire (CAT-Q, Hull et al., 2018) and feasibility of recruiting participants online. The CAT-Q was validated on adults with autism spectrum disorder, so it was necessary to recruit
adult participants to make valid comparisons across groups. Furthermore, consent to study participation is more complicated with child participants in an online format. Recruiting participants under the age of 18 years old requires parental consent, which would be difficult to monitor online. Limiting study participation to adults introduces many contextual variables that are not necessarily present with younger participants. However, focusing the current study on adults also presents a strength of the study. Much of autism research and services focuses on children affected by autism (Shattuck et al., 2011). Results of the present study demonstrate how adults with autism continue to be affected by their diagnosis.

The small sample size of typically developing males should also be acknowledged as a limitation of the current study. A preliminary power analysis indicated that 73 participants were necessary per group to detect a medium effect size. The typically developing male group included 66 participants, falling short of the projected sample size. Typically developing males did not play a role as a primary comparison group for this study (i.e., no hypotheses were made about their performance on measures compared to autistic males); however, typically developing male participants were necessary for data analyses and being able to compare scores across genders and diagnostic groups. The generalizability of the study’s results would have been further strengthened by adequate sampling of this participant group.

The present study also had significant demographic differences between groups in regard to age, education level, and employment status. Typically developing female participants were more likely to report high school or some college education than other groups. Additionally, they were more likely to be employed part time; not employed and looking for work; or not employed and not looking for work than other groups. These differences may be explained by the
recruitment of typically developing participants from an undergraduate research pool, given that the level of education and employment status reported by participating typically developing females mirrors the experience of undergraduates. Even with these significant demographic differences between groups, the differences did not necessarily change the interpretation of the study’s results. Education and employment are associated with better outcomes (Ross & Wu, 1995), so autistic people’s reporting of more adverse outcomes, despite typically developing females’ reported lower educational achievement and lower employment status, is compelling.

As part of the discussion of gender groups included in the study, it should be noted that, unfortunately, the study excluded transgender, nonbinary, and gender non-conforming individuals. This decision significantly limits the generalization of findings. The exclusion of transgender, nonbinary, and gender non-conforming individuals was not done lightly. Growing research has found elevated rates of transgender and gender-diverse identification among the autism community (Warrier et al., 2020). Furthermore, transgender and gender-diverse autistic individuals may be at an even greater risk of mental health issues (Murphy et al., 2020). The present study was limited by its small sample size of gender-diverse participants across groups, which made it difficult to conduct any analyses with power. Thus, it is important that the methods of the present study be expanded in future studies to include larger recruitment of gender-diverse participants.

Data collection for the present study was conducted during the SARS-CoV-2 (also known as COVID-19) global pandemic (Centers for Disease Control and Prevention [CDC], 2020). During this time, COVID-19 presented as a highly contagious illness that was spread through direct contact between individuals (CDC, 2020). In response to the virulent nature of COVID-19, the CDC and governmental officials across the country recommended that individuals practice
social distancing (CDC, 2020). Social distancing is described as maintain physical distance from others in public spaces and not physically socializing with people who lived outside of one’s household (CDC, 2020).

Many researchers continue to study the impact of experiencing a global pandemic and social distancing. Ettman and colleagues (2020) evaluated prevalence data on depression rates across the United States before and during the COVID-19 pandemic. Prior to the COVID-19 pandemic, 8.5% of participants reported depressive symptoms. When depression symptoms were measured during the COVID-19 pandemic, depression symptoms across participants rose to 27.8%. Though overall rates increased, patterns of depressive symptoms remained similar to those before COVID-19, such as depression affecting women more than men and affecting those with fewer resources. Another study conducted by Czeisler and colleagues (2020) found similar results regarding increased rates of depression. In addition, these researchers found that rates of anxiety, substance use, trauma, and stress increased during the COVID-19 pandemic. The social isolation required of individuals during the COVID-19 pandemic is thought to be a major contributor to the decline in mental health across United States citizens (Khan et al., 2020; Saltzman et al., 2020). Social support is a significant protective factor for mental health (Leigh-Hunt et al., 2017), which the pandemic had taken away from many people. The impact of the COVID-19 pandemic presents a significant limitation to the results of the present study. The study’s hypotheses were generated from research on the social isolation and mental health challenges often felt by autistic females, yet the global pandemic has increased social isolation and mental health challenges for everyone. Given this, camouflaging behaviors may not be playing as large a role, presently, in impacting mental health challenges and quality of life, as hypothesized.
Conclusion

The present study was affected by several limitations that should be addressed in future research. Firstly, the study would benefit from replication when the COVID-19 pandemic has subsided and social isolation and mental health challenges for the general public have decreased. Secondly, re-examination of outcome variables would benefit from a larger sample size, specifically among gender-diverse participants and typically developing male participants. Furthermore, the present study did not compare camouflaging behaviors at the domain level. This level of detail was outside of the scope of the present study, but it would be interesting to address in future research. There may be specific domains of camouflaging behavior that are more frequently endorsed by autistic females on the CAT-Q that affect their lives differently from others. Finally, the present study only examined mental health, quality of life, and substance use outcomes across participants. These outcomes, while important, do not encompass all areas of life that could be explored in future studies.

Despite limitations of the current study, results have provided continued evidence that autistic females are camouflaging their behavior at higher rates than others. Furthermore, people with autism are endorsing increased mental health concerns and lower quality of life. These findings present novel information to the growing body of literature on the lives of autistic individuals overall, and on the lives autistic females specifically. Autistic females have long been under-represented in autism spectrum disorder, and the current study sheds light on their experiences. Additional work is needed to further explore the impact of camouflaging on autistic females, and, as these results suggest, on autistic males as well.
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Appendix A

Recruitment email

Consent for individuals with autism spectrum disorder

SPARK consent form

Gift card delivery email

Consent for typically developing females and males
Recruitment email

Experiences of individuals with autism spectrum disorder
Researchers: Cortney Janicki, M.A., & Kristin V. Christodulu, Ph.D.

We are seeking participants for my dissertation study investigating the experiences of individuals with autism spectrum disorder related to their quality of life and relationships with others. Participation will take **20 - 30 minutes** to complete the survey.

Eligibility: Individuals with diagnosed autism spectrum disorder who are 18 years of age or older.

Should you agree to participate, you will be taken to a Qualtrics webpage, where you will be asked to:
1) Provide demographic information about yourself
2) Complete a survey regarding your experiences with others, your mood, and quality of life

If you are interested in participating in this study, please click the following link:

[LINK]
Consent for individuals with autism spectrum disorder

Welcome!

We are interested in understanding the experiences of individuals with autism spectrum disorder. You will be presented with information that may or may not be relevant to your experiences and asked to answer some questions about it. Please be assured that your participation will remain anonymous and your responses will be kept completely confidential.

The study should take you around 20-30 minutes to complete. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice. If you would like to contact the Principal Investigator in the study to discuss this research, please e-mail Cortney Janicki at cjanicki@albany.edu.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are at least 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

A. I consent to being in the study
B. I do not consent, I do not wish to participate
SPARK consent form

University at Albany
INFORMED CONSENT INFORMATION
FOR RESEARCH PARTICIPATION

Study Title: Impact of Camouflaging on Adults with Autism

Principal Investigator: Cortney Janicki, M.A.

Co-Principal Investigator: Kristin V. Christodulu, Ph.D.; kvchristodulu@albany.edu

IRB Study Number: 20E050

I am a graduate student at the University at Albany, in the Department of Psychology. I am planning to conduct a research study, which I invite you to take part in. This form has important information about the reason for doing this study, what we will ask you to do if you decide to be in this study, and the way we would like to use information about you if you choose to be in the study.

Why are you doing this study?
You are being asked to participate in a research study about the experiences of individuals with autism spectrum disorder.

The purpose of the study is to understand the quality of life for individuals with autism spectrum disorder and how they may or may not experience mental health concerns.

What will I do if I choose to be in this study?
You will be asked to provide information about yourself and answer questions that may or may not be relevant to your life experiences.

Study time: Study participation will take approximately 20-30 minutes.

Study location: All study procedures will take place online.

What are the possible risks or discomforts?
Your participation in this study does not involve any physical or emotional risk to you beyond that of everyday life. You may be uncomfortable with some of the questions and topics we will ask about. If you are uncomfortable, you are free to not answer or to skip to the next question.

As with all research, there is a chance that confidentiality of the information we collect from you could be breached – we will take steps to minimize this risk, as discussed in more detail below in this form.

What are the possible benefits for me or others?
You are not likely to have any direct benefit from being in this research study. This study is designed to learn more about the experiences of females with autism spectrum disorder by comparing how females and males with autism respond to social situations. The study results may be used to help other people in the future.

**How will you protect the information you collect about me, and how will that information be shared?**

Results of this study may be used in publications and presentations. Your study data will be handled as confidentially as possible. If results of this study are published or presented, individual names and other personally identifiable information will not be used.

To minimize the risks to confidentiality, we will use a unique numerical code instead of names to identify information collected and store data on a password-protected server that is only accessible to study investigators.

We may share the data we collect from you for use in future research studies or with other researchers – if we share the data that we collect about you, we will remove any information that could identify you before we share it.

For those individuals who participated in the SPARK study, we are asking your consent for the SPARK study, hosted by the Simons Foundation, to share with the Center for Autism and Related Disabilities at the University at Albany - SUNY the clinical and demographic data collected during your participation in SPARK. This information will be shared using your linked research ID number and using a secure transfer system. We are also asking for your consent to share the data we collect during the study here at the Center for Autism and Related Disabilities at the University at Albany – SUNY with SPARK in order to add to the information that was collected during your participation in SPARK. Please note that the SPARK study will be able to link your identifying information to the data you contribute to this project.

Researchers at the Center for Autism and Related Disabilities at the University at Albany – SUNY will receive only coded data (data with your identifying information such as your name will be removed) unless you enter identifying information into the open text fields of surveys.

The Simons Foundation funds innovative research and provides coded data access (data with your identifying information removed) to qualified researchers. Researchers can file an application with the Simons Foundation to obtain access to your study data for research purposes. Experts at the Simons Foundation who protect health and science information will look at every request carefully to minimize risks to your privacy.

**Financial Information**

Participation in this study will involve no cost to you. At the end of your participation in the study, you have the option to enter yourself into a raffle for a $25 Amazon gift card. One Amazon gift card will be raffled for every 40 survey entries, so there is a 1 in 40 chance of winning.
**What are my rights as a research participant?**

Participation in this study is voluntary. You do not have to answer any question you do not want to answer. If at any time and for any reason, you would prefer not to participate in this study, please feel free not to. If at any time you would like to stop participating, you may close the survey and terminate your participation. You may withdraw from this study at any time, and you will not be penalized in any way for deciding to stop participation.

If you decide to withdraw from this study, any information collected from you will not be used.

**What if I am a University at Albany student or employee?**

You may choose not to participate or to stop participating in this research at any time. This will not affect your class standing, grades, employment, or any other aspects of your relationship with the University at Albany.

**Who can I contact if I have questions or concerns about this research study?**

If you have questions, you may contact the Investigator, Cortney Janicki, at cjanicki@albany.edu or (518) 442-9078.

If you have any questions about your rights as a participant in this research, you can contact the following office at the University at Albany:

**Institutional Review Board**

University at Albany  
Office of Regulatory and Research Compliance  
1400 Washington Ave, MSC 100E  
Albany, NY 12222  
Phone: 1-866-857-5459  
Email: rco@albany.edu

**Consent**

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above. By clicking “I consent,” you consent to participating in the research study. If you do not consent to participating in this study, you may close out of the survey now.

- ◐ Yes, I consent
- ○ No, I do not consent

Participating (or choosing not to participate) in this study will not change your participation in the SPARK study. You may also choose to withdraw your participation at any time.
Gift card delivery email

To be sent to participants via email upon completion of the study/winning lottery drawing/etc depending on study protocol.

Subject: Follow-up: Impact of Camouflaging on Adults with Autism

Dear @@FirstName,

Thank you for participating in the Impact of Camouflaging on Adults with Autism study! We appreciate your time and effort to advance autism research. You were randomly selected as one of the lottery winners of a $25 gift card.

Below is the code for your Amazon gift card:
[Insert code]

For Amazon gift card help click here (links to: https://www.amazon.com/gp/help/customer/display.html/?nodeId=200138510#howto)

Thank you again for your time completing our study!

Sincerely,

Cortney Janicki-Menzie, MA
Center for Autism and Related Disabilities
University at Albany – SUNY
Consent for typically developing females and males

Welcome!

We are interested in understanding the experiences of adult women and men. You will be presented with information that may or may not be relevant to your experiences and asked to answer some questions about it. Please be assured that your participation will remain anonymous and your responses will be kept completely confidential.

The study should take you around 20-30 minutes to complete. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice. If you would like to contact the Principal Investigator in the study to discuss this research, please e-mail Cortney Janicki at cjanicki@albany.edu.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are at least 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

A. I consent to being in the study
B. I do not consent, I do not wish to participate
Appendix B

Demographic Questionnaire

Demographic Table (Table 1)
Demographic Questionnaire

1. Date of birth (mm/dd/yyyy) __________

2. Country in which you currently reside: ______________

3. If in the United States, in which state do you currently reside? ________________

4. What is your gender identity?
   a. Cisgender male
   b. Cisgender female
   c. Trans male
   d. Trans female
   e. Nonbinary/third gender
   f. Other: _______________

5. Are you of Hispanic, Latino, or Spanish origin?
   a. No, not of Hispanic, Latino, or Spanish origin
   b. Yes, Mexican, Mexican-American, Chicano
   c. Yes, Puerto Rican
   d. Yes, Cuban
   e. Yes, another Hispanic, Latino, or Spanish origin: ___________________

6. What is your race? (Check one or more boxes)
   a. White (e.g., German, Irish, English, Italian, Lebanese, Egyptian, etc.)

   _______________

   b. Black or African-American (e.g., African American, Jamaican, Haitian, Nigerian, Ethiopian, Somali, etc.)
c. American Indian or Alaskan Native Print name of enrolled or principal tribe(s) (e.g., Navajo Nation, Blackfeet Tribe, Mayan, Aztec, Native Village of Barrow Inupiat Traditional Government, Nome Eskimo Community, etc.)

d. Asian or Asian American (e.g., Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese, Pakistani, Cambodian, Hmong, etc.)

e. Pacific Islander (e.g., Native Hawaiian, Samoan, Chamorro, Tongan, Fijian, Marshallese, etc.)

f. Some other race

7. What is the highest level of school you have completed or the highest degree you have received?
   a. Less than high school degree
   b. High school degree or equivalent (e.g., GED)
   c. Some college, but no degree
   d. Associate degree
   e. Bachelor’s degree
   f. Graduate degree

8. Which of the following categories best describes your employment status?
   a. Employed full-time
   b. Employed part-time
c. Not employed, looking for work

d. Not employed, not looking for work

e. Retired

f. Disabled, not able to work

9. Do you have a current/active diagnosed mental health diagnosis?

   a. Yes

   b. No

10. If yes to question #9, please select and/or describe your current/active diagnosed mental health diagnosis

    a. Depression

    b. Generalized Anxiety Disorder

    c. Social Anxiety Disorder

    d. Agoraphobia

    e. Obsessive Compulsive Disorder

    f. Bipolar Disorder

    g. Other: ___________________________

11. If yes to question #9, who diagnosed you?

    a. Medical doctor (e.g., primary care physician)

    b. Psychologist or Psychiatrist

    c. Other: _______________

12. Do you have a diagnosed developmental disorder (e.g., attention-deficit/hyperactivity disorder, autism spectrum disorder) or learning disorder?

    a. Yes
b. No

13. If yes to question #12, please select and/or describe your developmental disorder or learning disorder diagnosis
   a. Autism spectrum disorder
   b. Attention-deficit/hyperactivity disorder
   c. Learning disorder
   d. Other: _______________

14. If yes to question #12, who diagnosed you?
   a. Medical doctor (e.g., primary care physician)
   b. Psychologist or Psychiatrist
   c. Other: _______________
Table 1 *Descriptive statistics of sample.*

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<td>21</td>
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<td>58</td>
</tr>
</tbody>
</table>
Appendix C

Debriefing letter with resources
Debriefing letter with resources

Thank you for your participation in our study! Some of the questions asked in this survey were sensitive in nature. Please be assured that your participation will remain anonymous and your responses will be kept completely confidential.

If you have any questions about the study, please contact Cortney Janicki at cjanicki@albany.edu.

The New York State Office of Mental Health has a list of mental health providers in each area of New York. These providers can address mental health concerns and provide diagnostic evaluations: https://my.omh.ny.gov/bi/pd/saw.dll?PortalPages

The Substance Abuse and Mental Health Services Administration provides information and connection to treatment services for those affected by alcohol and substance use. Their national helpline can be reached at 1-800-622-HELP (4357). https://www.samhsa.gov/find-help/national-helpline

The University at Albany has several mental health resources for students:
- Counseling and Psychological Services at 400 Patroon Creek Blvd. Ste 104 Albany, NY 12206. (518) 442-5800, https://www.albany.edu/counseling_center/

If you are thinking about suicide, are worried about a friend or loved one, or you would like emotional support, the National Suicide Prevention Hotline provides 24/7 access to trained professionals who can talk to you: https://suicidepreventionlifeline.org/talk-to-someone-now/; 1-800-273-8255.
Appendix D

Table 2 Descriptive statistics of outcome variables

Table 3 t-test results for camouflaging behaviors

Table 4 Two-way ANOVA results

Table 5 Multiple linear regression results
Table 2 *Descriptive statistics of outcome variables.*

<table>
<thead>
<tr>
<th></th>
<th>Autistic Females</th>
<th>Autistic Males</th>
<th>Typically Developing Females</th>
<th>Typically Developing Males</th>
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</thead>
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<tr>
<td><strong>CAT-Q M(SD)</strong></td>
<td>5.28 (.96)</td>
<td>4.64 (1.10)</td>
<td>3.29 (1.05)</td>
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<td>15.14 (2.56)</td>
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Table 3 *t-test results for camouflaging behaviors.*

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*Compared to autistic females.
Cannabis Use

| Diagnosis | 10.30 | 1 | .001 | .03 |
| Gender    | .09   | 1 | .77  | .000 |
| Diagnosis x | .89  | 1 | .35  | .002 |

*Only substance use scores that were categorically different across groups were examined for significance*

Table 5 *Multiple linear regression results.*

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