Title: The relationship between camouflaging and mental health in autistic children and adolescents

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Approved researchers can obtain the SSC population dataset described in this study by applying at https://base.sfari.org.

Lay Summary

Autistic people may mask or camouflage their autistic traits, particularly in social situations. There is a lack of information on camouflaging in young people, and also about how camouflaging relates to mental health. Our study found that older autistic young people were more likely to camouflage. We also found that camouflaging was associated with anxiety and depression in autistic children and adolescents.

Abstract

Camouflaging involves the masking of autistic traits in social situations. While camouflaging may function as a potential barrier to the early diagnosis of autism, minimal research into camouflaging in autistic young people has been conducted. It is also important to evaluate the impact of camouflaging on the mental health of autistic children and adolescents. This study evaluated camouflaging in a sample of 359 female and 374 male autistic children and adolescents(4-17 years, 48.9% females). Findings indicated that camouflaging was a significant predictor of internalising (i.e., anxiety, depression, somatic complaints) symptoms, when controlling for age, gender, and IQ. We also found evidence for some gender differences in camouflaging. Parents endorsed more autistic traits for females compared with males, whereas there were no differences in autistic traits across sex in the clinician-administered assessment. There was also evidence for a relationship between age and camouflaging, with adolescents showing a larger discrepancy between parent and clinician reported autistic traits. This has implications for clinical assessment and future research and is important for understanding how best to support the mental health of autistic children and adolescents.

Keywords: Camouflaging; Gender; Autism Spectrum Disorder; Internalising Symptoms; Children; Adolescents, Mental health.

Autism spectrum disorder is a neurodevelopmental disorder characterised by social and communication difficulties, as well as repetitive behaviours and restricted interests (Diagnostic and Statistical Manual of Mental Disorders; 5th ed.; DSM–5; APA, 2013). Autism is associated with a higher rate of mental health difficulties (Rynkiewicz & Łucka, 2018) and early identification is important to provide appropriate support for autistic individuals (Eldevik et al., 2009; Koegel, Koegel, Ashbaugh, & Bradshaw, 2014). Evidence further suggests that autism is diagnosed later in girls compared to boys (Begeer et al., 2013; Jorieke Duvekot et al., 2017; Rutherford et al., 2016), with autistic traits less likely to be detected in girls by clinicians (Lai et al., 2011) and teachers (Bargiela, Steward, & Mandy, 2016; Dean, Harwood, & Kasari, 2017).

Camouflaging has been identified as a potential barrier to the early identification of autism. Camouflaging refers to the masking of autistic traits as a coping strategy in social situations (Rynkiewicz et al., 2016; Tubío-Fungueiriño, Cruz, Sampaio, Carracedo, & Fernández-Prieto, 2020). Purported to first develop during childhood and adolescence (L. Hull et al., 2017), camouflaging may include deliberately copying another's body language (L. Hull et al., 2019) and covertly mimicking peers' gestures, facial expressions, interests, and topics of conversation, in an effort to 'fit in' (Tierney, Burns, & Kilbey, 2016). Research suggests that engaging in camouflaging is exhausting and may lead to detrimental mental health outcomes such as anxiety, stress, and depression (Cassidy et al., 2020; L. Hull et al., 2017). While the academic literature has used the term camouflaging, masking or compensation to describe this phenomenon, autistic people describe this phenomenon as 'adaptive morphing' in response to increased social, emotional and physical risk of harm (Lawson, 2020). Lawson (2020) argues that rather than coming from a conscious desire to deceive or pretend, adaptive morphing is a survival mechanism for autistic people. In this paper, we will be discussing this phenomenon using the term

camouflaging. However, it is important to note that our conceptualisation of camouflaging is from the perspective of this behaviour as an adaptive coping mechanism.

The study of camouflaging and its potential impacts is a relatively new and emerging area of research. Few clear definitions of camouflaging have been developed (Beck, Lundwall, Gabrielsen, Cox, & South, 2020; Fombonne, 2020), and some camouflaging research has been methodologically limited (L. Hull et al., 2020; Williams, 2021). Lai et al. (2017) have quantified camouflaging as "the discrepancy between a person's 'external' behavioural presentation in social–interpersonal contexts and a person's 'internal' status" (Lai et al., 2017, p. 699). This discrepancy approach calculates a camouflaging score based on the difference between clinically observed characteristics (as indicated by their score on the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, & DiLavore, 1999) and their self-reported endorsement of autistic traits (as indicated by their score on the Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), and the Reading the Mind in the Eyes test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Camouflaging has been shown to be significantly higher in adults with autistic traits compared to those without (L. Hull et al., 2019), and is reported more by autistic females than males (L. Hull et al., 2019; Lai et al., 2017). However, no gender differences in camouflaging have been reported for those without autistic traits (L. Hull et al., 2020). Evidence further suggests that camouflaging may have a significant impact on autistic individuals. For example, the situation specific utilisation of camouflaging (e.g., at work versus at home) has been positively correlated with stress, anxiety, social anxiety and depression and negatively correlated with wellbeing (Cage & Troxell-Whitman, 2019; L. Hull et al., 2019). In addition, camouflaging has been associated with suicidal thoughts and behaviours (Cassidy et al., 2020). Others have failed to

find significant associations between camouflaging and anxiety or stress, which the authors indicated may be due to camouflaging in adults being an "already adapted behavioural pattern" (Lai et al., 2017, p. 698). However, there is ample research to suggest that this is not the case (Lawson, 2020).

There is a lack of research on camouflaging in autistic children and adolescents. However, qualitative studies offer autobiographical reports of camouflaging and its consequences in young autistic females (Cook, Ogden, & Winstone, 2018; L. Hull et al., 2017). For example, young autistic girls reportedly utilise media sources to mimic social behaviours as well as smiling to appear happy (Tierney et al., 2016). Notably, autistic girls report that they cease camouflaging at home after having engaged in such behaviours at school (Tierney et al., 2016), and they also report that their teacher's fail to detect their autistic traits (Bargiela et al., 2016). Additionally, autistic girls report negative mental health impacts of camouflaging, including stress, anxiety, psychosomatic chronic pain (Cook et al., 2018), as well as identity confusion, self-harm and suicidal ideation (Tierney et al., 2016).

Observational and experimental research involving autistic children and adolescents has provided evidence of camouflaging behaviours as a function of sex. For example, autistic girls are more likely than autistic boys to sit near peer groups without contributing to conversation, as opposed to engaging in solitary activities (Dean et al., 2017). This behaviour, which is also higher in autistic children than neurotypical children, may make it more difficult for teachers to detect autistic traits in girls. Others have also reported differences in clinically assessed autistic traits such as expressive gestures and communication difficulties in autistic girls

(Rynkiewicz et al., 2016). In addition, Ratto et al (2018) showed that parents reported more autistic traits and poorer adaptive functioning in autistic girls, despite being matched on clinician administered observational assessments. This highlights the potential to use a discrepancy

approach for both self report and parent reported measures of autistic traits. While there is emerging evidence for gender differences in camouflaging using parent report measures, none of the aforementioned studies have looked at the potential association between camouflaging and mental health in young people. The current study sought to assess camouflaging in a sample of autistic children and adolescents. We used the discrepancy approach as outlined by Lai et al. (2017) to operationalise camouflaging as the difference between clinician observations and parent reported autistic traits. Our study aimed to examine gender differences in camouflaging, and the relationship between camouflaging and mental health in autistic children and adolescents.

Method

Participants

Participants were drawn from the Simons Foundation Autism Research Initiative's (SFARI) Simons Simplex Collection (SSC: Fischbach & Lord, 2010). SSC is a database of clinical, neurobiological, and genetic data on 1877 families with one autistic child. Families were recruited via partnerships with local disability service providers, advocacy and parent groups, and media and internet advertisements, and data was collected at university clinics across the United States. For study inclusion, children (aged between 4 years and 17 years, 11 months) were required to meet diagnostic thresholds on two standardized diagnostic measures– the Autism Diagnostic Interview- revised (ADI-R; Rutter, Bailey, & Lord, 2003) and the ADOS (Lord et al., 1999). Participants were excluded if they were born with perinatal complications, if they had co-occurring intellectual disability, or if one of their parents had a previous diagnosis of autism.

The sample was matched to ensure statistical power and a balanced female to male ratio. Version 27 of the Statistical Program for the Social Sciences (SPSS: IBM, 2020) was used for all statistical analyses. List-wise deletion was used to remove male participants with missing data.

'Fuzzy' case-control matching (IBM, 2020) was then used to randomly match male cases to all available female cases based on the demographic variables age, parent income, and highest level of parental education. Females with missing data on key variables were then removed. Visual inspection of frequency plots confirmed normal distributions of demographic variables for both females and males. T-tests confirmed there were no significant gender differences in age, parent income, or highest level of parental education ($p < 0.05$). The final sample consisted of 359 females ($M = 9.07$ years, $SD = 3.59$) and 374 males ($M = 8.74$ years, $SD = 3.70$).

Measures

Autism Diagnostic Observation Schedule

The Autism Diagnostic Observation Schedule (ADOS: Lord et al., 2000) is a semi-structured clinician administered diagnostic assessment of autism. It includes an assessment of social communication, social interaction, play, and restricted and repetitive behaviours. The ADOS consists of four modules, which are administered depending on age and verbal ability. The Calibrated Severity Score (CSS: Gotham, Pickles, & Lord, 2009) was used in this study, as it controls for age and verbal ability, allowing for comparison of scores across the four modules. The CSS was derived by mapping raw ADOS scores onto a 10-point scale, where a higher score indicates greater endorsement of autistic traits. The ADOS has high internal validity (Mazefsky, Kao, & Oswald, 2011) and good to excellent inter-rater reliability (Zander et al., 2016).

Social Responsiveness Scale

The Social Responsiveness Scale (SRS-parent; Constantino et al., 2003) is 65-item parent-completed questionnaire used to measure their child's social communication. Items are rated on a 4-point Likert scale from 0 (*never true*) to 3 (*almost always true*). A total raw score, where a higher score indicates greater endorsement of autistic traits, was computed by combining responses across five domains – 1) social awareness (e.g., "is aware what others are feeling"), 2)

social cognition ("understands meaning of facial expressions)", 3) social communication ("has trouble keeping up with the flow of a conversation"), 4) social motivation ("would rather be alone than with others"), and 5) autistic mannerisms (e.g., "shows unusual sensory interests"). The SRS-parent has satisfactory to good convergent validity with the ADOS (Takei et al., 2014), excellent internal consistency and test-retest reliability, and moderate to strong inter-rater reliability (Bölte, Poustka, & Constantino, 2008).

Child Behaviour Checklist

The Child Behaviour Checklist (CBCL: Achenbach & Rescorla, 2000) is a 113-item parent-report questionnaire of emotional and behavioural difficulties in children and adolescents. Items are scored on a 3-point Likert scale from 0 (*not true)* to 2 (*very true or often true*). The CBCL is comprised of two broad dimensions: internalising symptoms and externalising symptoms. The internalising domain, which was used in this study, is generated from questions that assess anxiety ("afraid to try new things"), depression ("cries a lot"), somatic complaints ("nausea without medical cause") and obsessive and disordered cognitions ("can't stand having things out of place"). T-scores standardised against age and sex norms were used to allow for comparisons across the preschool (1.5-5 years) and school-aged (6-18 years) versions. The CBCL has high to very high test-retest reliability, and good internal consistency (Achenbach & Rescorla, 2000).

Statistical procedure

This study utilised a discrepancy approach to calculate the difference between a clinician administered assessment and parent report measure. We followed the discrepancy approach outlined by Lai et al. (2017). Scores on the SRS-parent and ADOS were standardised using z-standardisation to allow for arithmetic manipulation between the two measures, as they are calculated on different scales. Following this, ADOS scores were subtracted from SRS-parent

scores to calculate a camouflaging (CAM) score for each participant. Higher scores indicate more discrepancy between clinician and parent report measures and therefore more potential camouflaging behaviours.

Independent samples t-tests were run to examine gender differences in both CAM, and scores on the ADOS and SRS-parent. T-tests were also conducted to compare gender differences across IQ and internalising symptom scores on the CBCL. IQ was assessed by the Mullen Scales of Early Learning (Mullen, 1995), the Differential Ability Scales-II (Elliot, 2007), the Wechsler Intelligence Scale for Children (Wechsler & Kodama, 1949) or the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999) depending on the age of the participant.

Two regression models were also implemented. The first was used to determine the relationship between age, gender and IQ and camouflaging scores. An additional regression model was implemented to examine the relationship between camouflaging and internalising symptoms, including gender, age, and IQ as covariates in the model.

Ethics approval

Ethics approval was obtained from University of Technology Sydney, Human Research Ethics Committee (ETH201800246 #021).

Results

Gender differences

Independent t-tests were conducted to examine gender differences across age, IQ, camouflaging, and SRS-parent, ADOS and CBCL scores. Scores on the SRS-parent were significantly higher in females compared to males. There were no significant gender differences in ADOS scores, with clinician rated scores showing similar distributions for both autistic males and

females. There were no significant differences in camouflaging scores between males and females. However, this result approached significance ($p = 0.08$), with an effect size of 0.13. In addition, the pattern of the data was in the direction predicted for each gender (i.e., the CAM female mean was a positive value ($z = 0.09$), whereas the CAM male mean was negative ($z = -0.08$). Figure 1 shows the distribution of CAM scores for males and females. Lastly, full-scale IQ was significantly higher in males than females. Group comparisons were also investigated based on IQ, indicating that participants with an IQ < 70 and > 70 showed no differences in camouflaging scores ($p < 0.05$). Results of the independent samples t-tests are presented in Table 1.

In order to determine the impact of age, gender and IQ on camouflaging, a multiple regression model was implemented. The results indicated that age was a significant predictor of camouflaging when controlling for gender and IQ ($p < 0.01$). Group comparisons indicated that autistic children aged <13 years (n = 608) had a CAM score of -0.06 (SD = 1.3), whereas autistic adolescents >=13 years (n = 125) had a significantly higher camouflaging score of 0.31 (SD = 1.3). Figure 2 shows the distribution of camouflaging scores across children and adolescents.

INSERT FIGURE 1 HERE

INSERT TABLE 1 HERE

INSERT FIGURE 2 HERE

A multiple regression model was constructed with internalising symptoms (i.e., CBCL) as the dependent variable, and CAM, age, and gender as predictor variables. IQ was added as a predictor covariate as a result of the significant t-test.

The overall regression model was significant with the four independent variables (CAM, age, gender, IQ) collectively accounting for 21% of variance in internalising symptoms. Results

indicated that camouflaging was a significant predictor of internalising symptoms, controlling for the effects of gender, age, and IQ (p <.001). Additionally, IQ was a significant predictor of internalising symptoms, after controlling for age and gender. Results of the regression analyses are presented in Table 2.

INSERT TABLE 2 HERE

Discussion

This study aimed to evaluate gender differences in camouflaging in a sample of autistic children and adolescents. It also aimed to examine the relationship between camouflaging and internalising symptoms. Parents reported autistic girls as having more social communication difficulties compared to autistic boys. However, clinician ratings were similar across both autistic males and females. Camouflaging was not significantly higher in females than males, although this result was approaching significance. Age was found to be a significant predictor of camouflaging scores, when controlling for gender and IQ. Finally, we found that camouflaging significantly predicted internalising symptoms, controlling for gender, age, and IQ.

Our results were consistent with previous research that has used the discrepancy approach to quantify camouflaging in adults, as we found no significant gender differences via clinician assessment alongside significant gender differences via parent assessment (Lai et al., 2017; Rynkiewicz et al., 2016). This also indicates that this approach may be useful for future research evaluating camouflaging in autistic children and adolescents.

A notable caveat to the discrepancy approach is that rather than providing a direct measure of camouflaging, it assesses variability in behaviour *due to* camouflaging (Lai et al., 2017). In addition, it may be that parent-report in the discrepancy approach is not an accurate representation

of a child's autistic traits, as parent report can be impacted by parental psychopathology (Schnabel et al., 2020), parental autistic traits (Hallmayer et al., 2011) or other factors such as parental expectations and gender norms. Interestingly, there were no significant gender differences reported on the CBCL, suggesting that gender did not impact reporting on this other parent report measure. While we were unable to provide this within the current study, future research would benefit from comparing this discrepancy approach with an independent measure of camouflaging. Observational studies that monitor a child's behaviour across both public and private contexts could provide a form of cross-validation of the use of the parent-report in the discrepancy approach.

Given that autistic females were rated as having more social communication difficulties by their parents and not by clinicians, it was surprising that the overall camouflaging score was not significantly higher in females compared to males. This is in contrast to previous research that indicated camouflaging is higher in autistic females compared to males in an adult sample (eg: Lai et al., 2017) and in autistic girls (Ratto et al., 2018). We offer two potential explanations for this non-significant result. Firstly, rates of camouflaging may be higher in males than previous research has claimed (eg: L. Hull et al., 2019; Lai et al., 2017). Importantly, such research does not claim that camouflaging is a behaviour that is unique to females, but simply higher in females compared to males. Clinically, the implication of this is that *both* boys and girls should be assessed for potential camouflaging behaviours. In our sample, male camouflaging may have been higher than evidenced in previous research.

Previous studies that have indicated that camouflaging is higher in females compared to males did so in non-clinical samples (eg: Lai et al., 2017). However, the sample in the current study included individuals with a pre-existing autism diagnosis. Thus, the individuals in our sample were required to show enough autistic traits to receive a formal diagnosis of autism.

Perhaps gender differences in camouflaging are most pronounced for those who do not meet the clinical threshold for autism. In addition, it is worth noting that, despite the non-significant result in camouflaging scores, the data did demonstrate trends in the expected directions; the mean for autistic females was above the population mean and the mean for autistic males was below the population mean.

Our results should be considered within the broader literature related to gender differences associated with autism. In girls compared to boys, autism is more likely to be misdiagnosed (Aggarwal & Angus, 2015) or entirely missed (Jorieke Duvekot et al., 2017). Additionally, research indicates that girls with similar levels of autistic traits are required to exhibit more severe intellectual difficulties, and higher levels of behavioural problems in order to receive an autism diagnosis (Dworzynski, Ronald, Bolton, & Happé, 2012). This evidence aligns with our finding of significantly lower IQ scores in autistic females, despite the equivalent levels of clinician-assessed autistic traits across genders. Understanding this is important for the timely assessment and diagnosis of autism in females, in order to provide appropriate support.

Age is also another factor that needs to be considered in terms of the development of camouflaging. Our results indicated that age was a significant predictor of camouflaging scores over and above gender and IQ. This highlights the importance of considering how these behaviours emerge over time and fits with previous research that states that camouflaging develops in childhood and adolescence (L. Hull et al., 2017). However, it also needs to be considered whether this finding may also indicate differences in how the SRS is reported on by parents for autistic chidren compared with adolescents. While our findings suggest that adolescents potentially exhibit more camouflaging behaviour, more research is needed to understand the development of camouflaging over time.

This study is the first to provide evidence for the relationship between camouflaging and internalising symptoms in autistic children and adolescents. Notably, it showed that camouflaging behaviours were associated with a significant increase in internalising symptoms for both autistic males and females. This supports the suggestion that camouflaging comes at a cost to mental health, and is an important consideration for clinicians, teachers, and parents. This potentially detrimental impact of camouflaging, even in very young children, highlights the importance of early diagnosis and the provision of appropriate support (Jorieke Duvekot et al., 2017). In addition, it also highlights the importance of reducing stigma and stereotypes around autism, as well as broadening the discussion on the reasons why autistic young people engage in camouflaging. As Lawson (2020) suggests, this is in response to a world where a non-autistic style of social interaction is the only form that is considered acceptable. This highlights the importance of social norms and expectations being adapted to suit autistic young people so that they are able to feel that they can be themselves, without the need to camouflage in order to protect themselves. This could also extend to other neurodevelopmental conditions (Young et al., 2020), where young people may also feel that they need to conform in socio-interpersonal contexts.

Despite these implications, several factors need to be addressed here. Firstly, the direction of influence between internalising symptoms and camouflaging cannot be determined. It is possible that participants experienced internalising symptoms prior to the use of camouflaging strategies. Indeed, cross-lagged modelling shows that anxiety symptoms result in later and higher levels of reported autistic traits (J. Duvekot, van der Ende, Verhulst, & Greaves-Lord, 2018), and meta-analytic evidence demonstrates that autism is highly comorbid with both anxiety (van Steensel, Bögels, & Perrin, 2011) and depression (Hudson, Hall, & Harkness, 2019). Secondly, since age of diagnosis was not included in the analysis, it cannot be determined whether a delayed diagnosis and access to support contributed to this association. Lastly, recent research has shown

that executive function rather than IQ is predictive of camouflaging (Hull, Petrides, & Mandy, 2021). It would be interesting for future research to include measures of executive functioning in order to determine the impact of this on camouflaging in autistic children and adolescents.

Limitations

This study identified a significant association between camouflaging and internalising symptoms in the early years. This is particularly noteworthy given the dearth of camouflaging research in autistic children and adolescents. However, this study was limited to the available measures and data in the existing dataset at the SSC. Inclusion of additional measures and variables are recommended for future research, including time since diagnosis, assessment of executive function and psychopathology, as well as the presence of autistic traits in parents. The discrepancy approach used to quantify camouflaging in this study is also reliant on both clinician and parent-report measures, which have the potential for bias. It would be beneficial for future research to also include an independent validation of the discrepancy approach with a validated measure of camouflaging. As mentioned earlier, the inclusion of individuals who do not have a formal diagnosis of autism would also be beneficial in order to determine gender differences in camouflaging in a non-clinical sample. Additionally, prospective longitudinal assessment would be beneficial to account for the development of camouflaging over time, as well as to further explore the how camouflaging behaviours change or develop throughout childhood and adolescence. Future research would also benefit from the development of appropriate definitions of camouflaging, as well as an understanding of how it is impacted by societal expectations, gender roles and social norms.

Conclusion

This research provided evidence for the role of camouflaging in autistic children and adolescents, including the presence of gender differences in parent and clinician reports of autistic

traits, and the relationship between camouflaging and internalising symptoms such as anxiety and depression. It also highlighted the potential impact of age on camouflaging, although further research is required to understand this in more depth. This research has implications for parents, teachers, and clinicians as it indicates the impact of camouflaging on the mental health of autistic young people. This highlights the importance of society adapting to support autistic children and adolescents in being able to be themselves. This will in turn reduce the burden of camouflaging and the impact on their mental health.

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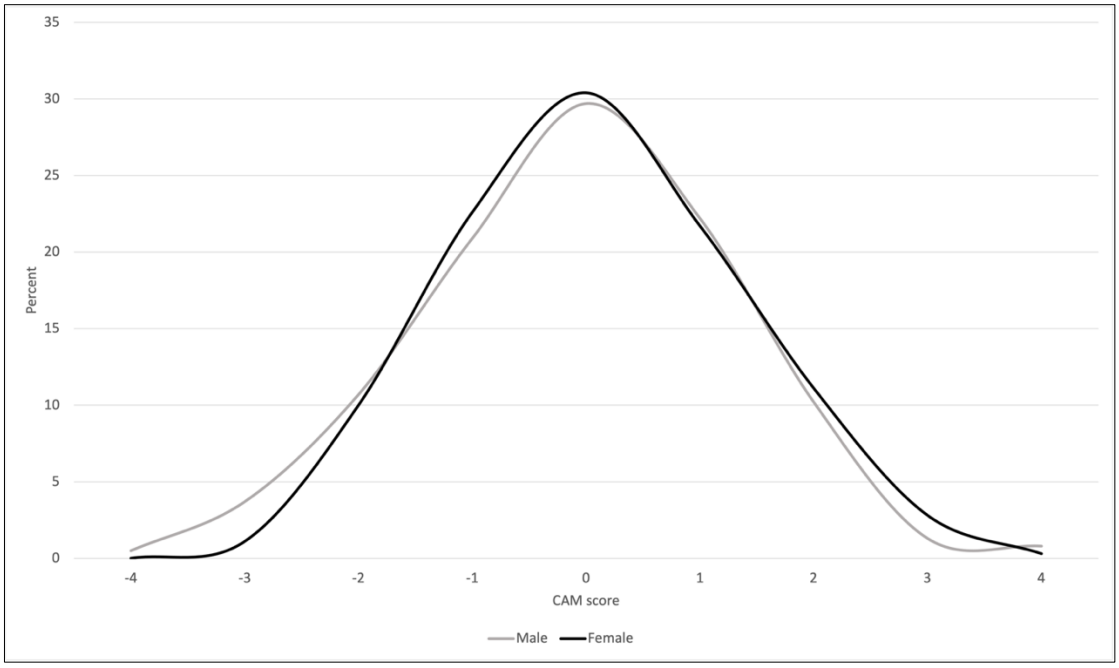

Figure 1. Distribution of camouflaging scores by sex

Table 1. Group comparisons across measures (N = 734)

		Total sample (n = 734)	**Females (n = 359)**	**Males (n = 374)**	
	Range	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Effect size**
Age	4 - 17	9.0 (3.7)	9.2 (3.7)	8.7 (3.7)	.09
Full scale IQ	18 - 167	82.0 (26.4)	75.1 (28.2)	89.0** (22.4)	.56
ADOS	4 - 10	7.5 (1.6)	7.5 (1.7)	7.4 (1.8)	.01
SRS-parent	12 - 169	97.4 (26.8)	99.9** (27.3)	94.8 (26.1)	.18
CBCL internalising	0 - 86	59.9 (10.4)	59.4 (10.9)	60.4 (9.8)	.08
CAM	-3.9 – 4.4	0.0 (1.3)	0.09 (1.3)	-0.08 (1.4)	.13

Note. ** $p < 0.001$.

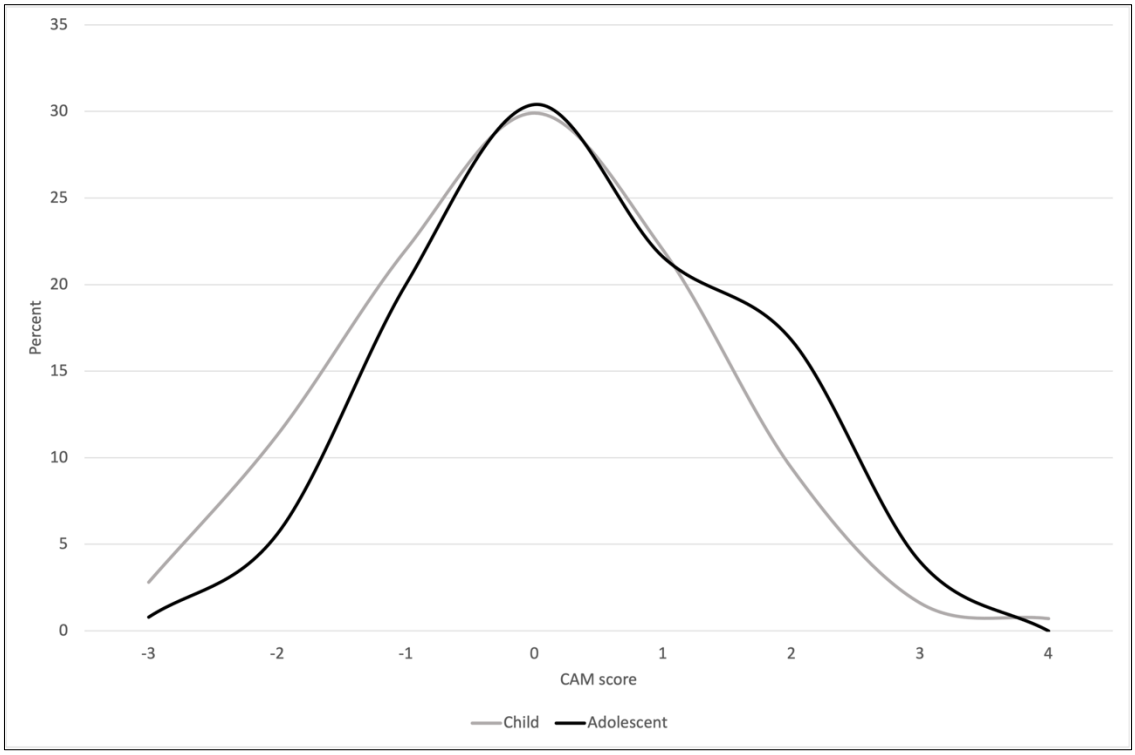

Figure 2. Distribution of camouflaging scores by age

Table 2. Multiple regression results for camouflaging as a predictor of internalising symptoms (n = 734)

	B	95% CI for *B*		*SE B*	β	R^2	ΔR^2
		LL	*UL*				
Model						.21	.20
Constant	55.88**	52.85	58.92	1.54			
CAM	3.197**	2.71	3.68	.25	.44		
Gender	-.550	-1.88	.781	.68	-.07		
Age	-.001	-.016	.013	.01	-.02		
IQ	.055**	.03	.08	.01	.05		

Note. B = unstandardised regression coefficient; CI = confidence interval, LL = lower limit, UL = upper limit, SE B = standard error of the coefficient; β = standardised coefficient.
**$p < .001$, * $p < .05$.