

The Hypothesised Female ASC Phenotype: Implications for Research and Practice

Henry Wood and Bonnie Wong

Trainee Educational Psychologists, University of Southampton

Authors' Notes

The authors would like to thank Dr Sarah Wright, Dr Matthew Wood and an anonymous reviewer for helpful comments on earlier drafts of this paper.

Correspondence concerning this paper should be addressed to:

Henry Wood, Building 44, Highfield Campus, University of Southampton, SO17 1BJ

Email: H.Wood-Downie@soton.ac.uk

Abstract

There is a growing body of evidence suggesting that the behavioural manifestation of autism spectrum condition (ASC) differs between males and females, and there may be a female-specific phenotype of the condition (Lai, Lombardo, Auyeung, Chakrabarti, & Baron-Cohen, 2015). However, current conceptualisations of ASC have been developed predominately from samples of males, meaning our understanding of the condition may be male-biased (Kirkovski, Enticott, & Fitzgerald, 2013). Consequently, ASC in females may be under-diagnosed because current assessments are based on a male-specific manifestation of the condition (Mandy et al., 2012). This paper begins with a review of qualitative literature exploring the experiences of females with ASC. Building upon identified themes, quantitative research is reviewed to ascertain whether there are sex/gender differences in four areas of the hypothesised ASC female phenotype. Preliminary evidence suggests there may be sex/gender differences in ASC, but more research is needed to fully substantiate this conclusion.

Keywords

autism spectrum condition/disorder, sex/gender differences.

Introduction

Autism spectrum condition (ASC), also known as autism spectrum disorder, is a neurodevelopmental syndrome characterised by “persistent impairment in reciprocal social communication and social interaction, and restricted, repetitive patterns of behaviour, interests or activities” (American Psychiatric Association [APA], 2013, p. 53). ASC is generally considered to be a dimensional construct, with traits distributed amongst the general population; a specified cut-off point, in combination with functional difficulties, is required for clinical diagnosis (APA, 2013; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Constantino, 2011). In addition to the core characteristics, there are a number of associated features encompassing the behavioural, cognitive, motor, emotional and sensory domains (Volkmar, Klin, & Cohen, 2005).

To date, no reliable biomarker has been identified for ASC (Hull, Mandy, & Petrides, 2016). Therefore, ASC is conceptualised and diagnosed at the behavioural level (Mandy et al., 2012). This conceptualisation has been developed predominantly from males with clinical diagnoses, which may have contributed to a male-biased understanding of ASC (Kirkovski, Enticott, & Fitzgerald, 2013; Kreiser & White, 2014; Kopp & Gillberg, 1992). Indeed, there is a growing body of evidence suggesting the phenotype of ASC differs between males and females (Lai, Lombardo, Auyeung, Chakrabarti, & Baron-Cohen, 2015). Consequently, some researchers argue that the late, under- or misdiagnosis of females with ASC can partly be attributed to gender-specific characteristics (e.g., Dworzynski, Ronald, Bolton, & Happé, 2012; Kopp & Gillberg, 1992; Mandy et al., 2012). Educational psychologists (EPs) should be aware of the hypothesised distinct female presentation of ASC, particularly because late identification may result in negative outcomes, for example, mental health challenges (Lai & Baron-Cohen, 2015).

The aim of this paper is to investigate whether there is a distinct female ASC phenotype. Building upon the themes identified in a critical review of qualitative literature exploring the experiences of females with ASC, quantitative research is then analysed to ascertain whether there are sex/gender differences in four areas of the proposed female phenotype. Lai et al. (2015) conducted a systematic review of sex/gender differences in ASC, developed a conceptual framework to help elucidate research to date and made recommendations for future research. Following their recommendations, this paper will explore whether there are sex/gender differences in ASC at the level of narrow, rather than broad, constructs. Broad constructs define ASC at the most abstract level independently of sex/gender (e.g., the core characteristics of difficulties with social interaction and social communication, and patterns of restricted and repetitive behaviour, interests or activities). Narrow constructs are subdomains of

the broad constructs, for example, “absence of interests in peers”, which will have a range of behavioural exemplars (e.g., number of initiated interactions with peers). Other narrow constructs include those in the domain of co-occurring conditions (e.g., social anxiety). Sex/gender differences at the level of narrow constructs and associated behavioural exemplars would provide evidence of a distinct female phenotype, suggesting diagnostic criteria should be modified accordingly. This paper concludes with a discussion of the implications for educational psychology practice and recommendations for future research.

Terminology

In accordance with the American Psychiatric Association (2013, p. 2), it is acknowledged that “sex” and “gender” are distinct constructs: “Sex usually refers to the biological aspects of maleness or femaleness, whereas gender implies the psychological, behavioural, social, and cultural aspects of being male or female.” To date, however, it has been difficult for researchers to separate the effects of sex and gender upon ASC presentation (Lai et al., 2015). The term “sex/gender” will be used throughout this paper to acknowledge this overlap (Springer, Stellman, & Jordon-Young, 2012). Future research is required to disentangle the effects of sex and gender, particularly because of the greater variance in sexual orientation, gender identity, diversity and expression amongst autistic individuals (Van Schalkwyk, Klingensmith, & Volkmar, 2015).

“Phenotype” and “behavioural manifestation” are used interchangeably, defined as the overt appearance and behaviour of an individual, regardless of their genetic blueprint (Kolb & Whishaw, 2014).

Both person-first (e.g., female with ASC) and identity-first (e.g., autistic person) language will be used throughout this paper. This is in accordance with recent research suggesting there is no one accepted way of describing ASC within the autistic community (Kenny et al., 2016).

Qualitative Research

To establish whether there is a distinct autistic female phenotype, this section critically evaluates qualitative literature documenting the experience of females with ASC to generate hypotheses (Bargiela, Steward, & Mandy, 2016). However, this will not be sufficient to demonstrate sex/gender differences because autistic males may have a similar presentation. As such, the following section examines quantitative research which directly compares males and females on the hypothesised areas. If differences are found, this will provide evidence that there are distinct male and female ASC phenotypes (Lai et al., 2015).

Tierney, Burns, and Kilbey (2016) interviewed ten adolescent girls with ASC to explore their experiences of managing social relationships. In accordance with previous research (e.g., Dworzynski et al., 2012; Gould & Ashton-Smith, 2011), all participants described using sophisticated masquerading or “masking” strategies that enabled them to appear more socially competent through a desire for friendship. However, for many, the use of these cognitively demanding strategies resulted in adverse psychological consequences; one describes an “identity crisis” that she attributed to “pretending to be the same as everyone else” (Tierney et al., 2016, p. 79). Eight of the participants were referred to child and adolescent mental health services (CAMHS), which the authors argue reflects the consequences of trying to cope in social situations. Adolescence was a period of particular challenge in which social difficulties were exacerbated. The autistic girls struggled to meet the increase in social demands associated with adolescence (e.g. Gould & Ashton-Smith, 2011). This difficulty is argued to be specific to females due to differing social expectations to males (Cridland, Jones, Caputi, & Magee, 2014; Wood, 2011).

The above findings are based on a small sample of “higher-functioning” girls. It is acknowledged that replications with larger samples of girls with “more severe deficits” are necessary to generalise findings. However, the results are consistent with other qualitative studies (e.g., Bargiela, Steward, & Mandy, 2016; Cridland et al., 2014). Cridland et al. (2014) interviewed three adolescent girls with ASC, their mothers and two additional mothers who had autistic daughters. One identified theme was “challenges developing and maintaining friendships”. Within this theme, participants spoke about masking underlying social deficits in childhood, such as imitating others in an attempt to develop friendships. Consistent with Tierney et al. (2016), however, these strategies often “fell apart” during adolescence because of the “increasing complexity of adolescent female friendships” compared with males (Cridland et al., 2014, p. 1266). The authors argue that these difficulties with social relationships are a key reason why more autistic girls than boys will experience internalising mental health conditions such as anxiety, depression, and eating disorders (Muller, Schuler, & Yates, 2008; Mandy et al., 2012; Rivet & Matson, 2011).

Bargiela et al. (2016) interviewed fourteen women diagnosed with ASC in late adolescence or adulthood. The authors reasoned that late-diagnosed females “would be more likely to exemplify elements of the female phenotype” (Bargiela et al., p. 3282); autistic females who present most differently to autistic males are more likely to be missed in childhood because, as discussed above, diagnostic criteria are based on a male presentation. In-depth accounts of “pretending to be normal” were given in which participants attempted to fit in with peers; explicit strategies were employed in their attempt to fit in. These included masking autistic traits, using learnt phrases and facial expressions from TV, books and magazines, and social mimicry. These strategies were associated with exhaustion and a sense of confusion about one’s identity. This is consistent with recent qualitative research conducted on a larger sample of adults with ASC (Hull et al., 2017). “Almost all” participants reported they had experienced a mental health condition, with depression, anxiety and eating disorders the most common. In addition, eight participants believed their peers were noticeably more advanced in their social abilities when teenagers. This led to difficulties forming friendships and feelings of “rejection”.

In summary, qualitative research suggests that there may be a female phenotype of ASC. However, research directly comparing males and females with ASC is needed to substantiate this hypothesis. The hypothesised areas of the female phenotype include higher levels of social motivation and employing explicit strategies — such as hiding ASC-associated traits — to appear more socially competent. For the remainder of this paper, these strategies will be referred to as

“camouflaging” (Lai et al., 2016). Camouflaging frequently results in negative consequences, such as exhaustion. In addition, internalising conditions in general, and anxiety in particular, may be key features of the female phenotype.

Quantitative Research

This section will summarise and evaluate quantitative research examining sex/gender differences based on the themes identified, as well as key areas proposed by Loomes (2016). These are:

- camouflaging
- social motivation, and
- internalising symptoms.

In addition, autistic girls may have different types of restricted and repetitive behaviours and interests (e.g., Hiller, Young, & Weber, 2014); this will also be examined. Evidence of sex/gender differences within these areas would support the hypothesis that there is a distinct female ASC phenotype. Qualitative research suggests adolescence is a time of particular struggle for females with ASC. However, because of a dearth of longitudinal studies of lifespan development, it is not possible to investigate whether adolescence moderates sex/gender differences in ASC (Lai et al., 2015).

Camouflaging

As discussed, camouflaging (described above as “masking” and “pretending to be normal”) may be a key feature of the female ASC phenotype. A number of quantitative studies indirectly provide evidence that camouflaging is more prevalent in autistic females than males (e.g., Baron-Cohen et al., 2014; Lai et al., 2011; Mandy et al., 2012; Mussey, Ginn, & Klinger, 2017). To our knowledge, however, only four quantitative studies have directly investigated this phenomenon: three in children (Dean, Harwood, & Kasari, 2016; Loomes, 2016; Rynkiewicz et al., 2016) and one in adults (Lai et al., 2016).

Despite the interest that camouflaging has attracted, there is no one agreed definition used by researchers. Following Livingston and Happé (2017), we conceptualise camouflaging as a specific form of “compensation”, defined as “the processes contributing to improved behavioural presentation of a neurodevelopmental disorder despite persisting core deficit(s) at cognitive and/or neurobiological levels” (p. 731). A core cognitive difficulty associated with ASC is social cognition (Frith, 2012). Social cognition “refers to the mental operations that underlie social interactions and involve interpersonal sensitivity in real social settings” (Miranda, Berenguer, Roselló, Baixauli, & Colomer, 2017, p. 2). One aspect of social cognition believed to be impaired in autistic populations is theory of mind, which is the ability to recognise the mental state of others (Baron-Cohen, 1995). Therefore, research showing autistic females presenting as behaviourally more advanced (e.g., greater conversational ability, more eye contact) than autistic males, despite similar levels of underlying social cognitive ability (e.g., theory of mind), would provide evidence of sex/gender differences in camouflaging. To date, however, only one study has directly investigated sex/gender differences in camouflaging using this social cognitive–behavioural discrepancy conceptualisation (Lai et al., 2016). Although defining camouflaging differently, Rynkiewicz et al. (2016) included both measures of social cognition and behaviour, allowing inferences to be drawn which are discussed below.

Loomes (2016) developed a coding frame — the Gendered Autism Behaviour Scale (GABS) — for use on videotaped administrations of the Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2000). The GABS was developed to measure behaviours associated with the hypothesised autistic female phenotype. Both males and females displayed few camouflaging behaviours, and no sex/gender difference was found. However, this may be because camouflaging was measured through the ADOS, which does not explicitly ask participants about this phenomenon. Indeed, current diagnostic assessments, such as the ADOS, are criticised for being male-biased and therefore may not capture female manifestations of ASC, such as camouflaging (Loomes, 2016). Further research that investigates camouflaging without reliance on existing diagnostic instruments is needed.

Dean et al. (2016) examined the behaviours of 96 schoolchildren (both with and without ASC) in the playground. They found that autistic girls tended to stay in close proximity to peers, weaving in and out of activities. Similarly, girls without ASC spent the majority of their time socialising with peers. In contrast, boys with ASC spent most of their time alone, whilst typically developing (TD) boys mostly played games. Consequently, girls — but not boys — with ASC looked very similar to TD peers. This provides preliminary evidence that girls camouflage more than boys; girls appeared behaviourally more advanced in their social abilities than boys through the use of compensatory behaviours (e.g., staying in close proximity to peers). Although the authors conclude that these results support the camouflaging hypothesis, underlying social cognitive abilities were not measured. Therefore the results are insufficient to meet Livingston & Happé’s (2017) definition of compensation (e.g., camouflaging); instead, it is possible that the sex/gender behavioural differences resulted from underlying differences in social cognitive abilities.

Rynkiewicz et al. (2016) found that autistic girls used more “vivid” gestures than boys across two “demonstration” activities of the ADOS; these activities assess participants’ abilities to communicate using both verbal language and accompanying gestures. The girls presented with better non-verbal communication than the boys, which the authors conclude “may be because they are effective at camouflaging other diagnostic features” (p. 6). It is noteworthy that the autistic girls scored significantly lower than boys on two measures of underlying cognitive ability: the Faces Test (Baron-Cohen, Wheelwright, & Jolliffe, 1997) and Eyes Test (Baron-Cohen, Wheelwright, Spong, Scahill, & Lawson, 2001). Both of these tests are measures of theory of mind, in which participants are required to infer the mental states (e.g., fear) of others when only the eye region (Eyes Test) or whole face (Faces Test) is visible (Baron-Cohen et al., 2015). This suggests that even with lower levels of underlying social cognitive abilities, girls may present as behaviourally more advanced than boys. However, the researchers

only focused on non-verbal behaviour; further research is needed to ascertain whether sex/gender differences are found in a broader range of behaviours.

Lai et al. (2016) operationalised camouflaging as the discrepancy between an individual's inter-social behaviour and their self-reported autistic traits and objectively measured social-cognitive abilities. Camouflaging was significantly higher in females than males. However, there was significant variability in groups, with the distributions of camouflaging scores overlapping. The authors conclude that, although a sex/gender difference was present, "it should be viewed as a phenomenon reflecting individual differences in social coping, rather than a diagnostic behavioural pattern distinguishing females versus males with autism at an individual level" (Lai et al., 2016, p. 9). These results provide evidence that males and females camouflage. However, on average, females camouflage more than males.

The studies discussed above only included males and females diagnosed with ASC. It is possible that those most likely to camouflage were not included in the study because, by definition, they were masking their symptoms and therefore would not have met diagnostic criteria (Hull et al., 2017). One way to address this limitation is to include participants with high levels of ASC traits, irrespective of diagnosis, to understand how camouflaging varies between those who do, and do not, receive a diagnosis (Hull et al., 2016; Lai et al., 2015). In addition, camouflaging can be operationalised in different ways (e.g., social imitation) from the studies above (Lai et al., 2016). Future quantitative studies, building upon qualitative research, should operationalise camouflaging in different ways to establish whether consistent results are found.

In summary, there is very limited research on camouflaging in general and sex/gender differences in particular. Preliminary findings suggest that females and, to a lesser extent, males with ASC camouflage. However, further research is needed before firm conclusions can be drawn.

Social motivation

Social motivation can be defined as "a set of psychological dispositions and biological mechanisms biasing the individual to preferentially orient to the social world, to seek and take pleasure in social interactions and to work to foster and maintain social bonds" (Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012, p. 232). Qualitative research reviewed above suggests females with ASC are more motivated to engage socially and have a stronger desire to form relationships (e.g., Tierney et al., 2016). However, there is very little research systematically investigating this phenomenon. Sedgewick, Hill, Yates, Pickering, and Pellicano (2016) compared adolescent male and females, either with ASC or special educational needs. They found that girls with ASC showed similar levels of social motivation to non-ASC girls, but significantly greater social motivation than boys with ASC. In contrast, boys with ASC showed significantly less social motivation than non-ASC boys. This provides evidence that girls with ASC are more socially motivated than boys with ASC. Motivation was measured using the Social Responsiveness Scale (Constantino & Gruber, 2012). However, only one of the five subscales specifically measures social motivation. Individual subscale scores were not reported, which means the difference may have been on another subscale (e.g., social awareness).

Sedgewick et al. (2016, p. 1298) provide a summary of Dean et al. (2014), who, they report, found that girls with ASC "had higher levels of social motivation, as indexed by a greater number of bids for social interaction during the observation period". However, having consulted the original source, no evidence of either higher levels of social motivation or an observation period can be found within the article. However, boys with ASC were more likely to be overtly excluded by peers than girls with ASC. In contrast, girls were likely to be overlooked. This provides evidence that there may be sex/gender differences in the nature of social relationships, which is consistent with findings by Dean et al. (2016), discussed above, in which boys with ASC spent more time alone than girls with the condition.

Head, McGillivray, and Stokes (2014) found that autistic girls scored significantly higher on the Friendship Questionnaire (Baron-Cohen & Wheelwright, 2003) than autistic boys, suggesting they have greater social skills. In addition, autistic girls had similar scores to TD males. Although this has been presented as evidence for the greater social motivation of girls with ASC (e.g., Sedgewick et al., 2016), it may simply reflect that, in general, females have greater social skills than males (Rivet & Matson, 2011). This interpretation is supported by the non-significant interaction between gender and diagnosis: both girls with and without ASC scored more highly than their male counterparts to a similar degree.

Loomes (2016) found no sex/gender difference in social motivation using the GABS, as discussed above. However, there was low inter-rater reliability for this item, suggesting it requires refinement. Furthermore, the emotions of autistic girls were influenced significantly more by social acceptance and rejection than were those of boys with ASC. The authors take this as indirect evidence that girls with ASC are more socially motivated than autistic boys.

Based on the research reviewed, there is insufficient evidence to conclude that autistic girls have greater social motivation than boys. There is some evidence that girls with ASC may have greater social skills and different social relationships than male counterparts. However, further studies are required to substantiate these claims and draw firmer conclusions about potential sex/gender differences in social motivation.

Internalising and externalising symptoms

Quantitative research studies consistently report findings that girls with ASC are more likely to have internalising symptoms, whereas boys are more likely to have externalising symptoms (e.g., May, Cornish, & Rinehart, 2014; Mandy et al., 2012; Hiller et al., 2014; Lai et al., 2016; Solomon, Miller, Taylor, Hinshaw, & Carter, 2012). Internalising symptoms are "characterised by depressed mood, anxiety, and related physiological and cognitive effects"; externalising symptoms are characterised by "antisocial behaviours, conduct disturbances, addictions, and impulse control difficulties" (APA, 2013, p. 13).

Solomon et al. (2012) found that females with ASC had higher internalising symptoms than males with ASC during adolescence (12 to 18 years). However, when data was used for all participants (8 to 18 years) no difference was found. This supports qualitative research which suggests adolescence is a period of particular challenge for females with ASC (e.g., Tierney et al., 2016). In addition, it illustrates the need for future research to consider developmental trajectories when examining sex/gender differences in ASC (Lai et al., 2016; Hull et al., 2016). May et al. (2014) followed girls and boys with ASC for a year, comparing parent-reported measurements at baseline and after one year. They found that females were more socially anxious, whereas males were more hyperactive at both time points. Hiller et al. (2014) also found that teachers reported greater concerns about boys' externalising behaviours than that of girls. Finally, Mandy et al. (2012) found that autistic girls were perceived to have more emotional problems, whereas autistic boys were seen as having more hyperactivity and inattention problems.

In summary, current research suggests that females with ASC are more likely to present with internalising symptoms, compared to males, who are more likely to present with externalising symptoms. However, longitudinal research is required to understand developmental changes and their relation to sex/gender phenotypic differences in ASC.

Repetitive and restricted interests and behaviours

Meta-analyses (Van Wijngaarden et al., 2014) and large-scale studies (Mandy et al., 2012) show that autistic girls demonstrate fewer repetitive and restricted behaviours and interests (RRBIs) than autistic boys. However, this does not preclude the possibility that girls have similar levels of RRBIs to boys. Instead, it may reflect the fact that the instruments used (e.g., the ADOS) have largely been developed on samples of males and, therefore, may not capture the way in which RRBIs manifest in females (Attwood et al., 2006; Rutter et al., 2003). This illustrates the need to focus on narrow constructs. Specifically, we need to ascertain whether females have different types of RRBIs than males.

Hiller et al. (2014) analysed teacher and clinician reports of 69 boys and 69 girls diagnosed with ASC. They found qualitative differences between the type of RRBIs exhibited by girls and boys. Girls were more likely to have RRBIs in the "seemingly random" category (e.g., animals and books). In contrast, boys were more likely to have RRBIs in the "screen time" category (e.g., gaming). In addition, slightly, but significantly, more girls (17 per cent) than boys (10 per cent) were reported to have RRBIs in the category of "specific program/character" (e.g., a specific television character). This result held after splitting the group into younger (less than 7 years) and older children (greater than 7 years). This suggests that this type of RRBIs is consistent across ages for girls with ASC. Unfortunately, the age range of participants is not given, and therefore it is difficult to draw conclusions about the extent to which this sex/gender difference holds across development. Overall, this study provides initial evidence that girls with ASC may have qualitatively different types of RRBIs to boys with the condition. Future research should focus on the types of RRBIs girls demonstrate (e.g., animals) within the broader "seemingly random" category. Loomes (2016) found that girls with ASC displayed a higher frequency of "relational" RRBIs than males. The core feature of these interests is that they involve relationships with others. This could include animals, people, fictional characters and/or imaginary friends. Boys, in contrast, were more likely to have RRBIs that were physical–mechanical in nature. Consistently, Nicholas et al. (2008) found that autistic boys were significantly more likely to have preoccupations with parts of objects than girls. These findings support and extend those of Hiller et al. (2014).

In summary, there is preliminary evidence that there may be qualitative differences between girls and boys with ASC regarding types of RRBIs. However, replications are needed to further substantiate this finding. In addition, future research should include TD males and females to ensure differences do not simply reflect sex/gender differences found in the general population (Hiller et al., 2014; Rutter et al., 2003).

Conclusion and Implications

Evidence concerning sex/gender differences on four narrow constructs has been examined. Research suggests that girls with ASC are more likely to suffer from internalising symptoms, whereas males are more likely to demonstrate externalising symptoms. Preliminary evidence suggests that both females and, to a lesser extent, males camouflage. In addition, girls and boys may have different types of RRBIs. There is insufficient evidence to conclude there are sex/gender differences in social motivation. However, compared with ASC boys, girls with ASC may have greater social skills and different types of social relationships. In summary, there is preliminary evidence suggesting there may be a distinct female phenotype but more research is needed to substantiate this conclusion.

On average, females are diagnosed with ASC later than males (Begeer et al., 2013; Shattuck et al., 2009). In addition, males are more easily diagnosed with ASC than females with similar levels of autistic traits (Russell, Steer, & Golding, 2011), who require more co-occurring cognitive and behavioural problems for a diagnosis (Dworzynski, et al., 2012). Sex/gender differences may partially account for this; for example, externalising problems are more likely to be noticed by teachers. Consequently, boys with ASC are more likely to receive interventions (Kreiser & White, 2014; McIntyre & Tong, 1998). In addition, sex/gender differences in types of RRBIs may mean girls with ASC are less likely to be noticed, because they are more in line with those of TD-developing children (Hiller et al., 2014). For a comprehensive review of how ASC sex/gender differences may contribute to bias in assessment tools and diagnostic practices see Kresner and White (2014).

EPs should be aware of potential sex/gender differences in the manifestation of ASC to enable them to identify students who may benefit from early intervention and to train school staff accordingly. Specifically, EPs should understand that both boys and girls with ASC may camouflage their symptoms (e.g., by staying close to peers), making it difficult to identify social difficulties. Girls may have greater social skills than their peers. In addition, they are more likely to present with internalising symptoms and have RRBIs in line with TD peers, meaning they are less likely to be noticed by school staff. EPs are well placed to disseminate

this information to other relevant professionals (e.g., speech and language therapists, social workers, early years' professionals and paediatricians) through training, consultations and the development of information leaflets.

In addition, EPs should carefully consider the type of interventions they recommend and their potential impact. Research suggests that camouflaging is associated with negative outcomes, such as anxiety (e.g., Bargiela et al., 2016). Therefore, programmes aimed at “teaching” social skills may inadvertently lead to anxiety for individuals with ASC. Despite this, camouflaging may make it easier to achieve socially desirable outcomes, for example in job interviews (Hull et al., 2017). The views of CYP should be taken into account when planning interventions because they are best placed to inform EPs of what is important to them (e.g., getting a job) and the level of anxiety that camouflaging may cause them. If deemed appropriate to teach CYP social skills, the potential anxiety associated with enacting these should also be addressed; for example, through psycho-education, teaching skills to help reduce anxiety, or informing the young person of the potential benefits (e.g., employment).

Future research should follow Rutter et al.'s (2003) general methodological advice for investigating sex/gender differences, as well as Lai et al.'s (2015) specific advice in terms of ASC sex/gender differences. Specifically, it is important to establish whether males and females with ASC differ on measures of narrow constructs, including other aspects of the hypothesised female phenotype (e.g., better conversational abilities). This may require the development of new instruments. In addition, longitudinal research should consider sex/gender-based biological mechanisms and how these may exert developmental effects. Sex/gender differences may be found during one developmental period (e.g., adolescence) but not another (e.g., childhood). Furthermore, it is essential that autistic males and females are compared with TD peers to account for normative sex/gender differences in the general population, as well as diagnostic male bias that may influence the results when only participants with ASC are included.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*. Washington, DC: American Psychiatric Association. <https://doi.org/10.1176/appi.books.9780890425596X>
- Attwood, T. (2009). *The pattern of abilities and development of girls with Asperger's syndrome*.
- Attwood, T., Grandin, T., Bolick, T., Faherty, C., Iland, L., Myers, J. M., & Wroble, M. (2006). *Asperger's and girls*. Arlington, TX: Future Horizons.
- Bargiela, S., Steward, R., & Mandy, W. (2016). The experiences of late-diagnosed women with autism spectrum conditions: An investigation of the female autism phenotype. *Journal of Autism and Developmental Disorders*, 46(10), 3281–3294. <https://doi.org/10.1007/s10803-016-2872-8>
- Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, Massachusetts: MIT Press.
- Baron-Cohen, S., & Wheelwright, S. (2003). The Friendship Questionnaire: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders*, 33(5), 509–517. <https://doi.org/10.1023/A:1025879411971>
- Baron-Cohen, S., Bowen, D. C., Holt, R. J., Allison, C., Auyeung, B., Lombardo, M. V., ... Lai, M.-C. (2015). The "Reading the Mind in the Eyes" Test: Complete absence of typical sex difference in 400 men and women with autism. *PLoS ONE*, 10(8), e0136521. <https://doi.org/10.1371/journal.pone.0136521>
- Baron-Cohen, S., Cassidy, S., Auyeung, B., Allison, C., Achoukhi, M., Robertson, S., ... Lai, M.-C. (2014). Attenuation of typical sex differences in 800 adults with autism vs. 3,900 controls. *PLoS ONE*, 9(7), e102251. <https://doi.org/10.1371/journal.pone.0102251>
- Baron-Cohen, S., Wheelwright, S., & Jolliffe, A. T. (1997). Is there a "language of the eyes"? Evidence from normal adults, and adults with autism or Asperger syndrome. *Visual Cognition*, 4(3), 311–331. <https://doi.org/10.1080/713756761>
- Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, male and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*, 31(1), 5–17. <https://doi.org/10.1023/A:1005653411471>
- Baron-Cohen, S., Wheelwright, S., Spong, A., Scahill, V., & Lawson, J. (2001). Are intuitive physics and intuitive psychology independent? A test with children with Asperger syndrome. *Journal of Developmental and Learning Disorders*, 5(1), 47–78.
- Begeer, S., Mandell, D., Wijnker-Holmes, B., Venderbosch, S., Rem, D., Stekelenburg, F., & Koot, H. M. (2013). Sex differences in the timing of identification among children and adults with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 43(5), 1151–1156. <https://doi.org/10.1007/s10803-012-1656-z>
- Chevallier, C., Kohls, G., Troiani, V., Brodtkin, E., & Schultz, R. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences*, 16(4), 231–239. <https://doi.org/10.1016/j.tics.2012.02.007>
- Constantino, J. N. (2011). The quantitative nature of autistic social impairment. *Pediatric Research*, 69(5), 55R–62R. <https://doi.org/10.1203/PDR.0b013e318212ec6e>
- Constantino, J., & Gruber, C. (2012). *The Social Responsiveness Scale, Second Edition (SRS-2)*. Los Angeles, CA: Western Psychological Services.
- Cridland, E. K., Jones, S. C., Caputi, P., & Magee, C. A. (2014). Being a girl in a boys' world: Investigating the experiences of girls with autism spectrum disorders during adolescence. *Journal of Autism and Developmental Disorders*, 44(6), 1261–1274. <https://doi.org/10.1007/s10803-013-1985-6>
- Dean, M., Harwood, R., & Kasari, C. (2016). The art of camouflage: Gender differences in the social behaviors of girls and boys with autism spectrum disorder. *Autism*, 21(6), 678–689. <https://doi.org/10.1177/1362361316671845>
- Dean, M., Kasari, C., Shih, W., Frankel, F., Whitney, R., Landa, R., ... Harwood, R. (2014). The peer relationships of girls with ASD at school: Comparison to boys and girls with and without ASD. *Journal of Child Psychology and Psychiatry*, 55(11), 1218–1225. <https://doi.org/10.1111/jcpp.12242>
- Dworzynski, K., Ronald, A., Bolton, P., & Happé, F. (2012). How different are girls and boys above and below the diagnostic threshold for autism spectrum disorders? *Journal of the American Academy of Child & Adolescent Psychiatry*, 51(8), 788–797. <https://doi.org/10.1016/j.jaac.2012.05.018>
- Frith, U. (2012). Why we need cognitive explanations of autism. *The Quarterly Journal of Experimental Psychology*, 65(11), 2073–2092. <https://doi.org/10.1080/17470218.2012.697178>
- Gould, J., & Ashton-Smith, J. (2011). Missed diagnosis or misdiagnosis? Girls and women on the autism spectrum. *Good Autism Practice*, 12(1), 34–41.

- Hartley, S. L., & Sikora, D. M. (2009). Sex differences in autism spectrum disorder: An examination of developmental functioning, autistic symptoms, and coexisting behavior problems in toddlers. *Journal of Autism and Developmental Disorders*, 39(12), 1715–1722.
- Head, A. M., McGillivray, J. A., & Stokes, M. A. (2014). Gender differences in emotionality and sociability in children with autism spectrum disorders. *Molecular Autism*, 5(1), 5–19. <https://doi.org/10.1186/2040-2392-5-19>
- Hiller, R. M., Young, R. L., & Weber, N. (2014). Sex differences in autism spectrum disorder based on DSM-5 criteria: Evidence from clinician and teacher reporting. *Journal of Abnormal Child Psychology*, 42(8), 1381–1393. <https://doi.org/10.1007/s10802-014-9881-x>
- Hull, L., Mandy, W., & Petrides, K. V. (2016). Behavioural and cognitive sex/gender differences in autism spectrum condition and typically developing males and females. *Autism*, 21(6), 706–727. <https://doi.org/10.1177/1362361316669087>
- Hull, L., Petrides, K. V., Allison, C., Smith, P., Baron-Cohen, S., Lai, M., & Mandy, W. (2017). “Putting on my best normal”: Social camouflaging in adults with autism spectrum conditions. *Journal of Autism and Developmental Disorders*, 47(8), 2519–2534. <https://doi.org/10.1007/s10803-017-3166-5>
- Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the UK autism community. *Autism*, 20(4), 442–462. <https://doi.org/10.1177/1362361315588200>
- Kirkovski, M., Enticott, P. G., & Fitzgerald, P. B. (2013). A review of the role of female gender in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 43(11), 2584–2603. <https://doi.org/10.1007/s10803-013-1811-1>
- Kolb, B., & Whishaw, I. Q. (2014). *An introduction to brain and behavior*. New York, NY: Worth Publishers.
- Kopp, S., & Gillberg, C. (1992). Girls with social deficits and learning problems: Autism, atypical Asperger syndrome of a variant of these conditions. *European Child & Adolescent Psychiatry*, 1(2), 89–99. <https://doi.org/10.1007/BF02091791>
- Kopp, S., & Gillberg, C. (2011). The Autism Spectrum Screening Questionnaire (ASSQ)-Revised Extended Version (ASSQ-REV): An instrument for better capturing the autism phenotype in girls? A preliminary study involving 191 clinical cases and community controls. *Research in Developmental Disabilities*, 32(6), 2875–2888. <https://doi.org/10.1016/j.ridd.2011.05.017>
- Kreiser, N. L., & White, S. W. (2014). ASD in females: Are we overstating the gender difference in diagnosis? *Clinical Child and Family Psychology Review*, 17(1), 67–84. <https://doi.org/10.1007/s10567-013-0148-9>
- Lai, M.-C., & Baron-Cohen, S. (2015). Identifying the lost generation of adults with autism spectrum conditions. *The Lancet Psychiatry*, 2(11), 1013–1027. [https://doi.org/10.1016/S2215-0366\(15\)00277-1](https://doi.org/10.1016/S2215-0366(15)00277-1)
- Lai, M.-C., Lombardo, M. V., Auyeung, B., Chakrabarti, B., & Baron-Cohen, S. (2015). Sex/gender differences and autism: Setting the scene for future research. *Journal of the American Academy of Child & Adolescent Psychiatry*, 54(1), 11–24. <https://doi.org/10.1016/j.jaac.2014.10.003>
- Lai, M.-C., Lombardo, M. V., Pasco, G., Ruigrok, A. N. V., Wheelwright, S. J., Sadek, S. A., ... MRC AIMS Consortium, & Baron-Cohen, S. (2011). A behavioral comparison of male and female adults with high functioning autism spectrum conditions. *PLoS ONE*, 6(6), e20835. <https://doi.org/10.1371/journal.pone.0020835>
- Lai, M.-C., Lombardo, M. V., Ruigrok, A. N. V., Chakrabarti, B., Auyeung, B., Szatmari, P., ... Baron-Cohen, S. (2016). Quantifying and exploring camouflaging in men and women with autism. *Autism*, 21(6), 690–702. <https://doi.org/10.1177/1362361316671012>
- Livingston, L. A., & Happé, F. (2017). Conceptualising compensation in neurodevelopmental disorders: Reflections from autism spectrum disorder. *Neuroscience & Biobehavioral Reviews*, 80, 729–742. <https://doi.org/10.1016/j.neubiorev.2017.06.005>
- Loomes, R. (2016). *Gender differences in children and adolescents with high-functioning autism spectrum disorders* (Unpublished doctoral dissertation). University College London, London, England.
- Lord, C., Risi, S., Lambrecht, L., Cook, E. H., Jr., Leventhal, B. L., DiLavore, P. C., ... Rutter, M. (2000). The Autism Diagnostic Observation Schedule—Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders*, 30(3), 205–223. <https://doi.org/10.1023/A:1005592401947>
- Mandy, W., Chilvers, R., Chowdhury, U., Salter, G., Seigal, A., & Skuse, D. (2012). Sex differences in autism spectrum disorder: Evidence from a large sample of children and adolescents. *Journal of Autism and Developmental Disorders*, 42(7), 1304–1313. <https://doi.org/10.1007/s10803-011-1356-0>
- May, T., Cornish, K., & Rinehart, N. (2014). Does gender matter? A one year follow-up of autistic, attention and anxiety symptoms in high-functioning children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 44(5), 1077–1086. <https://doi.org/10.1007/s10803-013-1964-y>
- McIntyre, T., & Tong, V. (1998). Where the boys are: Do cross-gender misunderstandings of language use and behavior patterns contribute to the overrepresentation of males in programs for students with emotional and behavioral disorders? *Education and Treatment of Children*, 21(3), 321–332.

- Miranda, A., Berenguer, C., Roselló, B., Baixauli, I., & Colomer, C. (2017). Social cognition in children with high-functioning autism spectrum disorder and attention-deficit/hyperactivity disorder: Associations with executive functions. *Frontiers in Psychology*, 8, 1035. <https://doi.org/10.3389/fpsyg.2017.01035>
- Muller, E., Schuler, A., & Yates, G. B. (2008). Social challenges and supports from the perspective of individuals with Asperger syndrome and other autism spectrum disabilities. *Autism*, 12(2), 173–190. <https://doi.org/10.1177/1362361307086664>
- Mussey, J. L., Ginn, N. C., & Klinger, L. G. (2017). Are males and females with autism spectrum disorder more similar than we thought? *Autism*, 21(6), 733–737. <https://doi.org/10.1177/1362361316682621>
- Nicholas, J. S., Charles, J. M., Carpenter, L. A., King, L. B., Jenner, W., & Spratt, E. G. (2008). Prevalence and characteristics of children with autism-spectrum disorders. *Annals of Epidemiology*, 18(2), 130–136. <https://doi.org/10.1016/j.annepidem.2007.10.013>
- Painter, K. K. (2006). *Social skills groups for children and adolescents with Asperger's syndrome*. London, England: Jessica Kingsley Publishers.
- Rivet, T. T., & Matson, J. L. (2011). Review of gender differences in core symptomatology in autism spectrum disorders. *Research in Autism Spectrum Disorders*, 5(3), 957–976. <https://doi.org/10.1016/j.rasd.2010.12.003>
- Russell, G., Steer, C., & Golding, J. (2011). Social and demographic factors that influence the diagnosis of autistic spectrum disorders. *Social Psychiatry and Psychiatric Epidemiology*, 46(12), 1283–1293. <https://doi.org/10.1007/s00127-010-0294-z>
- Rutter, M., Caspi, A., & Moffitt, T. E. (2003). Using sex differences in psychopathology to study causal mechanisms: Unifying issues and research strategies. *Journal of Child Psychology and Psychiatry*, 44(8), 1092–1115. <https://doi.org/10.1111/1469-7610.00194>
- Rynkiewicz, A., Schuller, B., Marchi, E., Piana, S., Camurri, A., Lassalle, A., & Baron-Cohen, S. (2016). An investigation of the 'female camouflage effect' in autism using a computerized ADOS-2 and a test of sex/gender differences. *Molecular Autism*, 7(1), 10. <https://doi.org/10.1186/s13229-016-0073-0>
- Sedgewick, F., Hill, V., Yates, R., Pickering, L., & Pellicano, E. (2016). Gender differences in the social motivation and friendship experiences of autistic and non-autistic adolescents. *Journal of Autism and Developmental Disorders*, 46(4), 1297–1306. <https://doi.org/10.1007/s10803-015-2669-1>
- Shattuck, P. T., Durkin, M., Maenner, M., Newschaffer, C., Mandell, D. S., Wiggins, L., ... Cuniff, C. (2009). Timing of identification among children with an autism spectrum disorder: Findings from a population-based surveillance study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 48(5), 474–483. <https://doi.org/10.1097/CHI.0b013e31819b3848>
- Snaith, R. P. (2003). The hospital anxiety and depression scale. *Health and Quality of Life Outcomes*, 1(29), 1–4.
- Solomon, M., Miller, M., Taylor, S. L., Hinshaw, S. P., & Carter, C. S. (2012). Autism symptoms and internalizing psychopathology in girls and boys with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 42(1), 48–59. <https://doi.org/10.1007/s10803-011-1215-z>
- Springer, K. W., Stellman, J. M., & Jordan-Young, R. M. (2012). Beyond a catalogue of differences: A theoretical frame and good practice guidelines for researching sex/gender in human health. *Social Science & Medicine*, 74(11), 1817–1824. <https://doi.org/10.1016/j.socscimed.2011.05.033>
- Tierney, S., Burns, J., & Kilbey, E. (2016). Looking behind the mask: Social coping strategies of girls on the autistic spectrum. *Research in Autism Spectrum Disorders*, 23, 73–83. <https://doi.org/10.1016/j.rasd.2015.11.013>
- Van Schalkwyk, G. I., Klingensmith, K., & Volkmar, F. R. (2015). Gender identity and autism spectrum disorders. *The Yale Journal of Biology and Medicine*, 88(1), 81–83.
- Van Wijngaarden-Cremers, P. J., van Eeten, E., Groen, W. B., Van Deurzen, P. A., Oosterling, I. J., & Van der Gaag, R. J. (2014). Gender and age differences in the core triad of impairments in autism spectrum disorders: A systematic review and meta-analysis. *Journal of Autism and Developmental Disorders*, 44(3), 627–635. <https://doi.org/10.1007/s10803-013-1913-9>
- VandenBos, G. R. (Ed.). (2015). *APA dictionary of psychology*. Washington, DC: American Psychological Association.
- Volkmar, F. R., Paul, R., Klin, A., & Cohen, D. (2005). *Handbook of autism and pervasive developmental disorders*. New York, NY: Wiley.