How Different Are Girls and Boys Above and Below the Diagnostic Threshold for Autism Spectrum Disorders?

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Objective: This study aimed to explore sex differences in autistic traits in relation to diagnosis, to elucidate factors that might differentially impact whether girls versus boys meet diagnostic criteria for autism or a related autism spectrum disorder (ASD). **Method:** Data from a large population-based sample of children were examined. Girls and boys (aged 10–12 years) meeting diagnostic criteria for an ASD were compared with those failing to meet diagnostic criteria despite very high scores on a trait measure of ASD, the Childhood Autism Spectrum Test (CAST). Information about behavioral difficulties as reported by teachers, and early estimates of intellectual functioning, were compared. **Results:** Girls, but not boys, meeting diagnostic criteria for ASD showed significantly more additional problems (low intellectual level, behavioral difficulties) than peers with similarly high CAST scores who did not meet diagnostic criteria. **Conclusions:** These data suggest that, in the absence of additional intellectual or behavioral problems, girls are less likely than boys to meet diagnostic criteria for ASD at equivalently high levels of autistic-like traits. This might reflect gender bias in diagnosis or genuinely better adaptation/compensation in girls. J. Am. Acad. Child Adolesc. Psychiatry, 2012;51(8):788–797. **Key Words:** autism spectrum disorder, gender differences, girls/females, diagnosis, autistic traits

Autism and related "autism spectrum disorders" (ASD; Asperger disorder, atypical autism, or pervasive developmental disorder not otherwise specified [PDD-NOS]) are diagnosed on the basis of social and communication deficits, and rigid and repetitive behaviors and interests. No biomarker exists to aid diagnosis of this strikingly heterogeneous condition. A behavioral diagnosis brings problems of interpretation and recognition: are the core deficits equally well recognized by clinicians across ages, cultures, and genders? The focus of the present study was the diagnosis of ASD in girls versus boys.

One of the most striking features of ASD is the high male-to-female ratio, which averages at approximately 4:1 but rises to approximately 10:1 in "high functioning autism" or Asperger syndrome, and drops to 2:1 in individuals with additional moderate-to-severe intellectual disability.[1] Although this male preponderance is not unique to ASD (indeed most developmental disorders are more common in males), it has been taken as an important pointer toward possible etiologies. Baron-Cohen *et al.* have recently reviewed possible biological bases for the male preponderance in ASD, including fetal testosterone and X chromosome theories.[2] Szatmari *et al.*[3] proposed a multiple threshold model of genetic liability for ASD, with females having a higher liability for affected status on the repetitive behavior (but not the social-communication) dimension of ASD.

It is also possible that the high sex ratio in ASD reflects, in part, bias in the diagnostic criteria currently used or in the way these criteria are applied to recognise ASD in the clinic.[4] If clinicians find it harder to recognize some or all manifestations of ASD in girls compared to boys, this would contribute to the reported high male:

This article is discussed in an editorial by Drs. Constantino and Charman on page 756.

CG Clinical guidance is available at the end of this article.

female ratio. It is important to know whether this is the case; potentially girls with ASD may be being missed, failing to receive services from which they might benefit. Lai et al.,[5] for example, suggest that superficial reduction in social-communication symptoms in women (versus men) with ASD might reduce the likelihood of diagnosis.

How might one establish whether the recognition of ASD in boys and girls is equivalent? Studying clinic samples of diagnosed children, albeit interesting,[6-9] may not elucidate possible biases, because complementary information is needed about those individuals whose ASD is *not* diagnosed. Even gold-standard diagnostic instruments rely on the clinician to judge whether observed or reported behaviors are different in quality or quantity/intensity from those expected in typical development or relative to the child's developmental level. As such, gender biases in diagnostic criteria, instruments, or processes may be difficult to uncover. Even studying individuals brought to the clinic for possible diagnosis might not escape the putative effects of male stereotypes of ASD, if these are operating in referral sources.

One way to address this issue is to examine data from a population-based study that has separate diagnostic and trait measures of ASD. In this way one can ask: what distinguishes girls who meet diagnostic criteria from those who do not? Do the same distinguishing features operate in boys? A recent paper by Russell *et al.*,[10] using data from the Avon Longitudinal Study of Parents and Children, examined factors influencing diagnosis by comparing early (age 2.5–4 years) behavioral problems predictive of ASD and later records of clinical diagnosis. Although ASD-relevant early problems were more common in boys than girls, diagnosis was found to be more likely for boys than for girls even when severity of symptoms was held constant. Similar findings emerge from a recent comparison of quantitative and categorical diagnostic assessment of siblings in the Interactive Autism Registry (IAN) volunteer register database.[11]

In the present study, we examined data from the Twins Early Development Study (TEDS), which is a population-based study of more than 15,000 twin pairs born in England and Wales between 1994 and 1996. We have previously reported data on autistic-like traits in this sample at various ages,[12-14] as well as data from those meeting diagnostic criteria for autism, Asperger syndrome, or atypical autism/PDD-NOS.[15] Work in this sample and others supports the notion that the underpinnings of autistic-like traits and diagnosed ASD lie on a continuum, with studies of the former in large populations being informative as to the origins of the latter.[16]

To answer the question, How does being a girl affect diagnosis of ASD? we compared girls in TEDS who met diagnostic criteria for ASD (on the Development and Well-Being Assessment [DAWBA], and/or independent clinical diagnosis by a qualified clinician) with girls who fell below the diagnostic threshold despite comparably high scores on a trait measure of ASD (the Childhood Autism Spectrum Test [CAST]). We hypothesised that, if current diagnostic criteria and practice are biased toward a male stereotype of ASD, girls may be likely to "fly under the radar" unless their ASD difficulties are made more prominent or obvious by the presence of, for example, additional intellectual or behavioral problems. We asked three specific questions: first, do girls have to show higher levels of ASD traits than boys in order to meet diagnostic criteria? Second, does meeting diagnostic criteria for ASD have to do with intellectual level in girls more than in boys? Third, do ASD-diagnosed girls have more additional behavior problems than ASD-diagnosed boys, compared with their undiagnosed but high ASD-trait peers?

METHOD

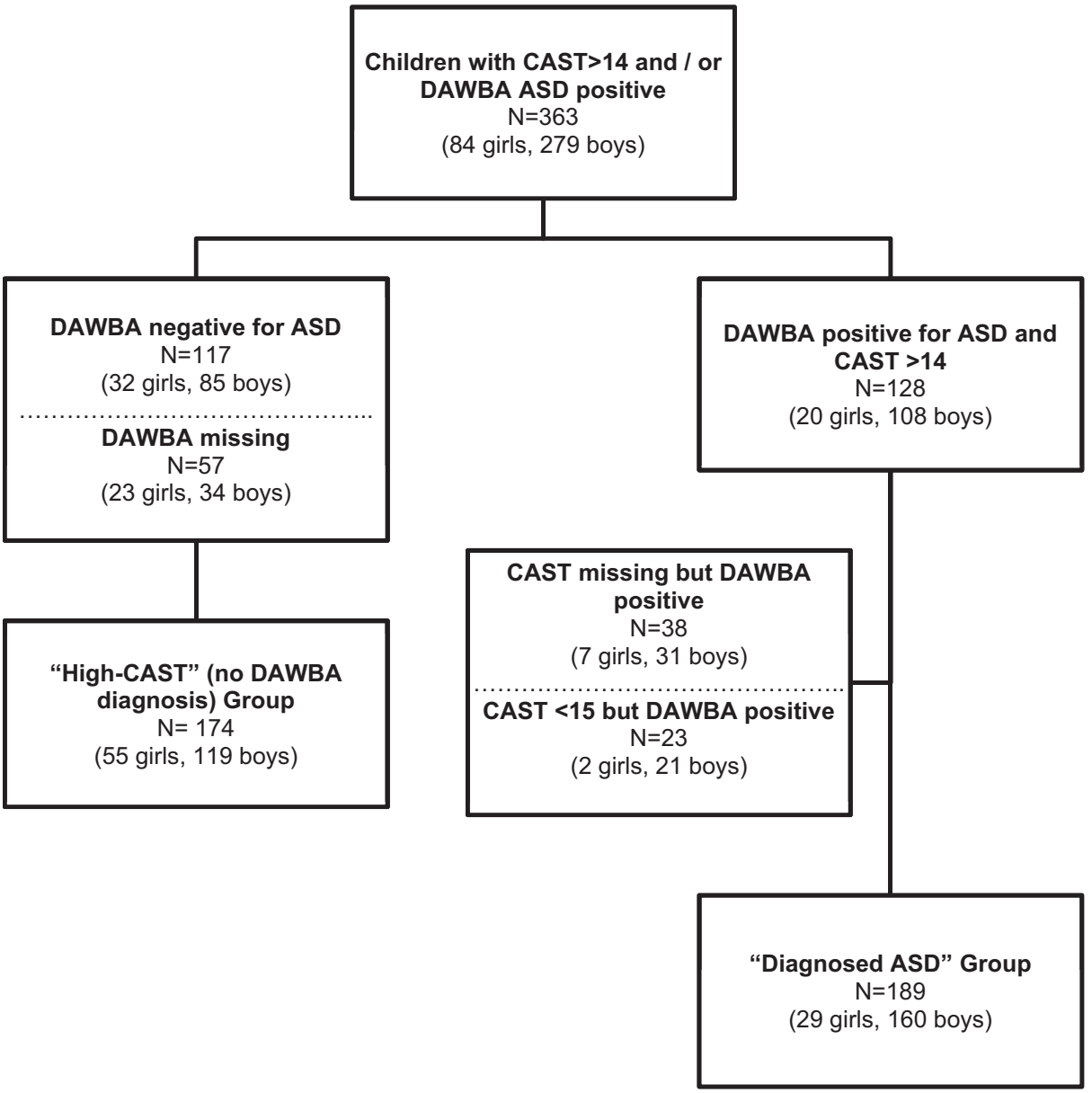
Sample

Participants were drawn from the TEDS, a United Kingdom–based population study of twins born in 1994 to 1996, followed up prospectively from the age of about 18 months onward. Details of this study have been described extensively elsewhere.[17,18] Families were contacted through records of all twin births in 1994 to 1996, as identified by the UK Office for National Statistics (ONS). Consent was given initially by 16,810 families, and more than a decade later the sample of involved families (>11,000) remains reasonably representative of the UK population of families (from the UK household survey), with regard to key demographics such as ethnicity, parental education, and employment rates.[17] Children were screened for autistic traits at age 8 years based on parental report using the CAST.[19] Twins at risk were then identified by one or more of the following factors: a twin or co-twin had a CAST score on or above the screening

cut-off (≥15); parents ticked a box for autism or Asperger syndrome at any age in TEDS questionnaires from age 4 years up to and including the 9-year data collection, or parents informed TEDS directly that one or both of their twins had autism or Asperger syndrome.

The current analysis focuses on two subsamples (a flow-chart showing how these groups were derived is shown in Figure 1). The "diagnosed ASD" group comprised 189 children who met diagnostic criteria for ASD according to parental interview with the DAWBA[20] when the children were between 10 and 12 years old. The details of the DAWBA diagnosis of this group of children have been described elsewhere.[15] The majority of these participants had been identified for DAWBA interview because of CAST scores over 14.

FIGURE 1 Flow diagram of participants partitioned into the "diagnosed autism spectrum disorder (ASD)" and "high–Childhood Autism Spectrum Test (CAST)" (nondiagnosed) groups. Note: Responses from a total of 363 children were analyzed. The diagnosed ASD group comprised 189 children, all of whom met diagnostic criteria for ASD according to the Development and Well-Being Assessment (DAWBA). The high-CAST (nondiagnosed) group comprised 174 children who scored above cut-off on the CAST (ASD screening questionnaire) but did not have a diagnosis of ASD according to DAWBA.



However, 61 children were identified to receive DAWBA because of parental report of an existing ASD (autism, Asperger syndrome, atypical autism/PDD-NOS) diagnosis (for the twin or cotwin), and either lacked CAST data (seven girls, 31 boys), or had CAST scores below 15 (two girls, 21 boys; all but two with CAST scores 9–14).

The "high-CAST" group comprised 174 children who showed a level of autistic like traits above the CAST screening cut-off (i.e., 15 or more) but did not meet full diagnostic criteria or did not participate in DAWBA interviews. Of the 119 high-CAST (nondiagnosed) boys, 85 were contacted and did not meet DAWBA diagnostic criteria, 34 had no DAWBA data and 2 others had ambiguous DAWBA results. Of the 55 high-CAST girls 32 were contacted and did not meet diagnostic DAWBA criteria, and 23 had no DAWBA data.

Given missing data for a number of participants, characteristics were compared for those children with DAWBA data and those for whom DAWBA could not be obtained. These groups did not differ significantly in age 4 estimates of intelligence, age 7 socioeconomic status (SES) or intelligence estimates, age 8/9 intelligence quotient (IQ) estimate or CAST, age 12 Strengths and Difficulties Questionnaire (SDQ) subscales, or on sex or zygosity frequencies.

DAWBA scores for the diagnosed versus high-CAST groups were significantly different [boys: $t(243) = 16.49$, $p < .001$; girls: $t(59) = 8.11$, $p < .001$, both partial $\eta^2 = 0.53$]. Scores did not differ significantly by gender [diagnosed girls: mean (SD), 30.72 (8.93); diagnosed boys: 33.64 (8.90); high-CAST girls: 14.22 (6.91); and high-CAST boys: 15.65 (6.43)].

Measures

ASD Trait Measure. The Childhood Autism Spectrum Test[19] (CAST, originally named the 'Childhood Asperger Syndrome Test') is a screening instrument for autism spectrum conditions, which is completed by parents, and is designed for nonclinical samples. The CAST was developed as a quantitative scale and is based on a dimensional concept of ASD. All questionnaire items are answered "yes" or "no," and responses are scored additively with a score above 14 indicating a cut-off for children at risk for ASD. In the case of missing data, a total score is calculated by summing all items and converting this into a mean of total possible scores given the number of items completed (with the constraint that more than half of items have to be answered). In a validation study,[21] the CAST was shown to have excellent sensitivity and specificity (the proportion of children with a diagnosis scoring over the cut-off was 100%, and the proportion of children without a diagnosis scoring under the cut-off was 95% to 97%, although positive predictive value was 50%, against clinicians' consensus diagnosis).

In addition to the total CAST score, three subscales were derived from the questionnaire using the same method as Ronald *et al.*[22]: social, communication, and restricted/repetitive behavior and interests (RRBI). The division is made on theoretical grounds (questions are divided according to the three subdomains of ASD as reflected, for example, in *DSM-IV*), and missing data are handled as for the total CAST. Examples of questionnaire items selected for the different subscales are as follows: Social subscale: "Is it important to him/her to fit in with the peer group?"; Communication subscale: "Can s/he keep a two-way conversation going?"; and RRBI subscale: "Does s/he try to impose routines on him/herself, or on others, in such a way that it causes problems?" In the current sample, CAST data showed good internal consistency, with acceptable Cronbach α values for total CAST ($\alpha = 0.76$) and the three theoretically derived subscales ($\alpha = 0.64$ for the social, 0.83 for the communication, and 0.73 for the RRBI subscales).

Intellectual Ability Estimates. Estimates of intellectual level have been collected at various time-points in TEDS, including early parent-administered measures, and later telephone and Internet-based assessments. Because children with difficulties such as ASD tended not to complete such assessments at later time points, the present analyses used data from parent-administered measures at ages 2, 3, and 4 years. These had the advantage of the fullest coverage of the key groups examined, and the least selective attrition.

For verbal ability, TEDS used the UK short form version of the MacArthur Communicative Development Inventories (MCDI:UKSF),[23] which assesses vocabulary, grammar, and semantic/pragmatic ability. For nonverbal ability, an age-appropriate instrument was specifically designed; the Parent Report of Children's Abilities (PARCA). Both measures showed good validity compared with performance on other standardized measures as reported by Oliver and Plomin.[24] An overall general score was then derived from a combination of the two measures.

Behavioral Problems at Ages 7 and 12. Behavior problems were assessed using teacher ratings on the SDQ.[25] This widely used and psychometrically sound instrument assesses internalizing and externalizing difficulties as well as peer problems, hyperactivity, and pro-social traits.

Statistical Analyses

Analysis comparing autistic-like traits and SDQ measures on a continuous scale were undertaken using SPSS software (SPSS Inc., Chicago, IL) using analysis of variance (ANOVA). Effect sizes were measured with partial η^2; and Cohen (p. 283)[26] suggests that values from 0.009 to 0.058 reflect a "small" effect, between 0.058 and 0.138 a "medium" effect, and above this a "large" effect. For dichoto-

mous measures, the data were coded categorically and odds ratios were then calculated to explore the relationship between categories, as well as the interaction between group and gender. The purpose of this was to analyze whether diagnosed individuals showed higher odds in specific impairments compared with nondiagnosed High-CAST groups, and to test the hypothesis that this would be more often the case in girls than in boys. An interaction between the two categories (diagnosed vs. high-CAST and male versus female) would then indicate that certain odds are significantly higher or lower in one sex compared with the other.

RESULTS

Of the 189 children meeting diagnostic criteria for ASD on the DAWBA, 29 were girls and 160 were boys, giving a male-to-female sex ratio of 5.5. In the high-CAST group (not meeting diagnostic criteria on DAWBA), the 174 children comprised 55 girls (32%) and 119 boys (68%), a 2.2 sex ratio.

How many of those scoring above threshold on the CAST went on to fulfil criteria for ASD on the DAWBA? Among boys, 108 of the 227 with CAST scores above 14 also met diagnostic criteria for ASD. Discounting the 34 boys who did not receive the DAWBA, this corresponds to a diagnosis rate of 56% among high-scoring boys. Among girls, 20 of the 75 with CAST scores over 14 also met criteria for ASD diagnosis. Again, discounting the 23 girls who did not receive the DAWBA, this corresponds to a diagnosis rate of 38% among high-scoring girls.

Continuous Measures

Autistic-like Traits. Overall CAST scores and subscales are shown in Table 1. It can be seen that there were no significant gender differences in the diagnosed groups of children (p values ranged from .11 to .82). High-CAST girls had significantly fewer social autistic-like traits [t(172) = −2.86, p = .005, partial η^2 = 0.05] and more communication autistic-like traits [t(172) = 3.14, p = .002, partial η^2 = 0.05] compared with high-CAST boys, as indicated by the boldface data in the table.

Within the gender groups, diagnosed girls had significantly more social autistic-like traits compared with high-CAST girls (t(75) = −2.77, p = .007, partial η^2 = .09). Diagnosed boys showed significantly more social and communication autistic traits than high-CAST boys (with p values <.01, and partial η^2 ranging from 0.02 to 0.09), but differences in RRBI traits were only marginally significant [t(245) = 1.93, p = .055, partial η^2 = 0.02].

Combined Teacher-Rated SDQ Behavior Problem Scores (Mid-childhood SDQ). To maximize numbers with SDQ data, new variables were created that used a mid-point of scores when children had been rated at both time points or data from a single time point when that was all that was available. The average scores from these new variables are shown in Table 2. It can be seen that the only gender difference was in the high-CAST group (bold font); high-CAST girls were significantly more prosocial than equivalent boys. Within the gender groups, diagnosed versus high-CAST girls had significantly higher reported levels of hyperactivity [t(51) = 3.29, p = .002, partial η^2 = 0.18] and higher overall behavioral problem scores [t(51) = 3.08, p = .003, partial η^2 = 0.16]. Diagnosed and high-CAST boys did not differ significantly on any SDQ measure.

TABLE 1 Parent-Rated Childhood Autism Spectrum Test (CAST) at age 8 Years, by Gender and Group (Meeting Diagnostic Criteria for Autism Spectrum Disorder [ASD] versus High-CAST (Not Diagnosed)

	Total CAST	Social	RRBI	Communication
Girls				
Diagnosed (n = 22)	18.40 (5.08)	6.68 (2.63)*	4.23 (1.66)	7.50 (2.77)
High-CAST (n = 55)	17.23 (3.04)	**5.00 (2.32)**	4.60 (1.59)	**7.63 (1.83)**
Boys				
Diagnosed (n = 129)	19.29 (5.12)**	6.83 (2.73)*	4.48 (1.70)	7.96 (2.34)**
High-CAST (n = 119)	16.82 (2.22)	**5.99 (2.02)**	4.09 (1.43)	**6.75 (1.68)**

Note: Data are mean (SD). Asterisk indicates significant differences between diagnosed versus high-CAST groups within gender. Differences in restricted/repetitive behavior and interests (RRBI) scores within boys were marginally significant (p = .055). Boldface type indicates where the gender difference reached significance p < .05 (i.e., girls witih subclinical disorder had fewer social difficulties and more communication difficulties). For all group comparisons, Bonferroni corrections were applied.

*p < .05, **p < .001.

TABLE 2 Teacher-Rated Strengths and Difficulties Questionnaire (SDQ) Score (Combined 7- and 12-Year Measure)

	Prosocial	Hyper-activity	Conduct	Peer Problems	Anxiety	Total Problem Score
Girls						
Diagnosed (n = 20)	5.77 (2.51)	6.63 (3.08)*	1.97 (1.84)	3.60 (2.22)	2.50 (2.06)	14.70 (6.13)*
High-CAST (n = 32)	**6.67 (2.15)**	3.78 (3.05)	1.47 (1.89)	2.33 (1.65)	2.10 (1.66)	9.62 (5.62)
Boys						
Diagnosed (n = 102)	4.69 (2.94)	5.92 (2.82)	1.78 (1.83)	3.25 (2.42)	2.92 (2.04)	13.25 (6.38)
High-CAST (n = 86)	**5.34 (2.47)**	5.22 (3.10)	2.18 (2.19)	2.49 (1.93)	2.22 (2.11)	12.14 (6.58)

Note: Data are mean (SD). All subscales range from 0 to 10 with higher scores indicating greater problems, except for Prosocial where higher scores indicate more prosocial behavior. Total SDQ Problem score ranges from 0 to 40 (in the calculation of which Prosocial scores are reversed). Asterisk indicates significant differences between Diagnosed versus High–Childhood Autism Spectrum Test (CAST) groups. Boldface type indicates where the gender difference reached significance p < .05 (i.e. subclinical girls had fewer social difficulties and higher communication difficulties). For all group comparisons Bonferroni corrections were applied.

*p < .05.

Dichotomous Measures

Early Overall, Verbal, and Nonverbal Cognitive Abilities. Not all cohorts and children provided cognitive data at each of the age 2-, 3-, and 4-year time points. Therefore a similar procedure to that used with the SDQ data was followed. New variables with averages scores were created when children had 2 or 3 scores, or a single score was included when a child provided cognitive data at only one early time point. Figure 2 shows the percentage of diagnosed and high-CAST boys and girls falling more than 1.5 SDs below the TEDS mean for overall (G), verbal (V) and nonverbal (NV) cognitive abilities. Odds ratios are shown in a table below of Figure 2. There were significant within-gender differences for girls, with the odds between 4 and 9 times higher for diagnosed girls to fall 1.5 SDs below the mean compared with their high-CAST counterparts. For boys, the odds for falling more than 1.5 SDs below mean were only significant for verbal cognitive abilities (2.7 times higher) compared with high-CAST boys.

SDQ Indicating Total Behavioral Problems at Ages 7 or 12. Children were classified as having scores higher than or equal to 16 (SDQ level indicative of behavioral difficulties) at either age 7 or 12 years. Figure 3 shows frequencies of children above this level at one or both times, as well as showing odds ratios. There was a significant within-gender difference for girls, with the odds 5.4 times higher for diagnosed versus high-CAST girls, to show high levels of behavioral difficulties. Frequencies for diagnosed versus high-CAST boys were not significantly different.

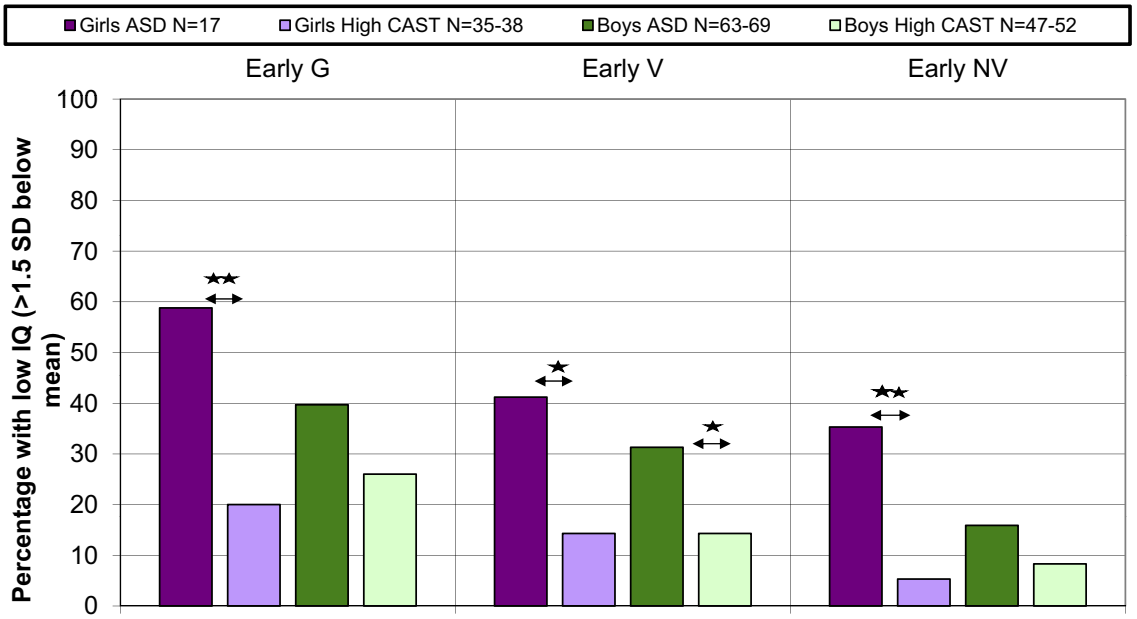
Combined Cognitive and/or Behavioral Difficulties. Figure 4 shows frequencies of children with low estimated intellectual level and/or behavioral difficulties. There was a significant within-gender difference for girls, with the odds 8.4 times more likely for diagnosed girls to show these cognitive/behavioral difficulties compared with high-CAST girls. In boys there was also a significant difference, but the odds ratio was significantly lower; diagnosed boys were 1.8 times more likely to show these additional difficulties compared with high-CAST boys [$\chi^2(1) = 5.81$, $p = .02$].

DISCUSSION

The results of this comparison of boys and girls with comparably high levels of ASD traits, who did or did not meet diagnostic criteria for ASD, suggested that low cognitive ability and/or additional behavior problems distinguished those who met diagnostic criteria in girls but not in boys. This may suggest that girls with ASD are more easily missed in the diagnostic process, and may require additional problems to push them over the diagnostic threshold. This could reflect current diagnostic criteria, concepts, or practices that are somewhat biased toward the male presentation of social and communication impairments and RRBIs.

Alternatively, the present pattern of data might reflect better adaptation to similar levels of ASD traits in girls versus boys. It is possible that girls with high levels of ASD traits but without additional intellectual or behavioral problems do not meet diagnostic criteria because they genuinely cope better in some way. THIS COULD BE FUR-

FIGURE 2 Frequencies of diagnosed ASD and high–Childhood Autism Spectrum Test (CAST) (nondiagnosed) girls and boys scoring more than 1.5 standard deviations below TEDS mean on general (G), verbal (V), or nonverbal (NV) abilities at ages 2, 3, or 4 years. Note: The corresponding odds ratios with 95% confidence intervals are shown in the text box. Asterisks indicate significant differences between diagnosed versus high-CAST groups within gender. *$p <$ .05, **$p <$ .001. ASD = autism spectrum disorder; IQ = intelligence quotient.

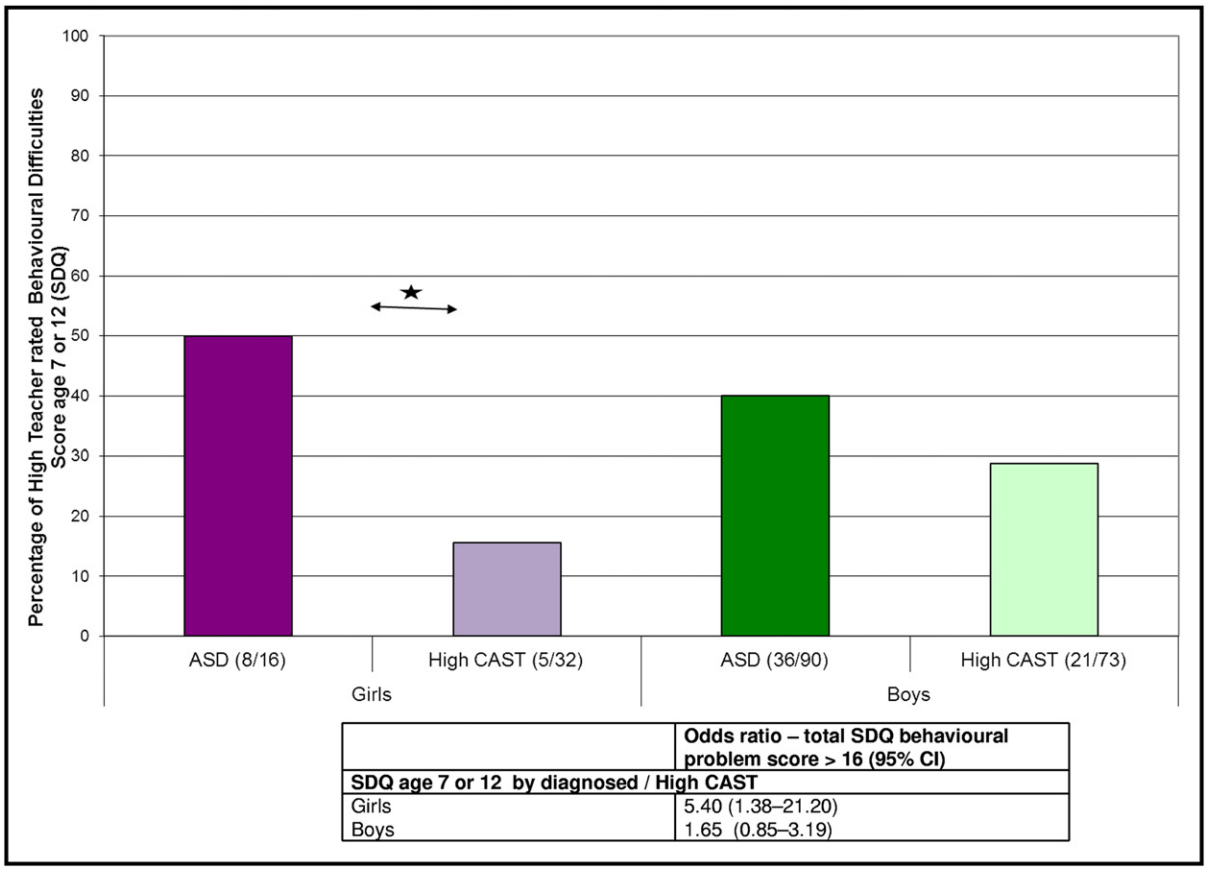


	Odds ratio – falling >1.5 SD below TEDS m IQ (95% CI)
Early total IQ (G) by diagnosed / High CAST	
Girls	5.71 (1.60 - 20.40)
Boys	1.88 (0.92 – 3.84)
Early verbal IQ (V) by diagnosed / High CAST	
Girls	4.20 (1.09-16.24)
Boys	2.73 (1.19 – 6.25)
Early nonverbal IQ (NV) by diagnosed / High CAST	
Girls	9.82 (1.73 – 55.77)
Boys	2.09 (0.76 – 5.71)

THER EXPLORED through investigation of concurrent mental health difficulties, stress, or self-reported strategies and suffering in girls versus boys with high levels of autistic-like traits. Such future investigations might also clarify whether females receive alternative diagnoses instead of ASD, because of either misdiagnosis or more prominent concurrent difficulties in other areas.

Although this is among the very first studies to address the difference between diagnosed and undiagnosed high-autism trait girls versus boys, some limitations should be noted. As is true for most studies of females with ASD, our sample sizes were small in some cells, despite the large sampling frame of TEDS. Large population-based samples are also vulnerable to missing data, adding noise to the analyses; examination of group characteristics did not suggest a systematic bias that would threaten our results or conclusions, but replication is clearly needed. To maximise numbers, we examined early IQ estimates and took as our marker of diagnosed status meeting criteria for an ASD on the DAWBA. We have recently finished collecting gold-standard diagnostic interview and observational data from in-person assessment of twins with ASD in TEDS. Preliminary data suggest good agreement between diag-

FIGURE 3 Percentage of diagnosed ASD and high–Childhood Autism Spectrum Test (CAST) (nondiagnosed) boys and girls rated by teachers above cut-off for total behavioral difficulties (Strength and Difficulties Questionnaire [SDQ] >16) at either age 7 or 12 years. Note: Asterisk indicates significant differences between diagnosed versus high-CAST groups within gender. *$p < .05$. ASD = autism spectrum disorder.



	Odds ratio – total SDQ behavioural problem score > 16 (95% CI)
SDQ age 7 or 12 by diagnosed / High CAST	
Girls	5.40 (1.38–21.20)
Boys	1.65 (0.85–3.19)

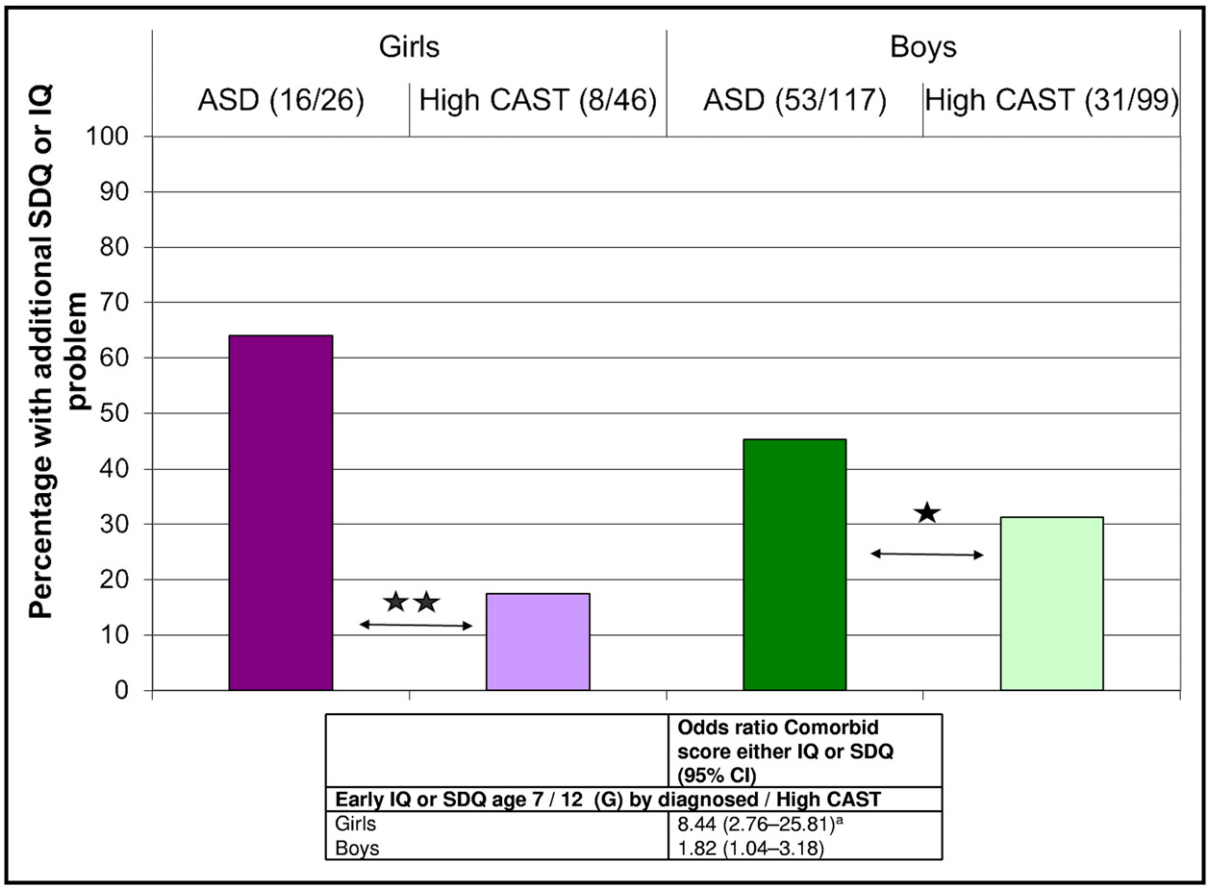
nosis based on ADOS and ADI-R and that derived from DAWBA. However, our use of CAST (which has been reported to have relatively low positive predictive value for ASD diagnosis) and DAWBA, is open to criticism, and highlights the need for future replication studies using other measures. An interesting question for further study is whether sex-specific thresholds would be helpful for ASD screening or diagnostic instruments.

What are the implications of the present findings? One construal of the data presented here would be that ASDs, and especially more subtle forms of ASD, may be more difficult for clinicians to recognize in girls than in boys, particularly in the presence of average-range IQ and without additional behavioral problems. We would not suggest that the unbalanced sex ratio in ASD could be entirely accounted for by such factors. However, more research is needed to establish the level of clinical need in girls versus boys showing high levels of autism-like traits. Such work will be important to establish whether current diagnostic systems, concepts, and practices are failing girls and women with ASD.

CG Clinical Guidance

- Girls, but not boys, who meet diagnostic criteria for Autism Spectrum Disorder (ASD) show more additional problems (lower intellectual level, behavioral problems) than their nondiagnosed peers with similar levels of ASD traits.
- ASD may be more difficult for clinicians to recognize in girls, especially when high functioning, than in boys.
- This may reflect gender stereotypes in the diagnostic process (leading to females being missed) or, alternatively, genuinely better adaptation/compensation in females with ASD.

FIGURE 4 Percentage of diagnosed ASD and high–Childhood Autism Spectrum Test (CAST) (nondiagnosed) girls and boys who had at least one additional problem (either or both low early intellectual ability estimate or high teacher-rated total behavioral problem score). Note: Asterisks indicate significant differences between diagnosed versus high-CAST groups within gender *$p < .05$, **$p < .001$. ASD = autism spectrum disorder; CI = confidence interval; IQ = intelligence quotient; SDQ = Strengths and Difficulties Questionnaire.



	Odds ratio Comorbid score either IQ or SDQ (95% CI)
Early IQ or SDQ age 7 / 12 (G) by diagnosed / High CAST	
Girls	8.44 (2.76–25.81)[a]
Boys	1.82 (1.04–3.18)

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