Towards equitable diagnoses for autism and attention-deficit/hyperactivity disorder across sexes and genders

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Purpose of review
Sex/gender-related factors contribute to contextual issues influencing the recognition of autism and attention-deficit/hyperactivity disorder (ADHD), and modulate how neurodevelopmental characteristics are manifested. This review summarizes the empirical literature to provide directions for improving clinical diagnostic practices.

Recent findings
Timing of autism and/or ADHD diagnosis, particularly in girls/women, is related to the individual's developmental characteristics and co-occurring diagnoses, and expectancy, alongside gender stereotype biases, of referral sources and clinicians. This is further compounded by sex and gender modulations of behavioural presentations. The emerging 'female autism phenotype' concept may serve as a helpful illustration of nuanced autism phenotypes, but should not be viewed as essential features of autism in a particular sex or gender. These nuanced phenotypes that can present across sexes and genders include heightened attention to socially salient stimuli, friendship and social groups, richness in language expression, and more reciprocal behaviours. The nuanced female-predominant ADHD phenotypes are characterized by subtle expressions in hyperactivity-impulsivity (e.g., hyper-verbal behaviours). Optimizing neurodevelopmental diagnoses across sexes and genders also requires an understanding of sex-related and gender-related variations in developmental trajectories, including compensation/masking efforts, and the influences of co-occurring conditions on clinical presentations.

Summary
Equitable diagnoses across sexes and genders for autism and ADHD require understanding of the nuanced presentations and the Gestalt clinical-developmental profiles, and addressing contextual biases that influence diagnostic practices.

Keywords
attention-deficit/hyperactivity disorder, autism, equitable diagnosis, gender, sex

INTRODUCTION

Autism and attention-deficit/hyperactivity disorder (ADHD) are two of the most prevalent neurodevelopmental conditions. Their male-predominant prevalence ratios [1,2▪▪,3▪,4▪] may have resulted in longstanding male-centred clinical prototypes in clinicians' mind as well as under-diagnosis in girls/women and gender-diverse individuals. Despite the fact that the Diagnostic and Statistical Manual of Mental Disorders (DSM)- and International Classification of Diseases (ICD)-based criteria criteria are sex- and gender-independent, their clinical diagnosis (i.e., practical operationalization of the criteria) is less ambiguous if one presents with prototypical behaviours (that are historically conceptualized largely from clinical descriptions of male individuals) than when the presentation is less prototypical and in nonmale individuals. Furthermore, factors related to sex and gender (both are multifaceted constructs) can modulate how autism and ADHD characteristics are expressed

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KEY POINTS

- Some girls/women (and gender-diverse individuals) with autism and/or ADHD in the community likely remain underdiagnosed or overlooked by clinicians because of stereotypical gendered expectations and interpretation of behaviours.
- Nuanced autism phenotypes (that may be more likely to present in autistic girls/women than boys/men) may include heightened attention to socially salient stimuli, friendship, and social groups; richness in language expression; and increased reciprocal behaviours – many of these may also be associated with observable behavioural and self-perceived compensation and masking efforts.
- ADHD girls/women may present with more subtle hyperactivity-impulsivity behaviours (compared with the stereotypical overactivity that is often expressed in ADHD boys/men), alongside compensation and masking efforts.
- Sex-related and gender-related factors, both biological and experiential-contextual, may modulate the developmental and adaptive trajectories of autistic and ADHD individuals towards differential development of personality, behaviours, and co-occurring diagnoses, impacting their daily functioning and wellbeing later in life.
- Current empirical literature on these clinical considerations is unfortunately limited by the under-representation of gender-diverse individuals and a lack of delineation between sex-related and gender-related effects in research.

behaviourally and how they evolve developmentally. This complexity substantiates the challenges of the diagnostic process. With increasing public awareness, shared lived experiences of diagnosed individuals (especially girls/women), advanced behavioural research findings, and accumulating clinical knowledge, this complexity is increasingly being appreciated and directions of clinical translation to enhance the recognition and diagnosis of autism and ADHD across sexes and genders have emerged [5▪,6▪▪,7,8▪,9▪▪].

AUTISM: IT'S NOT ONLY ABOUT SEX/GENDER DIFFERENCES – BEYOND THE 'FEMALE AUTISM PHENOTYPE'

The under-recognition of autism in nonmale populations [1] and the complexity of sex and gender impacts across autism nosology, diagnostic practice, and behavioural presentation and its developmental changes have been increasingly appreciated [7]. In some high-income countries such as the UK, the exponential growth of autism diagnosis is even greater for females than males, especially during the past decade [10▪]. Survey and qualitative studies targeting testimonials from specialized autism professionals consistently highlight clinicians' impression towards a 'partly different' autism presentation in females, including higher social motivation and masking of autistic characteristics, alongside greater internalizing and less externalizing symptoms than in males [11–14], resulting in some clinicians' reduced confidence in diagnosing autism in nonmale individuals [13,14]. The emerging concept of a 'female autism phenotype' highlights unique social relationship characteristics, relational interests (i.e., interests in relational topics such as fictional characters, animals, or psychology), internalizing symptoms, and so-called 'camouflaging' [8▪], and has led to novel scoring proposals of conventional instruments (e.g., the Autism Diagnostic Observation Schedule [ADOS]) [15▪]. However, the so-called 'female autism phenotype' characteristics are not specific to female individuals and can present in autistic people across sexes and genders [7,16▪▪].

The 'female autism phenotype' concept may serve as a helpful illustration of more subtle autistic phenotypes, but it should not be viewed as intrinsic or essential features of autism in females, nor does it imply distinct autism phenotypic profiles by sex or gender [17▪,18]. In view of the sex- and gender-independent diagnostic criteria at the broad-construct level (e.g., based on DSM-5 and ICD-11), the 'female autism phenotype' concept should rather be treated as a lens to enhance knowledge and understanding of the *more nuanced autism presentations that may be present and modulated by sex-related and gender-related factors*. To optimize clinical recognition of autism across sexes and genders, clinicians need to be aware of contextual factors and biases that impede timely diagnosis and be able to recognize the phenotypic nuances associated with the autism spectrum [7].

Direction 1: Being aware of contextual factors that may impede timely and accurate recognition of autism

The age distribution of formal autism diagnosis is wide but tends to be older for girls/women than boys/men [10▪,19–21]. Reasons for this likely involve the combination of sex/gender-modulated nuanced autism presentation (see Direction 2), variation of the timing of needs for a clinical diagnosis, and how autism presentations are interpreted and recognized by carers and clinicians [7]. The latter can be particularly impacted by (a) developmental characteristics and co-occurring diagnoses, and (b) expectancy bias and gender stereotype bias.

Autistic children with higher IQ (especially verbal IQ) tend to have a later age of autism diagnosis [22,23▪], and this pattern is more prominent in girls [23▪]. In autistic children and adolescents, previously diagnosed ADHD is related to a delayed autism diagnosis, more so in girls/women than boys/men [24,25]; a similar pattern for anxiety disorder is also found [21]. This suggests higher verbal ability and co-occurring ADHD and anxiety disorders may postpone the clinical recognition of autism, and the effects tend to be stronger in girls.

For those who have been clinically diagnosed with autism, girls/women tend to have higher co-occurring psychiatric diagnoses (that are associated with age of autism diagnosis in a disorder-specific way [26▪]) and symptoms than boys/men [26▪,27–29]. This can be interpreted as reflecting true co-occurrence as well as barriers for girls to be clinically diagnosed with autism unless they present with more concurrent difficulties – in line with the observation that girls' autism characteristics are at risk of being under-recognized during clinical assessments [30]. Autistic girls tend to make better first impressions (e.g., better perceived social-communication ability) than autistic boys with nonclinician conversational partners [31]. Experimental studies using case vignettes reveal that female-gender name reduces UK educators' concern about possible autism and inclination of seeking for support, especially when the presentation is more subtle [32▪]. Yet, Australian autism diagnosticians seem more likely to consider DSM-5 autism criteria met and tend to assign greater severity ratings when female-gender name is assigned to the vignette; interestingly, these diagnosticians seem less confident in assessing for autism in girls/women than boys/men [14]. These examples illustrate the evolving and context-dependent factors that alter how autism characteristics are perceived and interpreted by referral sources and diagnosticians in different settings and based on the perceived gender of the individual. To mitigate bias in recognition of autism across sexes and genders, clinicians need to be aware of their own expectancy bias (towards under- or over-diagnosis of autism) and gender stereotypes [7], gauging their own clinical knowledge against the evolving diagnostic concept of autism [33▪,34–41] especially related to sex and gender impacts [17▪,18,42▪▪].

Direction 2: Recognizing the nuanced autism presentations modulated by sex- or gender-related factors and across development (Table 1)

When autism phenotypes are measured with conventional standardized measures (e.g., Autism Diagnostic Interview-Revised [ADI-R], ADOS, Childhood Autism Rating Scale [CARS]), in large-scale studies of diagnosed autistic individuals, there are statistically significant but small-effect differences, that girls show lower repetitive patterns of behaviour, interests or activities (RRBI) than boys [44▪▪,45,46]. Within RRBI, diagnosed autistic boys have more repetitive motor behaviours [47▪,48▪,49], more circumscribed interests [46,48▪], and less compulsions and self-injurious behaviours than diagnosed autistic girls [48▪], with no differences in insistence on sameness [47▪,48▪]. RRBI seems more strongly associated with sleep problems in autistic girls than boys [50]. Conventional screeners (e.g., Modified Checklist for Autism in Toddlers [M-CHAT], Social Communication Questionnaire [SCQ]), however, may under-identify RRBI in toddler and preschool-aged girls [51]. Nevertheless, these small effects do not yet support sex/gender-specific scoring thresholds of these conventional instruments [44▪▪]. Instead, clinicians should attend to the more nuanced phenotypes that may not be readily captured by the scoring algorithms of these instruments, or the current items of these instruments per se. Indeed, these findings have partially increased clinicians' awareness to capture, for example, circumscribed interests that are not male-stereotypical (in terms of content) [7,42▪▪].

When evaluating sex/gender differences in social-communication that may not be captured by conventional instruments, the latest meta-analysis found significantly higher abilities in autistic females than males (standardized mean difference, SMD = 0.39, also reflecting specific patterns found in nonautistic females versus males, SMD = 0.35) [52▪▪]. For example, compared to autistic boys/men at a group-average level, patterns noted in autistic girls/women include: heightened attention to socially salient stimuli (e.g., faces) [53–55], friendship [56,57] and social groups (including awareness of being excluded) [58▪]; greater elaboration and richness in language expression [59–61]; and more reciprocal behaviours [62–64]. Many of these phenotypes may also be associated with the on-average heightened observable behavioural and self-perceived 'camouflaging' (or 'passing as nonautistic') efforts in autistic girls/women than boys/men [16▪▪,65▪▪].

Sex-related and gender-related factors, both biological and experiential-contextual, may further modulate the developmental trajectories of autism-related characteristics and must be considered for adequate recognition and support [7,66]. For children who are diagnosed with autism at preschool age, developmental trajectory-based stratifications that have identified subgroups with declining outward autistic features (i.e., ADOS scores) are more likely to include girls [67,68▪]. Meanwhile, there is a widening gap with aging of nuanced social-communication abilities between

Table 1. Nuanced autism phenotypes that tend to be modulated by sex and gender (e.g., more likely to present in under-recognized individuals such as girls/women)

DSM-5 criteria	Diagnostic considerations for nuanced presentation
A1: Social-emotional reciprocity	• Attention and interest to social stimuli can be present to some extent, and modulated by gendered contexts and upbringing • Conversation may be superficially back and forth (sometimes with scripted politeness, well rehearsed in asking questions, or seemingly 4-way but mostly offering own experiences/views), but reciprocity difficulty arises with topic shifting, unfamiliar contexts, or increasing complexity (e.g., more than 2 people conversing) • Conversation reciprocity improves and becomes more natural when talking about interests • Can have intact affective empathy and show sympathy (including towards animals)
A2: Nonverbal communication	• Nonverbal expressions (e.g., eye contact, facial expression orientation, conventional, descriptive, and emphatic gestures) can be superficially present, though can be exaggerated, inflexible, or with insufficient integration across modalities and with verbalization • Understanding neurotypical nonverbal communications may be the main challenge • Subjectively reporting learnt and forced alternative ways of making eye contact (e.g., looking at other's forehead or nose) and facial expression orientation throughout childhood/teenage – this effort can disrupt verbal exchange, objectively shown as reduced integration of verbal and nonverbal communication
A3: Developing, maintaining, and understanding relationships	• Interests to social relationships and peer interaction can be present, with developmentally appropriate desire for friendships, yet finding them difficult to navigate and manage • Social awareness can be present to certain levels • Tend to be naïve in relationships • May prefer to be alone in neurotypical social situations, but can have close friends especially when there are shared characteristics or interests • Can figure out neurotypical others' thoughts and feelings with deliberate efforts and sufficient processing time, but intuitive understanding is still challenging • Can invest large amounts of energy preparing for social interactions, and feeling exhausted and drained afterwards
B1: Stereotypy or repetitiveness	• Repetitiveness may not be apparent motor mannerisms • Stereotypy can manifest as idiosyncratic language expression, including unusually formal, pedantic, detailed, or precise language
B2: Insistence on sameness	• Can be perceived as perfectionism or preoccupation with details • Can manifest as strictly following rules, 'black and white' thinking, or insisting on believed truth (especially when co-existing with A3 features)
B3: Fixated interests	• Content of circumscribed interest can be typical to neurotypical and gendered contexts • Despite ego-syntonic, engagement with circumscribed interest can be exhaustive • Circumscribed interests can be used as social currency
B4: Idiosyncratic sensory responses	• Both hyper- and hypo-responsivity can be present within the same or across different sensory modalities • Can also present as enhanced perception • Can also present as difficulties in interoception • Can manifest as eating problems • Can be associated with choices of clothing and appearance not fitting stereotypical gender expectations
C: Evident characteristics in early developmental period but may not fully manifest until demands exceed capacity, or masked by learnt strategies	• Impression management of the individual following socio-cultural (including gendered) expectations may lead to learnt modification of own behaviours across development, resulting in attenuated autistic behavioural presentations (a process termed 'autistic camouflaging', 'masking', or 'passing as nonautistic', etc. [16▪▪,65▪▪]) that render some, but not all, cardinal features of autism less apparent. • However, impression management is not autism-specific nor diagnostic for autism. Positive subjective reports of developmental experiences of intention and efforts to 'camouflage/mask/pass' and the cognitively taxing nature due to autistic cognition and executive function challenges, alongside collateral information of evident autistic features in early years (i.e., childhood), are key to autism diagnostics in this scenario [17▪]. • Autistic 'camouflaging/masking/passing' should be recognizable. First, there should be autistic features early in life to be masked or compensated for, when camouflaging efforts started. Further, there should be repeated camouflaging practices/rehearsals that the individual exercised over time, so it was less successful initially but over time they were better at it. Finally, even when an autistic person masters camouflaging, there should still be observable signs of this effort, including (i) the exhaustion and withdrawal afterwards (e.g., signs of 'autistic burnout' [43▪]), (ii) inflexibility across contexts (e.g., much more difficult in the 'cocktail party' scenario), and (iii) subtle de-synchronization during interpersonal interactions, 'out of sync' episodes, and efforts to keep up with synchronization – hence, social-behavioural differences may manifest and become more observable over time during long interactions, and especially in novel or unpredictable settings.

Table 1 (*Continued*)

DSM-5 criteria	Diagnostic considerations for nuanced presentation
D: Clinically significant impairment in current functioning	• Despite superficially intact functioning, can easily feel exhausted due to impression management efforts [43▪] • Subjective distress should also be considered for making a clinical diagnosis • Context dependence of functioning is not uncommon: e.g., keeping oneself together in public (e.g., at school, workplace) but experiencing/expressing substantial emotion regulation challenges (e.g., burnout, meltdown) in private settings (e.g., at home) • Frequently requiring time alone to recover and restore energy • Overall, the clinical diagnosis is based on the Gestalt of behavioural-cognitive patterns and their developmental profiles, and that functional and wellbeing impacts are directly associated with this Gestalt in neurotypical contexts
Associated features that commonly co-exist	• Can have co-existing difficulties in understanding own emotions (i.e., alexithymia) and other's emotions, accompanied by long processing time or difficulty differentiating emotions • Childhood imaginative/pretend play (e.g., doll play) can be present, but is often predominated by setting up toys and scenes, scripted (even interactive), with limited reciprocity (even with the presence of agency using dolls/figures) • Good structural language ability, especially in expression (including hyperlexia) • Executive function difficulties, motor difficulties, and emotion regulation challenges may be common and can substantially cloud the clinical picture • Body focused repetitive behaviours may be common • Do not reach the level of adaptation or achievement expected given the intelligence level • Increased variance and fluidity in gender expression and identity, as well as sexual orientation and sexual identity

Also see: [7,12,16▪▪,17▪,42▪▪,52▪▪,65▪▪].

autistic and nonautistic girls (that was not found in boys) [52▪▪], and there are higher parent-reported autism-related challenges in autistic girls than boys emerging in adolescence [44▪▪]. This has been reported alongside increasing diagnosis of autism in adolescence and adulthood, more so in girls/women than boys/men [10▪,69]. These findings jointly highlight the necessity of tailoring assessment and diagnosis to the specific developmental stage and clinical needs of a particular individual.

In the general population, gendered role expectation and interpersonal complexity substantially increase in adolescence, especially for girls/women, translating into steeper increase of social-communication challenges over teenage years in girls/women than boys/men [70,71]. In this context, some autistic youth, especially girls/women, may eventually show clinical needs for autism diagnosis at an older age as the demands exceed their capacity. Meanwhile, the seemingly reduced outward autistic behaviour over time in some early diagnosed autistic youth, especially girls/women, should not be assumed to simply represent reduced clinical needs. This may result from learned survival strategies in response to contextual demands [16▪▪,17▪,65▪▪], and may come with increasing mental health burden (e.g., anxiety and depression) that is more prominent in girls/women than boys/men [72▪], corresponding to findings in diagnosed autistic individuals across life-stages and settings [28,73–76].

Direction 3: Co-occurring conditions matter

Appropriate clinical assessment should also include recognizing the substantial health burden found in autistic girls/women compared to nonautistic girls/women and autistic boys/men, whereby autistic girls/women have increased rates of epilepsy and endocrine/reproductive health problems [74,77▪,78–81], depressive disorders [28], and disordered eating [82,83]. These complex presentations reflect the intersections between biological and socio-contextual factors within the multifacet constructs of sex and gender.

ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: UNDER-RECOGNIZED AND UNDER-REPRESENTED GIRLS/WOMEN IN THE CONTEXT OF SEX/GENDER-RELATED NUANCES

When the DSM-IV criteria for ADHD were developed, the symptom lists were validated primarily based on observations in boys [84]. DSM-5 field trials also recruited male-excess samples [85]. Like autism, this practice may have in part led to overlooking specific patterns of presentations in girls/women, due to gender-related expectations [6▪▪,9▪▪]. Fortunately, there is growing awareness in research, media, and popular conceptions that some girls/women who meet criteria for ADHD may have been previously misdiagnosed or not diagnosed, because of gender-related biases [6▪▪,9▪▪,86,87▪,88]. Overall,

most clinicians and researchers hold the view that ADHD is the same condition across sexes/genders, despite the presence of sex/gender-related nuances in phenotypic expression [6▪▪,9▪▪,89].

Direction 1: Being aware of contextual factors that may impede timely and accurate recognition of attention-deficit/hyperactivity disorder

Boys show 2–2.5 times higher ADHD prevalence than girls based on population-based studies across countries and ethnicities [3▪,4▪]. The preponderance of boys with ADHD is even more pronounced in clinically referred than community samples [90]. Sex/gender differences in childhood ADHD rates attenuate, or become absent, in adulthood across referred and nonreferred samples [91–93]. The reason for this age-related diagnostic pattern remains unclear, yet there are several possibilities. First, girls/women appear to have greater persistence in ADHD symptoms into adulthood than boys/men: Girls are more likely to display inattention as the predominant presentation symptoms [94▪▪], which generally persist into adulthood, whereas overactivity and behavioural impulsivity, often seen in ADHD boys, generally decline from childhood to adulthood [95▪]. Second, girls generally do not meet stereotypical expectations of disruptive and impulsive ADHD-related behaviours [6▪▪,9▪▪] (Table 2), likely impacting the possibility of triggering clinical referrals. Third, teachers and parents systematically underreport ADHD in girls compared to boys [97,98▪▪], despite comparable objectively observed behaviours symptoms [94▪▪]. Conversely, adult assessment is typically based on self-initiated referral. On self-report, women endorse more relevant problems (in both inattention and hyperactivity-impulsivity) than men with ADHD [99,100]. Lastly, girls/women with ADHD may experience symptoms that become more obvious later on and thus are prone to be diagnosed later (i.e., with recognized impairment occurring in adolescence or adulthood, including those being described as the debatable 'late-onset' presentation) [93,100–102]. The late diagnosis of ADHD might in part arise from a change in informant reporting of ADHD symptoms (i.e., the third explanation above). In some of these late-diagnosis scenarios, their compensation/masking strategies (that are more likely to be employed by girls) [6▪▪,97] in childhood are surpassed by an increase in environmental demands alongside a decline in support resources with age, likely contributing to more problematic experiences for women given the gendered role expectations. In sum, regardless of the causes, the discrepancy in levels of sex/gender differences in ADHD rates between referral sources (i.e., clinical versus population samples) and between developmental stages (i.e., childhood versus adulthood) highlights the possibility that a substantial number of girls/women with ADHD in the community remain underdiagnosed/overlooked [6▪▪,9▪▪].

Direction 2: Recognizing nuanced attention-deficit/hyperactivity disorder presentations modulated by sex- or gender-related factors and across development (Table 2)

Much of the evidence so far implies a gross overlap in the clinical presentation of ADHD in boys/men and girls/women [94▪▪], with the caveat that this literature is based on predominantly male samples. Nonetheless, there are still nuanced on-average differences. A recent meta-analysis [94▪▪] indicates that boys are more hyperactive and experience more inhibition and flexibility difficulties than girls (with statistically significant but small effect sizes), whereas girls are inattentive and struggle with interference control comparably as boys. Yet, many assessment measures in the extant literature are with items emphasizing the prototypical presentation of ADHD in boys [6▪▪,103]. ADHD girls/women, as opposed to presenting stereotypical overactive physical behaviours as expressed in boys/men, may present with more subtle hyperactivity-impulsivity behaviours (e.g., hyper-verbal behaviours such as excessive talking, blurting out answers, and intruding on others) [6▪▪], rendering it harder for girls/women to meet the hyperactivity-impulsivity criteria. Although with comparable levels of inattentive symptoms, many girls, relative to boys, may have more coping strategies and compensatory efforts to mask key impairments [97], potentially contributing to reduced reporting of ADHD symptoms in girls/women during clinical or school encounters by adult informants.

Direction 3: Co-occurring conditions matter

Emotional-behavioural problems associated with ADHD may also be modulated by sex/gender. Boys with ADHD may show more externalizing problems [90], characterized by delinquent behaviours and higher rates of co-occurring oppositional defiant disorder or conduct disorder in childhood [104]. Conversely, internalizing problems (e.g., depression and anxiety) [92] and emotional dysregulation [105] are more common and severe in girls with ADHD. Girls/women may be more likely to first have internalizing disorders recognized, overshadowing their ADHD [97,106]. Although girls/women with ADHD seem

Table 2. Nuanced ADHD phenotypes that tend to be modulated by sex and gender (e.g., more likely to present in under-recognized individuals such as girls/women)

DSM-5 criteria	Diagnostic considerations for nuanced presentation
A1: Inattention	• Can mainly manifest overt inattention symptoms • Can manifest as daydreaming, disorganized, easily distracted, overwhelmed, and having low motivation/initiative • May compensate with efforts and mask behaviours and impairments • Teachers may rate girls with lower levels of inattention similar to the extent that they show less hyperactivity-impulsivity compared to boys, despite girls' inattentive symptoms manifest in a prototypical way • Hormonal changes during menstrual cycles, pregnancy, and menopause may exacerbate inattention
A2: Hyperactivity and impulsivity	• Can present with more subtle hyperverbal symptoms such as excessive talking, blurting out answers, fidgeting, interrupting and/or intruding on others, rather than prototypical symptoms of physical overactivity, extreme risk-taking, and/or disruptive behaviours • May show predominantly inner restlessness, rather than overt physical hyperactivity • May develop more overt risky and impulsive behaviours after mid-adolescence

B: Several symptoms occur prior to age 12 years	• May have mild symptoms rated by teachers and parents in childhood and symptoms become more obvious later on (from adolescence)
	• May present as late-diagnosed or 'late-onset' ADHD (with recognized impairment occurring in adolescence or young adulthood)
	  • May be related to increased self-awareness of difficulties in adolescence/adulthood, leading to belated self-referral
	  • Teachers and parents tend to report the symptoms in a way modulated by gender-based bias (i.e., fewer overt symptoms leading to less referral likelihood in childhood)
	  • Compensatory coping behaviours, which may mask impairments in childhood, are surpassed by environmental-contextual demands during periods of educational or social transition

C: Several symptoms are present in two or more settings	• Despite pervasive symptoms, may mask the impairments in specific settings
D: Clinically significant impairment in current functioning	• Can have less noticeable but persistent inattention symptoms into adulthood • May contribute to low self-esteem and self-worth • May experience increased school dropout and low academic achievement • May feel socially isolated and rejected • May have difficulties to address interpersonal problems and frustration, leading to vulnerability to social-relational and cyberbullying • May be easily gaslighted and abused by partners and have low satisfaction in romantic relationships • May experience negative relationship within own primary family • Increased morbidity and mortality rates associated with accidents

Associated features that commonly co-exist	• Can have more internalizing and fewer disruptive and externalizing behaviours, e.g.,
	  • More emotional problems (lability and emotion dysregulation), anxiety, and depression
	  • More borderline personality traits in individuals with early hyperactive-impulsive symptoms
	  • More nonsuicidal self-injurious behaviours
	• Internalizing problems may be (mis)interpreted as primary conditions
	• Sex-modulated biological and gender-related environmental factors can drive sequential progression from early ADHD to later oppositional defiant disorder, followed by differential development of personality and behaviours (e.g., borderline versus antisocial; nonsuicidal self-injury, risky sexual behaviour versus substance misuse)
	• Can have a higher risk of alcohol and cannabis misuse

ADHD, attention-deficit/hyperactivity disorder.
Also see: [5▪,6▪▪,9▪▪,89,92,94▪▪,96▪,98▪▪,99,100,102,108,111].

to have fewer disruptive behaviours, they may just have a later onset of such [107]. From a developmental perspective, sex-modulated biological and gender-related environmental factors may drive sequential progression from early ADHD to later oppositional defiant disorder, followed by self-injurious behaviours, mood disorders and adult borderline personality disorder/traits in women, and antisocial behaviours/personality disorder in men [108]. Children with ADHD, across sexes/genders, are at greater risk for developing substance use in adulthood [109,110]; girls/women, relative to boys/men, have an even higher risk of alcohol and cannabis misuse [111]. The heightened risks for co-occurring disordered

eating [112], social impairment and social cognitive difficulties [90,104,113,114] are similar between boys/men and girls/women with ADHD.

CONCLUSIVE REMARKS

In order to provide the best care, clinicians need to remain open-minded regarding queries for diagnoses of ADHD and autism across sexes and genders, by attending to questions regarding academic/vocational difficulties, executive dysfunction, and social-relating challenges during regular developmental-psychosocial history taking, screening for symptoms of either condition when the developmental history is positive for such difficulties, and reviewing academic/school reports to substantiate whether subtle cues of the presence of clinically significant ADHD/autism symptoms may have been present but missed or masked at an earlier age. Some mental health specialists may feel uncomfortable assessing for neurodevelopmental disorders, particularly in adults. Thus, capacity building initiatives are essential to enhance clinicians' comfort level and increase awareness of the nuanced presentations and the Gestalt of autism and ADHD, and the biases that may influence diagnostic practices. Although autism and ADHD may have a more nuanced presentation in girls/women, based on current consensus of clinical diagnostic criteria, such characteristics must be present in childhood (and observable to others) and lead to functional impairment in neurotypical contexts to warrant clinical diagnoses. In this context, integrating a given person's subjective experiences over development with valid collateral reports (e.g., from parents, teachers, etc.) is required to clarify the developmental and adaptation history and inform diagnosis [6▪▪,9▪▪,17▪]. In the case of co-occurrence of autism, ADHD, and other psychiatric and neuro developmental conditions, clarifying whether symptoms of another diagnosis contribute to impaired functioning and distress is critical to warrant co-occurring diagnosis.

Within the research and academic community, we need to be mindful of the limitations in the existing literature, especially regarding the under-representation of gender-diverse individuals (despite the increased prevalence of autism and ADHD in this group [115]) , and a lack of delineation between sex-related and gender-related effects in neurodevelopmental research to date [66]. Moving towards equitable clinical care, research should focus on improving population representation, appropriately delineating sex-related and gender-related factors, and reducing contextual biases surrounding recognition of characteristics and impairment (e.g., considering potential bias in the measurement of symptoms across different raters). Ultimately, we need more longitudinal and mechanistic research to elucidate sex- and gender-influenced developmental pathways to ensure that intervention and support strategies are addressing the social and biological underpinnings of the wellbeing and developmental needs of individuals.

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Conflicts of interest

There are no conflicts of interest.

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This latest World Federation of ADHD International Consensus Statement curates important scientific discoveries from the last 20 years with a substantial and rigorous body of evidence (either population-level studies or meta-analyses) to provide the most updated information about ADHD, including the male-predominance of ADHD prevalence

3. Our World in Data, Prevalence of ADHD in males vs females, 1990 to 2017,
■ Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD 2017) Results. Seattle: Institute for Health Metrics and Evaluation (IHME), 2018; 2021.

This chart is constructed in a scientific website 'Our World in Data' based on the Global Burden of Disease study and suggests that male to female ratios in prevalence of ADHD range from 1.48 (Chile in 2007) to 4.71 (Finland in 1990) across 230 countries/regions from 1990 to 2017

4. Wong A, Landes SD. Expanding understanding of racial-ethnic differences
■ in ADHD prevalence rates among children to include Asians and Alaskan Natives/American Indians. J Atten Disord 2021. doi: 10.1177/10870547211027932. [Epub ahead of print]

This study illustrates that across all racial-ethnic groups of children in the United States, boys have higher ADHD prevalence than girls. However, the male to female ratio and prevalence rates vary by race-ethnicity

5. Antoniou E, Rigas N, Orovou E, *et al.* ADHD Symptoms in females of
■ childhood, adolescent, reproductive and menopause period. Mater Sociomed 2021; 33:114–118.

This review indicates that the hormonal fluctuations and transitional periods of life seem to affect the symptoms of ADHD and co-occurring disorders in the female sex. It highlights the necessity that health professionals should be aware of the different presentations of ADHD symptoms in females throughout the lifespan

6. Young S, Adamo N, Ásgeirsdóttir BB, *et al.* Females with ADHD: An expert
■■ consensus statement taking a lifespan approach providing guidance for the identification and treatment of attention-deficit/hyperactivity disorder in girls and women. BMC Psychiatry 2020; 20:404.

This expert consensus statement by the United Kingdom ADHD Partnership illustrates the clinical presentation of ADHD in girls and women, explains the potential sex/gender biases which impact the recognition and referral, and provides sex/gender- and development-informed suggestions for treatment and support of girls and women with ADHD

7. Lai MC, Szatmari P. Sex and gender impacts on the behavioural presentation and recognition of autism. Curr Opin Psychiatry 2020; 33:117–123.
8. Hull L, Petrides KV, Mandy W. The female autism phenotype and camou-
■ flaging: a narrative review. Rev J Autism Dev Disord 2020; 7:306–317.

This is a summary of the current research discovery about the emerging concept of the 'female autism phenotype'

9. Hinshaw SP, Nguyen PT, O'Grady SM, *et al.* Annual research review:
■■ attention-deficit/hyperactivity disorder in girls and women: underrepresentation, longitudinal processes, and key directions. J Child Psychol Psychiatry 2021. doi: 10.1111/jcpp.13480. [Epub ahead of print]

This review illustrates key conceptual issues surrounding the underrecognition of ADHD in girls and women from prevalence, diagnostic practices, comorbidity, heterogeneity, biases, to causal factors. It also highlights the heterotypically continuous pathways in females with childhood ADHD and developmental progressions to concerning issues in adulthood, as well as the key directions for future research

10. Russell G, Stapley S, Newlove-Delgado T, *et al.* Time trends in autism
■ diagnosis over 20 years: a UK population-based cohort study. J Child Psychol Psychiatry 2021. doi: 10.1111/jcpp.13505. [Epub ahead of print]

This latest UK population-based study uses health administrative data to illustrate the increases of autism diagnoses over the past 20 years and evaluates differences in trends by self-reported gender and age groups, showing a larger increase of autism diagnosis in females than in males

11. Lundin K, Mahdi S, Isaksson J, *et al.* Functional gender differences in autism: An international, multidisciplinary expert survey using the International Classification of Functioning, Disability, and Health model. Autism 2021; 25:1020–1035.
12. Muggleton JTB, MacMahon K, Johnston K. Exactly the same but completely different: a thematic analysis of Clinical Psychologists' conceptions of Autism across genders. Res Autism Spectr Disord 2019; 62:75–84.
13. Tromans S, Chester V, Kapugama C, *et al.* The PAAFID project: exploring the perspectives of autism in adult females among intellectual disability healthcare professionals. Adv Autism 2019; 5:157–170.
14. Tsirgiotis JM, Young RL, Weber N. A mixed-methods investigation of diagnostician sex/gender-bias and challenges in assessing females for Autism Spectrum Disorder. J Autism Dev Disord 2021. doi: 10.1007/s10803-021-05300-5. [Epub ahead of print]
15. Clarke E, Hull L, Loomes R, *et al.* Assessing gender differences in autism
■ spectrum disorder using the Gendered Autism Behavioral Scale (GABS): An exploratory study. Res Autism Spectr Disord 2021; 88:101844.

This is the first empirical attempt to re-code behaviours elicited during a standardized assessment, the Autism Diagnostic Observation Schedule, to better capture sex/gender-modulated presentations of autism

16. Cook J, Hull L, Crane L, *et al.* Camouflaging in autism: a systematic review.
■■ Clin Psychol Rev 2021; 89:102080.

This is one of the most comprehensive systematic reviews to date about the emerging empirical research on the phenomenon termed 'camouflaging'. It offers the preliminary summary of the state of research, that '(1) adults with more self-reported autistic traits report greater engagement in camouflaging; (2) sex and gender differences exist in camouflaging; and (3) higher self-reported camouflaging is associated with worse mental health outcomes'

17. Lai MC, Hull L, Mandy W, *et al.* Commentary: 'Camouflaging' in autistic
■ people – reflection on Fombonne (2020). J Child Psychol Psychiatry 2021; 62:1037–1041.

This commentary offers a conceptual clarification for research and clinical issues pertaining to 'camouflaging' and discusses needed future research

18. Fombonne E. Camouflage and autism. J Child Psychol Psychiatry 2020; 61:735–738.
19. Huang Y, Arnold SRC, Foley KR, *et al.* Factors associated with age at autism diagnosis in a community sample of Australian adults. Autism Res 2021; 14:2677–2687.
20. Fusar-Poli L, Brondino N, Politi P, *et al.* Missed diagnoses and misdiagnoses of adults with autism spectrum disorder. Eur Arch Psychiatry Clin Neurosci 2020. doi: 10.1007/s00406-020-01189-w. [Epub ahead of print]
21. Wodka EL, Parish-Morris J, Annett RD, *et al.* Co-occurring attention-deficit/hyperactivity disorder and anxiety disorders differentially affect males and females with autism. Clin Neuropsychol 2021. doi: 10.1080/13854046.2021.1942554:1-25. [Epub ahead of print]
22. Harrop C, Libsack E, Bernier R, *et al.* Do biological sex and early developmental milestones predict the age of first concerns and eventual diagnosis in Autism Spectrum Disorder? Autism Res 2021; 14:156–168.
23. McDonnell CG, DeLucia EA, Hayden EP, *et al.* Sex differences in age of
■ diagnosis and first concern among children with Autism Spectrum Disorder. J Clin Child Adolesc Psychol 2021; 50:645–655.

In a large convenience cohort, this study examines factors associated with autism diagnosis age and how this differs by the child's sex assigned at birth

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■ elevated female-to-male odds ratios and are associated with the age of first autism diagnosis. Acta Psychiatr Scand 2021; 144:475–486.

This population-based study comprehensively illustrates the patterns of co-occurring diagnoses in male and female individuals who have been diagnosed with autism, and the associations with the age of autism diagnosis

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