

A Systematic Review of the Relationship Between Neurodiversity and Psychosexual Functioning in Individuals with Autism Spectrum Disorder (ASD) or Attention-Deficit/Hyperactivity Disorder (ADHD)

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Abstract: The scientific literature on psychosexual functioning shows a range of outcomes for individuals with neurodiversity. The aim of this article was to synthesize and critically evaluate evidence regarding psychosexual selfhood (orientation), behaviors and experiences in individuals with autism spectrum disorder (ASD) or attention-deficit/hyperactivity disorder (ADHD) to prioritize further research and identify interventions to reduce risk. A systematic review of the literature that compared sexual orientation, behavior and experiences of individuals with ASD or ADHD with those of neurotypical peers was performed in AMED, CINAHL, MEDLINE, PsycARTICLES and PsycINFO, Psychology and Behavioural Sciences Collection, Child Development and Adolescent Studies databases (supplemented by hand-searching of reference lists). Seventeen ASD and nineteen ADHD studies met inclusion criteria. Overall, the studies reviewed suggest poorer psychosexual functioning for individuals with ASD or ADHD compared to neurotypical peers, including a lack of satisfaction in their sexual relationships, sexual dysfunction, risky sexual behaviors, and victimization. This appears to be more marked for females. Individuals with ASD were more likely to identify with a non-heterosexual orientation compared with neurotypical peers. The study identifies gaps in our knowledge relating to risky sexual behaviors (in particular, those relating to sexual health and vulnerability to sexual victimization and perpetration). The public health implications of the findings are discussed. Future research is needed to clarify the mechanisms by which individuals with neurodevelopmental disorders may be at increased risk of adverse psychosexual outcomes and identify interventions that may mediate outcomes.

Keywords: ADHD, ASD, neurodiversity, sexual behavior, outcomes

Introduction

Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are both neurodevelopmental disorders associated with impaired functioning across a range of life domains, including psychosexual functioning.^{1,2} Psychosexual functioning consists of three domains - psychosexual behavior, psychosexual selfhood (orientation), and psychosexual socialization.^{3,4}

There is a dearth of research on the topic of psychosexuality and neurodiversity. Those that exist report a range of poor outcomes, including risky sexual behaviors (RSBs) and sexual victimization. Within the literature, observed associations have been attributed to ASD and ADHD-specific features. For those with ASD, social communication deficits central to diagnosis such as ability to understand and interpret social norms, cues and emotions are posited to affect ability to successfully initiate sexual interactions, leading to socially inappropriate sexual behavior.⁵ Some authors suggest that restricted and repetitive behaviors and stereotyped interests may manifest into a preoccupation with specific sexualized behaviours.⁶ Sensory sensitivities have also been suggested to affect psychosexual functioning.⁷ For example, hypersensitivity may make physical touch unpleasant, and hyposensitivity may cause difficulties in becoming aroused

and/or reaching orgasm. Further postulated barriers to the development of healthy sexual relationships for individuals with ASD include a lack of adequate informal and formal developmentally appropriate sexual education compared to neurotypical peers.⁸ There is some evidence that poor outcomes may be associated with greater severity of ASD symptoms and level of functioning.^{9,10}

ADHD related symptoms such as inattention, impulsivity, hyperactivity, sensation seeking, and mood instability are also hypothesized to have an effect on psychosexual functioning.^{11,12} For example, symptoms of impulsivity may hinder the implementation of protective methods against sexually transmitted infections (STIs) and unwanted pregnancies owing to a tendency to favor immediate gratification with little regard to consequences. There is evidence that for neurotypical peers, distractibility has a negative effect on sexual response.^{13,14} Hence inattention may increase the risk of sexual dysfunction. Further to the influence of ADHD symptoms, prescribed pharmacotherapy to treat ADHD has been found to impair sexual functioning which in turn may affect compliance with treatment.¹⁵

Large variability between and methodological problems within individual studies has however obscured our full understanding of the psychosexual behaviors and experiences of those with ASD or ADHD. Retrospective reporting by adults about their adolescent sexual experiences may call into question the validity of findings of some studies.

In order to identify common findings and gaps for future research, the objective of this review was to draw on the extant literature to collate, synthesize and critically appraise the current evidence regarding psychosexual selfhood (orientation), behaviors and experiences in individuals with ASD or ADHD. The integration of existing literature across a broad spectrum of psychosexual functioning may provide greater insight into the unique experience and vulnerabilities of neurodiverse individuals. This has public health implications for both individual- and community-wide approaches that aim to promote awareness, positive health and well-being via targeted psychosexual education and associated interventions.

Materials and Methods

This review was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.¹⁶

Search Strategy

We searched the following databases up to 31 May 2022: AMED, CINAHL, MEDLINE, PsycARTICLES, PsycINFO, Psychology and Behavioural Sciences Collection, Child Development and Adolescent Studies. Further searching was conducted using Google Scholar to identify any additional relevant articles. Reference lists of all included papers were also hand-searched.

Separate searches were completed for ASD and ADHD. The search terms were: “ASD OR Autism Spectrum Disorder OR autism”/“ADHD OR Attention Deficit Hyperactivity Disorder” paired with the following permutations AND “risky sexual behavior”, “sexual dysfunction”, “sexual deviance”, “sexual risk taking”, “sexual victim* OR coercive sexual behavior”, “sexual attitudes OR sexual interests”. The search strategy was designed with consideration to establishing a balance between sensitivity and specificity. No publication date or age restrictions were applied to allow for a comprehensive review of the literature. The electronic search strategy is provided in [Supplementary File 1](#).

Inclusion Criteria

Studies were included in narrative synthesis if they met the following criteria: (1) they were published in peer-reviewed journals and written in English language; (2) they provided data on study-specific psychosexual outcomes (eg sexual orientation and identity, sexual activity and satisfaction, sexual dysfunction, sexual disorders, risky sexual behaviors, sexual victimization, and sexual perpetration); (3) cases of any age who were reported to have met the ASD or ADHD diagnostic criteria; and (4) studies included a neurotypical comparison. Studies where comparison was performed between individuals with other diagnoses (eg intellectual disabilities) were excluded. Further exclusion extended to studies where cases were included with other externalizing disorders. Studies investigating the side effects of pharmacotherapy were also excluded. We excluded reviews, case reports, dissertations/theses, and editorial letters.

Study Selection

One reviewer screened all titles and abstracts for their relevance in accordance with the inclusion/exclusion criteria and retrieved the full text of any article considered potentially eligible for inclusion in the review. The full-text articles were evaluated carefully against the eligibility criteria by the same reviewer.

Data Extraction and Quality Assessment

The following data were extracted into an excel spreadsheet for included papers: first author, year of publication, geographic location, study design, sample size, age, sex, study measures including diagnostic criteria (ASD/ADHD), outcomes examined, mediators/moderators adjusted for in analysis, and findings. A narrative synthesis was conducted as heterogeneity of studies meant that a meta-analysis was not feasible.

The Newcastle-Ottawa Scale which is recommended for observational studies (eg case-control studies and cohort studies) was used to appraise the quality and risk of bias of included articles.¹⁷ The Newcastle-Ottawa Scale awards a maximum score of 9 points across three domains: selection, comparability, and outcome/exposure. As there is no agreed standard criterion for appraising a study as high quality, moderate quality, or low quality, this was at the discretion of the authors. For this review, we considered studies scoring 7 to 9, 4 to 6, and 0 to 3, to represent high quality, moderate quality, and low quality, respectively. To ensure a comprehensive review, no studies were excluded from synthesis based on the ratings obtained. The quality of all included articles was assessed by the same reviewer.

Results

[Figure 1](#) shows the screening and selections processes. A total of 5529 ASD and 5499 ADHD titles and abstracts were screened after removing duplicates. After further screening, 117 ASD and 128 ADHD articles were retained for full-text review. Of these, 17 ASD studies comprising 1939 individuals with ASD and 13,193 neurotypical peers, and 19 ADHD studies comprising 62,556 individuals with ADHD and 3,169,682 neurotypical peers met our inclusion criteria. The sample sizes varied widely across studies, ranging from 60 to 8739 for ASD studies and from 58 to 2,698,052 for ADHD studies. The mean age of ASD and neurotypical controls ranged from 12 to 46.44 years old. For ADHD individuals and neurotypical controls the mean age ranged from 10.4 to 43 years old. All studies were published in English from 2005 to 2022. Studies (ASD/ADHD) were conducted in Australia (4/0), US (3/10), Canada (4/3), Taiwan (0/2), Germany (1/2), Denmark (0/1), Netherlands (4/1), Sweden (1/1), Iran (0/1), and Italy (1/0).

Quality Evaluation

According to our classification using the Newcastle-Ottawa Scale, of the 17 included ASD studies, no studies were of high quality, 10 studies were of moderate quality and 7 studies were of low quality. Of the 19 included ADHD studies, 8 studies were of high quality, 9 studies were of moderate quality and 2 studies were of low quality (see [Supplementary Files 2](#) and [3](#) for further details of the quality assessment).

Autism Spectrum Disorder

See [Supplementary File 4](#) for a summary of studies reporting outcomes for ASD.

Sexual Orientation and Identity (Psychosexual Selfhood)

Seven studies investigated the association between ASD and sexual orientation. Inconsistent findings were reported, with five studies reporting higher rates of non-heterosexual attraction for individuals with ASD compared to neurotypical peers,^{18–22} and two studies reporting no differences in sexual orientation.^{3,23} Where differences were found, this was particularly evident for females; when separated by gender, some studies showed significantly lower rates of heterosexual preference, and higher rates of bisexuality and uncertainty in attraction between ASD and neurotypical females, but no significant differences between ASD and neurotypical males.^{20,22}

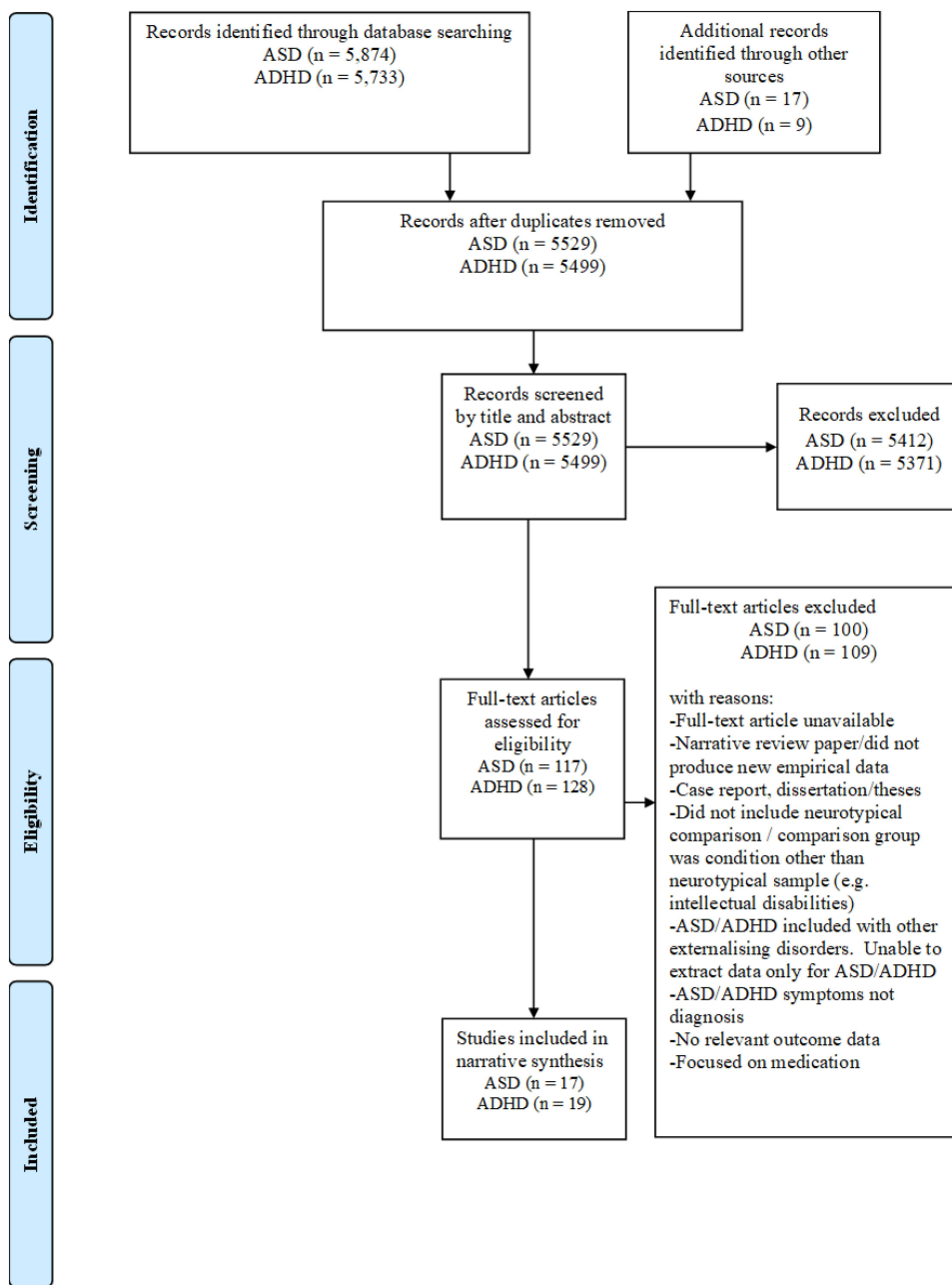


Figure 1 PRISMA flow diagram.

Gilmour et al examined whether individuals with ASD and neurotypical peers differed with respect to whether a person’s sexual behavior pattern was actually reflective of reported direction of sexual attraction; no significant group differences were reported.¹⁹ The comparability of ASD and neurotypical peers in this study was however limited.

Significantly lower rates of young people with ASD report to identify with their sex assigned at birth compared with neurotypical peers.²³ However, this was a small study. In another small study, Bejerot and Eriksson found significantly more females with ASD than neurotypical peers reported an “atypical gender identity”, with ASD females rating themselves as being more tomboyish in childhood compared to neurotypical females. No significant differences were found between ASD and neurotypical males.²² Further confirmatory studies with larger sample sizes are needed.

Sexual Activity and Satisfaction

Number of Sexual Partners

Gilmour et al investigated “breadth of sexuality” which they defined as overall number of sexual partners and/or the number of potential partners the participant was interested in. There were no significant between group differences, however, there was a significant sex by group interaction. Compared with neurotypical females, neurotypical males had a significantly broader range of sexual partners/interest; breadth of sexuality did not significantly differ between ASD males and females.¹⁹

Sexual Activity and Satisfaction

Nine studies investigated the association between ASD and sexual activity and satisfaction. Findings were mixed, with some studies reporting no significant differences in self-reported previous sexual experience (solo and partnered) between individuals with ASD and neurotypical peers,^{3,19,20,24} and other studies indicating fewer sexual experiences (eg, oral sex, sexual intercourse) for people with ASD compared with neurotypical controls.^{22,23,25,26} Age may partly account for differing findings; in their follow-up study of adolescent boys, Dewinter et al found that in contrast to two years previously, significantly fewer ASD boys than neurotypical peers had partnered sexual experiences (eg French-kissing and petting).²⁶ The authors noted that sexual experiences can rapidly change across small time-frames during adolescence and young adulthood, with differences changing or disappearing across the developmental trajectory. The authors indicated that their results are suggestive of the existence of a subgroup who are slower to gain partnered sexual experiences, commensurate with research in adult samples. However, the small sample size, selection bias and that the neurotypical control group differed from their earlier study due to lack of follow-up data, impedes conclusions. Follow-up of larger groups across developmental trajectories are required. Other factors may be associated or predictive of trajectories, such as culture, relationship skills, self-image/confidence, anxiety, and sexual desire which were not accounted for across included studies hindering interpretation of mixed findings.

Joyal et al found a significantly higher proportion of ASD than neurotypical individuals reported to “never or rarely” think about sex (ASD 29.4% vs neurotypical 9.6%) and a lower proportion reported perceiving their interest in sex to be “equal or greater” to that of peers (ASD 60.3% vs neurotypical 91.3%). A significantly lower proportion of ASD males watched pornography (ASD 41.5% vs neurotypical 75.9%) and/or regularly masturbated with pornography (ASD 39% vs neurotypical 75.9%), compared with neurotypical peers. No significant differences were found between the groups of females.²³ It is however noted that dividing the sample by gender significantly lowered the statistical power of the study.

Similarly, Turner et al found that while there were no differences in relationships and sexual satisfaction between ASD and neurotypical females, ASD females viewed sexuality to be much less important in their lives compared with neurotypical females (neurotypical 53.8% vs ASD 20%). ASD females also perceived themselves to be less sexually attractive (neurotypical 53.8% vs ASD 20%). No differences were found concerning the importance of sexuality for males. Males with ASD were however substantially less satisfied with their current relationship (neurotypical 63.8% vs ASD 11.1%) and sex life (neurotypical 59.6% vs ASD 10.7%) than neurotypical peers. Like females, males with ASD did not perceive themselves as being sexually attractive (neurotypical 73.7% vs ASD 3.6%).²⁷

Sexual Dysfunction

Two studies investigated sexual dysfunction.^{24,27} Turner et al reported significantly lower scores in sexual excitation and greater problems across all sexual functioning domains (desire, arousal, orgasm, satisfaction, pain, and lubrication) for ASD females compared with neurotypical females. ASD males reported greater problems in erectile functioning than neurotypical males, but no significant differences were found concerning sexual desire or orgasmic functioning. ASD males had significantly higher scores for sexual excitation. None of the additional clinical characteristics assessed in the study (regular alcohol or illegal drug intake, any psychiatric disorders, any endocrine disorders, genital abnormalities, regular intake of psychopharmacological agents and hormone replacement therapy) predicted sexual functioning scores for either females or males.²⁷ The study however is limited because diagnoses were self-reported. A small study of adolescent boys also found sexual problems for boys with ASD compared to neurotypical peers but the group of those with sexual experiences was too small to interpret findings.²⁴

Sexual Disorders

No studies investigating sexual disorders met inclusion criteria.

Risky Sexual Behaviors

Age of Onset for Sexual Behavior

Five studies investigated age of onset for a range of partnered sexual behavior (eg, French-kissing, petting, masturbating another/being masturbated, oral sex, intercourse). Three studies found no significant differences in self-reported age of onset for boys and girls.^{3,24,26} May et al however found that females with ASD were a younger age than neurotypical females for first sexual intercourse (ASD 12.7 years vs neurotypical 14.2 years), although findings are inconclusive as only three ASD females reported to have had sexual intercourse in the sample.²⁰ Conversely, in Bejerot and Eriksson's study, ASD participants experienced sexual intercourse later than the neurotypical group (ASD males 22.1 years, ASD females 18.7 years vs neurotypical males 17.4 years, neurotypical females 16.5 years).²² Considering the small sample size of the study and likelihood of selection bias, caution is warranted when interpreting results.

Use of Contraception, Pregnancy, and Sexually Transmitted Infections (STIs)

In a small male-only sample, Dewinter et al reported on condom use for the first time participants had sexual intercourse and found that 64.7% of ASD boys and 77.5% of neurotypical boys had used a condom.²⁶ There were no studies investigating use of contraception more widely, pregnancy and STI's that met inclusion criteria.

Sexual Victimization

Three studies investigated the association between sexual victimization and ASD, with higher rates of sexual victimization reported for individuals with ASD when compared with neurotypical peers (odds ranging between 2.21 and 7.3).²⁸⁻³⁰ One small study included flashing or sexual exposure in their investigation and found the opposite outcome, with the neurotypical group being 2.3 times more likely than the ASD group to be victim of these behaviors.³⁰

Brown-Lavoie et al examined data by gender; they found that both females and males with ASD were significantly more likely than neurotypical peers to have experienced unwanted sexual contact and sexual coercion. Only males with ASD were more likely to experience rape than their neurotypical peers. Actual (rather than perceived) sexual knowledge partly mediated the relationship between ASD and sexual victimization, with less knowledge being associated with increased risk of victimization.²⁸ The study however utilized a cross-sectional design and thus directionality of effects cannot be discerned.

Studies have also investigated other negative sexual experiences. Joyal et al found that approximately half of girls with ASD reported negative sexual experiences, but this did not differ significantly from neurotypical girls.²³ Pecora et al found that while ASD and neurotypical females were comparable regarding whether they had sexual experiences that they later regretted, ASD females were over twice more likely than neurotypical peers to have consented to an unwanted sexual event (OR 2.56) and be subject to an unwanted sexual advance or experience (OR 2.21).²⁹

There may be an effect of sexual orientation, this was investigated by Pecora et al who found differences between ASD and neurotypical females by sexual orientation. ASD homosexual females were almost three times more likely to report an unwanted sexual experience than neurotypical heterosexual females (OR 2.98) and over twice more than neurotypical homosexual females (OR 2.38). No significant differences were reported in rates of regretted sexual experiences between ASD homosexual females and neurotypical females with either a heterosexual or homosexual orientation. Comparisons for ASD bisexual females found the likelihood of having negative sexual experiences was similar for bisexual females with and without ASD, but those with ASD were less likely to have engaged in sexual behavior they regretted (OR 0.38) than neurotypical heterosexual females.²¹ As the study is limited by examining sexuality and sexual victimization among autistic females, results cannot be generalized to the broader autistic population; further research is needed to ascertain if experiences are also elevated among autistic males with a non-heterosexual orientation compared with neurotypical counterparts.

Sexual Perpetration

Weiss and Fardella investigated adult sexual perpetration, reporting low rates and no significant differences between ASD and neurotypical adults.³⁰ Similarly, low rates of sexual coercion have been found in an adolescent boy sample (eg, ASD boys 3 and neurotypical boys 2).^{24,26} Both studies however had a small sample size and low statistical power to detect differences.

The relationship between victimization and perpetration may be complex. Parent-report studies have consistently found that parents perceive their ASD children to be less experienced in typically appropriate sexual/intimate behaviors (eg French-kissing) but display more inappropriate sexualized behaviors (eg, allowing or seeking physical contact with family-members or well-known acquaintances and initiating physical contact with less known acquaintances/strangers, touching others inappropriately, touching private body areas in public, masturbating in public, speaking about sexual activities inappropriately, and intrusive courting behaviors which may be interpreted as stalking) and express greater parental concern than neurotypical peers.^{3,31–33} These studies however are similarly limited due to small sample sizes; further larger confirmatory studies are warranted.

Attention-Deficit/Hyperactivity Disorder

See [Supplementary File 5](#) for summary of studies reporting outcomes for ADHD.

Sexual Orientation and Identity (Psychosexual Selfhood)

Two studies reported no significant differences between individuals with ADHD and neurotypical peers in self-reported sexual orientation.^{34,35} However, significantly more individuals with an ADHD diagnosis reported previous homosexual experiences than neurotypical peers, with the difference even more pronounced for females.³⁵ The authors noted that the neurotypical comparison group was small, with only 21 males included which could have hindered detection of gender specific group differences. Comparing neurotypical females with ADHD females, Bijlenga et al found the latter were more prone to report ambivalent gender identity. No significant differences in gender identity were found between ADHD and neurotypical males.³⁶ Whilst this study did not have an issue with the size of the neurotypical comparison group, ADHD males and females were significantly younger than their neurotypical counterparts impeding comparability.

Sexual Activity and Satisfaction

Number of Sexual Partners

Seven studies investigated number of sexual partners. Some reported ADHD is significantly associated with a greater number of sexual partners,^{34,37–40} and this may be irrespective of whether symptoms persist or remit in adulthood.³⁹ Others reported no significant association.^{35,41} Mediating factors may influence outcomes; having a positive bias towards behavioral competence³⁸ and a high-quality relationship with mother⁴¹ may predict fewer sexual partners. Disruptive behavioral disorders may also be important; when examining those with ADHD but without ODD or CD, risk was not significantly increased.³⁷

Sexual Activity and Satisfaction

Only one study investigated sexual activity and satisfaction. Bijlenga et al found that compared to neurotypical males, males with ADHD more often reported sexual aversion (12% vs 1%) and little desire for sexual contact (6% vs 0%). Females with ADHD more often reported sexual aversion (15% vs 4%) than neurotypical females. Nevertheless, they found ADHD males were more sexually active than neurotypical males; the male ADHD group had a significantly lower rate of infrequent (defined as a maximum of once per month) sexual fantasies (24% vs 41%) and masturbation (15% vs 35%) and a higher rate of frequent (defined as more than once per week) masturbation (49% vs 32%) compared to neurotypical males. Although the male ADHD group was more sexually active, they were less satisfied with their sex life than neurotypical males (27% vs 68%). ADHD females also had a lower rate of infrequent sexual fantasies (49% vs 68%) and reported less satisfaction with their sex life compared to neurotypical females (35% vs 65%). There was no

significant difference with neurotypical females for masturbation.³⁶ The generalizability of these findings is however limited as the ADHD sample were individuals treated in an outpatient ADHD clinic.

Sexual Dysfunction

Four studies investigated sexual dysfunction. Three studies reported no difference in the prevalence of sexual dysfunctions when comparing individuals with and without ADHD.^{34,35,42} However, Amani Jabalkandi et al found that compared to neurotypical females, females with ADHD showed significantly poorer results in all sexual functioning domains (desire, arousal, orgasm, satisfaction, pain, and lubrication); the most reported sexual complaints related to orgasm, satisfaction, and pain. Sexual dysfunction was similarly more common in males with ADHD compared to neurotypical males, with significantly lower scores in all domains (erectile function, orgasmic function, intercourse satisfaction, and overall satisfaction), except for desire. The most reported sexual complaints related to overall satisfaction and erectile dysfunction.⁴³ This study however was limited by the small sample size, and that ADHD participants were recruited from a clinical population without comorbidity, hindering interpretation and generalisability of results. In another small study, Abdel-Hamid et al found that comorbidity (eg anxiety/depression) may mediate differences in sexual dysfunction between ADHD and neurotypical peers.⁴²

Sexual Disorders

Hypersexuality

Two studies investigated hypersexuality. When applying a non-validated questionnaire, Bijlenga et al found that 5–12% (using two different measures) of males and 2% of females with ADHD met criteria for hypersexuality, but this did not significantly differ from neurotypical peers (5% males; 2% females).³⁶ Applying a widely validated questionnaire to assess hypersexual behaviors, Hertz et al found individuals with ADHD reported significantly more hypersexual behaviors at a sub-clinical level compared to neurotypical individuals, but when considering those meeting criteria for classification as hypersexual (at or above the pre-defined cut-off), there were no between-group differences. A sex difference in motive for hypersexuality was present, however. For females, this was associated with impulsivity, temper, affective lability, emotional over-reactivity, and oppositional symptoms. For males, hypersexual behaviors were related to social attitudes.³⁵

Atypical Sexual Desires and Behavior

Bijlenga et al found that compared with neurotypical females, females with ADHD were more prone to report transvestic fetishistic desire (5% vs 0%), transvestic fetishistic activity (5% vs 0%), and pedophilic desire (2% vs 0%). No significant differences were found between ADHD and neurotypical males.³⁶

Risky Sexual Behaviors

Age at First Sexual Intercourse

Six studies investigated age at first sexual intercourse.^{34,35,37–40} These studies consistently reported that compared with neurotypical individuals, people with ADHD engage in sexual relations and/or intercourse at a significantly younger age (ADHD ranging from 15.3 to 17.90 years old and neurotypical peers ranging from 16.3 to 18.39 years old). When outcome was examined separately by gender, one study found that while ADHD females were significantly younger at the time of their first sexual experience than neurotypical females (ADHD females 14.3 years vs neurotypical females 17.0 years), there were no significant differences for males (ADHD males 15.8 years vs neurotypical males 16.5 years).³⁵ This however contrasted to a small study by Rokeach and Wiener,⁴⁰ who found the reverse (ADHD males 14.50 years vs neurotypical males 16.40 years; ADHD females 15.50 years vs neurotypical females 15.33 years). The small sample however limits the generalizability of the findings. The relationship between ADHD and earlier age at first sexual intercourse may be partially mediated by an academic positive bias.³⁸

Use of Contraception

Five studies investigated use of contraception. Two studies found no direct association between ADHD and irregular use of contraception,^{38,40} whilst other studies found that those with ADHD were less likely to regularly use contraception

when compared to neurotypical peers,^{34,37,41} this was however dependent on definitions used. For example, Huggins et al found no significant differences between groups on item “failure to use effective prophylactic method”, though they did find a significant interaction between gender and ADHD status on item “failure to use condoms”; sexually active females with ADHD were significantly less likely to use condoms compared to neurotypical females, ADHD males and neurotypical males.⁴¹ Similarly, in a male only sample, Flory et al found no significant differences between groups for infrequent (defined as less than almost always) use of reliable birth control methods (pill, condoms, foam, diaphragms), though ADHD males were significantly more likely to have had casual sex with infrequent condom use. ADHD status demonstrated an independent risk, with ADHD males without comorbid ODD or CD being 5 times more likely to have had casual sex with infrequent condom use compared to neurotypical peers.³⁷

Pregnancy

Eleven studies investigated association between ADHD status and pregnancy, and mediating factors. Studies generally reported ADHD was associated with an earlier age and higher incidence of pregnancy in comparison to neurotypical peers,^{34,37,39,44–49} with the exception of two small studies that had reduced power.^{40,41} One nationwide cohort study which examined pregnancy across various age intervals found that individuals with ADHD were significantly less likely than neurotypical peers to become parents in general. Those that did become parents were more likely to become parents at an early age compared to neurotypical peers (aged 12–16 IRR females 3.62; males 2.30).⁴⁶

Other studies have examined mediators through which ADHD may lead to early pregnancy. Owens and Hinshaw found that substance use and academic achievement each mediated the relationship between ADHD and unplanned pregnancy in early adulthood via risky sexual behaviors. However, when analyzed simultaneously, only the pathway from childhood ADHD to academic achievement to risky sexual behavior to unplanned pregnancy was significant.⁴⁷ Another study found that in simple univariate mediation models, delinquency/substance use, academic achievement, and persistence of ADHD symptoms during adolescence each mediated the association between ADHD and early pregnancy, though when allowed to covary, only delinquency/substance use remained a significant mediator of the association between ADHD and early pregnancy.⁴⁵

A nationwide longitudinal study found that long-term ADHD medication use may significantly lower risk of any pregnancy (HR 0.72) and early pregnancy (HR 0.69).⁴⁴

Sexually Transmitted Infections (STIs)

Five studies reported the association between ADHD and STIs. Three studies with limited generalizability due to sample size and sample characteristics found no significant differences between groups for contracting STIs,^{37,40,41} whereas two studies did.^{34,50} Barkley et al found that more individuals with ADHD reported having contracted an STI than neurotypical peers (17% vs 4%) and had also been tested for HIV (54% vs 21%), although no individuals reported testing positive.³⁴ In Chen et al nationwide longitudinal study, adolescents (HR 3.27) and young adults (HR 3.57) with ADHD were more prone to developing any STI later in life when compared to those without ADHD. This increased risk was found for both men (HR 3.81) and women (HR 2.71). Both short-term (HR 0.70) and long-term users (HR 0.59) of ADHD medications had a significantly lower risk of developing any STI, although this effect was only observed for men.⁵⁰

Sexual Victimization

Three studies investigated sexual victimization. A study which solely investigated sexual victimization at first sexual experience found no significant differences between individuals with ADHD and neurotypical peers.³⁵ Two studies which examined experiences more broadly reported increased sexual victimization for individuals with ADHD (OR ranging from 1.41 to 3.31), compared with neurotypical peers.^{51,52} Rates of sexual victimization were reported to be similar for adults with both persisting and desisting ADHD.⁵¹ Authors have examined potential factors including sex, alcohol abuse, illicit drug use and history of child abuse as moderators and found that the link between ADHD and (attempted) rape was not strengthened in adults with these additional risk factors.⁵¹ In their study of college women, Snyder also found that ADHD remained a significant risk factor in predicting women’s sexual victimization when other theoretically important

predictors were included in multivariate analysis.⁵² Data however was collected at the same time point for included studies, thus limits causal interpretations.

Sexual Perpetration

No studies investigating sexual perpetration met inclusion criteria.

Discussion

This review, to our knowledge is the first to provide a synthesis of a broad spectrum of psychosexual functioning in individuals with neurodiversity (specifically ASD or ADHD). The review revealed few available studies with a neurotypical comparison for each of the psychosexual outcomes, making it difficult to draw firm conclusions. Future research needs to address this, nevertheless some important findings were identified, and these are summarized in Table 1.

Autism Spectrum Disorder

Several studies investigated the association between ASD and sexual orientation. While findings were mixed, there was some evidence of sexual ambivalence, higher homosexual, bisexual and asexual interest in individuals with ASD compared to neurotypical peers. Some authors caution that for people with ASD, their limited experience of relationships may hinder their understanding of what is meant by sexual orientation. Bejerot and Eriksson propose that “gender blindness” may lead to individuals with ASD not identifying the person’s specific gender as part of their appraisal of a potential partner.²² The results indicate the need to raise awareness of the higher representation of sexual and gender diversity for those with ASD, particularly among females. Parents/caregivers and practitioners should be aware of the additional challenges and risks that some of these individuals with ASD may encounter when identifying with a sexual minority (eg, difficulty telling others about their sexual attraction and/or gender identity, stigma, exclusion). Early attention to sexuality that supports adolescents with ASD to understand their sexuality and to explore and develop a healthy sexual identity that fits their self-concept is likely to be important for positive sexual development and functioning.^{18,24} This is deemed important as there is evidence of poor mental health outcomes for those who identify with a sexual minority.^{53–55}

Regarding sexual behavior and experiences, our review suggests that findings may be contingent on informant (eg, self or parent/caregiver). Self-report is limited by insight and parent-report by assumptions and/or second hand-information.⁸ It has been suggested that consistent with stereotypes about ASD individuals,⁵⁶ parents of ASD individuals may see their children as asexual and assume they do not engage in sexual behavior.³ Nevertheless, parent-report indicated that they do consider their children to be sexual but inappropriately so, which is a concern due to the potential risk this may cause. Adolescents and adults with ASD exhibited significantly more inappropriate sexual behavior than their neurotypical peers. These behaviors included speaking about sexual activities inappropriately, engaging in inappropriate sexualized/intimate behaviors with others (eg family members, strangers), touching others inappropriately (in private or in public), masturbating in public, and intrusive courting behavior which may be interpreted as stalking (showing obsessional interest, monitoring person’s activities, following them, pursuing in a threatening manner, making threats against the person, and threatening self-harm); in these cases, individuals will be at risk of negative outcomes such as criminalization of their behavior, regardless of intention.

This may relate to lack of knowledge including privacy related rules and/or naivety; a negative correlation has been reported between psychosexual knowledge and inappropriate sexual behavior.³ While not causative, this may suggest that, with intervention, improvement of sexual knowledge may lead to a reduction in inappropriate behavior. A problem, however, is that young people with ASD feel that their knowledge about sexuality is limited; they report that they find it difficult to understand sexual education compared with neurotypical peers.²³ The school curriculum may provide basic sexual information, but the issue of appropriate behavior and relationships is not explicit or concretely communicated in a way that individuals with ASD will fully understand, or in a way that they then know how to apply in real life situations.⁵⁷ This may leave young people researching and/or obtaining sex education from informal sources (eg media and internet) which may provide an overly romantic or distorted perspective.²⁸ To support an understanding of “safe” and

Table 1 Summary of Findings for ASD and ADHD from the Systematic Review

	ASD	ADHD
Sexual Orientation and Identity (psychosexual selfhood)	<p>Most studies report higher rates of non-sexual attraction compared with neurotypical peers. One study found significantly lower rates of young people with ASD identified with their sex assigned at birth.</p> <p>Some evidence for within group differences. Females with ASD may have greater sexual ambivalence and higher rates of bisexuality than males with ASD.</p> <p>References:^{3,18–23}</p>	<p>Individuals with ADHD did not significantly differ from neurotypical peers in reporting sexual orientation, but they reported significantly greater history of homosexual experiences (especially females). Females were more ambivalent about their gender identity than neurotypical peers.</p> <p>References:^{34–36}</p>
Sexual Activity and Satisfaction	<p>Findings were mixed regarding group differences in sexual experiences. Some reported lower rates of sexual activity for ASD, others did not. Age may partly explain differences, with some ASD individuals delayed in experiencing early common partnered sexual experiences. Both males and females with ASD perceived themselves to be less sexually attractive than neurotypical peers.</p> <p>No difference between neurotypical/ASD females for satisfaction in their current relationships and sex life. Males with ASD were substantially less satisfied.</p> <p>References:^{3,19,20,22–27}</p>	<p>The majority of studies suggest a significantly higher number of sexual partners compared with neurotypical peers. Mediating factors may be comorbid disruptive behavioral disorders, positive bias towards behavioral competence, and high-quality mother-child relationship.</p> <p>ADHD males were more sexually active than neurotypical peers. Compared with neurotypical peers, ADHD males and females were less satisfied with their sex life.</p> <p>References:^{34,36–40}</p>
Sexual Dysfunction	<p>Even when controlling for mediating factors, sexual dysfunction appears to be present for both males and females with ASD compared with neurotypical peers. Females report lower sexual excitation, and greater problems across desire, arousal, orgasm, satisfaction, pain, and lubrication sexual functioning domains. ASD males report higher excitation and problems in erectile functioning.</p> <p>References:^{24,27}</p>	<p>Mixed results – three studies suggest no difference in sexual dysfunction. One study suggests that, compared with neurotypical peers, both males and females report a broad range of sexual dysfunction. The most common for females relate to sexual desire, orgasm, satisfaction, and pain and lubrication. For males, this was erectile dysfunction, orgasmic function, intercourse satisfaction and overall satisfaction.</p> <p>Comorbid anxiety/depression may mediate differences in sexual function.</p> <p>References:^{34,35,42,43}</p>
Sexual Disorders	<p>No studies met inclusion criteria.</p>	<p>Compared with neurotypical peers, there may be greater hypersexual behaviors at sub-clinical level but not at a level of clinical concern. Within group differences suggest hypersexuality in females is associated with impulsivity, temper, affective lability, emotional over-reactivity, and oppositional symptoms. For males, these relate to social attitudes.</p> <p>One study found females report more atypical desires and behaviors for transvestic fetishism and pedophilic desire (very low base rates). Males did not differ from neurotypical peers.</p> <p>References:^{35,36}</p>

(Continued)

Table 1 (Continued).

	ASD	ADHD
Risky Sexual Behaviors	<p>Findings were mixed regarding age of onset for sexual behavior. One study indicated that those with ASD were younger at first experience, with another study finding the opposite for neurotypical peers. Other studies indicated no differences in age.</p> <p>ASD boys were less likely to use a condom at first time of sexual intercourse (one study only). No studies met inclusion criteria investigating use of contraception more widely, or other RSBs including pregnancy and STIs.</p> <p>References:^{3,20,22,24,26}</p>	<p>Compared with neurotypical peers, young people with ADHD have sexual relations/intercourse at a significantly younger age. One study suggests younger activity relates to females only, while another study found the reverse for males. Mixed findings for contraception use. Some report people with ADHD rarely use contraception. Other studies have found no direct association between ADHD and contraception use; it appears results may differ dependent on definitions used between and within studies. One study of a male-only sample reported 5 times elevated risk of infrequent use of condoms in ADHD males without ODD or CD. Another study reported females with ADHD were less likely to use condoms than ADHD males, neurotypical males and neurotypical females. Disruptive disorders, IQ and alcohol use may be mediators.</p> <p>Compared with neurotypical peers, there is a significant association between ADHD and younger age of pregnancy. Key mediators may be academic achievement, delinquency, and substance use. Long-term ADHD medication use may significantly lower risk of early pregnancy.</p> <p>Mixed findings for STIs. For males only, ADHD medication use may significantly lower risk of developing any STI.</p> <p>References:^{34,35,37–41,44–50}</p>
Sexual Victimization	<p>Higher rates of sexual victimization are reported for ASD compared to neurotypical peers. Females are more likely to experience unwanted sexual contact and coercion; around half of young girls with ASD report negative sexual experiences. They are over twice more likely than neurotypical peers to consent to an unwanted sexual event and be subject to an unwanted sexual experience. Sexual orientation may be an influential factor; risk appears to be substantially greater for homosexual females.</p> <p>Males with ASD are more likely to experience rape than their neurotypical peers. Actual sexual knowledge may partly mediate the relationship between ASD and sexual victimization.</p> <p>References:^{21,23,28–30}</p>	<p>Compared with neurotypical peers, individuals with ADHD have higher rates of sexual victimization, irrespective of persisting/desisting symptoms. One study showed the effect is not mediated by theoretically important predictors such as alcohol abuse, illicit drug use and/or history of child abuse.</p> <p>One study found no significant difference in sexual victimization at first sexual experience compared with neurotypical peers.</p> <p>References:^{35,51,52}</p>
Sexual Perpetration	<p>Inconclusive findings due to small sample sizes.</p> <p>References:^{3,24,26,30–33}</p>	<p>No studies met inclusion criteria.</p>

“unsafe” sexual behaviors and recognize how violations in social exchanges may increase risk of perceived sexual perpetration, accurate accessible sources of information that are tailored to meet the developmental, social communicative and cognitive needs of those with ASD must be identified. Sex education (which should include social skills training) should be commenced in childhood and continue throughout adolescence and adulthood.

Our review found that those with ASD are at increased risk of negative sexual experiences and sexual victimization which is of concern. It has been speculated that a difficulty understanding the intentions of others may partly contribute to association between ASD and sexual victimization.²⁸ Others speculate that the increased risk of negative sexual experiences among homosexual ASD participants may have occurred with individuals of the opposite sex before the individual had developed a clear and felt sense of sexual identity.²¹ Negative sexual experiences have been associated with poor psychological wellbeing and future research should focus on context of victimization and examine specific factors that may mediate risk.

Attention-Deficit/Hyperactivity Disorder

The review revealed that individuals with ADHD did not significantly differ in their sexual orientation compared with neurotypical peers, however they report a significantly greater history of homosexual experiences. Females report greater ambivalence about their gender identity.

There were mixed findings regarding sexual dysfunctions. One study found no differences between ADHD and the neurotypical group after controlling for anxiety/depression.⁴² It is possible that comorbid symptomatology may have a more important role in sexual dysfunctions than ADHD symptoms, although further research in this area is needed.

There was some evidence that ADHD was associated with RSBs including engagement in sexual activity at a younger age, pregnancy at a younger age, and significantly higher number of sexual partners, especially for females.

Hertz et al suggested observed differences between studies may partly be explained by age of participants, with RSBs occurring especially during adolescence and less so in adulthood.³⁵ This review indicated that RSBs may be mediated and/or moderated by other factors including delinquency, oppositional and conduct problems, substance use and academic achievement. While some mediators were no longer significant in multivariate analysis, the interplay of mediating effects is likely to be complex (eg, earlier academic problems and persisting ADHD symptoms may lead to increased delinquency and substance use).

ADHD medications may provide a protective effect for both early pregnancy and STIs, although the number of studies investigating the effects on these psychosexual outcomes are limited. One longitudinal study comparing Taiwanese adolescents and young adults with ADHD (n=17,898) with age and sex-matched controls (n=71,592) reported a 30% and 41% reduction in STIs with short-term and long-term use of ADHD medication, respectively.⁵⁰ When following up a Taiwanese adolescent sample (ADHD n=7500) vs controls (n=3020) and applying a similar methodology, Hua et al reported that long-term use of ADHD medication was associated with a 30% reduction in teenage pregnancy.⁴⁴ However, these Taiwanese studies found that 40–42% did not receive any ADHD medication; of those who did, only 16–26% of ADHD participants took it over the long-term. This emphasizes the risk for young people at this time, many of whom disengage from healthcare services in adolescence and young adulthood and at a time when there is a need for increased attention and support regarding sexual health and risk behaviors.⁵⁸ Public health authorities need to become aware of the potential protective effect of ADHD medication treatment for prevention of early pregnancy and STIs. If not to confer health gain, this will undoubtedly provide cost savings for societal health economics in the long-term.

The results suggest a developmental pathway of risk which may lead to RSBs including early age pregnancy. Interventions intended to promote educational success and that support young people with ADHD to succeed in school, in addition to interventions for adolescent substance use would appear to be potential targets for early intervention to reduce/prevent poor psychosexual outcomes for those with ADHD. Other interventions may include sexual education by mental health professionals involved in diagnosis and treatment of ADHD to address the issue in a timely manner. Increasing awareness in sexual health clinics may also have the potential to intervene in the process.⁵⁹ Though only based on one study,⁴¹ there may be a role for interventions to target improving and maintaining positive close mother-child relationships as a means of reducing engagement in RSBs.

The findings also indicate an association between ADHD and sexual victimization (even when accounting for common risk factors such as alcohol and drug use). This is a concern. Mechanisms underlying increased risk for sexual victimization are unclear and further research is required. Authors have speculated that individuals with ADHD may be perceived by motivated perpetrators as more vulnerable or easy targets due to their presentation (low self-esteem, impulsive, socially isolated or rejected).⁵² Research indicates that individuals with ADHD are prone to developing relationships with deviant peers, including those who use substances and are potentially violent which may inadvertently increase their exposure to perpetrators.⁵¹

Limitations of Evidence and Review Processes

To our knowledge this is the first systematic review of the literature on this topic. The review excluded the grey literature as dissertations/theses are not peer reviewed and may be less scientifically rigorous. Only peer-reviewed English language articles were included as there was no funding for translation. Screening, data extraction and quality analysis was conducted by one author which may also have introduced bias.

There is a dearth of studies that comprehensively cover the topic of psychosexuality. Some of the findings were based on one or few publications and need replication applying robust methodologies. Most studies were of low to moderate quality. The design of many studies precluded the establishment of a causal relationship between ASD/ADHD and psychosexuality outcomes. Sample sizes varied widely, with some small sample sizes which had insufficient power to detect differences (especially for low frequency occurring outcomes such as victimization or perpetration) and/or limited generalizability. Some studies used multiple exploratory comparisons which increased the risk of Type I error, although this was not corrected for in analysis.

Sampling biases in the way that participants were recruited (eg, self-selected) may have resulted in highly motivated participants and/or those with a higher interest in sexuality, more sexually experienced, more sexual problems and/or adverse sexual experiences, and less conservative/traditional sexual opinions.^{60–62} More generally, the dearth of robust, controlled studies reporting psychosexual orientation, behaviors and experiences may be hampered by a reluctance to disclose deeply personal, intimate information.

Our search was directed by the extant literature that describes a range of negative outcomes. Future research might take a more general approach to provide an opportunity to consider positive outcomes and/or overlap with neurotypical peers. Importantly, not matching case-controls on demographic variables may have introduced bias. Whilst age was often considered an important factor to control for in the included studies sex was not always considered, despite research indicative of the impact of sex on psychosexual outcomes.

Diagnosis of ASD/ADHD was frequently self-reported with some studies using rating scales which are susceptible to false positives and negatives to confirm diagnosis. For ASD studies, most sampled individuals had “high functioning” Autism and thus data may not generalize to those who exhibit greater difficulties since research has shown that poor outcomes may be associated with greater severity of ASD symptoms and impairments in functioning.^{9,10}

In relation to outcomes, some studies used measures designed specifically for the study where the psychometric properties (reliability and validity) had not been established. Reporting of outcomes often involved retrospective ratings which are susceptible to recall bias. There was a lack of consideration of other factors that may moderate and/or mediate outcomes such as psychiatric comorbidity which research has found to be associated with psychosexual functioning,⁶³ and may be common for both individuals with ASD and ADHD.

Conclusion

This review has highlighted that young people and adults with ADHD and/or ASD perceive themselves to be “different” in their sexual orientation, psychosexual behaviors and experience compared to neurotypical peers. They both report a lack of satisfaction in their sexual relationships, sexual dysfunction, risky sexual behaviors, and victimization. The evidence is sparse across topics, and researchers appear to be prioritizing different themes. For example, sexual perpetration has been investigated in ASD and not in ADHD; pregnancy has been investigated in ADHD but not in ASD. The different interests in research themes may reflect hypothesis-driven research questions associated with underlying symptoms (eg vulnerability and misunderstanding of social cues in people with ASD influencing sexual

perpetration; impulsive behavior influencing unprotected sex). If we are to identify common themes across neurodiverse conditions, future research should be more inclusive with respect to the investigation of topics as this may prevent biases towards neurodiversity.

Where sex differences were investigated, female functioning featured strongly. ASD females appear to be more ambivalent in their sexual identity and practices. A higher rate of sexual victimization was reported in both ADHD and ASD studies, but more so for the latter. Strikingly, compared with neurotypical females, over half of females with ASD were over twice more likely to report negative sexual experiences characterized by coercion and unwanted sexual contact. It seems that they may give consent to these sexual advances. Males with ASD are also more likely than neurotypical males to be sexually assaulted.

Research shows a 21% overlap between ASD and ADHD.⁶⁴ This represents a “double deficit” for problems associated with psychosexual functioning and the challenges to address them. Given the overlap, clinicians should consider general neurodevelopmental symptoms as a potential indicator of risk for poor psychosexual outcomes and should more routinely enquire about sexual selfhood and practices and identify potential risky behaviors that may lead to negative outcomes.

The findings indicate that further research is needed on the psychosexuality of individuals (both male and female) with ASD and ADHD across every domain presented in this review. Particular gaps in our knowledge relate to RSBs (in particular those relating to sexual health) and vulnerability to sexual victimization and perpetration. Many of the published studies are limited by methodological problems, nevertheless they consistently indicated greater risk for females. Further research applying qualitative and/or longitudinal designs is needed to gain an in-depth understanding of individual and contextual factors that may make people with neurodiversity vulnerable to poor psychosexual outcomes and identify interventions that may mediate outcomes.

Disclosure

Professor Susan Young reports personal fees from Medice, personal fees from Takeda, personal fees from Janssen, personal fees from Psychology Innovations Limited, personal fees from Cognitive Centre of Canada, during the conduct of the study; personal fees from Medice, personal fees from Takeda, personal fees from Janssen, personal fees from Psychology Innovations Limited, personal fees from Cognitive Centre of Canada, outside the submitted work; and is the author of the Diagnostic Autism Spectrum Interview, the ADHD Child Evaluation and ACE+ for assessing ADHD in young people and adults. KC reports no conflicts of interest.

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