

[Commentary] Recognising Physical and Mental Health Issues in Neurodivergent Females: Opinion Piece

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Abstract

The term 'neurodiversity' acknowledges that there are many different ways in which people experience life and interact with others. The term 'neurodivergence' refers to variations in mental or neurological function from what is considered typical or normal and usually incorporates autism, ADHD and Tourette's syndrome, with increasing evidence of an overlap with dyslexia and dyspraxia. Research and education into neurodivergent conditions is essential in shaping clinicians' approaches to people who may present with a wide range of symptoms. Neurodivergence may influence a person's style of communication, learning, attitudes, and behaviour, and they may experience social isolation and inequity. A formal diagnosis improves access to social and medical support and helps them and their family understand their challenges and differences. Neurodivergent people are more prone to a wide variety of physical and psychological health issues, and it is important that clinicians learn to recognise and respond to these.

Explaining neurodiversity and neurodivergence

The term 'neurodiversity' acknowledges that there are many different ways in which people experience life and interact with others. It was first proposed by Judy Singer, an Australian sociologist, in her PhD thesis to promote equality for and inclusion of "neurological minorities" [1]. The term 'neurodivergence' refers to variations in mental or neurological function from what is considered typical or normal and usually incorporates autism, ADHD and Tourette's syndrome, with increasing evidence of an overlap with dyslexia and dyspraxia [2]. Research and education into neurodivergent conditions is essential in shaping clinicians' approaches to people who may present with a wide range of symptoms.

Neurodivergence may influence a person's style of communication, learning, attitudes, and behaviour, and they may experience social isolation and inequity. Therefore, the focus should be on problems that neurodivergent people have rather than the problems that they are [3]. A formal diagnosis improves access to social and medical support and helps them and their family understand their challenges and differences. Neurodivergent people are more prone to a wide variety of physical and psychological health issues, and it is important that clinicians learn to recognise and respond to various clinical cues and clues for these.

Increasing recognition of the high prevalence of neurodivergence in females

Traditionally neurodivergence has been perceived to be more common among males, but it has become increasingly recognised among females in the last decade [4]. The diagnosis is often made later in females because of their tendency to mask or 'camouflage' their differences to reduce the perceived risk of social exclusion [5]. Partially due to this, the pattern of symptoms that they may develop is often also different to that seen in males. Increased sensitivity to a wide variety of sensory and emotional stimuli underlies much of the widespread distress and discomfort perceived by neurodivergent women [6]. This may manifest from an early age as anxiety, hyperfocus and rigidity of thought [7], leading to the later development of distress expressed through both mental and physical signs and symptoms. Difficulty in making and maintaining friendships despite often developing special interests and abilities can lead to low self-image and self-harm [8]. Widespread discomfort and an imbalance in their autonomic regulation may associate with increasing fatigue, even among those with a tendency to hyperactivity [9]. Such presentations often occur in primary care but not infrequently lead to contact with neurology, rheumatology or pain services at a relatively young age, with circulatory, metabolic, and endocrine involvement over time. Adjustment disorders and secondary personality disorders are common features, while associations with eating disorders and gender incongruence are increasingly prevalent and relevant [10].

The healthcare needs of neurodivergent females

A recent review of the literature demonstrated that autistic people were more likely to suffer from many disorders than their neurotypical peers [11]. Adverse childhood experiences can adversely affect health [12] and appear to occur more frequently among autistic females [13]. This may help explain why autistic females access healthcare more than neurotypical females [14][15] and are more likely to require hospital treatment as both outpatients and inpatients [15][16]. A systematic review suggested that hypersensitivity, impaired executive function and communication issues all contributed to autistic females experiencing difficulties with access to medical care [17]. Lack of awareness of these issues by health care professionals accentuated the neglect of their health care needs, leading to poorer outcomes as a result [18].

Whilst virtually every organ system is represented in the list of disorders experienced by neurodivergent people, very little published literature relates specifically to females. However, there is consensus within the limited available data that autistic females are at higher risk than their neurotypical female peers for many disorders and have a higher prevalence of circulatory disorders, asthma, symptomatic hypotension, and diabetes than neurotypical females, despite controlling for risk factors [11]. Data on mortality confirm that autistic females are higher risk of early death than autistic males [19][20][21]. Risks are greater for autistic females than autistic males for most disorders and their health status is generally reduced in comparison [22][23][24][25]. These findings apply across the age spectrum applying to both young autistic individuals [14][16][22][23][24][26], as well as older ones [27]. While some of these observations may be explained by genetic predisposition, especially to circulatory disorders, cancer, and diabetes [28], a further factor may relate to hormonal dysregulation which appears increased among autistic females both prior to birth and in later life [29][30][31][32][33]. This may promote obesity and predispose towards diabetes and circulatory disease [34][35][36].

Physical health issues in neurodivergent females

Whilst a full description of each of the disorders associated with neurodivergence is outside the scope of this article, the range of conditions are briefly described below.

Neurodivergent people have an increased risk of certain neurological conditions, especially epilepsy and rhythmic movement disorders. They may also have an increased prevalence of neurological structural anomalies such as the Chiari malformation [37] which commonly presents with headaches and may cause syncope or collapse due to compression at the foramen magnum. Magnetic resonance imaging of the brain is usually diagnostic. Other causes of syncope in females may relate to dysfunction of the autonomic nervous system producing postural hypotension and tachycardia (POTS) [38] which is well recognised as being associated with hypermobile joints [39]. Indeed, a range of joint hypermobility syndromes including Ehlers-Danlos (EDS) are now known to be linked to the presence of neurodivergence [40]. Many patients with fibromyalgia exhibit neurodivergent features [41] and this may have a familial link [42]. Sleep disturbance and disorders are common and may contribute to fatigue [43]. Other chronic pain syndromes are also over-represented among neurodivergent females, and many women attending chronic pain clinics carry a diagnosis of autism and / or ADHD [44]. Migraine and irritable bowel syndrome are also common causes of chronic pain in younger neurodivergent females [45]. Intestinal dysbiosis, characterised by profound gut microbiota alterations, are frequent amongst autistic individuals [46], although gastrointestinal symptoms may have more specific causes. There appears to be an increase in the prevalence of inflammatory bowel disease [47], probably coeliac disease [48] and subsequent possibly bile acid nutrients malabsorption in this population, along with an increased risk of eating disorders, especially of the restrictive intake type [49]. This can lead to nutritional deficiencies especially of iron and of vitamins B and D. Autistic children have reduced bone mineral density at all skeletal sites compared to controls [50]. Low bone density in has also been shown in young people with ADHD and may relate to medication [51]. Low bone density contributes to a greatly increased risk of fractures at the hip, spine and forearm in both autistic children and adults, again especially in females. The odds ratio for hip fractures in females rises from 8.1 in autistic girls to 24.8 in autistic adults [52]. Multiple potential contributing factors to this greatly increased fracture risk include vitamin D deficiency and restrictive eating disorders [53].

Endocrine disorders are also over-represented among younger neurodivergent females, where there appears to be an increase in auto-immune thyroid disorders [54]. Maternal hypothyroidism is also believed to contribute to an increased risk of autism in the offspring. Other auto-immune disorders are also over-represented in mothers of neurodivergent females, especially connective tissue disorders such as rheumatoid arthritis (RA) [55] and systemic lupus erythematosus [56][57]. Raynaud's phenomenon may be an early manifestation of a similar tendency in their female offspring. Neurodivergent females report an increased tendency to develop allergies and skin rashes including eczema and hives [58]. They may have an increased prevalence of mast cell activation syndrome, a condition that is attracting greater interest through its links with hypermobility and autism [59]. Perhaps related to this observation is the finding that the prevalence of airways disease, and especially of asthma, is much increased among neurodivergent females [11][60]. A relationship between intestinal dysbiosis and the occurrence of asthma and eczema in children with ADHD has now been established [61][62].

With increasing age, obesity and diabetes become increasingly evident among autistic females, and those with ADHD [11][63], while hypertension and hyperlipidaemia contribute to their high levels of cerebrovascular and cardiovascular disease [11][63].

The challenges of navigating a world where neurodivergent people are the exception rather than the norm poses particular problems for the neurodivergent woman. The difficulty she faces in the realm of relating to others often leads to camouflaging behaviour. De Vaan et al. argue that neurodivergent people 'are more susceptible to stress', due to missing 'auditory and visual information [which makes] situations more unpredictable, uncertain, and stressful' [64]. This additional stress leads to an elevated production of cortisol. Persistently elevated cortisol levels may play a causative role in some of the common physical co-morbidities of neurodivergent females. Polycystic Ovarian Syndrome (PCOS) and hypercortisolaemia share symptoms such as hirsutism, elevated adrenal androgens, and insulin resistance, with resulting hyperglycaemia. A clinical trial of pioglitazone and metformin has been undertaken to assess reversibility [65]. Cortisol is also associated with inflammatory responses, particularly in the musculoskeletal system, and chronic hypercortisolaemia is associated with increased inflammation [66]. This may help explain the increased rates of EDS and RA among neurodivergent females and might contribute towards the mood disorders and emotional dysregulation seen in autism and ADHD.

Hormonal events are believed to have a large impact on autistic females throughout their lives [67][68][69]. Clinically young autistic females report experiencing higher levels of dysmenorrhoea, menorrhagia, and more intrusive effects of menstruation than their neurotypical peers [65]. The sensory implications of menstruation care can also impact on the mental health and presentation of autistic females [66]. Parents report witnessing increased anxiety and emotional difficulties during menstruation, impacting socially and educationally [70]. Research indicates that autistic females and females with ADHD may experience the physical symptoms of menopause over a longer period, while also experiencing greater impact from psychological and emotional symptoms such as poor sleep, increased anxiety, poor memory and concentration [67][69]. The menopause is known to impact on the mental health of neurotypical females, with greater impact on neurodivergent females who have experienced anxiety and/or depression from a young age. Autistic females may also experience more difficulties in reporting their experiences or accessing appropriate support [68]. The whole subject of the effect of hormonal factors from menarche to menopause in autistic females merits further research.

Mental health issues in neurodivergent females

Neurodivergent conditions are highly inheritable [71] while brain structure and function appear significantly different in neurodivergent females [72], along with both the peripheral and autonomic nervous systems [73]. Therefore, it may not be surprising that mental health problems occur frequently in neurodivergent people and are a particularly common feature in younger females. Emotional impulsivity is especially common among girls with ADHD [74] and may be associated with a variety of undesirable outcomes [75], including self-harm and suicidality [76]. The risk of serious self-harm extends to autistic females [77]. Anxiety disorders are an almost invariable accompaniment of neurodivergence in females, where ADHD is thought to be more strongly associated with anxiety than is autism alone [78]. Both autism and ADHD may

associate with meltdowns and panic attacks. Depression is also found in 38% of neurodivergent people, although it is as common in adolescent males as in young females [79]. Dysfunctional coping mechanisms can trigger self-harm [76], substance abuse [80] or eating disorders [81]. Some females with neurodivergence experience body dysmorphia, while gender incongruence is well-recognised among young autistic females [82], both often being associated with higher levels of chronic pain [83]. Personality disorders may develop because of disordered resilience and are more common in neurodivergent females [84]. The prevalence of bipolar disorder [85] and schizophrenia [86] are also each significantly increased, although it is important to appreciate that what is sometimes initially thought to be psychotic behaviour may simply reflect the rich inner life of certain autistic women whose imagination can be extremely vivid, and whose state of social withdrawal represents their construction of a self-absorbed inner world of fantasy based on special interests. Other aspects of the mental health of neurodivergent females and their consequences are addressed elsewhere [87].

Challenges for the clinician

The medical profession has generally been slow to appreciate the wide range of differing symptoms that neurodivergent females can develop. This has been compounded by the trend towards increasing medical specialisation, meaning that such patients may have already been referred to multiple different departments. The difficulty many neurodivergent people experience with accurately communicating their feelings and bodily experiences can compound these challenges, as does the frequent lack of any objective signs on physical examination. Previously, this often led to autistic females being described as having psychosomatic illness or those with ADHD as being hard to help. Such terminology is insensitive and outdated.

There are often subtle clues in the way that neurodivergent people present. They are more likely to bring a spokesperson and to avoid eye contact at consultation. They may appear unduly agitated or sometimes disengaged with the process. The frequent overlap in presentations between different specialities emphasises the need for all trainees to have 'common stem' experience in general medicine. Within a general practice setting, a wider appreciation of the range of common disorders experienced by neurodivergent females is important to acquire. The art of 'learning to listen' remains an essential tool in diagnosis. Neurodivergent people can feel uncomfortable if they are not given enough time to share their concerns, and an open unhurried dialog is more likely to facilitate a diagnosis. However, given the service pressures and time constraints clinicians face, this can be difficult to guarantee. However, if patients are encouraged to share their lived experience, it becomes easier for the clinician to 'join the dots', which may allow the diagnosis of a neurodivergent condition to surface from what may have previously appeared to be a random collection of unrelated symptoms.

However, neurodivergent females may exhibit anxiety or anger in medical consultations, especially if they feel that they are invalidated or not taken seriously. Avoiding conflict with patients who may have fixed ideas and expectations of what they are entitled to receive is as much an art as a science and requires experience and patience. Consistency within clinical contact to ensure continuity of care can help develop trust which neurodivergent people often take time to achieve. Once a diagnosis of a neurodevelopmental condition is made or suspected, it is important to offer access to appropriate multidisciplinary support whilst avoiding unnecessary multiple cross-referral. It is relevant to recognise that the increasing

delays to accessing such services at present may trigger a meltdown, panic attack, dissociative episode, or the threat of self-harm.

Future priorities

It is essential that all clinicians are aware of the broad range of conditions experienced by neurodivergent females and the wide range of symptoms described by their patients. If we are to become more effective at managing these conditions, breaking down barriers between services for physical and mental health would be a great help. Improving access to eating disorder services and gender identity clinics are important examples, as neurodivergent females are greatly over-represented among those seeking such support. Increasing the evidence base around treatment for people in these situations would facilitate this aim.

Neurodivergent females also account for a high percentage of patients presenting with chronic pain syndromes to pain clinics and rheumatologists. A more comprehensive understanding of what pain means to those with neurodivergence is essential, as this seems to differ from the experience of many neurotypical people. Broadening our concept of pain to include the role of the autonomic nervous system is important as dysautonomia is both common and under-recognised in neurodivergent females and accounts for a significant component of their lived experience of discomfort and dysfunction.

The multiple conditions experienced by many neurodivergent females are influenced by both genetic and environmental factors. A better understanding of the relationship between these influences is essential, although it is important that we appreciate the reasons behind the heightened suspicion and sensitivity expressed by many autistic people over the use of gene studies in autism ^[88]. Further exploration of the reasons behind the physical and psychological hypersensitivity that many neurodivergent females exhibit would be useful. This may allow the relationship between the limbic, endocrine, and immune systems in neurodivergent individuals to be more fully understood. Ultimately, the sense of isolation and alienation experienced by so many neurodivergent females could, and should be addressed, as this plays a significant part in their health-seeking behaviour and support needs. If we can help society increase insight and understanding into neurodivergence by developing a concept of '*neuroconvergence*', with the aid of non-judgemental language and acceptance of inter-personal differences, the mental and physical health burdens carried by many females with autism, ADHD or related conditions may be diminished.

How patients and the public contributed to this article

Two of the authors of this paper have direct lived experience of female neurodivergent conditions, and two authors work in the provision of health care delivery to females with neurodivergent conditions.

References

1. [^] Singer, J. (1998). *Odd People In: The Birth of Community Amongst People on the “Autistic Spectrum”*: a personal exploration of a New Social Movement based on Neurological Diversity. A thesis presented to the faculty of Humanities and Social Sciences in partial fulfilment of the requirements for the degree of Bachelor of Arts Social Science (Honours), Faculty of Humanities and Social Science, University of Technology, Sydney, 1998.
2. [^] Koi, P. (2021) ‘Genetics on the neurodiversity spectrum: Genetic, phenotypic and endophenotypic continua in autism and ADHD’, *Studies in history and philosophy of science. Part A*, 89pp. 52-62. 73
3. [^] Anna Stenning & Hanna Bertilsdotter Rosqvist (2021) *Neurodiversity studies: mapping out possibilities of a new critical paradigm*, *Disability & Society*, 36:9, 1532-1537, DOI: 10.1080/09687599.2021.1919503
4. [^] Young, S., Adamo, N., Ásgeirsdóttir, B.B. 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* 20, 404 (2020). <https://doi.org/10.1186/s12888-020-02707-9>
5. [^] Rynkiewicz A, Schuller B, Marchi E, Piana S, Camurri A, Lassalle A, Baron-Cohen S. *An investigation of the ‘female camouflage effect’ in autism using a computerized ADOS-2 and a test of sex/gender differences*. *Mol Autism*. 2016 Jan 21;7:10. doi: 10.1186/s13229-016-0073-0. PMID: 26798446; PMCID: PMC4721191.
6. [^] Rynkiewicz A, Janas-Kozik M, Słopień A. *Girls and women with autism*. *Psychiatr Pol*. 2019 Aug 31;53(4):737-752. doi: 10.12740/PP/OnlineFirst/95098. Epub 2019 Aug 31. PMID: 31760407.
7. [^] Babinski DE, Kujawa A, Kessel EM, Arfer KB, Klein DN. *Sensitivity to peer feedback in young adolescents with symptoms of ADHD: examination of neurophysiological and self-report measures*. *J Abnorm Child Psychol*. 2019;47(4):605-617. doi:10.1007/s10802-018-0470-2
8. [^] Swanson EN, Owens EB, Hinshaw SP. *Pathways to self-harmful behaviors in young women with and without ADHD: A longitudinal examination of mediating factors*. *J Child Psychol Psychiatry Allied Discip*. 2014; 55:505-15.
9. [^] Edvinsson D, Lindström E, Bingefors K, Lewander T, Ekselius L. *Gender differences of axis I and II comorbidity in subjects diagnosed with attention-deficit hyperactivity disorder as adults*. *Acta Neuropsychiatr*. 2013; 25:165-74.
10. [^] Stepp SD, Burke JD, Hipwell AE, Loeber R. *Trajectories of attention deficit hyperactivity disorder and oppositional defiant disorder symptoms as precursors of borderline personality disorder symptoms in adolescent girls*. *J Abnorm Child Psychol*. 2012; 40:7-20.
11. ^{a, b, c, d, e} Weir, E., Allison, C., Warrier, V., & Baron-Cohen, S. (2021). *Increased prevalence of non-communicable physical health conditions among autistic adults*. *Autism*, 25(3), 681–694. <https://doi.org/10.1177/1362361320953652>
12. [^] Rígles B. (2017). *The relationship between adverse childhood events, resiliency and health among children with autism*. *Journal of Autism and Developmental Disorders*, 47(1), 187–202. <https://doi.org/10.1007/s10803-016-2905-3>
13. [^] Griffiths S., Allison C., Kenny R., Holt R., Smith P., Baron-Cohen S. (2019). *The vulnerability experiences quotient (VEQ): A study of vulnerability, mental health and life satisfaction in autistic adults*. *Autism Research: Official Journal of the International Society for Autism Research*, 12, 1516–1528. <https://doi.org/10.17863/CAM.40985>
14. ^{a, b} Vohra R., Madhavan S., Sambamoorthi U. (2017). *Comorbidity prevalence, healthcare utilization, and expenditures of Medicaid enrolled adults with autism spectrum disorders*. *Autism*, 21(8), 995–1009. <https://doi.org/10.1177/1362361316665222>
15. ^{a, b} Zerbo O., Qian Y., Ray T., Sidney S., Rich S., Massolo M., Croen L. A. (2018). *Health care service utilization and*

- cost among adults with autism spectrum disorders in a U.S. integrated health care system. *Autism in Adulthood*, 1(1), 27–36. <https://doi.org/10.1089/aut.2018.0004>
16. ^{a, b}Weiss J. A., Isaacs B., Diepstra H., Wilton A. S., Brown H. K., McGarry C., Lunsky Y. (2018). Health concerns and health service utilization in a population cohort of young adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 48(1), 36–44. <https://doi.org/10.1007/s10803-017-3292-0>
 17. [^]Mason D., Ingham B., Urbanowicz A., Michael C., Birtles H., Woodbury-Smith M., et al. (2019). A systematic review of what barriers and facilitators prevent and enable physical healthcare services access for autistic adults. *Journal of Autism and Developmental Disorders*, 49(8), 3387–3400. <https://doi.org/10.1007/s10803-019-04049-2>
 18. [^]Nicolaidis C., Raymaker D., McDonald K., Dern S., Boisclair W. C., Ashkenazy E., Baggs A. (2013). Comparison of healthcare experiences in autistic and non-autistic adults: A cross-sectional online survey facilitated by an academic-community partnership. *Journal of General Internal Medicine*, 28(6), 761–769. <https://doi.org/10.1007/s11606-012-2262-7>
 19. [^]Hirvikoski T., Mittendorfer-Rutz E., Boman M., Larsson H., Lichtenstein P., Bölte S. (2016). Premature mortality in autism spectrum disorder. *The British Journal of Psychiatry: The Journal of Mental Science*, 208(3 Special Issue: Physical Health Across the Lifespan), 232–238. <https://doi.org/10.1192/bjp.bp.114.160192>
 20. [^]Hwang Y. I., Srasuebkul P., Foley K.-R., Arnold S., Trollor J. N. (2019). Mortality and cause of death of Australians on the autism spectrum. *Autism Research*, 12(5), 806–815. <https://doi.org/10.1002/aur.2086>
 21. [^]Woolfenden S., Sarkozy V., Ridley G., Coory M., Williams K. (2012). A systematic review of two outcomes in autism spectrum disorder—Epilepsy and mortality. *Developmental Medicine & Child Neurology*, 54(4), 306–312. <https://doi.org/10.1111/j.1469-8749.2012.04223.x>
 22. ^{a, b}Croen L. A., Zerbo O., Qian Y., Massolo M. L., Rich S., Sidney S., Kripke C. (2015). The health status of adults on the autism spectrum. *Autism*, 19(7), 814–823. <https://doi.org/10.1177/1362361315577517>
 23. ^{a, b}Davignon M. N., Qian Y., Massolo M., Croen L. A. (2018). Psychiatric and medical conditions in transition-aged individuals with ASD. *Pediatrics*, 141(Suppl. 4), S335–S345. <https://doi.org/10.1542/peds.2016-4300K>
 24. ^{a, b}Fortuna R. J., Robinson L., Smith T. H., Meccarello J., Bullen B., Nobis K., Davidson P. W. (2016). Health conditions and functional status in adults with autism: A cross-sectional evaluation. *Journal of General Internal Medicine*, 31(1), 77–84. <https://doi.org/10.1007/s11606-015-3509-x>
 25. [^]Rydzewska E., Hughes-McCormack L. A., Gillberg C., Henderson A., MacIntyre C., Rintoul J., Cooper S.-A. (2018). Prevalence of long-term health conditions in adults with autism: Observational study of a whole country population. *BMJ Open*, 8(8), e023945. <https://doi.org/10.1136/bmjopen-2018-023945>
 26. [^]Kohane I. S., McMurry A., Weber G., MacFadden D., Rappaport L., Kunkel L., Churchill S. (2012). The co-morbidity burden of children and young adults with autism spectrum disorders. *PLOS ONE*, 7(4), Article e33224. <https://doi.org/10.1371/journal.pone.0033224>
 27. [^]Hand B. N., Angell A. M., Harris L., Carpenter L. A. (2020). Prevalence of physical and mental health conditions in Medicare-enrolled, autistic older adults. *Autism*, 24, 755–764. <https://doi.org/10.1177/1362361319890793>
 28. [^]Wen Y., Alshikho M. J., Herbert M. R. (2016). Pathway network analyses for autism reveal multisystem involvement, major overlaps with other diseases and convergence upon MAPK and calcium signaling. *PLOS ONE*, 11(4), Article

e0153329. <https://doi.org/10.1371/journal.pone.0153329>

29. [^]Baron-Cohen S., Tsompanidis A., Auyeung B., Nørgaard-Pedersen B., Hougaard D. M., Abdallah M., Pohl A. (2019). Foetal oestrogens and autism. *Molecular Psychiatry*. Advance online publication. <https://doi.org/10.1038/s41380-019-0454-9>
30. [^]Cherskov A., Pohl A., Allison C., Zhang H., Payne R. A., Baron-Cohen S. (2018). Polycystic ovary syndrome and autism: A test of the prenatal sex steroid theory. *Translational Psychiatry*, 8(1), 1–10. <https://doi.org/10.1038/s41398-018-0186-7>
31. [^]Pohl A., Cassidy S., Auyeung B., Baron-Cohen S. (2014). Uncovering steroidopathy in women with autism: A latent class analysis. *Molecular Autism*, 5(1), 27. <https://doi.org/10.1186/2040-2392-5-27>
32. [^]Ruta L., Ingudomnukul E., Taylor K., Chakrabarti B., Baron-Cohen S. (2011). Increased serum androstenedione in adults with autism spectrum conditions. *Psychoneuroendocrinology*, 36(8), 1154–1163. <https://doi.org/10.1016/j.psyneuen.2011.02.007>
33. [^]Schwarz E., Guest P. C., Rahmoune H., Wang L., Levin Y., Ingudomnukul E, Bahn S. (2011). Sex-specific serum biomarker patterns in adults with Asperger's syndrome. *Molecular Psychiatry*, 16(12), 1213–1220. <https://doi.org/10.1038/mp.2010.102>
34. [^]Bhupathy P., Haines C. D., Leinwand L. A. (2010). Influence of sex hormones and phytoestrogens on heart disease in men and women. *Women's Health (London, England)*, 6(1), 77–95. <https://doi.org/10.2217/whe.09.80>
35. [^]Brand J. S., van der Tweel I., Grobbee D. E., Emmelot-Vonk M. H., van der Schouw Y. T. (2011). Testosterone, sex hormone-binding globulin and the metabolic syndrome: A systematic review and meta-analysis of observational studies. *International Journal of Epidemiology*, 40(1), 189–207. <https://doi.org/10.1093/ije/dyq158>
36. [^]Mantovani A., Fucic A. (2014). Puberty dysregulation and increased risk of disease in adult life: Possible modes of action. *Reproductive Toxicology*, 44, 15–22. <https://doi.org/10.1016/j.reprotox.2013.06.002>
37. [^]Jayarao M, Sohl K, Tanaka T. Chiari malformation I and autism spectrum disorder: an underrecognized coexistence. *J Neurosurg Pediatr*. 2015 Jan;15(1):96-100. doi: 10.3171/2014.10.PEDS13562. PMID: 25396704.
38. [^]Owens A, Mathias C and Iodice V. Autonomic Dysfunction in Autism Spectrum Disorder. *Front. Integr. Neurosci.*, 30 December 2021. Volume 15 - 2021 | <https://doi.org/10.3389/fnint.2021.787037>
39. [^]Eccles, J., Iodice, V., Dowell, N., and Owens, A. (2014). Joint hypermobility and autonomic hyperactivity: relevance to neurodevelopmental disorders. *J. Neurol. Neurosurg. Psychiatry* 85:8883. doi: 10.1136/jnnp-2014-308883.9
40. [^]Casanova EL, Baeza-Velasco C, Buchanan CB, Casanova MF. The relationship between autism and Ehlers-Danlos syndromes/hypermobility spectrum disorders. *J Pers Med*. 2020; 10:260.
41. [^]Reyero F, Ponce G, Rodriguez-Jimenez R, Fernandez-Dapica P, Taboada D, Martin V, et al. High frequency of childhood ADHD history in women with fibromyalgia. *Eur Psychiatry*. 2011;26: 482-3
42. [^]Kelly C, Martin R and Saravanan V. The links between fibromyalgia, hypermobility and neurodivergence. *Touch Reviews* March 15th 2022 <https://www.touchimmunology.com/fibromyalgia/journal-articles/the-links-between-fibromyalgia-hypermobility-and-neurodivergence/>
43. [^]Philipsen A, Hornyak M, Riemann D. Sleep and sleep disorders in adults with attention deficit / hyperactivity disorder. *Sleep Med Rev*. 2006; 10:399-405.

44. [^]Asztély K, Kopp S, Gillberg C, Waern M, Bergman S. *Chronic Pain And Health-Related Quality Of Life In Women With Autism And/Or ADHD: A Prospective Longitudinal Study.* *J Pain Res.* 2019;12:2925-2932 <https://doi.org/10.2147/JPR.S212422>
45. [^]Drossman D.A. *Functional Gastrointestinal Disorders: History, Pathophysiology, Clinical Features and Rome IV.* *Gastroenterology.* 2016; 150:1262–1279. doi: 10.1053/j.gastro.2016.02.032.
46. [^]Xu M, Xu X, Li J, Li F. *Association Between Gut Microbiota and Autism Spectrum Disorder: A Systematic Review and Meta-Analysis.* *Front Psychiatry.* 2019 Jul 17;10:473. doi: 10.3389/fpsy.2019.00473. PMID: 31404299; PMCID: PMC6673757.
47. [^]Lee M, Krishnamurthy J, Susi A, Sullivan C, Gorman GH, Hisle-Gorman E, Erdie-Lalena CR, Nylund CM. *Association of Autism Spectrum Disorders and Inflammatory Bowel Disease.* *J Autism Dev Disord.* 2018 May;48(5):1523-1529. doi: 10.1007/s10803-017-3409-5. PMID: 29170940.
48. [^]Quan J, Panaccione N, Jeong J, Underwood FE, Coward S, Windsor JW, Ronksley PE, Gidrewicz D, deBruyn J, Turner JM, Lebwohl B, Kaplan GG, King JA. *Association Between Celiac Disease and Autism Spectrum Disorder: A Systematic Review.* *J Pediatr Gastroenterol Nutr.* 2021 May 1;72(5):704-711. doi: 10.1097/MPG.0000000000003051. PMID: 33847288.
49. [^]Nickel K, Maier S, Endres D, Joos A, Maier V, Tebartz van Elst L, Zeeck A. *Systematic Review: Overlap Between Eating, Autism Spectrum, and Attention-Deficit/Hyperactivity Disorder.* *Front Psychiatry.* 2019 Oct 10; 10:708. doi: 10.3389/fpsy.2019.00708. PMID: 31649563; PMCID: PMC6796791.
50. [^]Rostami Haji Abadi, M., Neumeyer, A., Misra, M. et al. *Bone health in children and youth with ASD: a systematic review and meta-analysis.* *Osteoporos Int* 32, 1679–1691 (2021). <https://doi.org/10.1007/s00198-021-05931-5>
51. [^]Howard J, Walick K, Rivera J. *Evidence of an Association between ADHD Medication and Diminished Bone Health in Children and Adolescents.* Abstract 641 presented at 2016 Annual Meeting of the American Academy of Orthopaedic Surgeons, Orlando, Florida.
52. [^]Neumeyer AM, O'Rourke JA, Massa A, Lee H, Lawson EA, McDougale CJ, Misra M. *Brief report: bone fractures in children and adults with autism spectrum disorders.* *J Autism Dev Disord.* 2015 Mar;45(3):881-7. doi: 10.1007/s10803-014-2228-1. PMID: 25193141; PMCID: PMC4590779.
53. [^]Farag F, Sims A, Strudwick K, Carrasco J, Waters A, Ford V, Hopkins J, Whitlingum G, Absoud M, Kelly VB. *Avoidant/restrictive food intake disorder and autism spectrum disorder: clinical implications for assessment and management.* *Dev Med Child Neurol.* 2022 Feb;64(2):176-182. doi: 10.1111/dmcn.14977. Epub 2021 Aug 17. PMID: 34405406.
54. [^]Frye RE, Wynne R, Rose S, Slattery J, Delhey L, Tippett M, Kahler SG, Bennuri SC, Melnyk S, Sequeira JM, Quadros EV. *Thyroid dysfunction in children with autism spectrum disorder is associated with folate receptor α autoimmune disorder.* *J Neuroendocrinol.* 2017 Mar;29(3). doi: 10.1111/jne.12461. PMID: 28199771.
55. [^]Sun CK, Cheng YS, Chen IW, Chiu HJ, Chung W, Tzang RF, Fan HY, Lee CW, Hung KC. *Impact of parental rheumatoid arthritis on risk of autism spectrum disorders in offspring: A systematic review and meta-analysis.* *Front Med (Lausanne).* 2022 Nov 10;9:1052806. doi: 10.3389/fmed.2022.1052806. PMID: 36438039; PMCID: PMC9687371.
56. [^]Dalsgaard S. *More Evidence Linking Autoimmune Diseases to Attention-Deficit/Hyperactivity Disorder.* *JAMA Pediatr.*

2021;175(3):e205502. doi:10.1001/jamapediatrics.2020.5502

57. [^]Li DJ, Tsai CS, Hsiao RC, Chen YL, Yen CF. Associations between Allergic and Autoimmune Diseases with Autism Spectrum Disorder and Attention-Deficit/Hyperactivity Disorder within Families: A Population-Based Cohort Study. *Int J Environ Res Public Health*. 2022 Apr 8;19(8):4503. doi: 10.3390/ijerph19084503. PMID: 35457368; PMCID: PMC9025211.
58. [^]Chua R, Tay M, Ooi D et al., Understanding the Link Between Allergy and Neurodevelopmental Disorders: A Current Review of Factors and Mechanisms. *Front. Neurol.*, 15 February 2021 Sec. Pediatric Neurology Volume 11 - 2020 | <https://doi.org/10.3389/fneur.2020.603571>
59. [^]Song Y, Lu M, Yuan H, Chen T, Han X. Mast cell-mediated neuroinflammation may have a role in attention deficit hyperactivity disorder (Review). *Exp Ther Med*. 2020 Aug;20(2):714-726. doi: 10.3892/etm.2020.8789.
60. [^]Cortese S Sun S Zhang J et al. Association between attention deficit hyperactivity disorder and asthma: a systematic review and meta-analysis and a Swedish population-based study. *Lancet Psychiatry*. 2018; (published online July 24.) [http://dx.doi.org/10.1016/S2215-0366\(18\)30224-4](http://dx.doi.org/10.1016/S2215-0366(18)30224-4).
61. [^]Salameh M, Burney Z, Mhaimed N, Laswi I, Yousri N, Bendriss G et al. The role of gut microbiota in atopic asthma and allergy, implications in the understanding of disease pathogenesis. *Scand J Immunol*. 2020 Mar; 91(3):e12855.
62. [^]Loo EXL, Ooi DSQ, Ong M, Ta LDH, Lau HX, Tay MJY, et al. Associations Between Eczema and Attention Deficit Hyperactivity Disorder Symptoms in Children. *Front Pediatr*. 2022 Mar 30;10:837741. doi: 10.3389/fped.2022.837741. PMID: 35433544; PMCID: PMC9007142.
63. ^{a, b}Gilmore, D.G., Longo, A. & Hand, B.N. The Association Between Obesity and Key Health or Psychosocial Outcomes Among Autistic Adults: A Systematic Review. *J Autism Dev Disord* 52, 4035–4043 (2022). <https://doi.org/10.1007/s10803-021-05275-3>.
64. [^]De Vaan G, Beijers R, Vervloed M, Knoors H, Bloeming-Wolbrink K, de Weerth C, Verhoeven L. Associations Between Cortisol Stress Levels and Autism Symptoms in People With Sensory and Intellectual Disabilities' *Frontiers in Education*, Vol.5, 2020. <https://doi.org/10.3389/feduc.2020.540387>>
65. ^{a, b}Bethany Klopfenstein. Cortisol Regulation in Polycystic Ovary Syndrome, National Library of Medicine (2019). <https://beta.clinicaltrials.gov/study/NCT00694759?tab=table>>
66. ^{a, b}Liu Y-Z, Wang Y-X, Jiang C-L. Inflammation: The Common Pathway of Stress-Related Diseases', *Frontiers in Human Neuroscience*, June 20, 2017. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5476783/>>
67. ^{a, b}Duffy O. K., Iversen L., Aucott L., Hannaford P. C. (2013). Factors associated with resilience or vulnerability to hot flushes and night sweats during the menopausal transition. *Menopause*, 20(4), 383–392. <https://doi.org/10.1097/gme.0b013e31827655cf>
68. ^{a, b}Groenman, A. P., Torenvliet, C., Radhoe, T. A., Agelink van Rentergem, J. A., & Geurts, H. M. (2022). Menstruation and menopause in autistic adults: Periods of importance? *Autism*, 26(6), 1563–1572. <https://doi.org/10.1177/13623613211059721>
69. ^{a, b}Moseley RL, Druce T, Turner-Cobb JM. 'When my autism broke': A qualitative study spotlighting autistic voices on menopause. *Autism*. 2020 Aug;24(6):1423-1437. doi: 10.1177/1362361319901184. Epub 2020 Jan 31. PMID: 32003226; PMCID: PMC7376624

70. [^]Steward, R., Crane, L., Roy, E., Remington, A., Pellicano, E. (2018). "Life is Much More Difficult to Manage During Periods": Autistic Experiences of Menstruation. *Journal of Autism and Developmental Disorders*, 48(12), 4287-4292.
71. [^]Demontis, D., Walters, R.K., Martin, J. et al. Discovery of the first genome-wide significant risk loci for attention deficit/hyperactivity disorder. *Nat Genet* 51, 63–75 (2019). <https://doi.org/10.1038/s41588-018-0269-7>
72. [^]Hoogman M, Bralten J, Hibar DP, Mennes M, Zwiers MP, Schweren LSJ et al. (2017) Subcortical brain volume differences in participants with attention deficit hyperactivity disorder in children and adults: a cross-sectional mega-analysis. *Lancet Psychiatry* 4:310-319. [https://doi.org/10.1016/S2215-0366\(17\)30049-4](https://doi.org/10.1016/S2215-0366(17)30049-4)
73. [^]Bellato A, Arora I, Hollis C, Groom MJ. Is autonomic nervous system function atypical in attention deficit hyperactivity disorder (ADHD)? A systematic review of the evidence. *Neurosci Biobehav Rev*. 2020 Jan; 108:182-206. doi: 10.1016/j.neubiorev.2019.11.001. Epub 2019 Nov 10. PMID: 31722229.
74. [^]Barkley RA, Fischer M. The unique contribution of emotional impulsiveness to impairment in major life activities in hyperactive children as adults. *J Am Acad Child Adolesc Psychiatry*. 2010; 49:503-13 <https://doi.org/10.1016/j.jaac.2010.01.019>.
75. [^]Young S, Heptinstall E, Sonuga-Barke EJS, Chadwick O, Taylor E. The adolescent outcome of hyperactive girls: Self-report of psychosocial status. *J Child Psychol Psychiatry Allied Discip*. 2005; 46:255-62.
76. ^{a, b}Swanson EN, Owens EB, Hinshaw SP. Pathways to self-harmful behaviors in young women with and without ADHD: A longitudinal examination of mediating factors. *J Child Psychol Psychiatry Allied Discip*. 2014; 55:505-15.
77. [^]Veenstra-VanderWeele J. Recognizing the Problem of Suicidality in Autism Spectrum Disorder. *J American Acad of Child and Adolescent Psychiatry EDITORIAL| VOLUME 57, ISSUE 5, P302-303, MAY 2018*.
78. [^]Hargitai, L.D., Livingston, L.A., Waldren, L.H. et al. Attention-deficit hyperactivity disorder traits are a more important predictor of internalising problems than autistic traits. *Sci Rep* 13, 31 (2023). <https://doi.org/10.1038/s41598-022-26350-4>
79. [^]Accardo, A.L., Pontes, N.M.H. & Pontes, M.C.F. Heightened Anxiety and Depression Among Autistic Adolescents with ADHD: Findings From the National Survey of Children's Health 2016–2019. *J Autism Dev Disord* (2022). <https://doi.org/10.1007/s10803-022-05803-9>
80. [^]Quinn PO, Madhoo M. A review of attention-deficit/hyperactivity disorder in women and girls: uncovering this hidden diagnosis. *Prim Care Companion CNS Disord*. 2014;16 <https://doi.org/10.4088/PCC.13r01596>.
81. [^]Kaisari P, Dourish CT, Higgs S. Attention deficit hyperactivity disorder (ADHD) and disordered eating behaviour: a systematic review and a framework for future research. *Clin Psychol Rev* (2017) 53:109-21. doi:10.1016/j.cpr.2017.03.002
82. [^]Warrier V, Greenberg DM, Weir E, Buckingham C, Smith P, Lai MC, Allison C, Baron-Cohen S. Elevated rates of autism, other neurodevelopmental and psychiatric diagnoses, and autistic traits in transgender and gender-diverse individuals. *Nat Commun*. 2020 Aug 7;11(1):3959. doi: 10.1038/s41467-020-17794-1. PMID: 32770077; PMCID: PMC7415151.
83. [^]Ryan L, Thomson E, Beer H, Philcox E, Kelly C. Autistic traits correlate with chronic musculoskeletal pain: a self-selected population survey. *OBM Neurobiology* 2023, Volume 7, Issue 1, doi:10.21926/obm.neurobiol.2301155 16 February 2023;

84. [^]Matthies S, Philipsen A. Comorbidity of Personality Disorders and Adult Attention Deficit Hyperactivity Disorder (ADHD): Review of Recent Findings. *Curr Psychiatry Rep.* 2016;18:1-7.
85. [^]Dunalska A, Rzeszutek M, Dębowska Z, Bryńska A. Comorbidity of bipolar disorder and autism spectrum disorder - review paper. *Psychiatr Pol.* 2021 Dec 31;55(6):1421-1431. English, Polish. doi: 10.12740/PP/OnlineFirst/122350. Epub 2021 Dec 31. PMID: 35472236.
86. [^]Pina-Camacho, L., Parellada, M., & Kyriakopoulos, M. (2016). Autism spectrum disorder and schizophrenia: Boundaries and uncertainties. *BJPsych Advances*, 22(5), 316-324. doi:10.1192/apt.bp.115.014720
87. [^]Kelly CA, Kelly CM, Gullon-Scott F, Taylor R. The neuropsychiatric and social consequences of female ADHD. In press @ *Psychological Medicine*
88. [^]Heini Natri. *Spectrum 10K and The Questionable Past, Present, and Future of Genetic Autism Research*. November 2021. ResearchGate preprint DOI: 10.13140/RG.2.2.14973.28642