Research Article

Autism and ADHD in old age

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The impact of neurodiversity conditions such as ASD (Autism Spectrum Disorder), and Attention Deficit Hyperactivity Disorder (ADHD) upon the older individual is considerable but not well studied. Chronic degenerative conditions which affect the brain, such as dementia, may share several symptoms with autism and ADHD, including behavioural, social and genetic elements. Both autism and ADHD are portrayed in the medical literature as adverse conditions, as disorders which need medical treatment, and this is a valid consideration to a large extent. However, both have positive aspects which need to be encouraged in older people so that they can reach their full potential, and ensuring that a correct diagnosis is made. In this review, we explore the links between these neurodiverse and neurodegenerative conditions, providing insights which may be useful in a clinical setting. While the available research is still not sufficient, it is nevertheless important to be aware of how one condition affects the other, and what are the similarities and differences which can confuse the clinician who may provide the wrong diagnosis and treatment approach.

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1. Introduction

There is a hidden health cost of autism and ADHD in adults. Not only there is no sufficient research regarding this, particularly in older people (Maguire et al. 2022) but it seems that the existing research shows some disappointing facts. Adults with autism die earlier compared to the general population, and may suffer from depression, anxiety, and many other conditions (Robinson 2019). They are generally more likely to have other physical illnesses compared to non-autistic adults, and this will be discussed below.

Autism Spectrum Disorder includes 'traditional' autism, Asperger's syndrome and atypical autism. Asperger's syndrome is now considered within the ASD and it is not thought as a separate condition. Asperger's syndrome refers to autism with high intelligence without speech or developmental problems, and people previously labelled as Asperger's are now grouped under the ASD umbrella (Tarazi et al. 2015).

The characteristic behavior seen in adults with autism can vary, from mild to severe, and it could also change over time, or in response to changes in circumstances. Life experiences such as the death of a loved one, continuing employment or financial problems, etc., may exacerbate or unmask several symptoms of adult autism. It is important to highlight that evidence does not suggest that autism just develop *de novo* in adult life. What is more well accepted is that young people with undiagnosed autism, with the passage of years, may continue to have symptoms in later life, symptoms which have not been diagnosed at a younger age. A diagnosis may then be made at a later stage. Statistics suggest that one in 68 adults in North America has autism, but the majority of these individuals have not been diagnosed even after the age of 55 (Hickey et al. 2018). In retrospect, adults with autism may realize that their symptoms were present from a young age, but remained undiagnosed.

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental condition characterized by symptoms of inattention, hyperactivity, and impulsivity. It typically begins in childhood and can persist into adulthood. ADHD is believed to have a genetic component, and it is thought to involve differences in brain structure and function. Environmental factors, such as prenatal exposure to toxins, may also play a role. Common features of ADHD include difficulty maintaining attention, impulsiveness, hyperactivity, forgetfulness, and difficulties with organization and time management. Individuals with ADHD often struggle with academic and occupational tasks that require sustained attention. The prevalence of ADHD in older people is up to 4% (Michielsen et al. 2012).

While ASD and ADHD were initially thought to be different conditions with some common symptomatology, it is now increasingly believed that these conditions may share much more than originally assumed. It has even been proposed that a new term should be used, a term that unifies these conditions under one umbrella: AuDHD (autism + ADHD). Up to 80 percent of people with autism also meet several of the criteria for ADHD. In addition, up to 50 percent of people who have been diagnosed with ADHD also meet several of the criteria for autism. Therefore, the relationship between these two conditions is now being re-evaluated (Velarde et al. 2022). In any case, below we will discuss these two conditions separately to avoid confusion of this complex subject.

2. Diagnosis of autism in adults

An increasing number of older people are being diagnosed with autism, something that, paradoxically, may come as a relief to some people. Most older people with autism have lived with the condition all their lives without being properly diagnosed, and so giving a name to their condition helps address the symptoms more effectively (Stagg and Belcher 2019). Some of these people have been treated erroneously for anxiety and depression. Due to the fact that autism was poorly defined at that time, many people have been misdiagnosed as depressive, demented, or with other neurodegenerative conditions associated with ageing (Brugha et al. 2011).

Some important diagnostic criteria for autism spectrum disorder (ASD) according to the DSM-5 (the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, 5th Edition), are:

- **A. Avoidance of social situations**, described as: "Persistent deficits in social communication and social interaction across multiple contexts." The affected older individual may talk over others, or stay totally silent, or talk at inappropriate times, and/or exhibit inappropriate eye contact (avoiding eye contact or exhibiting excessive and persistent eye contact), all of which may be confused with symptoms of dementia, or other chronic neurodegenerative conditions. They may feel anxious in social situations, particularly in new and unfamiliar ones. In addition, avoidance of interactions with other people may lead to social isolation, which could also be confused with other pathology. They may have an inability to form new social contacts or interacting with people, and prefer to be on their own rather than with others. According to CDC (Centre for Disease Control, 2020), up to 40% of older adults with autism spend little or no time with friends. They may find it hard to comprehend the thoughts and feelings of others, and may not understanding common social norms. They dislike, sometimes to an extreme degree, getting too close to other people, or if someone touches them.
- **B. Limited or fixated interests,** where the individual has certain favourite activities and becomes agitated when they are unable to pursue these. The intensity and rigidity of interest exhibited in pursuing these activities is abnormal, and it can be mild, moderate or even extreme. In addition, there is resistance to change, with insistence on routine activities with extreme frustration and anger in case of disruption of these. These symptoms are also shared with dementia, but resistance to change may be generally encountered even in healthy older people. It is the degree and severity of the reaction that matters in these cases. There could be obsessive tendencies (Cooper et al. 2022) and taking things

very literally. They choose to plan things carefully before doing them, although others are unable to organize and plan their life (Gotham et al. 2015).

- **C. Lack of insight** in to their own – or other people's, feelings and emotions (Alexithymia). There is a general lack of empathy and an apparent indifference to the emotional state of others, another symptom which is also shared with dementia and specifically, frontotemporal dementia (Mendez 2021). They may appear rude or indifferent to others, without intending to.

Other symptoms and signs of autism in older adults include:

Noticing small details, patterns, smells or sounds that others do not. There may be a feeling of rejection by society (Elmose 2020) and, as a consequence, an inability to pursue higher education – due a preference to avoid social situations in the educational establishment (Chan et al. 2023). Although there is a lack of adequate published research in this specific older age group, there exist some clinical tools which may aid in the diagnosis. These tools include detailed history-taking by psychologists, as well as questionnaires such as: The Social Communication Questionnaire (SCQ), Autism Spectrum Quotient (AQ), Adaptive Behavior Questionnaire, Autism Diagnostic Interview-Revised (ADI-R), and Autism Diagnostic Observation Schedule-2 (ADOS). It may be difficult to assess the efficacy of these tools in adults, because the answers rely on the older person's own recollection of earlier behavior, and not on an independent third party (a parent in the case of children for example).

3. The spectrum of autism in adults

ASD, as the name suggests, exists in a spectrum, a range. It can be mild, moderate, or severe. For example, there could be mild subclinical autistic-like traits which have not been diagnosed (Chopik et al. 2021). The individual may have developed coping strategies, over the course of their life, and can adapt and function well despite these symptoms. Older people with mild autism may be described as eccentric, strange or weird, and they will be able to control their symptoms to a good degree. It is important to consider this group of people in the differential diagnosis between autism and other conditions (dementia etc.), if nothing else, to provide them with a diagnosis, a name for their condition, which will be emotionally comforting to them, even if there is no need for any treatment.

Unfortunately, most research concentrates on the moderate or severe forms of the disease, and so the milder cases remain unrecognized and not studied. Despite the name (ASD- emphasis on '**spectrum**') in other words, a range of severity, many researchers refer to the entire subject of autism with negative

connotations, as if autism is only a severe disease. There are comments in the scientific literature describing autism as: "*... a class of developmental disorders with extremely high rates of disability".* And other negative terminology referring to severe disease, such as: *"affecting patients, no cure, difficult and challenging treatment".*

This is true in some or even many respects but it does not apply to all cases of autism, when people can manage their situation without being overwhelmed by it. Health is the ability to successfully adapt and manage in the face of physical, mental and social challenges (Huber et al. 2011), therefore people who have managed to overcome the difficulties caused by autism, should be considered healthy.

In addition, research tends to report on the negative aspects of autism (including the previously named Asperger's syndrome), i.e. the adverse symptoms, but very little interest exists in the medical literature in highlighting the positive aspects of the conditions also seen in adult autism. There are certain common positive aspects of autism, and, although not all of these are present in everybody, should be considered and enhanced for a better, more enriched functioning of the individual (Myers 2023). See BOX 1.

* Good memory, logic, and learning functions, also good concentration if encouraged.
* Excellence in academic matters which do not require a great degree of social interactions, for example science, mathematics and other technical sciences.
* Personal qualities such as accuracy, honesty, reliability, being dependable, punctual and precise.
* A capacity for being original, analytical, creative, thinking out of the box, and may easily think of innovative concepts, and form new and imaginative ideas beyond what is 'normal'.

BOX 1. Positive characteristics of older people with autism

4. Diagnosing ADHD in adults

ADHD in adults may have different symptoms than ADHD in children. For example, impulsivity and hyperactivity may be reduced in severity, although problems with cognition may persist, or worsen. It is of course possible for ADHD in older people to co-exist with mild or more severe dementia (with memory deficits, poor attention span and slow processing of new information), and in this case the situation

becomes more complex. In addition, other common symptoms of ADHD and early dementia include sleep problems, anxiety and depression, poor mental effort, and poor planning of activities (Kooij et al. 2016).

Taking a full history including symptoms which were present 40 –50 years ago, is important for making the correct differentiation between ADHD in older people, and early dementia. It was found that individuals with ADHD may indeed have memory and concertation problems, but these may fluctuate in severity, over time. This is because the individual may have developed adaptive strategies over the course of several decades, and is able to compensate for the memory deficit, whereas early dementia patients may not present with this fluctuation of severity (Sibley et al. 2022).

It is possible to make a retrospective diagnosis of ADHD using tools such as the Wender Utah Rating Scale, the Brown Attention-Deficit Disorder Scale, and the Conners Rating Scale (Ivanchak et al. 2011). Most experts agree that screening tools developed for children are not suitable for diagnosing autism or ADHD in adults with great accuracy. They are, nevertheless, used.

It is essential to make the correct diagnosis in older adults who have not received a formal diagnosis at a younger age. These individuals may be having therapies and pharmacological interventions which are directed at conditions which share symptoms of autism/ADHD, in other words, are receiving the wrong treatment. In addition, they may be missing out on appropriate metal health support services, or other social assistance (Mukaetova-Ladinska et al. 2012). As the need for treatment for mild adult ADHD remains debatable, adults with moderate or severe symptoms need to have interventional treatment, such as psychotherapy in order to assist in the management of their social and physical relations with the community. It is also possible to find online support which may help in improving self-esteem, a sense of belonging and better understanding of how the feelings of the patient impact on their everyday life.

5. Psychiatric conditions

Autism and ADHD in older people may be confused with certain other psychiatric or psychological conditions, such as schizophrenia, obsessive–compulsive personality disorder, depression and/or anxiety, bipolar conditions, and other cognitive deficits (Heijnen-Kohl and van Alphen 2009). We will concentrate on the example of Diogenes syndrome and the common or similar symptomatology with ASD/ADHD.

5.1. Autism and Diogenes syndrome

Diogenes syndrome is also known as ‘Severe Domestic Squalor’, or ‘Senile Squalor Syndrome’. It is a psychological/behavioural condition where the sufferer exhibits extreme self-neglect with disregard for

health and hygiene, excessive hoarding (a pathological propensity to gather items - often trash or worthless items - also called 'syllogomania'), squalor, and social withdrawal among other signs. (Proctor and Rahman 2021). The condition typically occurs in older adults and it is a relatively rare condition which may affect approximately 0.05 percent of people aged 60 years and older. In other words, around 50,000 older people in Europe and perhaps another 40,000 in the USA are affected. The exact cause of Diogenes syndrome is not well understood, but it is often associated with underlying mental health issues, such as depression, anxiety, or personality disorders. Traumatic life events or social isolation can also contribute.

The link between autism and Diogenes syndrome has remained unrecognized for decades, but it is slowly being increasingly elucidated. It has also been suggested that certain main aspects of autism may predispose to Diogenes syndrome (Sadlier et al. 2011). Diogenes syndrome may co-exist with alcohol abuse, anxiety, depression, personality disorders (such as Obsessive Compulsive Disorder), dementia, and some of its symptoms may be similar to those of autism. A closely related condition is Hoarding Disorder, characterized by hoarding but generally without the other symptoms of Diogenes. The Hoarding Disorder involves a persistent difficulty and distress when throwing unnecessary items away, which then clutter and block areas of the house. There is some overlap with autism, when some people with autism experience a sense of comfort and stability, a relief from anxiety by collecting, keeping and arranging their possessions in certain specific ways that they like. (BOX 2).

The diagnosis of Diogenes syndrome depends on one major criterion (the inability to ask for medical or social help) and three minor criteria: a pathological relationship to the body, which leads to somatic illness; a pathological relationship to society, which leads to a progressive exclusion from it; and a pathological link with objects (Lavigne et al. 2016).

Symptoms	Social Isolation	Atypical Social Behavior	Sensory Sensitivities	Rigidity and Routine
1. Autism	arising from challenges in understanding and engaging in social interactions	difficulty in reading social cues, maintaining eye contact, and forming typical social relationships	to various stimuli, such as lights, sounds, textures, and tastes	rigid adherence to routines and rituals, and deviations from these routines can cause distress
2. Diogenes	results from self-neglect, extreme hoarding behaviors, and avoidance of others due to concerns about hygiene or embarrassment	socially unconventional or inappropriate behaviours: neglecting personal hygiene, or living in squalor	excessive amounts of items or neglect of the environment, resulting in sensory discomfort and distress due to clutter and uncleanliness	rigidity in hoarding behaviors and reluctance to change one's living conditions or clean up

BOX 2. Similarity of symptoms between Autism and Diogenes syndrome

5.2. ADHD and Diogenes syndrome

Certain characteristics of ADHD may be similar to those encountered in Diogenes Syndrome. Common features of ADHD and Diogenes syndrome include severe neglect of personal hygiene, a disorganized and cluttered living environment, and a tendency to avoid social interactions. People with this syndrome may resist efforts to help them improve their living conditions. The hoarding aspect as well as the social withdrawal aspect may appear similar to those with AHDH, particularly the most severe cases of ADHD. However, there are key differences between the two conditions (Figure 1):

- * Age of Onset: Diogenes syndrome typically occurs in older adults, while ADHD is typically diagnosed in childhood and may continue into adulthood.
- * Underlying Causes: Diogenes syndrome is often associated with underlying mental health issues or social isolation, while ADHD is primarily a neurodevelopmental condition with genetic and neurobiological components.

- * Behavioral Characteristics: The behavioral characteristics of the two conditions are quite different. Diogenes syndrome involves self-neglect, hoarding, and social withdrawal, whereas ADHD involves inattention, hyperactivity, and impulsivity.

In summary, while there may be some overlap in behavior, Diogenes syndrome and ADHD are distinct conditions with different underlying causes, age of onset, and primary behavioral features. However, while ADHD and hoarding are separate conditions, research indicates that people with ADHD have an increased risk of exhibiting hoarding tendencies, and ADHD is a condition most commonly associated with hoarding. A person with ADHD may live in a cluttered house, or just be untidy and give less priority to cleanliness compared to others. They may be less willing to get themselves organized and be tidy. This may appear as a similarity with hoarding or Diogenes syndrome and has to be differentially diagnosed.

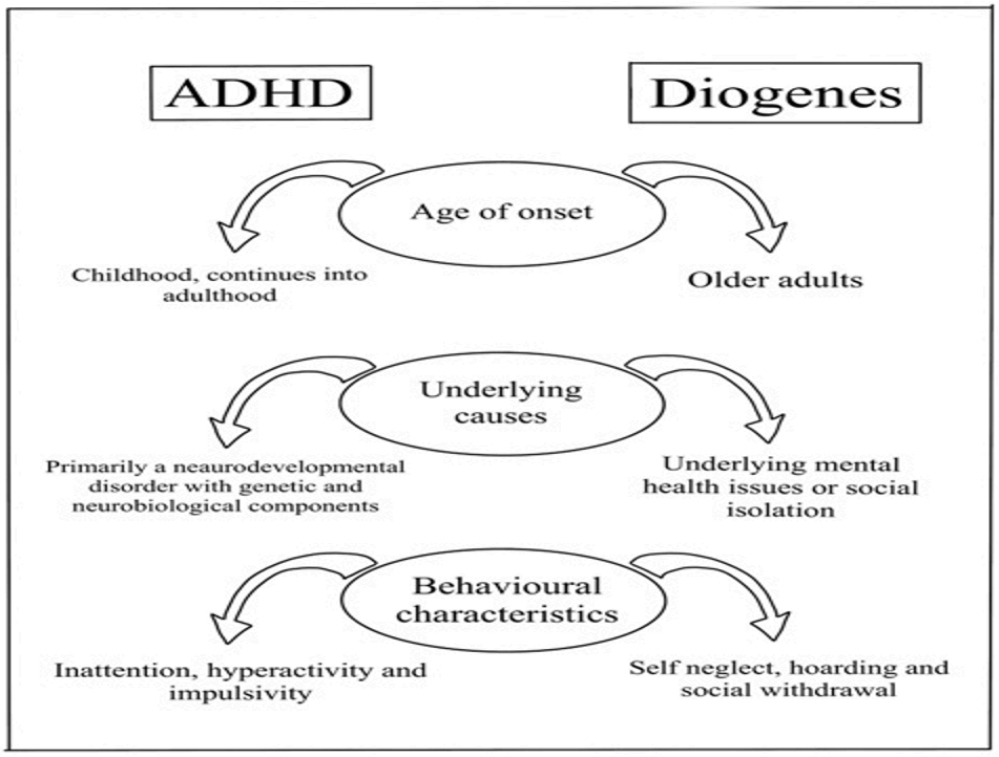

Figure 1. Differentiating between ADHD in older people and Diogenes syndrome

6. Autism and dementia

Is there a link between dementia and autism? The short answer is 'yes'. Autism spectrum disorder (ASD) and Alzheimer's disease (AD) have several apparent similarities in symptoms, and can make the

diagnosis difficult in some cases. Examples of shared apparent similarities are (Figure 2):

- * Insomnia,
- * Communication issues, including non-verbal communication
- * Cognitive impairment, memory problems
- * Weak neuromuscular capabilities
- * Language impairment, motor and executive function problems.

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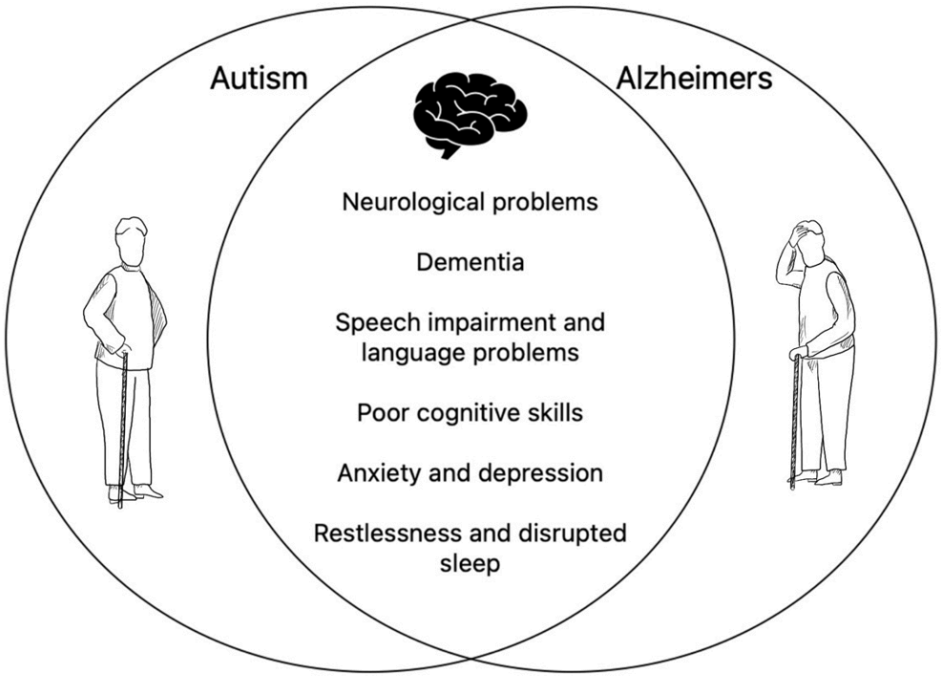

Figure 2. Common symptoms and signs between Autism and Alzheimer's Dementia

Wandering, is a term that means moving disoriented, and without self-awareness, without any definite purpose. This is found both in autism and in dementia (Solomon and Lawlor 2018). If the action of wandering is abnormal (over and above what most people do) then the individual may be considered as a danger to self and others.

Asperger's syndrome can mimic frontotemporal dementia (Okamura et al. 2011). It is well accepted that many older people may have met the criteria for Asperger's syndrome, if the proper diagnosis was made

when they were children. But lack of appropriate diagnostic criteria was one of the reasons why this did not happen.

Research also shows certain common genetic factors which link autism and dementia. Genes such as those in BOX 3, which are present in people with autism are associated with an increased risk of developing dementia later in life. Although there exists an interactive play between genes and environment, which has not yet been elucidated, there are genes or proteins which may be shared between these two conditions. The incidence of both conditions is increasing worldwide and it may continue to increase as lifespan is lengthening (Nadeem et al. 2021). The onnection between autism and dementia is not yet fully elucidated but it is clear that there is a significant overlap between these two conditions. For instance, Vivanti et al. (2021) have shown that:

> *" We examined for the first time the nationwide prevalence and incidence of Alzheimer's Disease and other types of dementia in ASD in a sample of adults with ASD aged 30-64 years who were enrolled in Medicaid, the largest insurer of behavioral health services in the US. Medicaid claims data ... suggested that the adults with ASD were approximately 2.6 times more likely to be diagnosed with early-onset Alzheimer's disease and related dementias compared to the general population".*

The shared genetic factors between these two conditions may provide therapeutic clues about treatment development, when it could be quite conceivable that certain already existing treatments for autism may also be useful for individuals with dementia.

Abbreviation	Full name	Action
NLGN	Neuroligin	affects synaptic function and mediates signaling
SCN2A	Neuronal voltage-gated sodium (NaV) channel gene	involved in generating and transmitting electrical signals
ADNP	Activity-dependent neuroprotective protein	affecting neuronal development
SHANK	Proline-rich synapse-associated protein 2	supporting synaptic and dendritic spine function
PTEN	Protein-tyrosine phosphatase gene	a tumor suppressor, regulator of cell division and involved in apoptosis
hnRNPC	Heterogeneous nuclear ribonucleoprotein C	influences pre-mRNA processing
IRP	Iron regulatory proteins	regulate the expression of genes involved in iron metabolism
RELN	Encodes Reelin	plays a part in cell migration, dendritic and axonic functions and synaptic plasticity
miRNAs	MicroRNAs	Regulation and dysregulation of several neural processes
α-, β0, and γ-secretases		posttranscriptional regulation of cellular synthesis and processing of APP (amyloid-β precursor protein)
FMRP	Fragile X mental retardation protein	modulates the local translation of several synaptic proteins
MECP2	Methyl CpG binding protein 2	affecting synaptic function

BOX 3. Genetic factors in dementia and autism

It was also described (Alemany et al. 2015) that polymorphisms in the gene SORCS2 (sortilin-related VPS10p domain containing receptor 2) present in certain cases of autism, were found to be associated

with an increased risk for dementia. This gene (SORCS2) is involved in the processing of amyloid precursor protein (APP).

7. Autism and disease in general

It has been reported that autistic traits are correlated with a faster rate of aging (Mason et al. 2021), and particularly pace of aging, and facial age. The authors state:

> *"The role that autistic traits have in relation to health outcomes has not been investigated. We looked at how physical health and aging (measured with self-reported questions and decline in multiple biological measures) were related to autistic traits (measured with a questionnaire, at age 45). We found that higher autistic traits were associated with poorer reports of physical health, and a faster pace of aging. This suggests that both those with autism and those with higher autistic traits may be more likely to experience poorer health outcomes".*

However, as mentioned above, most scientific studies tend to concentrate on moderate or severe autism, and do not take into account the fact that autism has also positive aspects, particularly the milder forms of the condition.

Several researchers have described physical degenerative (ageing-related) conditions which are more common in adults with autism. Hand et al. (2020) studied 4685 older individuals (over the age of 65) with autism and found that these have significantly increased risk of epilepsy, Parkinson's disease, cancer, osteoporosis, gastrointestinal conditions, schizophrenia and psychotic disorders, attention deficit disorders, personality disorders, suicidal ideation, osteoporosis, cognitive disorders, heart disease, cancer, cerebrovascular disease, compared to normal controls. It is rather strange that the risk of so many diseases is increased, and one wonders whether this is a true finding. In any case, the risk of increased incidence of anxiety and depression remains relatively high (Uljarević et al. 2019).

Older people with autism are more prone to suffer social and economic exclusion, compared to the rest of the population. In addition, educational, work and healthcare needs may remain unaddressed. The risk of increased criminality or increased victimization is higher, as their condition remains untreated or undiagnosed, or misdiagnosed (NICE 2021).

8. ADHD and dementia

The connection of ADHD to dementia is real and relatively poorly studied. In a paper reviewing the connections between ADHD and dementia (Beehuspoteea and Badrakalimuthu 2023) the authors concluded:

> *"Even though the associations between dementia/MCI and ADHD are postulated and not definitively evidenced based currently, appraisal of evidence and knowledge/consideration of ADHD as a less common but possible contributor to some cases of cognitive impairment are important. It is important for memory clinic staff and other health care professionals who do assess people presenting with cognitive complaints in old age to consider undiagnosed ADHD as a differential diagnosis or as a comorbidity. Recognising undiagnosed ADHD would guide treatment options and may reduce diagnostic uncertainty and over-investigation. It is therefore essential that health care professionals who specialise mostly in older adults feel suitably trained and up-to-date with ADHD diagnostic criteria and presentation, so that a relevant collateral history can be considered."*

Early dementia may share several symptoms or signs with ADHD, and it is important to have this in mind when presented with a patient who has mild cognitive and behavioural problems such as memory problems, absent-mindedness, difficulty multitasking, or is unable to plan the daily activities properly.

9. Gender Dysphoria and Autism

Research shows a very interesting and intriguing relationship between autism and sexuality. It was shown repeatedly that people with autism are more likely to exhibit LGBTQ (lesbian, gay, bisexual, transgender, or queer) characteristics, compared to the general population, with studies suggesting that the rate is 15 to 35 percent among autistic people who do not have intellectual disability (Vermaat et al. 2018, Jacobs et al. 2014, Graham Homes et al. 2022).

This concept could be taken further to include, not only alternative sexual preferences, but no sexual preferences at all (Ronis 2021). In other words, there is a relationship between autism and asexuality. Not only there is disinterest in the traditional male/female relationships but there is also lack of interest to any gender. In a paper, it was summarized that a significant number of adults with ASD have a reduced

sexual interest, including reduced feelings of sexual attraction (Attanasio et al. 2022). These authors concluded that:

> *"We conducted a systematic review of the literature to examine whether asexuality and autism spectrum disorder are connected. We conclude that asexuality and autism share various aspects, such as a possible role of prenatal factors, reference to romantic dimensions of sexual attraction and sexual orientation, and non-partner-oriented sexual desire, but future research should explore and clarify this link".*

The issue is quite complex but interesting. Why do people with autism, have these tendencies? This may be explained partly in a more abstract sense but it is an aspect of the Indispensable Soma Hypothesis, developed by one of us (MK), which sees mild or even moderate autism as an issue of higher intelligence and cognition, which contrasts with the need to procreate, and thus have less interest in procreative sexual practices. As society becomes more cognitive and intellectually complex, childbearing decreases (Kyriazis et al. 2023). This effect has been described repeatedly in the r-K selection theory (Kyriazis 2016). A short explanation of the r-K selection is given by Rushton (1988):

> *"The symbols r and K originate in the mathematics of population biology and refer to 2 ends of a continuum in which a compensatory exchange occurs between gamete production (the r-strategy) and longevity (the K-strategy). Both across and within species, r and K strategists differ in a suite of correlated characteristics. Humans are the most K of all. K's supposedly have a longer gestation period, a higher birthweight, a more delayed sexual maturation, a lower sex drive, and a longer life".*

We therefore see in this case a confirmation of this particular principle of the Indispensable Soma Hypothesis: Not only humanity is heading towards higher cognitive complexity (i.e. indicated by certain positive aspects of autism and ADHD as described above), but this agrees with the reduced sexuality and procreation principles of nature (the r-K selection model). It is nevertheless a complex issue which requires more study and explanation.

10. Autism and Psychosis

Extensive evidence indicates a substantial comorbidity between autism and psychosis, with prevalence rates reaching as high as 34.8% (Ribolsi et al. 2022). This comorbidity has significant implications for the treatment and prognosis of individuals affected. However, identifying comorbid psychosis in individuals

with Autism Spectrum Disorder presents a complex challenge, especially in those with pronounced deficits in verbal communication. Detecting the onset of a psychotic episode in individuals with autism can be particularly challenging. Both conditions exist on a phenotypic continuum of clinical severity, and in many cases, psychotic symptoms manifest in a milder, attenuated form.

Shared characteristics between the two include (Larson et al. 2017, Chandrasekhar et al. 2020):

Mutual Genetic Variants: Some studies have identified certain genetic variants that are associated with an increased risk of both autism and schizophrenia. These shared genetic factors are not specific to either condition but appear to contribute to a general susceptibility to neurodevelopmental and neuropsychiatric disorders.

De Novo Mutations: Both autism and schizophrenia have been associated with de novo mutations, which are genetic changes that occur spontaneously in an individual and are not inherited from their parents. These mutations can disrupt normal brain development and function, potentially contributing to the risk of both conditions.

Polygenic Risk Scores: Researchers have developed polygenic risk scores (PRS) that combine information from many genetic variants to estimate an individual's genetic risk for various disorders, including autism and schizophrenia. Some studies have found that individuals with higher PRS for one condition may also have an increased risk for the other.

Overlap in Biological Pathways: There is growing evidence that certain biological pathways and processes involved in brain development and function are implicated in both autism and schizophrenia. This suggests that disruptions in these common pathways could contribute to the development of either condition.

Family Studies: Family studies have shown that relatives of individuals with autism or schizophrenia may have a higher risk of developing either condition, indicating a potential genetic component.

11. Therapies, Interventions (or no need for therapy)

Before an appropriate therapy is given (or the decision not to treat is made), the condition has to be diagnosed with some accuracy. Early diagnosis of autism is challenging in older people but there are efforts to find some effective markers to help with the screening. These markers concentrate on characteristics of certain proteins, specifically proteins involved in synaptic scaffolding, microtubule-

associated proteins, apolipoproteins, immunoglobulin G complement factor-related proteins, and others (Zhou and Feng 2023).

Several supportive interventions have been proposed over the years. Below is a short list, in no particular order.

- * Music therapy has been suggested as an effective intervention. The role of music therapy in physical and mental health is already known. Although music therapy was found effective at improving behaviour, social communication, and brain connectivity, this was seen in children with autism, while research is adult or older people with autism is lacking (Gassner et al. 2022). It is known however that music therapy is effective in age-related neurodegenerative conditions such as dementia, depression etc. (Gómez-Romero et al. 2017).
- * The role of the gut microbiome on brain health is increasingly being recognized. It was shown that probiotics may have a positive effect on certain neurodegenerative and neurodiversity conditions, including autism (Ansari et al. 2020). However, other researchers are less optimistic, and found no significant association between probiotic treatment and autism symptom improvement (Ng et al. 2019). Appropriate probiotic intake should be used in association with other supportive psychological treatments (Tan et al. 2021),
- * General therapeutic approaches. Some aspects of the treatment of moderate to severe symptoms may be similar to that of dementia. Mild cases of autism or ADHD may not need any treatment, as long as the individual is aware of the diagnosis and can modify his/her behavior to adapt to the social norms, without being suffocated by these norms. The aim is for the caregiver to be more flexible towards the autistic individual and to strive to maximize the positive potential that is hidden in autism.

This means:

- * Be more patient during conversations, allowing time for the autistic person to respond.
- * Ignore (or forgive) any rudeness or bad behavior, having in mind that the autistic person does not purposefully intent to be rude.
- * Don’t put too much emphasis on inappropriate eye contact exhibited by the person with autism.

All of the above are similar approaches to treat patients with dementia or with other neurodegenerative conditions associated with ageing.

Conclusions

The similarities and differences between neurodiverse conditions (ASD, ADHD) and neurodegenerative conditions (e.g. dementia, psychosis) may lead to a delayed or erroneous diagnosis in older people. This means that the patient may not have the full or appropriate intervention to address the symptoms. Although research is generally lacking in this area, efforts are being made by an increasing number of researchers and clinicians, in order to elucidate more details regarding the impact of these conditions on older people. A clinician should be aware of the common ground that exists between these pathologies, although in many cases it could be that there is no pathology at all, just deviations from what is considered 'normal'. The positive aspects of these neurodiverse conditions should be encouraged in order for the individual to achieve their full potential, in a healthy and challenging environment.

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Author contributions

MK prepared the context and the text. LW designed the figures, checked the text and provided comments and corrections. She also handled the AI platform (ChatGPT). GM provided expert comments and additions to the paper. All authors have read and approved the final version of the paper.

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