



Invited review

# Neurodiversity at work: a biopsychosocial model and the impact on working adults

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## Abstract

**Introduction:** The term neurodiversity is defined and discussed from the perspectives of neuroscience, psychology and campaigners with lived experience, illustrating the development of aetiological theories for included neurodevelopmental disorders. The emerging discourse is discussed with relevance to adults, social inclusion, occupational performance and the legislative obligations of organizations.

**Sources of data:** Literature is reviewed from medicine, psychiatry, psychology, sociology and popular press. No new data are presented in this article.

**Areas of agreement:** There is consensus regarding some neurodevelopmental conditions being classed as neurominorities, with a 'spiky profile' of executive functions difficulties juxtaposed against neurocognitive strengths as a defining characteristic.

**Areas of controversy:** The developing nomenclature is debated and the application of disability status versus naturally occurring difference. Diagnosis and legal protections vary geographically, resulting in heretofore unclear guidance for practitioners and employers.

**Growing points:** The evolutionary critique of the medical model, recognizing and updating clinical approaches considering the emerging consensus and paradigmatic shift.

**Areas timely for developing research:** It is recommended that research addresses more functional, occupational concerns and includes the experiences of stakeholders in research development, moving away from diagnosis and deficit towards multi-disciplinary collaboration within a biopsychosocial model.

**Key words:** neurodiversity, neurodevelopmental disorders, disability, autism, ADHD, dyslexia, DCD, reasonable adjustments, accommodations

## Neurodiversity at work

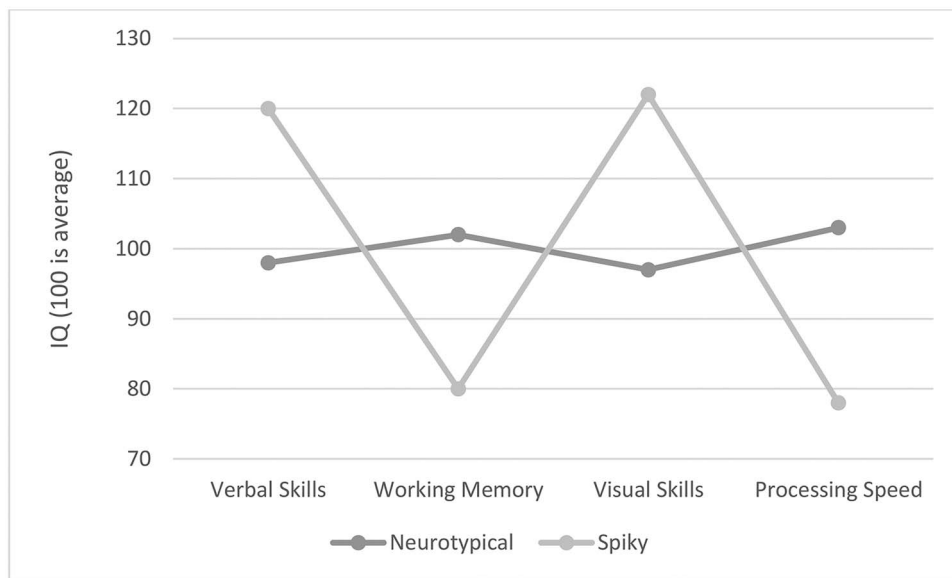
Neurodiversity has become a popular concept at work and is increasingly popular within the business press, following the promotion of targeted inclusion programs from famous companies such as SAP, Virgin and Microsoft<sup>1</sup> as well as the worldwide docuseries ‘Employable Me’/The Employables’.<sup>2</sup> However, from an academic point of view, neurodiversity is not yet well captured, suffers from poor and conflicting definitions, confusing, overlapping symptomatology and little guidance on practical support at work. This introductory article provides an overview of the history of neurodiversity in order to contextualize a description of occupational presentation, which has wide reaching impact on the social determinants of health. Bringing together threads from disparate research fields including medicine, psychology, sociology, education, management science and vocational rehabilitation, a multi-disciplinary, biopsychosocial summary of the current picture is presented. A key issue for clinicians is understanding how to respond to the emerging dynamics when delivering everyday consultation and treatment for individuals. Practice guidance is provided, as well as advice on referring individuals to available workplace support. Avenues for future, multi-disciplinary research are recommended.

## Defining neurodiversity

The term ‘Neurodiversity’ was originally developed by stakeholders influenced by the social model of disability.<sup>3–5</sup> It was based on ‘Biodiversity’, a term primarily devised for political ends: to advocate for conservation of all species, since a

high level of biodiversity is considered desirable and necessary for a thriving ecosystem. Neurodiversity advocates adapted this principle to argue that society would benefit from recognizing and developing the strengths of autism or dyslexia (for example) instead of pathologizing their weaknesses.<sup>6,7</sup> Within the discipline of psychology, though, weaknesses have historically been the focus of research and practice. Analysis of cognitive strengths is only used to differentiate between general learning disabilities and specific-learning disabilities. A definition has emerged for psychologists and educators which positions neurodiversity ‘within-individuals’ as opposed to ‘between-individuals’.<sup>8</sup> To elucidate: the psychological definition refers to the diversity within an individual’s cognitive ability, wherein there are large, statistically-significant disparities between peaks and troughs of the profile (known as a ‘spiky profile’, see Fig. 1).<sup>8,9</sup> A ‘neurotypical’ is thus someone whose cognitive scores fall within one or two standard deviations of each other, forming a relatively ‘flat’ profile,<sup>8</sup> be those scores average, above or below. Neurotypical is numerically distinct from those whose abilities and skills cross two or more standard deviations within the normal distribution.

Figure 1 is adapted from the British Psychological Society report on Psychology at Work,<sup>10</sup> page 44, and depicts scores from the Wechsler Adult Intelligence Scale,<sup>11</sup> which provides clear guidance on the level of difference between strengths and weaknesses that is typical or of clinical significance. Scores are used to support a diagnosis of dyslexia, Developmental Coordination Disorder (DCD, previously referred to as ‘dyspraxia’, see Table 2) and Attention Deficit



**Fig. 1** A 'Spiky Profile' showing example IQ scores.

Hyperactivity Disorder (ADHD)<sup>8,12,13</sup> and to understand the cognitive ability of an employee following injury or illness.<sup>14</sup>

To refer to individuals, the terms 'neurodivergent' 'neurodifferent' and 'neurodiverse' are in current use both academically and for self-identification; this is a matter of stakeholder debate.<sup>15–17</sup> In recognition of the lack of consensus regarding which term is more appropriate, all may be referred to interchangeably, asking individuals how they prefer to identify. Spiky-profile conditions have historically been grouped under umbrella terms such as hidden impairments, specific-learning disabilities and neurodevelopmental disorders. Autistic autism researchers have critiqued the widespread use of deficit highlighting in nomenclature and advise a wide scale revision of language.<sup>18</sup> A new umbrella term is proposed herein for included conditions that is neutral and statistically accurate: 'neurominorities'.

## Introduction: an emerging paradigm

### Stakeholder activism

Judy Singer, the Australian sociologist, is widely credited with producing the first research-based publication of the term in 1999, following her thesis

in which she synthesized her first-person experience in the middle of three generations of women 'somewhere' on the autistic spectrum, with critical disability studies.<sup>19</sup> In the decades since publication, the term and its philosophy of difference, not deficiency, has been appropriated for a wider range of conditions, diagnoses and identities and formed a grass roots movement.<sup>17,20</sup> This paper focuses on the main four neurominorities of ADHD, autism, DCD and dyslexia for ease of comparison, literature review and recommendation. It is acknowledged that this will overlook some conditions and complexities within the emerging paradigm, yet many of the principles can be applied in a wider context.

The Neurodiversity movement holds ambitions of equal rights for members, appreciation of the diversity of human cognition and political power to break down structures of exclusion.<sup>6</sup> Nowhere has this argument been more compelling to date than the innovative technology, finance and defence industries, where programs to deliberately hire neurominority employees are becoming more frequent as talent strategies, rather than social responsibility projects.<sup>1,15,21–25</sup> Neurominority employees may bring talents, yet, in line with the spiky profile, there may also be difficulties. Understanding the discourse

is essential for understanding neurodiversity at work because it affects how we must fluidly move between medical and social models to support individuals and employers.

### Ontological controversy

The disparity between the language and assumptions of psychological and medical ‘experts’ and the lived experience of ‘stakeholders’ has led to dissent and conflict both between and within these groups.<sup>6,17,26</sup> For example, some argue that autism is inherently disabling irrespective of context<sup>27</sup>; some propose that differentiating between autistic people who are ‘high’ or ‘low’ functioning is fundamentally discriminatory,<sup>28</sup> whereas others propose their identity to be a superpower.<sup>29</sup> In practice, we will encounter individuals from all these polarized perspectives, some who feel strongly about their position, and will assert their right to be treated accordingly. However, we should not presume that those who do not self-advocate articulately to be without preference; agency in accessing professional services is compromised by layers of intersectional exclusion including race, gender, class and sexual orientation, as well as verbal skills themselves. In research, there are increasingly calls to include stakeholder voice (‘nothing about us without us’<sup>35</sup>) and to focus on matters of importance to those with lived experience, such as workplace adjustment interventions, outcomes and inclusion best practice, as opposed to diagnosis and deficits.<sup>30–32</sup> Educopsychological and psychiatric debates include comorbidity and the difficulty distinguishing between the conditions,<sup>33–37</sup> as well as controversy around the ‘correct’ approach for differential diagnosis, given that the main conditions are diagnoses of exclusion, in which there are no objective, clear measures of assessment.<sup>38–40</sup> A clear way forward for medical research and clinical practice is thus lacking, and it is important to understand the confusing influence of a disconnected discourse upon occupational health guidance. Employers may look to experts for advice and find the advice incongruous with the popular business narrative. Employees may be hired as part

of a talent program yet present with stress and anxiety. Practitioners are thus advised to enquire with patients directly for feedback and to approach any treatment sensitively, balancing the influence of intervention protocol controversy: for example, Applied Behavioural Analysis is considered abusive and traumatic by many autistic people.<sup>41</sup>

## The biopsychosocial history of neurominorities

### Psychological adoption

The umbrella term of neurodiversity began to replace ‘Specific Learning Difficulties’ for some educational psychologists in the late 2000s<sup>20,42,43</sup> and became common within occupational psychology in the 2010s.<sup>13</sup> In psychological literature, ADHD, autism, DCD and dyslexia are the conditions most frequently referred to under this banner, though others have also included mental health conditions such as depression and anxiety,<sup>6,9,20</sup> general learning disability<sup>20</sup> as well as Tourette Syndrome, dyscalculia, dysgraphia and acquired brain injury,<sup>9</sup> depending upon whether the within or between definition is applied. Distinction has been made between conditions that are applied and developmental, clinical and developmental, acquired and transient or acquired and chronic<sup>9</sup>; [Table 1](#) depicts a taxonomy of neurominorities adapted and updated from the British Psychological Society’s Psychology at Work report.<sup>10</sup> (Please refer to the full chapter for more details).

The major themes within the medical history of the main developmental conditions are presented in the next section. Neurocognitive, psychosocial and legal commonalities are noted, within which occupational advice must be contextualized. A timeline of the various theories is depicted in [Table 2](#). Note that all start with a pathologization of socially referenced behaviour or skill, followed by varying hypothetical causal nature/nurture theories. All include reference to ‘Executive Functions’ by the 21st century, defined as ‘goal-oriented self-regulation—including planning, organisation, response inhibition and behavioural sequencing’.<sup>44</sup>

**Table 1** A taxonomy of neurominorities

Dyslexia, DCD, dyscalculia, dysgraphia	Tourette syndrome, autism and ADHD	Mental ill health	Neurological illness or brain injury
Applied, developmental neurominority <ul style="list-style-type: none"><li>• Born with condition</li><li>• Relates to applied, educational skills such as reading or motor control</li><li>• Not considered a health condition</li></ul>	Clinical, developmental neurominority <ul style="list-style-type: none"><li>• Born with condition</li><li>• Relates to behavioural skills such as communication and self-control</li><li>• Considered a health condition (currently)</li></ul>	Acquired neurominority (potentially transient) <ul style="list-style-type: none"><li>• Develops in response to a health condition such as anxiety or depression</li><li>• Could return to ‘neurotypical’ if health condition resolves</li></ul>	Acquired neurominority <ul style="list-style-type: none"><li>• Develops in response to a health condition</li><li>• Potentially resolves as injury heals or worsens as health deteriorates</li></ul>

**An evolutionary critique of the psychomedical model**

Given the extent of overlap between the conditions, the under-diagnosis of females who instead present with anxiety, depression or eating disorders,<sup>45,46</sup> and the estimated prevalence of each condition, a reasonable estimate of all neurominorities within the population is around 15–20%, i.e. a significant minority. Research supports a genetic component to most conditions<sup>47</sup> which, when considered with combined prevalence rates, suggests an evolutionary critique of the medical model: if neurodivergence is essentially disablement, why do we keep replicating the gene pool? The less extensive, yet persistent, body of work indicating specialist strengths within neurodiversity,<sup>9,20,48–52</sup> supports the hypothesis that the evolutionary purpose of divergence is ‘specialist thinking skills’ to balance ‘generalist’ thinking skills (as per the ‘spiky profile’). The evolutionary perspective is congruent with the Neurodiversity movement and essential to understanding the occupational talent management perspective that is currently in vogue.

The psychomedical histories outlined in Table 2 speak to the evolutionary critique for two reasons. Firstly, they demonstrate the consistency of the ‘specific’ rather than ‘general’ nature of impairment (the spiky profile) across all four conditions over time, irrespective of the changing nature of causal theories. The conditions are named and identified according to their most prominent deficits, which are themselves contextualized within our normative

educational social history. Dyslexia is discovered around the same time as literacy becomes mainstream through education; ADHD becomes more prevalent with the increasing sedentary lifestyles from the industrial revolution; autism increases in line with modern frequency of social communication and sensory stimulation and DCD as our day-to-day need for motor control of complex tools and machinery becomes embedded. The evolutionary critique of neurodevelopmental disorders is that their perceived pathology is related to what we consider normal in modern times, as opposed to what is normal development within the human species.<sup>3,7,53–55</sup> Secondly of interest from the timeline in Table 2 is the final column, wherein we see that, despite consistent observation of similar neurobiological differences, we lack a single unifying theory for any condition.

**Towards a biopsychosocial model**

Most humans are average in all functional skills and intellectual assessment, some excel at all, some struggle in all and some have a spiky profile, excelling/average/struggling. The spiky profile may well emerge as the definitive expression of neurominority, within which there are symptom clusters that we currently call autism, ADHD, dyslexia and DCD; some primary research supports this notion.<sup>33,56</sup> In the future, these may shift according to our educational and occupational norms such as social demands,

**Table 2** Timeline of neurominorities

Condition	First records	Dominant 20th Century approaches	Since neuroscience paradigm
ADHD	1798, some patients are described with an inability to maintain concentration; also referenced in 1844 as 'Fidgety Phil' syndrome, <sup>115</sup> where no general disability can explain the difficulties related to an absence of 'moral control'. <sup>116</sup>	Known as hyper-kinetic reaction of childhood <sup>117</sup> and Attention Deficit Disorder (with and without hyperactivity). <sup>118</sup> Treatment with stimulants present from the 1940s, though not widely used initially as most behaviour attributed to poor parenting. <sup>116</sup>	Deficits in dopaminergic/noradrenalnergic pathways <sup>119</sup> and combined executive functions <sup>120</sup> implicated. Still mainly treated through stimulant medication augmented with psycho-social support for parents, teachers and individuals. <sup>113,121</sup>
Autism	Re-interpretation of historical medical and legal reports indicate case studies of autism in popular discourse since 1700s, both a specific difference issue related to eye contact and social communication as well as a general learning disability in which no 'normal' day-to-day social functions are observed. <sup>123</sup>	'Refrigerator Mother' hypothesis was proposed <sup>124</sup> and Autism was considered a 'Schizophrenia of Childhood'. <sup>125</sup> Asperger's syndrome used to differentiate high from low functioning. <sup>118,123</sup> 'Theory of Mind'—an observation-based theory inferring deficits in social imagination. <sup>126</sup> The notion of an 'Autistic Spectrum' with behavioural symptoms along a continuum. <sup>127</sup>	Differences in connectivity of the brain, lower activity in pre-frontal cortex affecting executive functions <sup>108,128</sup> and higher activity in sensory cortex resulting in sensory over-responsivity; 'Intense World Theory'. <sup>106,107</sup> Latest advice from American Psychiatric Association <sup>129</sup> indicates one spectrum with different levels of IQ coexisting rather than determining separate sub-conditions.
DCD	A physician named Collier is reported as providing the first report on 'congenital maladroitness' in the early 20th century <sup>131</sup> defined as difficulty with motor coordination despite normal levels of intelligence.	Dyspraxia, developmental apraxia absorbed into the pejoratively named 'Clumsy Child Syndrome' in the later 20th century, <sup>132</sup> however dyspraxia and developmental coordination disorder more widely used in diagnosis according to DSM criteria. <sup>118</sup>	Consensus on terminology of Developmental Coordination Disorder (DCD) within DSM criteria. <sup>129</sup> Neurobiological observed differences include internal modelling and executive functions deficits, but likely point again towards a complex whole brain approach in which several specific pathways may be all or partially compromised. <sup>130</sup>
Dyslexia up to 10% <sup>45</sup>	Dyslexia described as 'word blindness' in medical journals from the late 1800s, referring to both acquired and developmental inability to read despite otherwise normal levels of intelligence. <sup>133</sup>	Initially thought to be related to visual perception <sup>134</sup> but later in the 20th century this assumption was superseded by Phonological Deficit Theory and more specifically a deficit in the phonological component of working memory, part of the executive functions. <sup>135,136</sup> Several other competing neurocognitive theories are proposed <sup>137</sup> and there is a lack of a single, unifying theory. <sup>138</sup>	Neuroimaging suggests that dyslexia is not caused by a single neurocognitive function but is instead a complex presentation with many potential causes, dependent on the interaction between individual neurocognitive capacity and the language that one speaks. <sup>139</sup>



sedentary lifestyles, literacy dependency and automation of gadgets. To elucidate, although there are clear biological markers for those with a spiky profile<sup>33,55</sup> which lead to observable, measurable psychological differences, there is nothing innately disabling about those differences when we consider a traditional, tribe-based community of humans. Within the biopsychosocial model of neurodiversity, understanding work-related intervention and treatment becomes more about adjusting the fit between the person and their environment<sup>58</sup> than about treating a disorder. Critical review of the extant biopsychosocial research supports the social model proposition that the individual is not disabled, but the environment is disabling.

### The legal status of neurodiversity

Since the early 21st century, most nations have adopted disability legislation congruent with the United Nations Statute<sup>59</sup> on the rights of Persons with Disabilities. Such legislation refers to the need for organizations to make ‘accommodations’, to use US terminology,<sup>60</sup> referred to in the UK as ‘adjustments’,<sup>61</sup> such that individuals with disabilities can learn, work and be included in society. The term accommodation is adopted for the remainder of this paper to denote the general process of compromise and flexibility; adjustment is used to refer to the implementation of equipment, services or changes to requirement, though in practice the two are used interchangeably dependent on geographical location. Note that there is no compulsion for individuals to change to fit in, no mention of treatment for individuals. Legally compliant intervention is at the organizational level, including the requirement for businesses, services and educators to work towards ‘Universal Design’, in which there is flexibility of environment, communication and tools to accommodate the widest possible range of human experience.<sup>62</sup> Disability status is predicated not on diagnosis of condition, but on the assessment of functional impairment, the extent to which the individual is inhibited and excluded. One could have a diagnosis of diabetes, spinal injury, psychiatric disorder and be disabled

or not, depending on the impact on ‘normal day-to-day functioning’ that persists over a minimum period, for example 12 months.<sup>61</sup> The context may or may not disable the individual (‘disabled people’) as opposed to the disability automatically assigned to the person by nature of their diagnosis (person with a disability). From a legal perspective then, any form of neurominority may qualify for protections requiring accommodation depending on what is currently normal and how that interacts with an individual’s cluster of functional difficulties.

Neurodiversity should not be used as a synonym for disability, hence the adoption of the neurominority term herein. Many neurominority employees find themselves in need of disability accommodation at work.<sup>63,64</sup> Irrespective of legal protection, social and occupational exclusion are endemic for neurominorities. Studies vary in the percentages quoted, yet there is persistent evidence of disproportional representation within prison populations,<sup>64–67</sup> long-term unemployment<sup>32,68–70</sup> and failure to achieve career potential.<sup>70,71</sup> Exclusion rates point to an economic, social and moral imperative to improve outcome-based research, from which we can advise practitioners and individuals on which adjustments improve inclusion, within a biopsychosocial model.

### Occupational considerations of neurodiversity

To summarize the context before moving to presentation and accommodation: an occupational narrative has developed around the ‘diamond in the rough’,<sup>72</sup> in which neurominority employees resemble thwarted geniuses, who would be able to succeed given the right support, environment or tools. The extent to which this narrative is plausible for individuals is not well captured by academic research, which is biased towards reductive neuropsychology in search of ‘bits that are broken’<sup>3,73</sup> as opposed to more functional, contextual performance. A reductive, medical paradigm of research is incongruent with the legal status of neurominorities as protected conditions in most developed countries, to which

organizations must adjust. Given this, in the following section, a neutral pragmatic summary of knowledge regarding individual-level symptoms and occupational difficulties is attempted. The effectiveness of adjustments and issues related to systematic inclusion at the organizational level is discussed.

### Occupational symptomatology

At the functional level, there are similarities between neurominorities in terms of presentation. As alluded to in Table 2, executive functions are a common psychological complaint, resulting in difficulties with short-term and working memory, attention regulation, planning, prioritizing, organization and time management. Self-regulation of work performance is required in many modern employment contexts and therefore these issues present as the most disabling for individuals.<sup>74</sup> There is also commonality among strengths, many related to higher order cognitive functioning reliant on comprehension and creativity.<sup>75</sup> Table 3, adapted again from the British Psychological Society's 2017 report,<sup>10</sup> describes reported strengths and weaknesses associated with the four main neurominorities. The comparatively fewer references regarding strengths may reflect a research bias as opposed to an accurate representation of lived experience; it certainly is incongruent with the 'talent' narrative that is becoming dominant in workplaces.

### Accommodations

The aim of occupational accommodations for neurominorities is to access the strengths of the spiky profile and palliate the struggles. The most frequently deployed adjustments<sup>31,76–78</sup> fall into the categories listed in Table 4. Note that additional time to complete work is not mentioned; this adjustment is common in education but not at work, because it is not reasonable to pay someone the same money to produce less work. In exams, the validity of extra time is because we are measuring long-term memory or analytic skill via the medium of literacy alone, when verbal, visual and/or spatial skills may be more relevant in the workplace (for example multiple

choice quizzes to assess medical knowledge). When assessment methods are more matched to the eventual job performance (for example observation of physical examination skills using role play patients) extra time becomes less important. This principle applies across education, recruitment and employment but is poorly understood by lay people or those without an understanding of cognitive functions and the antecedent components of job performance.

### Adjustment effectiveness

There are very few studies evaluating the effectiveness of adjustments in the workplace and this is an urgent research need.<sup>79</sup> Rice and Brooks<sup>30</sup> stated the following in the conclusion of their adult dyslexia interventions review (p. 12): 'good practice in this field rests almost entirely on professional judgment and common sense, rather than on evidence from evaluation studies'. Over-reliance on heuristical guidance must be addressed by the research communities, and requires collaboration within applied psychological sub-disciplines, occupational therapy, occupational medicine and human resources departments. The limited evidence that does exist broadly supports the implementation of adjustments<sup>64,74,77,80,81</sup> but, without sophistication, we are unable to speak to quality control, return on investment or predict which type will work for different individuals/roles. Intensive personalized employment support (IPS) such as that provided to autistic people with multiple needs and people with moderate mental health conditions have found that the benefits only outweigh the costs when wider community measures such as housing and health costs are factored in.<sup>82–85</sup> However, employment-based neurominority adjustments typically cost <£1200 per person,<sup>86</sup> which is cheaper than the cost of re-recruiting<sup>87</sup> and significantly cheaper than IPS. More broadly, cross-sectional research has indicated biases in cost perceptions of disability adjustment, with objective records of expenditure less than presumed.<sup>88</sup> Although an appropriate evidence-base builds, practitioners must be guided by individual



**Table 3** Work-related difficulties and strengths attributed to neurominorities

	Difficulty	Strength
ADHD	Time management <sup>140</sup>	Creative thinking <sup>145</sup>
	Concentration, attention and self-regulation difficulties <sup>141</sup>	Visual-spatial reasoning ability <sup>8</sup>
	Insomnia, depression, injury and absence <sup>142</sup>	Hyper-focus, passion and courage <sup>20</sup>
	Maintaining employment <sup>143</sup>	
	Difficulty with team work <sup>144</sup>	
Autism	Time management <sup>146</sup>	Memory ability, and other 'specialist individual skills' including reading, drawing, music and computation <sup>149</sup>
	Concentration and coping with more than one task <sup>147</sup>	Innovative thinking and detail observation <sup>20</sup>
	Social and communication difficulties <sup>148</sup>	High verbal comprehension ability <sup>8</sup>
	Need for routine <sup>148</sup>	
DCD	Difficulties with driving, self-care, organization, communication and self-esteem <sup>32,51</sup>	
	Processing speed and working memory <sup>8</sup>	
	Persistence of motor difficulties in operating equipment <sup>150</sup>	
Dyslexia	Literacy, memory, organization, communication and self-esteem <sup>12,151</sup>	Entrepreneurialism <sup>50</sup>
	Memory, organizational skills, time management, stress management, literacy <sup>74</sup>	Creativity and cognitive control <sup>153</sup>
	Workplace participation in terms of mental functions and social interactions <sup>63</sup>	Visual reasoning <sup>154</sup>
	Cognitive functioning and social self-esteem <sup>152,153</sup>	Practical skills, visual-spatial skills and story-telling ability <sup>155</sup>
	Higher incidence of worklessness and incarceration <sup>65,154</sup>	

presentation, compromise and collaboration with employers, bearing in mind the biopsychosocial model and the strongly held opinions of individuals. Professionals can support the ambitions of the Neurodiversity movement in the workplace but must also maintain a cautious approach to prognosis of workplace performance improvements and job retention until we have more longitudinal data.

Accessing adjustments

In the UK, the Access to Work program funded by the Department of Work and Pensions provides a free assessment to over 30 000 disabled people per annum, including ~6000 neurominority employees or those with mental health needs.<sup>86</sup> The program acts as triage and signposting, enabling individual employees to self-refer and acquire an assessment of workplace need, following which a report is produced recommending adjustment as per the types in

Table 4. Access to Work is widely respected in the UK and valued by users<sup>89</sup> but there is a clear short fall in resourcing, considering the number of eligible individuals likely to be working in the UK. There are few programs of its kind internationally. The same role is more typically provided informally or privately by Occupational Health, Human Resources or Employee Assistance Programs from an organizational point of view, acting on behalf of the company rather than the individual. Professionals providing these services are less likely to possess the specialist skills in working with executive functions deficit, and are liable to misdiagnose/mistreat executive dysregulation as stress, anxiety or wilful lack of motivation, particularly with women, black people and ethnic minorities.<sup>46,90,91–94</sup> Clinicians are advised to check for specialist knowledge on referral rather than assume a mental health generalist will have required expertise. Adjustments tend to be provided as a compliance activity per individual,

**Table 4** Typical adjustments for neurominorities

Adjustment type	Example activity
Work Environment flexibility	Reducing sensory distractions by allowing flexible hours; use of private meeting rooms; noise-cancelling headphones; redesign of shared working space.
Schedule flexibility	Avoiding rush hour travel to prevent sensory overwhelm; remote working to avoid sensory overwhelm, improve concentration and reduce social communication demands.
Supervisor or co-worker support	Additional feedback time with supervisor; differences in instructions provided—more clarity or concreteness given.
Support from different stakeholders	Peer mentoring networks within the company; allowing support activities via employee assistance, mental health, or family support throughout the working day; allowing access to stakeholder groups and charities throughout the working day.
Executive functions coaching	Workplace coaching to focus on areas such as planning, prioritization, organizational skills using workplace coaching psychology.
Training	Adjustments to training provision including sending materials in advance or providing additional induction training.
Work-station adjustments	Use of dual screens to improve concentration, whiteboards and other aide memoires; standing desks with wobble boards to improve access to movement through the day.
Assistive technology and tools	Speech-to-text, text-to-speech software to reduce demands on literacy, handwriting skills and improve concentration; mind mapping software to support shift from overview to detailed thinking; specialist spell checkers designed for dyslexia; planning and memory software.
Literacy coaching	This will be targeted coaching based on the literacy requirements of the role rather than teaching basic skills, such as speed reading, making notes whilst reading, summarizing or structuring and planning written work.

with few businesses looking systemically at Universal Design<sup>62,95</sup> for neurominorities as would be recommended in the United Nations Convention on disability.<sup>59</sup> Access to accommodations is thus predicated on individual disclosure, typically occurring following a conflict or episode of poor performance. Individuals are reluctant to voluntarily disclose in advance<sup>79,96,97</sup> as they fear discrimination (with some justification<sup>98</sup>) and therefore the aims of the disability legislation programs worldwide are not yet having the intended effect on inclusion.<sup>99–101</sup>

**Implications of the neurodiversity phenomenon for medical practitioners**

In this final section, the potential ways in which medical practice can embrace the developments of the Neurodiversity movement and support individuals within a biopsychosocial model are explored.

**Reactional stress and hidden neurominority**

Physicians are likely to be interacting with neurominority individuals who are in work, unemployed,

incarcerated or requiring health care. Neurominorities can be misdiagnosed as mental health issues due to symptoms overlapping with bipolar disorder, anxiety, depression and/or eating disorder.<sup>45,46,102</sup> A presenting mental health need may be a direct consequence of unsupported neurominority; an individual who is frustrated, excluded and unable to reach potential will naturally feel anxious or depressed. We need to improve recognition of cognitive symptoms (as opposed to mood) in frontline medical and nursing services to ensure accurate signposting. There is a potential for a vicious cycle in which treatment for mood and stress will only mask an underlying cognitive deficit or difference leading to 'revolving door' patterns of health care access. Where possible, physicians should feel comfortable to ask about the possibility of a neurominority as an explanation for ongoing distress and underachievement and refer to a specialist psychiatrist or psychologist for confirmation. It must also be noted that those experiencing precarious employment and unemployment will be experiencing adverse impacts on health, stress and well-being more generally,<sup>103</sup> that those with neurominorities are more likely to be under-employed and that access to diagnosis is compromised by intersectional influences of race, gender, sexual orientation and socioeconomic background.

### Following diagnosis

Once a condition or conditions have been identified, an individual may feel vindicated, and experience catharsis. Psychology practitioners report their clients' mental shift following correct diagnosis at the identity level and warn that, done badly, it can lead to disempowerment.<sup>12</sup> However, done well, understanding one's strengths and weaknesses can lead to breaking down barriers and removing self-reproach. A late diagnosis adult client reported 'now that I understand my dyspraxia and that I literally have less processing power than most people, I don't give myself such a hard time. I take things slowly, at my own pace, which reduces my anxiety and actually makes me do things more accurately'. Physicians can recommend approaching employers for accommodation advice, recommending Access

to Work if in the UK and human resources departments globally. A benefit of increased, general Neurodiversity awareness has been capacity building within businesses to manage and respond to requests for adjustments. Although not every employer has an established process, and there are still incidences of discrimination, guidance from respected professional bodies in human resources is clear about legally-compliant activities and how to access them.<sup>104,105</sup>

### Accommodations in providing medical treatment

Differences in sensory perception have been reported as a hallmark of neurominority internal experience,<sup>102–108</sup> which may affect pain management, sleep patterns and increase routine-change difficulties during in-patient care. Pamphlets explaining treatment, obtaining consent, confirming after care may not be read or absorbed by those struggling with literacy or attention. Difficulties in independently maintaining organizational routines might affect self-management of medication protocols. Neurominority patients may therefore respond differently to treatment, with increased anxiety or confusion. A patient who appears unwilling to take responsibility for health care may be forgetful not defiant, even if they seem verbally competent, which could result in prejudicial treatment from clinicians. A significant risk is that a neurominority individual may experience a 'meltdown', defined as 'an intense response to overwhelming situations'.<sup>109</sup> For those with sensory sensitivity, overwhelm can be caused by pain, bright hospital lights, background noise, smells and continual changes in personnel. Someone experiencing a meltdown may scream, shout, swear and become physically aggressive to avoid being touched (as opposed to physically violent with intent to harm). Medical staff in all contexts need to be aware that any unnecessary physical contact or verbal persuasion in this circumstance may exacerbate distress rather than palliate and that an appropriate response is to provide calm, quiet decompression space wherever possible.

Treatment for mental ill health, insomnia and stress-related illness must be reviewed in terms of the

reactive nature of distress in the context of continual sensory overload and/or exclusion. A common theme in discrimination for neurominorities is to be told to 'try harder' or 'yes, but we all feel like that sometimes', leading to self-doubt and increased exposure to harm. Validation of the biological nature of distress from clinicians can be liberating, but it does not follow that alleviating distress must always result from individual treatment. In this context, care must be taken to alleviate acute symptoms, but encourage long-term adaptation of the individual's environment, developing self-awareness and agency over home situations and work. Psychosocial support referral should accompany pharmacological treatment; a multi-disciplinary approach is recommended. At work for example, occupational physicians specifically can advocate for neurominority inclusion with employers, by liaising with human resources and occupational psychologists to systemically improve environmental compatibility in building, schedule and work-station design accommodating assistive technology, sensory overwhelm, the need to move and reducing social anxiety.

### Research avenues

The dearth of research about the occupational implications of neurodiversity is less of a gap, and more of a 'blind spot'.<sup>110</sup> Medical research could support the development of evidence-based practice in employment by incorporating long-term outcomes into treatment and diagnostic studies. Including dependent variables such as formal education, salary, hours of employment, job satisfaction and career attainment will provide occupational psychologists with much-needed data on inclusion and adjustment effectiveness. Collaborations with multi-disciplinary occupational health teams are required to improve our understanding of what works, for whom and when. A Realist methodology<sup>111</sup> within a 'Pragmatic Paradigm'<sup>112</sup> can embrace the biopsychosocial model and enable us to provide better advice to individuals and employers. There is an opportunity to make a real difference to the lives of many and improve health outcomes through social inclusion using a neurodiversity focus.

### Conclusions

From within an emerging paradigm, clinicians and researchers must appreciate the shift in discourse regarding neurodiversity from an active, vocal stakeholder group and embrace new avenues for study and practice that address practical concerns regarding education, training, work and inclusion. This article has provided an overview of the neurodiversity employment picture; namely high percentages of exclusion juxtaposed against a narrative of talent and hope. Understanding the importance of nomenclature, sensory sensitivity and the lasting psychological effects of intersectional social exclusion is key for physicians wanting to interact confidently and positively with neurominorities. The proposed biopsychosocial model allows us to provide therapeutic intervention (medical model) and recommend structural accommodation (legislative obligation) without pathologization (social model). In other words, we can deal pragmatically with the individuals who approach us and strive for the best outcomes, given their profile and environment. It is acknowledged that, by focusing on the main four developmental neurominorities to the exclusion of others, some nuance is unexplored, though the main principles herein can be applied more broadly. Summarized above are adjustments representing current best practice, though the need to assess and evaluate these beyond description and cross-sectional studies is highlighted. The neurodiversity phenomenon is coming of age and will begin to translate into public policy and education as well as employment. Medical and social scientists are uniquely placed to support an ambitious inclusion agenda through rigorous evaluative research partnerships.

### Addendum

A new umbrella term is proposed herein for included conditions that is neutral, statistically accurate and has support from communities with lived experience: 'neurominorities'.<sup>156,157</sup>

### Data availability statement

No new data were generated or quantitatively analysed in support of this review.

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