Do-IT Profiler
Neurodiversity Tools & Training

A Needs-Led, Transdiagnostic Approach

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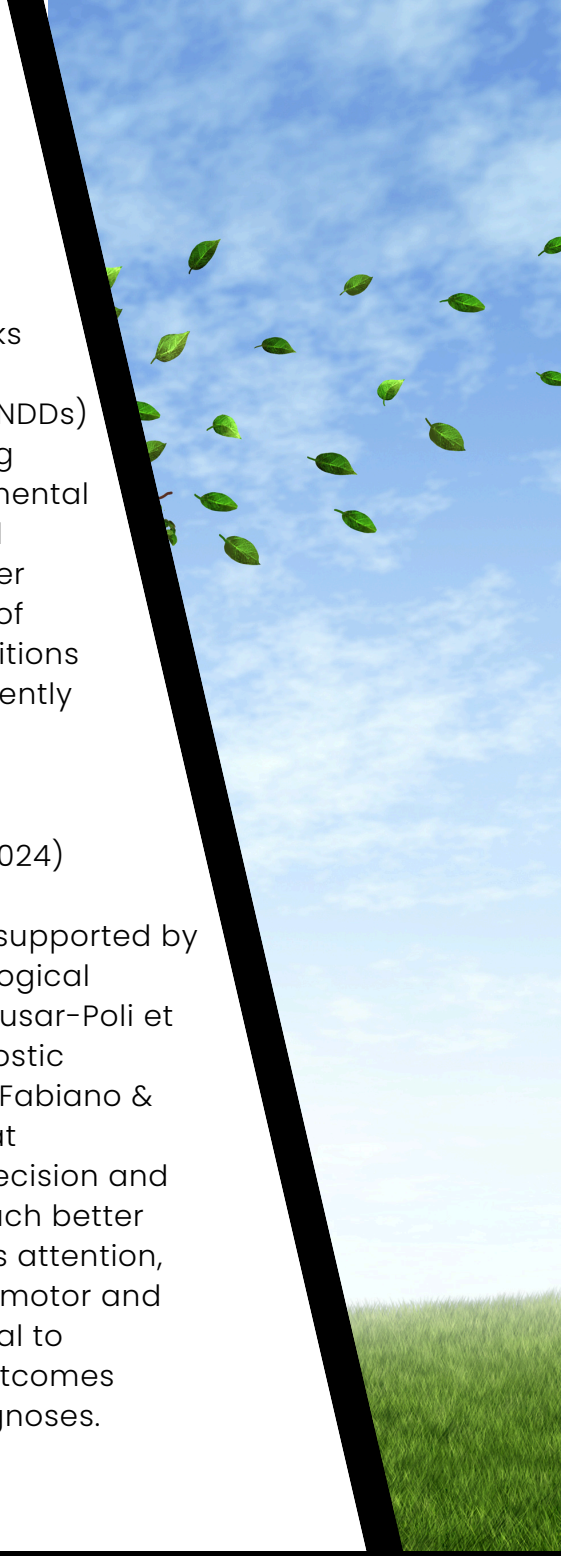
Executive Summary



Traditional diagnostic frameworks such as the DSM and ICD divide neurodevelopmental disorders (NDDs) into discrete categories including autism, ADHD, dyslexia, developmental coordination disorder (DCD) and developmental language disorder (DLD). However, a growing body of evidence shows that these conditions share core characteristics, frequently co-occur, and rarely present as isolated or static entities.

Recent work by Michelini et al. (2024) proposes a transdiagnostic neurodevelopmental spectrum, supported by genetic, cognitive and neurobiological findings. Alongside critiques by Fusar-Poli et al. (2019) and evidence of diagnostic variability across DSM revisions (Fabiano & Haslam, 2020), this highlights that categorical models lack both precision and inclusivity. A dimensional approach better captures shared variance across attention, social communication, learning, motor and cognitive functioning, from typical to impairing levels, and explains outcomes more effectively than single diagnoses.

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For ICBs and the NHS, this shift has major implications. Diagnosis-led pathways are often slow, inequitable and poorly suited to people with complex, subthreshold, masked or context-shaped needs.

Waiting for categorical certainty delays support and increases pressure on mental health, education and social care systems.

A dynamic, biopsychosocial and needs-led model offers a practical alternative. Digital profiling systems such as Do-IT Profiler operationalise this by:

- screening across multiple neurodevelopmental domains simultaneously
- capturing strengths, functional impact and contextual risk factors
- supporting early triage, prioritisation and personalised guidance
- using dynamic norming to ensure tools remain fair, current and representative

This approach aligns with NHS priorities for prevention, early intervention, personalised care and population health management.

It enables faster identification of need, improves pathway flow, reduces pressure on specialist diagnostic services, and delivers more equitable and precise support that reflects how neurodevelopmental differences present in real life.

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What are the Key Suggestions?

- A move from static, categorical systems to dynamic, data-driven, biopsychosocial models making sure this aligns with current understanding.
- To treat neurodevelopmental differences as a spectrum, explicitly embedded within transdiagnostic psychiatric frameworks and recognize the heterogeneity.
- To embed contextual and social factors and lived experience (e.g. exclusion, homelessness, trauma, gendered pathways) into profiling.
- To use dynamic norming and regular factor-analytic re-examination to ensure stability and equity across populations.
- To align assessment and service design with neuroinclusive, needs-led tools (such as Do-IT Profiler systems), rather than relying solely on DSM/ICD single diagnostic labels which are dynamic and allow assessment of needs to be reviewed over time as person, context, environment and other factors change over time.
- To deliver precision guidance that is needs led and personalized.

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Setting the Scene

01 Introduction

There has been a marked shift towards dimensional conceptualisations of neurodevelopment and mental health. Dissatisfaction with categorical models such as DSM and ICD reflects recognition of shared risk factors, heterogeneity within categories, and fluctuating symptoms over time (Astle & Bathelt, 2019; Dalgleish et al., 2020). For neurodevelopmental conditions, this is amplified by their early onset, complex co-occurrence and strong interaction with environmental factors across the life course.

The Diagnostic and Statistical Manual of Mental Disorders has undergone several major revisions since DSM-III. Public and professional debate has often centred on whether criteria have been progressively "loosened", inflating prevalence. A meta-analysis of 123 studies by Fabiano and Haslam (2020) found no overall change in diagnostic stringency from DSM-III to DSM-5 but did identify disorder-specific inflation for ADHD, autism, eating disorders and substance dependence. This suggests that certain constructs have expanded conceptually and clinically, while others have narrowed, reshaping who is recognised, when, and on what basis.

In parallel, transdiagnostic psychiatry has attempted to move beyond condition-by-condition thinking. However, a systematic review by Fusar-Poli et al. (2019) of 111 self-described transdiagnostic studies found conceptual and methodological inconsistency, limited replication and heavy dependence on DSM/ICD anchors. Much of this work has "cut across" but rarely replaced categorical scaffolding.

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Michelini et al. (2024) take this further by asking explicitly: where do neurodevelopmental conditions fit within transdiagnostic frameworks? Using large-scale factor-analytic, genetic, neuroimaging and clinical data, they show that features of autism, ADHD, learning disorders, intellectual disabilities, motor and communication disorders consistently cluster into a neurodevelopmental spectrum.

This spectrum:

- runs dimensionally from typical to impairing profiles
- is partly genetically and neurobiologically distinct from internalising, externalising and psychosis spectra
- shows earlier onset and relatively stable developmental trajectories
- has greater prognostic and explanatory value than individual diagnoses in predicting later psychiatric outcomes and functioning.

These converging lines of evidence strengthen the case for reclustering NDDs within a broader transdiagnostic architecture, and for assessment systems that reflect this reality in practice.

02

Co-occurrence and the need for reclustering

Co-occurrence among neurodevelopmental conditions is the rule rather than the exception. Kaplan and colleagues in 1998 proposed at that time that the 'comorbidity' (term used at the time) found in childhood disorders reflects a single underlying etiology and called this Atypical Brain Development. Other researchers and clinicians over the years have used other labels recognizing this including terms in the past such as Minimal Brain Dysfunction.

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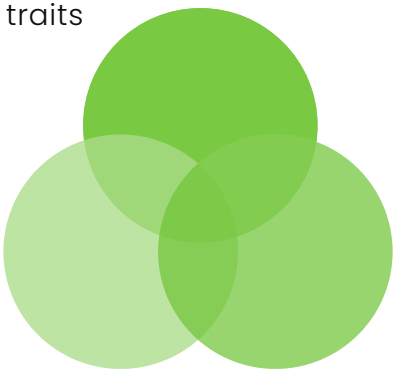
There is extensive evidence of overlap across neurodevelopmental conditions and traits which means that people rarely have a single diagnosis without some other traits being present of other neurodevelopmental conditions. Behavioural and cognitive profiles commonly cross diagnostic autistic people frequently have attentional, sensory, language and coordination difficulties but may not have had all these cognitive traits considered in their assessments. Twin, genomic and neuroimaging studies consistently demonstrate shared heritability and overlapping neural circuitry across these conditions.

Michelini et al. (2024) found that dimensional structures better capture shared heritability and functional outcomes than discrete diagnoses. This supports earlier models such as Gillberg's (2010) ESSENCE framework, which emphasised early overlapping developmental syndromes requiring integrated assessment. This built on earlier work (2003) with the recognized cluster of symptoms represented by DAMP.

Michelini et al. (2024) synthesise structural evidence from population cohorts, twin registries and clinical samples. Across multiple factor-analytic studies they identify a neurodevelopmental factor that loads on:

- inattention and hyperactivity
- social communication and autistic traits
- learning and academic difficulties
- motor coordination problems
- broader cognitive, language and executive function challenges.



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Importantly, this factor emerges alongside, not subsumed within, internalising/externalising spectra, and is only visible when neurodevelopmental features are included explicitly rather than represented solely by ADHD. ADHD appears genetically and psychometrically closer to this neurodevelopmental spectrum than to classic externalising dimensions once co-occurring oppositional and conduct problems are modelled.

In early childhood, difficulties often present as broad developmental delays relating to language, motor, cognitive or social rather than as discrete syndromes (Gillberg, 2010; Lipkin et al., 2020).

Michelini et al.'s developmental evidence shows that:

- onset of neurodevelopmental features typically precedes other psychiatric conditions
- trajectories are often persistently elevated, with variable expression across the life course
- higher scores on the neurodevelopmental spectrum predict greater risk of later internalising and externalising problems than single diagnoses.

Waiting for categorical clarity therefore risks missing the window where early, transdiagnostic intervention could alter trajectories.

Within condition variability and heterogeneity e.g. Autism

A major new study published in Nature Genetics has identified four biologically and clinically distinct autism subtypes by analysing data from more than 5,000 children in the SPARK cohort, using over 230 traits to characterise individuals holistically rather than focusing on single features.

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The subtypes are: Social and behavioural challenges, Mixed ASD with developmental delay, Moderate challenges, and broadly affected, each with unique patterns of developmental, behavioural, medical and psychiatric features, and importantly, distinct genetic profiles and developmental trajectories.

By linking these clusters to different biological mechanisms, the research advances understanding of autism's heterogeneity and opens avenues for precision diagnostics and personalised care. The findings also suggest that the timing of gene activity differs by subtype, which could explain why previous genetic studies struggled to map autism's complexity.

This work represents a shift toward data-driven classification that could improve early identification and targeted intervention strategies.

Litman, A., Sauerwald, N., Green Snyder, L. et al. Decomposition of phenotypic heterogeneity in autism reveals underlying genetic programs. Nat Genet 57, 1611–1619 (2025). https://doi.org/10.1038/s41588-025-02224-z

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03

Strengths and limitations of traditional psychometric approaches

Traditional psychometric tools have been crucial in establishing reliability, test–retest stability and a shared technical language across settings.

However, when viewed through a transdiagnostic, neurodevelopmental-spectrum lens, their limitations become more obvious:

- Population bias – norming samples often over-represent white, male, majority- language participants; female, minoritised and multiply marginalised groups are under recognised
- Static snapshots – assessments capture performance at one time point, rarely accounting for fatigue, stress, trauma history, hormonal cycles or environmental demand
- Threshold dependence – strict cut-offs obscure subthreshold but impairing profiles, particularly those with "spiky" patterns of strengths and weaknesses
- Contextual blindness – social determinants (poverty, homelessness, exclusion, maltreatment) and differential diagnostic factors (e.g. TBI, developmental trauma) are seldom integrated.

Fabiano & Haslam (2020) reviewed diagnostic stringency across DSM-III to DSM-5, revealing no overall inflation but significant variability across disorders such as autism, ADHD, and eating disorders showing expansion. This evolution reflects shifting conceptual boundaries rather than empirical precision.

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Michelini et al. (2024) show that dimensional measures of neurodevelopmental features have:

- higher reliability than categorical diagnoses
- better measurement invariance across sex and age when designed appropriately
- stronger predictive power for later outcomes than binary diagnostic status.

Without addressing language proficiency, culture, context, gendered presentation and construct clarity, new instruments risk simply re-labelling the same problems that beset categorical systems.

04

Transdiagnostic and dimensional approaches

Transdiagnostic frameworks such as HiTOP and RDoC aim to integrate overlapping traits and shared mechanisms across mental health conditions. Michelini et al. (2024) extend these frameworks by formally introducing a neurodevelopmental spectrum, characterised by dimensional variation in attention, communication, learning, and motor functioning. Their review highlights structural, validity, and utility evidence for this model, which aligns with biopsychosocial practice. Astle et al (2021) "the DSM-5 is a system used for assigning individuals to discrete diagnostic categories that appears to be straining at its limits."

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They go on to say that:

> **"The current taxonomies are not particularly effective in capturing the needs of the full population of children requiring additional support in the broad areas of learning, behaviour or social functioning. The application of arbitrary thresholds leads to the failure to identify individuals with milder difficulties that nonetheless impact significantly on their lived experience. This diagnostic problem is amplified by inequalities in access to both diagnoses and therapeutic support based on racial, ethnic and socioeconomic characteristics."**

Many studies support a dimensional approach, highlighting within-diagnosis variability and between-diagnosis overlap, motivating the search for shared patterns of brain-behaviour associations across neurodevelopmental conditions.

Traits change over time as well - longitudinal studies such as the ALSPAC study have shown that traits are not stable and can change over time and with age. There is evidence of this in DCD, ADHD and Autism for example.

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Differential Diagnosis

Before we screen individuals for ADHD, and Autism for example it makes sense to also consider if there are other reasons now or in the past for their symptoms.

We need to also consider if these are 'diverse' traits or having an impact on day-to-day functioning.

Condition	Acronym	Possible differential diagnosis
Attention Deficit Hyperactivity Disorder	ADHD	Traumatic brain injury; anxiety; sleep disorders; attachment difficulties; sensory processing differences
Autism Spectrum Disorder	ASD	OCD; anxiety disorders; social communication disorder; trauma-related presentations
Developmental Coordination Disorder	DCD	Cerebral palsy (mild); muscular dystrophy; visual impairment; dyspraxia secondary to TBI; joint hypermobility, MS, CVA.
Developmental Language Disorder	DLD	Hearing impairment; intellectual disability; ASD; selective mutism; language delay due to deprivation
Dyslexia	-	General learning difficulty; visual impairment; ADHD-related inattention; inadequate literacy instruction, English as an additional language
Dyscalculia	-	General learning difficulty; maths anxiety; poor teaching or gaps in schooling; ADHD
Fetal Alcohol Spectrum Disorder	FASD	ADHD; ASD; attachment disorder; learning disability; trauma-related difficulties
Traumatic Brain Injury	TBI	Stroke; brain tumour; neurodegenerative disorder; ADHD (especially post-injury attentional changes); functional neurological disorder

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There are cross overs in symptoms and signs:

Areas relating to DSM-5	**ADHD (Attention Deficit/ Hyperactivity Disorder)**	**Autism Spectrum Disorder (ASD)**	**DCD (Developmental Coordination Disorder)**	**Developmental Language Disorder (DLD)**
Onset of symptoms	Usually early in development	Early in development	Early in development	Early in development
Social Interaction	May have difficulties with social interactions	Persistent deficits in social communicati on and social interaction	Motor difficulties may indirectly affect participation	Impairment in language comprehension and/or expression significantly below age-appropriate levels
Activity	May exhibit impulsive behaviours	Restricted, repetitive patterns of behaviour, interests or activities	May avoid activities because coordination is challenging or not yet attained	May avoid participation because instructions or social nuances are not understood
Inattention	May struggle with inattention; may exhibit impulsive behaviours	May appear inattentive due to sensory issues or lack of interest	May appear inattentive because tasks are effortful to complete	May appear inattentive because the activity or instructions are not understood

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Areas relating to DSM-5	**ADHD (Attention Deficit/ Hyperactivity Disorder)**	**Autism Spectrum Disorder (ASD)**	**DCD (Developmental Coordination Disorder)**	**Developmental Language Disorder (DLD)**
Motor coordination	Hyperactivity may be present but motor coordination is not the core difficulty	May show stereotyped or repetitive movements; sensory hyper- or hypo-reactivity	Significant motor coordination difficulties	Motor skills usually within typical range
Interference with functioning	Symptoms interfere with functioning or development	Symptoms cause significant impairment in social, occupational or other areas of functioning	Interference with daily living and academic activities	Symptoms significantly impact language use and communication
Co-occurrence with other neurodevelopmental traits	Common	Common	Common	Common

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05

The case for dynamic norming and digital profiling

Dynamic norming represents an evolution rather than a rejection of psychometrics. By harnessing large, diverse datasets, it enables:

- iterative recalibration of norms as new data accumulate
- conditional reference groups and consideration of intersectionality (e.g. age × gender × sector × socioeconomic status) rather than single global norms
- the incorporation of co-occurring conditions and contextual variables into expected profiles – we have seen how important this is in specific settings such as justice where the cumulative impact of cognitive challenges has been identified in male, female and youth offending groups rather than in specific diagnostic siloes.
- linkage to additional behavioural indicators (sleep, stress, work/learning participation, school exclusion, in care experience, justice contact).

Dynamic norming recalibrates assessment benchmarks using real-time, population-level data.

This aligns with Michelini et al. (2024)'s call for data-driven frameworks reflecting developmental continuity and contextual diversity.

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06

Our knowledge & understanding of neuro-developmental traits has changed over the past 50 years

6.1. Diagnostic criteria have broadened – which changes the apparent phenotype

Over the last 50 years we've moved from Kanner/ICD-8 style "classic autism with language delay and intellectual disability" to a much broader spectrum:

DSM-III (1980) → DSM-IV (1994) → DSM-5 (2013) and ICD-9 → ICD-10 → ICD-11 have:

- merged subtypes (e.g. Asperger, PDD-NOS) into a single ASD category
- dropped language delay as a requirement
- expanded recognition of sensory features and more subtle social-communication differences.

Epidemiological reviews and the Scottish microsegmentation work explicitly argue that this broadening has pulled in more cognitively able and less "classically disabled" individuals, altering the case mix without requiring a genuine biological shift in autism itself.

6.2. Cognition: less intellectual disability in diagnosed samples

Historically, it was often stated that 70–80% of autistic children had intellectual disability (ID). More recent population data paint a different picture:

- A review on ASD and IQ notes that early 2000s studies still found about 50% of children with ASD had IQ <70, whereas a more recent large study reports only 31% with ID, 25% in the borderline range, and 44% with average or above-average IQ.

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- Longitudinal cohort work (e.g. Fountain et al.) shows that later birth cohorts are over-represented in "higher functioning" developmental trajectories, again suggesting that broader, milder profiles are now being included.
- A JAMA Pediatrics analysis of ~17,000 autistic individuals across 40 countries found that more recent cohorts, controlling for age, tended to show milder developmental delays, in part because ID is less common among newly diagnosed children than previously.

Taken together, this is good evidence that the average cognitive profile of diagnosed autism has shifted upwards, mainly because we now diagnose autistic people who would previously have been missed or given other labels.

6.3. Sex/gender: greater recognition of "female autism" and camouflaging

Over 50 years the sex ratio has moved from a very "male-dominated" picture (often quoted as 4–5:1) towards narrower ratios, particularly in samples without ID.

- Reviews of the "female autism phenotype" and camouflaging show that autistic women are more likely to have internalising difficulties, better superficial social skills, and to compensate or mask in ways that hid them from older diagnostic frameworks.

As a result, newly recognised cohorts contain more girls and women, with somewhat different symptom emphasis (e.g. internalising, social exhaustion, camouflaging) than the mostly male samples from 30–50 years ago. That changes our impression of what autism looks like.

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Neurodevelopmental Condition	Some areas of challenge	Gender biases and difference (each person will differ in their pattern of strengths and challenges)
ADHD	Inattentiveness, hyperactivity, impulsivity	Historically underdiagnosed in females due to focus on hyperactivity in males and societal expectations of girls' behaviour. Girls may be more inattentive and dreamier, less disruptive, more likely to internalise difficulties and mimic others to cope in social settings.
Autism (ASD)	Impaired social interaction, specific areas of interest, need for consistency	Research bias towards males. Females may show subtler traits and more masking or camouflaging. This may present as anxiety, meltdowns, eating disorders or self-harm. Interests may appear more socially typical.
Developmental Language Disorder (DLD)	Language comprehension and/or expression difficulties	Language delays may be attributed to personality. Girls may develop compensatory strategies that mask difficulties. Difficulties may emerge indirectly as anxiety, meltdowns, eating disorders or self-harm.
Developmental Coordination Disorder (DCD)	Motor coordination difficulties, balance and organisation	Gender norms influence recognition, such as expectations around sporting ability. Girls may avoid activities that highlight their difficulties.

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Neurodevelopmental Condition	Some areas of challenge	Gender biases and difference (each person will differ in their pattern of strengths and challenges)
Dyslexia	Challenges with reading accuracy, fluency, spelling and recording	Compensation through strong verbal skills; higher academic expectations for girls may hide difficulties.
Dyscalculia	Difficulty with mathematical tasks	Compensation through verbal skills; stereotypes linking maths difficulties to boys lead to under-recognition in girls.
Tic disorders	Motor and vocal tics	Tics in females may be seen as less disruptive; stereotypes associate tics with males. Tics may be masked or consciously suppressed.

6.4. Age and context of diagnosis: toddlers and adults, not just children with clear delays

Fifty years ago, autism was usually picked up in early childhood when language and global developmental delays were obvious.

What's changed:

- Reviews of age at diagnosis show that in many countries the median age of diagnosis has fallen into the preschool years, especially for children with clear developmental delay or ID.
- However, UK family database work suggests that the median age around 4½ years (≈55 months) has been stubbornly stable, even as awareness has grown.

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- At the same time, registry data from the US and elsewhere show sharp rises in autism diagnoses in older children and adults over the last decade, particularly in the 5–8 year age group and beyond.
- A recent Nature-level genetic study of >45,000 autistic people found that early-diagnosed cases (before ~5–6) show a different genetic and developmental profile from those diagnosed later in childhood/adolescence, who look more genetically like ADHD and internalising/trauma-related conditions.

Do early signs always indicate it is or is not ADHD/ASD for example?

Condition	**Acronym**	**Typical age when first symptoms are noticeable**
Attention Deficit Hyperactivity Disorder	ADHD	Early childhood, usually **before age 12** (DSM-5 requirement). Often visible from **3–5 years** as high activity, impulsivity or attention difficulties.
Autism Spectrum Disorder / Condition	ASD/C	**Early developmental period**, usually **before age 3**, though social and communication differences may become clearer in **school years**.
Developmental Coordination Disorder	DCD	Early childhood, usually **by age 5–7**, when motor demands increase (dressing, handwriting, PE, cutlery use).
Developmental Language Disorder	DLD	Early language development, typically **2–4 years**, when speech and language delay becomes evident.
Dyslexia	-	Usually identified **6–8 years**, once formal reading instruction begins and difficulties persist despite teaching.

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Condition	Acronym	Typical age when first symptoms are noticeable
Dyscalculia	-	Typically emerges 7–9 years, when number sense, arithmetic and mathematical reasoning demands increase.
Fetal Alcohol Spectrum Disorder	FASD	Neurodevelopmental signs present from birth, but cognitive, behavioural and executive difficulties often become clearer in early childhood to school age.
Traumatic Brain Injury	TBI	Symptoms begin after the injury, at any age, with presentation depending on severity and brain region affected.

We now have two very visible "front doors":

- early signs: language delay, social attention differences, repetitive behaviours
- later signs: anxiety, burnout, executive-function and social-identity struggles, often on a background of average or high ability.

That makes the phenotypic mix look very different to the 1970s, even if the underlying biology is stable.

6.5. Co-occurring conditions and "soft signs" are more foregrounded

Compared with 50 years ago, there is much more systematic documentation of:

- ADHD and other NDD co-occurrence
- anxiety, depression and self-harm
- sensory hyper- and hyposensitivities
- executive-function and emotion-regulation difficulties

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Large reviews note that autistic females in particular show high rates of internalising disorders, which may dominate the clinical picture and delay diagnosis. SpringerLink

Many of these features were present historically but rarely recorded as "autism symptoms". They now appear as prominent parts of the clinical description, which again shifts the described phenotype over time.

6.6. Within-person change: symptoms do evolve across the lifespan

This isn't strictly "50-year secular change", but it's relevant when thinking about signs and symptoms:

- Longitudinal ADOS/ADI-based studies show that social-communication scores often reduce modestly between early childhood and middle childhood, with some children moving to milder categories, while restricted/repetitive behaviours are more stable.

These trajectories were likely present 50 years ago but weren't tracked with today's standardised tools, so historical reports may over-represent the most severe, persistent presentations.

6.7. Is there evidence that the underlying autistic phenotype itself has biologically changed?

The consensus from epidemiology and genetics so far is:

- Rising prevalence and changing case mix are mostly explained by:
    - broader criteria and reclassification (diagnostic substitution)
    - increased awareness and screening
    - service/benefit incentives

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    - better recognition in girls/women and in adults increased awareness and screening
    - survival of preterm/medically complex infants

- Some commentators, summarising meta-analytic work, argue that classic cognitive correlates (e.g. theory-of-mind deficits, executive dysfunction, certain EEG markers) appear less extreme in more recent cohorts, implying that "milder" or qualitatively different profiles now meet criteria.
- Genetic data strongly support autism as highly heritable and heterogeneous, with multiple biological pathways rather than a single shifting entity.

There are signals that our diagnostic net has changed its size and mesh. If you strip out changes in criteria, awareness and services, the evidence suggests:

- The core signs — differences in social communication and interaction, and restricted/repetitive behaviours/interests look much the same now as they did in classic descriptions.
- What has changed is:
    - more people with average or high IQ
    - more girls, women and gender diverse individuals
    - more people diagnosed later in life for internalising, burnout and executive-functioning issues
    - more explicit recognition of sensor, emotional and co-occurring psychiatric features

The observed phenotype of "people who carry an autism diagnosis" is different from 50 years ago, but primarily because we are labelling a wider and more diverse group of neurodivergent people, rather than because autism itself has fundamentally changed.

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It also recognizes what we considered how the neurodevelopmental traits we defined 10-15 years ago are different to today's understanding especially in e.g. females with autism.

Michelini et al.'s neurodevelopmental spectrum provides a conceptual scaffold for what dynamic norming should measure: latent dimensions of attention, social communication, learning, motor and cognitive functioning that vary across the population and carry prognostic weight.

- Rather than asking "Does this person meet DSM criteria for ADHD?", a dynamically normed system asks: Where does this person sit along the neurodevelopmental spectrum and its subdimensions?
- How does that profile interact with internalising/ externalising dimensions, and with their environment?
- What is the impact on them day to day in the context of their lives?
- What are the primary concerns to focus on at the moment and what needs to be considered longer term?

This is particularly critical for those whose difficulties emerge at transition points (starting school, moving into work, entering prison or homelessness services) or whose profiles are shaped by camouflaging, trauma or systemic discrimination.

The Do-IT Profiler system applies dynamic norming by combining validated psychometric measures with contextual analytics across age, and context including the differences in education, health, justice, and employment sectors, allowing for iterative refinement and cross-sector comparability.

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07

Operationalising a biopsychosocial, transdiagnostic model: the example of Do-IT Profiler

7.1. Alignment with the neurodevelopmental spectrum

Do-IT Profiler system was explicitly designed to move away from single-condition screening. Its architecture maps closely onto Michelini et al.'s proposed neurodevelopmental spectrum, with domains covering:

- literacy and learning
- attention and executive functioning
- social communication and interaction
- motor coordination and sensory processing
- wellbeing, emotion regulation and daily functioning.

By capturing these domains dimensionally and simultaneously, the system constructs an individualised profile along the neurodevelopmental spectrum and its subcomponents, rather than allocating people into mutually exclusive categories.

7.2. Psychometric stability and large-scale validation

The Profiler retains classical psychometric rigor. Building on validated tools for dyslexia, DCD and related conditions, items have been tested and refined across:

- more than 200,000 individuals overall
- over 10,000 people with known diagnoses (e.g. ADHD, autism, dyslexia, DCD)
- 10s of 1000s of people from specific populations e.g. university, school, justice setting

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Factor analyses are used to:

- examine whether intended constructs (e.g. attention, coordination, literacy) cohere across populations
- test measurement invariance across sectors (education, employment, health, justice), age and gender
- identify whether additional factors such as trauma-related presentations in justice settings need to be incorporated.

This echoes Michelini et al.'s structural work but applies it directly to real-world datasets and sectors.

7.3. Sector-specific stability and contextual factors

Profiles and factor structures are regularly re-examined within specific sectors:

- Prisoners versus mainstream individuals.
- Prisoners and outcome data linkage.
- Unemployed adults versus those in work.
- Young people in alternative provision versus mainstream education.

These analyses recognise that trait distributions and risk patterns differ by context: for example, the high prevalence of language disorders and TBI alongside ADHD in justice populations, often compounded by homelessness, in care experience and trauma.

The Profiler incorporates:

- risk indicators (school exclusion, unemployment, self-harm, substance use, justice contact)
- social determinants (homelessness, care experience, digital exclusion, caring responsibilities)
- differential diagnostic flags (e.g. TBI, maltreatment-associated ND, sensory impairment).

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In Michelini et al.'s terms, this allows the neurodevelopmental spectrum to be viewed within its environmental surround, not as a purely "brain-based" property.

7.4. Dynamic recalibration and independent scrutiny

Because the platform is digital and used at scale, normative baselines can be updated continuously. Scores can be re-scaled as more data are accrued from under-represented groups (e.g. women in prison, racially minoritised communities, autistic girls and women).

Collaboration with independent researchers and clinicians supports:

- external validation of factor structures and percentile distribution.
- exploration of longitudinal outcomes and prognostic validity
- transparent reporting of limitations and areas needing refinement.

This aligns with Michelini et al.'s call for iterative, stakeholder-informed development of transdiagnostic frameworks, and for measures that are reliable, prognostic and clinically useful.

Dynamic, spectrum-based profiling raises important ethical questions:

- representation and bias – who is in the dataset, and whose experiences are missing?
- interpretability – how are dimensional scores communicated to non-specialists without pathologising difference?
- governance – how are data stored, linked and used across systems (education, health, justice, employment)?
- power and consent – who benefits from profiling, and who may be disadvantaged if systems remain deficit-focused?

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Michelini et al. acknowledge similar tensions in situating a neurodevelopmental spectrum within "psychopathology" frameworks while respecting neurodiversity and identity-first perspectives. A biopsychosocial implementation must therefore:

- foreground strengths and autonomy
- link profiles to support and environmental change, not simply risk stratification
- allow opt-out and data minimisation where appropriate
- include lived experience in governance and interpretation.

Do-IT Profiler systems employ anonymized analytics and co-research partnerships to ensure ethical governance. Do-IT Profiler's approach using anonymized analytics, sector-specific agreements, co-design with users and practitioners, and emphasis on person-centered guidance offers one model of how this can be operationalised.

08

Challenges of open access referral systems.

System knowledge and access:

- GP and health visitor knowledge of neurodevelopmental conditions
- School staff awareness and confidence in raising concerns
- Local pathway clarity (how easy it is to refer)
- Waiting list pressures discouraging referrals
- Digital literacy needed to complete tools

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Socio-economic status (SES):

- Higher SES → higher identification (more advocacy, time, confidence, private routes)
- Lower SES → under-identification (competing priorities, access barriers, distrust of services)

English as an additional language (EAL):

- Language delay misattributed to bilingualism
- Parents less likely to engage with forms or digital tools
- Cultural norms about disability and help-seeking
- Fear of stigma or statutory involvement

Cultural and social factors:

- Different expectations of child behaviour
- Gender norms (boys over-identified for ADHD; girls under-identified for ASD)
- Neurodivergence seen as personality or parenting issue
- Parental past personal experiences

Professional bias:

- Over-focus on:
    - Trauma and attachment
    - Behavioural management
- Under-recognition of:
    - DCD
    - DLD
    - Dyscalculia
    - FASD
    - TBI
    - Adversity factors

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Tool design factors:

- Literacy level of questions
- Digital skills to complete it
- Cultural relevance of examples
- Self-report vs informant report
- Binary wording rather than dimensional- and explanation
- Length and cognitive load

Context of completion:

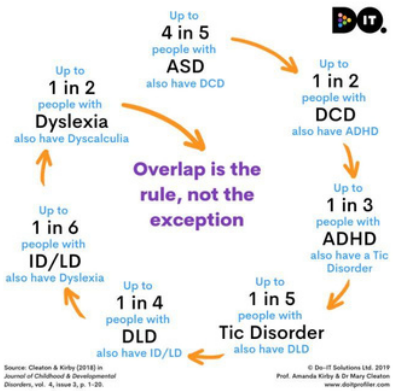
- Completed during crisis → inflated scores
- Completed when stable → suppressed scores
- Time of day, and time to complete it?
- Who completes it (parent, teacher, self)-
- Level of insight into development, memory or knowledge of past behaviours
- Insight

Stigma and fear:

- Fear of labelling
- Fear of schools or social services
- Fear of discrimination/cultural differences

Co-occurrence effects:

- ADHD masking ASD or DLD
- Anxiety inflating ADHD traits
- Trauma mimicking ASD or ADHD
- Motor difficulties misread as behaviour



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Age and developmental stage:

- Younger children → symptoms less differentiated
- Adolescents → internalising presentations dominate
- Adults → compensatory strategies mask traits

In short:

Open access screening measures visibility, access, trust and literacy, not just neurodevelopmental difference.

09

Discussion and future directions

The convergence of evidence from transdiagnostic psychiatry, dimensional modelling, and digital profiling suggests that the field is shifting toward a dynamic neurodevelopmental paradigm. Integrating Michelini et al.'s neurodevelopmental spectrum into operational systems such as Do-IT Profiler can transform assessment and early intervention. Future research should test the predictive validity of digital dynamic models, align them with clinical outcomes, and embed them within health and education pathways to enable equitable, personalised support.

Reclustering NDDs around a neurodevelopmental spectrum offers a way to reconcile several strands of evidence and practice:

- Fabiano & Haslam (2020) show that DSM revisions have not uniformly relaxed criteria, but that some conditions (e.g. ADHD, autism) have expanded selectively.

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- Fusar-Poli et al. (2019) highlight that many "transdiagnostic" studies still operate within categorical scaffolds and lack conceptual clarity.
- Michelini et al. (2024) provide multi-level evidence (structural, genetic, neurobiological, developmental, clinical) for a distinct but intersecting neurodevelopmental spectrum.

Taken together, these findings suggest we are not simply dealing with "more diagnoses", but with a deeper misalignment between how we classify and how difficulties actually cluster and develop.

From a systems perspective, this has several implications:

- assessment – tools should screen across the neurodevelopmental spectrum and other spectra (internalising, externalising, psychosis), not within single siloes; language and communication need routine screening because of their centrality to social functioning and to the validity of any subsequent testing
- service design – provision organised around single diagnoses (autism clinics, ADHD clinics, dyslexia services) will continue to miss complexity, especially for marginalised groups and those in justice, homelessness or insecure work
- policy – funding and eligibility criteria tied tightly to categorical diagnoses may perpetuate inequity, excluding those with subthreshold but debilitating profiles or with complex co-occurrence.

Dynamic, biopsychosocial profiling systems such as Do-IT Profiler embody a pragmatic response. They operationalise the neurodevelopmental spectrum in a way that is:

- dimensional and transdiagnostic

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- context-sensitive, embedding risk and protective factors
- amenable to continuous recalibration as evidence and population structures change.

10

Background to the development of Do-IT Profiler systems

10.1. Clinical origins

Professor Amanda Kirby was a GP working also in adult psychiatry and had a child diagnosed with developmental coordination disorder (DCD) in 1988. At that time there was limited knowledge about DCD, and when a child had more than one condition this often required seeing different specialists with little or no coordination. Until 2013 in the DSM categorisation, for example, it was not permitted to diagnose ADHD and ASD together, despite the clear reality of co-occurrence.

In 1998 Amanda founded one of the first transdisciplinary centres in the world aimed to reduce the need for parents of children with a range of neurodevelopmental disorders to attend multiple services. The centre offered a one-stop shop for assessment and diagnosis. To do this, an assessment matrix was developed with paediatricians, educational psychologists, occupational therapists, physiotherapists and speech and language therapists, aligning with the diagnostic measures of the time.

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10.2. Collaborations and psychometric foundations

This work led to collaboration with leading global specialists in neurodevelopment. Amanda co-authored a book with Professor Bonnie Kaplan, one of the first researchers to examine co-occurrence across conditions such as DCD, ADHD and ASD, and worked closely with Professor David Sugden, co-developer of the Movement ABC and Movement ABC Checklist, who had extensive experience of psychometric tool development. Amanda has published a number of papers with him and other colleagues relating to DCD and screening tools, including work with Professor Sara Rosenblum as part of her PhD. She has continued to collaborate with neurodevelopmental leaders, including reviewing ADHD service delivery in the UK in work referenced by the NHS Independent ADHD Taskforce (chaired by Professor Anita Thapar).

In the early 2000s' Amanda started working with Dr Ian Smythe and the British Dyslexia Association on an EU Interreg project recognising the high co-occurrence across neurodevelopmental conditions and the importance of person-centred support rather than siloed diagnostic approaches.

Dr Smythe, an education consultant and psychologist, had extensive expertise in literacy and assessment. His PhD research examined cognitive diversity and reading difficulties in different languages. He co-developed the Dyslexia Checklist with John Everatt (2001), still widely used and translated into multiple languages, which became the basis of the dyslexia component in Do-IT Profiler. He has published extensively in Assessment and Development Matters.

Amanda co-developed the Adult DCD screening too with Professor Sara Rosenblum, which is now translated and standardised in several languages (including Korean, German,

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Japanese, Italian, Spanish and Hebrew) and recognized as the key adult screener for DCD internationally and also used as a core part of screening and assessment by PATOSS in the UK. An assessment framework was also developed with Professor Anna Barnett and Professor Elizabeth Hill which is in the SASC guidelines.

The combined research background, understanding of psychometrics and software development skills, particularly in literacy, enabled Amanda and Ian to develop the framework for the Do-IT Profiler system.

10.3. Digitisation and large-scale data

Do-IT Profiler emerged from this work, drawing on frameworks relating to DLD, ADHD and ASC from ICD-10, ICD-11 and DSM IV/DSM-5. Question development and testing were undertaken with children and adults, in mainstream and specialist settings, with a deliberate focus on capturing traits seen in females as well as males. There is increasing recognition that relying solely on DSM/ICD and some traditional checklists can lead to bias in screening, especially in ADHD, autism and DCD.

Digitisation allowed for large-scale data collection and improved accessibility (for example, Kirby, 2016). From the outset, the tools were never intended to be “just” screening instruments that identify challenges in diagnostic siloes. They were designed to showcase strengths, adopt a biopsychosocial approach and capture other relevant factors, aligning more closely with the WHO ICF model as a way forward for assessing need in children and adults with neurodevelopmental traits.

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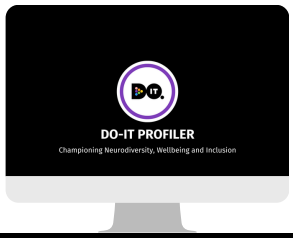
10.4. Current scope and ongoing evaluation

Today the system has been used by hundreds of thousands of people in education, health and justice settings, across ages and genders.

The tools include neurodiversity screeners, executive functioning screening, wellbeing tools and a sensory profiler, alongside additional components to capture the “whole person” and provide person-centred, needs-led guidance.

Data from different groups and mainstream populations are continually reviewed. Do-IT works with external experts (for example, Dr Hope Kent and Professor Huw Williams), researchers and data analysts to publish findings in peer reviewed journals and to ensure transparency.

This ongoing process of validation and refinement underpins the dynamic norming and biopsychosocial approach described in the main paper.



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Development of the Do-IT Profiler System: From Clinical Practice to dynamic, biopsychosocial screening

Executive Summary

This section outlines the clinical, academic, and collaborative journey that led to the creation and ongoing evolution of the Do-IT Profiler system. It traces Professor Amanda Kirby's work from her early medical and research experiences through to the development of a digital, biopsychosocial assessment framework.

The Do-IT Profiler system integrates validated psychometric measures with contextual analytics, supporting inclusive and evidence-based identification of neurodivergent strengths and challenges across education, health, employment, and justice sectors.

Clinical Origins

Professor Amanda Kirby was a GP working in adult psychiatry and the parent of a child diagnosed with Developmental Coordination Disorder (DCD) in 1988.

At that time, there was little awareness or coordinated understanding of DCD. Families with children presenting multiple conditions were often required to attend numerous appointments with different specialists, without cohesive care. Until 2013, the DSM classification system did not allow for co-diagnosis of ADHD and ASD, despite clear evidence of co-occurrence.

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In 1998, Professor Kirby founded one of the first transdisciplinary centres designed to streamline the diagnostic journey for children with neurodevelopmental differences. The Dyscovery Centre provided a 'one-stop shop' for assessment and diagnosis, involving a collaborative team of paediatricians, educational psychologists, occupational therapists, physiotherapists, and speech and language therapists. Together the team created an assessment matrix aligned to the diagnostic frameworks available at the time and providing one integrated report.

Collaborations and psychometric foundations

This foundational work led to collaborations with leading global specialists in neurodevelopment. Professor Kirby co-authored a book with Professor Bonnie Kaplan who was one of the first people to do work on co-occurrence across conditions such as DCD, ADHD and ASD,a pioneer in the study of co-occurrence across DCD, ADHD, and ASD.

She worked closely with Professor David Sugden, co-developer of the Movement ABC and Movement ABC Checklist, who contributed significant psychometric expertise.

Her PhD research, undertaken in collaboration with Professor Sara Rosenblum, expanded this work into adult screening for DCD. She has continued to collaborate with neurodevelopmental leaders, including contributing to ADHD service reviews referenced in the Independent ADHD Taskforce report chaired by Professor Anita Thapar -

(https://www.england.nhs.uk/long-read/report-of-the-independent-adhd-taskforce-part-1/#references; https://www.researchsquare.com/article/rs-5956482/v1).

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Early international collaboration

In the early 2000s, Professor Kirby began collaborating with Dr Ian Smythe on an EU-funded project recognising the high rates of co-occurrence among neurodevelopmental conditions. This project emphasized the need for person-centered, cross-domain assessment rather than condition-specific siloes. It provided extensive user engagement and greater understanding of the lived experiences.

Dr Smythe, an education consultant and psychologist, brought deep expertise in literacy, multilingualism, and assessment. His international work evolved from PhD research into cognitive diversity and reading difficulties across languages.

He co-developed the Dyslexia Checklist with John Everatt (2001), now translated into multiple languages and used globally — forming the basis of the dyslexia component in Do-IT Profiler. Languages include Brazilian Portuguese, Hungarian, and Chinese, as well as English and Welsh.

Dr Smythe has published widely in Bosnian, Brazilian, Bulgarian, Polish, Czech, and English, contributing to EU multilingual resources. This combination of psychometric and software development expertise provided the foundation for the Do-IT Profiler framework.

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Development and global standardisation

Professor Kirby co-developed the Adult DCD screening tool with Professor Sara Rosenblum, now translated and standardised in seven languages (Korean, German, Japanese, Italian, Spanish, Hebrew, and English). It is widely used for screening and assessment by PATOSS in the UK. An associated framework was developed with Professors Anna Barnett and Elizabeth Hill. It is in the SASC guidelines today.

The Do-IT Profiler evolved from the work in Dyslexia and DCD and using frameworks from DLD, ADHD, and ASC, grounded in ICD-10/ICD-11, and DSM-IV/DSM-5 classifications.

Profiler development in 2002/2003 used a paper- based system to begin with.Testing and question development were conducted with both children and adults in mainstream and specialist settings, ensuring sensitivity to gendered and cultural presentation differences. Accessibility and usability were also core to the development of the online platform.

Digitisation and large-scale data collection

Digitisation enabled large-scale data collection and enhanced accessibility, as described in Kirby (2016): https://hpp.education.leeds.ac.uk/wp-content/uploads/sites/131/2016/02/HPP2016-3-Kirby.pdf

From the start, the tools were designed not merely as screening nstruments but as biopsychosocial profiling systems identifying both strengths and challenges using ICF principles. The design aligns with the WHO ICF model, emphasizing contextual and environmental factors , considering impact, functioning and ability to be active and participate to guide equitable and holistic support.

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It was there to be far more than a tick box screening tool but to deliver person centred and needs led guidance and considering the person's context (and age).

Current scope and ongoing evaluation

Today, the Do-IT Profiler system has been used by hundreds of thousands of individuals across education, employment, health, and justice sectors. It is now rolled out for example in every prison in the UK, it is used as a screener for all students in some universities, workplaces and apprenticeship settings. It is also being used upstream by NHS providers delivering ADHD and Autism services.

The system has a suite including the neurodiversity screener, executive function and wellbeing tools, and a sensory profiler. Additional modules capture whole-person context, delivering personalized, needs-led guidance. The content and guidance is determined by the context of the person and their age.

Data from diverse populations are regularly reviewed, with collaborations involving experts such as Dr Hope Kent and Professor Huw Williams providing new learnings in different settings.

Do-IT continues to publish findings in peer-reviewed journals to maintain transparency, validation, and continuous refinement of its biopsychosocial and dynamic norming framework such as:

Kirby, A (2016) Using data driven decision systems to deliver person-centred approaches in developmental disorders: one example of complexity - the criminal justice system - https://hpp.education.leeds.ac.uk/wp-content/uploads/sites/131/2016/02/HPP2016-3-Kirby.pdf

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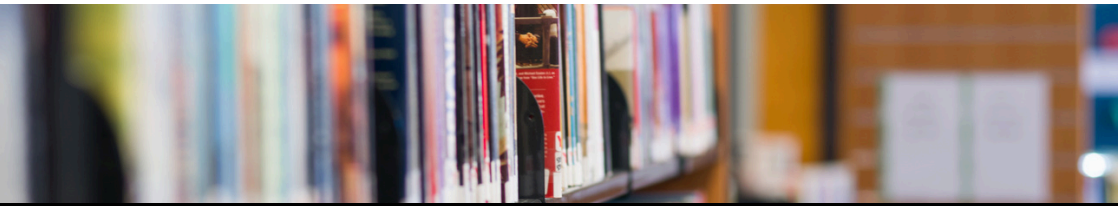

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Appendix

The Takeaway

There isn't one ADHD.
There are thousands — each shaped by biology, experience, and environment. The task ahead is to design systems that recognise this diversity, rather than trying to fit everyone into the same diagnostic mould.

1. **The raw symptom lists**
   DSM-5 has:
   - 9 Inattention symptoms
   - 9 Hyperactivity/Impulsivity symptoms

   For a child (under 17):
   - Need ≥ 6 of 9 inattention symptoms to "meet" the inattentive domain.
   - Need ≥ 6 of 9 hyperactive/impulsive symptoms to "meet" that domain.

   For an adult (17+):
   - Threshold is ≥ 5 of 9 in each domain.

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2. **How many ways to meet one domain? (children)**

For children, to "meet" one domain you can have:

- Exactly 6, 7, 8, or all 9 symptom

Number of possible subsets for one domain:

- 6 of 9: $C(9,6) = 84$
- 7 of 9: $C(9,7) = 36$
- 8 of 9: $C(9,8) = 9$
- 9 of 9: $C(9,9) = 1$

Add them up:

$84 + 36 + 9 + 1 = 130$ different ways to meet one domain.

There are also 382 ways not to meet the domain (0–5 symptoms), because there are $2^9 = 512$ total possible subsets and $512 - 130 = 382$.

3. **Combinations that produce a DSM-5 ADHD diagnosis (children)**

DSM-5 presentations (for children):

1. Predominantly Inattentive:
   - Inattention: ≥ 6 symptoms (130 patterns)
   - Hyperactive/Impulsive: ≤ 5 symptoms (382 patterns)
     ⇒ $130 \times 382 = 49{,}660$ possible symptom combinations.

2. Predominantly Hyperactive/Impulsive:
   - Mirror image of above
     ⇒ 49,660 combinations.

3. Combined Presentation:
   - Inattention: ≥ 6 symptoms (130 patterns)
   - Hyperactive/Impulsive: ≥ 6 symptoms (130 patterns)
     ⇒ $130 \times 130 = 16{,}900$ combinations.

Now add all three:

$49{,}660 + 49{,}660 + 16{,}900 = 116{,}220$

For children, DSM-5 allows 116,220 different symptom combinations that all "count" as ADHD.

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4. **For adults (5 -symptom threshold)**

   For adults, you "meet" a domain with ≥ 5 of 9 symptoms:
   So:

   1. Predominantly Inattentive:
      - Inattention ≥5 (256) × Hyperactive ≤4 (256) = 65,536

   2. Predominantly Hyperactive/Impulsive:
      - Same = 65,536

   3. Combined:
      - Inattention ≥5 (256) × Hyperactive ≥5 (256) = 65,536

   Total adult ADHD patterns:

   65,536 + 65,536 + 65,536 = 196,608

   For adults, DSM-5 allows 196,608 different symptom combinations that all meet ADHD criteria.

Why this matters

- These huge numbers show how heterogeneous ADHD is even within DSM-5 rules.
- Two people with an ADHD diagnosis can share very few actual symptoms in common.
- This is a big part of the argument for dimensional, transdiagnostic, biopsychosocial models, rather than relying only on categorical cut-offs.

Further reading

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Do-IT Profiler
Neurodiversity Tools & Training

A Needs-Led, Transdiagnostic Approach

Professor Amanda Kirby

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