

Neurodevelopmental areas of assessment: criteria for severe impairment

1. Brain structure	Definition	<p>Brain structure and neurology includes:</p> <ul style="list-style-type: none"> • abnormal occipitofrontal head circumference • structural brain abnormalities • seizure disorder not due to known postnatal causes • significant neurological diagnoses otherwise unexplained.
	Direct/indirect assessment	<p>Severe impairment is present when one or more of the following are identified:</p> <ul style="list-style-type: none"> • occipitofrontal head circumference is <3rd percentile or ≤ 2 SD below the mean <ul style="list-style-type: none"> - For premature infants OFC should be corrected for gestational age until two years of age • structural brain abnormalities known to be associated with prenatal alcohol exposure are shown on brain imaging <p>Examples include:</p> <ul style="list-style-type: none"> - reduction in overall brain size - corpus callosum (agenesis, hypoplasia) - cerebral cortex (reduced gyrification or anterior cingulate cortex surface area) - reduction in volume in specific areas: cerebellum, hippocampus, basal ganglia-caudate • seizure disorder in which other aetiologies have been excluded • significant neurological diagnoses otherwise unexplained are identified, eg cerebral palsy, visual impairment, sensorineural hearing loss when other aetiologies have been excluded.
	Considerations	<p>Microcephaly</p> <p>There are many other causes of microcephaly which should be excluded, including familial microcephaly, chromosomal abnormalities, intrauterine infection or exposure to teratogens other than alcohol. These causative factors may be identified in addition to PAE. When possible, parental head circumference should be measured. Investigate as clinically indicated.</p> <p>In some circumstances a child may have reliable past documentation of an OFC <3rd percentile, but at the time of assessment the OFC is >3rd percentile. In this situation, clinical judgement should be used to judge whether this discrepancy reflects persistent microcephaly or may reflect measurement error.</p> <p>Neuroimaging</p> <p>Brain imaging such as MRI is not required for a diagnosis of FASD, but is recommended when clinically indicated, eg by the presence of microcephaly or macrocephaly that is not familial; localising neurological signs; focal seizure disorder; or signs of neurodegenerative disorder.</p>

2. Motor Skills	Definition	Motor skills include fine motor skills (manual dexterity, precision), gross motor skills (balance, strength, co-ordination, ball skills and agility), graphomotor skills (handwriting) and visuo-motor integration.
	Direct Assessment	<p>Severe impairment in motor skills is present <i>when</i> on a validated test of motor skills:</p> <ul style="list-style-type: none"> • a <i>composite score is below the clinical cut-off</i>; or • <i>1 or more major subdomain scores</i> (gross motor skills, fine motor skills, graphomotor skills and VMI) <i>is/are below the clinical cut-off</i> (eg gross motor and fine motor skills can be scored separately using the BOT-2). <p>Examples of standardised tests:</p> <ul style="list-style-type: none"> - Movement Assessment Battery for Children, 2nd Edition (Movement-ABC 2); 3 years–16 years 11 months - Beery-Buktenika Developmental Test of Visual-Motor Integration, 6th Edition; 3–7 years (short form) 7–100 years (full form) - Bruininks Oseretsky Test of Motor Proficiency, 2nd Edition (BOT-2); 4 years–21 years 11 months - Bayley Scales of Infant and Toddler Development, 3rd Edition (Bayley-III); 1–42 months - Griffiths Scales of Child Development, Third Edition; Birth–6 years.
	Indirect assessment	<p>Clinical assessment may provide supporting evidence of severe impairment, eg report of problems with balance or co-ordination.</p> <p>Abnormal tone, reflexes, strength, soft neurological signs and other findings on the neurological examination may be considered in combination with direct assessment of motor skills using a standardised assessment tool.</p> <p>Clinical evidence of impairment in speech articulation or oromotor function may be considered in combination with direct assessment of motor skills.</p> <p>For motor skills, significant functional impairment may be evident in learning and play when motor skill levels are at 1 standard deviation below the mean ($\leq 16^{\text{th}}$ centile). If this is documented during assessment it is important to ensure adequate therapeutic supports are in place, even if criteria for severe impairment (≤ 2 SD or $< 3^{\text{rd}}$ percentile) are not met.</p> <p>As therapeutic approaches differ significantly for different components of motor function (eg gross motor versus fine motor) it is preferential to use a motor assessment (eg BOT-2) which provides separate composite scores for gross and fine motor function to inform therapy. An overall motor composite score may hide an individual's relative strengths and weaknesses.</p>

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<p>2. Motor Skills continued</p>	<p>Indirect assessment continued</p>	<p>Musculoskeletal-based structural defects may also need to be considered for their impact on the motor skills area of assessment, eg lack of complete extension of one or more digits, decreased supination/pronation at the elbows, other joint contractures including inability to completely extend and/or contract at the hips, knees, and ankles.</p> <p>Examples of non-standardised assessment:</p> <ul style="list-style-type: none"> - Child Development Scales (preschool).
<p>3. Cognition</p>	<p>Definition</p>	<p>Cognition includes IQ, verbal and non-verbal reasoning skills, processing speed, and working memory.</p>
	<p>Direct assessment</p>	<p>Severe impairment is present when standardised tests of cognition or intelligence show:</p> <ul style="list-style-type: none"> • a <i>composite score below the clinical cut-off</i> eg full scale IQ <70, or • a <i>major subdomain score below the clinical cut-off</i>, eg for the WISC this includes Verbal Comprehension, Visual Spatial, Fluid Reasoning, and Processing Speed, or • there is a <i>significant discrepancy</i> among major subdomain scores. <p>Examples of standardised tests:</p> <p><6 years</p> <ul style="list-style-type: none"> - Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV); 2 years 6 months–7 years 7 months - Stanford-Binet Intelligence Scales (SB-5); 2–85 years - Differential Abilities Scales (DAS-II); 2 years 6 months–17 years 11 months - Wechsler Non-Verbal Scale of Ability-II (WNV-II); up to 21 years. <p>>6 years</p> <ul style="list-style-type: none"> - Wechsler Intelligence Scales for Children (WISC-V ANZ); 6 years–16 years 11 months - Stanford-Binet Intelligence Scales (SB-5); up to 85 years - Wechsler Adult Intelligence Scale (WAIS-IV); 16–90 years - Differential Abilities Scales (DAS-II); up to 17 years - Universal Nonverbal Intelligence Test (non-verbal test); 5 years–21 years 11 months - Wechsler Non-Verbal Scale of Ability (WNV); 4–21 years - Naglieri Nonverbal Ability Test – Second Edition (NNAT-2); 4–18 years.
	<p>Indirect assessment</p>	<p>N/A</p>

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<p>3. Cognition continued</p>	<p>Considerations</p>	<p>Individuals who fulfil criteria for an intellectual disability, by definition, typically will have impairment in at least three neurodevelopmental areas of assessment (eg cognition, adaptive behaviour, language, motor skills).</p> <p>If working memory alone is severely impaired (below the clinical cut-off), this should be considered evidence of impairment in the executive functioning area of assessment rather than in the cognition area of assessment.</p> <p>A test that is independent of language and culture may be appropriate for certain populations.</p>
<p>4. Language</p>	<p>Definition</p>	<p>Language includes expressive and receptive language skills.</p>
	<p>Direct assessment</p>	<p>Severe impairment is present when:</p> <ul style="list-style-type: none"> • a <i>composite score</i> assessing core language, receptive language, and/or expressive language is <i>below the clinical cut-off</i>, or • there is a <i>significant discrepancy</i> between receptive and expressive composite scores, or • there are <i>two or more scores below the clinical cut-off</i> on subtests assessing higher-level language skills (ie the integrative aspects of language such as narrative and complex comprehension abilities). <p>Examples of standardised tests:</p> <ul style="list-style-type: none"> - Clinical Evaluation of Language Fundamentals (CELF-4); 5 years-21 years 11 months - Pre-School Language Scales, 5th Ed (PLS-5); birth-7 years 11 months.
	<p>Indirect assessment</p>	<p>Clinical judgment regarding severity of impairment is required if:</p> <ul style="list-style-type: none"> • testing is not standardised • testing is not in an individual's first language • direct assessment is not possible.
	<p>Considerations</p>	<p>This domain should be assessed as if it is a single entity. It is inappropriate to use scores on verbal IQ subtests as a measure of both language and cognition.</p> <p>When possible, testing should be done in the individual's first language.</p> <p>Problems with phonological awareness may impact on language and, if present, may contribute to impairment in this area of assessment.</p>
<p>5. Academic achievement</p>	<p>Definition</p>	<p>Academic achievement includes skills in reading, mathematics, and/or literacy (including written expression and spelling).</p>

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5. Academic achievement continued	Direct assessment	<p>Severe impairment is present when standardised measures of reading, mathematics, and/or literacy show:</p> <ul style="list-style-type: none"> • a <i>composite score below the clinical cut-off</i>, or • a <i>significant discrepancy</i> between cognition and either reading, mathematics, and/or written expression. <p>Examples of standardised tests:</p> <ul style="list-style-type: none"> - Wechsler Individual Achievement Test (WIAT II); 4 years–adult - Woodcock–Johnson Achievement Test (WJAT-III); 4 years–adult.
	Indirect assessment	<p>School reports with literacy and numeracy achievement levels can be used as supporting evidence for severe impairment.</p>
	Considerations	<p>The clinical team must determine whether the individual has had adequate access to and attendance at school or alternative instruction and/or remedial intervention before a deficit can be recorded. Consideration must also be given to the individual's educational placement, ie mainstream versus educational support class and opportunity, eg remote location, multilingual setting, new immigrant. Even if the Full Scale IQ is below 70 (indicating impairment of cognition), impairment can also be given in the area of assessment of academic achievement, as cognitive and academic skills do not necessarily directly correlate (eg some individuals with mild intellectual disability perform in the low average range academically). Both areas of assessment should be tested and considered separately.</p> <p>If an individual has a specific developmental disorder of scholastic skills according to ICD-10 they fulfil criteria for severe impairment in academic achievement, providing testing shows evidence of impairment at clinical cut-off of at or below 2SD.</p> <p>Problems with phonological awareness may impact on academic achievement and if present may contribute to impairment in this area of assessment.</p>
6. Memory	Definition	<p>Memory includes overall memory, verbal memory, and visual memory.</p>
	Direct assessment	<p>Severe impairment in memory is present when:</p> <ul style="list-style-type: none"> • a <i>composite score</i> for overall memory and/or verbal memory, and/or visual memory score is <i>below the clinical cut-off</i>, or • there is a <i>significant discrepancy</i> between verbal and nonverbal memory. <p>Examples of standardised tests:</p> <ul style="list-style-type: none"> - Developmental Neuropsychological Assessment (NEPSY-II), Memory and Learning sub-tests; 3–16 years - Wide Range Assessment of Memory and Learning, 2nd Edition (WRAML-II); 5–90 years - Children's Memory Scale (CMS); 5–16 years.

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6. Memory continued	Indirect assessment	N/A
	Considerations	A deficit in working memory should be considered in the executive function, including impulse control and hyperactivity area of assessment rather than the memory area of assessment.
7. Attention	Definition	<p>Attention has several components:</p> <ul style="list-style-type: none"> i) <i>selective</i> attention (ie focusing on a particular stimulus) ii) <i>divided</i> attention (ie attending to two or more stimuli at the same time) iii) <i>alternating</i> attention (ie switching focus from one stimulus to another) iv) <i>sustained</i> attention (ie attending for a long period of time and resistance to distractions). <p>Attention deficits usually manifest as problems with concentration, task focus and work organisation.</p> <p>In many definitions and theories of brain function, attention overlaps with some of the executive functions. In order to distinguish these areas of assessment for diagnostic purposes in FASD, attention has been defined separately.</p> <p>Deficits in inhibition, impulse control or hyperactivity should be considered in the executive function, impulse control and hyperactivity area of assessment rather than the attention area of assessment.</p>
	Direct assessment	<p>Severe impairment in attention is present on <i>direct</i> assessment when <i>two or more subtest scores are below the clinical cut-off</i> on continuous performance tests or other neuropsychological measures of selective, divided, alternating or sustained attention.</p> <p>Examples of standardised tests:</p> <ul style="list-style-type: none"> - Conner's Continuous Performance Test: 3rd Ed; 8-60+ years - Test of Everyday Attention for Children (Tea-CH); 6-16 years - Delis-Kaplan Executive Function System (DKEFS), ie Trail Making Test, Colour/Word Interference; 8-89 years - Developmental Neuropsychological Assessment (NEPSY-II), Attention subtests; 3-16 years - Children's Colour Trails Test; 8-16 years - Adult Colour Trails Test; 18-89 years.

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<p>7. Attention continued</p>	<p>Indirect assessment</p>	<p>Severe impairment in attention by <i>indirect</i> assessment is present when <i>two or more assessments provide converging evidence of impairment</i>, eg:</p> <ul style="list-style-type: none"> • clinical interview by different professionals • scores at or below the clinical cut-off on standardised observer rating scales, eg Connors 3 (parent, teacher or self report) • file review • direct clinical observation during neurodevelopmental testing. <p>Examples of standardised rating scales:</p> <ul style="list-style-type: none"> - Connors 3rd Edition (Connors 3); 6-18 years - Connors Adult ADHD Rating Scales (CAARS); 18-50+ years - Achenbach school-age scales - Child Behaviour Check List (CBCL), Teacher Report Form (TRF), Youth-Self Report (YSR); 6-18 years - Connors Comprehensive Behaviour Rating Scales (CBRS); 6 years-17 years 11 months.
	<p>Considerations</p>	<p>A diagnosis of ADHD based on DSM-5 criteria (either inattentive or combined presentation) fulfils criteria for severe impairment in the attention area of assessment. Valid direct or indirect assessment methods and cut-offs should be used to make this diagnosis. ADHD hyperactive-impulsive presentation contributes to impairment in the executive function, including impulse control and hyperactivity area of assessment.</p> <p>Direct tests of attention which are part of testing in other domains (eg WISC, memory testing) can be used as evidence of impairment.</p> <p>When indirect and direct tests of attention do not concur, clinical judgment is required to determine whether severe impairment exists. Consideration that indirect assessment may better reflect attention deficits in real life situations (eg at work or in school) may be pertinent.</p>
<p>8. Executive function, including impulse control and hyperactivity</p>	<p>Definition</p>	<p>Executive function refers to a set of higher-level skills involved in organising and controlling one's own thoughts and behaviours in order to fulfil a goal with maximum efficiency.</p> <p>For the purposes of FASD assessment criteria, the executive function area of assessment includes impulse control and inhibition response, hyperactivity, working memory, planning and problem solving, shifting and cognitive flexibility. While in many definitions and theories of brain function attention overlaps with some of the executive functions, they have been defined separately for assessment purposes in FASD.</p> <p>Impulse control deficits are characterised by actions without forethought, which often have potential for harm to self or others.</p> <p>Hyperactivity is characterised by inappropriate and excessive levels of motor activity or speech.</p>

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8. Executive function, including impulse control and hyperactivity continued	Direct assessment	<p>Severe impairment in executive function and/or impulse control by <i>direct</i> assessment is present when <i>at least two or more subtest scores below the clinical cut-off</i> are obtained on neuropsychological measures of executive function (which often assess impulse control).</p> <p>Examples of standardised assessment tools:</p> <ul style="list-style-type: none"> - Behavioural Assessment of the Dysexecutive Syndrome in Children (BADS-C); 7-16 years - Developmental Neuropsychological Assessment (NEPSY-II) Executive Functioning sub-tests; from 3-16 years - Delis-Kaplan Executive Function System (DKEFS); from 8-89 years - Rey-Osterrieth Complex Figure (ROCF)
	Indirect assessment	<p>Severe impairment in executive function and/or impulse control by <i>indirect</i> assessment is present when a <i>clinical assessment provides converging evidence of impairment from multiple sources</i>, including scores at or below the clinical cut-off on standardised rating scales and supporting evidence from clinical interview, file review and direct clinical observation during neurodevelopmental testing.</p> <p>Examples of standardised rating scales:</p> <ul style="list-style-type: none"> - Behavior Rating Inventory of Executive Function (BRIEF-II); 5-18 years - Comprehensive Executive Function Inventory (CEFI); 5-18 years - Frontal Systems Behaviour Scale (FrsBe); 18-95 years. <p><i>Hyperactivity</i> is measured on rating scales which also measure attention problems, as listed for <i>indirect</i> assessment in the attention area of assessment (eg Conners 3).</p>
	Considerations	<p>Assessment may show a discrepancy between <i>direct</i> and <i>indirect</i> tests in this area of assessment due to the varying conceptualisations of executive function and related tests. In the situation where <i>indirect</i> tests show impaired scores but direct tests scores are normal, significant weight should be given to the <i>indirect</i> assessments, as they are a more valid measure of functional brain impairment in this area. Hence, if two or more standardised rating scales (eg observer and self report or two observers) are below the clinical cut-off, then the executive function, impulse control and hyperactivity area of assessment is considered severely impaired.</p>

9. Affect regulation	Definition	Affect regulation includes mood and anxiety disorders.
	Direct assessment	Not possible
	Indirect assessment	<p>Severe impairment in affect regulation by <i>indirect</i> assessment is present when an individual meets the ICD-10 criteria for any of the following:</p> <ul style="list-style-type: none"> • recurrent depressive disorder • separation anxiety disorder, elective mutism, social phobia, panic disorder, agoraphobia, or generalised anxiety disorder • mixed anxiety disorders or mixed anxiety and depressive disorder • conduct disorder or oppositional defiant disorder. <p>Clinicians should formally ascertain that the individual meets criteria rather than assign a diagnosis on the basis of clinical impression or data from rating scales alone.</p> <p>Standardised rating scales which may assist diagnosis include:</p> <ul style="list-style-type: none"> - Spence Children's Anxiety Scales (SCAS); 8-15 years - Behaviour Assessment System for Children-III; 2-21 years - Beck Youth Inventories, 2nd Edition (BYI-II); 7-18 years - Children's Depression Inventory 2 (CDI-2); 7-17 years - Multidimensional Anxiety Scale for Children 2nd Edition (MASC 2).
	Considerations	Care should be taken to document longstanding dysregulation rather than a short-term response to unfavourable life events or environmental conditions (eg multiple foster placements).
10. Adaptive Behaviour, Social Skills, or Social Communication	Definition	<p>Adaptive behaviour is defined as the life skills which enable an individual to live independently in a safe and socially responsible manner, and how well they cope with everyday tasks.</p> <p>These include:</p> <ul style="list-style-type: none"> • <i>conceptual</i> skills – language, reading, writing, maths, reasoning, knowledge, and memory • <i>social</i> skills – empathy, social judgment, interpersonal communication skills, the ability to make and retain friendships • <i>practical</i> skills – self-management in areas such as personal care and daily living skills, job responsibilities, money management, recreation, and organising school and work tasks. <p>Social communication is a critical component of adaptive function but can be assessed separately.</p>

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<p>10. Adaptive Behaviour, Social Skills, or Social Communication continued</p>	<p>Direct assessment</p>	<p>Severe impairment in social communication by <i>direct</i> assessment is present when a <i>composite score measuring social language, social communication skills or pragmatic language skills is below the clinical cut-off</i>.</p> <p>Examples of standardised assessment tools for individuals >6 years of age:</p> <ul style="list-style-type: none"> - The Social Language Development Test – Elementary (SLDT-E); 6 years–11 years 11 months - The Social Language Development Test – Adolescent (SLDT-A); 12 years–17 years 11 months.
	<p>Indirect assessment</p>	<p>Severe impairment in adaptive behaviour, social skills or social communication by <i>indirect</i> assessment is present when, according to a standardised interview or rating scale completed by a key informant a:</p> <ul style="list-style-type: none"> • <i>composite score</i> is below the clinical cut-off, or • a <i>major subdomain score</i> is below the clinical cut-off. <p>For children and most adolescents, standardised observer rating scales for adaptive function (typically for caregiver and/or teacher) should be used, although this may not be possible, eg for a child in detention.</p> <p>Examples include:</p> <ul style="list-style-type: none"> - Vineland Adaptive Behaviour Scales, 2nd Edition (VABS-II); birth–90 years - Adaptive Behaviour Assessment System (ABAS-III); birth–89 years - Behaviour Assessment System for Children–3 (BASC-3); 2–21 years - The Pragmatics Profile of Everyday Communication Skills in Children; 0–10 years - Children’s Communication Checklist, 2nd Edition; child and adult versions available. <p>Observation by a speech and language therapist of the individual interacting with their peers in institutional, school or family settings may also provide supporting evidence of impairment.</p>
	<p>Considerations</p>	<p>Severe impairment in social skills and social communication is present when on <i>formal testing an individual meets the DSM-5 criteria</i> for:</p> <ul style="list-style-type: none"> • autism spectrum disorder • social (pragmatic) communication disorder. <p>When an individual meets DSM-5 or ICD-10 criteria for conduct disorder and/or severe oppositional defiant disorder, this provides supporting evidence for impairment in the adaptive behaviour, social skills or social communication area of assessment however the individual still needs to meet other criteria demonstrating severe impairments in multiple aspects of social, practical and conceptual function (eg on Vineland Rating Scales).</p>

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<p>10. Adaptive Behaviour, Social Skills, or Social Communication continued</p>	<p>Considerations continued</p>	<p>Older adolescents and adults</p> <p>For older adolescents or adults, a standardised, indirect rating scale for adaptive behaviour is preferred wherever possible and may be required for eligibility for some services and financial support.</p> <p>Alternative assessment methods may be required for people living alone or in an institutional setting who have not had a consistent caregiver or partner within the last two years who can act as an informant.</p> <p>For example, assessment of <i>adaptive function</i> may involve structured interview, observation of self-care and living skills, or use of historical records. Severe impairment is based on clinical judgement that deficits are sufficiently severe to fall below clinical cut-off. This might include:</p> <ul style="list-style-type: none"> • documented inability to function in key aspects on independent living (eg inability to manage money, maintain a household of reasonably safety and cleanliness, obtain/maintain a job, uphold personal hygiene, exhibit socialisation/coping strategies, care for children) • documented difficulty in social competence (eg being financially victimised or unintentionally involved in criminal behaviour due to social gullibility; chronic inability to participate successfully in group treatments and/or group home placements). <p>For <i>social communication</i> assessment, a direct, age-appropriate measure should be used with the client, in combination with reports and historical information. Cultural and linguistic considerations should be applied if relevant, and testing and interpretation altered accordingly.</p>
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