

Table 3: Neurodevelopmental domains: criteria for severe impairment

1. Brain Structure / neurology	Definition	Brain structure and neurology includes: <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 PC or ≤2 SD <ul style="list-style-type: none"> ○ For premature infants OFC should be corrected for gestational age until 2 years of age ▪ Structural brain abnormalities known to be associated with prenatal alcohol exposure are shown on brain imagingⁱ Examples include: <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 e.g. cerebral palsy, visual impairment, sensorineural hearing loss <i>when other aetiologies have been excluded</i>
	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 e.g. 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	<p>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 (VMI). (44, 45)</p>
	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 composite score is below the clinical cut-off; or ▪ 1 or more major subdomain scores (gross motor skills; fine motor skills; graphomotor skills; and visuo-motor integration) is/are below the clinical cut-off (e.g. gross motor and fine motor skills can be scored separately using the BOT-2). (39) <p>Examples of standardised tests:</p> <ul style="list-style-type: none"> ○ Bruininks-Oseretsky Test of Motor Proficiency (BOT-2); (40) (gross motor and fine motor); 4y-6y. ○ Berry-Buktenica Development Test of Visual-Motor Integration (VMI); (32) (visual motor integration); 2y - adult. ○ BOT-2 (40) (gross motor and fine motor); 6y- 21y. ○ Movement Assessment Battery for Children 2nd Ed (Movement-ABC 2) (45) 3y- 16y 11m
	Indirect assessment	<p>Clinical assessment may provide supporting evidence of severe impairment: e.g. report of problems with balance, coordination.</p>

		<p>Abnormal tone, reflexes, strength, soft neurological signs (46) 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 oral-motor function may be considered in combination with direct assessment of motor skills.</p>
	Considerations	<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 ($\leq 2\text{SD}$ or $< 3^{\text{rd}}$ PC) are not met.</p> <p>As therapeutic approaches differ significantly for different components of the motor domain (e.g. gross motor versus fine motor) it is preferential to use a motor assessment (e.g. BOT-2) (39) 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> <p>Musculoskeletal based structural defects may also need to be considered for their impact on the motor domain e.g. 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. (47)</p>
3. Cognition	Definition	Cognition includes IQ, verbal and non-verbal reasoning skills, processing speed, and working memory.
	Direct assessment	<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> - e.g. full scale IQ < 70; or ▪ a <i>major subdomain score below the clinical cut-off</i> e.g. for the WISC (34) 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> <ul style="list-style-type: none"> ▪ < 6 years <ul style="list-style-type: none"> ○ Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV) (34); 2y 6m - 7y 7m

		<ul style="list-style-type: none"> ○ Stanford-Binet Intelligence Scales (SB-5); (48) 2y - 85 y ○ Differential Abilities Scales (DAS-II) (49); 2y 6m - 17y 11m ○ Wechsler Non-Verbal Scale of Ability-II (WNV-II); (50) up to 21 y ▪ > 6 years <ul style="list-style-type: none"> ○ Wechsler Intelligence Scales for Children (WISC-V ANZ)(35); 6y - 16y 11m ○ Stanford-Binet Intelligence Scales (SB-5); (48); up to 85 y ○ Wechsler Adult Intelligence Scale (WAIS-IV) (35); 16 - 90 y ○ Differential Abilities Scales (DAS-II); (49); up to 17 y ○ Universal Nonverbal Intelligence Test (non-verbal test) (37); 5 - 21y 11m ○ Wechsler Non-Verbal Scale of Ability (WNV); (50) 4 -21y ○ Naglieri Nonverbal Ability Test - Second Edition (NNAT-2) (51) 4 - 18 y
	Considerations	<p>Individuals who fulfil criteria for an Intellectual Disability, by definition, typically will have impairment in 3 domains of neurodevelopment as defined for FASD criteria (e.g. 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 <i>Executive functioning</i> domain rather than in the <i>Cognition</i> domain.</p> <p>A test that is independent of language and culture may be appropriate for certain populations (see Cultural and Linguistic Considerations, Section B).</p>
4. Language	Definition	Language includes expressive and receptive language skills.
	Direct assessment	<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>2 or more scores below the clinical cut-off</i> on subtests assessing higher-level language skills (i.e. 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);(52) 5y - 21y 11m ○ Pre-School Language Scales, 5th Ed (PLS-5); (53) birth - 7y 11m

	Considerations	<p>This domain should be assessed as if it is a single entity.. It is inappropriate to use scores on verbal IQ sub-tests as a measure of <i>both</i> language and cognition.</p> <p>When possible, testing should be done in the individual’s first language. Specific tests may be available e.g. for some Indigenous languages.</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>Problems with phonological awareness may impact on language and if present may contribute to impairment in this domain.</p>
5. Academic Achievement	Definition	Academic achievement includes skills in reading, mathematics, and/or literacy (including written expression and spelling).
	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</i> below the <i>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) (54) 4y- adult ○ Woodcock–Johnson Achievement Test (WJAT-III) (55) 4y- adult
	Indirect assessment	<p>The following information can be used as supporting evidence for severe impairment:</p> <ul style="list-style-type: none"> ▪ The National Assessment Program Literacy and Numeracy (NAPLAN) test results (54) ▪ School semester reports with achievement levels
	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 i.e. mainstream versus educational support class and opportunity e.g. remote location, multi-lingual</p>

		<p>setting, new immigrant. Even if the Full Scale IQ is below 70 (indicating impairment of <i>Cognition</i>), impairment can also be given in the domain of <i>Academic Achievement</i> as cognitive and academic skills do not necessarily directly correlate (e.g some individuals with mild intellectual disability perform in the low average range academically). Both domains should be tested and considered separately.</p> <p>If an individual has a Specific Learning Disorder according to DSM-5 (30) 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 domain.</p>
6. Memory	Definition	Memory includes overall memory, verbal memory, and visual memory
	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 below the clinical cut-off;=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) (55), Memory and Learning sub-tests; 3 - 16 years ○ Wide Range Assessment of Memory and Learning, 2nd Edition (WRAML-II); (56) 5 - 90 years ○ Children's Memory Scale (CMS), (57) 5 - 16 years
	Considerations	A deficit in <i>working memory</i> should be considered in the <i>Executive Function, including impulse control and hyperactivity</i> rather than <i>Memory</i> domain.
7. Attention	Definition	<p>Attention has several components:</p> <ul style="list-style-type: none"> i) <i>selective</i> attention (i.e. focusing on a particular stimuli) ii) <i>divided</i> attention (i.e. attending to 2 or more stimuli at the same time) iii) <i>alternating</i> attention (i.e. switching focus from one stimuli to another)

		<p>iv) <i>sustained</i> attention (i.e. attending for a long period of time and resistance to distractions). 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 domains for diagnostic purposes in FASD, attention has been defined separately.</p> <p>Deficits in inhibition, impulse control or hyperactivity should be considered in the domain of <i>Executive function, Impulse control and Hyperactivity</i> rather than <i>Attention</i>.</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 (58); 8 - 60+ y ○ Test of Everyday Attention for Children (Tea-CH) (59); 6 - 16 y ○ Delis-Kaplan Executive Function System (DKEFS) (60) i.e. Trail Making Test, Colour/Word Interference; 8 - 89 y ○ Developmental Neuropsychological Assessment (NEPSY-II)(55), Attention subtests; 3 - 16 y ○ Children's Colour Trails Test (61) ; 8 - 16 y ○ Adult Colour Trails Test; (62) 18 - 89 y
	Indirect assessment	<p>Severe impairment in attention by <i>indirect</i> assessment is present when <i>two or more assessments provide converging evidence of impairment</i> e.g.:</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 e.g. Connors 3 (parent, teacher or self-report) (58) ▪ 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) (58); 6 - 18y

		<ul style="list-style-type: none"> ○ Conners Adult ADHD Rating Scales (CAARS) (63); 18 - 50+ y ○ Achenbach school-age scales - Child Behaviour Check List (CBCL), Teacher Report Form (TRF), Youth-Self Report (YSR) (64); 6-18y ○ Conners Comprehensive Behaviour Rating Scales (CBRS) (65); 6 - 17y 11m
	Considerations	<p>A diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) based on DSM-5 criteria (30) – either <i>inattentive</i> or <i>combined</i> presentation - fulfils criteria for severe impairment in the domain of <i>Attention</i>. 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 <i>Executive function, including impulse control and hyperactivity</i> domain.</p> <p>Direct tests of attention which are part of testing in other domains (e.g. 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 <i>indirect</i> assessment may better reflect attention deficits in real life situations (e.g. at work or in school) may be pertinent.</p>
8. Executive Function, including impulse control and hyperactivity	Definition	<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 diagnostic criteria, the domain of <i>Executive Function</i> 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 diagnostic 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>
	Direct assessment	<p>Severe impairment in executive function and/or impulse control by <i>direct</i> assessment is present <i>when 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"> ○ Developmental Neuropsychological Assessment (NEPSY-II) (55) Executive Functioning sub-tests – from 3 - 16 y ○ Delis-Kaplan Executive Function System (DKEFS) (60) – from 8 - 89 y ○ Rey-Osterrieth Complex Figure (ROCF) (66)
	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) (67); 5 – 18y ○ Comprehensive Executive Function Inventory (CEFI) (68); 5 - 18y ○ Frontal Systems Behaviour Scale (FrsBe) (69);18 - 95 y <p><i>Hyperactivity</i> is measured on rating scales which also measure attention problems, as listed for <i>indirect assessment</i> in the <i>Attention</i> domain (e.g. Conners 3) (58).</p>
	Considerations	<p>A diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) – either combined or hyperactive-impulsive presentation - based on DSM-5 criteria (30), does <u>not</u> fulfil criteria for severe impairment in the domain of <i>Executive function, including impulse Control and hyperactivity Domain</i>. Additional evidence is required from other indirect and direct assessments to fulfil criteria for severe impairment.</p> <p>Assessment may show a discrepancy between <i>direct</i> and <i>indirect</i> tests in this domain due to the varying conceptualisations of executive function and related tests. In the situation where <i>indirect</i> tests show impaired scores but <i>direct</i> 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 domain. Hence, if two or more standardised rating scales (e.g. observer and self-report or two observers) are below clinical cut-off, then the <i>Executive Function, Impulse Control and Hyperactivity</i> domain 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 <i>when an individual meets the DSM-5 (30) criteria for:</i></p> <ul style="list-style-type: none"> ▪ Major Depressive Disorder (with recurrent episodes) ▪ Persistent Depressive Disorder ▪ Disruptive Mood Dysregulation Disorder (DMDD) ▪ Separation Anxiety Disorder, Selective Mutism, Social Anxiety Disorder, Panic Disorder, Agoraphobia, or Generalised Anxiety 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); (70) 8-15y ○ Behaviour Assessment System for Children-III (71); 2 - 21y ○ Beck Youth Inventories, 2nd Edition (BYI-II) (72) ○ Children’s Depression Inventory 2 (CDI-2), (73)7 – 17y ○ Multidimensional Anxiety Scale for Children 2nd Edition (MASC 2) (74)
Considerations	<p>Care should be taken to document longstanding dysregulation rather than a short-term response to unfavourable life events or environmental conditions (e.g. multiple foster placements).</p> <p>For the purpose of FASD diagnoses, children who meet criteria A to F for the Disruptive Mood Dysregulation Disorder may be considered to have impairment in this domain. This diagnosis cannot be formally made until children are >6 and <18 years of age and the onset of symptoms must occur before the age of 10 years.</p>	
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: (30)</p> <ul style="list-style-type: none"> ▪ <i>Conceptual</i> skills - language, reading, writing, math, reasoning, knowledge, and memory

		<ul style="list-style-type: none"> ▪ <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>
	Direct assessment	<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) (75); 6y - 11y11m ○ The Social Language Development Test – Adolescent (SLDT-A) (76); 12y - 17y11m
	Indirect assessment	<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 <i>or</i> ▪ <i>a major subdomain score</i> is below the clinical cut-off <p><i>For children and most adolescents</i>, standardised observer rating scales for adaptive function (typically for caregiver and/or teacher) should be used, although this may not be possible e.g. for a child in detention.</p> <p>Examples include:</p> <ul style="list-style-type: none"> ○ Vineland Adaptive Behaviour Scales, 2nd Ed (32) (VABS-II); birth - 90 y ○ Adaptive Behaviour Assessment System (ABAS-III); (77) birth - 89y ○ Behaviour Assessment System for Children – 3 (BASC-3) (77); 2 - 21 y ○ Pragmatic Language Observation Scale (PLOS) (78); 8 – 17y 11m ○ Children’s Communication Checklist, 2nd Edition (79); child and adult versions available. ○ Clinical Evaluation of Language Fundamentals (CELF-4 Australian) (52) Pragmatics Profile; 5 - 21y 11m

		Observation by a speech pathologist of the individual interacting with their peers in institutional, school or family settings may also provide supporting evidence of impairment.
	Special considerations	<p>Severe impairment in social skills and social communication is present when <i>on formal testing an individual meets the DSM-5 (30) criteria</i> for:</p> <ul style="list-style-type: none"> ▪ Autism Spectrum Disorder ▪ Social (Pragmatic) Communication Disorder <p>When individuals individual meet DSM-5 criteria for Conduct Disorder and/or severe Oppositional Defiant Disorder, this provides supporting evidence for impairment in the <i>Adaptive behaviour, Social skills or Social communication</i> domain however the individual still needs to meet other criteria demonstrating severe impairments in multiple aspects of social, practical and conceptual function (e.g. on Vineland Rating Scales). In some older adolescents and adults, indirect assessment can be complicated and additional considerations apply (see below).</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 (e.g. 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).

		<ul style="list-style-type: none"> • Documented difficulty in social competence (e.g. 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. (see Cultural and Linguistic Considerations in Section B).</p>
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